

***Technical Publication***

***TR-1005R4***

# **Troubleshooting**

**HF Series Generators**

***with Low or High Speed Starter***

## REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	JAN 24, 2000	First edition
2	NOV 1, 2000	New edition
3	FEB 17, 2005	New error codes and procedures
4	APR 15, 2005	New Battery Charger

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 HEHEDED OR AVOIDED WILL CAUSE SERIOUS PERSONAL INJURY OR DEATH.***



**ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEHEDED 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 that all microprocessors function correctly. Each microprocessor contains LEDs that indicate its 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.

On arrival in 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 it is not, try to reproduce the failure in the conditions reported by the Operator. It is possible that the Error Code displayed is different from either that indicated by the Operator. In all cases, run the troubleshooting routines for the last Error Code displayed.



***When any major component, such as a X-ray Tube, HV Transformer or Circuit Board, is replaced in the system, perform the respective Configuration and Calibration procedures.***

***If the HT Controller Board or the ATP Console CPU Board are replaced, check specifically 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 and if U3-EEPROM is not transferred a complete Calibration must be performed.***

***Also, make some exposures using different techniques and Focal Spots to verify that mA stations are calibrated correctly, if not perform Calibration procedures.***

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

## 1.1 TOOLS AND EQUIPMENT REQUIRED

- Standard service engineers tool kit.
- Configuration and Calibration test equipment (*refer to Installation document*).
- Antistatic Kit.
- Oscilloscope (Tektronics 486 or similar).

## 1.2 GENERAL CAUTIONS



***MAKE SURE THAT THE MAIN 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, APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF.***



***ALWAYS HAVE THE "IPM DRIVER BOARD" CONNECTED IN THE GENERATOR PREVIOUS TO MAINS POWER IS ACTIVATED IN IT. IF THE "IPM DRIVER BOARD" IS NOT CONNECTED, PERMANENT DAMAGE WILL OCCUR TO IGBTs.***



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

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## SECTION 2 GENERAL PROCEDURES

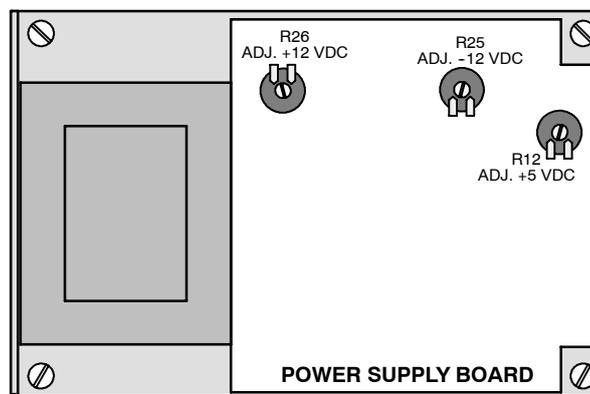
### 2.1 LOW DC VOLTAGE POWER SUPPLY TEST

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  $+5 \pm 0.2$  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  $+12 \pm 0.1$  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  $-12 \pm 0.1$  VDC (this voltage must be  $-12.7 \pm 0.1$  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 in the Front Panel**



The ATP Console CPU Board operates from a 12 VDC Non-Regulated Supply located in the Generator Cabinet that supplies to a 5 VDC Switching Regulator located in the ATP Console CPU Board.

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

- TS1-30 (GND) and TS1-29 (+12 V Unr.) on the Generator Cabinet. Check that the voltage at this point is  $+12 \pm 1.5$  VDC.
- TP GND and TP +5 on the ATP Console CPU Board. Check that the voltage at this point is  $+5 \pm 0.2$  VDC.

**Note** 

*No adjustments are required for both voltage measurements. The ATP Console CPU Board may be located inside the Console or inside the Generator Cabinet.*

## 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 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 the Console Microprocessor U30 is operating correctly.
- 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 the Error 10 disappears.

After this, the normal start up will take place.

We recommend setting this switch back to OFF once the installation has been completed. This will not enable the operator to enter in Configuration or in Calibration Mode (Service Modes).

## 2.4 PROCEDURES RELATED TO THE PUSH-BUTTON CONSOLES

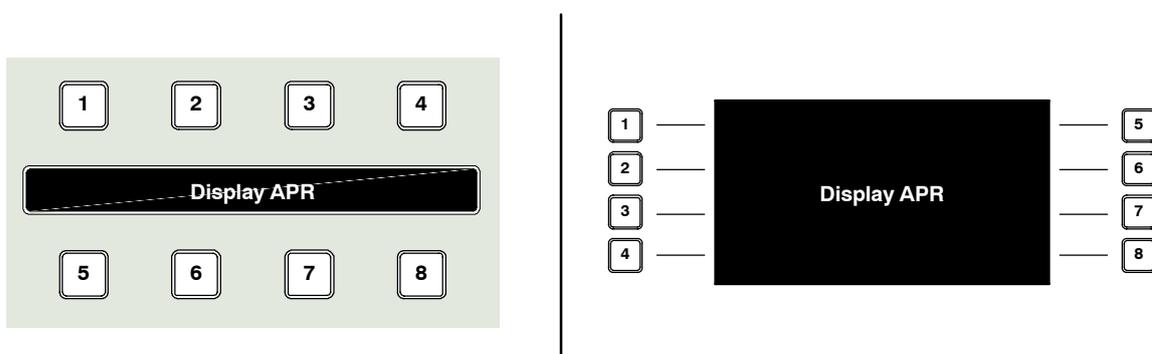
### 2.4.1 APR OPERATION

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 Manual).

**Note** 

*This section only applies to Consoles equipped with Anatomical Programmer (APR).*

**Illustration 2-2**  
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 set the APR techniques only for the selected workstation.

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



***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 makes a copy of the parameters and selections of the APR techniques stored in the U23-NVRAM to the U18-E2PROM of the ATP Console CPU Board. This action make a copy of all the APR techniques stored in the “APR working file” to 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 press simultaneously push-buttons 1-5-6 of the APR module. (*Refer to Illustration 2-2*).

#### 2.4.4 APR RESTORE

The APR Restore makes a copy of the parameters and selections of the APR techniques stored in the U18-E2PROM to the U23-NVRAM of the ATP Console CPU Board. This action replaces the data stored in the “APR working file” by the data stored in the “APR backup file” for all the 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 2-2*).

## 2.5 PROCEDURES RELATED TO THE TOUCH SCREEN CONSOLES

DESCRIPTION	POSSIBLE CAUSES	ACTIONS
The Console and the Generator do not start up.	Malfunction of the Power-ON button.	Check if the button works properly.
	Cable connection or cable status.	Check that all the internal cable are connected. (A7031-xx Cable)
	Generator / Console is not connected to mains.	Power ON the Generator / Console.
	Power Supply does not work properly.	Check all the power connectors from/to the power supply (power values are +5V and +12V). Check the power input selector, change the power supply (Kit Power Supply) if the selector is wrong.
The Console starts but the Generator do not start.	Cable A7067-xx is not properly connected	Connect again this cable. Check all the cables to the board. If the problem persist, change the A3515-02 board (you should also check the connection to the Generator)
The Console beeps before start.	BIOS error. If there is a problem with the video chipset the beep code will consist of a single long beep followed by three short beeps	Disconnect the power connector. Wait ten seconds and connect it again. Push the power button and if the problem persists, replace the mainboard.
	BIOS error. If there is a problem with the DRAM, the beep code will consist of a single long beep repeatedly.	Check that the DRAM is connected right. If so, try to reboot the system, and if the problem persists, replace the mainboard.
There is no image on the screen.	The TFT inverter is not working properly.	First check that the fans are working. If so, check that cable 55001042 is right connected. Replace the inverter if the problem persists.
	Cable 55001042 is broken.	Try to move the cable. If the screen suddenly bright, replace Kit TFT Screen TPC 12".
	Mainboard is broken.	Replace the mainboard. If the problem persists, replace the whole Console.
The operator application is not launched	The operating system is not working properly.	Replace the Compact Flash Card.
Upper fans are stopped	Power cable is broken	Check the power cable. If it is broken, replace the power supply
	Fan broken	Change the kit fans Console
Touch panel. If you push a button, and nothing happens, or another button is selected	Calibration error of the touch panel controller	Check the calibration process.
	Touch panel controller is broken.	Check that there is a blinking led in the controller. If not, check the power supply. If it is correct, replace the Controller. When the panel is pushed, the led is on continuously. If not, replace the kit TFT Screen TPC 12". If the problem persists, replace the Kit PC GESPAC.

#### 2.5.1 SOFTWARE UPGRADE

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

**Note** 



*To perform any of these operations, it is necessary to connect a Keyboard to the connector labelled “Kb” on the back side of the Touch Screen Console.*

*Please, make sure that the Keyboard connector is suitable (MiniDin type).*

#### 2.5.2 TOUCH SCREEN SENSOR CALIBRATION

If required to calibrate the Sensor of the Touch Screen because the buttons can not be properly selected or because the Compact Flash has been changed, perform the next procedure:

1. Enter in “*Service Mode*” and press the “*Software Upgrade*” button.
2. On the PC Desktop, press the “*Start-Windows*” button on the keyboard connected to the Touch Screen Console, then select: “*Programs / UPDD / Calibrate*”.
3. Execute the “*Calibrate*” program and follow the process clicking on the indicated places.
4. When finish this calibration, come back to the Application by entering again in “*Start*” and select: “*Programs / Start up (select the first one) / Console*”.

### 2.5.3 EXTERNAL BACKUP OF THE APR TECHNIQUES

1. Connect a Laptop (PC) to the Touch Screen Console with a serial cable (*DB9 with female pins on both ends; on one end Pin 2 connected with Pin 3; on the other end Pin 2 connected with Pin3; Pin 5 connected with Pin 5*). Connect the serial cable to port "**COM4**" of the Touch Screen Console and any free port on the Laptop (PC).
2. On the Laptop (PC):
  - a. Select: "*StartMenu / Programs / Accessories / Communications / Hyperterminal / hypertrm.exe*".
  - b. Once the Hyperterminal is opened on the Laptop (PC), configure the connection. For that select on the Menu bar:  
  
*File -> Properties -> Connect using: **COM \*** (selected free port)*  
  
*Configure -> Bits per second: **115200***  
*Data Bits: **8***  
*Parity: **None***  
*StopBits: **1***  
*Flow Control: **None***
  - c. Then press "OK" and "OK".
  - d. Select on the Menu bar: *Transfer -> **Receive File***  
  
on this window select:  
  
*Place received file in the following folder:*  
***(choose a folder in the Laptop)***  
  
*Use receiving protocol:*  
***Xmodem***
  - e. Let that window open without pressing "**Receive**", by the moment.
3. On the Touch Screen Console:
  - a. Enter in "*Service Mode*" and press the "*Software Upgrade*" button.
  - b. Press the "*Start-Windows*" button on the keyboard connected to the Touch Screen Console, then select: "*Programs / accessories / hyperterminal / PORT4.ht*".

