Technical Publication
TR-1005R8

Troubleshooting

HF Series Generators
with Low or High Speed Starter

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	JAN 24, 2000	First edition
6	NOV 04, 2011	Changes in Error E13 due to ROHS Generator
7	DEC 11, 2012	ROHS Inverter images
8	SEP 19, 2016	Information about CTSC Console, Thermal Switch for Battery Powered Generator and Error E82 (LV-DRAC)

This Document is the English original version, edited and supplied by the manufacturer.
The Revision state of this Document is indicated in the code number shown at the bottom of this page.

ADVISORY SYMBOLS

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

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

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

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

Note ☞

Alert readers on 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 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:

- If the Generator cannot be Powered up, run the troubleshooting for Error Code E01.
- If the Generator can be Powered up:
  - 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, X-ray Tube, ATP Console CPU Board, HT Controller Board, or Filament Control Board is replaced in the Generator, the respective Configuration and Calibration procedures must be performed.

If the HT Controller Board or the ATP Console CPU Board are replaced, check that the Extended Memory data have not been lost or modified with the Board change. Compare Extended Memory data displayed on the Console with the values noted in the Data Book.

If the HT Controller Board is replaced in the Power Module, transfer U3-EEPROM from the old Board to the new Board. U3-EEPROM contains calibration data.

If U3-EEPROM is not transferred, a complete Calibration must be performed.

Make various exposures, using different techniques and Focal Spots, to verify that mA stations are calibrated correctly. If they are not, perform Calibration procedures.

Update and record in the Data Book any new data entered in the Extended Memory Locations.

1.1 TOOLS AND TEST EQUIPMENT

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

- Standard service engineer's tool kit, including 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.
  - Copper Plates for the Collimator Filter Holder (recommended for AEC / ABC calibration):
    2 units of 1 mm thickness,
    1 unit of 0.5 mm thickness,
    2 units of 0.2 mm thickness,
    1 unit of 0.1 mm thickness.
  - Acrylic Plastic Plates can be used Instead of Copper Plates:
    6 units of 5 cm. thickness,
    5 units of 1cm. thickness.
- *Only for Tomo purposes:*
  - Tomophantom tool.
- *Only for Fluoro purposes:*
  - Dosimeter, with R/min and mR/min meters and/or mGy/min and μGy/min meters.
  - Imaging Test Phantom tool.
  - Copper Plates: 2 units of 1 mm thickness,
    1 unit of 0.5 mm thickness,
    2 units of 0.2 mm thickness,
    1 unit of 0.1 mm thickness.

1.2 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 (LEDS) ON THE CHARGE-DISCHARGE MONITOR BOARDS ARE OFF (APPROXIMATELY THREE (3) MINUTES AFTER THE UNIT IS TURNED OFF).

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OF THE CIRCUIT BOARDS EVEN 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.

<u>ALWAYS</u> HAVE THE "IPM DRIVER BOARD" CONNECTED IN THE GENERATOR PREVIOUS TO ACTIVATING MAINS POWER. IF THE "IPM DRIVER BOARD" IS NOT CONNECTED, IRREVERSIBLE DAMAGE WILL OCCUR TO THE IGBTS.

<u>LINE POWERED GENERATOR</u>:
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 ON, THE NEON LAMP (GREEN) LOCATED ON THE TRANSFORMER 6T2 (GENERATOR CABINET) IS ON.

INTERNAL PARTS OF THE GENERATOR (ALL FUSES, LINE CONTACTOR (6K5), INPUT TRANSFORMER (6T2), ON/OFF RELAY (3K3) AND LF-RAC MODULE) RECEIVE CONTINUOUS POWER THROUGH THE POWER LINE ALTHOUGH THE CONTROL CONSOLE IS OFF. BE SURE THAT THE SAFETY SWITCH IS OFF BEFORE HANDLING ANY INTERNAL PART OF THE EQUIPMENT.

BATTERY POWERED GENERATOR:
THIS GENERATOR IS PERMANENTLY CONNECTED TO THE POWER LINE THROUGH A LINE PLUG.

WHEN IT DOES NOT WORK WITH STAND-ALONE, IT IS POWERED ON UNLESS THE SAFETY SWITCH INSTALLED IN THE ROOM ELECTRICAL CABINET IS OFF. WHEN THE UNIT IS POWERED, THE NEON LAMP (GREEN) LOCATED ON THE TRANSFORMER 6T2 IS ON.

WHEN IT WORKS WITH OPTIONAL STAND-ALONE IT IS POWERED ON IN ALL SITUATIONS. WHEN THE UNIT IS TURNED ON, THE NEON LAMP (GREEN) LOCATED ON THE TRANSFORMER 6T2 IS ON.

KEEP THE PROTECTION COVERS IN PLACE ALL THE TIME, ONLY REMOVE THE COVERS TO PERFORM SERVICE OPERATIONS. INTERNAL PARTS (CONTACTOR 6K5, LINE FUSES, BATTERY CHARGER BOARD, LINE MONITOR BOARD, BATTERY MONITOR BOARD, ENERGY GUARD BOARD AND STAND-ALONE BOARD) ARE PERMANENTLY POWERED ON AND HAVE THE FULL VOLTAGE POTENTIAL OF THE BATTERIES (APPROX. 400 VDC) ALTHOUGH THE UNIT IS DISCONNECTED FROM THE LINE OR THE CONTROL CONSOLE IS OFF. USE CAUTION WHEN WORKING IN THIS AREA.

CAPACITOR ASSISTED GENERATOR:
THIS GENERATOR IS PERMANENTLY CONNECTED TO THE POWER LINE THROUGH A LINE PLUG. IT IS POWERED ON UNLESS THE SAFETY SWITCH INSTALLED IN THE ROOM ELECTRICAL CABINET IS OFF. WHEN THE UNIT IS POWERED, THE NEON (GREEN) LOCATED ON THE TRANSFORMER 6T2 IS ON.

KEEP THE PROTECTION COVERS IN PLACE ALL THE TIME, ONLY REMOVE THE COVERS TO PERFORM SERVICE OPERATIONS. INTERNAL PARTS (CAPACITOR OF HV INVERTER, STORAGE CAPACITORS MODULE, LINE FUSES, DC BUS FUSES, ETC.) ARE PERMANENTLY POWERED ON AND HAVE THE FULL VOLTAGE POTENTIAL OF THE CAPACITORS (APPROX. 800 VDC), ALTHOUGH THE UNIT IS DISCONNECTED FROM THE LINE OR THE CONTROL CONSOLE IS OFF. USE CAUTION WHEN WORKING IN THIS AREA.

SECTION 2 GENERAL PROCEDURES

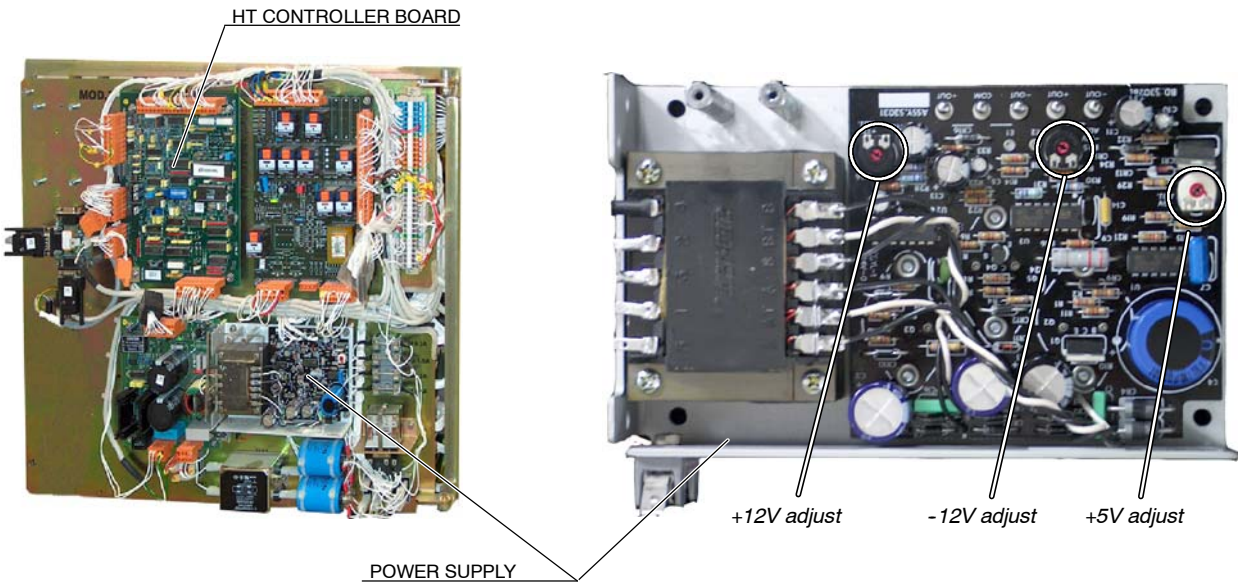
2.1 LOW DC VOLTAGE POWER SUPPLY TEST

The Generator operates from a Low DC Voltage Power Supply located in the Front Panel (MOD. 3) of the Generator Cabinet. (*Refer to Illustration 2-1*).

Turn the Generator ON and with a Digital Multimeter measure between:

- P2-3 (+) and P2-4 on the HT Controller Board. Check that the voltage at this point is +5 (±0.2 VDC). If required, adjust voltage with the +5 VDC Adjustment Potentiometer on the Power Supply Board.
- P2-2 (+) and P2-4 on the HT Controller Board. Check that the voltage at this point is +12 (±0.1 VDC). If required, adjust voltage with the +12 VDC Adjustment Potentiometer on the Power Supply Board.
- P2-1 (–) and P2-4 on the HT Controller Board. Check that the voltage at this point is –12 (±0.1 VDC) (this voltage must be –12.7 (±0.1 VDC) if the Console is provided with a Graphic Display). If required, adjust voltage with the –12 VDC Adjustment Potentiometer on the Power Supply Board.

Illustration 2-1
Power Supply and HT Controller Board in the Front Panel



The ATP Console CPU Board operates from a 12 VDC Unregulated Supply located in the Generator Cabinet that supplies to a 5 VDC switching regulator located in the ATP Console CPU Board.

The ATP Console CPU Board may be located in the back panel (MOD. 4) of the Generator Cabinet or inside the Control Console.

Turn the generator ON and with a Digital Multimeter measure between:

- J1-2 or J1-8 (12V UNR) with J1-6 or J1-1 (GND) on the ATP Console CPU Board; likewise, TP11 (GND UNR) with TP9 (12V UNR) on the ATP Console CPU Board. Check that the voltage at this point is +12 (±1.5 VDC).

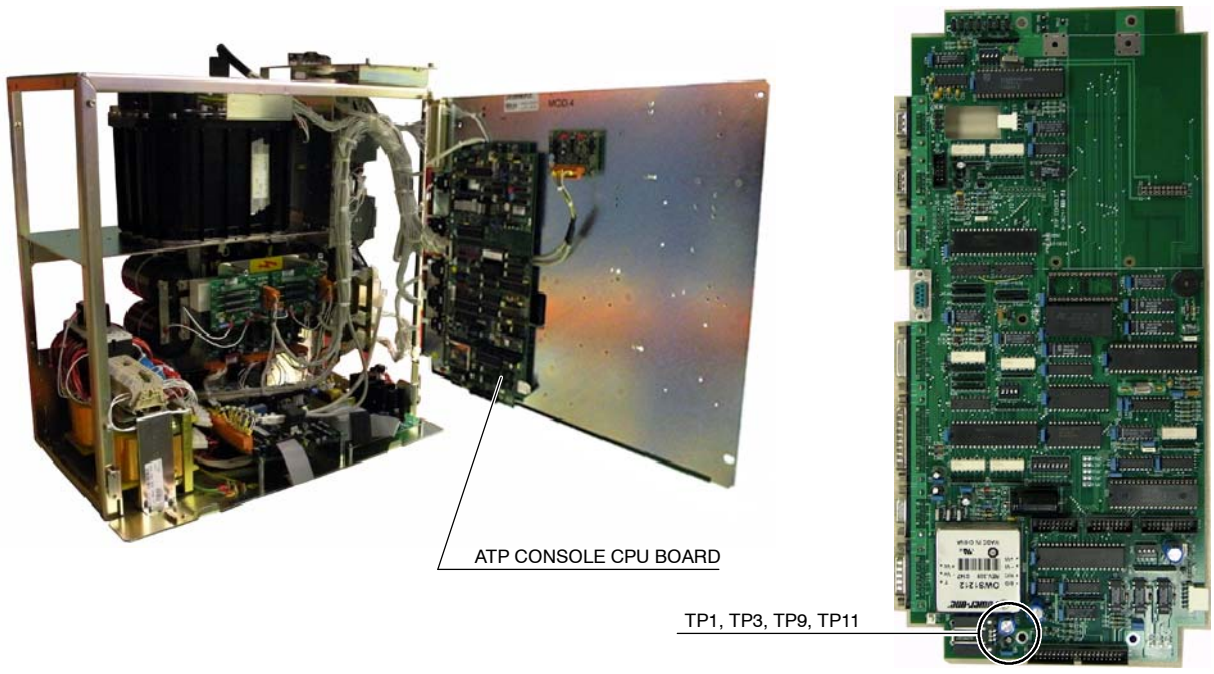
  If the ATP Console CPU Board is not located in the Generator Cabinet (Non Serial Communication), + 12 VDC Unregulated can also be checked at 6J2-2 or 6J2-8 (+12V UNR) and 6J2-1, 6J2-6 or 6J2-7 (GND).

  If the measured voltage is not +12 (±1.5 VDC), check the 12 VDC Unregulated Supply of the generator, that is, between terminals 11 and 12 of the Input Transformer 6T2, Fuse 3F7 (3A, 250 V), Contactor 3K3, Rectifier 3BR4, and Capacitor 3C7. (*Refer to schematic 543020xx*).

- TP1 GND and TP3 +5 V on the ATP Console CPU Board. Check that the voltage at this point is +5 (±0.2 VDC). If not, replace the ATP Console CPU Board.

Note ☞ *No adjustments are required for both voltage measurements.*

Illustration 2-2
ATP Console CPU Board in the Back Panel



2.2 MICROPROCESSORS AND GENERAL OPERATION

The following LEDs indicate the proper operation of each Microprocessor in the Generator:

- The LED DS1 located on the HT Controller Board blinks fast during power up, then slows to a steady blink of about two (2) per second, indicating that the Microprocessor U5 is operating normally.

- The LED DS2 located on the ATP Console CPU Board normally blinks at the same rate as LED DS1 on the HT Controller Board, indicating that communication between both Boards is correct.

- The LED DS1 located on the Fluoro CPU Board only blinks in Fluoro mode indicating that the Fluoro Microprocessor is operating correctly.

Also observe the following LEDs to facilitate general troubleshooting:

- When LED DS1 located on the Interface Control Board is ON (lit), it indicates that the Generator is ON.

- The LED DS1 located on the ATP Console CPU Board is normally ON (lit), indicating that the Watch-Dog Timer of the Console is operating and insuring the correct timing of data communications with the HT Controller Board.

2.3 REPLACEMENT OF MEMORY IN ATP CONSOLE CPU BOARD AND/OR HT CONTROLLER BOARD

Before starting up the system, you have to set ON the switch A3024SW2-3 at the ATP Console CPU Board to enable Service Mode. A few seconds after pressing the ON button on the Console, you will see E10 (this is shown because the EPROM U24 has been replaced).

Reset the error indication by pressing the respective button on the Console and keep it pressed until Error 10 disappears.

After this, the normal start up will take place.

It is recommended to set this switch back to OFF once the installation has been completed, so the operator will not have access to Configuration or Calibration Modes (Service Modes).

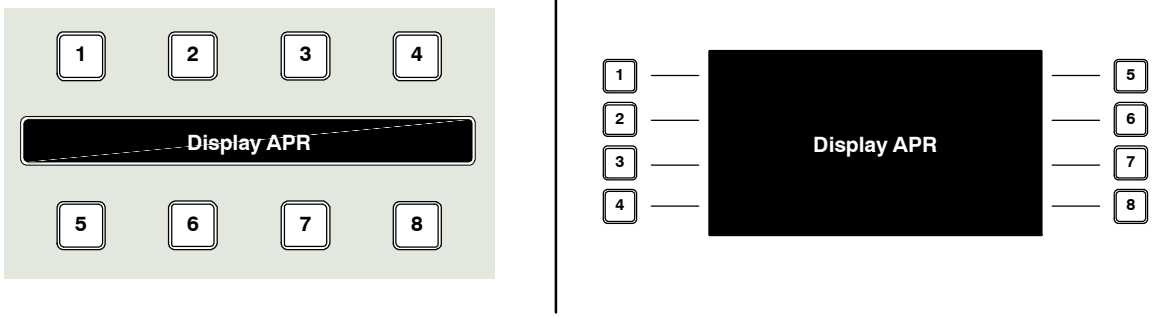
2.4 PROCEDURES RELATED TO THE PUSH-BUTTON CONSOLES

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 Manua*l).

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

Illustration 2-3
APR Module version in Push-buttons Consoles



2.4.2 APR RE-INITIALIZATION

The APR re-initialization makes a new copy of the factory pre-programmed parameters of the APR techniques in the U23-NVRAM of the ATP Console CPU Board.

APR re-initialization sets the APR techniques for the selected workstation.

To re-initialize the APR techniques, exit the APR mode and simultaneously press the push-buttons 5-6-7-8 on the APR module. (*Refer to Illustration 2-3)*.

The APR re-initialization deletes all the APR parameters and related selections previously modified and stored by the operator for both X-ray Tubes.

2.4.3 APR BACKUP

The APR Backup copies parameters and selections of the APR techniques stored in the U23-NVRAM and transfers this information to the U18-E2PROM of the ATP Console CPU Board. This procedure copies all APR techniques stored in the "*APR working file*" and stores them in the "*APR backup file*" .

The APR backup is automatically performed when the equipment is turned OFF/ON, whenever any APR technique has been modified and stored in the U23-NVRAM by the operator.

To backup the APR techniques, exit the APR mode and simultaneously press push-buttons 1-5-6 of the APR module. (*Refer to Illustration 2-3*).

2.4.4 APR RESTORE

The APR Restore copies the parameters and selections of the APR techniques stored in the U18-E2PROM and transfers this information to the U23-NVRAM of the ATP Console CPU Board. This action replaces the data stored in the "*APR working file*" with the data in the "*APR backup file*" for all APR techniques.

The APR Restore is automatically performed when the Console is turned OFF-ON, whenever any problem had been detected during the U23-NVRAM checksum.

To restore the APR techniques, turn the Console ON and with the APR mode OFF press simultaneously the push-buttons 4-7-8 of the APR module. (*Refer to Illustration 2-3*).

2.5 PROCEDURES RELATED TO THE CTSC TOUCH SCREEN CONSOLE

2.5.1 TROUBLESHOOTING 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.

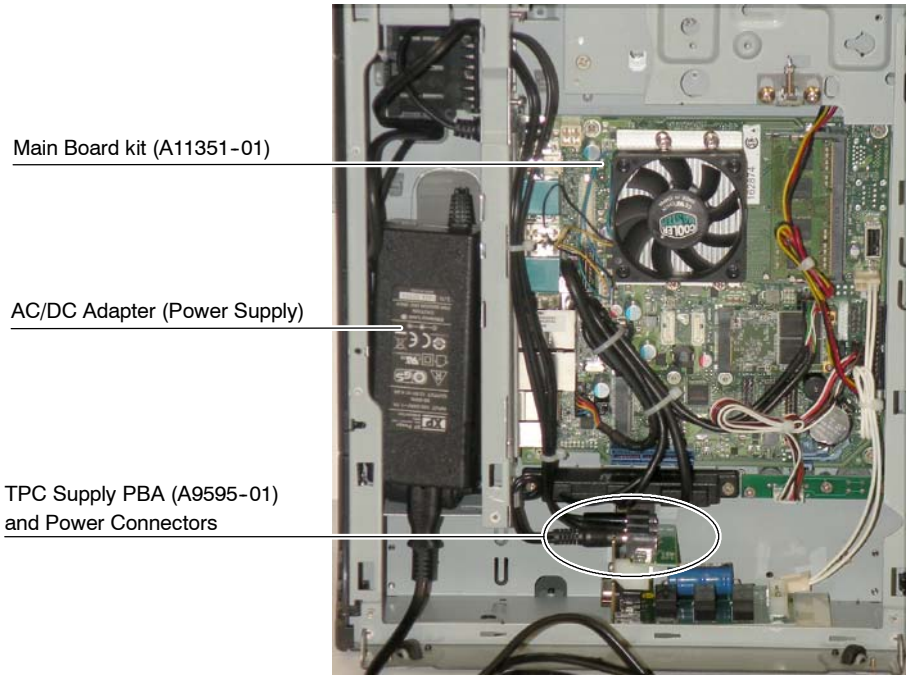
PROBLEM 1: THE CONSOLE AND GENERATOR DO NOT START-UP

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.

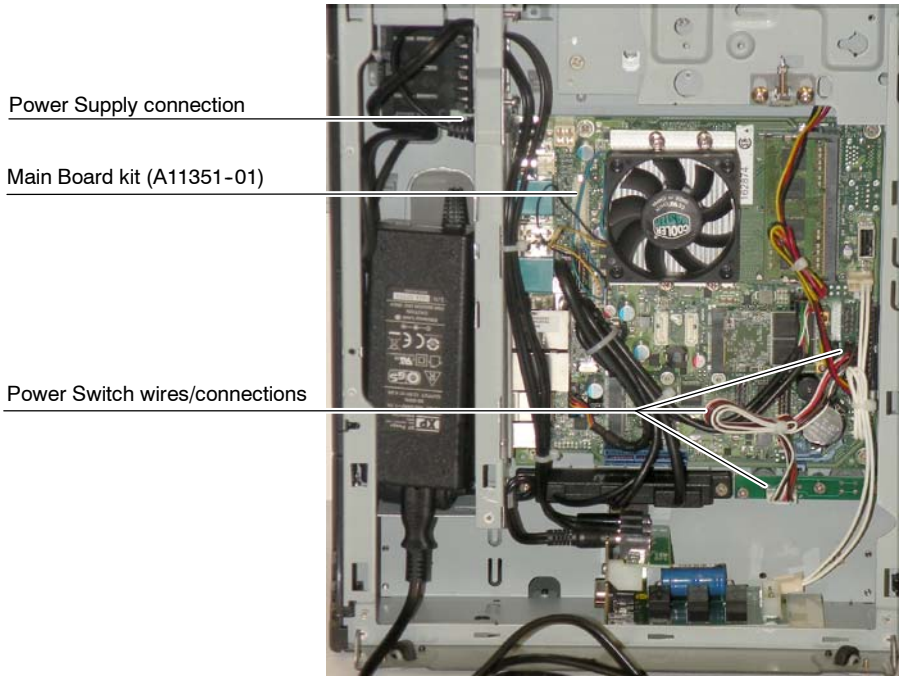
2. Open the back covers of the Console as indicated in the Installation procedure.

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 VDC 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 VDC in all connectors of TPC Supply PBA (A9595-01) and the 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), 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 Control Board (A3009-xx) in SHF Generators or Interface Board (A3674-xx) in SHFR Generators, 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 Generator 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 A3363-xx Cable is correctly connected to CTSC Console and to the PC Interface Box (*refer to the general wiring schematic 54302351*).

5. Check for 12 VDC the J4 connector in Auto ON/OFF Board (A3179-xx). Replace the Main Board (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 the proper connections on the CTSC Main Board (A11351-01), not only on the Main Board Processor and its ventilator but also on the DRAM board. If there is a proper connection, replace the CTSC Main Board Kit (A11351-01).

PROBLEM 4: THERE IS NO IMAGE ON THE SCREEN

Theory:

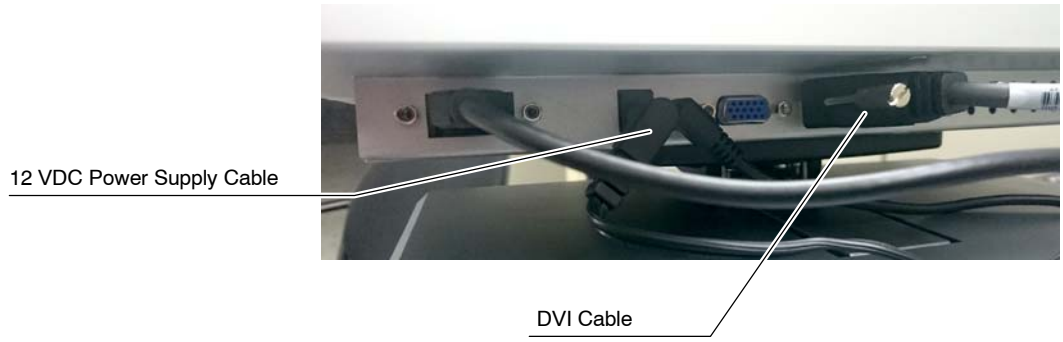
The CTSC Console Monitor is powered by TPC Supply PBA (A9595-01), when the connection is correct the Monitor must be lighted and display the operating software.

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 connections for +12 V 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 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 software necessary 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 Fan Power Supply Cable connection in the Main Board. Check for 12 VDC in the corresponding connector of the Main Board (A11351–01), if it is not present, replaces the Main Board kit (A11351–01).

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 Main Board freezes, first try to restart the Console. If the condition persists, proceed to the next step.

2. Open the CTSC Console, power the Console ON and check 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 problem before attempting service.*

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

1. With the CTSC Console OFF disconnect the USB Cable of the Monitor.

2. Switch ON the CTSC Console and wait until the operating system is running.
3. Connect the USB Cable to the Monitor and check its connections to the Main Board. Verify that now the Touch Screen is working properly.
4. If it does not work properly yet, connect an USB keyboard to the CSTC Console.
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, if not replace the USB Cable or connect it to another USB connector in the Main Board.
7. In both cases if the Monitor does not respond correctly it must be necessary to replace the Monitor.

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 Console. 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 an USB Keyboard at the bottom of the CTSC Console.*

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 storage external 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.

2.6 PROCEDURES RELATED TO THE BATTERY POWERED GENERATORS

HANDLE ALL INTERNAL PARTS OF THE EQUIPMENT WITH CARE, ESPECIALLY PARTS UNDER COVERS. DANGEROUS DC VOLTAGE IS PRESENT IN THE UNIT EVEN IF IT IS UNPLUGGED FROM THE AC LINE.

THE HEAT SINKS ON THE BATTERY CHARGER BOARD ARE NOT ELECTRICALLY ISOLATED. DANGEROUS VOLTAGE IS PRESENT. DO NOT TOUCH OR SHORT THESE HEAT SINKS TO ONE ANOTHER NOR TO ANY OTHER CIRCUIT COMPONENTS.

KEEP IN MIND THE GENERAL CAUTIONS FOR BATTERY POWERED GENERATORS INDICATED IN SECTION 1.2.

ALWAYS USE PROTECTIVE GLOVES TO PREVENT ELECTRIC SHOCK AND SAFETY GLASSES WHEN HANDLING BATTERIES OR BATTERY CHARGERS.

Note ☞

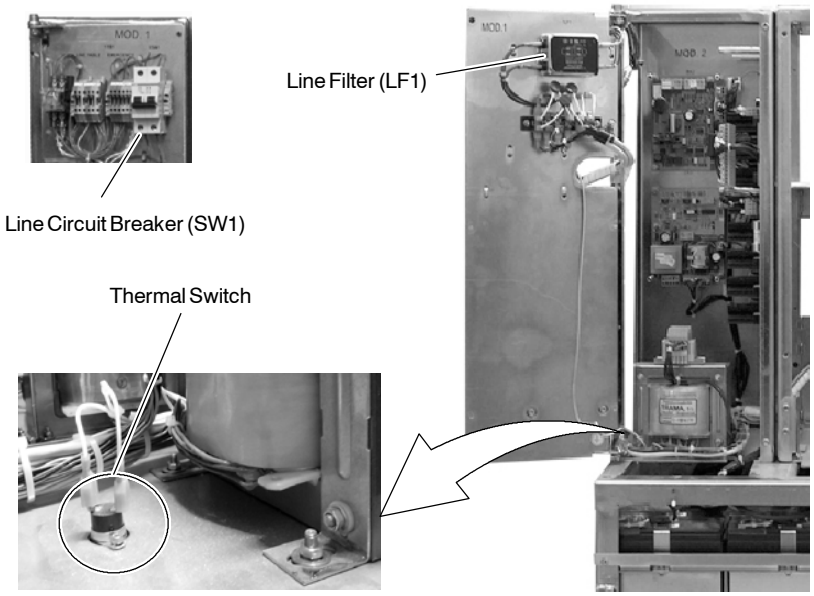
Before performing the following procedure, be sure that the unit has been sufficiently connected to the mains (recommended eight hours) to ensure a complete charging of all the Batteries.

2.6.1 POWER LINE INDICATOR LAMP AND THERMAL SWITCH CHECKING

Check that the external "*Power Line Indicator Lamp*" (LINE) lights when the Generator is connected to the mains, that is in charging mode of the batteries.

Note ☞

If during the Battery charging process, the "Power Line Indicator Lamp" is OFF and a correct voltage is present in the mains, it could mean that the temperature inside the unit has reached 50 ±3ºC (122 ±5.4ºF) due to one or more damaged batteries, and thus the Thermal Switch located at the Battery Charger area (MOD. 2) interrupts the charging process in order to prevent damages in the other batteries. This Lamp can also be turned off due to another failure in the unit.



Note ☞ *Only perform this section if the "Power Line Connection Lamp" is OFF during the Battery charging process, that is the Battery Powered Generator is connected and powered through the mains.*

1. Dismount the Generator Cover placing it near the Generator Cabinet in order to keep connected the "*Power Line Indicator Lamp*".

2. Check that the "*Line Circuit Breaker (Magnetothermic Switch)*" (SW1) is in ON position and voltage mains is present in it. If not, replace the "*Line Circuit Breaker (Magnetothermic Switch)*" (SW1).

3. If the "*Line Circuit Breaker (Magnetothermic Switch)*" (SW1) is correct, turn OFF the "*Line Circuit Breaker (Magnetothermic Switch)*" (SW1) and the power line (mains).

   With the Generator disconnected (not in charging mode), reduce the temperature around the Thermal Switch below 29°C (84.2°F) in order to close the contacts of the Thermal Switch.

4. Set the Generator in charging mode, that is, turn ON the power line and the "*Line Circuit Breaker (Magnetothermic Switch)*" (SW1), then check if the "*Power Line Indicator Lamp*" is ON.

   If the "*Power Line Indicator Lamp*" is OFF, check that the lamp is not burnt or disconnected *(refer to Schematic 543020xx).*

   If the Lamp is correct, check the Thermal Switch and replace it if needed. The Thermal Switch contacts are opened at 50 ± 3°C (122 ± 5.4°F) and the contacts are closed at 35 ± 6°C (95 ± 10.8°F).

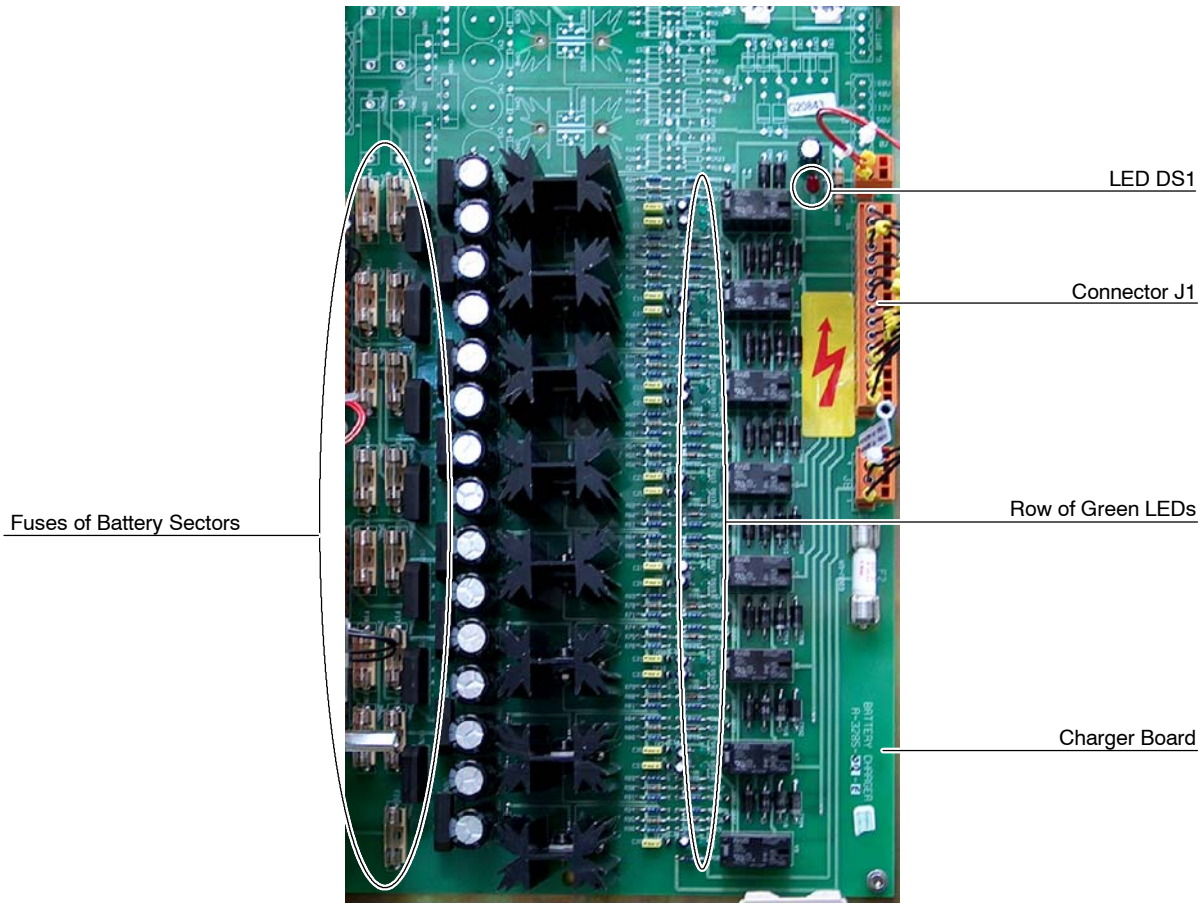
   If the Lamp and Thermal Switch are correct, the problem could be in the Line Filter LF1 *(refer to Schematic 543020xx).*

2.6.2 BATTERY CHARGER TEST

The Battery Charger Board consists of several Battery Chargers or Sectors. Each Sector charges two 12 volt Batteries and has one green LED which is used to provide a visual indication of the Charger and Battery status.