- c. Once the Hyperterminal is opened on the Touch Screen Console, configure the connection. For that select on the Menu bar:

*File -> Properties -> Connect using: **COM4***

*Configure -> Bits per second: **115200**  
Data Bits: **8**  
Parity: **None**  
StopBits: **1**  
Flow Control: **None***

- d. Then press “OK” and “OK”.
- e. Select on the Menu bar: *Transfer -> **Send File***

on this window select:

*Filename:*

***C:\ program files\Rad\_Console (this name can be different)  
\APR\_English.ini (or APR\_French.ini, or APR\_Spanish.ini,  
or APR\_German.ini, or APR\_Italian.ini, or  
APR\_Portuguese.ini, according to the APR language  
previously selected on the Settings / Settings Menu.)***

*Use sending protocol:*

***Xmodem***

- f. Let that window open without pressing “**Send**”, by the moment.
4. Press “**Reveice**” on the Laptop (PC) window. It will ask for the name to save the file: Type “**APR\_English.ini**” (or **APR\_French.ini**, or **APR\_Spanish.ini**, or **APR\_German.ini**, or **APR\_Italian.ini**, or **APR\_Portuguese.ini**, according to the APR language previously selected on the Settings / Settings Menu.)
5. Press “**Send**” on the Touch Screen window.
6. Wait until the transference is complete (this can take a few minutes)
7. When the transference is complete, close the Hyperterminal application in the Laptop and Touch Screen Console. Disconnect the serial cable.
8. On the Touch Screen, press the “**Start-Windows**” button on the keyboard and select: “**Programs / Start up (select the first one) / Console**”, to come back to the Application.

## 2.6 PROCEDURES RELATED TO THE BATTERY POWERED GENERATORS



**CAREFULLY HANDLE ALL INTERNAL PARTS OF THE EQUIPMENT, SPECIFICALLY 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.**

*Note* 

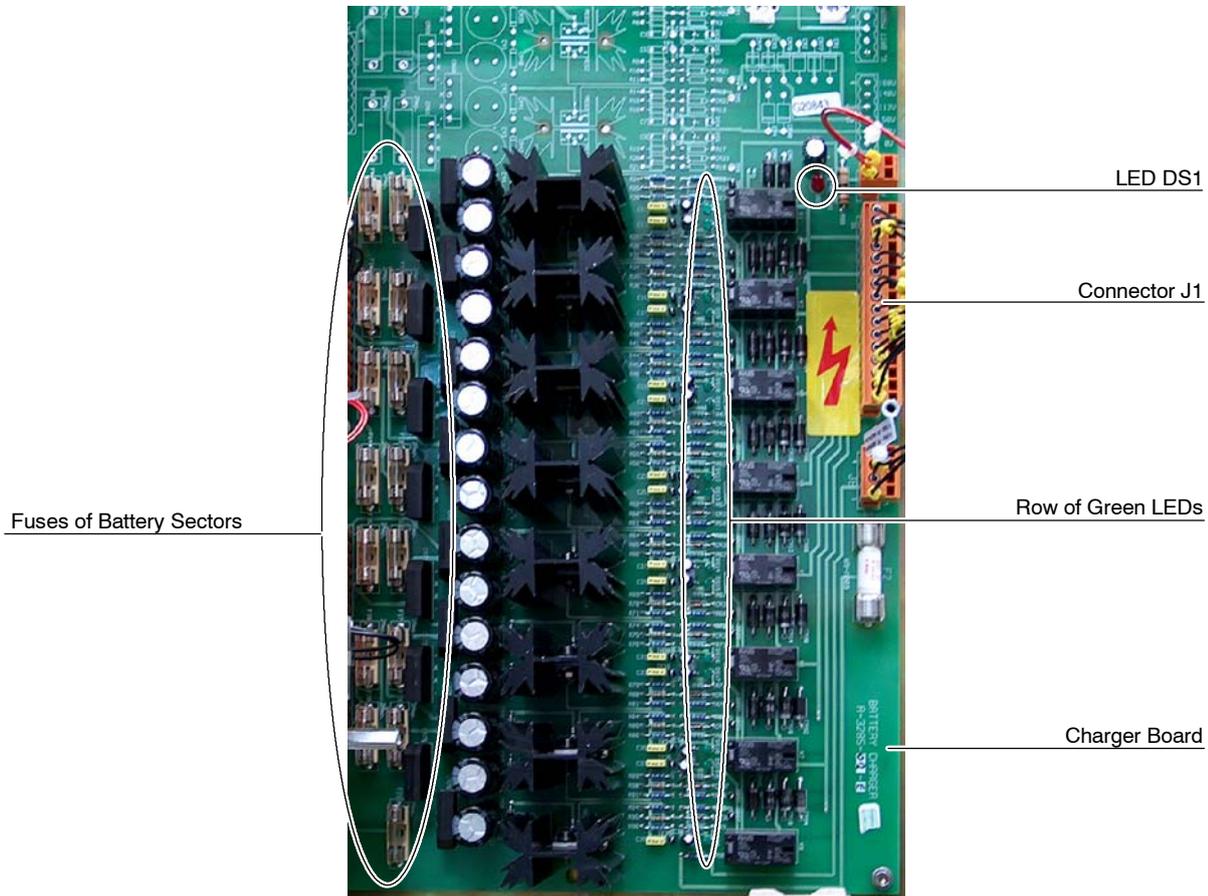
*Before performing the following procedure, be sure that the unit has been connected to mains enough time (recommended eight hours) for a full charging of all the Batteries.*

### 2.6.1 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 lighting when the 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 2-3*).

**Illustration 2-3**  
**Battery Charger Board**



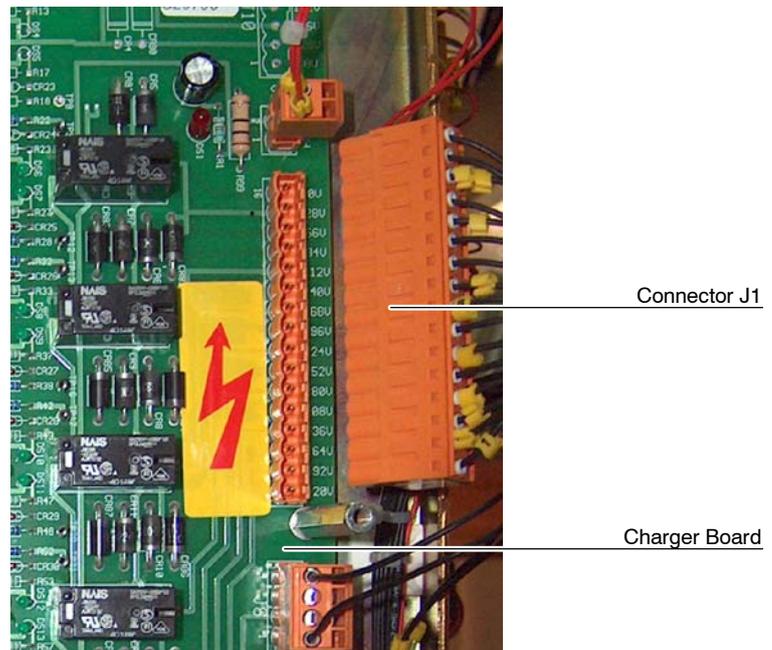
If all of the green LEDs are not lighting and the “Line Present” external Lamp is off, check that the Input Line Magnetothermic 1SW1 is in ON position. If it is in ON position and all of the green LEDs are not lighting, check that Yellow LED DL1 on the Line Monitor Board is blinking. if LED DL1 is not 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 voltage supplied from the Battery Charger Board for charging every couple of Batteries (one sector) is the correct voltage.
  - a. Turn OFF the Unit with the Input Line Magnetothermic 1SW1 in OFF position.
  - b. Remove Connector J1 from the Battery Charger Board.



- c. Turn ON the Unit with the Input Line Magnetothermic 1SW1 in ON position.
- d. At this moment check on the Battery Charger Board that all the green LEDs and the LED DS1 are lighting. If not, replace the Battery Charger Board.

- e. If the LED lights are correct, measure between all consecutive pins of Connector J1 (base). Voltage between consecutive pins should be around 27.5 V. If this measure is wrong it means that the last charging sector in board is defective and the Battery Charger Board must be replaced.



Measurement at Pins 1-2



Measurement at Pins 2-3

- f. After checking it, turn OFF the Unit with the Input Line Magnetothermic 1SW1 in OFF position. Replace the Battery Charger Board if it is necessary and connect J1 and the rest of connectors.
- g. Turn ON the Unit with the Input Line Magnetothermic 1SW1 in ON position.
3. Check always the Batteries status as described in *Section 2.6.2 - Identifying and Replacing Defective Batteries*.

## 2.6.2 IDENTIFYING AND REPLACING DEFECTIVE BATTERIES

Batteries have a life time after which they should be replaced as they go bad. The problem arises at the moment of determining if the Battery is good or defective and need to replace it.

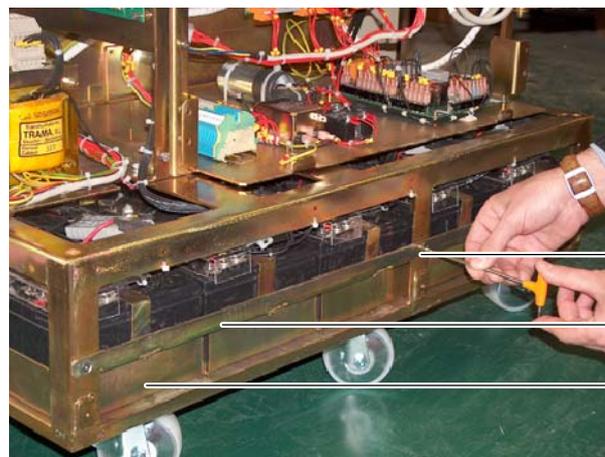
Tools required to determine which Batteries are defective:

- 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 with the Input Line Magnetothermic 1SW1 in OFF position.
2. Remove the Protection Plate of the Battery Trays (3 Allen screws).