All green LEDs and the LED DS1 on the Battery Charger Board should be lit whenever line power is being supplied. It indicates that the chargers (sectors) are operating correctly. Also the external Power Line Indicator Lamp (green Neon) is On (charging). (*Refer to Illustration 2-4*).

Illustration 2-4
Battery Charger Board



If all of the green LEDs are not lit and the "*Line Present*" external Lamp is off, check that the Input Line Magnetothermic 1SW1 is in the ON position. If it is in the ON position and all of the green LEDs are not lit, check that the Yellow LED DL1 on the Line Monitor Board is blinking. If LED DL1 is not blinking check:

- If the Line Monitor Board is working properly (*refer to Error Code E25 in this document*) and replace it if necessary.
- If one of the Red LEDs DL2 or DL3 on the Line Monitor Board is lighting. It means that the Input Line is too high (DL3) or too Low (DL2).

If the Line Monitor Board is working properly, then check primary and secondary connections on Transformer 2T1. If some green LEDs are lighting and some are not, check secondary connections on Transformer 2T1 and/or circuit operation and fuse of each individual charger that are not lighting.

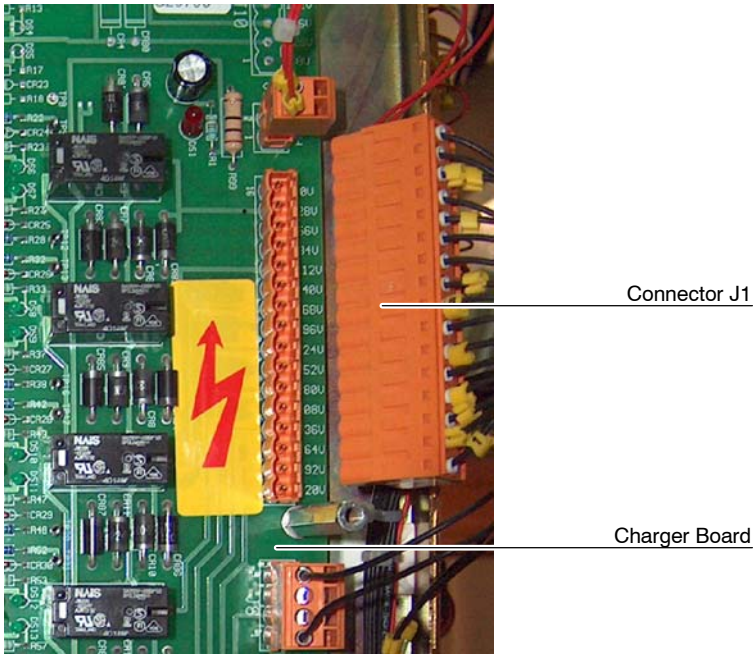
If error "*E25*" is shown on the Console and exposures are inhibited, perform the following procedures:

1. If the green LED of any sector is off, check the respective components and power supply of that sector. If they are defective, replace the Battery Charger Board.

2. Check that the correct voltage is supplied from the Battery Charger Board to charge each Battery pair (one sector).

   a. Turn OFF the Unit by placing the Input Line Magnetothermic 1SW1 in the OFF position.

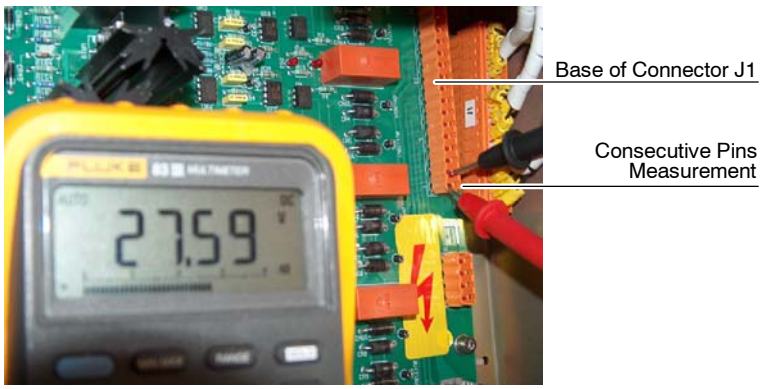
   b. Remove Connector J1 from the Battery Charger Board.



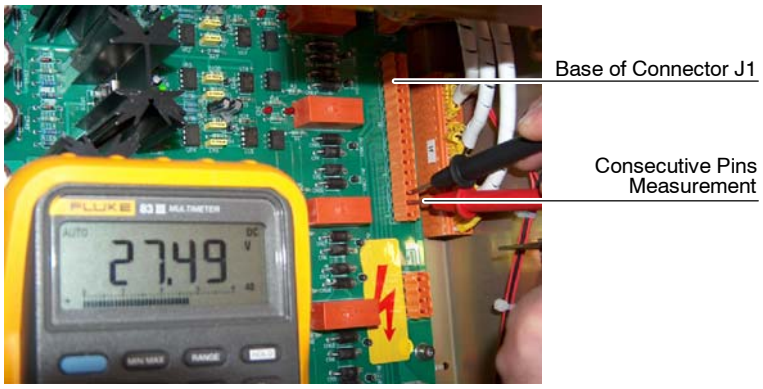
   c. Turn ON the Unit by placing the Input Line Magnetothermic 1SW1 in the ON position.

   d. If any of the green LEDs or the LED DS1 on the Battery Charger Board is not lit, replace the Battery Charger Board.

e. If the LEDs are correctly lit, measure the voltage between consecutive pins of Connector J1 (base). If the voltage between consecutive pins is not 27.5 V, the last charging sector in the board is defective and the Battery Charger Board must be replaced.



Measurement at Pins 1-2



Measurement at Pins 2-3

f. After checking pins, turn OFF the Unit by placing the Input Line Magnetothermic 1SW1 in the OFF position. Replace the Battery Charger Board if necessary and reconnect J1.

g. Turn ON the Unit by placing the Input Line Magnetothermic 1SW1 in the ON position.

3. Batteries status must always be checked as described in *Section 2.6.3 - Identifying and Replacing Defective Batteries*.

2.6.3 IDENTIFYING AND REPLACING DEFECTIVE BATTERIES

Batteries have a finite lifetime and should be replaced to prevent any peripheral damage. Follow the instructions below to determine the state of a Battery.

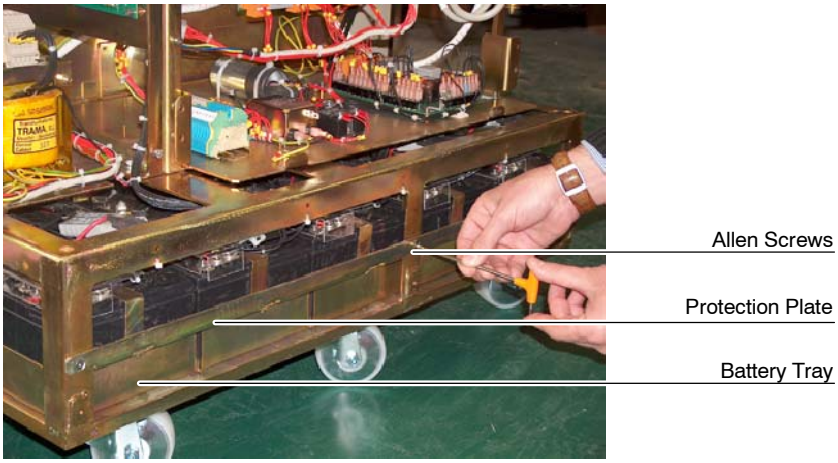
Tools required to determine which Batteries are defective:

- Allen Screwdriver Set (Standard service tool).
- Digital Multimeter.
- Load Resistance of 3 Ohms, > 50 Watts.

Note ☞ *Before performing the following procedure, be sure that the unit has been connected to mains enough time (recommended eight hours) for a full charging of all the Batteries.*

1. Turn OFF the Unit by placing the Input Line Magnetothermic 1SW1 in the OFF position.

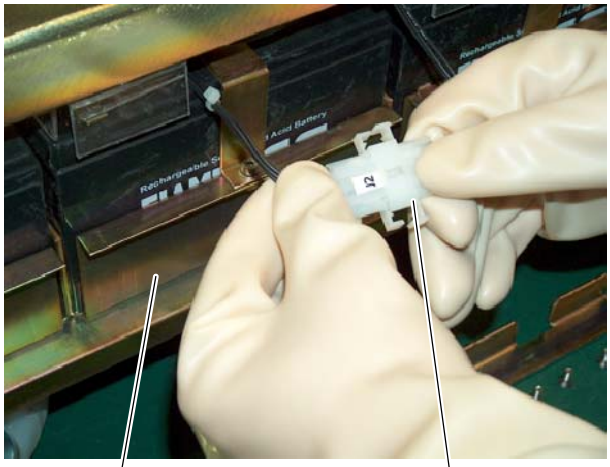
2. Remove the Protection Plate of the Battery Trays (3 Allen screws).

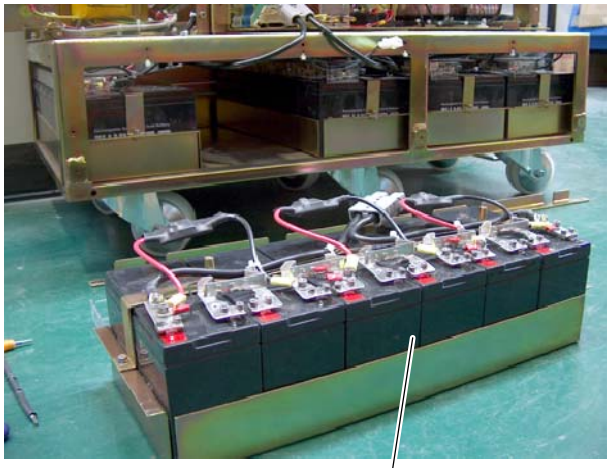


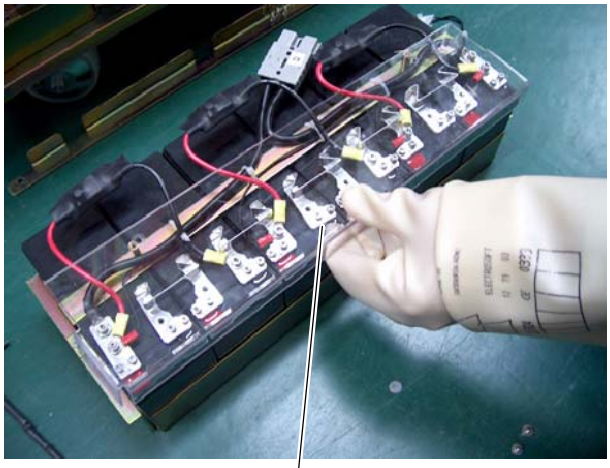
3. Take out the first Battery Tray by first disconnecting the Anderson and Molex Connectors of the Battery Tray. Then remove the Protective Cover of the Battery Tray.

WARNING

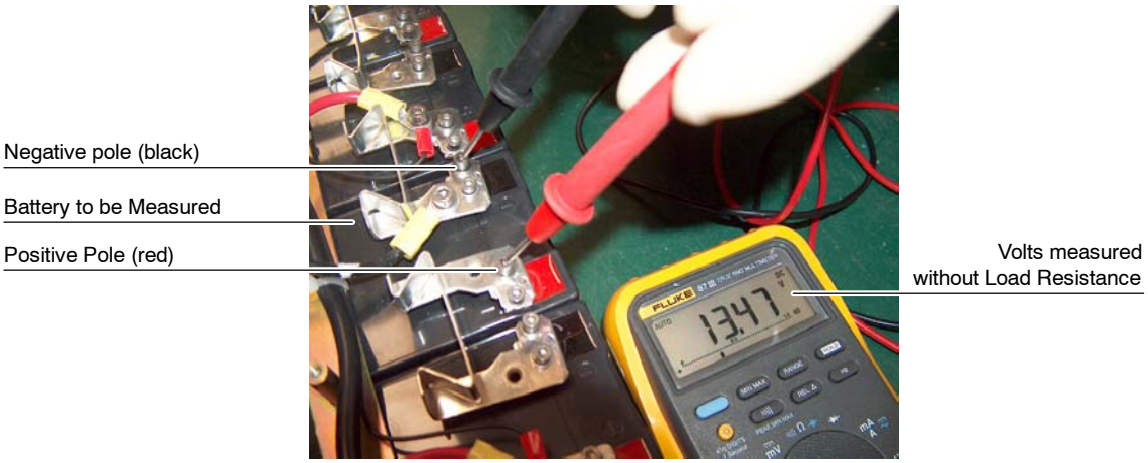
GLOVES WHICH PROTECT AGAINST ELECTRIC SHOCK HAZARDS AND SAFETY GLASSES SHOULD BE WORN WHEN HANDLING BATTERIES DURING SERVICE TASKS.







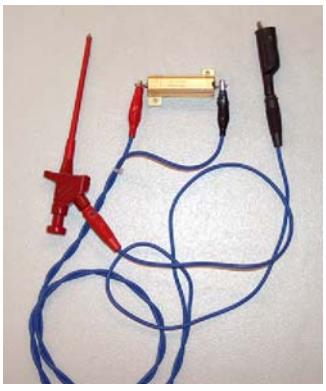
4. Identify the positive and negative poles of the Battery to be measured. Measuring the output voltage of the Battery is not enough to determine the state of the Battery. The image below shows a Battery with a good voltage (Multimeter reads around 12V).
However, this voltage is without a load.



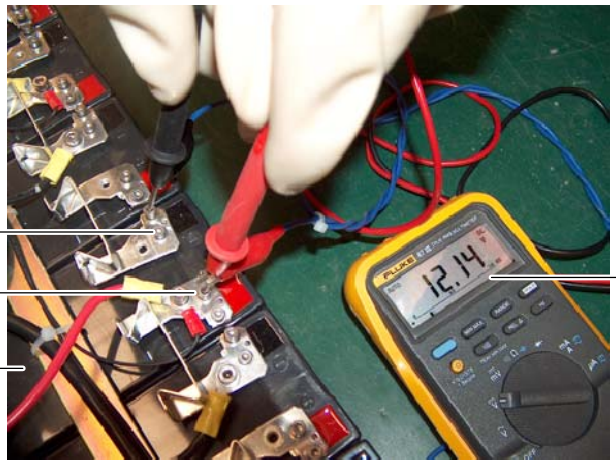
5. Connect the Load Resistance (3 Ohms, > 50 Watts) to the positive and negative Battery poles as shown in the following pictures.

6. Repeat the voltage measurement with the Load Resistance connected. The Battery should be replaced if the voltage with load is less than 10 V (often closer to 0 V), since it will never completely load.

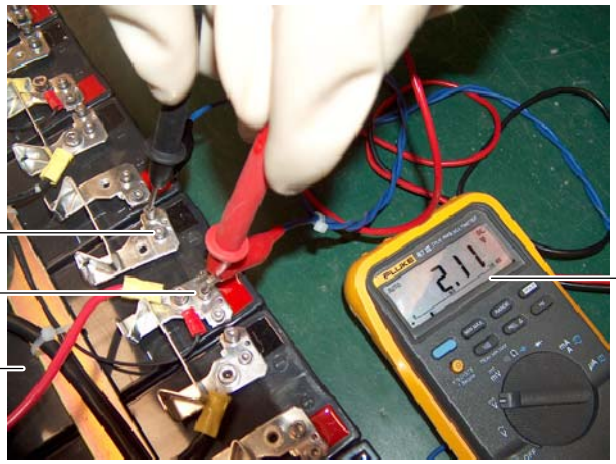
LOAD RESISTANCE BECOMES VERY HOT DURING THE TEST.



Load Resistance



Battery in good condition

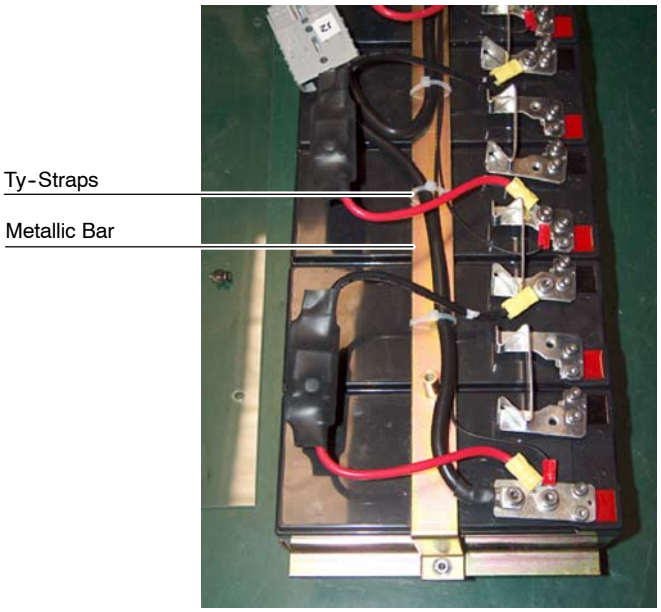


Battery in bad condition

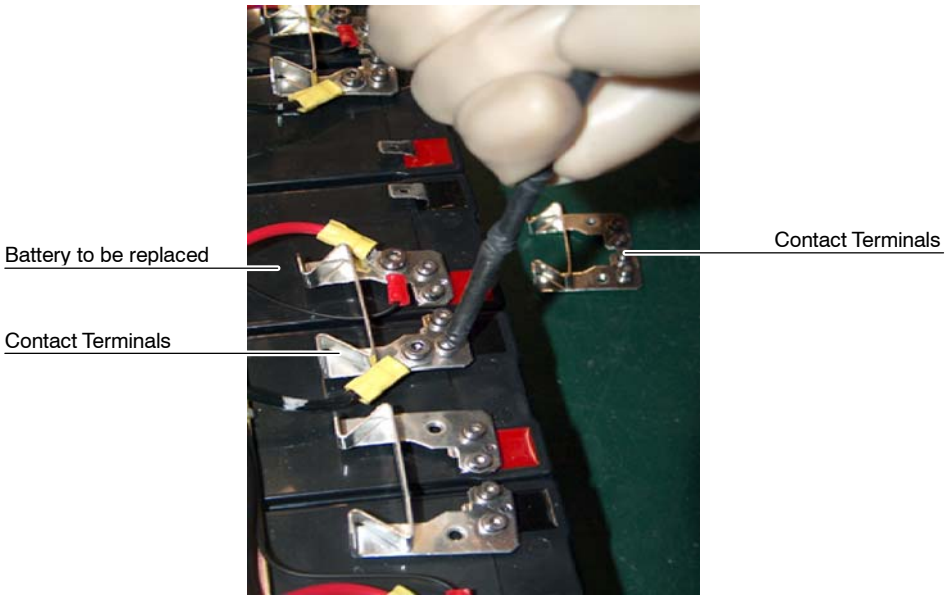
7. All Batteries should be tested, replacing when necessary as shown in the following steps.

8. Exercise **Caution** when handling batteries, avoiding jerks or tugs and unnecessary sudden collisions:

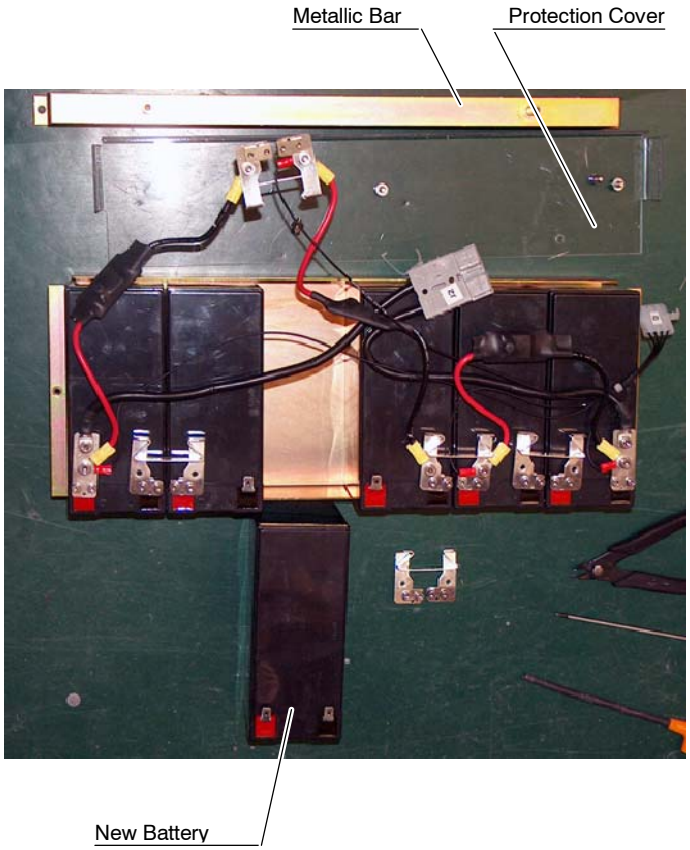
   a. Cut the ty-straps and remove the Metallic Bar on the Battery Tray.



   b. Disconnect the contact terminals (negative and positive poles) using an insulated Allen Screwdriver and remove the Battery.



c. Insert the new Battery and Connect the terminals. Then replace the Metallic Bar and ty-straps. Finally, return the Protective Cover to its position.



Note ☞ *It is recommended to replace the couple of Batteries of the defective sector.*

d. **Carefully** return the Battery Tray to its original position in the cabinet and connect the respective Anderson and Mollex Connectors. Replace the lateral Protective Plate with the three Allen Screws.

2.7 PROCEDURES RELATED TO THE CAPACITOR ASSISTED GENERATORS

HANDLE ALL INTERNAL PARTS OF THE EQUIPMENT WITH CARE, ESPECIALLY PARTS UNDER COVERS. DANGEROUS DC VOLTAGE IS PRESENT IN THE UNIT EVEN IF IT IS UNPLUGGED FROM THE AC LINE.

NEVER TOUCH METAL PARTS UNDER COVERS BEFORE TESTING THAT VOLTAGE IS BELOW 10 VDC. PERFORM CAPACITOR DISCHARGING AND VOLTAGE TESTING PROCEDURES PREVIOUS TO MANIPULATING INSIDE THE GENERATOR FOR SERVICE.

ACKNOWLEDGE GENERAL CAUTIONS FOR CAPACITOR ASSISTED GENERATORS INDICATED IN SECTION 1.2.

2.7.1 PROCEDURE FOR STORAGE CAPACITORS DISCHARGING AND VOLTAGE TESTING

1. First turn the Generator OFF and isolate the Power Supply Cable from the Mains socket.

2. Remove the Generator cover.

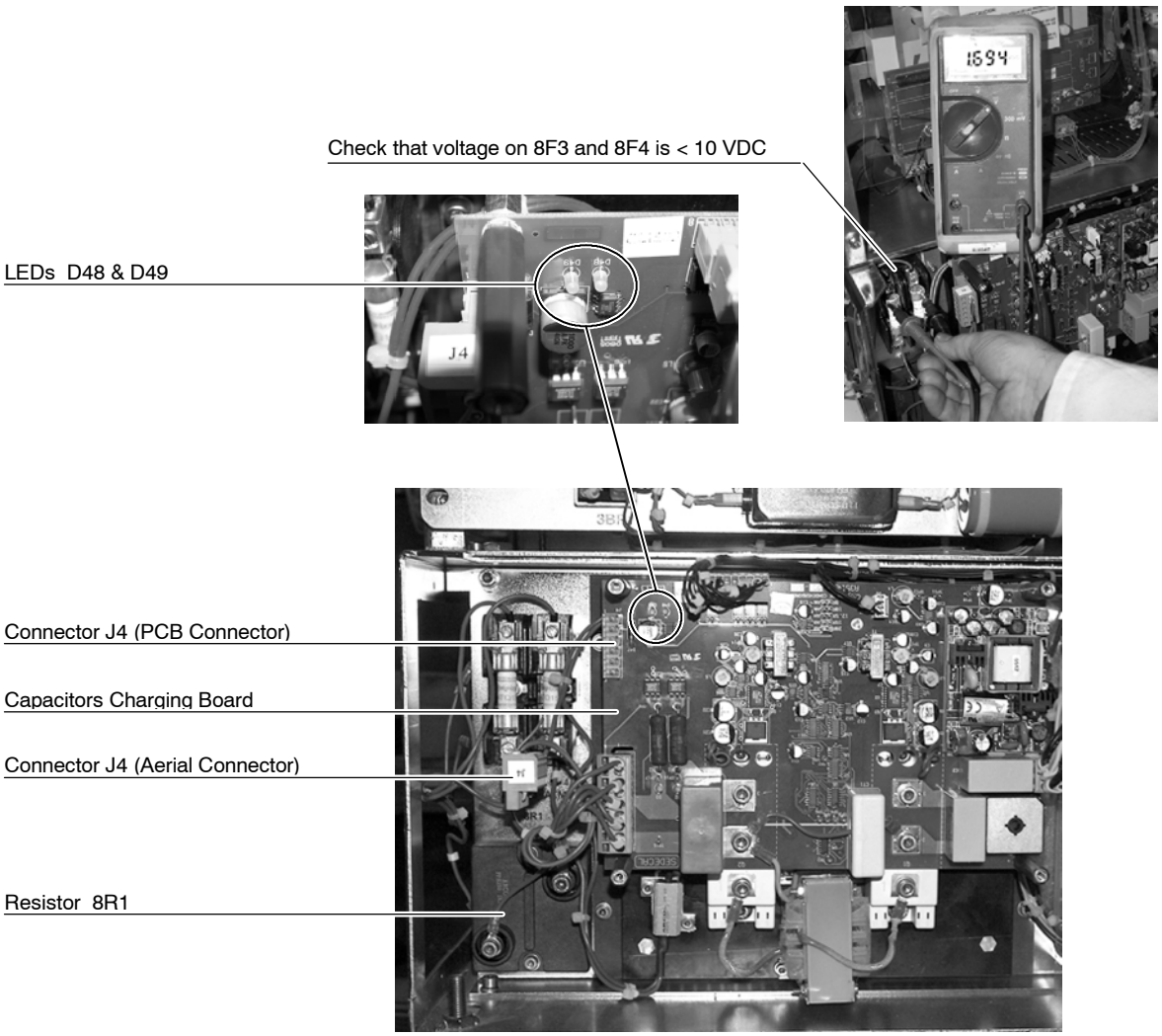
3. Carefully remove the Protection Cover over the Capacitor Charger Board (A3517-xx). **DO NOT TOUCH ANY METAL PART UNDER COVERS UNTIL AFTER THE CAPACITORS ARE FULLY DISCHARGED.**

4. Resistor 8R1 (1K5 ohms, 250 W) facilitates Capacitor discharging. Connector J4 (from this resistor) must be disconnected for normal operation of the Unit and MUST ONLY BE CONNECTED to J4 of the Capacitor Charger Board to perform Capacitor Discharging processes.

5. Plug Connector J4 into the Capacitor Charging Board. Check that LEDs D48 and D49 of this Board are blinking. When the Capacitors are fully discharged, both LEDs will be OFF. Capacitors will be discharged from 800 VDC (fully charged) to 10 VDC in approximately 5 minutes.

6. Check that the voltage stored in Capacitors is < 10 VDC (maximum voltage for a safe service manipulation). It is recommended that voltage will be close to 0 VDC. For that, check that LEDs D48 and D49 are OFF, and then measure the voltage at the base of Fuses 8F3 and 8F4.

Illustration 2-5
Connection of J4 for Capacitor Discharging



DANGER!

DO NOT MANIPULATE INTERIOR PARTS WITHOUT HAVING FIRST CHECKED THAT THE CAPACITORS MODULE HAS BEEN DISCHARGED (LESS THAN 10 VDC).

Note ☞

Storage Capacitors are fully charged four seconds after turning the Generator ON for a line of 230 VAC with selection of 20 A in the Generator; up to a maximum of 40 seconds for a line of 110 VAC with selection of 8 A in the Generator.

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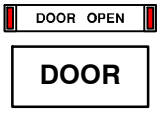
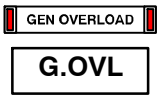
SECTION 3 SELF-DIAGNOSIS INDICATORS

Some Consoles are provided with Self-Diagnosis indicators that identify a malfunctions in the system, alerting the operator about any error existence that may inhibit exposure. 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).

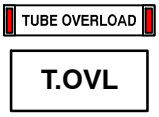


DOOR OPEN: Indicates the X-ray room door is open when the X-ray equipment is in use. (*Also refer to Error Code "E35"*).



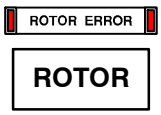
GENERATOR OVERLOAD: Indicates that the exposure has been interrupted during exposure due to an arcing or malfunction in the HV circuitry (X-ray Tube, HV Transformer and/or HV Cables) or a failure of IGBT module (overheated or defective IGBTs) has been detected. (*Also refer to Error Code "E09"*).

Generator Overload may also appear when attempting a high power and lengthy exposure with the X-ray Tube not sufficiently warmed-up.

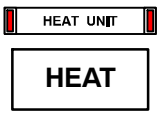


TUBE OVERLOAD: Indicates that either the technique selected is beyond the X-ray tube ratings or the present conditions of the X-ray tube inhibit the exposure (anode overheated). Parameters for next exposure may be temporally limited by the Generator (change the exposure values or wait for the X-ray tube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

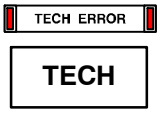
Check that available heat units are lower than calculated for the next exposure. Reduce exposure factors or wait for the X-ray tube to cool.



ROTOR ERROR: Indicates that the X-ray tube anode is not rotating while "*Prep*" is active, then exposures are inhibited. (*Also refer to Error Code "E18"*).



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"*).



TECHNIQUE ERROR: If it activates during exposure it means that:

The exposure has been interrupted by the "Security Timer" because of a system failure. Call Field Service. (Also refer to Error Code "E34").

This error can also be shown:

- after an APR technique selection to advise that exposure parameters displayed on the Console are not the values stored for this APR technique. Exposure parameters are adapted by the Generator. (R*efer to Error Code "E34"*).
- after the "*ABC*" selection, when ABC is not enabled. (*Also refer to Error Code "E34"*).
- in Capacitor Assisted Generators during parameter selection meaning that the selected technique requires a capacity that is not available.
- if a failure on the Automatic Collimator has been detected (blades are fully open or in movement during exposure, etc.). In this case the indicator light is constantly lit (not blinking). (*Also refer to Error Code "E48"*).

SECTION 4 ERROR CODES

ERROR CODE LIST	
ERROR CODE	**DESCRIPTION**
" - - - - - - "	System failure.
E01	Failure in power up routine. No communication link between HT Controller Board and ATP Console CPU Board.
E02	Failure in power up routine. RAD Generator configured as R&F Generator. No communication link between ATP Console CPU Board and Fluoro CPU Board.
E03	Failure in power up routine. Workstations are not configured.
E04	"*Prep*" signal received without Console order.
E05	"*Fluoro*" signal active without request.
E06	"*Prep*" and/or "*Exposure*" orders activated during power-up routine.
E07	Wrong data for X-ray Tube-2.
E08	Wrong data for X-ray Tube-1.
E09	Generator overload. Arcing or IGBT fault.
E10	EEPROM corrupted or not initialized on ATP Console CPU Board or on HT Controller Board. Wrong data calibration.
E11	No voltage in the Main Storage Capacitors of the Generator (Inverter Module).
E12	No mA during exposure or mA out of tolerance. Wrong filament current.
E13	No kVp during exposure, kVp out of tolerance (±33%) or insufficient time parameters during AEC operation. For Capacitor Assisted Generators, this can also be due to an incorrect Generator configuration.
E14	Exposure signal without X-ray Exposure Console command.
E15	Filament Driver Circuit Open, No current on Filament. Wrong selection of Focal Spot detected during "*Prep*".
E16	Invalid value of : kVp, mA or kW.
E17	Communication error among ATP Console, CPU Board and HT Controller Board.
E18	Rotor error or Rotor running without order (only with Low Speed Starter).
E19	mA detected without "*Exp*" command.
E20	kVp detected without *"Exp"* command.
E21	Wrong Tube-1 selection.
E22	Wrong Tube-2 selection.
E23	Calibration data not stored
E24	Bucky Movement Signal has not been detected or DR Device is not ready for exposure.
E25	Battery failure in Battery Powered Generators.
E26	Voltage failure in Battery Powered Generators with Stand-Alone.
E27	Failure in EPROM U24 of the ATP Console CPU Board. Bad checksum.