Allen Screws

Protection Plate

Battery Tray

3. Take out the first Battery Tray disconnecting before the Anderson and Molex Connectors of the Battery Tray. Remove the Protection Cover of the Battery Tray.

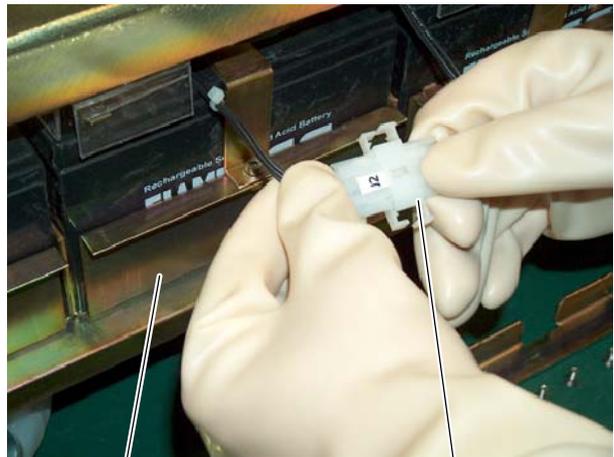


**USE PROTECTION GLOVES AGAINST ELECTRIC SHOCK HAZARDS AND SAFETY GLASSES WHEN HANDLING BATTERIES DURING SERVICE TASKS.**



Anderson Connectors

Molex Connector

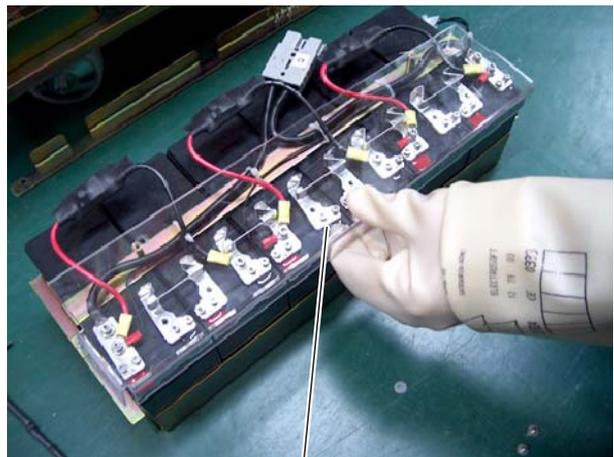


Battery Tray

Molex Connector



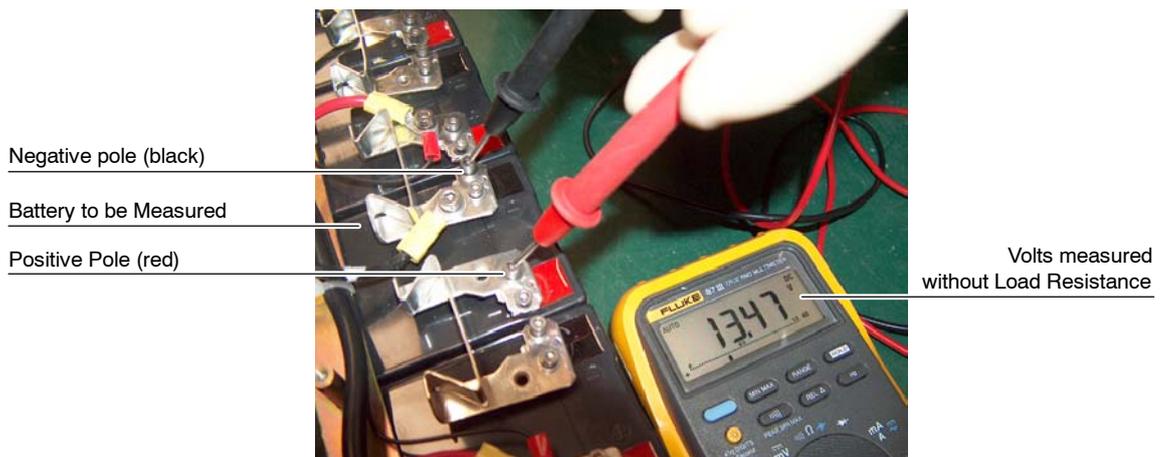
Battery Tray



Protection Cover

- Identify the positive and negative poles of the Battery to be measured. Measuring the output voltage of the Battery is not enough to determine whether a Battery is OK. The image bellow shows the measurement of a Battery which has good voltage (around 12V) as shown in the Multimeter.

This measurement can lead us to the thought that the Battery is in good condition, but this is a voltage without load.



- Connect the Load Resistance (3 Ohms, > 50 Watts) to the positive and negative Battery poles. Repeat the voltage measurement with the Load Resistance connected. If the voltage with load is less than 10 V (usually close to 0 V), the Battery is not good since it will never be completely loaded.



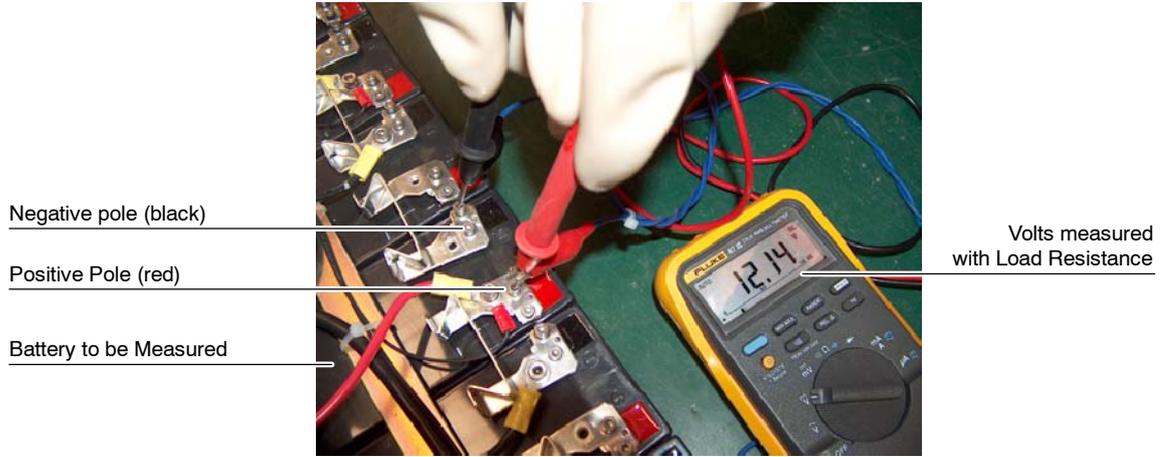
**BE CAREFUL WITH THE LOAD RESISTANCE AS IT MAY GET VERY HOT DURING THE TEST.**



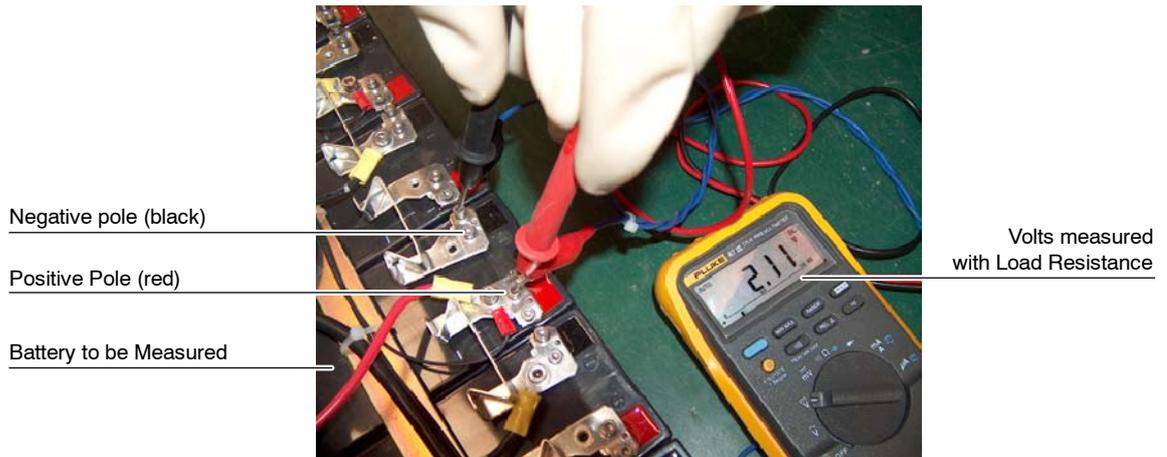
Load Resistance

# HF Series Generators

## Troubleshooting

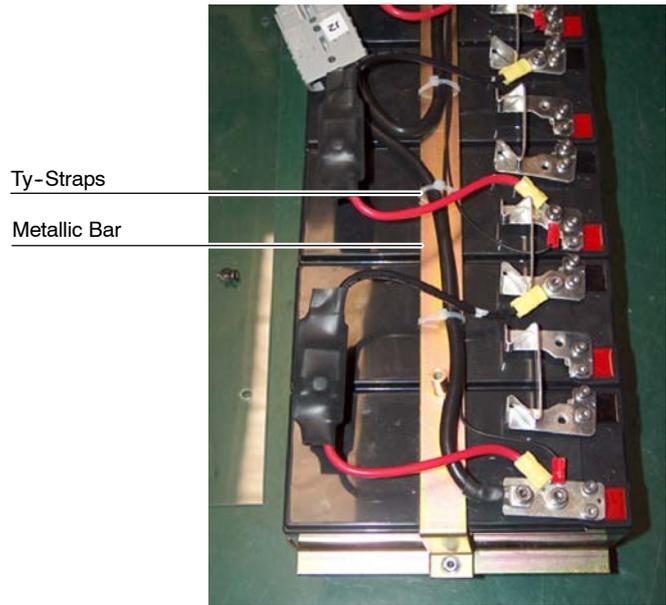


**Battery in good condition**

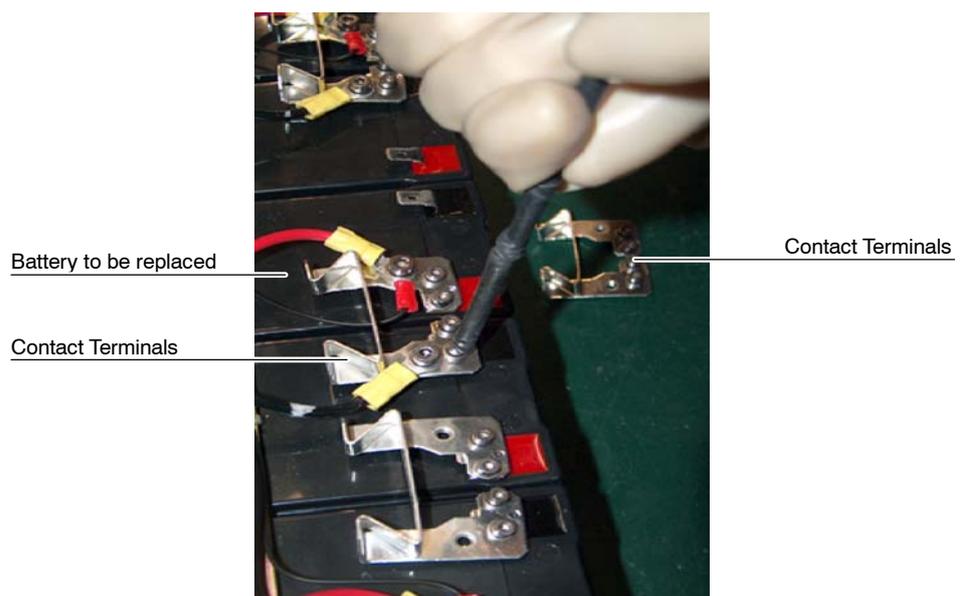


**Battery in bad condition**

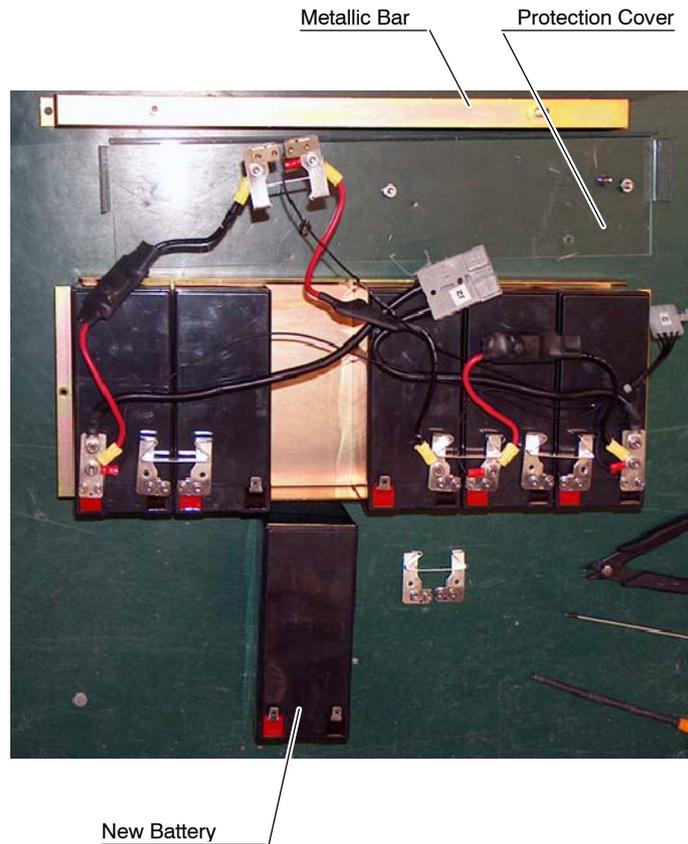
6. Follow the Battery testing with the rest of Batteries and after checking all of them replace the defective Batteries as described in the next step.
7. Battery replacement:
  - a. Cut the ty-straps needed to replace the Battery and remove the Metallic Bar on the Battery Tray.



- b. **CAREFULLY**, disconnect the contact terminals of the Battery (negative and positive poles) using an isolated Allen Screwdriver.



- c. **CAREFULLY**, place the new Battery, connect the terminals of the Battery again, and re-install the ty-straps, Metallic Bar and Protection Cover over the Batteries.



- d. **CAREFULLY**, re-install the Battery Tray inside the Cabinet connecting the respective Anderson and Mollex Connectors. Screw the lateral Protection Plate of the Battery Trays.

## 2.7 PROCEDURES RELATED TO THE CAPACITOR ASSISTED GENERATORS



***CAREFULLY HANDLE ALL INTERNAL PARTS OF THE EQUIPMENT, 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 THE PROCEDURE FOR CAPACITORS DISCHARGING AND VOLTAGE TESTING PREVIOUS TO MANIPULATE INSIDE THE GENERATOR FOR SERVICE.***



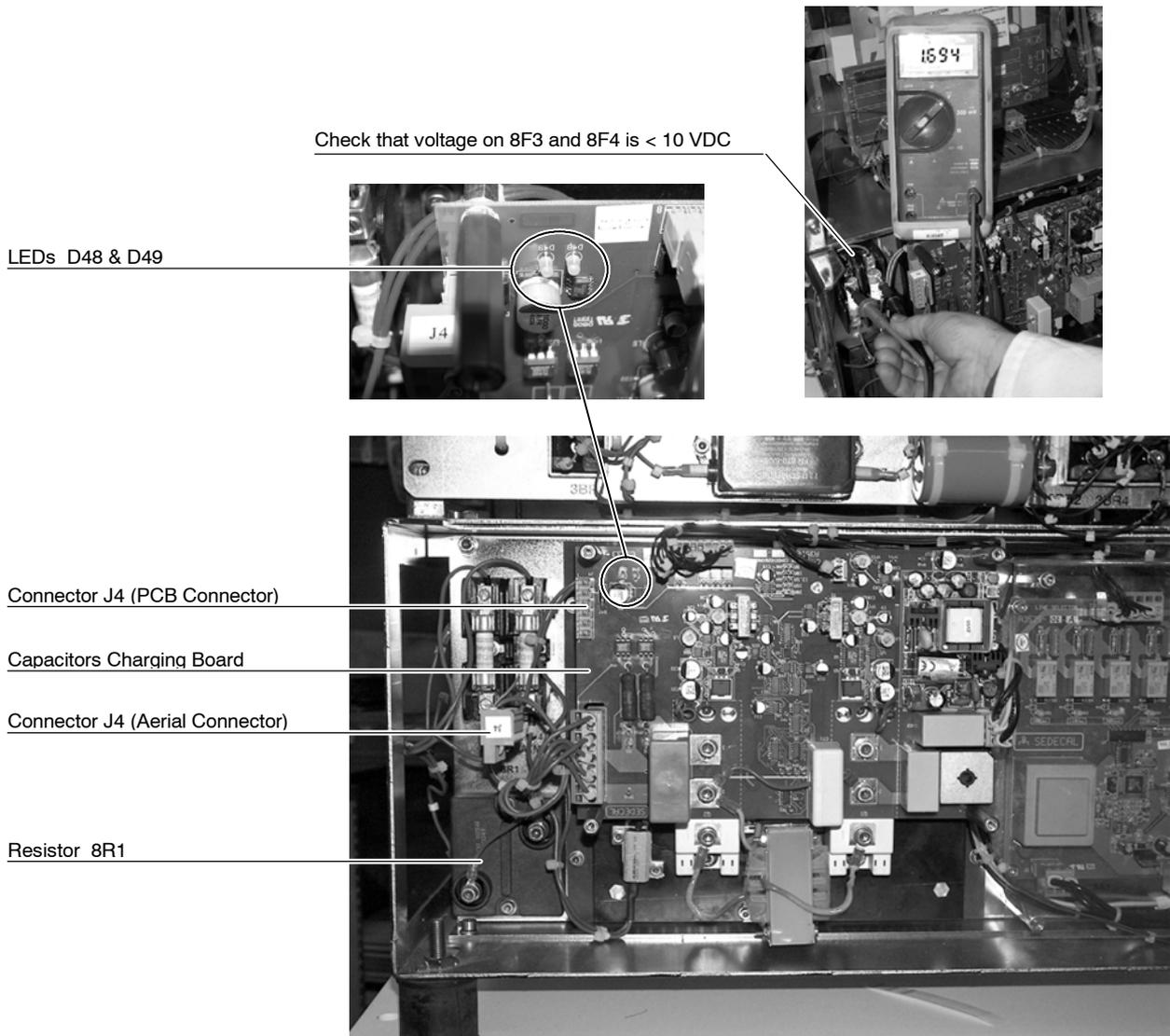
***KEEP IN MIND THE GENERAL CAUTIONS FOR CAPACITOR ASSISTED GENERATORS INDICATED IN SECTION 1.2.***

### 2.7.1 PROCEDURE FOR STORAGE CAPACITORS DISCHARGING AND VOLTAGE TESTING

1. With the Generator turned OFF, be sure that the Power Supply Cable is unplugged from the Mains socket.
2. Take away 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 THE CAPACITORS ARE FULLY DISCHARGED AFTER THIS PROCEDURE.**
4. Resistor 8R1 (1K5 ohms, 250 W) is assembled close to the Capacitor Charger Board to allow the Capacitors discharging. Connector J4 (from this resistor) must be disconnected for normal operation of the Unit, and **ONLY MUST BE CONNECTED** to the J4 of the Capacitor Charger Board for Capacitors discharging process.
5. Plug Connector J4 in 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 2-4**  
**Connection of J4 for Capacitor Discharging**



**DO NOT MANIPULATE INSIDE THE UNIT WITHOUT CHECKING THAT VOLTAGE IN CAPACITORS MODULE HAS BEEN DISCHARGED (LESS THAN 10 VDC).**

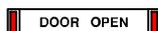
Note

*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, or maximum 40 seconds for a line of 110 VAC with selection of 8 A in the Generator).*

## SECTION 3

## SELF-DIAGNOSIS INDICATORS

Some Console are provided with Self-Diagnosis indicators that identify a malfunction in the system alerting operator about error existence that inhibits exposure. During normal operation of the system, 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).

A rectangular icon with a black border and a white background. Inside, the text "DOOR OPEN" is centered in a black, sans-serif font. The icon is flanked by two vertical bars on each side.

DOOR

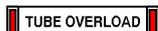
**DOOR OPEN:** Indicates the X-ray room door is open when the X-ray equipment is in use. (Also refer to Error Code "E35").