ERROR CODE LIST	
ERROR CODE	**DESCRIPTION**
E29	“ALL CLEAR” signal not activated.
E30	Relay K1 not active.
E31	Long exposition is not initiated.
E32	Long exposition is not cut (after 3.2 seconds) as relay K3 was not detected.
E33	No communication link between the Generator and the Operator Console or PC Unit.
E34	Technique error.
E35	Door Open. For Generators with HV Transformer equipped with a Security Pressure Switch, the HV Transformer surpasses the maximum internal pressure capacity.
E36	Safety Thermostat Open. Overheating.
E37	Tube Overload.
E41	Dosimeter failure. Communication failure between Tube-1 Dosimeter and Generator.
E42	Dosimeter failure. Autotest error on Tube-1 Dosimeter.
E43	Dosimeter failure. Tube-1 DAP Ion Chamber status check error.
E44	Dosimeter failure. Communication failure between Tube-2 Dosimeter and Generator.
E45	Dosimeter failure. Autotest error on Tube-2 Dosimeter.
E46	Dosimeter failure. Tube-2 DAP Ion Chamber status check error.
E47	Capacitors not charged when “PREP” is activated.
E48	Collimator Error.
E49	Exposure Cycle Error.
E50	Interrupted Exposure.
E51	LV-DRAC: Checksum failure or Microcontroller U17 corrupted in Control DRAC Board.
E52	LV-DRAC: Microcontroller RAM failure.
E53	LV-DRAC: Insufficient DC BUS voltage at low level voltage (220 VAC).
E54	LV-DRAC: Insufficient DC BUS voltage at high level voltage (400 / 480 VAC).
E55	LV-DRAC: Excessive DC BUS voltage at 480 VAC.
E58	LV-DRAC: Excessive current in the main winding during acceleration up to 3300 RPM
E59	LV-DRAC: Excessive current in the auxiliary winding during acceleration up to 3300 RPM
E60	LV-DRAC: Insufficient current in the auxiliary winding during acceleration up to 3300 RPM
E61	LV-DRAC: Insufficient current in the main winding during acceleration up to 3300 RPM
E62	LV-DRAC: Excessive current in the main winding during acceleration up to 10000 RPM
E63	LV-DRAC: Excessive current in the auxiliary winding during acceleration up to 10000 RPM
E64	LV-DRAC: Insufficient current in the auxiliary winding during acceleration up to 10000 RPM
E65	LV-DRAC: Insufficient current in the main winding during acceleration up to 10000 RPM

ERROR CODE LIST	
ERROR CODE	**DESCRIPTION**
E66	LV-DRAC: Excessive current in the main winding running at 3300 RPM
E67	LV-DRAC: Excessive current in the auxiliary winding running at 3300 RPM
E68	LV-DRAC: Insufficient current in the auxiliary winding running at 3300 RPM
E69	LV-DRAC: Insufficient current in the main winding running at 3300 RPM
E70	LV-DRAC: Excessive current in the main winding running at 10000 RPM
E71	LV-DRAC: Excessive current in the auxiliary winding running at 10000 RPM
E72	LV-DRAC: Insufficient current in the auxiliary winding running at 10000 RPM
E73	LV-DRAC: Insufficient current in the main winding running at 10000 RPM
E74	LV-DRAC: Excessive current in the main winding braking at 3300 RPM
E75	LV-DRAC: Excessive current in the auxiliary winding braking at 3300 RPM
E76	LV-DRAC: Insufficient current in the auxiliary winding braking at 3300 RPM
E77	LV-DRAC: Insufficient current in the main winding braking at 3300 RPM
E78	LV-DRAC: Excessive current in the main winding braking at 10000 RPM
E79	LV-DRAC: Excessive current in the auxiliary winding braking at 10000 RPM
E80	LV-DRAC: Insufficient current in the auxiliary winding braking at 10000 RPM
E81	LV-DRAC: Insufficient current in the main winding braking at 10000 RPM
E82	LV-DRAC: Wrong X-ray Tube selection.
E83	LV-DRAC: Excessive current in DC Brake.
E87	LV-DRAC: Insufficient current in common wire during acceleration up to 3300 RPM
E88	LV-DRAC: Insufficient current in common wire running at 3300 RPM.
E89	LV-DRAC: Insufficient current in common wire during acceleration up to 10000 RPM.
E90	LV-DRAC: Insufficient current in common wire running at 10000 RPM.
E91	LV-DRAC: Incorrect signal measure in IPRINC (CH2).
E92	LV-DRAC: Incorrect signal measure in IAUX (CH3).
E93	LV-DRAC: Incorrect signal measure in ICOM (CH4).
E95	Rapid Termination
E96	No power supply at the Capacitor Charger Board (A3517-02).
E97	Voltage in capacitors not balanced.
E98	DIP Switch 3024SW2-3 on ATP Console Board set for Configuration and Calibration Mode Active.
EL0	Operator safety alert: more than one Workstation Interlock are active at the same time.
EL1	Operator safety alert: X-ray Tube orientation is incorrect for the selected Workstation. EL1 configured for Alignment Interlock-1 (usually the Table).
EL2	Operator safety alert: X-ray Tube orientation is incorrect for the selected Workstation. EL2 configured for Alignment Interlock-2 (usually the Wall Stand).

ERROR CODE : "- - - - - -" - SYSTEM FAILURE

DESCRIPTION : System failure.

ERROR TYPE : Fatal error. Generator must be switched off.

APPLICABLE TO : All Generators

APPEARS WHEN : This indication may appear at any time together with another Error Code on the Console.

INFORMATION / SYMPTOM : This Error Code requires the Generator to be turned OFF/ON before it can be fixed.

ACTIONS

1. Turn the Generator OFF, wait a few seconds, and turn it ON.

ERROR CODE : E01

DESCRIPTION : Failure in power up routine.
No communication link between HT Controller Board and ATP Console CPU Board.

ERROR TYPE : Fatal error. Generator can not continue with power up.

APPLICABLE TO : All Generators

APPEARS WHEN : Only during initialization phase. If it appears during normal functioning of equipment, it means that a problem has caused a power off in the unit.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

POSSIBLE CAUSES

Dipswitch 3000SW2-1 is in “ON” position at the HT Controller Board.

It has not been possible to establish a correct communication link between the ATP Console CPU Board and the HT Controller Board during power ON.

The communication link between the ATP Console Board and the HT Controller Board is not reliable.

The Microprocessor U5 on the HT Controller Board has not started-up.

The Generator has been affected by a loss of the main power.

Faulty DC power supply.

ACTIONS

1. With the Generator switched OFF, check that Dipswitch 3000SW2-1 is in “OFF” position at the HT Controller Board.

   This switch is set in “ON” position only for programming the Rotor Acceleration Time, Rad Filament Setting Time, Fluoro Rotor and Filament Hold-over Time, therefore it changes the functions of Switches SW2-2 and SW2-4 to SW2-8. For normal operation it must set in “OFF” position.

2. Turn OFF/ON the Generator to verify that the initialization procedure has been established correctly. Check that connections of the ATP Console CPU Board and HT Controller Board are secure.

3. If the error appears just after EPROM U24 on the ATP Console Board (A3024-xx) or Microprocessor U5 on the HT Controller Board (A3000-xx) have been replaced or updated, then check the software version compatibility. If necessary, replace or update again .

4. Visually check the performance of DS1 on the HT Controller Board during start-up.
   - If DS1 *remains illuminated* (not blinking), replace the HT Controller Board (A3000-xx).
   - If DS1 *blinks*, go to step-6.
   - If DS1 *remains OFF*, go to step-5.

5. The DC supply may be faulty either at the source or at the Boards themselves.
   - On the HT Controller Board, check for DC at TP3 (+12V), TP4 (-12V) and TP2 (+5V) with GND connection at either TP1, TP9 & TP10.
   - On the ATP Console Board, measure between TP9 (+12V UNREG) with TP11 (GND UNREG); TP10 (+12V ISO), TP3 (+5V), TP7 (+12V) and TP8 (-12V) with TP1 (GND).
     - If DC supply is *not present*, there might be a faulty fuse: shutdown the Generator and test Fuse 3F9 on the Generator with an Multimeter (replacing if necessary). Fuse 3F9 is located below the Power Supply 3PS1 in the Generator Front Panel.
     - If DC supply *is present* (or error persists with correct DC), proceed to the next step.

6. Check continuity between J3 terminals 2, 3, 5 and 6 on the ATP Console CPU Board with P1 terminals 4, 11, 5 and 10 on the HT Controller Board respectively. Connector 6J3 terminals 2, 3, 5 and 6 on the Generator should also be checked. Repair or replace if necessary.

   If there is continuity in these connections, proceed to the next step.

7. Verify with an oscilloscope the signal presence (pulses) for C-HT CLK (J3-5) and C-HT DAT (J3-2) from the ATP Console Board to the HT Controller Board (P1-5 and P1-4 respectively).
   - If any signal is *not present*, replace the ATP Console CPU Board.
   - If the signals *are present*, proceed to the next step.

8. Verify with an oscilloscope the signal presence (pulses) for HT-C CLK (P1-10) and HT-C DAT (P1-11) from the HT Controller Board to the ATP Console CPU Board (J3-6 and J3-3 respectively). If any signal is not present, replace the HT Controller Board. If the problem persists, replace Microprocessor U5 on the HT Controller Board.

ERROR CODE : E02

DESCRIPTION : Failure in power up routine. RAD Generator configured as R&F Generator.
No communication link between ATP Console CPU Board and Fluoro CPU Board.

ERROR TYPE : Fatal error. Generator can not continue with power up.

APPLICABLE TO : R&F Generators or Generators configured by mistake as R&F.

APPEARS WHEN : Only during initialization phase. If it appears during normal functioning of equipment, it means that a problem has caused a power-off in the unit.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

An incorrect or corrupt communication link occurred between the ATP Console and the Fluoro CPU Boards during power ON and the Generator is not able to make exposures.

POSSIBLE CAUSES

A RAD Generator has been configured by mistake as a R&F Generator. See Configuration Section.

The communication link between ATP Console CPU Board and Fluoro CPU Board is not reliable.

The Fluoro CPU Board does not work properly.

The Microprocessor U9 on the Fluoro CPU Board did not start-up.

An incorrect communication between the ATP Console and Fluoro CPU Board has been established during power ON.

After changing the ATP Console CPU Board or U18 / U23. The error is removed by entering and then exiting from Workstation configuration.

ACTIONS

1. Turn OFF/ON the Generator to verify that the initialization procedure has been established correctly. Check that connections of the ATP Console CPU Board and Fluoro CPU Board are secure.

2. If the error appears just after EPROM U24 on the ATP Console Board (A3024-xx) or Microprocessor U9 on the Fluoro CPU Board (A3213-xx) have been replaced or updated, then check the software version compatibility. If necessary, replace or update again .

3. Visually check the performance of DS1 on the Fluoro CPU Board during startup.
   - If DS1 *remains illuminated* (not blinking), replace Microcontroller U9 on the Fluoro CPU Board.
   - If DS1 *blinks*, go to step-6.
   - If DS1 *remains OFF*, go to step-5.

4. The DC supply may be faulty either at the source or at the Boards themselves. On the Fluoro CPU Board, check for DC at TP5 (+12V), TP3 (+5V) with GND connection at TP4. If DC supply *is present* (or error persists with correct DC), proceed to the next step.

5. Check continuity between J4 terminals 1, 7, 3 and 4 on the ATP Console CPU Board with J4 terminals 1, 4, 5 and 7 on the Fluoro CPU Board respectively. Repair or replace if necessary.

   If there is continuity in these connections, proceed to the next step.

6. Verify signal presence for C-FL CLK (J4-7) and C-FL DAT (J4-1) from the ATP Console CPU Board to the Fluoro CPU Board (J4-4 & J4-1 respectively).
   - If any signal is *not present*, replace the ATP Console CPU Board.
   - If the signals *are present*, proceed to the next step.

7. Verify signal presence for FL-C CLK (J4-7) and FL-C DAT (J4-5) from the Fluoro CPU Board to the ATP Console CPU Board (J4-4 and J4-3 respectively). If any signal is not present, replace the Fluoro CPU Board . If the problem persists, replace Microcontroller U9 on the Fluoro CPU Board.

ERROR CODE : E03

DESCRIPTION : Failure in power up routine. Workstations are not configured.

ERROR TYPE : Fatal error. Generator can not continue with power up.

APPLICABLE TO : All Generators.

APPEARS WHEN : Only during initialization phase. If it appears during normal functioning of equipment, it means that a problem has caused a power off in the unit.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

It has not been possible to establish a correct communication link between the ATP Console CPU Board and the HT Controller Board during power ON and the Generator is not able to make Exposures.

POSSIBLE CAUSES

All workstations have been configured as Tube = 0.

The EEPROM (U18) on the ATP Console CPU Board is defective.

ACTIONS

1. Configure workstations according to the Service Manual.

2. If not fixed after the previous steps, replace the ATP Console CPU Board and configure workstations again.

ERROR CODE : E04

DESCRIPTION : "*Prep*" signal received without Console order.

ERROR TYPE : Fatal error. Generator re-start automatically once error is solved.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment once initialization phase is over.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

An incorrect or corrupt communication link has been established between the ATP Console CPU Board and the HT Controller Board.

POSSIBLE CAUSES

The Generator receives the *"Prep"* signal without a Console command.

ACTIONS

1. Check continuity between P1-3 on HT Controller Board and J3-4 on ATP Console CPU Board. Check with special care connector 6J3 of the Generator (6J3-4 of the Generator connects with P2-3 on the HT Control Board).

2. If all is correct, check signal from P1-3 to U5 on HT Controller Board.

3. If the signal is OK, replace the HT Controller Board .

ERROR CODE : E05

DESCRIPTION : "*Fluoro*" signal active without request.

ERROR TYPE : Fatal error. Generator cannot continue with Power up.

APPLICABLE TO : R&F Generators or Generators configured by mistake as R&F.

APPEARS WHEN : Only during initialization phase.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

POSSIBLE CAUSES

The Generator receives the "*Fluoro*" signal without a Console command.

"Exp" has been pressed in a Workstation not configured for standard R&F.

An incorrect or corrupt communication link has been established between the ATP Console CPU Board and the Fluoro CPU Board during power ON and the Generator is not able to make exposures.

Absence of 24 VDC in the Power Cabinet due to a blown fuse (3F6 in the Front Panel)

ACTIONS

1. Check for an accidental press on the Fluoro pedal.
2. Ensure that there is 24 V between 3TS1-17 and GND. If not present, Check Fuse 3F6 and replace if necessary. If 24 VDC is present, proceed to the next step.
3. Measure the Voltage (DC) between the Anode of Diode CR13 on the ATP Console CPU Board and GND. If the measurement is exactly 4.3 VDC: change the ATP Console. If the Voltage is appreciably different from 4.3 VDC, disconnect Connector J2 from the ATP Console CPU Board and go to the next step.
4. Restart the equipment. If the error disappears, check for a short circuit between J2-17 (-FL EXP) and other signals on the cable, repairing or replacing as necessary (*see diagram 54301045 in the Installation chapter in the Service Manual*). This signal may also be present at 3TS1-37 and 6J1-7 as well as J4-16 of the Control DRAC for systems with High Speed Starters (*see Block Diagram Schematic 543020xx in the Service Manual for the -Fl EXP signal)*. If the error persists, reconnect J2 to the ATP Console CPU Board and proceed to the next step.
5. Remove Jumper W2 from the Fluoro CPU and restart the equipment. If the error persists, check for a short circuit in the flat cable that unites the Fluoro CPU with the ATP Console CPU Board. If the error disappears, put Jumper W2 back to its original position and proceed to the next step.
6. Disconnect J1 from the Fluoro CPU and restart the equipment. If the error persists, Change the Fluoro CPU. If the error disappears, reconnect J1 to the Fluoro CPU and go to the next step.
7. Disconnect J1 from the R/F Adaptation Board and restart the equipment. If the error persists, check for a short circuit in the cable between the Fluoro CPU and the R/F Adaptation Board. If the error disappears, reconnect J1 to the R/F Adaptation Board and proceed to the next step.
8. Disconnect TB4 and TB1 from the R/F Adaptation Board and restart the equipment, if the error persists, change the R/F Adaptation Board. If the error disappears, check for activity which may have produced the signal coming from either the R/F system or the Footswitch itself, repairing or replacing as necessary.

Note ☞ *If the system does not have an R/F Adaptation Board, refer to the schematics of the Boards which correspond to its functionalities.*

ERROR CODE : E06

DESCRIPTION : "*Prep*" and/or "*Exposure*" orders activated during power-up routine.

ERROR TYPE : Informative.

APPLICABLE TO : All Generators

APPEARS WHEN : At any moment once initialization phase is over.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

POSSIBLE CAUSES

The Generator has detected "*Prep*" or "*Exposure*" signals during initialization.

ACTIONS

1. In Generators equipped with *"Prep"* and *"Exposure"* keys on the Console, check that no object has accidentally activated the function. Also check for possible damages on keys. Check for damages on flat cables to connector J9 on the ATP Console CPU Board.

2. In Generators with external Handswitch, check contacts, cable and connectors.

3. If the error persists, check for continuity between TS1-37 and J2-17 on the ATP Console CPU Board and TS1-36 and J2-4 also on the ATP Console CPU Board.

4. If the error persists, replace the ATP Console CPU Board.

ERROR CODE : E07

DESCRIPTION : Wrong data for X-ray Tube-2.

ERROR TYPE : Fatal error. Generator can not continue with power up.

APPLICABLE TO : All Generators

APPEARS WHEN : Only during initialization phase.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

An incorrect or corrupt communication link has been established between the ATP Console CPU Board and the HT Controller Board during power ON.

POSSIBLE CAUSES

Data on Extended Memory Location “E18” are larger than the maximum allowed.

ACTIONS

1. Replace the HT Controller Board.

ERROR CODE : E08

DESCRIPTION : Wrong data for X-ray Tube-1.

ERROR TYPE : Fatal error. Generator can not continue with power up.

APPLICABLE TO : All Generators

APPEARS WHEN : Only during initialization phase.

INFORMATION / SYMPTOM : This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

An incorrect or corrupt communication link has been established between the ATP Console CPU Board and the HT Controller Board during power ON.

POSSIBLE CAUSES

Data on Extended Memory Location “E02” are larger than the maximum allowed.

ACTIONS

1. Replace the HT Controller Board.

ERROR CODE : E09 - GENERATOR OVERLOAD

DESCRIPTION : Generator overload. Arcing or IGBT fault.

ERROR TYPE : Informative.

APPLICABLE TO : All Generators

APPEARS WHEN : During the exposure and In Stand-by,

INFORMATION / SYMPTOM : This error may appear at the Console as "E09" Error Code or as a "Generator Overload" indication.

During exposure an over current on the IGBTs of the HV Inverter Module has been detected. This may be produced by an arc or malfunction on the HV Circuitry.

In stand-by, the Console is continuously displaying "E09" or "Generator Overload" due to a defective or overheated IGBT Module.

POSSIBLE CAUSES

Symptom-1:

- Defective X-ray Tube.
- Defective HV Transformer or HV Cable.
- Defective Inverter Module.
- Defective HT Controller Board.

Symptom-2:

- 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.

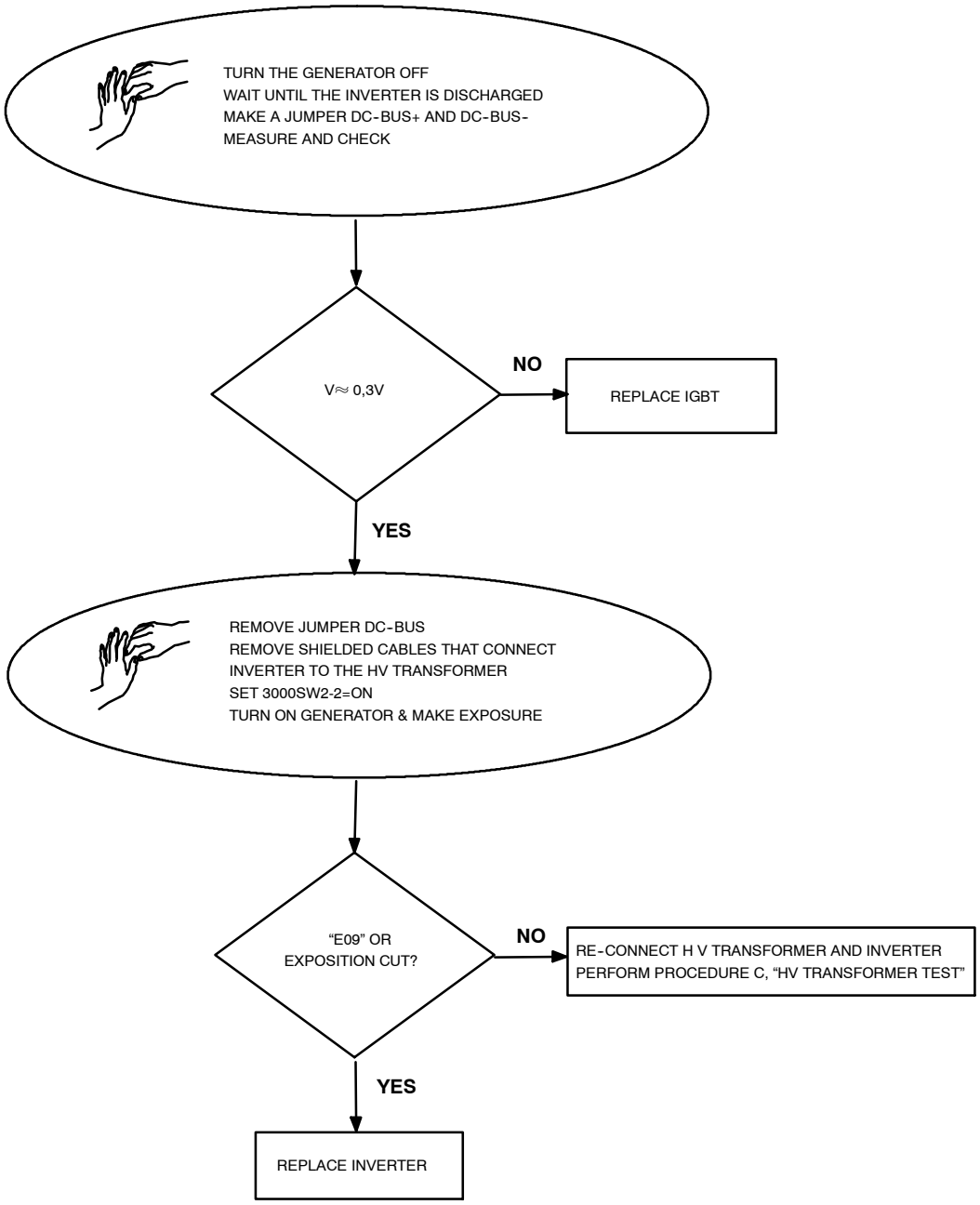
2. In case the anode is rotating correctly, make an exposure:
   - If "09" or "Generator Overload" appears, follow the procedure in paragraph B, "Inverter Module Test."
   - If not, follow step 3.

3. Increment kVp in 10 kVp steps, select the same mA and time. Make an exposure:
   - If "E09" or "Generator Overload" appears, or the exposure is cut before 80 ms, then follow Procedure C, "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, 150 kVp for 150 kVp HV Transformers) making Exposures at each kVp selected.
     - If "E09" or "Generator Overload" appears or the exposure is cut before 80 ms at any kVp selected, follow Procedure C, "HV Transformer Test."
     - If "E09" 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 "E09" or "Generator Overload"." In this case high mA causes "E09" or "Generator Overload".

B. INVERTER MODULE TEST

Illustration 4-1 shows a Flowchart for Procedure “B.”

Illustration 4-1
Flowchart for B: Inverter Module Test



1. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF.

2. Remove the cover 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 Monitor Board will be completely turned off.

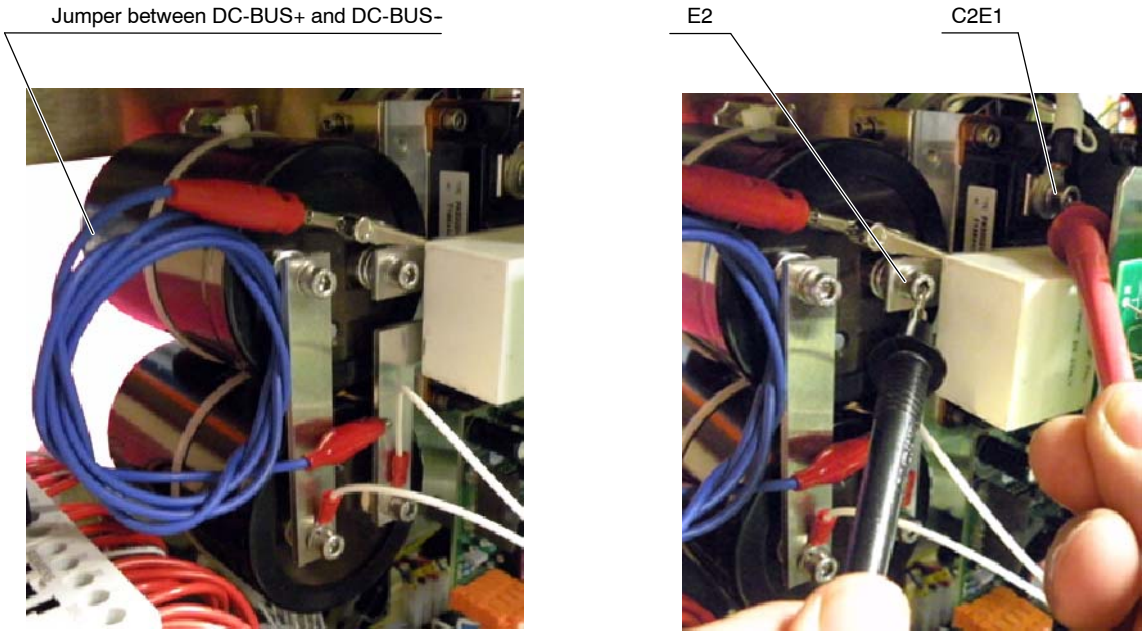
MAKE SURE THAT THE MAIN STORAGE CAPACITORS OF THE HIGH VOLTAGE INVERTER DO NOT CONTAIN ANY RESIDUAL CHARGE. WAIT UNTIL THE LIGHT EMITTING DIODES ON THE CHARGE-DISCHARGE MONITOR BOARDS ARE OFF, APPROXIMATELY THREE (3) MINUTES AFTER THE UNIT IS TURNED OFF.

4. When LEDs are off make a jumper between DC-BUS+ and DC–BUS- (use a wire AWG 22 (0.5 mm^2) or higher). Make sure that there is less than 10 VDC across the BUS. (Refer to Illustration 4-2 to see where to make the jumper.)

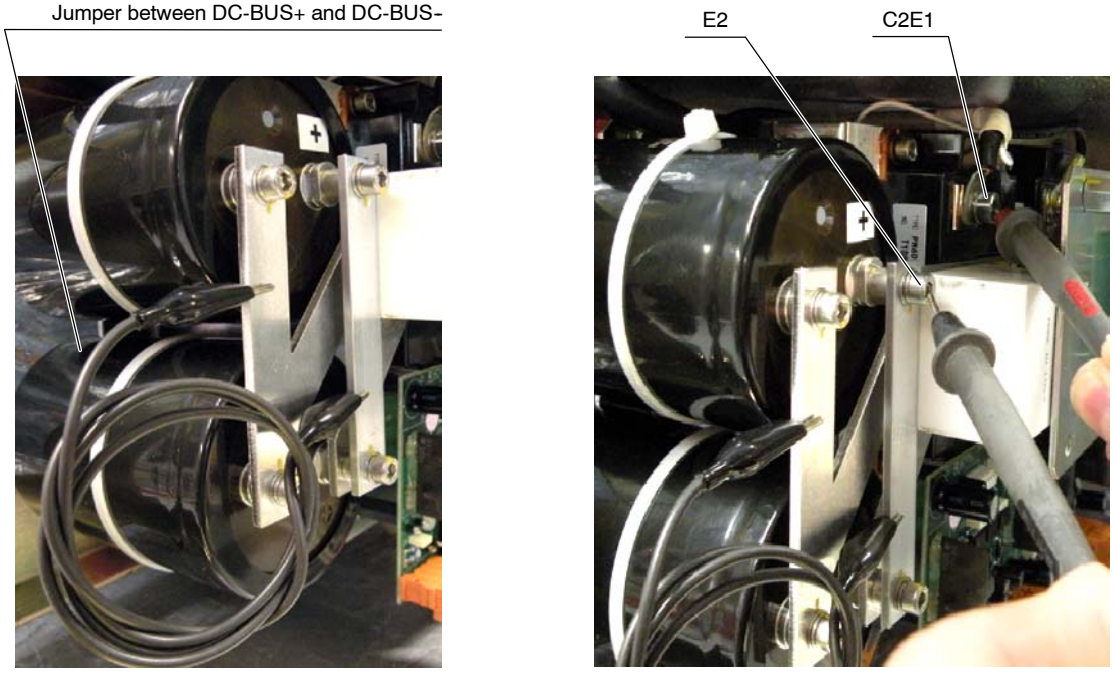
5. Measure with a Multimeter in Diode (or ohms) between C2E1 (positive polarity) and E2 or C1 (negative polarity) in both IGBTs (refer to Illustration 4-2 for more details). Repeat the measure with different polarity between C2E1 (negative polarity) and E2 or C1 (positive polarity).

   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.

Illustration 4-2
Jumper and Measurement Points



3-PHASE LINE POWERED GENERATOR OR CAPACITOR ASSISTED 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. Set DIP switch 3000SW2-2 in the ON position at the HT Controller Board.

10. Turn the Room Electrical Cabinet (Mains Disconnect) and Generator ON.

11. Make an exposure:
    - If "E09" or "Generator Overload" does not appear and the exposure has not been cut before 80 ms, re-connect both shielded cables to the HV Transformer (P1, P2, and P3). Follow Procedure C, "HV Transformer Test."
    - If "E09" or "Generator Overload" appears or the exposure has been cut before 80 ms, replace the whole Inverter Module.

Note ☞

At the end of an Exposure and right after releasing the Handswitch, error "E13" is shown on the Console. This is normal. Reset and continue.

12. Turn the Electrical Room Cabinet (Main Disconnect) and generator OFF. Wait three (3) minutes for the Main Storage Capacitors to discharge.

13. Set DIP switch 3000SW2-2 in the OFF position at the HT Controller Board. Re-connect both shielded cables that connect the Inverter to the HV Transformer P1, P3, and SHLD (P2).

C. HV TRANSFORMER TEST

1. Make these connections with the Oscilloscope:
   - CH.1 on + mA (TP14) on the HT Controller Board.
   - CH.2 on - mA (TP13) on the HT Controller Board.
   - Base Time in 10 ms per division and 1 V per division

2. Turn the mains and Generator ON. Set DIP switch 3000SW2-4 to the ON position at the HV Controller Board.

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 HV Transformer the jumper is correctly placed and secure.
     - that connector J1 is correctly placed and secure in the HV Transformer.
     - continuity between J1-D and P4-7, J1-E and P4-6, J1-B and P4-2, and J1-C and P4-1. Check that they are correctly connected and secure.
     - if after these actions the waveform is not OK, replace the HV Transformer.

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.

6. On the HT Controller Board, make a jumper FIL (TP8) and + 5 V (TP2).

7. Turn the Electrical Room Cabinet (Main Disconnect) and Generator ON.

8. Make these connections with the Oscilloscope:
   - CH.1 on + kV (TP11) on the HT Controller Board.
   - CH.2 on -kV (TP12) on the HT Controller Board.
   - Base time in 10 msec. per division and 2 V per division.

9. Select 40 kVp, 10 mA, and 80 ms. Make an Exposure and check that both waveforms are symmetric. A difference of 12% is normal.

Note ☞ *If error code "E15" appears after pressing PREP, reset the Error and select the lowest mA for Large Focus. Repeat the exposure.*

   - If it is OK, follow procedure in step 10.
   - If it is not OK, follow Procedure D, "Asymmetry on the kVp Loop."

10. Make exposures from 40 kVp to 150 kVp with the same Exposure Time and check that all kVp waveforms are symmetric and the values are similar according the table below.

Select	TP11 & TP12 on the HT Controller
50 kVp	2.1 V
70 kVp	2.9 V
90 kVp	3.7 V
110 kVp	4.5 V
130 kVp	5.3 V
150 kVp	6.1 V

11. If the waveforms are not symmetric (within 12% at any point), follow Procedure D, “Asymmetry on the kVp Loop.”

12. 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.”

13. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Set DIP switch 3000SW2-4 in the OFF position at the HV Controller Board and remove the jumper between FIL (TP8) and + 5 V (TP2).

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 HT Controller Board.

1. Turn the generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

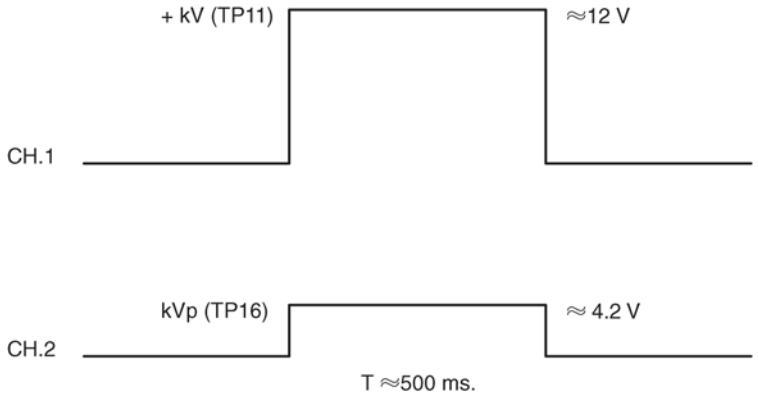
2. Set DIP Switch 3000SW2-2 to the “ON” position at the HV Controller Board.

3. Turn the Room Electrical Cabinet (Main Disconnect) and generator ON.

4. Make these connections with the Oscilloscope:
   - CH.1 on +kV (TP11) on the HT Controller Board.
   - CH.2 on kVp (TP16) on the HT Controller Board.

5. Apply +12VDC (P2-2) to +kV (P4-2) for 500 ms. This operation may cause Error “20” if the voltage is applied for more than 500 ms; in this case turn the generator OFF and ON to reset the error.

6. Check the waveform's result:

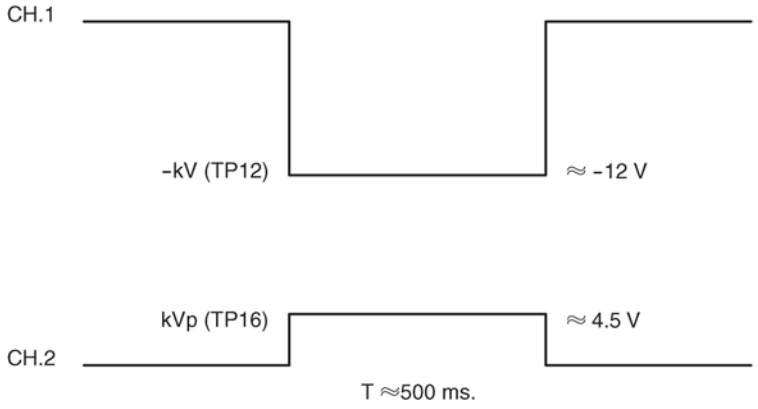


   - If it is OK, follow the procedure in step 7.
   - If it is not OK, replace the HT Controller Board. It is recommended to perform Procedure C, "HV Transformer Test," again.