A rectangular icon with a black border and a white background. Inside, the text "GEN OVERLOAD" is centered in a black, sans-serif font. The icon is flanked by two vertical bars on each side.

G.OVL

**GENERATOR OVERLOAD:** Indicates that the exposure has been interrupted because during exposure has been produced arcing or bad function on 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").

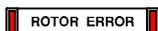
It can be also shown making a high power and long exposure with the X-ray tube cool (X-ray Tube has not been warmed-up).

A rectangular icon with a black border and a white background. Inside, the text "TUBE OVERLOAD" is centered in a black, sans-serif font. The icon is flanked by two vertical bars on each side.

T.OVL

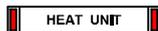
**TUBE OVERLOAD:** Indicates that either the technique selected is beyond the X-ray tube ratings or the present conditions of the X-ray tube inhibit the exposure (anode overheated). Parameters for next exposure may be temporally limited by the Generator (change the exposure values or wait for the X-ray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

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

A rectangular icon with a black border and a white background. Inside, the text "ROTOR ERROR" is centered in a black, sans-serif font. The icon is flanked by two vertical bars on each side.

ROTOR

**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").

A rectangular icon with a black border and a white background. Inside, the text "HEAT UNIT" is centered in a black, sans-serif font. The icon is flanked by two vertical bars on each side.

HEAT

**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 to another enable values. *(Also refer to Error Code “E34”).*
- after the “ABC” selection, when ABC is not enable. *(Also refer to Error Code “E34”).*
- if a failure on the Automatic Collimator has been detected (blades are full open or in movement during exposure, etc.). In this case the indicator light is constant (not blinking). *(Also refer to Error Code “E48”).*

## SECTION 4 ERROR CODES

ERROR CODE LIST	
ERROR CODE	DESCRIPTION
" - - - - - "	SYSTEM FAILURE. FATAL ERROR.
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. ALL WORKSTATIONS ARE UNCONFIGURED.
E04	"PREP" SIGNAL RECEIVED WITHOUT CONSOLE ORDER.
E05	"FLUORO" SIGNAL ACTIVE WITHOUT REQUEST.
E06	"PREP" OR/AND "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 NO INITIALIZED ON ATP CONSOLE CPU BOARD OR ON HT CONTROLLER BOARD. WRONG DATA CALIBRATION.
E11	NO VOLTAGE IN CAPACITOR BANK.
E12	NO mA DURING EXPOSURE OR mA OUT OF TOLERANCE. WRONG FILAMENT CURRENT.
E13	NO kVp DURING EXPOSURE OR kVp OUT OF TOLERANCE.
E14	EXPOSURE SIGNAL WITHOUT X-RAY EXPOSURE CONSOLE COMMAND.
E15	NO CURRENT ON FILAMENT. WRONG SELECTION OF FOCAL SPOT DETECTED DURING "PREP".
E16	INVALID VALUE OF: kVp, mA OR kW.
E17	COMMUNICATION ERROR BETWEEN ATP CONSOLE CPU BOARD AND HT CONTROLLER BOARD.
E18	ROTOR RUNNING WITHOUT ORDER OR ROTOR ERROR.
E19	mA DETECTED WITHOUT "EXPOSURE" ORDER.
E20	kVp DETECTED WITHOUT "EXPOSURE" ORDER.
E21	WRONG TUBE-1 SELECTION.
E22	WRONG TUBE-2 SELECTION.
E23	CALIBRATION DATA NOT STORED.
E24	THE BUCKY HAS NOT BEEN DETECTED TO BE MOVING.
E25	BATTERY FAILURE IN BATTERY POWERED GENERATORS.
E26	VOLTAGE FAILURE IN BATTERY POWERED GENERATORS WITH STAND-ALONE.
E27	FAILURE IN CONSOLE EPROM. BAD CHECKSUM.

## HF Series Generators

### Troubleshooting

ERROR CODE LIST	
ERROR CODE	DESCRIPTION
E29	ALL CLEAR SIGNAL NOT ACTIVE - NUCLETRON GENERATOR.
E30	RELAY K1 NOT ACTIVE - NUCLETRON GENERATOR.
E31	LONG EXPOSITION IS NOT INITIATED - NUCLETRON GENERATOR.
E32	LONG EXPOSITION IS NOT CUT AFTER 3.2 SECONDS - NUCLETRON GENERATOR.
E33	NO COMMUNICATION LINK BETWEEN GENERATOR AND SERIAL CONSOLE OR PC UNIT.
E34	TECHNIQUE ERROR.
E35	DOOR OPEN.
E36	HEAT UNITS. OVERHEATING.
E37	TUBE OVERLOAD.
E41	DOSIMETER - COMMUNICATION FAILURE BETWEEN TUBE-1 DOSIMETER AND GENERATOR.
E42	DOSIMETER - AUTOTEST ERROR ON TUBE-1 DOSIMETER.
E43	DOSIMETER - TUBE-1 ION CHAMBER STATUS CHECK ERROR.
E44	DOSIMETER - COMMUNICATION FAILURE BETWEEN TUBE-2 DOSIMETER AND GENERATOR.
E45	DOSIMETER - AUTOTEST ERROR ON TUBE-2 DOSIMETER.
E46	DOSIMETER - TUBE-2 ION CHAMBER STATUS CHECK ERROR.
E47	CAPACITOR ASSISTED GENERATOR - CAPACITOR NOT CHARGED WHEN "PREP".
E48	COLLIMATOR ERROR.
E49	EXPOSURE CYCLE ERROR.
E50	INTERRUPTED EXPOSURE.
E51	DRAC - CHECKSUM FAILURE OR EPROM CORRUPTED.
E52	DRAC - MICROCONTROLLER RAM FAILURE.
E53	DRAC - INSUFFICIENT DC BUS VOLTAGE AT LOW LEVEL VOLTAGE (220 VAC).
E54	DRAC - INSUFFICIENT DC BUS VOLTAGE AT HIGH LEVEL VOLTAGE (480 VAC).
E55	DRAC - EXCESSIVE DC BUS VOLTAGE AT HIGH LEVEL VOLTAGE (480 VAC OR 380 VAC).
E56	DRAC - EXCESSIVE REFERENCE VOLTAGE.
E58	DRAC - EXCESSIVE CURRENT IN MAIN WINDING DURING ACCELERATION UP TO 3300 RPM.
E59	DRAC - EXCESSIVE CURRENT IN AUXILIAR WINDING DURING ACCELERATION UP TO 3300 RPM.
E60	DRAC - INSUFFICIENT CURRENT IN AUXILIAR WINDING DURING ACCELERATION UP TO 3300 RPM.
E61	DRAC - INSUFFICIENT CURRENT IN MAIN WINDING DURING ACCELERATION UP TO 3300 RPM.
E62	DRAC - EXCESSIVE CURRENT IN MAIN WINDING DURING ACCELERATION UP TO 10000 RPM.
E63	DRAC - EXCESSIVE CURRENT IN AUXILIAR WINDING DURING ACCELERATION UP TO 10000 RPM.
E64	DRAC - INSUFFICIENT CURRENT IN AUXILIAR WINDING DURING ACCELERATION UP TO 10000 RPM.
E65	DRAC - INSUFFICIENT CURRENT IN MAIN WINDING DURING ACCELERATION UP TO 10000 RPM.

ERROR CODE LIST	
ERROR CODE	DESCRIPTION
E66	DRAC - EXCESSIVE CURRENT IN MAIN WINDING RUNNING AT 3300 RPM.
E67	DRAC - EXCESSIVE CURRENT IN AUXILIAR WINDING RUNNING AT 3300 RPM.
E68	DRAC - INSUFFICIENT CURRENT IN AUXILIAR WINDING RUNNING AT 3300 RPM.
E69	DRAC - INSUFFICIENT CURRENT IN MAIN WINDING RUNNING AT 3300 RPM.
E70	DRAC - EXCESSIVE CURRENT IN MAIN WINDING RUNNING AT 10000 RPM.
E71	DRAC - EXCESSIVE CURRENT IN AUXILIAR WINDING RUNNING AT 10000 RPM.
E72	DRAC - INSUFFICIENT CURRENT IN AUXILIAR WINDING RUNNING AT 10000 RPM.
E73	DRAC - INSUFFICIENT CURRENT IN MAIN WINDING RUNNING AT 10000 RPM.
E74	DRAC - EXCESSIVE CURRENT IN MAIN WINDING BRAKING AT 3300 RPM.
E75	DRAC - EXCESSIVE CURRENT IN AUXILIAR WINDING BRAKING AT 3300 RPM.
E76	DRAC - INSUFFICIENT CURRENT IN AUXILIAR WINDING BRAKING AT 3300 RPM.
E77	DRAC - INSUFFICIENT CURRENT IN MAIN WINDING BRAKING AT 3300 RPM.
E78	DRAC - EXCESSIVE CURRENT IN MAIN WINDING BRAKING AT 10000 RPM.
E79	DRAC - EXCESSIVE CURRENT IN AUXILIAR WINDING BRAKING AT 10000 RPM.
E80	DRAC - INSUFFICIENT CURRENT IN AUXILIAR WINDING BRAKING AT 10000 RPM.
E81	DRAC - INSUFFICIENT CURRENT IN MAIN WINDING BRAKING AT 10000 RPM.
E82	DRAC - WRONG X-RAY TUBE SELECTION.
E83	DRAC - EXCESSIVE CURRENT IN DC BRAKE.
E84	DRAC - INCORRECT TUBE SELECTION SIGNAL.
E85	DRAC - INCORRECT TUBE SELECTION SIGNAL.
E86	DRAC - INCORRECT TUBE SELECTION SIGNAL.
E87	DRAC - INSUFFICIENT CURRENT IN COMMON WIRE DURING ACCELERATION UP TO 3300 RPM
E88	DRAC - INSUFFICIENT CURRENT IN COMMON WIRE RUNNING AT 3300 RPM
E89	DRAC - INSUFFICIENT CURRENT IN COMMON WIRE DURING ACCELERATION UP TO 10000 RPM
E90	DRAC - INSUFFICIENT CURRENT IN COMMON WIRE RUNNING AT 10000 RPM
E91	DRAC - INCORRECT MEASURE AT IPRINC (CH2)
E92	DRAC - INCORRECT MEASURE AT IAUX (CH3)
E93	DRAC - INCORRECT MEASURE AT ICOM (CH4)
E95	RAPID TERMINATION
E96	CAPACITOR ASSISTED GENERATOR - VOLTAGE MISSING
E97	CAPACITOR ASSISTED GENERATOR - VOLTAGE IN CAPACITORS NOT BALANCED
E98	DIP SWITCH 3024SW2-3 ON ATP CONSOLE CPU BOARD SET FOR CONFIGURATION AND CALIBRATION MODE ACTIVE (SERVICE MODE).