7. Make these connections with the Oscilloscope:
   - CH.1 on -kV (TP12) on HT the Controller Board.
   - CH.2 on kVp (TP16) on HT the Controller Board.

8. Apply -12VDC (P2-1) to -kV (P4-1) for 500 ms. This operation may cause Error "20" if the voltage is applied for more than 500 ms. In this case turn the generator OFF and ON to reset the error.

9. Check the waveform's result:



   - If it is OK, replace the HV Transformer.
   - If it is not OK, replace the HT Controller Board. It is recommended to perform Procedure C, "HV Transformer Test," again.

10. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

11. Set DIP Switch 3000SW2-2 in the OFF position at the HV Controller Board.

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 “E09” or “Generator Overload” appears follow Procedure C, “HV Transformer Test,” if it has not been performed before. If Procedure C has been already performed follow the procedure in step 4.
   - If “E09” 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 “E09” or “Generator Overload” appears at any kVp selected it means that the Tube has dielectric problems above the selected kVp.
     - If “E09” 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 “E09” or “Generator Overload” appears. This will give an idea of the maximum mA allowed by the Tube without arcing. If “E09” 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 “E09” 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 “E09” OR “GENERATOR OVERLOAD”

If everything is OK and random “E09” or “Generator Overload” appears, check:

1. That the signal IGBT FAULT on Pin 3 of P5 on the HT Controller Board is not low (logic 0) in stand-by and during the exposure. If there is noise, check for a loose connection between Pin 3 of P5 on HT Controller Board and Pin 4 of J2 in both IPM Driver Boards

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 : E10

DESCRIPTION : EEPROM corrupted or not initialized on ATP Console CPU Board or on HT Controller Board. Wrong data calibration.

ERROR TYPE : Fatal Error during power up (when EEPROM U3 on HT Controller Board is corrupted or not initialized).

Informative error during power up (when EEPROM U18 on ATP Console CPU Board is corrupted or not initialized or when EPROM U24 on ATP Console CPU Board has been changed). In both cases, “E10” appears together with “E34” Error Code or “Technique Error” indication.

APPLICABLE TO : All Generators.

APPEARS WHEN : Only during initialization phase.

INFORMATION / SYMPTOM : Generator does not continue with start up.

POSSIBLE CAUSES

EEPROM U3 on the HT Controller Board corrupted or not initialized.

EEPROM U18 on the ATP Console CPU Board corrupted or not initialized.

EPROM U24 on the ATP Console CPU Board has been changed.

ACTIONS

1. If EPROM U24 in the ATP Console CPU Board has been replaced, reset the Error Code to acknowledge that the NVRAM has been initialized.
2. If the error does not reset, turn the Generator OFF and set Dip-switch A3024SW2-3 in the ON position to allow Service Mode.
3. Turn the Generator ON and enter into Workstations Configuration and follow the checks as indicated in the Service Manual (do not forget to exit from Configuration mode to store the Workstation Configuration).
4. If the problem persists and “E10” appears together with the “E34” Error Code or “Technique Error” indication, replace the ATP Console CPU Board.
5. If the problem persists and only “E10” appears on the Console, replace the HT Controller Board.

ERROR CODE : E11

DESCRIPTION : No voltage in the Main Storage Capacitors of the Generator (Inverter Module).

ERROR TYPE : Informative. "*Prep*" is not allowed.

APPLICABLE TO : All Line or Battery Powered Generators

APPEARS WHEN : Only during initialization phase or when pressing "*PREP*".

INFORMATION / SYMPTOM : -

POSSIBLE CAUSES

No voltage in the Main Storage Capacitors (5C1, 5C2, 5C3, 5C4) of the Generator (Inverter Module).

Defective Charge/Discharge Monitor Board.

Precharge 6K5 contactor located inside the Generator Cabinet is not energized.

Main line fuses F3 and/or F4 are blown.

"-CHRG" signal of Pin 7 on connector P1 on the HT Controller Board is not present.

Cables disconnected accidentally or damaged connectors.

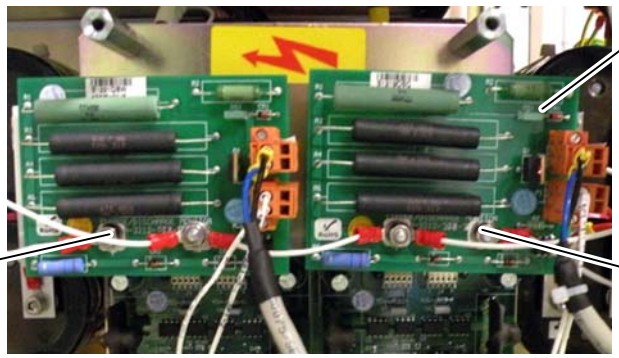
ACTIONS

A. IF LED DS1 IN CHARGE/DISCHARGE MONITOR IS ILLUMINATED (LINE OR BATTERY POWERED GENERATOR)

Check the voltage at the Main Storage Capacitors (5C1, 5C2, 5C3, 5C4) (Inverter Module) measuring the voltage between DC BUS (+) and DC BUS (-) as indicated in the illustration below.

1-PHASE LINE or BATTERY POWERED GENERATOR

3-PHASE LINE POWERED GENERATOR



Voltage at the Main Storage Capacitors should be the voltage of the Input Power Line multiply by 1.4142 for Line Powered Generators (not in "Prep") (±10%). See the following examples:

Input Power Line	Voltage at the Main Storage Capacitors
Line Powered Generator at 230 VAC	230 x 1.4142 = 325 VDC (±10%)
Line Powered Generator at 400 VAC	400 x 1.4142 = 566 VDC (±10%)
Line Powered Generator at 480 VAC	480 x 1.4142 = 679 VDC (±10%)
Battery Powered Generator at any Power Line	approx. 400 VDC (±10%) with all batteries fully charged.

- If the voltage is OK, check that P1-7 on the HT Controller is at logic level "0". (0.75 V for Generators with 1 Charge/ Discharge Monitor Board and 1.5 V for Generators with 2 Charge/Discharge Monitor Boards).
  - If logic level is OK (logic level 0), replace the HT Controller Board.
  - If logic level is not OK, check the links between P1-7 on the HT Controller Board and P1-2 on Charge/Discharge Monitor Board #1 and P1-1 on Charge/Discharge Monitor Board #1 and P1-2 on Charge/Discharge Monitor Board #2,
    - If these links are OK, replace defective Charge/Discharge Monitor Board.
    - If they are not OK, repair connection.

- If the voltage in capacitors is not OK, check VAC on AC1, AC2 and AC3 at the Input Rectifier Board (for Battery Powered Generators: check battery voltage).
  - If VAC is not OK, verify input connections and input fuses.
  - If VAC is OK, disconnect BUS+ and BUS- at the Input Rectifier Board and check the VDC.
    - If VDC is not OK, replace any defective components (CR1, CR2, CR3) at the Input Rectifier Board.
    - If VDC is OK, check for and replace any defective components at the Generator Cabinet.

B. IF LED DS1 IS NOT ILLUMINATED AND IT IS A NON-BATTERY POWERED GENERATOR

- Check input VAC on 6LF1,
  - If VAC is OK, replace any defective components at the Input Rectifier Board (CR2, CR3 or CR1).
  - If VAC on 6LF1 is not OK, check that contactor 6K5 is ON.
    - If 6K5 is ON, check VAC on T1,T2 and T3 (in 6K5).
      - If voltage is OK, replace the defective 6R1.
      - If voltage is not OK, replace the defective fuse (F3, F4 or F5).

- If Contactor 6K5 is not ON, check if signal +24VPSU is OK.
  - If the signal is not OK, check and/or replace 3F6 and 6T2.
  - If +24VPSU is OK, check that signal -LINE CONT is at 0 VDC,
    - if -LINE CONT is OK (0 VDC), replace 6K5.
    - If -LINE CONT is not OK, check continuity in J3-10 at the ATP Console CPU Board.
      - If -LINE CONT is OK, repair the connection between J3-10 and "A" in 6K5, at the ATP Console CPU Board.
      - If -LINE CONT is not OK at the ATP Console CPU Board, replace the ATP Console CPU Board.

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

Check Contactor 6K5,

- If 6K5 is ON, check output voltage of 6K5.
  - If 6K5 output voltage is OK, replace defective 6R1.
  - If 6K5 output voltage is not OK, check and replace 6F1, 6J1 and Andersen connectors.

- If 6K5 is not ON, check if signal +24VPSU is OK.
  - If it is not OK, check and/or replace 3F6 and 6T2.
  - If +24VPSU is OK, check that signal -LINE CONT is at 0 VDC on J3-10 at the ATP Console CPU Board,
    - If -LINE CONT is OK at the ATP Console CPU Board, repair the connection between J3-10 and "A" in 6K5.
    - If -LINE CONT is not OK at the ATP Console CPU Board, replace the ATP Console CPU Board.

- If both signals (+24VPSU and -LINE CONT) are OK, then replace Contactor 6K5.

ERROR CODE : E12

DESCRIPTION : No mA during exposure or mA out of tolerance. Wrong filament current.

ERROR TYPE : Informative.

APPLICABLE TO : All Generators

APPEARS WHEN : After exposition.

INFORMATION / SYMPTOM : Error 12 appears after the Exposure to alert the operator that the mA at the start of the exposure has not been correct. During the first 10 ms the Generator applies constant filament current to the Tube. This current is proportional to the current already calibrated for that mA station at the kVp selected for that Exposure (filament numbers). Near the end of these 10 ms, the HT Controller Board reads the mA and if they are found to be 30% under or over what has been selected, it sends error "12" to the Console.

POSSIBLE CAUSES

Calibration data for kVp and mA is not correct causing error E12.

The mA jumper on the HV Transformer is open, or it is not making good contact. The mA read at the beginning of the exposure is 50% of the correct value (because one branch is open).

There is a problem on the reading of the mA.

No correct heating prior to the Exposure. The filament has not reached its correct temperature and the mA at the start of the exposure is low. It usually occurs when the *"Prep"* and *"Exp"* buttons are pressed down at the same time.

Making an exposure immediately after getting out of Calibration mode in Extended Memory.

+5 VDC , +12 VDC or -12 VDC Power Supplies of HT Control Board (measured at TP2, TP3 and TP4 of this Board) have excessive ripple or VDC measured is not correct.

ACTIONS

1. Connect a Oscilloscope to the following Test Points on the HT Controller Board and check that the voltage is correct. Adjust an incorrect voltage with the respective Potentiometer in the Power Supply Board (*refer to Section 2.1 - Low DC Voltage Power Supply Test*):
   - TP2 (+5 VDC) on HT Control Board is adjusted with R12 Pot. in the Power Supply Board.
   - TP3 (+12 VDC) on HT Control Board is adjusted with R26 Pot. in the Power Supply Board.
   - TP4 (-12 VDC) on HT Control Board is adjusted with R25 Pot. in the Power Supply Board.

2. Check calibration data for the mA Open Loop (filament numbers) as described in the Service Manual for all combinations of kVp and mA when this error appears.

   With a Oscilloscope connected to Test Point TP5 (mA) on the HT Controller Board, check that the mA reading is within a ratio of 1V=100 mA (± 5%) for software V2 and V3. For later versions (V4 and up), the ratio is 1V=10mA from the min. mA to 80 mA and 1V=100mA from 100 mA to maximum rating.

   If it is not, the cause could be that the mA second test is not measuring correctly, or a wrong measurement performed in the Generator. *(Refer to step 3).*

3. Check that the jumper in the mA Test Point of the HV Transformer is correctly placed and secure.

4. With a Oscilloscope check that during the entire Exposure signals on Test Points TP13 (-mA) and TP14 (+mA) on the HT Control Board connectors are symmetrical (12%).
   - If one is found missing or not symmetrical, measure on Pin 6 and 7 of J4 on the HT Control Board.
   - If they are symmetrical on both Points, the problem could be on the HT Control Board.
   - If they are not correct, check that the connections made on the HV Transformer in J1-E, D, K terminals are correctly connected and secure. Also check that the GND wire is connected to GND stud.
   - If connections are correct the problem is in the HV Transformer.

5. Connect an Oscilloscope to Test Point TP5 (mA) on the HT Controller Board.

Note ☞ *For the following test with a High Speed Generator, the self-running mode has not been active. DIP switch 3243SW4-6 on the Control DRAC Board must be in the "OFF" position (only High Speed Generator).*

Check that:

- when the exposure is made by pressing first the PREP control and then the EXP control, the mA reading at the beginning of exposure is correct.
- and when an exposure is made by pressing at the same time the PREP and EXP controls, the mA reading at the beginning of exposure is low.

6. For Low Speed Generators:
   - Reprogram the "*Rotor Acceleration and Filament Setting Time*" as stated in the Service Manual (Configuration chapter) : one (1) step over the previously configured time (e.g.: if it was 1.2 seconds, reprogram for 1.8 seconds) and check if boosting is correctly configured.

     If it is not correct, reprogram the "*Rotor Acceleration and Filament Setting Time*" one (1) step over the previously configured time and test again.

7. For High Speed Generators:
   - Reprogram the "*RAD Filament Setting Time*" as stated in the Service Manual (Configuration chapter) : one (1) step over the previously configured time (e.g.: if the Filament Setting Time programmed was 1.8 seconds, reprogram it for 2.7 seconds).

In order to verify that the problem has disappeared:

- 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.
- 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.

  If it is not correct, reprogram the "RAD Filament Setting Time" one (1) step over the previously configured time and test again.

ERROR CODE : E13

DESCRIPTION : No kVp during exposure, kVp out of tolerance (±33%) or insufficient time parameters during AEC operation. For Capacitor Assisted Generators, this can also be due to an incorrect Generator configuration.

ERROR TYPE : Informative. May abort exposition.

APPLICABLE TO : All Generators

APPEARS WHEN : During and after exposures.

INFORMATION / SYMPTOM : No kVp during exposure.

POSSIBLE CAUSES

Note ☞ *This error assumes that the fault is not on the IGBT and is not due to arcing in the X-ray Tube.*

Connection between the ATP Console CPU Board and HT Controller Board (-EXP signal)

Connection on the IPM Driver Boards

Faulty HT Controller

Faulty IPM Driver Board

Faulty IGBT

Faulty HV Transformer

Open Serial Capacitor (5C9)

5V OUT during exposure

Power to IPM Drivers is not supplied from the Interface Control Board

For Capacitor Assisted Generators, this may also indicate an incorrect Generator configuration with respect to the Power Line.

ACTIONS

Note ☞ *For Capacitor Assisted Generators, ensure that Extended Memories E67, E68 & E69 as well as **all** Jumpers on the Capacitor Charger Board (A3517-xx) are set correctly according to the Power Line.*

1. With an Oscilloscope, measure between TP-12 & TP-11 on the HT Controller. These signals should be incomplete and/or irregular.

2. Assure that the power supply to the *HT Controller Board* and the two *IPM Drivers* are correct.

   HT Controller: Schematic A3000-xx - Check for 5V, -12VAC and +12VAC.

   IPM Driver: Schematic A3063-06 - Check for +24 VDC ±10 % (ROHS Generator) and check for 5 V (both voltages are supplied from the Interface Control Board). 5V should be constant (not presenting any variation), *including during the entire Exposure.*

3. Measure the pulses at P3-1 (KV DR1) and P3-2 (KV DR2) on the HT Controller. If these pulses are not present during the Exposure, change the HT Controller. If they are present, proceed to the next step.

CAUTION

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

4. Ensure that KV DR1 and KV DR2 reach the IPM Drivers at J1-1 & J1-2. If these signals are not present at the connection points, revise the connection or cables. If these signals are present, proceed to the next step.

5. Turn OFF the equipment. Dismount one of the IPM Drivers from the IGBT disconnecting the terminals to IGBT side but keeping J1 & J2 connected.

   Turn ON the equipment and ensure the power supply by measuring at J3-1 (+15 V OUTPUT 1) & J3-4 (GND 1), and by measuring at J4-1 (+15 V OUTPUT 2) & J4-4 (GND 2).

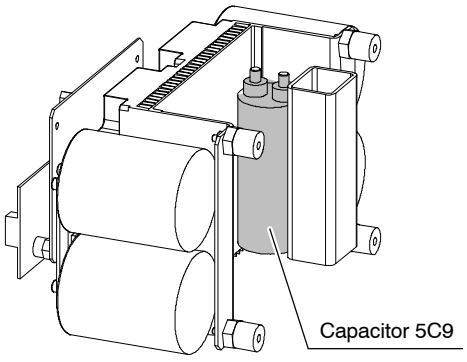
   Turn OFF the equipment. If +15 V OUTPUT is not present, repair or replace if necessary. Return the first IPM Driver to its original position connected to the IGBT. Then dismount the second IPM Driver and repeat this step.

   If +15 V OUTPUT is present in both IPM Drivers. proceed to the next step.

6. Turn OFF the equipment and ***wait a few moments for the equipment to fully discharge***. Remove the rear cover of the Generator Cabinet for accessing to Capacitor 5C9 located at the back side of the HV Inverter. Check the Capacitor 5C9 as follows:

   - by using a meter (e.g. Fluke 87) in “capacitor” mode
     - If Capacitor 5C9 is in good condition, the meter shows: “O.L μf (out of limit)” .
     - If Capacitor 5C9 is defective, the meter shows an abnormally low value (e.g: 0.19 μf).
   - or, by using a meter in “ohms” mode
     - If Capacitor 5C9 is in good condition, the meter shows the resistance changing. If the polarity of the probes is reversed, the meter shows a negative resistance.
     - If Capacitor 5C9 is defective, the meter shows a very high Impedance (1 MOhms) or Open circuit.

   If Capacitor 5C9 is defective, replace it. If not, proceed to the next step.



7. Refer to Schematic 543020xx for the connections between the HV Transformer and the IGBTs. Measure the resistance (continuity) of the following cables from the IGBTs to the HV Transformer, replacing or repairing where necessary:
   - Capacitor 5C9 (Transformer side terminal) and P1 of the HV Transformer.
   - C2E1 and P2

8. Disconnect P1 & P2 on the HV Transformer. Check that the resistance at P1 & P2 is low (approximately 0.2 Ω). If the resistance is too high, replace the HV Transformer. If the resistance is correct, proceed to the next step.

9. On the HT Controller Board, place SW2-2 to ON. Disconnect A2(B) +24V PSU (Faston Terminal) at the 6K5 contactor (some are simply marked as K5).

10. Turn ON the equipment and verify that 6K5 does not activate and that there is NO TENSION on the DC Bus (± 300 VDC), Charge / Discharge Screws or Capacitor Bars.

Note ☞

The following action requires the Inverter Module (L2), to which the Charge/Discharge Boards are mounted, to be dismounted in order to gain access to the IPM Driver Boards. Do not disconnect the Charge/Discharge Boards.

11. With an Oscilloscope at one of the IPM Driver boards, measure pulses between J3-4 (GND 1) & J3-3 (CP1 KVDR1) and pulses between J4-4 (GND 2) & J4-3 (CN1 KVDR2). Repeat the test on the other IPM Driver board. If the pulses are not present, replace the respective IPM Driver Board.

ERROR CODE : E14

DESCRIPTION : Exposure signal without X-ray Exposure Console command.

ERROR TYPE : Informative.

APPLICABLE TO : All Generators

APPEARS WHEN : During and after exposition.

INFORMATION / SYMPTOM : Exposure signal without X-ray Exposure Console command.

POSSIBLE CAUSES

The *"Exp"* signal is active on the HT Controller Board.

ACTIONS

1. Remove the connector J1 on HT Controller Board and check grounding of Pin 6 of P1.
2. If Pin 6 of P1 is grounded, replace the HT Controller Board.
3. If Pin 6 of P1 on the HT Controller Board is not grounded, then check grounding of Pin 6 of Connector J1.
4. If it is grounded, remove the connector J3 on the ATP Console CPU Board and check grounding of Pin 6 of Connector J1 again. If it is grounded, repair the wire short-circuit.
5. If it is not grounded, replace the ATP Console CPU Board.

Note ☞ *The resistance value between Pin 6 of P1 on HT Controller Board and Ground (with all cables connected) should be around 900 Ω.*

ERROR CODE : E15

DESCRIPTION : Filament Driver Circuit Open, No current on Filament. Wrong selection of Focal Spot detected during "*Prep*".

ERROR TYPE : Informative. Does not allow "*Prep*". Requires to be reset twice.

APPLICABLE TO : All Generators

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : No current detected on Focal Spot (Filaments Off). After resetting the Error Code, the filament driver will be shut off.

POSSIBLE CAUSES

Absence of -12 V Power Supply at the HT Controller

A There is no power supplied to the Filament Board
Poor connection at the Cathode HV Cable
Defective Filament Transformer inside the HV Transformer
Defective HV Switch inside the HV Transformer (if the system is equipped with two Tubes)

B Wrong signal -FIL1 ACK

ACTIONS

Note ☞ *"E15" may be provoked by an absence of -12 V (power supply) to the HT Controller at P2-1 or from the Low Voltage Power Supply (LVDC Power Supply 3PS1) at 3TS1-16. See schematics 543020xx and HT Controller 3000-xx for further information.*

Before Troubleshooting for the Possible Causes listed above, proceed with the following steps.

1. Verify -12V from the Low Voltage Power Supply to the HT Controller, identifying and correcting any possible short circuit. If -12V is present, Troubleshoot for the causes listed in the Possible Causes section above (Causes A and B). It -12V is not present, proceed to the next step.

2. There is a possibility of a short circuit at the Ion Chamber connections. If the system has AEC and doesn't have an AEC Adaptation Board, proceed to the next step. If the system has an AEC Adaptation Board, proceed to step 4.

3. It is likely that there is a short circuit in 3TS1, most probably at 3TS1-16.

4. Disconnect J1, J2, J3 & J5 at the AEC Adaptation Board that go to the Ion Chambers and test for a short circuit in one of these aforementioned connections.

A. THERE IS NO SUPPLY TO THE FILAMENT BOARD, A POOR CONNECTION ON THE CATHODE HV CABLE, A DEFECTIVE FILAMENT TRANSFORMER OR A DEFECTIVE HV SWITCH.

Note ☞

For Generators with two Tubes:

- if the error appears in both Tubes, go to step 1.

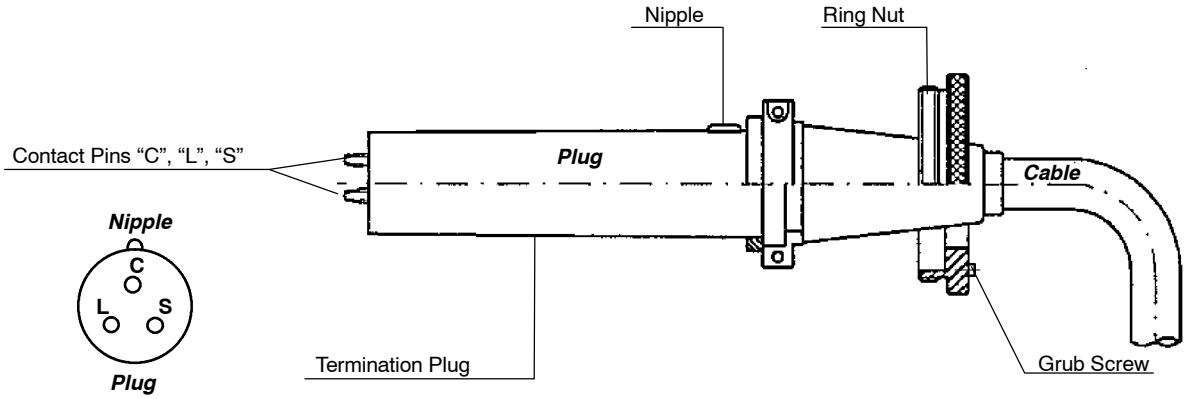
- if the error appears in only one Tube, interchange HV Cables. Then, if error remains when selecting the same Tube from Console, replace HV Transformer.

1. Visual Check for Unplugged Connectors:
   With the Generator turned OFF, first of all take a visual inspection at all the connectors in the Front Panel of the Generator (HT Controller Board, Filament Driver Board, Interface Control Board and the High Voltage Switch Control Board). It could have happened that by an accident some connector has been unplugged when removing or placing the generator cover. Take a close inspection because sometimes a connector is disconnected a little bit from one of the sides but not totally disconnected from the connector of the board. Please take a close look with a flash light.

2. X-Ray Tube Filaments Resistance Test:
   With the Generator turned OFF, measure the Filaments of each 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.



3. Primary Filament Resistance Test (1):
   With the Generator turned off, measure the resistance of the primary of the Filament Transformer for the Small Focus by removing connector J1 on the HV Transformer and measuring on the Connector of the HV Transformer between the pin marked G (FIL SUP) and H (FIL 2 RTN). Also measure between G (FIL SUP) and F (FIL 1 RTN). These readings should be about 5 ohms each primary.

4. Primary Filament Resistance Test (2):
   Reconnect J1 to the HV Transformer and ensure that it is securely connected and "locked" into position by twisting the outside cover until a "click" is heard. Measure the Ohms between the following points (Each one should read about 5 Ohms):

   - FIL 1 RTN (Large Focus) P3-4 on the Filament Driver Board and P4-15 on the Interface Control Board.
   - FIL 2 RTN (Small Focus) P3-4 on the Filament Driver Board and P4-16 on the Interface Control Board.

   Move around the J1 cable that goes into the HV Transformer looking for a possible wrong connection.

5. High Voltage Switch Connection:

   a. If the primary resistance tests do not reveal the source of the error, remove the Cathode High Voltage Cable from the HV Transformer for both X-ray Tubes.

   b. Set dipswitch "SW2-2" of the HT Controller Board in "ON" position to turn OFF the Filament Circuit (No Error 15) .

   c. Turn the Generator "ON" and select "Tube 1" (or "Tube 2").

   d. Measure with an Ohm Meter the pins inside the HV Transformer receptacle for "Tube 1" . 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.

   e. Select "Tube 2", if it is present, and repeat the measurement done in step-d. for "Tube 2".

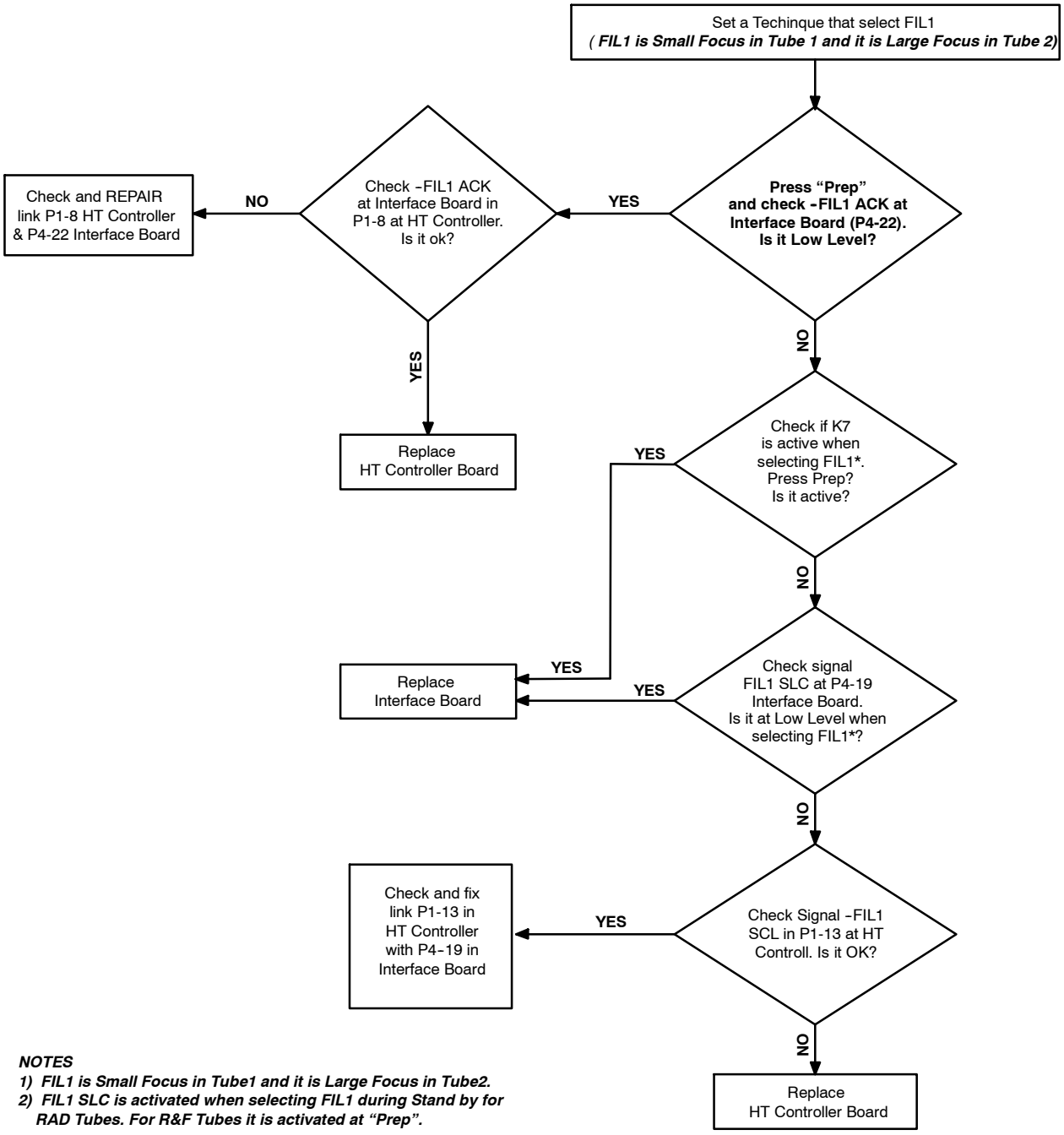
6. Once the test is finished, reconnect the Cathode HV cable for "Tube 1" in its position of the HV Transformer (it is marked in the Cable and in the HV Transformer). Clean the cable with a piece of clean dry paper before placing it inside the HV Transformer. Make sure you tighten the big washer of the HV Cable into the HV Transformer.

7. Repeat the previous step for "Tube 2".

8. Set dipswitch "SW2-2" of the HT Controller Board in "OFF" position to turn ON the Filament Circuit.

B. WRONG SIGNAL -FIL1 ACK

Perform the following diagnosis if after pressing "*Prep*" the Error Code "E15" appears on the Console.



NOTES

1) FIL1 is Small Focus in Tube1 and it is Large Focus in Tube2.

2) FIL1 SLC is activated when selecting FIL1 during Stand by for RAD Tubes. For R&F Tubes it is activated at "Prep".

ERROR CODE : E16

DESCRIPTION : Invalid value of : kVp, mA or kW.

ERROR TYPE : Informative. Does not allow "*Prep*" or "*Exp*".

APPLICABLE TO : All Generators

APPEARS WHEN : In "Prep"

INFORMATION / SYMPTOM : Selected mA or kVp are not correct.

POSSIBLE CAUSES

Wrong maximum kVp configuration.

Wrong software compatibility on the Generator Cabinet and Console.

When pressing "Prep" during the calibration of "Digital mA Loop Open" with a technique that overpasses the Generator power kVp/mA.

ACTIONS

1. Check dipswitch-5 of SW2 on the HT Controller Board , it must be set in accordance with the Generator configuration (maximum kVp of Generator) (dipswitch-5 must be in "open" position for 125 kVp Generator, / dipswitch-5 must be in "closed" position for 150 kVp Generator).

2. When "Digital mA Loop Open" is manually calibrated (in calibration mode), this error may appears if the Generator power is exceeded by a kVp / mA combination selection. Reset the error indication and enter manually the Filament Current number following the instructions described in the Calibration chapter without make any exposure for that combination (kVp / mA).

ERROR CODE : E17

DESCRIPTION : Communication error among ATP Console CPU Board and HT Controller Board.

ERROR TYPE : Fatal Error. Generator opens line contactor.

APPLICABLE TO : All Generators

APPEARS WHEN : Once initialization phase is over at any moment.

INFORMATION / SYMPTOM : No communication link between HT Controller Board and ATP Console CPU Board.
This Error Code requires that the Generator be turned OFF/ON before it can be fixed.

POSSIBLE CAUSES

The communication link between the ATP Console Board and the HT Controller Board is not reliable.

The Generator has been affected by a loss of the main power.

Faulty DC power supply.

Noise on the bucky circuitry.

Defective HT Controller Board or defective ATP Console CPU Board.

ACTIONS

1. Turn Generator OFF/ON.

2. If “E01” appears, follow the same procedure as for “E01”.

3. If “E01” does not appear, error “E17” can be due:
   - a loss of the main power.
   - an intermittent error produced by an external device, install a R-C filter in the power supply and at Bucky start circuitry.

ERROR CODE : E18 OR ROTOR ERROR

DESCRIPTION : Rotor error or Rotor running without order (only with Low Speed Starter).

ERROR TYPE : Fatal Error when the Rotor is running without order. Exposure is not allowed.
Informative Error when the Rotor is not running while “Prep” is active. Exposure is not allowed.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : The X-ray Tube is not detected to be rotating while “Prep” is active, then exposure is inhibited. For Generators with Low Speed Starter, it can be due to the X-ray Tube anode is rotating without a command from the Console.

POSSIBLE CAUSES

For all Generators:

“-PREP” signal is not going low in the HT Controller Board when “Prep” is pressed.

Only for Generators with High Speed Starter:

HT Controller Board is not receiving the “RTR Ready” signal back from the Control DRAC Board.

Only for Generators with Low Speed Starter:

“–RTR” signal on HT Controller Board is active.

Defective relay K1 (solid State) on the low speed module.

±12 VDC power supply missing on the HT Controller Board.

Defective Low Speed Control or HT Controller Boards.

ACTIONS

A. PREVIOUS CHECK FOR ALL GENERATORS (LOW OR HIGH SPEED STARTER)

Check that the “-PREP” signal is going low in the HT Controller Board when “Prep” is active.