#### **ERROR CODE : “ \_ \_ \_ \_ \_ ”**

<b>DESCRIPTION :</b>	System failure.
<b>ERROR TYPE :</b>	Fatal error. Generator must be switched off.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	This indication may appear at any time together with another Error Code on the Console.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed.

---

#### **ACTIONS**

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

#### **ERROR CODE : E01**

<b>DESCRIPTION :</b>	Failure in power up routine. No communication link between HT Controller Board and ATP Console CPU Board.
<b>ERROR TYPE :</b>	Fatal error. Generator can not continue with power up.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	Only during initialization phase. If it appears during normal functioning of equipment, it means that a problem has caused a power off in the Console.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed.  It has not been possible to establish a correct communication link between ATP Console and HT Controller Boards during power ON and the Generator is not able to make Exposures.  If Led 1 of the HT Controller remains lit, it means that HT Controller has not been started.

---

#### **POSSIBLE CAUSES**

- The Console has been suddenly switched OFF by operator or by a loss of the main power.
  - The Microprocessor U5 on the HT Controller Board has not started-up.
  - The communication link between ATP Console Board and HT Controller Board is not reliable.
- 

#### **ACTIONS**

1. Check DC supplies.
2. Check the software version in case of update or change the ATP Console or HT Controller Boards. Check and replace if necessary U5 on HT Controller and U24 on ATP Console Board.
3. Check continuity between terminals 2, 3, 5 and 6 on J3 of ATP Console Board and P1-4, P1-11, P1-15, P1-10 of HT Controller Board. Check with special care connector 6J3 of the Generator.
4. Switch OFF, wait a few seconds and switch ON again to reset the Error Code.
5. If not fixed after previous steps, check Led DS1 on HT Controller Board when powering the equipment, if it has not turned off, replace HT Controller Board.
6. If Led DS1 is off, check with an oscilloscope the following signals: HT-C CLK, HT-C DAT, C-HT CLK and C-HT DAT in order to find a possible defective component at any of both Boards (HT Controller and ATP Console). Replace the Board where the defective component is found.

**ERROR CODE : E02**

<b>DESCRIPTION :</b>	Failure in power up routine. RAD Generator configured as R&F Generator. No communication link between ATP Console CPU Board and Fluoro CPU Board.
<b>ERROR TYPE :</b>	Fatal error. Generator can not continue with power up.
<b>APPLICABLE TO :</b>	R&F Generators or Generators configured by mistake as R&F.
<b>APPEARS WHEN :</b>	Only during initialization phase. If it appears during normal functioning of equipment, it means that a problem has caused a power off in the Console.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed.  It has not been possible to establish a correct communication link between ATP Console and 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 Board and Fluoro CPU Board is not reliable.  
The Fluoro CPU Board does not work properly.

**ACTIONS**

1. Check Communication Cable between J4 of ATP Console and J4 of Fluoro CPU Boards.
2. Check and replace if necessary U12 in Fluoro CPU Board.
3. If Fluoro values are not displayed on the Console, check DC supplies and Fluoro CPU Board. Replace Fluoro CPU Board if necessary.

**ERROR CODE : E03**

<b>DESCRIPTION :</b>	Failure in power up routine. All workstation are unconfigured.
<b>ERROR TYPE :</b>	Fatal error. Generator can not continue with power up.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	Only during initialization phase. If it appears during normal functioning of equipment, it means that a problem has caused a power off in the Console.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed.  It has not been possible to establish a correct communication link between ATP Console and HT Controller Boards 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 ATP Console Board is defective.  
The ATP Console Board is not able to communicate with U18.

**ACTIONS**

1. Configure the workstations as referred in Service Manual.
2. Change U18 and configure the workstations as referred in Service Manual.
3. If not fixed after previous steps, replace ATP Console Board and configure the workstations.

#### **ERROR CODE : E04**

<b>DESCRIPTION :</b>	"Prep" signal received without Console order.
<b>ERROR TYPE :</b>	Informative. Generator re-start automatically once error is solved.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment once initialization phase is over.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed. It has not been possible to establish a correct communication link between ATP Console and HT Controller Boards.

---

#### **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 Board. Check with special care connector 6J3 of the Generator.
2. If all is correct, check signal from P1-3 to U5 on HT Controller Board.
3. If the signal is OK, replace HT Controller Board.

#### **ERROR CODE : E05**

<b>DESCRIPTION :</b>	"Fluoro" signal active without request.
<b>ERROR TYPE :</b>	Fatal error. Generator can not continue with Power up.
<b>APPLICABLE TO :</b>	R&F Generators or Generators configured by mistake as R&F.
<b>APPEARS WHEN :</b>	Only during initialization phase.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed. It has not been possible to establish a correct communication link between ATP Console and Fluoro CPU Boards during power ON and the Generator is not able to make exposures.

---

#### **POSSIBLE CAUSES**

The Generator receives the "Fluoro" signal without Console command.  
"Exp" has been pressed in a Workstation not configured for standard R&F.

---

#### **ACTIONS**

1. Check an unwilling press on the Fluoro pedal.
2. If not the case, check continuity between TS1-37 and J2-17 on ATP Console Board.
3. Then, check signal -FL EXP on ATP Console Board.
4. If the Signal is OK, replace the ATP Console Board.

**ERROR CODE : E06**

<b>DESCRIPTION :</b>	"Prep" or/and "Exposure" orders activated during power-up routine.
<b>ERROR TYPE :</b>	Informative. Generator re-start automatically once error is solved.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	At any moment once initialization phase is over.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed. It has not been possible to establish a correct communication link between ATP Console and HT Controller Boards.

**POSSIBLE CAUSES**

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

**ACTIONS**

1. In Generators equipped with "Prep" and "Exposure" keys on the Console, check that not object is activating the function. Also check for possible damages on keys.
2. Check damages on flat cable with connector J9.
3. In Generators with external Handswitch, check contacts, cable and connectors.
4. If the error remains, check continuity between TS1-37 and J2-17 on ATP Console Board and TS1-36 and J2-4 also on ATP Console Board.
5. If not solved yet, replace the ATP Console Board.

**ERROR CODE : E07**

<b>DESCRIPTION :</b>	Wrong data for X-ray Tube-2.
<b>ERROR TYPE :</b>	Fatal error. Generator can not continue with power up.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	Only during initialization phase.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed. It has not been possible to establish a correct communication link between ATP Console and HT Controller Boards during power ON.

**POSSIBLE CAUSES**

Wrong configuration of X-ray Tube-2.  
Corrupted calibration data.  
Data on Extended Memory Location E18 are larger than the maximum allowed.

**ACTIONS**

1. Check data in Extended Memory Location E18.
2. If it is OK, replace U3 on HT Controller Board.

#### **ERROR CODE : E08**

<b>DESCRIPTION :</b>	Wrong data for X-ray Tube-1.
<b>ERROR TYPE :</b>	Fatal error. Generator can not continue with power up.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	Only during initialization phase.
<b>INFORMATION / SYMPTOM :</b>	This Error Code needs to turn OFF/ON the Generator to be fixed. It has not been possible to establish a correct communication link between ATP Console and HT Controller Boards during power ON.

---

#### **POSSIBLE CAUSES**

Wrong configuration of X-ray Tube-1.  
Corrupted calibration data.  
Data on Extended Memory Location E02 are larger than the maximum allowed.

---

#### **ACTIONS**

1. Check data in Extended Memory Location E02.
  2. If it is OK, replace U3 on HT Controller Board.
- 

#### **ERROR CODE : E09 - GENERATOR OVERLOAD**

<b>DESCRIPTION :</b>	Generator overload. Arcing or IGBT fault.
<b>ERROR TYPE :</b>	Informative.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	<u>During the exposure</u> and <u>In Stand-by</u> .
<b>INFORMATION / SYMPTOM :</b>	This error may appear at the Console as "E09" Error Code or as a "Generator Overload" indication.  <u>During exposure</u> an over current on the IGBT's of the HV Inverter Module has been detected. This may be produced by an arc or mal-function on the HV Circuitry.  <u>In stand-by</u> , the Console is continuously displaying "E09" or "Generator Overload" due to a defective or overheated IGBTs Module.

---

#### **POSSIBLE CAUSES**

Symptom-1:

- Defective X-ray Tube.
- Defective HV Transformer or HV Cable.
- Defective IGBT module.
- Defective HT Controller.

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 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 in paragraph 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 in paragraph 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 HV Transformer and HV Cables are OK. Then follow the procedure in paragraph E. In this case high mA causes E09 or "Generator Overload".