- “-PREP” signal can be measured in connector P1-3 of the HT Controller Board or by looking at the LED DS2 in the HT Controller Board (it must be ON when “Prep” is active).
- If not, check the communication cable (J3) between the ATP console CPU Board and the Generator connector 6J3 and then to the HT Controller Board (P1-3). Make sure it is properly connected and that all the pins are well inserted on both sides (especially 6J3-4 on both sides).
  - If there is not signal continuity between the ATP Console CPU Board (J3-4) and the HT Controller Board (P1-3), repair or replace the communication cable.
  - If the “-PREP” signal is going low and there is signal continuity between the ATP Console CPU Board (J3-4) and the HT Controller Board (P1-3) and LED DS2 in the HT Controller Board is OFF when “Prep” is active, replace the ATP Console CPU Board.
  - If the “-PREP” signal is going low and there is signal continuity between the ATP Console CPU Board (J3-4) and the HT Controller Board (P1-3) and LED DS2 in the HT Controller Board is ON when “Prep” is active, perform procedure B for Generators with High Speed Starter or procedure C for Generators with Low Speed Starter.

B. ONLY FOR GENERATORS WITH HIGH SPEED STARTER (LV-DRAC)

In "Prep" (the Rotor is not running while "Prep" is active)

"Rotor Error" means that the ATP Console CPU Board is not receiving the "Ready" communication signal back from the HT Controller Board. This could be also because the HT Controller Board is not receiving the "Ready" (-RTR RDY) signal from the High Speed Starter (LV-DRAC).

1. Perform the Programming of the High Speed Starter and RAD Filament Setting Time as explained in the Configuration Chapter of the Generator Service Manual. Perform the following sequence:
   - Turn OFF the Generator and take note of the setting of Dipswitch 3000SW2 on the HT Controller Board.
   - Set all Dipswitch positions to OFF.
   - Set Dipswitch of positions 1, 2, 5 and 7 to ON (position 2 to ON informs to the HT Controller Board that it has a LV-DRAC connected).
   - Turn ON the Generator and wait of E01. If E01 is not displayed leave the Generator for 1 minute and then proceed to turn it off.
   - Set all Dipswitch positions as they were originally.
2. If after this, the "Rotor Error" is still present check that the "-RTR RUN" signal is going low in the Control DRAC Board by measuring J4-20 in the Control DRAC Board when "Prep" is active. Normally, if this signal is received by the Control DRAC Board a noise can be heard on the LV-DRAC Transformers because the starter is trying to start the Tube.
   - If there is no signal, check the signal continuity between the HT Controller Board (P5-5), connector 6J1 of the Generator Cabinet (6J1-1) and Control DRAC Board (J4-20). If the continuity is correct but there is no signal in the Control DRAC Board (J4-20), replace the HT Controller Board.
   - If this signal is arriving to the Control DRAC Board then most probably is that the LV-DRAC (High Speed Starter) is accelerating the Tube and therefore the "-RTR RDY" signal is not being received in the HT Controller Board.
     - Measure the signal "-RTR RDY" (active-low) in J4-4 of the Control DRAC Board. Also the LED DL3 must be ON on the Control DRAC Board. If either is not correct:

       - Set Dipswitches for "Minimum Time for Ready (Delay)" on the Control DRAC Board are set for "0" seconds (Dipswitches 3243SW1-1, SW1-2 and SW1-3 in ON position).

       - Check the voltage at the following Test Points on the Control DRAC Board: +5 VDC at TP14, +15 VDC at TP15, -15 VDC at TP37, using for GND reference the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19. If they are correct, replace the Control DRAC Board.

       - If voltages at the above points are correct, turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.Turn the generator ON.

         Check the voltage at the following points on the Interface DRAC Board:
         +5 VDC at Anode of diode CR6,
         +15 VDC at Anode of diode CR5 or at Cathode of diode CR6,
         -15 VDC at Cathode of diode CR7.
         For GND reference use the Terminal J2-3 on the Interface DRAC Board.

         If voltages at the above points are correct, replace the Control DRAC Board. If any voltage at the above points are not correct, verify at the Interface DRAC Board that there is 220 VAC between J3-1 and J3-2, and fuse F1 and F2 are correct, if 220 VAC is present and the fuses are correct replace the Interface DRAC Board.

     - If the signal "-RTR RDY" (active-low) in J4-4 of the Control DRAC Board is correct and the LED DL3 is ON on the Control DRAC Board, check the signal continuity between the Control DRAC Board (J4-4), connector 6J1 of the Generator Cabinet (6J1-5) and HT Controller Board (P5-4). If the continuity is correct but there is no signal in the HT Controller Board (P5-4), replace the HT Controller Board.

Connect all the wires / cables removed during the procedure back to the original connections.

C. ONLY FOR GENERATORS WITH LOW SPEED STARTER (LF-RAC)

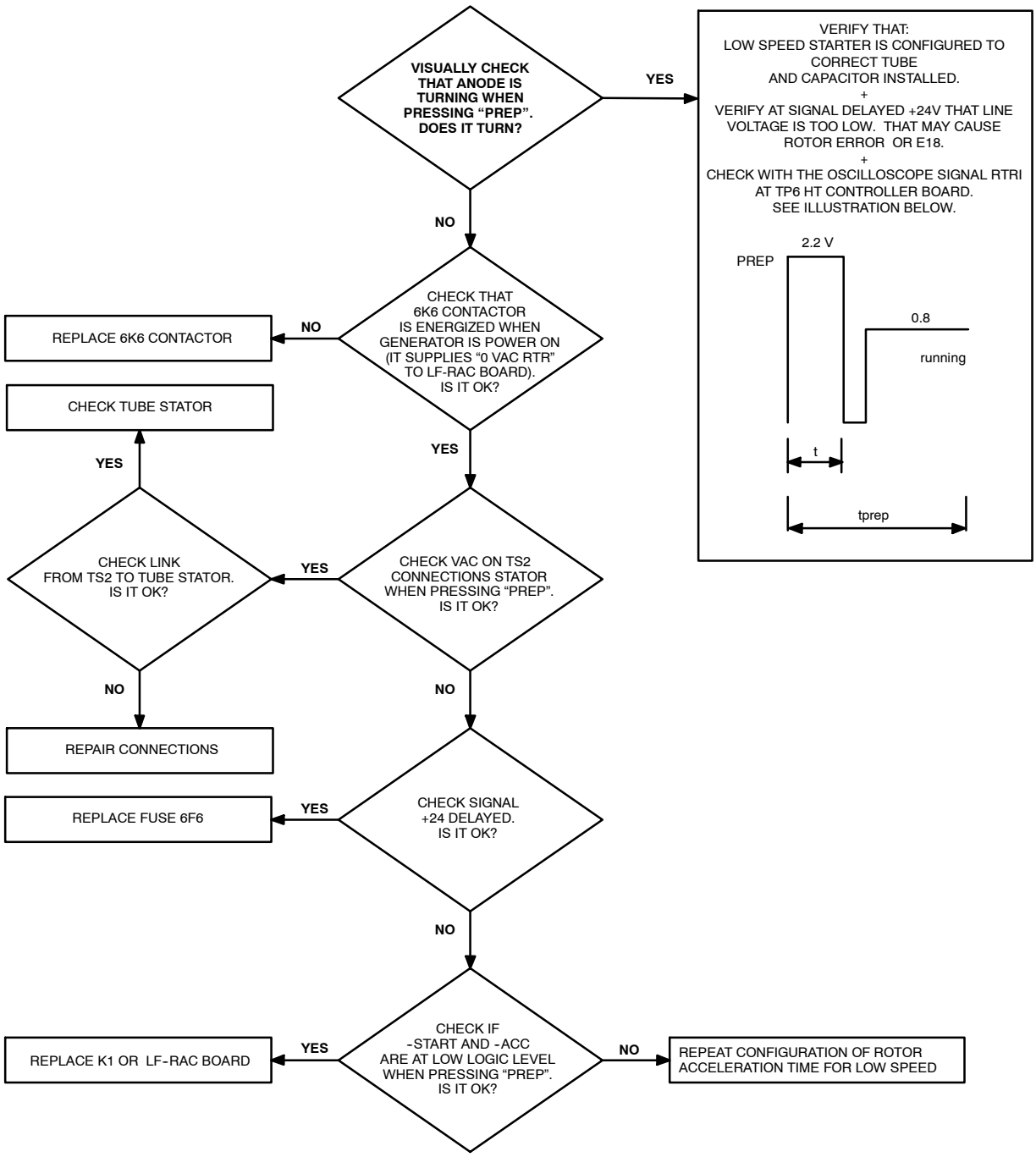
In Stand-by (the Rotor is running without order)

1. Check if the signal “RTR I” Test Point (TP6 on HT Controller) is 0 VDC.
   - If it is 0 VDC, replace the HT Controller Board.
   - If it is not 0 VDC, remove wire P4-3 “RTR I2” on the HT Controller Board and check again the voltage at TP6.
     - If it is not 0 VDC, replace the HT Controller Board.
     - If it is 0 VDC, connect wire P4-3 “RTR I2” on the HT Controller Board and then ensure that Solid Relay K1 (4K1 or 10K1) in the Low Speed Starter Module works properly. For that, check the voltage between terminals 3 and 4 of the Solid Relay K1 is 0 VDC.
2. If the voltage between terminals 3 and 4 of the Solid Relay K1 it is not 0 VDC, replace the HT Controller Board.
3. If the voltage between terminals 3 and 4 of the Solid Relay K1 is 0 VDC, check the voltage between terminal 1 and 2 of the Solid Relay K1 is 60 VAC.
   - If it is 60 VAC replace the LF-RAC Board.
   - If it is not 60 VAC replace the Solid Relay K1 (4K1 or 10K1).

In “Prep” (the Rotor is not running while “Prep” is active)

Refer to the following Flowchart for procedure in “Prep”.

IF "E18" OR ROTOR ERROR APPEARS IN "PREP" (ONLY FOR LF-RAC)



ERROR CODE : E19

DESCRIPTION : mA detected without "*Exp*" command.

ERROR TYPE : Fatal Error. Generator has opened a line contactor that remains in an endless loop. It is necessary to turn off the equipment.

APPLICABLE TO : All Generators

APPEARS WHEN : In stand-by or during initialization.

INFORMATION / SYMPTOM : Current in tube without *"Prep"* command.

POSSIBLE CAUSES

± 12 VDC power supplies missing on the HT Controller Board.

Defective HT Controller.

mA signal on H T Controller is active.

ACTIONS

1. Check ± 12 VDC power supplies.
2. In stand-by mode (no exposure), check for 0 VDC in TP5, TP13, TP14 as well as in connector P4-6 and P4-7 of the HT Controller Board.
3. If voltage V ≠ 0 VDC in P4-6 and P4-7, check connections between P4-6 / P4-7 and J1 of the HV Transformer.
4. If it is OK, replace HT Controller Board.

Note ☞

As reference values:

- the resistance measured between P4-6 or P4-7 on the HT Controller Board and Ground (with all cables connected) should be around 900 Ω.

- the resistance measured between P4-6 or P4-7 on the HT Controller Board and Ground (with cable of J4 connector removed from the HT Controller Board) should be around 200 KΩ.

ERROR CODE : E20

DESCRIPTION : kVp detected without *"Exp"* command.

ERROR TYPE : Fatal Error. Generator has opened a line contactor that remains in an endless loop.

APPLICABLE TO : All Generators.

APPEARS WHEN : In stand-by or during initialization.

INFORMATION / SYMPTOM : kVp detected without *"Exp"* command.

"E20" on the Console indicates that the error must be solved with the equipment OFF.

POSSIBLE CAUSES

-12 VDC power supply missing.

Defective HT Controller Board.

ACTIONS

1. Check -12 VDC power supply.
2. In stand-by mode (no exposure), check for 0 VDC in TP7, TP11, TP12, as well as in connector P4-1 and P4-2 of the HT Controller Board.
3. If voltage V $\neq$ 0 VDC in P4-1 and P4-2, check connections between P4-1 / P4-2 and J1 of the HV Transformer.
4. If it is OK, replace HT Controller Board.

Note ☞

As reference values:

- the resistance measured between P4-1 on the HT Controller Board and Ground (with all cables connected) should be around 18.5 KΩ.

- the resistance measured between P4-2 on the HT Controller Board and Ground (with all cables connected) should be around 17.5 KΩ.

- the resistance measured between P4-1 or P4-2 on the HT Controller Board and Ground (with cable of J4 connector removed from the HT Controller Board) should be around 20 KΩ.

ERROR CODE : E21

DESCRIPTION : Wrong Tube-1 selection.

ERROR TYPE : Informative. Does not allow operation until the error is solved or another Tube is selected.

APPLICABLE TO : All Generators.

APPEARS WHEN : Principally after initialization, at any moment or when changing Tube selection.

INFORMATION / SYMPTOM : Wrong Tube 1 selection.

POSSIBLE CAUSES

The –HT INTLK is not grounding (Tube 1 selection).

Defective HV Switch inside the HV Transformer (two Tubes option).

The -HT INTLK is missing.

ACTIONS

Note ☞ *Before performing any action, check the Workstation configuration for each Tube.*

Only for one (1) Tube option:

1. Check the –HT INTLK in 6J3-13 (Generator Cabinet), it should be 0 VDC with Tube-1 selected.
2. If it is not 0 VDC, check the Jumper between 6J3-13 and 6J3-16 (GND).
3. If 6J3-13 = 0 VDC, check J3-13 on the ATP Console CPU Board.
4. If not 0 VDC in J3-13, check link between 6J3-13 of the Generator Cabinet and J3-13 on the ATP Console CPU Board.
5. If voltage is 0 VDC and “E21” appears, replace the ATP Console CPU Board.

Only for two (2) Tubes option:

1. Check J3-13 on the ATP Console CPU Board. If it is 0 VDC, replace the ATP Console CPU Board. If it is 5 VDC, proceed to the second step.
2. Turn off the equipment, disconnect J1 from the HV Transformer and check continuity between J1-J and J3-13 on the ATP Console CPU Board.
3. If the continuity is not OK, check cable and replace if necessary.
4. If connection is OK, replace the HV Transformer.

ERROR CODE : E22

DESCRIPTION : Wrong Tube-2 selection.

ERROR TYPE : Informative. Does not allow operation until the error is solved or another Tube is selected.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment mainly after initialization or when changing Tube selection.

INFORMATION / SYMPTOM : Wrong Tube 2 selection.

POSSIBLE CAUSES

The –HT INTLK is not at high logic level 5V (Tube 2 selected).

Defective HV Switch inside the HV Transformer (two Tubes option).

The -HT INTLK is grounding.

ACTIONS

Note ☞ *Before performing any action, check the Workstation configuration for each Tube.*

Only for one (1) Tube option:

1. Check the –HT INTLK in 6J3-13 (Generator Cabinet), it should be 5 VDC with Tube 2 selected.
2. If it is not 5 VDC, check that 6J3-13 is not grounding.
3. If 6J3-13 = 5 VDC, check J3-13 on the ATP Console CPU Board.
4. If not 5 VDC in J3-13, disconnect J3-13 on the ATP Console CPU Board and check for short-circuits between J3-13 and ground or others signals.
5. If voltage is 5 VDC and “E22” appears, replace the ATP Console CPU Board.

Only for two (2) Tubes option:

1. Check J3-13 on the ATP Console CPU Board. If it is 5 VDC, replace the ATP Console CPU Board. If it is 0 VDC, proceed to the second step.
2. Turn off the equipment, disconnect J1 from the HV Transformer and check for short-circuits between J1-J and ground or others signals.
3. If previous steps are correct, replace the HV Transformer.

ERROR CODE : E23

DESCRIPTION : Calibration data not stored

ERROR TYPE : Indicative although it is almost impossible to find if not provoked.

APPLICABLE TO : All Generators.

APPEARS WHEN : When trying to save calibration data.

INFORMATION / SYMPTOM : Calibration data not stored. Calibration value intended to be stored has not been properly recorded.

POSSIBLE CAUSES

This problem may be shown randomly.

This problem is continuos or occurs frequently and the communication link between the Generator Cabinet and the Console is too noisy.

ACTIONS

1. Check calibration data and enter them manually if required.
2. Check communication cable (J3) between ATP Console CPU Board and HT Controller Board.
3. Route communication cables in a different way.

ERROR CODE : E24

DESCRIPTION : Bucky Movement Signal has not been detected or DR Device is not ready for exposure.

ERROR TYPE : Indicative. Does not allow exposition.

APPLICABLE TO : All Generators.

APPEARS WHEN : At the beginning of the exposition.

INFORMATION / SYMPTOM : Wrong Exposure signal from Bucky or DR Devices.

POSSIBLE CAUSES

Wrong Workstation configuration or selection.

Wrong wiring of the Bucky.

Malfunction of the Bucky / DR Device / Standard Tomo Device.

ACTIONS

1. Check the configuration of the selected Workstation corresponds to the device (Bucky / DR / Standard Tomo) connected to the Generator (*refer to the Installation / Configuration chapters of the Generator Service Manual*).

2. If none of these devices (Bucky / DR / Standard Tomo) have to be connected to the Generator and "E24" Error Code is present, check if the Workstation configuration is correct, that is, "Device value" $\neq$ 1 (Bucky-1), or $\neq$ 2 (Bucky-2), or $\neq$ 3 (Standard Tomo) (*refer to the Configuration chapter of the Generator Service Manual*).

3. If the error is present selecting a Workstation configured as Bucky-1 (1) or Standard Tomo (3), proceed with step 4.

   If the error is present selecting a Workstation configured as Bucky-2 (2), proceed with step 5.

4. **The error is present selecting a Workstation configured as Bucky-1 (1) or Standard Tomo (3)**, make a provisional jumper between 3TS1-5 and 3TS1-6 of the Generator. Then, make an exposure.

   a. If the exposure is finished and "E24" Error Code is not present, check cable connection between 3TS1 of the Generator and the respective Device (Bucky or DR). *(Refer to the Interconnection Map at the end of the Installation chapter of the Generator Service Manual).*

   b. If "E24" Error Code is present, check if Relay K5 of the Interface Control Board (A3009-xx) is activated.

   c. If Relay K5 is not activated, check if signal $\overline{\text{BUCKY1 DRCMD}}$ is active ("Low Level") in P4-12 of the Interface Control Board when making an exposure.

      - If signal $\overline{\text{BUCKY1 DRCMD}}$ is active, replace the Interface Control Board (A3009-xx).
      - If it is not active, check this signal ($\overline{\text{BUCKY1 DRCMD}}$) is active ("Low Level") in J3-14 of the ATP Console CPU Board (A3024-xx) when making an exposure.

        If it is active, check connection between J3-14 of the ATP Console CPU Board (A3024-xx) and P4-12 of the Interface Control Board.

        If it is not active, replace the ATP Console CPU Board (A3024-xx).

d. If Relay K5 is activated, check if Relay K3 is activated when making an exposure.

- If Relay K3 is activated, check if signal $\overline{\text{BUCKY EXP}}$ is active ("Low Level") in P4-6 of the Interface Control Board when making an exposure.
- If signal $\overline{\text{BUCKY EXP}}$ is not active, replace the Interface Control Board (A3009-xx).
- If signal $\overline{\text{BUCKY EXP}}$ is active, check for this signal active in J3-12 of the ATP Console CPU Board (A3024-xx) when making an exposure.

  If it is active, replace the ATP Console CPU Board (A3024-xx).

  If it is not active, check connection between J3-12 of the ATP Console CPU Board (A3024-xx) and P4-6 of the Interface Control Board.

5. **The error is present selecting a Workstation configured as Bucky-2**, Make a provisional jumper between 3TS1-12 and 3TS1-13 of the Generator. Then make an exposure.

a. If the exposure is finished and "E24" Error Code is not present, check cable connection between 3TS1 of the Generator and the respective Device (Bucky or DR). *(Refer to the Interconnection Map at the end of the Installation chapter of the Generator Service Manual).*

b. If "E24" Error Code is present, check if Relay K4 of the Interface Control Board (A3009-xx) is activated.

c. If Relay K4 is not activated, check if signal $\overline{\text{BUCKY2 DRCMD}}$ is active ("Low Level") in P4-13 of the Interface Control Board when making an exposure.

- If signal $\overline{\text{BUCKY2 DRCMD}}$ is active, replace the Interface Control Board (A3009-xx).
- If it is not active, check this signal ($\overline{\text{BUCKY2 DRCMD}}$) is active ("Low Level") in J3-11 of the ATP Console CPU Board (A3024-xx) when making an exposure.

  If it is active, check connection between J3-11 of the ATP Console CPU Board (A3024-xx) and P4-13 of the Interface Control Board.

  If it is not active, replace the ATP Console CPU Board (A3024-xx).

d. If Relay K4 is activated, check if Relay K3 is activated when making an exposure.

- If Relay K3 is activated, check if signal $\overline{\text{BUCKY EXP}}$ is active ("Low Level") in P4-6 of the Interface Control Board when making an exposure.
- If signal $\overline{\text{BUCKY EXP}}$ is not active, replace the Interface Control Board (A3009-xx).
- If signal $\overline{\text{BUCKY EXP}}$ is active, check for this signal active in J3-12 of the ATP Console CPU Board (A3024-xx) when making an exposure.

  If it is active, replace the ATP Console CPU Board (A3024-xx).

  If it is not active, check connection between J3-12 of the ATP Console CPU Board (A3024-xx) and P4-6 of the Interface Control Board.

6. Finally, remove the provisional jumpers in 3TS1 of the Generator.

ERROR CODE : E25

DESCRIPTION : Battery failure in Battery Powered Generators.

ERROR TYPE : Indicative. Does not allow exposition.

APPLICABLE TO : All Battery Powered Generators.

APPEARS WHEN : At "*Prep*" in any Battery Powered Generators and at any moment in Generators with Stand-Alone.

INFORMATION / SYMPTOM : Battery charge level is momentarily low or some batteries are discharged or damaged.

POSSIBLE CAUSES

Batteries are discharged.

Some Battery Charger Sector/s may not be working properly or some Batteries are damaged.

ACTIONS

PRELIMINARY

"E25" appears when the Generator has not been used for a long period of time, it usually allows 2 or 3 exposures and then "E25" appears.

If this is the case, charge Batteries and perform exposures until the batteries are totally discharged, then charge again and perform exposures again to discharge, repeat the procedure 5 or 6 times. This is the way to charge batteries fully and safely.

STATIONARY BATTERY POWERED GENERATOR

A. BATTERIES FULLY CHARGED AND "E25" APPEARS

1. Check for Corrosion in metal contacts of Batteries.

2. Check charger Leds on the Battery Charger Board. Green Leds and LED DS1 should be ON.

3. Check voltage in J1 of Battery Charger Board: J1-16 & J1-15, J1-14 & J1-13..... , J1-2 & J1-1.

   With the Generator OFF and disconnected from Mains, the voltage should be: 26.6 VDC.

   In Stand-Alone mode (Generator disconnected from Mains and turned ON) the voltage should be: 25.4 VDC.

   - If voltage is not OK, check the batteries status and replace defective batteries if needed (*refer to Section 2.6.3 - Identifying and Replacing Defective Batteries).*

   - If total voltage is correct and "E25" appears, check the measure circuit.

     - **In Generators with Stand-Alone**, check links between J1-18 (HT Controller) & J3-5 (Stand-Alone), J1-19 (HT Controller) & J3-6 (Stand-Alone), J1-20 (HT Controller) & J3-7 (Stand-Alone). If links and battery voltage are OK but signals are below minimum required (that is –BATST3 is "0", BATST2 is "0" and BATST1 is "1"), check the Stand-Alone Board and replace it if needed.

       If the Stand-Alone Board is not defective, check the batteries status with a load resistance connected and replace defective batteries if needed (*refer to Section 2.6.3 - Identifying and Replacing Defective Batteries).*

- **For Generators without Stand-Alone** (with Battery Charger Board A3285-xx and Battery Monitor Board A3580-xx), if the total Battery voltage is over 365 VDC when the Generator is ON and appears "E25" error code:

  - Check 5 VDC power supply is present on J1-6 (+) and J1-2 (0 VDC) at the Battery Monitor Board (A3580-xx). If 5VDC is not present, check connections.

  - Check in J1-4 of Battery Monitor Board (with reference to TP1= GND) there is a proportional voltage respect to the total battery voltage (a.e. if the total battery voltage is 385 VDC, then voltage in J1-4 should be 37 VDC).

    - If voltage in J1-4 is correct, check in J2-2 of Battery Monitor Board (with reference to TP1= GND) there is a "0" logic signal. If it is inot correct, replace the Battery Monitor Board. If J2-2 = "0", check continuity between J2-2 of the Battery Monitor Board and 4TS3-5 and then J2-7 of ATP Console CPU Board (A3024-xx). If continuity is correct, then replace the ATP Console CPU Board (A3024-xx).

    - If voltage in J1-4 is not correct, check F2 Fuse (6A, 600 V) on the Battery Charger Board (A3285-xx). If F2 is OK, check connections between Battery Charger Board J8-2 and Battery Monitor Board J1-4. If connections are correct, replace the Battery Charger Board (A3285-xx).

B. CHECKING LEDs ON THE BATTERY CHARGER BOARD

1. ***GREEN LEDS ARE ON BUT LED DS1 IS OFF***

Check that 24 V is present in J2-1 of the Battery Charger Board (A3285-xx).

- If 24 V is present, replace the Battery Charger Board (A3285-xx).
- If it is not, check for 24V in the J2-7 Line Monitor (A3139-xx).
  - If 24 V is present, repair links between J2-1 of the Battery Charger Board & J2-7 of the Line Monitor Board.
  - If not, check for 20 VAC between J2-5 and J2-6 at the Line Monitor Board.
    - If it is present, replace the Line Monitor Board.
    - If it is not present, check voltage from the 2T1 Battery Charger Transformer to the Line Monitor Board and replace if necessary.

2. ***SOME GREEN LEDS ARE NOT ON AND DS1 IS ON***

Check Fuses F7 to F21(2A, 250 VAC) (Charger Sectors) of the Battery Charger Board (A3285-xx).

Check VAC at J6 and J4 in Battery Charger Board (connectors J6 and J4 must be plugged in the Board), it should be 28 VAC (measure between: J6-1 & J6-2, J6-3 & J6-4..... until J6-15 & J6-16, and also check J4-1 & J4-2 ..... until J4-13 & J4-14).

- If VAC is OK, replace the Battery Charger Board (A3285-xx).
- If not, unplug connectors J6 and J4 from the Battery Charger Board and measure again, checking VAC from 2T1 Battery Charger Transformer at connectors J6 and J4. It should be 28 VAC (measure: J6-1 & J6-2, J6-3 & J6-4..... until J6-15 & J6-16, and also check J4-1 & J4-2 ..... until J4-13 & J4-14). Check 2T1 Battery Charger Transformer and replace if necessary.

3. ***NONE OF THE LEDs ON***

Check that the Generator is Powered ON.

If DL1 is blinking (yellow) at the Line Monitor Board and DL2 and DL3 are OFF:

- Check VAC between J2-1 and J2-3 at the Line Monitor Board. If no VAC is found, replace the Line Monitor Board. If VAC is present, check VAC on the 2T1 Battery Charger Transformer.
  - If no VAC is found, check and fix connection at 2T1 Battery Charger Transformer.
  - If VAC is present, check the 2T1 Battery Charger Transformer.

If DL1 is blinking (yellow) at the Line Monitor Board while DL2 and DL3 are ON (any of them)*:*

- Check Line for VAC +/- 15%.
  - If Line VAC is not OK, it is an external problem.
  - If Line VAC is OK, review the Line Monitor Board adjustment.

    Line Monitor Board Adjustment: Configure SW1 at the Line Monitor Board according to the Power Line Voltage (*refer to Installation chapter in Service Manual*). Measure the Power Line Voltage with a Digitalmeter and adjust the VDC of TP2 with POT1 at the Line Monitor Board as indicated in the following formula:

    $$\frac{V_{measured}}{V_{nominal}} \times 2.5 = V_{TP2} \qquad \textit{Example:} \quad \frac{V_{(measured:220V)}}{V_{(nominal:230V)}} \times 2.5 = V_{TP2}(2.4VDC)$$

    V measured is the real voltage obtained with polymeter.
    V nominal is the SW1 configuration Voltage.

If all Leds are off at the Line Monitor Board:

- Check VAC on J2-1 / J2-2 at Line Monitor Board.
  - If VAC is OK, review configuration of Jumper SW1.
  - If VAC is not OK, check (Magnetothermic) 1SW1 is ON and external VAC power.

MOBILE X-RAY UNITS WITH BATTERY POWERED GENERATOR

Note ☞

Before performing any troubleshooting procedures, verify that the Unit has been connected to the mains for approximately ten (10) hours, until the Battery Charge Level Indicators on both columns stop scrolling and the Green Indicators remain illuminated. This will ensure a complete and full Battery charging.

The Batteries require approximately 10 hours for a fully charge. To charge the Batteries, there is not need to have the Console turned ON. When the Batteries are fully charged, the Battery charge level Indicators on both columns stop scrolling and only the Green Indicators remain illuminated.

The Battery charge level (only for Generator) will be reduced consistent with the exposures made by the Generator. During the charging sequence, connected to the mains, the Battery Charge Level for the **Generator** reaches approximately 420 Volts. When the Unit is unplugged and Batteries are fully charged, the Battery Charge Level reduces to about 390 Volts.

When the Generator Battery charge level is below 10% (Red indicators are blinking when the Unit is unplugged from mains), the "*Battery Low*" signal becomes active. Error "*E25*" is shown when the Generator is in "*Prep*" and the "*Battery Low*" signal (from the "*Battery Monitor Board*" to J2-7 of the "*ATP Console CPU Board*") is at "High Level" (around 5 Volts).

Check status of the Generator Batteries and Generator Battery Charger Boards ("E25" Error Code does not apply to Batteries and Charger for Motors) as described in Section 2.3 "*Preliminary Test of Battery and Charger Conditions*".

ERROR CODE : E26

DESCRIPTION : Voltage failure in Battery Powered Generators with Stand-Alone.

ERROR TYPE : Fatal error. System shut down.

APPLICABLE TO : All Battery Powered Generators with Stand-Alone.

APPEARS WHEN : At the beginning of the exposition.

INFORMATION / SYMPTOM : System failure

POSSIBLE CAUSES

No voltage detected at Stand Alone.

Shutdown

DC is below or over specifications

HT Controller cables are accidentally grounded.

ACTIONS

1. Check that DL4 is ON; if OFF, Stand Alone Board is not powered.
2. Check that DL3 is OFF; if ON, a shutdown has occurred.
3. Check that DL5 is OFF; if ON, DC is below or above specifications.
4. Check that battery voltage cables connected to the HT Controller are not grounded.

ERROR CODE : E27

DESCRIPTION : Failure in EPROM U24 of the ATP Console CPU Board. Bad checksum.

ERROR TYPE : Fatal Error. Generator does not start.

APPLICABLE TO : All Generators

APPEARS WHEN : During Generator initialization.

INFORMATION / SYMPTOM : The ATP Console CPU Board performs a checksum procedure of EPROM U24 when it has been configured to a non-allowed calibration and it has found this value to be incorrect.

POSSIBLE CAUSES

The ATP Console CPU Board has been configured in a non communication mode.

The non volatile RAM does not calculate and compare the ATP Console CPU Board checksum.

The EPROM U24 has been corrupted.

ACTIONS

1. Check if dip-switch 3024SW2 on ATP Console CPU Board is correctly configured (*refer to Configuration Chapter - "Configuration and Test Switches" of the Service Manual).*

2. If error remains, replace the Non-Volatile RAM U23 on ATP Console CPU Board.

3. If error remains, replace the EPROM U24 on ATP Console CPU Board.

ERROR CODE : E29

DESCRIPTION : "ALL CLEAR" signal not activated.

ERROR TYPE : Indicative. Does not allow "Prep".

APPLICABLE TO : Nucletron Generators.

APPEARS WHEN : When pressing "Prep" in P00 mode.

INFORMATION / SYMPTOM : Exposure is not permitted.

POSSIBLE CAUSES

"All Clear" signal is not ready after 5 seconds with "Prep" activated.

ACTIONS

Release the exposure controls, press the "System Reset" button and check the system.

ERROR CODE : E30

DESCRIPTION : Relay K1 not active.

ERROR TYPE : Indicative. Does not allow “Prep”.

APPLICABLE TO : Nucletron Generators.

APPEARS WHEN : When pressing “Prep” in P00 or P03 mode.

INFORMATION / SYMPTOM : Test-scan not started.

POSSIBLE CAUSES

MOSTA signal is not received at system or relay K1 is not active.

ACTIONS

Release the exposure controls, press the “System Reset” push-button and check the system.

ERROR CODE : E31

DESCRIPTION : Long exposition is not initiated.

ERROR TYPE : Indicative. Does not allow long “Exp”.

APPLICABLE TO : Nucletron Generators.

APPEARS WHEN : During exposition phase in P00 mode.

INFORMATION / SYMPTOM : Signal from K3 has not been detected after 1.6 seconds.

POSSIBLE CAUSES

Signal from K3 has not been detected after 1.6 seconds.
The system is not ready to make the exposure or the operator has aborted the exposure.

ACTIONS

Release the exposure controls, press the “System Reset” push-button and check the system.

ERROR CODE : E32

DESCRIPTION : Long exposition is not cut (after 3.2 seconds) as relay K3 was not detected.

ERROR TYPE : Indicative. Cut exposition at 3.2 seconds of backup time.

APPLICABLE TO : Nucletron Generators.

APPEARS WHEN : During exposition phase in P00 mode.

INFORMATION / SYMPTOM : Signal from K3 is not received.

POSSIBLE CAUSES

Signal from K3 is not received.
Exposure not complete, time is longer than 1.6 seconds.

ACTIONS

Release the exposure controls, press the “System Reset” push-button and check the system.

ERROR CODE : E33

DESCRIPTION : No communication link between the Generator and the Operator Console or PC Unit.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Operator Console.

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : Serial Communication Error.

POSSIBLE CAUSES

Connecting cable between Console and Generator is loose or damaged.

ATP Console CPU Board, or Operator Console, or Serial Port of the PC is damaged.

The Generator is turned OFF and PC is ON.

ACTIONS

This error means that there is NO serial communication (RS232) between the ATP Console CPU Board and the Operator Console or PC (depends on the installation).

Note ☞ *The ATP Console CPU Board (for serial communication) is located at the back side of the Front Panel the Generator cabinet.*

1. Check the connection cable between connector J8 (or J7 depends on the Generator configuration) from the ATP Console CPU Board to connector J5 of the Generator cabinet. Then check the serial communication cable and connections from J5 to the Operator Console or to the ON/OFF Interface Box (when a PC is used). *(Refer to schematics 54301052 and A6188-03 of the Installation chapter in the Service Manual).*

2. In order to isolate the problem, turn the Generator ON and measure if any of the following voltages are present in order to know if the Generator is really turned ON.
   - 240 VAC SW: between 3TS1-26 and 3TS1-10.
   - 115 VAC SW: between 3TS1-27 and 3TS1-10.
   - Relay 3K3 (located on the front door of the generator) is energized.
   - LED DS1 in the Interface Control Board is ON.

3. If the Generator is turned ON, check the following points:
   a. 12 VDC UNR: In the ATP Console CPU Board between TP9 and TP11.

      If 12 VDC UNR is not present in the ATP Console CPU Board, check Fuse 3F7. If Fuse 3F7 is OK, check the presence of 11 VAC at the input of Rectifier 3BR4.

      - If 11VAC is not present, check for 11 VAC between terminals 11 and 12 of Transformer 6T2 and check Relay 3K3 works properly.
      - If 11 VAC is present at the input of Rectifier 3BR4, check for 12 VDC UNR measuring in Capacitor 3C7. If 12 VDC UNR is not present, replace the Rectifier 3BR4. If 12 VDC UNR is present, check the wire connections.

b. If 12 VDC UNR is present between TP9 and TP11 of the ATP Console CPU Board, check for:

- 12 VDC ISO: In the ATP Console CPU Board between TP10 and TP1.
- 5 VDC of the ATP: In the ATP Console CPU Board between TP3 and TP1.
- DS1 of the ATP Console CPU Board (normally ON).

If any of the voltages is not present or correct, or if LED DS1 is OFF, replace the ATP Console CPU Board.

c. If previous steps are correct, the problem is isolated in the RS232 connection between the ATP Console CPU Board and the Operator Console or PC (depends on the installation).

Check the Serial Port on the PC and if possible the RxD and TxD signal between the ATP Console CPU Board and the PC. *(Refer to schematics 54301052 and A6188-03 of the Installation chapter in the Service Manual).* Replace any defective part found.

To check the Serial Communication using an Oscilloscope measure the following signal:

- On the ATP Console CPU Board, measure and check that there is a wave form on the connector J8-3, if some RS232 signal is present that means the ATP Console CPU Board is sending some information to the Operator Console, in case that no signal is present on this pin replace the ATP Console CPU Board.
- On the ATP Console CPU Board, measure and check that there is a wave form on the connector J8-2, if some RS232 signal is present that means the ATP Console CPU Board is receiving some information from the Operator Console, in case that no signal is present check the following points:

  - For Push-button Console, check that all VDC are present on the Operator Console and all internal connections are secure inside the Console.

  - For Touch Screen Console, check that all internal connections are secure inside the Console.

  - If after the previous checking the wave form is present on the connector J8-2 but the “E33” Error Code persists, then replace the ATP Console CPU Board.

ERROR CODE : E34 - TECHNIQUE ERROR

DESCRIPTION : Technique error.

ERROR TYPE : Informative without acoustic alarm or
Fatal error after exposition. It does not allow exposure.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment after parameter selection or after exposure.

INFORMATION / SYMPTOM : Warning Indication: "Technique error" on Consoles with written indicators. For other Consoles, "E34" appears on the display.

POSSIBLE CAUSES

Calibration for specific parameters is incorrect.

ACTIONS

1. If this error occurs with time parameters close to 1ms - The cable capacity is excessive for a short exposure. Also the calibration for that parameters is wrong. Check the Calibration section of the Service Manual: "*Exposure Time Adjustment*".

2. If this error occurs in Fluoroscopy mode with ABC, it means that the equipment is not able to perform the intended operation. Perform Jumper W1 in Fluoro CPU.

3. **DANGER: If it happens after an exposition, it indicates a failure in the exposition timer; backup timer has been cut.** Reset APR and reconfigure values.

ERROR CODE : E35 - DOOR OPEN

DESCRIPTION : Door Open.
For Generators with HV Transformer equipped with a Security Pressure Switch, the HV Transformer surpasses the maximum internal pressure capacity.

ERROR TYPE : Informative. It may inhibit Exposition depending on the configuration of Dipswitch 3024SW1-2 on the ATP Console CPU Board.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : Indicated with warning “Door Open” or error code “E35”. Does not allow “Prep” and “Exp”.

POSSIBLE CAUSES

“Door Open” Circuit is open (X-Ray Room Door open, cable disconnected or jumper cable not installed).

When the HV Transformer is equipped with a Pressure Switch: Could indicate a need to replace the HV Transformer because it has surpassed its maximum internal pressure capacity and is close to deforming.

Fault at the ATP Console CPU Board.

ACTIONS

1. If the X-Ray Door signal is setup, ensure continuity in the *Door Interlock Signal* from the X-Ray Room Door through 3TS1 (3TS1-22 & 3TS1-23) and J2 (J2-19 & J2-18) on the ATP Console CPU Board (*see the Installation Chapter of the Service Manual: “Door Interlock Signal”*), correcting continuity where necessary.

   If the X-Ray Door signal is not setup, ensure the same continuity as above from the Jumper at 3TS1 (3TS1-22 & 3TS1-23).

2. If the error persists and the HV Transformer is equipped with a Security Pressure Switch, 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.

3. If the error persists and the HV Transformer has been replaced or is not equipped with a Security Pressure Switch, replace the ATP Console CPU Board.

ERROR CODE : E36 - HEAT UNITS

DESCRIPTION : Safety Thermostat Open. Overheating.

ERROR TYPE : Informative without acoustic alarm. Does not allow expositions.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : Indicated with "*Heat Unit*" warning in Consoles with written indicators. For the rest of Consoles "E36" appears in display. Does not allow "*Prep*" and "*Exp*".

POSSIBLE CAUSES

The thermostat of the selected Tube is open due to an overheated Tube Housing (temperature > 60ºC), a defective thermostat connection, or a faulty thermostat.

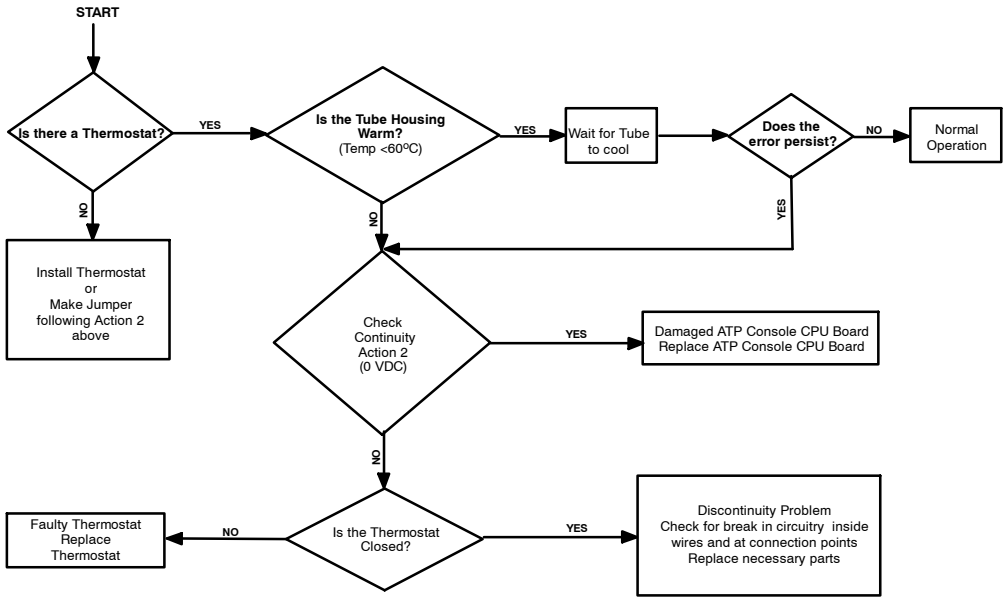
Discontinuity problem inside the wires or at connection points.

If the Tube Housing is cool (temperature < 60ºC) and there is a closed circuit (connections are not faulty and Voltmeter reading for Tube-1/2 is 0 VDC), there is a damaged ATP.

It may also appear during calibration due to the high volume of exposures (starting, braking and Anode heating)

ACTIONS

1. If the error is due to overheating, wait until the temperature is lower than 60ºC, the thermostat will be closed.
2. When there is no thermostat on the X-ray Tubes, the respective thermostat signals have to be connected to ground (For Tube-1: TS2-4 & TS2-5 / For Tube-2: TS2-12 & TS2-13)
3. Check for a correct installation of the Thermostat/Presostat (connections for Tube-1: TS2-4 & TS2-5 / For Tube-2: TS2-12 & TS2-13).
   - If the Tube does not have this signal, make the Jumpers as indicated above.
   - If the Tube has this signal, check for a faulty ATP Console CPU Board.



ERROR CODE : E37 - TUBE OVERLOAD

DESCRIPTION : Tube Overload.

ERROR TYPE : Informative without acoustic alarm. Does not allow Exposition.

APPLICABLE TO : All Generators.

APPEARS WHEN : After “Exp” due to Tube overheating. After changing radiographic parameters. In some Consoles this error may not appear as they are provided with an automatic blocking that disables parameters above Tube capacity.

INFORMATION / SYMPTOM : Indicated with warning “Tube Overload” in Consoles with written indicators. For the rest of the Consoles “E37” appears in the display. Exposures are not allowed.

POSSIBLE CAUSES

Parameters selected for a new exposition are above Tube capacity. (Heat Units or Rating).

The Capacity Line frequency is wrong or the Tube selected in the extended position “E02” or “E18” is not correct.

ACTIONS

1. Wait until X-ray Tube temperature is lowered, so capacity of available Heat Units increase, or modify Exposition parameters.

2. If Heat Units of the Tube are 100% and “E37” or “Tube Overload” warning appear, check that Dip-switch 3024SW1-1 on ATP Console CPU Board is properly configured (Dip-switch 3024SW1-1 in “OFF” position for High Speed generators). (*Refer to the Configuration Chapter in the Service Manual*).

3. Check the X-Ray Tube configured in the Extended Memory Location “E02” for Tube-1 and “E18” for Tube-2 (*refer to Section“X-ray Tube Selection” of the Configuration Chapter of the Service Manual*).

ERROR CODE : E41

DESCRIPTION : Dosimeter failure. Communication failure between the Tube-1 Dosimeter and Generator.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Dosimeter.

APPEARS WHEN : Communication error starting the measuring.

INFORMATION / SYMPTOM : Indicated as Error Code "E41".

POSSIBLE CAUSES

Wrong Physical connection between Dosimeter and Generator for Tube-1.

Defective Radiation Meter Board (A3170-01) or defective ATP Console CPU Board (A3024-xx).

ACTIONS

1. Turn OFF/ON the Generator to reset the Radiation Measuring System.
2. Check the cable connections between the Dosimeter Ion Chamber for Tube-1 (located under the Collimator) and the Connector IC-1 located on the Front Panel (Module-3) of the Generator Cabinet (*for more information, refer to Appendix "Adaptation of the Radiation Measuring System*).
3. Check the cable connections between Connector IC-1 and Connector P2 of the Radiation Meter Board (A3170-01).
4. Check the cable connections between Connector P3 of the Radiation Meter Board (A3170-01) to Connector J7 of the ATP Console CPU Board (A3024-xx) or to Connector COM4 of the TPC (if ATP Console CPU Board is not used for the Dosimeter System).
5. Verify +24VDC is present between J1-2 and J1-3 of the Radiation Meter Board (A3170-01).
   - If +24VDC is not present, check wire connections between J1 of the Radiation Meter Board and 3TS1-17/18 in the Generator Cabinet.
   - If +24VDC is present, disconnect the JACK connector next to Connector IC1 and check if verify 23 VDC is present on the JACK connector (Generator side).
     - If 23 VDC is not present, check wire connection between P2 of the Radiation Meter Board and JACK Connector, and if the connection is correct replace the Radiation Meter Board (A3170-01).
     - If 23 VDC is present, follow next step.
6. On the Radiation Meter Board, verify between both ends of Diode D1 is 0 VDC present.
   - If the voltage in Diode D1 is 24 VDC, check if there is a short-circuit between J1-1 and GND.
   - If the voltage in Diode D1 is 0 VDC, disconnect P2 and P3 of the Radiation Meter Board. Maintain the Unit switched ON, measure continuity between P3-2 and P2-2, and between P3-3 and P2-3. If there is not continuity between the mentioned points, replace the Radiation Meter Board (A3170-01).
7. Only for Radiation Measuring Systems with connections through the ATP Console CPU Board.

   Using an Oscilloscope, measure on the ATP Console CPU Board the presence of pulses between connector J7-2 (reception) and GND, and between J7-3 (transmission) and GND.
   - If pulses are present in J7-3 but pulses are not present in J7-2 , replace the DAP Ion Chamber.
   - If pulses are not present in J7-3, replace the ATP Console CPU Board (A3024-xx).
   - If pulses are present in both mentioned points, replace the ATP Console CPU Board (A3024-xx).

ERROR CODE : E42

DESCRIPTION : Dosimeter failure. Autotest error on Tube-1 Dosimeter.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Dosimeter.

APPEARS WHEN : Communication error starting the measuring for Tube-1 or during regular operation.

INFORMATION / SYMPTOM : Indicated as Error Code “E42”. Failure test in Dosimeter.

POSSIBLE CAUSES

Error during electronic checking of DAP Ion Chamber for Tube-1.

ACTIONS

1. Turn OFF/ON the Generator to reset the Radiation Measuring System.
2. If the error persists, replace the DAP Ion Chamber.

ERROR CODE : E43

DESCRIPTION : Dosimeter failure. Tube-1 DAP Ion Chamber status check error.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Dosimeter.

APPEARS WHEN : Communication error starting the measuring for Tube-1 or during regular operation.

INFORMATION / SYMPTOM : Indicated as Error Code “E43”. Wrong DAP Ion Chamber status request.

POSSIBLE CAUSES

Error during DAP Ion Chamber checking. DAP Ion Chamber not operative.

ACTIONS

1. Turn OFF/ON the Generator to reset the Radiation Measuring System.

2. If the error persists, it is necessary to recalibrate the DAP Ion Chamber.

ERROR CODE : E44

DESCRIPTION : Dosimeter failure. Communication failure between the Tube-2 Dosimeter and Generator.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Dosimeter.

APPEARS WHEN : Communication error starting the measuring.

INFORMATION / SYMPTOM : Indicated as Error Code "E44".

POSSIBLE CAUSES

Wrong Physical connection between Dosimeter and Generator for Tube-2.

Defective Radiation Meter Board (A3170-01) or defective ATP Console CPU Board (A3024-xx).

ACTIONS

1. Turn OFF/ON the Generator to reset the Radiation Measuring System.
2. Check the cable connections between the Dosimeter Ion Chamber for Tube-2 (located under the Collimator) and the Connector IC-2 located on the Front Panel (Module-3) of the Generator Cabinet (*for more information, refer to Appendix "Adaptation of the Radiation Measuring System*).
3. Check the cable connections between Connector IC-2 and Connector P1 of the Radiation Meter Board (A3170-01).
4. Check the cable connections between Connector P3 of the Radiation Meter Board (A3170-01) to Connector J7 of the ATP Console CPU Board (A3024-xx) or to Connector COM4 of the TPC (if ATP Console CPU Board is not used for the Dosimeter System).
5. Verify +24VDC is present between J1-2 and J1-3 of the Radiation Meter Board (A3170-01).
   - If +24VDC is not present, check wire connections between J1 of the Radiation Meter Board and 3TS1-17/18 in the Generator Cabinet.
   - If +24VDC is present, disconnect the JACK connector next to Connector IC1 and check if verify 23 VDC is present on the JACK connector (Generator side).
     - If 23 VDC is not present, check wire connection between P1 of the Radiation Meter Board and JACK Connector, and if the connection is correct replace the Radiation Meter Board (A3170-01).
     - If 23 VDC is present, follow next step.
6. On the Radiation Meter Board , verify between both ends of Diode D1 is 24 VDC present.
   - If the voltage in Diode D1 is 0 VDC, check wire connection between J1-1 of the Radiation Meter Board and J1-12 of the HT Controller Board.
   - If the voltage in Diode D1 is 24 VDC, disconnect P1 and P3 of the Radiation Meter Board. Maintain the Unit switched ON, measure continuity between P1-2 and P3-2, and between P1-3 and P3-3. If there is not continuity between the mentioned points, replace the Radiation Meter Board (A3170-01).
7. Only for Radiation Measuring Systems with connections through the ATP Console CPU Board. Using an Oscilloscope, measure on the ATP Console CPU Board the presence of pulses between connector J7-2 (reception) and GND, and between J7-3 (transmission) and GND.
   - If pulses are present in J7-3 but pulses are not present in J7-2 , replace the DAP Ion Chamber.
   - If pulses are not present in J7-3, replace the ATP Console CPU Board (A3024-xx).
   - If pulses are present in both mentioned points, replace the ATP Console CPU Board (A3024-xx).

ERROR CODE : E45

DESCRIPTION : Dosimeter failure. Autotest error on Tube-2 Dosimeter.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Dosimeter.

APPEARS WHEN : Communication error starting the measuring for Tube-2 or during regular operation.

INFORMATION / SYMPTOM : Indicated as Error Code “E45”. Failure test in Dosimeter.

POSSIBLE CAUSES

Error during electronic checking of DAP Ion Chamber for Tube-2.

ACTIONS

1. Turn OFF/ON the Generator to reset the Radiation Measuring System.
2. If the error persists, replace the DAP Ion Chamber.

ERROR CODE : E46

DESCRIPTION : Dosimeter failure. Tube-2 DAP Ion Chamber status check error.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators with Dosimeter.

APPEARS WHEN : Communication error starting the measuring for Tube-2 or during regular operation.

INFORMATION / SYMPTOM : Indicated as Error Code “E46”. Wrong DAP Ion Chamber status request.

POSSIBLE CAUSES

Error during DAP Ion Chamber checking. DAP Ion Chamber not operative.

ACTIONS

1. Turn OFF/ON the Generator to reset the Radiation Measuring System.

2. If the error persists, it is necessary to recalibrate the DAP Ion Chamber.

ERROR CODE : E47

DESCRIPTION : Capacitors not charged when “PREP” is activated.

ERROR TYPE : Informative. Does not allow exposition.

APPLICABLE TO : Capacitor Assisted Generators.

APPEARS WHEN : At any moment or during the “PREP” order.

INFORMATION / SYMPTOM : Indicated as Error Code “E47”.

POSSIBLE CAUSES

Fault in one of the Capacitors or the Capacitor Charger Board.

Lack of Power Supply at the Capacitor Charger Board input.

ACTIONS

1. Visually inspect the Capacitor Charger Board (A3517-xx) for damage, replacing or repairing where necessary.

2. Ensure line voltage between J2-1 & J2-3 at the Capacitor Charger Board.
   - If voltage is not present, ensure a correct connection between J2 of the Capacitor Charger Board and 8TS1-1 & 8TS-2.
   - If voltage is present, visually check that both LED D2 and D3 on the Capacitor Charger Board are lit.
     - If LEDs are lit, proceed to the next step 3.
     - If LEDs are not lit, proceed to step 4.

3. LEDS ON:Verify the status of the signal “*/READY*” from J3-2 of the Capacitor Charger Board (A3517-02), “/READY” signal must be at LOW level.
   - If the signal at J3-2 is not at the correct level, change the Capacitor Charger Board.
   - If the signal is at the correct level, ensure that the same signal “*/READY*” reaches J13-1 on the ATP Console CPU Board (from J3-2 on the Capacitor Charger Board), repairing or replacing where necessary. If the connection between these points is correct, change the ATP Console CPU Board (A3024-xx).

4. LEDS OFF: Check that 12 VDC is present between J3-8 and J3-7 of the Capacitor Charger Board, if it is not present, check that 12 VDC is present between J1-6 and J1-1 of the Interface Control Board and check connections between Capacitor Charger Board, Interface Control Board and LVDC Power Supply (at the Front Panel).

   Check that 0 VDC is present between J3-1 and J3-7 of the Capacitor Charger Board, if it is not present, check continuity between J3-1 of the Capacitor Charger Board and J13-11 of the ATP Console CPU Board. If continuity is correct, replace the ATP Console CPU Board (A3024-xx).

5. If 12 VDC and 0 VDC are present in the respective connections, turn the Generator OFF and discharge the Capacitors as described in Section “*Procedure for Storage Capacitors Discharging and Voltage Testing*” of this chapter.

6. Verify that there is not a short circuit in the Capacitor Module.
   - If a short circuit is found, disconnect 6J1 to find out whether the short circuit is in the Capacitor Bank or in the Inverter Module, repairing or replacing where necessary.
   - If a short circuit is not detected, replace the Capacitor Charger Board (A3517-xx). If the problem persists, change IGBTs Q1 & Q2 of the Capacitor Charger Board.

ERROR CODE : E48

DESCRIPTION : Collimator Error.

ERROR TYPE : Informative. Does not allow exposure.

APPLICABLE TO : All Generators.

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : Showed as “Technique Error” in Consoles with this light indicator. On other Consoles, “E48” is displayed.

POSSIBLE CAUSES

Collimator blades closed or in motion during exposure.

Defective Collimator.

ACTIONS

1. Check collimator blades.

2. If they are OK, check that the TS3-20 is at “Low level”
   - If it is not at “Low level”: The problem is in the Collimator.
   - If the signal is at “Low level”, check J2-6 on ATP Console.
     - if it is at “Low level”, replace ATP Console CPU Board
     - If is at “High level”, check and fix the link between J2-6 and TS3-20.

ERROR CODE : E49

DESCRIPTION : Exposure Cycle Error.

ERROR TYPE : Informative. Does not allow exposure.

APPLICABLE TO : Generators with two X-ray Tubes for RAD only with “Exposure Cycle” feature (a.e. IBA).

APPEARS WHEN : Exposure not performed or aborted.

INFORMATION / SYMPTOM : “E49” appears on the Console.

POSSIBLE CAUSES

Operator releases “EXP” button before exposure time has ended.

Exposure order is interrupted.

ACTIONS

1. Reset the Error indication.
2. Repeat the exposure.
3. If the error persists, check:
   - Handswitch condition and connections, replace if needed.
   - “EXP” button on the Console, Console condition and connections, replace the respective parts if needed.

ERROR CODE : E50

DESCRIPTION : Interrupted Exposure.

ERROR TYPE : Indicative.

APPLICABLE TO : All Generators.

APPEARS WHEN : When operator releases "*Exp*" control before exposure time has finished.

INFORMATION / SYMPTOM : Indicated as Error Code "E50" or "Exposure Aborted by the Operator".

POSSIBLE CAUSES

Operator releases "*Exp*" button before exposure time has finished.

ACTIONS

1. Reset the Error indication.
2. Repeat the exposure.
3. If the error persists, check:
   - Handswitch condition and connections, replace if needed.
   - "EXP" button on the Console, Console condition and connections, replace the respective parts if needed.

ERROR CODE : E51

DESCRIPTION : LV-DRAC: Checksum failure or Microcontroller U17 corrupted in Control DRAC Board.

ERROR TYPE : Indicative. System does not allow exposition.

APPLICABLE TO : Generators with High Speed Starter

APPEARS WHEN : After self-test.

INFORMATION / SYMPTOM : At power On, after the Generator autocheck, Error Code “E51 is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

DRAC program memory corrupted.

ACTIONS

1. Replace Microcontroller U17 on the Control DRAC Board.

ERROR CODE : E52

DESCRIPTION : LV-DRAC: Microcontroller RAM failure.

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter

APPEARS WHEN : After self-test.

INFORMATION / SYMPTOM : At power On, after the Generator autocheck, Error Code “E52” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

U17 on the Control DRAC Board is defective.

ACTIONS

1. Replace Microcontroller U17 on Control DRAC Board.

ERROR CODE : E53

DESCRIPTION : LV-DRAC: Insufficient DC BUS voltage at low level voltage (220 VAC).

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : Error Code “E53” is displayed and it is not possible to make *Prep*.

POSSIBLE CAUSES

Low or no DC BUS Voltage on the Control DRAC Board.

Voltage at TP18 on the Control DRAC is <1.1VDC.

ACTIONS

1. Turn the generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

2. On the Interface DRAC Board check that the voltage between J2-1 (-) and J2-2 (+) is higher than 200 VDC.
   - If it is not, perform Error Code “E11” checking.
   - If it is higher than 200 VDC, go to next step.

3. On the Interface DRAC Board check that there is the same voltage between J2-5 (-) and J2-4 (+) than the voltage measured before between J2-1 (-) and J2-2 (+).
   - If VDC is OK, go to step 8.
   - If VDC is not OK, go to next step.

4. Turn the generator OFF and wait three (3) minutes for Main Storage Capacitors to discharge.

5. Check Fuses F3 and F4 on the Interface DRAC Board and that the Fuse Holders are making contact with the Fuses. If necessary, replace the Fuses and close the contacts of the Fuse Holders.

6. Turn the generator ON.

7. If the error persists, check on the Interface DRAC Board that there is the same voltage between J2-5 (-) and J2-4 (+) than the VDC measured before between J2-1 (-) and J2-2 (+).
   - If VDC is OK, go to step 8.
   - If VDC is not OK, turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
     - If any of the Fuses are blown again, replace the Fuse(s) and replace the Control DRAC Board.
     - If both Fuses are OK, replace the Interface DRAC Board.

8. On the Control DRAC Board, check that the voltage between J2-1 (-) and J2-2 (+) is the same than the voltage measured before between J2-1 (-) and J2-2 (+) on the Interface DRAC Board.
   - If VDC is not OK:
     - Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
     - Check the Faston terminals of the DC BUS Cable on both Boards (Control and Interface DRAC Boards). If necessary, close the Faston terminals.
     - Check the continuity of the DC BUS Cable. If necessary, replace the DC BUS Cable.
   - If VDC is OK, but the error persists, check that the voltage at TP18 on Control DRAC Board is < 1.1 VDC.

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

   - If VDC is higher than 1.1 VDC, replace the Control DRAC Board.
   - If VDC is lower than 1.1 VDC, check the voltage at the following Test Points on the Control DRAC Board:
     - +5 VDC at TP14
     - +15 VDC at TP15
     - -15 VDC at TP37

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

   - If voltages at the above Test Points are correct, replace the Control DRAC Board.
   - If any voltage at the above Test Points are not correct, go to next step.

9. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

10. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.

11. Turn the generator ON.

12. Check the voltage at the following points on the Interface DRAC Board:
    - +5 VDC at Anode of diode CR6
    - +15 VDC at Anode of diode CR5 or at Cathode of diode CR6
    - -15 VDC at Cathode of diode CR7

Note ☞ *For GND reference use the Terminal J2-3 on the Interface DRAC Board.*

   - If voltages at the above points are correct, replace the Control DRAC Board.
   - If any voltage at the above points are not correct, replace the Interface DRAC Board.

CAUTION

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E54

DESCRIPTION : LV-DRAC: Insufficient DC BUS voltage at high level voltage (400 / 480 VAC).

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter

APPEARS WHEN : At any moment

INFORMATION / SYMPTOM : Error Code "E54" is displayed and it is not possible to make *Prep*.

POSSIBLE CAUSES

Low or no DC BUS Voltage on the Control DRAC Board.

Voltage at TP18 on the Control DRAC is <2.48VDC.

ACTIONS

1. Turn the generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

2. On the Interface DRAC Board check that the voltage between J2-1 (-) and J2-2 (+) is higher than 447 VDC.
   - If it is not, perform Error Code "E11" checking.
   - If it is higher than 447 VDC, go to next step.

3. On the Interface DRAC Board, check that there is the same voltage between J2-5 (-) and J2-4 (+) than the voltage measured before between J2-1 (-) and J2-2 (+).
   - If VDC is OK, go to step 8.
   - If VDC is not OK, go to next step.

4. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

5. Check Fuses F3 and F4 on the Interface DRAC Board and that the Fuse Holders are making contact with the Fuses. If necessary, replace the Fuses and close the contacts of the Fuse Holders.

6. Turn the generator ON.

7. If the error persists, check on the Interface DRAC Board that there is the same voltage between J2-5 (-) and J2-4 (+) than the voltage measured before between J2-1 (-) and J2-2 (+).
   - If VDC is OK, go to step 8.
   - If VDC is not OK, turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
     - If any of the Fuses are blown again, replace the Fuse(s) and replace the Control DRAC Board.
     - If both Fuses are OK, replace the Interface DRAC Board.

8. On the Control DRAC Board, check that the voltage between J2-1 (-) and J2-2 (+) is the same than the voltage measured before between J2-1 (-) and J2-2 (+) on the Interface DRAC Board.
   - If VDC is not OK:
     - Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
     - Check the Faston terminals of the DC BUS Cable on both Boards (Control and Interface DRAC Boards). If necessary, close the Faston terminals.
     - Check the continuity of the DC BUS Cable. If necessary, replace the DC BUS Cable.
   - If VDC is OK, but the error persists, check that the voltage at TP18 on the Control DRAC Board is < 2.48 VDC.

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

   - If VDC is higher than 2.48 VDC, replace the Control DRAC Board.
   - If VDC is lower than 2.48 VDC, check the voltage at the following Test Points on the Control DRAC Board:
     - +5 VDC at TP14
     - +15 VDC at TP15
     - -15 VDC at TP37

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

   - If voltages at the above Test Points are correct, replace the Control DRAC Board.
   - If any voltage at the above Test Points are not correct, go to next step.

9. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

10. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.

11. Turn the generator ON.

12. Check the voltage at the following points on the Interface DRAC Board:
    - +5 VDC at Anode of diode CR6
    - +15 VDC at Anode of diode CR5 or at Cathode of diode CR6
    - -15 VDC at Cathode of diode CR7

Note ☞ *For GND reference use the Terminal J2-3 on the Interface DRAC Board.*

   - If voltages at the above points are correct, replace the Control DRAC Board.
   - If any voltage at the above points are not correct, replace the Interface DRAC Board.

CAUTION

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E55

DESCRIPTION : LV-DRAC: Excessive DC BUS voltage at 480 VAC.

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : At any moment

INFORMATION / SYMPTOM : Error Code "E55" is displayed and it is not possible to make *Prep*.

POSSIBLE CAUSES

DC BUS Voltage out of range on the Control DRAC Board.

Voltage at TP18 on the Control DRAC is > 4.92 VDC.

ACTIONS

1. Turn the generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

2. Check that the input voltage to the Generator (at Input Line Fuses) is according to specifications (480 VAC, ±10%). If it is not, check the Input Power Line.

Note ☞

For a three-phase Generator, the DC BUS voltage should be approximately the RMS voltage value between phases times 1.5, when the generator is ON and not making exposures.

- The following steps are a few recommendations to check the Input Power Line. These steps are not related with the Generator.
- Measure the voltage between all the phases: L1 and L2; L2 and L3; L3 and L1. They may have a big disequilibrium in one (1) of them.
- If the three (3) measurements are equal, maybe the input voltage in the installation is not sinusoidal and the peek between any of the phases is too higher.

  Use an Oscilloscope with the shield of the probe isolated from ground. Both the probe and the scope have to be able to handle and insulation voltage of 480 VAC (±10%) between the active of the probe and the shield.

  Connect the probe between all the phases: L1 and L2; L2 and L3; L3 and L1. Check the peek between any of the phases.

3. If the input voltage is OK, check on the Control DRAC Board that the voltage between J2-1 (-) and J2-2 (+) is < 800 VDC. Take note of the measured VDC.
   - If VDC is > 800 VDC, go to step 8.
   - If VDC is < 800 VDC, but the error persists, measure on the Control DRAC Board the voltage between TP18 and a GND Test Point (TP2, TP4, TP12, TP13 or TP19).

     Check that VDC measured at TP18 complies with the following scale factor:
     181 VDC measured between J2-1 and J2-2 = 1 VDC measured at TP18.
     - If VDC ratio is OK, but the error persists, replace the Control DRAC Board.
     - If VDC ratio is not OK, check the voltage at the following Test Points on the Control DRAC Board:
       - +5 VDC at TP14
       - +15 VDC at TP15
       - -15 VDC at TP37

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

     - If voltages at the above Test Points are correct, replace the Control DRAC Board.
     - If any voltage at the above Test Points are not correct, go to next step.

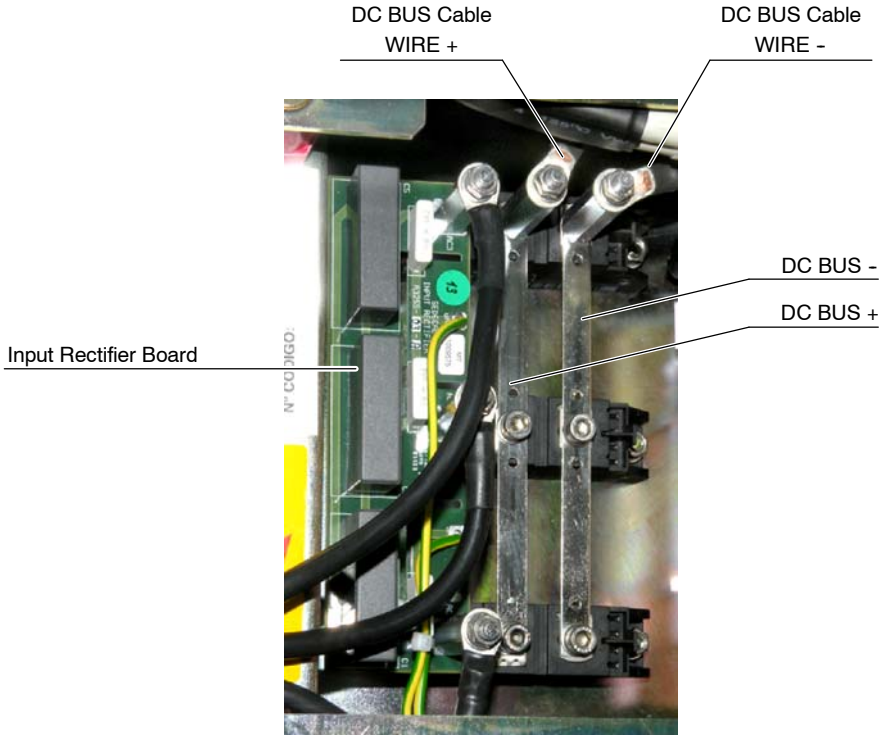
4. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
5. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.
6. Turn the generator ON.
7. Check the voltage at the following points on the Interface DRAC Board:
   - +5 VDC at Anode of diode CR6
   - +15 VDC at Anode of diode CR5 or at Cathode of diode CR6
   - -15 VDC at Cathode of diode CR7

Note ☞ *For GND reference use the Terminal J2-3 on the Interface DRAC Board.*

   - If voltages at the above points are correct, replace the Control DRAC Board.
   - If any voltage at the above points are not correct, replace the Interface DRAC Board.

8. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
9. Disconnect the DC BUS Cable from J2-5 (-) and J2-4 (+) on the Interface DRAC Board.
10. Turn the generator ON.
11. Check on the Interface DRAC Board that the voltage between J2-1 (-) and J2-2 (+) is < 800 VDC.
    - If VDC is < 800 VDC, replace the Control DRAC Board.
    - If VDC is > 800 VDC, go to the next step.
12. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
13. Disconnect the DC BUS Cable from J2-1 (-) and J2-2 (+) on the Interface DRAC Board.

14. Turn the generator ON.
15. At the wire ends (-) and (+) of the DC BUS Cable disconnected before from the Interface DRAC Board, check that the voltage is < 800 VDC.
    - If VDC is < 800 VDC, replace the Interface DRAC Board.
    - If VDC is > 800 VDC, go to the next step.
16. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
17. Disconnect the wires (-) and (+) of the DC BUS Cable from the Input Rectifier Board.



18. Turn the generator ON.
19. Check if the voltage is < 800 VDC between BUS+ and BUS- on the Input Rectifier Board (Inverter Module).
    - If VDC is > 800 VDC, replace the Input Rectifier Board.
    - If VDC is < 800 VDC, at least one of the Main Storage Capacitors (Inverter Module) is defective. Replace the Main Storage Capacitors.
20. Turn the generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

CAUTION

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E58

DESCRIPTION : LV-DRAC: Excessive current in the main winding during acceleration up to 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code “E58” is displayed and it is not possible to make exposures.

POSSIBLE CAUSES

Excessive current in the main winding up to 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

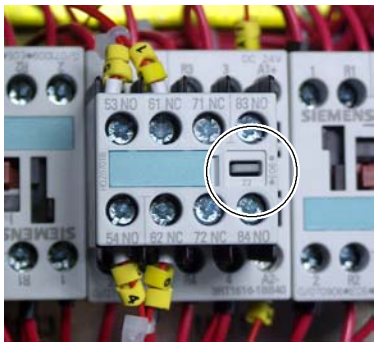
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

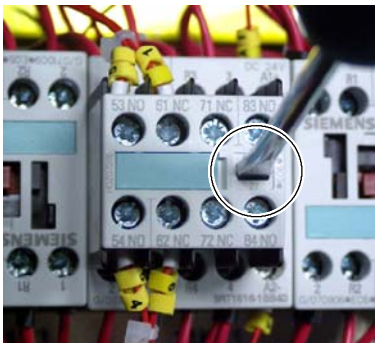
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Main wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Main wire (11TS2-1 for Tube-1 or 11TS2-9 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. Desolder the wire marked as “12” on the Main Transformer of the LV-DRAC Module. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
10. On the Control DRAC Board, remove wire J1-1 (Main). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
11. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E59

DESCRIPTION : LV-DRAC: Excessive current in the auxiliary winding during acceleration up to 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E59" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the auxiliary winding up to 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

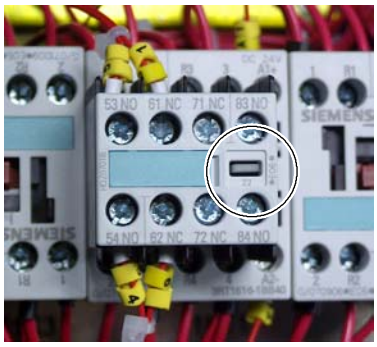
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

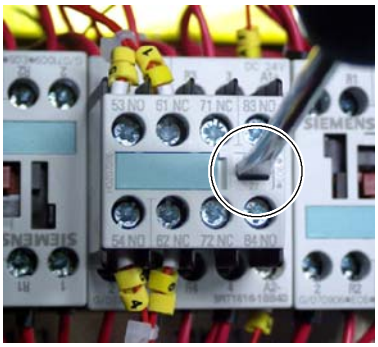
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.
6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Auxiliary wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Auxiliary wire (11TS2-2 for Tube-1 or 11TS2-10 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. On the Interface DRAC Board, remove J5-1 and J5-4 wires. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, replace the Interface DRAC Board.
10. Remove the two (2) wires connected to the Clamping Board. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Clamping Board.
11. Desolder the wire marked as “12” on the auxiliary Transformer of the LV-DRAC Module. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
12. On the Control DRAC Board, remove wire J1-4 (Auxiliary). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
13. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E60

DESCRIPTION : LV-DRAC: Insufficient current in the auxiliary winding during acceleration up to 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E60" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the auxiliary winding up to 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

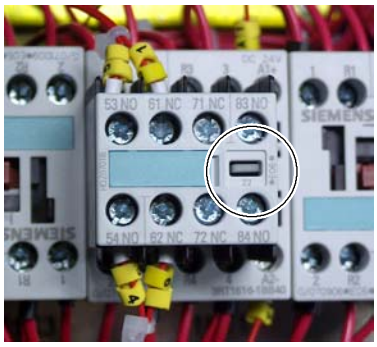
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

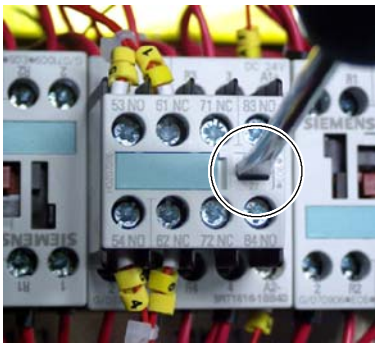
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E61

DESCRIPTION : LV-DRAC: Insufficient current in the main winding during acceleration up to 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E61" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the main winding up to 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

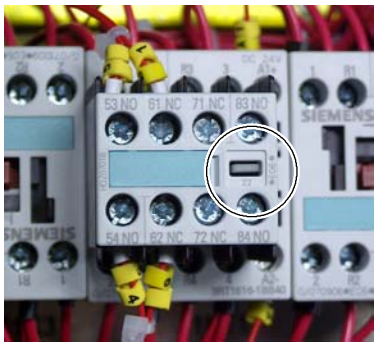
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

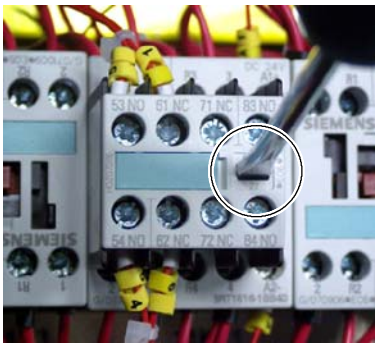
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E62

DESCRIPTION : LV-DRAC: Excessive current in the main winding during acceleration up to 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code “E62” is displayed and it is not possible to make exposures.

POSSIBLE CAUSES

Excessive current in the main winding up to 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

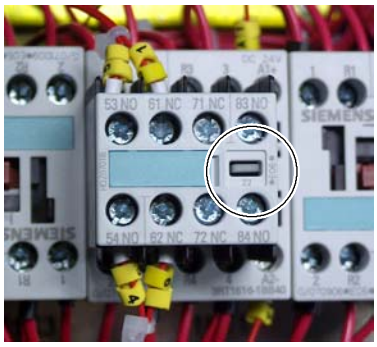
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

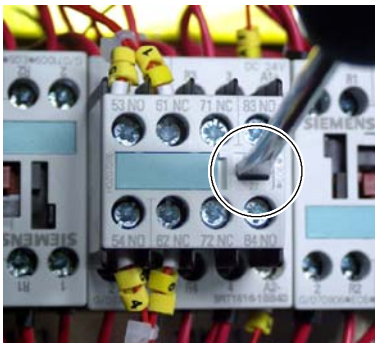
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.
6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Main wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Main wire (11TS2-1 for Tube-1 or 11TS2-9 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. Desolder the wire marked as “12” on the Main Transformer of the LV-DRAC Module. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
10. On the Control DRAC Board, remove wire J1-1 (Main). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
11. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E63

DESCRIPTION : LV-DRAC: Excessive current in the auxiliary winding during acceleration up to 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E63" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the auxiliary winding up to 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

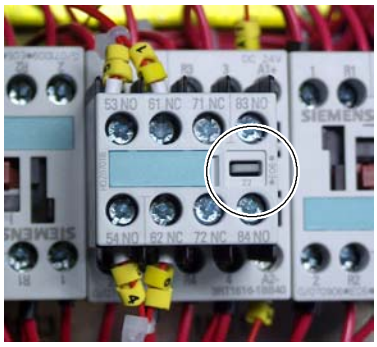
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

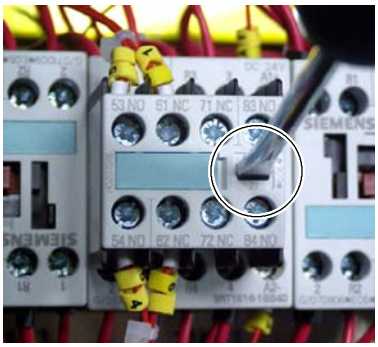
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists, replace the X-ray Tube.
6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Auxiliary wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Auxiliary wire (11TS2-2 for Tube-1 or 11TS2-10 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. On the Interface DRAC Board, remove J5-1 and J5-4 wires. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, replace the Interface DRAC Board.
10. Remove the two (2) wires connected to the Clamping Board. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Clamping Board.
11. Desolder the wire marked as “12” on the auxiliary Transformer of the LV-DRAC Module. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
12. On the Control DRAC Board, remove wire J1-4 (Auxiliary). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
13. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E64

DESCRIPTION : LV-DRAC: Insufficient current in the auxiliary winding during acceleration up to 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E64" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the auxiliary winding up to 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

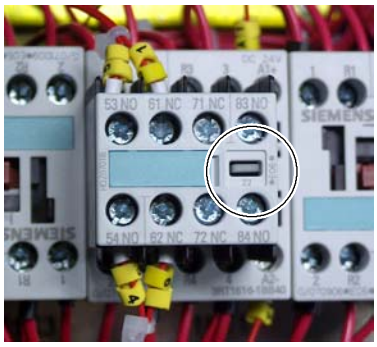
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

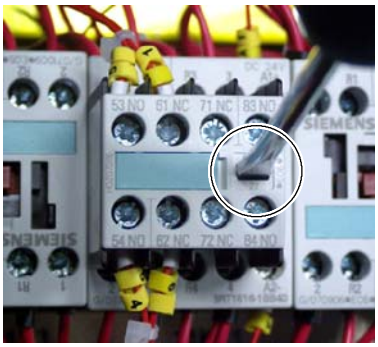
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E65

DESCRIPTION : LV-DRAC: Insufficient current in the main winding during acceleration up to 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code “E65” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the main winding up to 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

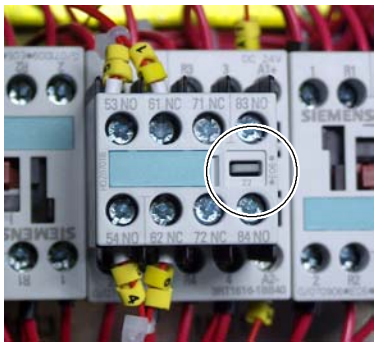
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

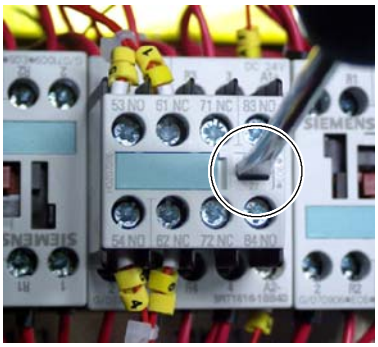
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E66

DESCRIPTION : LV-DRAC: Excessive current in the main winding running at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E66" is displayed and it is not possible to make exposures.

POSSIBLE CAUSES

Excessive current in the main winding running at 3300 RPM is detected.

During the acceleration time the Contactor 11K2 remains OFF. Once the acceleration time has been completed the Contactor 11K2 must be energized to apply to the Stator a lower voltage (running voltage). This is the step where the errors are appearing (excessive current in running mode). For any reason, Contactor 11K2 is not energized so that the voltage applied to the Stator is higher than should be and this is causing the excessive current.

Defective: cable connections, or Contactor 11K2, or Control DRAC Board, or Stator Cable, or Tube Stator.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

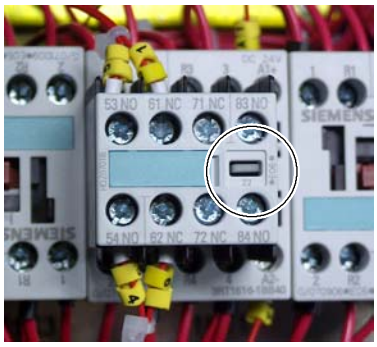
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

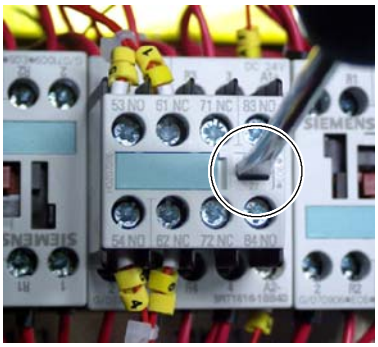
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

7. Check that the Contactor 11K2 is energized few moments after the “Prep” order.
   - If it is OK, check if Contactor 11K2 is providing a good contact, if needed replace Contactor 11K2.
   - If Contactor 11K2 is not energized, check +24 VDC at the coil of 11K2 (between A1 and A2).

Note ☞ *The voltage must be verified when the Contactor is supposed to be ON (after the acceleration time)*

- If the voltage is OK, check the coil of the Contactor by an ohmmeter. It must be around 160 Ohms. If it is not correct replace the Contactor.
- If the voltage is not present, check 24 VDC (Delayed) between A1 of Contactor 11K2 and ground (this voltage must be present at any time).
  - If 24 VDC is not present between A1 of Contactor 11K2 and ground, check continuity between the Interface Control Board (J5-2) and A1 of Contactor 11K2, checking it also in the aerial connector 11J7-1. Repair defective connections..
  - If 24 VDC is present between A1 of Contactor 11K2 and ground, check the link between A2 of Contactor 11K2 and J4-2 of the Interface DRAC Board.

    If the link is not correct, repair or replace it.

    If the link is correct, check low logic level at the cathode of CR13 when Contactor 11K2 is supposed to be ON. If the low level is present check the diode CR13, and if diode CR13 is defective replace this diode or the Interface DRAC Board. Check also the flat cable between Interface DRAC Board (J1) and Control DRAC Board, if the flat cable is not correct, replace this cable.

    If the flat cable is correct but you have +24 VDC between cathode of CR13 and ground, replace the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E67

DESCRIPTION : LV-DRAC: Excessive current in the auxiliary winding running at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E67" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the auxiliary winding running at 3300 RPM is detected.

During the acceleration time the Contactor 11K2 remains OFF. Once the acceleration time has been completed the Contactor 11K2 must be energized to apply to the Stator a lower voltage (running voltage). This is the step where the errors are appearing (excessive current in running mode). For any reason, Contactor 11K2 is not energized so that the voltage applied to the Stator is higher than should be and this is causing the excessive current.

Defective: cable connections, or Contactor 11K2, or Control DRAC Board, or Stator Cable, or Tube Stator.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

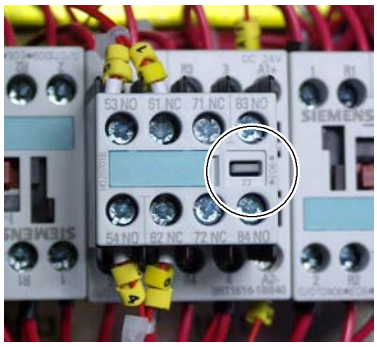
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

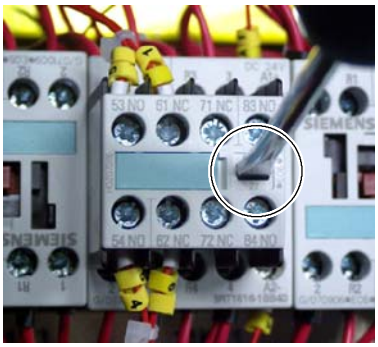
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

7. Check that the Contactor 11K2 is energized few moments after the “Prep” order.
   - If it is OK, check if Contactor 11K2 is providing a good contact, if needed replace Contactor 11K2.
   - If Contactor 11K2 is not energized, check +24 VDC at the coil of 11K2 (between A1 and A2).

Note ☞ *The voltage must be verified when the Contactor is supposed to be ON (after the acceleration time)*

- If the voltage is OK, check the coil of the Contactor by an ohmmeter. It must be around 160 Ohms. If it is not correct replace the Contactor.
- If the voltage is not present, check 24 VDC (Delayed) between A1 of Contactor 11K2 and ground (this voltage must be present at any time).
  - If 24 VDC is not present between A1 of Contactor 11K2 and ground, check continuity between the Interface Control Board (J5-2) and A1 of Contactor 11K2, checking it also in the aerial connector 11J7-1. Repair defective connections..
  - If 24 VDC is present between A1 of Contactor 11K2 and ground, check the link between A2 of Contactor 11K2 and J4-2 of the Interface DRAC Board.

    If the link is not correct, repair or replace it.

    If the link is correct, check low logic level at the cathode of CR13 when Contactor 11K2 is supposed to be ON. If the low level is present check the diode CR13, and if diode CR13 is defective replace this diode or the Interface DRAC Board. Check also the flat cable between Interface DRAC Board (J1) and Control DRAC Board, if the flat cable is not correct, replace this cable.

    If the flat cable is correct but you have +24 VDC between cathode of CR13 and ground, replace the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E68

DESCRIPTION : LV-DRAC: Insufficient current in the auxiliary winding running at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E68" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the auxiliary winding running at 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

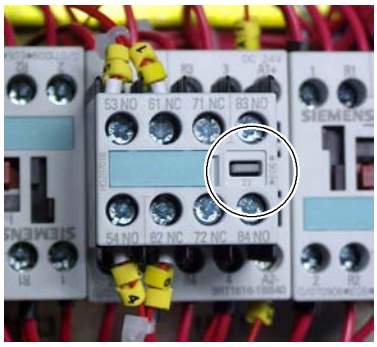
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

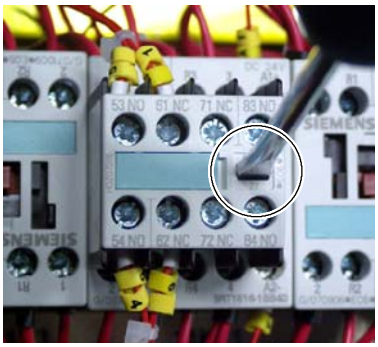
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E69

DESCRIPTION : LV-DRAC: Insufficient current in the main winding running at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E69" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the main winding running at 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

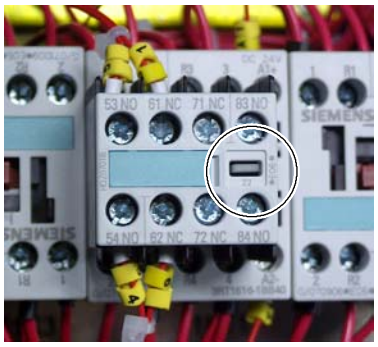
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

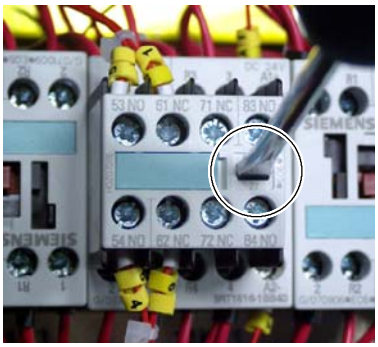
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E70

DESCRIPTION : LV-DRAC: Excessive current in the main winding running at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code “E70” is displayed and it is not possible to make exposures.

POSSIBLE CAUSES

Excessive current in the main winding running at 10000 RPM is detected.

During the acceleration time the Contactor 11K2 remains OFF. Once the acceleration time has been completed the Contactor 11K2 must be energized to apply to the Stator a lower voltage (running voltage). This is the step where the errors are appearing (excessive current in running mode). For any reason, Contactor 11K2 is not energized so that the voltage applied to the Stator is higher than should be and this is causing the excessive current.

Defective: cable connections, or Contactor 11K2, or Control DRAC Board, or Stator Cable, or Tube Stator.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

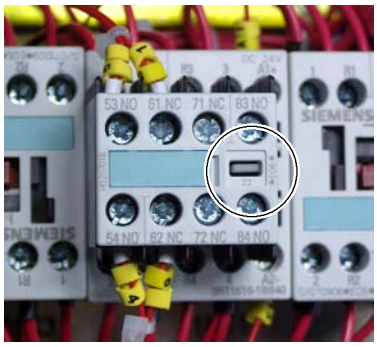
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

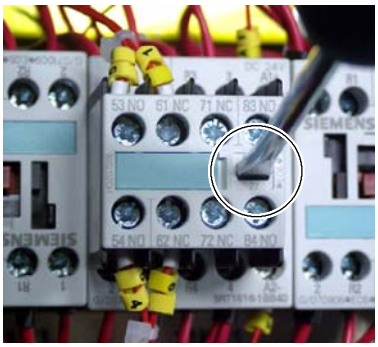
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

7. Check that the Contactor 11K2 is energized few moments after the “Prep” order.
   - If it is OK, check if Contactor 11K2 is providing a good contact, if needed replace Contactor 11K2.
   - If Contactor 11K2 is not energized, check +24 VDC at the coil of 11K2 (between A1 and A2).

Note ☞ *The voltage must be verified when the Contactor is supposed to be ON (after the acceleration time)*

- If the voltage is OK, check the coil of the Contactor by an ohmmeter. It must be around 160 Ohms. If it is not correct replace the Contactor.
- If the voltage is not present, check 24 VDC (Delayed) between A1 of Contactor 11K2 and ground (this voltage must be present at any time).
  - If 24 VDC is not present between A1 of Contactor 11K2 and ground, check continuity between the Interface Control Board (J5-2) and A1 of Contactor 11K2, checking it also in the aerial connector 11J7-1. Repair defective connections..
  - If 24 VDC is present between A1 of Contactor 11K2 and ground, check the link between A2 of Contactor 11K2 and J4-2 of the Interface DRAC Board.

    If the link is not correct, repair or replace it.

    If the link is correct, check low logic level at the cathode of CR13 when Contactor 11K2 is supposed to be ON. If the low level is present check the diode CR13, and if diode CR13 is defective replace this diode or the Interface DRAC Board. Check also the flat cable between Interface DRAC Board (J1) and Control DRAC Board, if the flat cable is not correct, replace this cable.

    If the flat cable is correct but you have +24 VDC between cathode of CR13 and ground, replace the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E71

DESCRIPTION : LV-DRAC: Excessive current in the auxiliary winding running at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E71" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the auxiliary winding running at 10000 RPM is detected.

During the acceleration time the Contactor 11K2 remains OFF. Once the acceleration time has been completed the Contactor 11K2 must be energized to apply to the Stator a lower voltage (running voltage). This is the step where the errors are appearing (excessive current in running mode). For any reason, Contactor 11K2 is not energized so that the voltage applied to the Stator is higher than should be and this is causing the excessive current.

Defective: cable connections, or Contactor 11K2, or Control DRAC Board, or Stator Cable, or Tube Stator.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

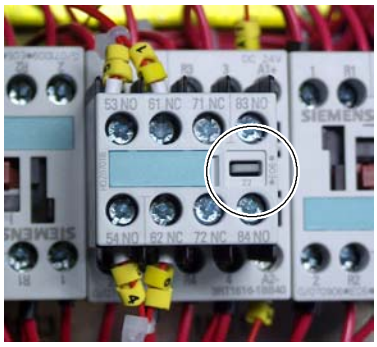
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

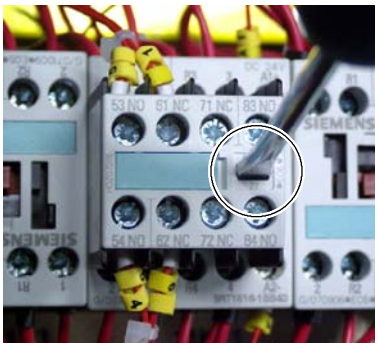
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

7. Check that the Contactor 11K2 is energized few moments after the “Prep” order.
   - If it is OK, check if Contactor 11K2 is providing a good contact, if needed replace Contactor 11K2.
   - If Contactor 11K2 is not energized, check +24 VDC at the coil of 11K2 (between A1 and A2).

Note ☞ *The voltage must be verified when the Contactor is supposed to be ON (after the acceleration time)*

- If the voltage is OK, check the coil of the Contactor by an ohmmeter. It must be around 160 Ohms. If it is not correct replace the Contactor.
- If the voltage is not present, check 24 VDC (Delayed) between A1 of Contactor 11K2 and ground (this voltage must be present at any time).
  - If 24 VDC is not present between A1 of Contactor 11K2 and ground, check continuity between the Interface Control Board (J5-2) and A1 of Contactor 11K2, checking it also in the aerial connector 11J7-1. Repair defective connections..
  - If 24 VDC is present between A1 of Contactor 11K2 and ground, check the link between A2 of Contactor 11K2 and J4-2 of the Interface DRAC Board.

    If the link is not correct, repair or replace it.

    If the link is correct, check low logic level at the cathode of CR13 when Contactor 11K2 is supposed to be ON. If the low level is present check the diode CR13, and if diode CR13 is defective replace this diode or the Interface DRAC Board. Check also the flat cable between Interface DRAC Board (J1) and Control DRAC Board, if the flat cable is not correct, replace this cable.

    If the flat cable is correct but you have +24 VDC between cathode of CR13 and ground, replace the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E72

DESCRIPTION : LV-DRAC: Insufficient current in the auxiliary winding running at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E72" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the auxiliary winding running at 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

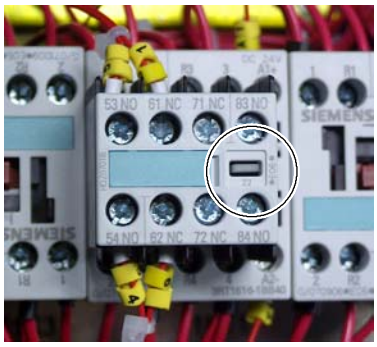
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

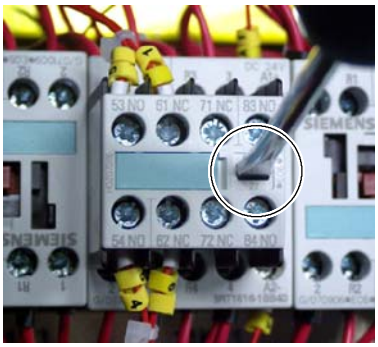
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E73

DESCRIPTION : LV-DRAC: Insufficient current in the main winding running at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E73" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the main winding running at 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

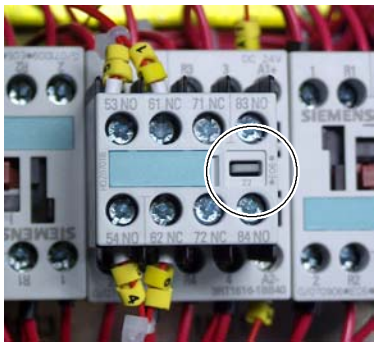
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

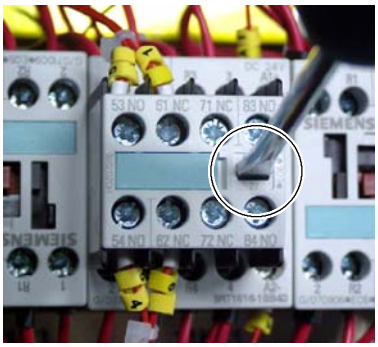
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E74

DESCRIPTION : LV-DRAC: Excessive current in the main winding braking at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E74" is displayed and it is not possible to make exposures.

POSSIBLE CAUSES

Excessive current in the main winding braking at 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

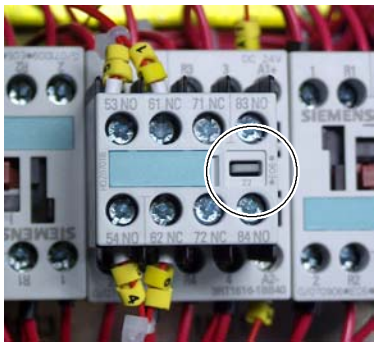
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

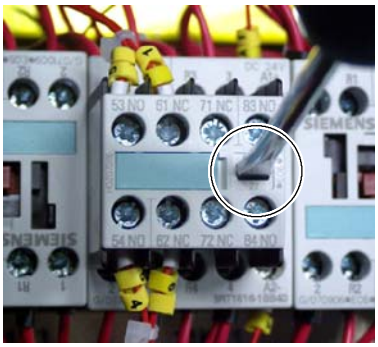
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Main wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Main wire (11TS2-1 for Tube-1 or 11TS2-9 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. Desolder the wire marked as “12” on the Main Transformer of the LV-DRAC Module. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
10. On the Control DRAC Board, remove wire J1-1 (Main). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
11. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E75

DESCRIPTION : LV-DRAC: Excessive current in the auxiliary winding braking at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E75" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the auxiliary winding braking at 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

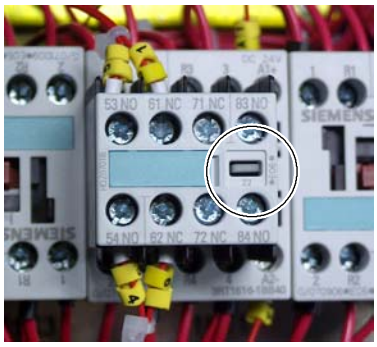
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

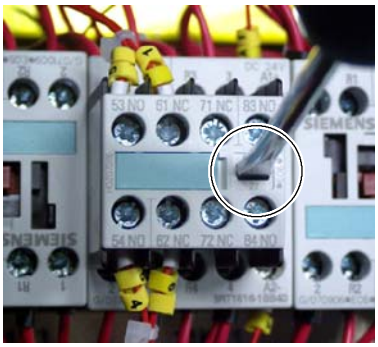
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.
6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Auxiliary wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Auxiliary wire (11TS2-2 for Tube-1 or 11TS2-10 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. On the Interface DRAC Board, remove J5-1 and J5-4 wires. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, replace the Interface DRAC Board.
10. Remove the two (2) wires connected to the Clamping Board. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Clamping Board.
11. Desolder the wire marked as “12” on the Auxiliary Transformer of the LV-DRAC Module. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
12. On the Control DRAC Board, remove wire J1-4 (Auxiliary). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
13. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E76

DESCRIPTION : LV-DRAC: Insufficient current in the auxiliary winding braking at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E76" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the auxiliary winding braking at 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

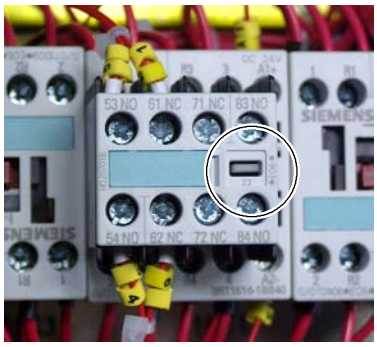
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

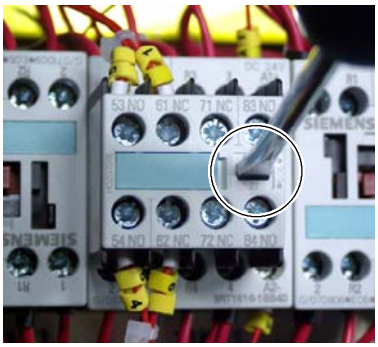
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E77

DESCRIPTION : LV-DRAC: Insufficient current in the main winding braking at 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code "E77" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the main winding braking at 3300 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

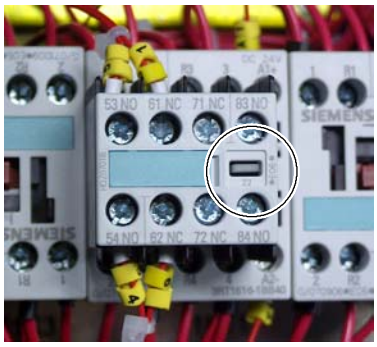
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

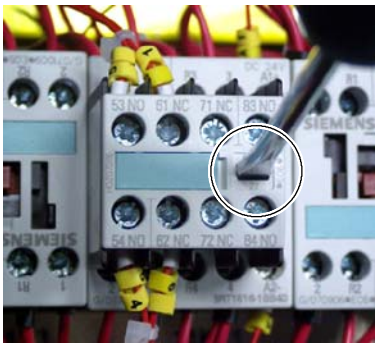
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E78

DESCRIPTION : LV-DRAC: Excessive current in the main winding braking at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E78" is displayed and it is not possible to make exposures.