**B. INVERTER MODULE TEST**

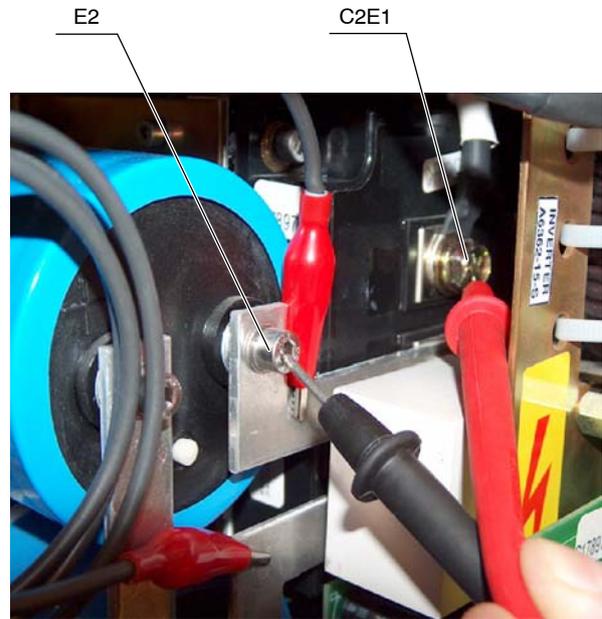
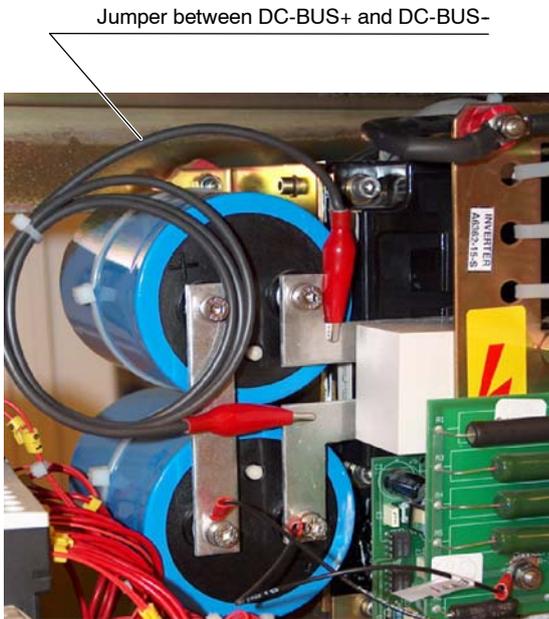
1. Power off Generator and mains.
2. Remove the cover from the Generator Cabinet.
3. Wait for the DC Bus of the Inverter to be fully discharged. When it is fully discharged the Leds on the Charge-Discharge Monitor Board will be completely turned off.
4. When Leds are off make a jumper between DC-BUS+ and DC-BUS-. Make sure that there is less than 10 VDC across the BUS. (*Refer to Illustration 4-1 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 4-1 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 Ohms) or very close.

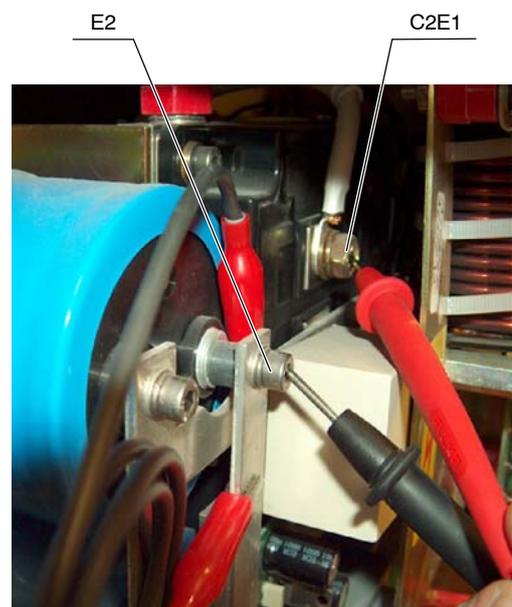
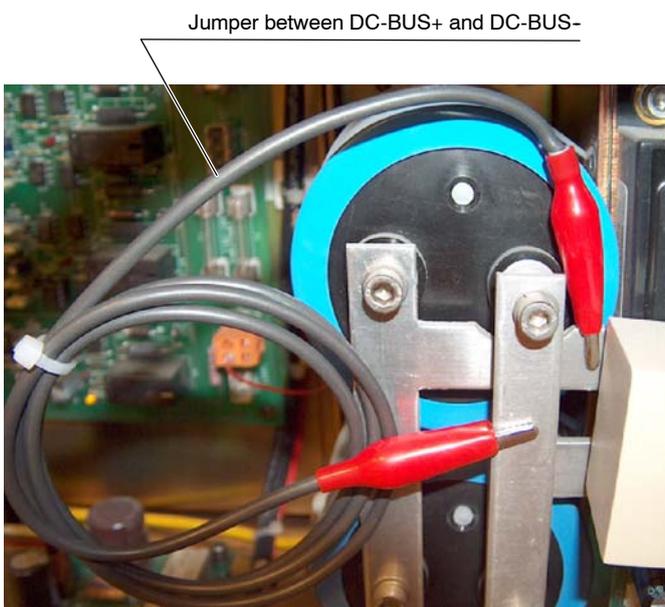
# HF Series Generators

## Troubleshooting

### Illustration 4-1 Jumper and Measurement Points



3-PHASE LINE POWERED GENERATOR



1-PHASE LINE POWERED GENERATOR, BATTERY POWERED GENERATOR OR CAPACITOR ASSISTED GENERATOR

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

**Note** 

*Don't forget to remove the jumper across the DC Bus after all measurements are made, otherwise the Inverter will suffer serious damage.*

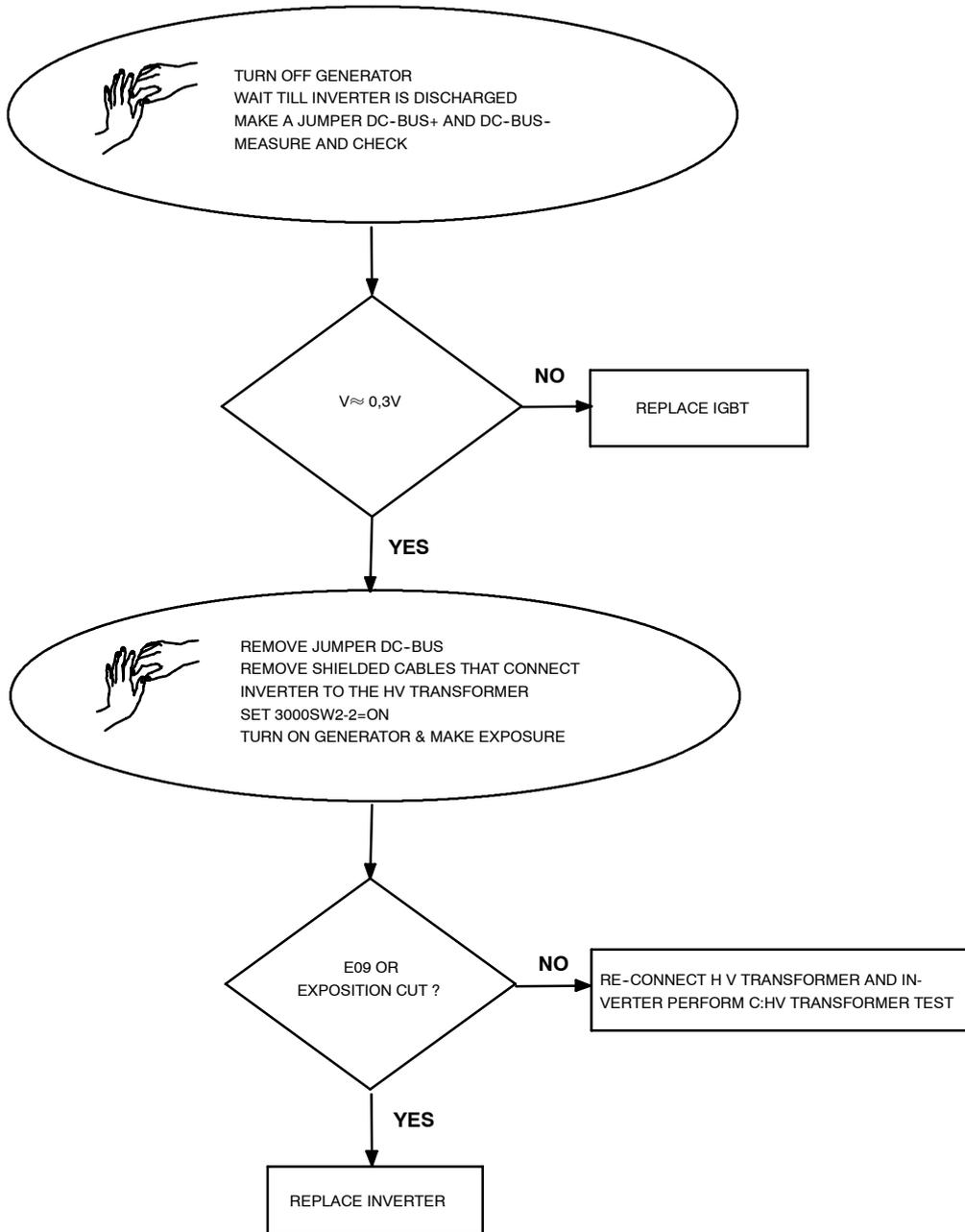
7. If any of the IGBTs are short-circuited, replace the IGBT.
8. If both IGBTs are OK, remove both shielded cable that connect the Inverter to the HV Transformer: P1, P3 and SHLD (P2) . Isolate the three wires completely from each other and from the metal sheet or ground. Make sure that wires are perfectly isolated and that no short-circuit is made otherwise serious damages could result.
9. Set Dip-switch 3000SW2-2 in ON position at the HT Controller Board.
10. Turn ON mains and Generator.
11. Make an exposure:
  - If "E09" or "Generator Overload" appear or the exposure has not been cut before 80ms, change (if possible) the whole Inverter. If it is not possible check capacitor C9 and choke L1 of the inverter (normally placed at the backside of the inverter). If both seem OK, change both IGBTs and IPM Drivers (Do not forget to re-connect both shielded cables to the HV Transformer (P1, P2 and P3).
  - 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 H. Voltage Transformer (P1, P2 and P3). Follow the procedure in paragraph C (High Voltage Transformer Test).

**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 OFF mains and Generator.
13. Set Dip-switch 3000SW2-2 in 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).

Illustration 4-2  
Flowchart for B: Inverter Module Test



**C. HV TRANSFORMER TEST**

1. Connect the scope as follows:
  - CH.1 on + mA (TP14) on HT Controller Board.
  - CH.2 on - mA (TP13) on HT Controller Board.
  - Base Time in 10 ms per division and 1 V per division
2. Turn ON mains and Generator. Set Dip-switch 3000SW2-4 in ON position at the HV Controller Board. Select 50 kVp, 25 mA and 50 ms.
3. Make an exposure and check that both waveforms are almost symmetric (a difference of  $\pm 10\%$  is normal).
  - If it is OK, follow 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 HV Transformer.
4. Turn OFF Generator and mains.
5. Remove 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 ON mains and Generator. Select 50 kVp, 50 mA and 50 ms.
8. Connect the scope as following:
  - CH.1 on + kV (TP11) on HT Controller Board.
  - CH.2 on -kV (TP12) on HT Controller Board.
  - Base time in 10 msec. per division and 2 V per division.
9. Make an Exposure and check that both waveforms are symmetric.
10. Make exposures from 50 kVp to 110 kVp with the same Exposure Time and check that all kVp waveform are symmetric and the values are similar according the table below.