POSSIBLE CAUSES

Excessive current in the main winding braking at 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

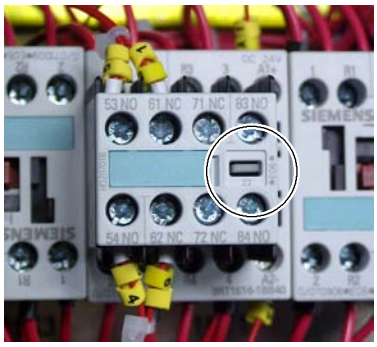
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

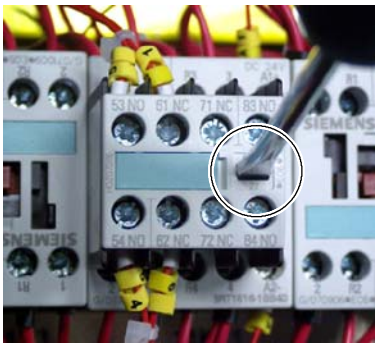
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.

6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Main wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Main wire (11TS2-1 for Tube-1 or 11TS2-9 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. Desolder the wire marked as “12” on the Main Transformer of the LV-DRAC Module. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
10. On the Control DRAC Board, remove wire J1-1 (Main). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
11. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E79

DESCRIPTION : LV-DRAC: Excessive current in the auxiliary winding braking at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E79" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the auxiliary winding braking at 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

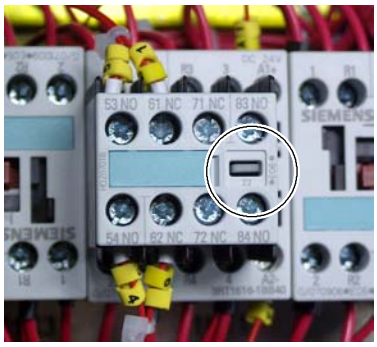
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

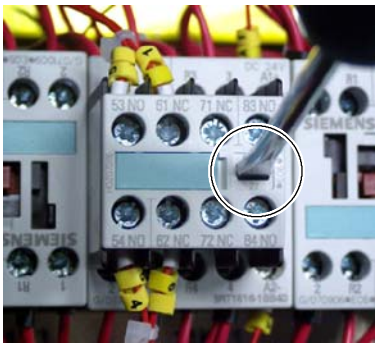
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.
6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Auxiliary wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Auxiliary wire (11TS2-2 for Tube-1 or 11TS2-10 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. On the Interface DRAC Board, remove J5-1 and J5-4 wires. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, replace the Interface DRAC Board.
10. Remove the two (2) wires connected to the Clamping Board. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Clamping Board.
11. Desolder the wire marked as “12” on the Auxiliary Transformer of the LV-DRAC Module. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
12. On the Control DRAC Board, remove wire J1-4 (Auxiliary). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
13. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E80

DESCRIPTION : LV-DRAC: Insufficient current in the auxiliary winding braking at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E80" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the auxiliary winding braking at 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

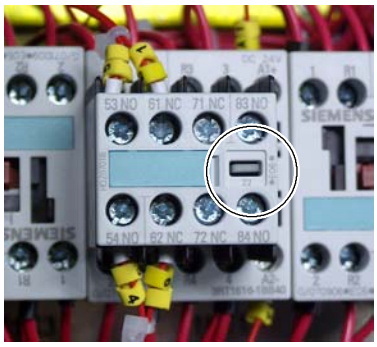
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

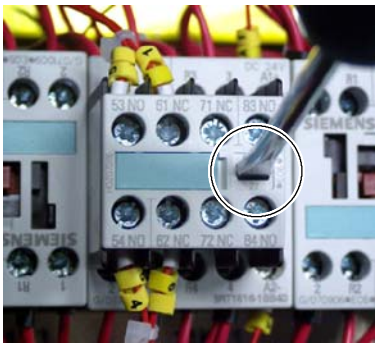
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E81

DESCRIPTION : LV-DRAC: Insufficient current in the main winding braking at 10000 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code "E81" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the main winding braking at 10000 RPM is detected.

Defective: Interface DRAC Board, or Control DRAC Board, or Tube Stator, or Stator Cable, or Clamping Board, or Transformers, or Contactors in LV-DRAC Module.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

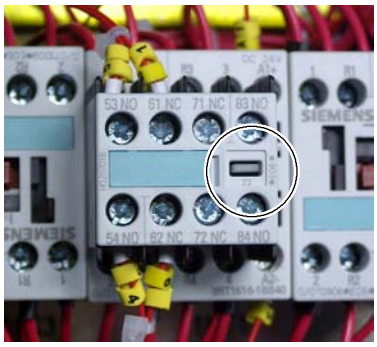
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

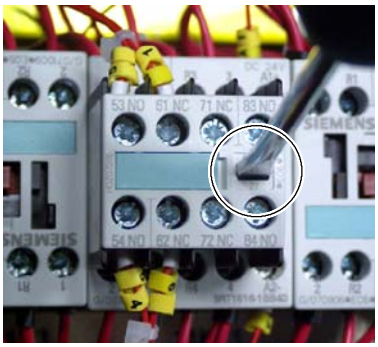
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E82

DESCRIPTION : LV-DRAC: Wrong X-ray Tube selection.

ERROR TYPE : Indicative. Does not allow exposures.

APPLICABLE TO : All Generators with High Speed Starter (LV-Drac).

APPEARS WHEN : During POWER OFF or in stand by.

INFORMATION / SYMPTOM : E82 appears on display

POSSIBLE CAUSES

Incorrect turning off routine.

Incorrect signals of tube selection in the LV-DRAC.

Defective Delayed Switch Off PCB.

Defective Control DRAC PCB.

ACTIONS

1. With the Generator off, disconnect J12 from A3274 Delayed Switch Off PCB and jumper the aerial connector J1-1 & 8. Turn the Generator ON, if the error persists, replace A3243 Control DRAC PCB.
2. If the error dissapears, verify that the generator performs the turning off routines in a correct way. if ok, replace the Delayed Switch OFF PCB A3274-XX.
3. If the Generator turning off routines are not correct, verify the connections between 6J2 in the Generator Cabinet and J1-8 in the Delayed Switch OFF PCB as well verify connection between J1-8 in the Interface Control PCB and J1-1 in the Delayed Switch OFF PCB.
4. If the connections are not ok, repair accordingly, if the connections are ok, verify the components related to the Turning OFF function of the Generator according to the system configuration.

ERROR CODE : E83

DESCRIPTION : LV-DRAC: Excessive current in DC Brake.

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode braking in DC voltage.

INFORMATION / SYMPTOM : Error Code “E83” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Excessive current in the main or auxiliary winding is detected.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

1. Verify the Generator is turned OFF.

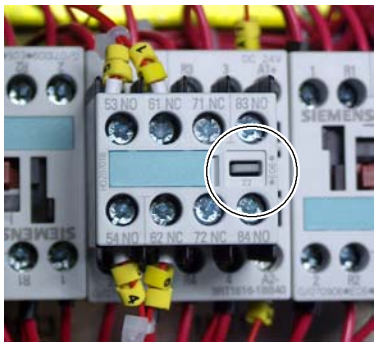
2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

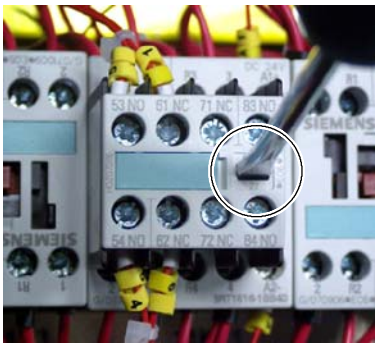
4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞

The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞

Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check for correct isolation between the connections for the Main winding and Auxiliary winding in 11TS2 on the LV-DRAC Module. Measure the impedance between Main and Ground, Auxiliary and Ground, Common and Ground; in all cases it must be high impedance (mega-ohms).
   - If the impedance is OK, go to the next step.
   - If the impedance is not correct, it can be due to:
     - a wrong connection of the Stator Cable on the Tube side or on the Generator side. Check the connection of the Stator Cable and connect it properly if necessary.
     - or the Stator Cable is short-circuited, then disconnect the Stator Cable on the Tube side and measure impedance in the Tube. If the problem persists replace the X-ray Tube.
6. Turn the Generator ON.

To perform each one of the following checks it is necessary:
- Turn the Generator OFF and wait three (3) minutes to discharge the Main Storage Capacitors.
- Remove the wire indicated in each step below.
- Turn the Generator ON. Press PREP and note the error code and reset it.

7. On the Tube side, remove the Auxiliary wire. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Tube Stator. Replace the X-ray Tube.
8. On the Generator side, remove the Auxiliary wire (11TS2-2 for Tube-1 or 11TS2-10 for Tube-2). Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, the problem is in the Stator Cable. Replace the Stator Cable.
9. On the Interface DRAC Board, remove J5-1 and J5-4 wires. Check:
   - If an “Excessive Current” code appears, go to the next step.
   - If an “Insufficient Current” code appears, replace the Interface DRAC Board.
10. Remove the two (2) wires connected to the Clamping Board. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Clamping Board.
11. Desolder the wire marked as “12” on the Auxiliary Transformer of the LV-DRAC Module. Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, there is a bad contact from 11TS2 to Terminal “12” in the Transformer on the Contactor’s Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic “543020xx” in the Service Manual*). Identify faulty connections, clean the contacts, tighten each wire connection, and/or replace Contactors if necessary.
12. On the Control DRAC Board, remove wire J1-1 (Main) and J1-4 (Auxiliary). Check:
    - If an “Excessive Current” code appears, go to the next step.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.
13. On the Control DRAC Board, remove wire J1-3 (Shield). Check:
    - If an “Excessive Current” code appears, replace the Control DRAC Board.
    - If an “Insufficient Current” code appears, replace the Main Transformer at the LV-DRAC Module.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E87

DESCRIPTION : LV-DRAC: Insufficient current in common wire during acceleration up to 3300 RPM

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code “E87” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the common wire up to 3300 RPM is detected.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

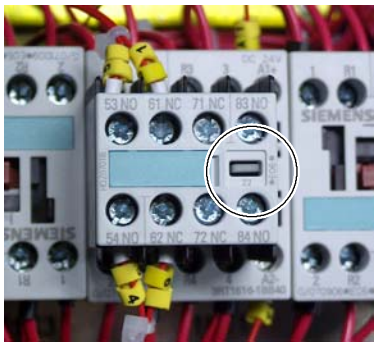
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

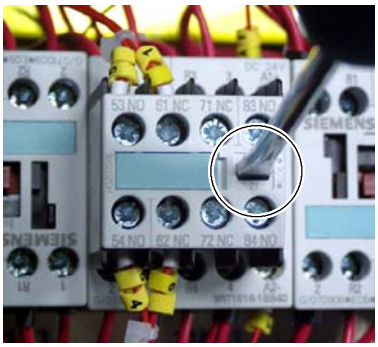
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E88

DESCRIPTION : LV-DRAC: Insufficient current in common wire running at 3300 RPM.

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at Low Speed.

INFORMATION / SYMPTOM : Error Code “E88” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the common wire running at 3300 RPM is detected.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

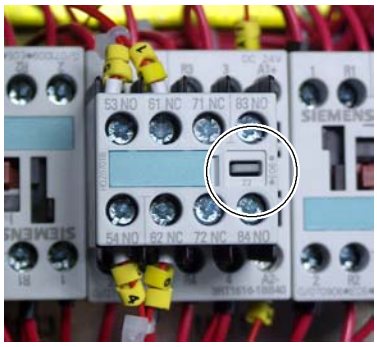
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

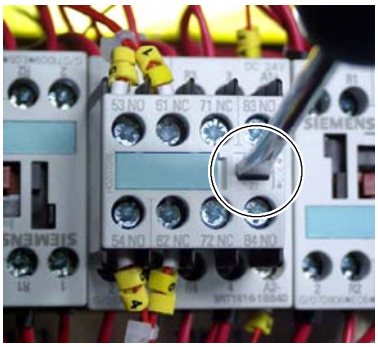
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E89

DESCRIPTION : LV-DRAC: Insufficient current in common wire during acceleration up to 10000 RPM.

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code “E89” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in the common wire during acceleration up to 10000 RPM is detected.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

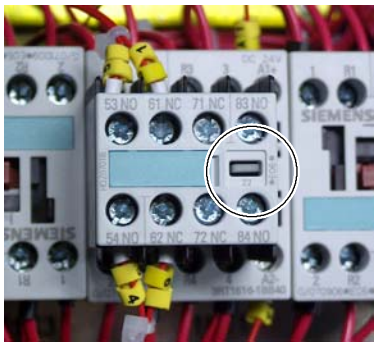
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

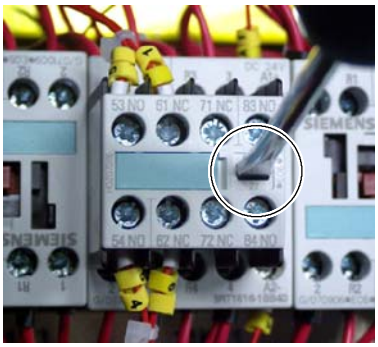
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E90

DESCRIPTION : LV-DRAC: Insufficient current in common wire running at 10000 RPM.

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : During Anode acceleration at High Speed.

INFORMATION / SYMPTOM : Error Code “E90” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

Insufficient current in common wire running at 10000 RPM is detected.

ACTIONS

All the wires / cables removed during the procedure have to be isolated to avoid contact with any other wire or ground.

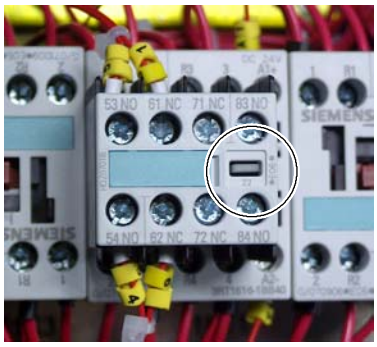
1. Verify the Generator is turned OFF.

2. Check that the DIP switches on the Control DRAC Board are set in the correct position. *(Refer to the LV -DRAC Documentation in this Service Manual, especially check that DIP-switches 3243SW3-5 and 3243SW4-5 are in the correct position according to the Tube Family Selection.)*

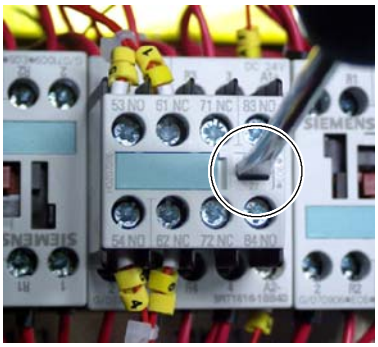
3. Check each wire connection of the Stator Cable on the Tube side and on 11TS2 on the LV-DRAC Module are correct and secured (good contact), connect properly, and tighten each wire if necessary. Check if the error has been corrected. If not, go to the next step.

4. With the Generator turned OFF, measure the Stator Tube Winding impedances on 11TS2 on the LV-DRAC Module.

Note ☞ *The Contactor 11KT1 on the LV-DRAC Module have to be not energized (contactor indicator is visible) when measuring the Stator impedances of Tube-1 and have to be energized (by manually pressing the contactor indicator) when measuring the Stator impedances of Tube-2.*



Contactor 11KT1 measuring Stator impedances of Tube-1



Contactor 11KT1 measuring Stator impedances of Tube-2

- For Tube-1 measure:
  - between Main (11TS2-1) and Common (11TS2-3).
  - between Auxiliary (11TS2-2) and Common (11TS2-3).
  - between Main (11TS2-1) and Auxiliary (11TS2-2), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
- For Tube-2 measure:
  - between Main (11TS2-9) and Common (11TS2-11).
  - between Auxiliary (11TS2-10) and Common (11TS2-11).
  - between Main (11TS2-9) and Auxiliary (11TS2-10), it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.

Note ☞ *Impedance must be as stated in the X-ray Tube Stator specifications. (Refer to the Manufacturer X-ray Tube Data Sheet.)*

- If the impedance is OK, go to the next step.
- If the impedance is not correct:
  - Measure the Stator Tube Winding impedances on the Tube side:
    - Between Main and Common.
    - Between Auxiliary and Common.
    - Between Main and Auxiliary, it must be the sum of impedance measured between Main and Common plus Auxiliary and Common.
    - If the impedance is correct on the Tube, replace the Stator Cable.
    - If the impedance is not correct on the Tube, replace the X-ray Tube.

5. Check that there is a low resistance (ohms) on the primary and secondary side of either the Main or Auxiliary Transformer (depending if the error is in the Main or Auxiliary winding):
   - For Primary measure between terminals 1-7 of the Transformer.
   - For Secondary measure between terminals 8-10 and 10-12 of the Transformer.
   - If the low resistance is OK, go to the next step.
   - If the low resistance is not correct, replace the Transformer.

6. On the Control DRAC Board, check that there is a continuity between the following points:
   - For Main measure between J1-1 and J1-3.
   - For Auxiliary measure between J1-3 and J1-4.
   - If the continuity is OK, go to the next step.
   - If the continuity is not correct, check cable connections in J1 of the Control DRAC Board and in Primary side of the Transformers.

7. With the Generator turned OFF, check that Contactors 11KT1, 11K2, and 11K3 are not energized (OFF) on the LV-DRAC Module.
   - If it is OK, go to the next step.
   - If any Contactor is energized (ON), replace the Contactor.

8. Turn the Generator ON, check on the LV-DRAC Module that ten (10) seconds after power-up Contactors 11K2 and 11K3 are not energized (OFF) and Contactor 11KT1 is energized (ON) when Tube-1 is selected (Contactor 11KT1 is not energized (OFF) when Tube-2 is selected).
   - If it is OK, go to the next step.
   - If Contactor 11K2 or 11K3 is energized (ON), replace the Control DRAC Board.
   - If Contactor 11KT1 is not energized (OFF) (when Tube-1 is selected), turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge. Check that Diode CR14 is OK on the Interface DRAC Board.
     - Diode CR14 is OK, replace the Control DRAC Board.
     - Diode CR14 is not OK, replace the Interface DRAC Board.

9. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

10. Check that there is a continuity between the following points:
    - For Main measure between terminal 12 of the Main Transformer and 11TS2-1 (for Tube-1) or 11TS2-9 (for Tube-2).
    - For Auxiliary measure between terminal 12 of the Auxiliary Transformer and 11TS2-2 (for Tube-1) or 11TS2-10 (for Tube-2).
    - For Common measure between terminal 8 of each Transformer (Main and Auxiliary) and then between terminal 8 of the Main Transformer and 11TS2-3 (for Tube-1) or 11TS2-11 (for Tube-2).
    - If the continuity is OK, go to the next step.
    - If the continuity is not correct, there is a bad contact on the Transformer Terminals or on the Contactor's Terminals 11KT1, 11K2, and/or 11K3 (*refer to Schematic "543020xx" in the Service Manual*). Identify faulty connections, clean the contacts, and/or tighten each wire connection.

11. Check the proper operation of the Control DRAC Board. For that:
    - Set DIP switch 3243SW4-7 in the “ON” position to inhibit errors.
    - Select: 40 kVp, 10 mA and 10 ms (low speed) and Direct Workstation. Check the X-ray Tube is starting properly by performing an Anode Rotation Test (*refer to “Configuration” chapter in the Service Manual*).
        - If the Tube does not start, replace the Control DRAC Board.
        - If the Tube starts, the Control DRAC Board has to be replaced but the unit can work (for a short period of days) whenever DIP switch 3243SW4-7 is in the “ON” position to inhibit errors.
        - In both cases, set DIP switch 3243SW4-7 in the “OFF” position after replacing the Control DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E91

DESCRIPTION : LV-DRAC: Incorrect signal measure in IPRINC (CH2).

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : In Stand-by situation.

INFORMATION / SYMPTOM : Error Code "E91" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

The Generator is detecting current through the main wire when it should be zero (0).

ACTIONS

1. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

2. Check the voltage at TP1 and TP17 on the Control DRAC Board. Both voltages should be 0 VDC.

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

- If both voltages at TP1 and TP17 are 0 VDC and the Error Code persists, replace the Control DRAC Board.
- If any voltage at TP1 and TP17 is different than 0 VDC, go to the next step.

3. Check the voltage at the following Test Points on the Control DRAC Board:
   - +5 VDC at TP14
   - +15 VDC at TP15
   - -15 VDC at TP37

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

- If voltages at the above Test Points are correct, replace the Control DRAC Board.
- If any voltage at the above Test Points are not correct, go to the next step.

4. Turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
5. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.
6. Turn the Generator ON.
7. Check the voltage at the following points on the Interface DRAC Board:
   - +5 VDC at Anode of diode CR6
   - +15 VDC at Anode of diode CR5 or at Cathode of diode CR6
   - -15 VDC at Cathode of diode CR7

Note ☞ *For GND reference use the Terminal J2-3 on the Interface DRAC Board.*

- If voltages at the above points are correct, replace the Control DRAC Board.
- If any voltage at the above points are not correct, replace the Interface DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E92

DESCRIPTION : LV-DRAC: Incorrect signal measure in IAUX (CH3).

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : In Stand-by situation.

INFORMATION / SYMPTOM : Error Code "E92" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

The Generator is detecting current through the auxiliary wire when it should be zero (0).

ACTIONS

1. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

2. Check the voltage at TP3 and TP16 on the Control DRAC Board. Both voltages should be 0 VDC.

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

- If both voltages at TP3 and TP16 are 0 VDC and the Error Code persists, replace the Control DRAC Board.
- If any voltage at TP3 and TP16 is different than 0 VDC, go to the next step.

3. Check the voltage at the following Test Points on the Control DRAC Board:
   - +5 VDC at TP14
   - +15 VDC at TP15
   - -15 VDC at TP37

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

- If voltages at the above Test Points are correct, replace the Control DRAC Board.
- If any voltage at the above Test Points are not correct, go to the next step.

4. Turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
5. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.
6. Turn the Generator ON.
7. Check the voltage at the following points on the Interface DRAC Board:
   - +5 VDC at Anode of diode CR6
   - +15 VDC at Anode of diode CR5 or at Cathode of diode CR6
   - -15 VDC at Cathode of diode CR7

Note ☞ *For GND reference use the Terminal J2-3 on the Interface DRAC Board.*

- If voltages at the above points are correct, replace the Control DRAC Board.
- If any voltage at the above points are not correct, replace the Interface DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E93

DESCRIPTION : LV-DRAC: Incorrect signal measure in ICOM (CH4).

ERROR TYPE : Indicative. Exposure is not allowed.

APPLICABLE TO : All Generators with High Speed Starter.

APPEARS WHEN : In Stand-by situation.

INFORMATION / SYMPTOM : Error Code "E93" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

The Generator is detecting current through the main wire when it should be zero (0).

ACTIONS

1. Turn the Generator ON.

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH ANY HEATSINK OR ANY COMPONENT IN THE LV-DRAC MODULE.

2. Check the voltage at TP1, TP3, and TP36 on Control DRAC Board. All voltages should be 0 VDC.

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

- If both voltages at TP1 and TP17 are 0 VDC and the Error Code persists, replace the Control DRAC Board.
- If any voltage at TP1, TP3, or TP36 is different than 0 VDC, go to the next step.

3. Check the voltage at the following Test Points on the Control DRAC Board:
   - +5 VDC at TP14
   - +15 VDC at TP15
   - -15 VDC at TP37

Note ☞ *For GND reference use the following Test Points on the Control DRAC Board: TP2, TP4, TP12, TP13, or TP19.*

- If voltages at the above Test Points are correct, replace the Control DRAC Board.
- If any voltage at the above Test Points are not correct, go to the next step.

4. Turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.
5. Remove the Ribbon Cable from Connector J3 at the Control DRAC Board.
6. Turn the Generator ON.
7. Check the voltage at the following points on the Interface DRAC Board:
   - +5 VDC at Anode of diode CR6
   - +15 VDC at Anode of diode CR5 or at Cathode of diode CR6
   - -15 VDC at Cathode of diode CR7

Note ☞ *For GND reference use the Terminal J2-3 on the Interface DRAC Board.*

- If voltages at the above points are correct, replace the Control DRAC Board.
- If any voltage at the above points are not correct, replace the Interface DRAC Board.

Connect all the wires / cables removed during the procedure back to the original connections.

ERROR CODE : E95

DESCRIPTION : Rapid Termination

ERROR TYPE : Indicative. Does not allow exposures.

APPLICABLE TO : Generators with Rapid Termination application Installed.

APPEARS WHEN : While Exposure (after 30% of the exposure back-up time and after 10 ms of exposure, both conditions have to be fulfilled).

INFORMATION / SYMPTOM : Error Code “E95” is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

No radiation is detected on the Ion Chamber.

The selected parameters are not appropriate for an exposure with AEC (due to a short backup time / mAs Operator selection).

The selected Ion Chamber is not correct.

Dipswitch 3024SW1-3 on the ATP Console CPU Board A3024-XX is in the ON position.

ACTIONS

Rapid Termination is a Safety device that cuts the X-ray exposure in case of an error with the selected Ion Chamber or the selected parameters (short backup time) are not appropriate for an exposure with AEC.

AEC Rapid Termination compares the AEC ramp with a 25% of the final value at the 30% of the Backup Time. It is activated after 30% of the exposure back-up time and after 10 ms of exposure, both conditions have to be fulfilled.

For a proper operation of the Rapid Termination feature, the operator must select an exposure back-up time higher or equal to 100 ms whenever the AEC is ON.

1. Press the respective button on the Console to reset the Error indication.
2. Check the Collimator blades are properly open and no object is blocking the X-ray beam.
3. Increase the backup Time / mAs.
4. Select appropriate Ion Chamber, check the Ion Chamber configured for that Workstation is the same as one physically connected (a.e. IC1 connected to J1 at the AEC Adaptation Board).
5. Check that 3024SW1-3 at the ATP Console CPU Board (A3024-XX) is OFF.

ERROR CODE : E96

DESCRIPTION : No power supply at the Capacitor Charger Board (A3517-02).

ERROR TYPE : Fatal. Does not allow exposures.

APPLICABLE TO : Capacitor Powered Generators only.

APPEARS WHEN : At any time.

INFORMATION / SYMPTOM : Error Code "E96" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

PS signal active in J3-3 of the Capacitor Charger Board (A3517-02).

Failure of the power supply to the Capacitor Charger Board (A3517-02)

Failure in reference voltage 10V.

ACTIONS

1. Turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter.

2. Check continuity between J3-3 of the Capacitor Charger Board (A3517-02) and J13-2 of the ATP Console CPU Board (A3024-xx).

   - If continuity is not present, repair the cable and connections.
   - If continuity is correct, disconnect wire J3-3 of the Capacitor Charger Board and connect it to GND. Turn the Generator ON.
     - If the error persists, replace the ATP Console CPU Board (A3024-xx).
     - If the error code is not present, check on the Capacitor Charger Board:
       - the line voltage of the power supply (mains) is present between J2-1 and J2-3 .
       - 12 VDC is present between J3-8 and J3-1.
       - 12 VDC is present between J3-8 and J3-7.

       If the above checking are correct, replace the Capacitor Charger Board.

ERROR CODE : E97

DESCRIPTION : Voltage in capacitors not balanced.

ERROR TYPE : Fatal. Does not allow exposures.

APPLICABLE TO : Capacitor Powered Generators.

APPEARS WHEN : At any moment.

INFORMATION / SYMPTOM : Error Code "E97" is displayed and it is not possible to make Exposures.

POSSIBLE CAUSES

1.- Failure in the circuitry measurements of the Capacitor Charger Board (A3517-xx).

2.- Failure in Resistors 8R1 and 8R3 (voltage regulating resistors).

3.- Failure in connections of Capacitor Bank.

ACTIONS

1. With the Generator turned ON, measure with a Multimeter in VDC mode, the voltage between terminals (+) and (-) of each Charge/Discharge Board (A3212-02). This voltage should be around +390 VDC on each board.
   - If the difference of the voltage measured between both boards is more than 50 VDC it means that voltage in Capacitor Bank is not balanced, then proceed with step 4.
   - If the difference is least than 50 VDC, proceed with next step.

2. Turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter.

3. Check continuity between J3-4 of the Capacitor Charger Board (A3517-02) and J13-3 of the ATP Console CPU Board (A3024-xx)
   - If continuity is not present, repair the cable and connections.
   - If continuity is correct, disconnect wire J3-4 of the Capacitor Charger Board and connect it to GND. Turn the Generator ON.
     - If the error persists, replace the ATP Console CPU Board (A3024-xx).
     - If the error code is not present, replace the Capacitor Charger Board.

4. If the difference of the voltage measured between both boards is more than 50 VDC, turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter.

5. Check Fuses 8F3 and 8F4 next to the Capacitor Charger Board. Replace if it is needed.

6. Disconnect the 6J1Anderson Connector 6J1 in the Generator Cabinet. Turn the Generator ON.
   - If the error code disappears, check:
     - Fuses 6F3 and 6F4.
     - Charge/Discharge Monitor Boards (A3212-02).
     - Cable connections of the Inverter.

- If the error code disappears, turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter.

  Disconnect the wire J1-3 and J1-7 of the Capacitor Charger Board. Using a multimeter in Ohm mode, check the resistor R1 and R3 (22K, 25w), measuring in the Capacitor Charger Board between J1-1 and wire J1-3 (disconnected) for resistor R1, and measuring between J1-5 and wire J1-7 (disconnected) for resistor R3. Replace the resistor if needed.

  If both resistor are correct, isolate the disconnected wires (J1-3 and J1-7) and turn the Generator ON.

  - If the error code is not present, replace the Capacitor Charger Board.
  - If the error code persists, turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter. Check each one of the connections and resistors at the Capacitor Bank (R6-R7-R8-R9-R10-R11-R12-R13-R14-R15). Replace if it is needed. If the connections and resistors are correct, the problem is some defective Capacitor in the Capacitor Bank, then proceed as described in the next step.

7. For checking the Capacitor status:
   - Turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter.
   - Disconnect and isolate the first pair of Capacitors (at the Capacitor Bank).
   - Turn the Generator ON and check if the voltage in the Capacitor Bank is balanced.
     - If balance is not correct and the voltage difference is the same measured in step 1. Turn the Generator OFF and discharge the Capacitors as described in Section "*Procedure for Storage Capacitors Discharging and Voltage Testing*" of this chapter. Connect the first pair of Capacitors again. Disconnect and isolate the second pair of Capacitors. Turn the Generator ON and check if the voltage in the Capacitor Bank is balanced or not. Follow this procedure with the rest of Capacitor pairs.
     - If after checking a pair of Capacitors, the balance is correct or the voltage difference is reduced in approx. 50 V, replace this pair of Capacitors and follow checking the rest of Capacitor pairs as indicated before.

ERROR CODE : E98

DESCRIPTION : DIP Switch 3024SW2-3 on ATP Console Board set for Configuration and Calibration Mode Active.

ERROR TYPE : Informative. It allows normal operation.

APPLICABLE TO : All Generators.

APPEARS WHEN : After turning on the Control Console.

INFORMATION / SYMPTOM : Error Code “E98” is displayed.

POSSIBLE CAUSES

DIP Switch 3024SW2-3 on the ATP Console CPU Board (A3024-xx) set in the ON position.

ACTIONS

1. Reset the error condition by pressing the respective button on the Console.

Note ☞

Keep in mind that this error will appear each time the Generator is turned OFF/ON during service procedures (configuration, calibration, etc.) whenever Dip-switch 3024SW2-3 on ATP Console CPU Board is in “ON” (closed) position (for Service Mode allowed).

2. When servicing is finished and the Generator is ready for normal operation, turn the Generator OFF and set DIP Switch 3024SW2-3 on ATP Console CPU Board in the OFF (open) position (operation mode).

ERROR CODE : EL0

DESCRIPTION : Operator safety alert: more than one Workstation Interlock are active at the same time.

ERROR TYPE : Preventive. The error must be reset and the alignment corrected.

APPLICABLE TO : All Generators with an X-ray Tube Alignment Safety Kit

APPEARS WHEN : Just after “Prep” is pressed.

INFORMATION / SYMPTOM : Error Code “EL0” is displayed along with an audible alarm and it is not possible to make Exposures.

POSSIBLE CAUSES

More than one Workstation Interlock are active at the same time.

ACTIONS

1. Keep pressed the respective button (“Reset”) until the error indication disappears.
2. Check the Workstation Lock (Alignment Interlock) configuration and cable connections.
3. If the error persists, replace the Alignment Board (A3540-01).

ERROR CODE : EL1

DESCRIPTION : Operator safety alert: X-ray Tube orientation is incorrect for the selected Workstation. EL1 configured for Alignment Interlock-1 (usually the Table).

ERROR TYPE : Preventive. The error must be reset and the alignment corrected.

APPLICABLE TO : All Generators with an X-ray Tube Alignment Safety Kit

APPEARS WHEN : Just after “Prep” is pressed.

INFORMATION / SYMPTOM : Error Code “EL1” is displayed along with an audible alarm and it is not possible to make Exposures.

POSSIBLE CAUSES

The X-ray Tube orientation is not aligned for the selected Workstation (out of an acceptable alignment range).

ACTIONS

1. Align the X-ray Tube with the selected workstation (usually Interlock-1 (EL1) for the Table and Interlock-2 (EL2) for the Wall Stand) and then keep pressed the respective button (“Reset”) until the error indication disappears.
2. If the error persists, check the Workstation Lock (Alignment Interlock) configuration and cable connections according to Appendix “X-ray Tube Alignment Kit”.

ERROR CODE : EL2

DESCRIPTION : Operator safety alert: X-ray Tube orientation is incorrect for the selected Workstation. EL2 configured for Alignment Interlock-2 (usually the Wall Stand).

ERROR TYPE : Preventive. The error must be reset and the alignment corrected.

APPLICABLE TO : All Generators with an X-ray Tube Alignment Safety Kit

APPEARS WHEN : Just after “Prep” is pressed.

INFORMATION / SYMPTOM : Error Code “EL2” is displayed along with an audible alarm and it is not possible to make Exposures.

POSSIBLE CAUSES

The X-ray Tube orientation is not aligned for the selected Workstation (out of an acceptable alignment range).

ACTIONS

1. Align the X-ray Tube with the selected workstation (usually Interlock-1 (EL1) for the Table and Interlock-2 (EL2) for the Wall Stand) and then keep pressed the respective button (“Reset”) until the error indication disappears.
2. If the error persists, check the Workstation Lock (Alignment Interlock) configuration and cable connections according to Appendix “X-ray Tube Alignment Kit”.