Select	TP11 & TP12 on the HT Controller (Compact Generators)
50 kVp	2.1 V
70 kVp	2.9 V
90 kVp	3.7 V
110 kVp	4.5 V
130 kVp (only for 150 kVp HV Transf.)	5.3 V

11. Select the maximum kVp allowed (depending on the tube type) and maximum Exposure Time allowed but **NEVER** go over the 110–130 kVp limit. Make several Exposures and check that waveforms are correct. If the waveforms are not symmetric within  $\pm 10\%$  at any point, replace the HV Transformer.
12. Repeat the above procedure for the X-ray Tube-2 if the room has two tubes.
13. 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. To know when the Tube begins to arc follow procedure in paragraph D. At any case, X-ray Tube must be replaced.
14. Set on the HT Controller Dip-switch SW2 position 4 in OFF and remove jumper between FIL (TP8) and + 5 V (TP2).

#### D. X-RAY TUBE TEST

After the performance of the above referred test everything is found OK, the Service 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 minimum kVp and minimum mA 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 in step C.1 (HV Transformer Test).
  - If not, keep on incrementing the kVp in steps of 10 kVp (60, 70, 80, 90, 100, 110, 120 and 125 kVp for 125 kVp HV Transformers; and 130, 140, 150 kVp HV Transformers) 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 procedure in step-4.
4. Select minimum kVp and minimum 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.

#### E. 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 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 (Bucky, Fluoro devices, etc.). Or it may occur when selecting a high power Exposure and the voltage of the main line goes down more than 10% (in this case check the part number of the IPM Driver Board, it must be A3063-03 or greater).

**ERROR CODE : E10**

<b>DESCRIPTION :</b>	EEPROM corrupted or not initialized on ATP Console CPU Board or on HT Controller Board. Wrong data calibration.
<b>ERROR TYPE :</b>	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 Board is corrupted or not initialized or when EPROM U24 on ATP Console Board has been changed). In both cases, "E10" appears together with "E34" Error Code or "Technique Error" indication.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	Only during initialization phase.
<b>INFORMATION / SYMPTOM :</b>	Generator does not continue with start up.

**POSSIBLE CAUSES**

EEPROM U3 on HT Controller Board corrupted or no initialized.  
EEPROM U18 on ATP Console Board corrupted or no initialized.  
EPROM U24 on ATP Console Board has been changed.

**ACTIONS**

1. If EPROM U24 in the ATP Console 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 ON position to allow Service Mode. Turn the Generator ON and enter in workstations configuration and check as referred in Service Manual (do not forget to exit from Configuration mode to store the workstation configuration).
3. If the problem is still present, and "E10" error appears together with "E34" Error Code or "Technique Error" indication, replace ATP Console Board.
4. If the problem is still present and only "E10" error appears on the Console, replace HT Controller Board.

## ERROR CODE : E11

<b>DESCRIPTION :</b>	No voltage in the Capacitor Bank.
<b>ERROR TYPE :</b>	Informative. "Prep" is not allowed.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	Only during initialization phase or when pressing "PREP".
<b>INFORMATION / SYMPTOM :</b>	It was not possible to perform "Prep" or "Exp".

---

### POSSIBLE CAUSES

- No voltage in the Capacitor Bank (5C1, 5C2, 5C3, 5C4) of the Generator Cabinet.
- Defective Charge/Discharge Monitor Board.
- Precharge K6 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 HT Controller Board is not present.
- Exposition parameters selected above IGBT maximum current (only software versions before V2.R06)
- Cables disconnected accidentally or damaged connectors.
- Test Switch SW1 of the Generator Cabinet is in "Test" position (only for Factory use). This is only applicable to old Generators.

---

### ACTIONS

#### A. IF LED DS1 IN CHARGE/DISCHARGE MONITOR LIGHTS

Check Capacitors Voltage,

- If it is OK, check that P1-7 on 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 it is OK (logic level 0), replace HT Controller Board.
  - If it is not OK, check links between P1-7 on HT Controller Board and P1-2 in Charge/Discharge Monitor Board #1 and P1-1 in Charge/Discharge Monitor Board #1 and P1-2 in Charge/Discharge Monitor Board #2.
    - If it is OK, replace defective Charge/Discharge Monitor Board.
    - If it is not OK, repair connection.
- If voltage in capacitors is not OK, check VAC on AC1, AC2 and AC3 at 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 Input Rectifier Board and check VDC.
    - If VDC is not OK, replace defective component (CR1, CR2, CR3) at Input Rectifier Board.
    - If VDC is OK, check and replace defective component at Generator Cabinet.

**B. IF LED DS1 DOES NOT LIGHT AND IT IS NOT A BATTERY POWERED GENERATOR.**

- Check input VAC on 6LF1,
  - If VAC is OK, replace a defective component at 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 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 it 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, replace 6K5.
    - If -LINE CONT is not OK, check continuity in J3-10 at ATP Console Board.
      - If -LINE CONT is OK at ATP Console Board, repair connection between J3-10 and "A" in 6K5.
      - If -LINE CONT is not OK at ATP Console Board, replace ATP Console Board.

**C. IF LED DS1 LIGHTS 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 ATP Console Board,
    - if -LINE CONT is OK, replace 6K5.
    - If -LINE CONT is not OK, check continuity in J3-10 at ATP Console Board.
      - If -LINE CONT is OK at ATP Console Board, repair connection between J3-10 and "A" in 6K5.
      - If -LINE CONT is not OK at ATP Console Board, replace ATP Console Board.

**D. IF LED DS1 DOES NOT LIGHT 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 ATP Console Board,
    - If -LINE CONT is OK at ATP Console Board, repair connection between J3-10 and "A" in 6K5.
    - If -LINE CONT is not OK at ATP Console Board, replace ATP Console Board.

## ERROR CODE : E12

<b>DESCRIPTION :</b>	No mA during exposure or mA out of tolerance. Wrong filament current.
<b>ERROR TYPE :</b>	Informative.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	After exposition.
<b>INFORMATION / SYMPTOM :</b>	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 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 scope to the following Test Points on the HT Control Board and check that the voltage is correct, if not adjust it 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 stated in the Service Manual for all combinations of kVp and mA when this error appears.

With a scope connected to the Test Point TP5 (mA) on the HT Control Board check that the mA read is within the ratio of 1V=100 mA ( $\pm 5\%$ ) for V2 and V3 software versions, for V4 and up the ratio is 1V=10mA from minimum mA to 80 mA and 1V=100mA from 100 mA to the 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 scope check that during the entire Exposure signals on Test Points TP13 (-mA) and TP14 (+mA) on the HT Control Board connectors are symmetrical ( $\pm 10\%$ ). 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 for Compact Generators (in TB1, terminals 1, 4 and 5 for no Compact Generators) 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 a scope to Test Point TP5 (mA) on the HT Control Board. Check that when an exposure is made by pressing at the same time the "Prep" and "Exp" controls, the mA at the beginning of exposure is low. Check that when the exposure is made by pressing first the "Prep" control and then the "Exp" control, the mA at the beginning of exposure is correct.
6. For Low Speed Generators:
  - Reprogram the "Rotor Acceleration and Filament Setting Time" as stated in the Service Manual, one step over the time as it was before (a.e.: if it was 1.2 seconds, reprogram for 1.8 seconds) and check if boosting is correctly configured.
7. For High Speed Generators:
  - When performing the test for High Speed Generators check that the self-maintaining mode is not active. In order to check if the problem disappears, select the highest mA station for Small Focus and the lowest kVp allowed for this mA station (a.e. 40 kVp, 150 mA, SF). 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. Do the same for Large Focus (a.e. 50 kVp, 500 mA, LF). If it is not correct, reprogram a step over at the time for each case, and test again.

**ERROR CODE : E13**

<b>DESCRIPTION :</b>	No kVp during exposure or kVp out of tolerance.
<b>ERROR TYPE :</b>	Informative. May abort exposition.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	During and after exposures.
<b>INFORMATION / SYMPTOM :</b>	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.*

- Defective HV Transformer.
- Defective HT Controller Board.
- Defective IPM Driver Boards.
- Poor connection on the IPM Driver Boards.

**ACTIONS**

1. Check 5 VDC between P1-4 and P1-3 (GND) in both IPM Driver Boards.
2. Check 115 VAC between Pins 1 and 2 of connector P2 on the same Boards.
3. If it is OK, check if the -kVp (TP12) and +kVp (TP 11) Test Points on the HT Controller Board are symmetrical. If they are not, check signals - kV and + kV (in Compact Generators between P4-1 and J1-B at HV Transformer and also between P4-2 and J1-C at HV Transformer) (in no Compact Generators between P4-1 and TB1-3 at HV Transformer and also between P4-2 and TB1- 4at HV Transformer) if they are OK, replace the HV Transformer.
4. Check the connectors on the IPM Driver Boards. Check continuity in P3-1 (-kV DR1), P3-2 (-kVDR2) and those signals in IPM Driver Boards. Check with a scope in TP17 (1V=33.33kVp), if value is OK, replace HT Controller Board; if value is not OK, replace IPM Driver Boards.
5. If kVp value and time is OK and "E13" appears, check that for software version V3 and up the Dip-switches of A3024SW3 are all in OFF position at ATP Console Board.

#### **ERROR CODE : E14**

<b>DESCRIPTION :</b>	Exposure signal without X-ray Exposure Console command.
<b>ERROR TYPE :</b>	Informative.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	During and after exposition.
<b>INFORMATION / SYMPTOM :</b>	Exposure signal without X-ray Exposure Console command.

---

#### **POSSIBLE CAUSES**

The "Exp" signal is grounding 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 so, replace the HT Controller Board.
3. If it is not, remove the connector J3 on the Console, and check Pin 1 on connector J3 on the Generator Cabinet.
4. If GND, replace the communication cable J3; if not, replace the ATP Console Board.

#### **ERROR CODE : E15**

<b>DESCRIPTION :</b>	No current on Filament. Wrong selection of Focal Spot detected during "Prep".
<b>ERROR TYPE :</b>	Informative. Does not allow "Prep".
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	No current detected on Focal Spot (Filaments Off).

---

#### **POSSIBLE CAUSES**

- A - There is no power supplied to the Filament Board or poor connection on the Cathode HV Cable or defective Filament Transformer inside the HV Transformer or defective HV Switch inside the HV Transformer (if the system is equipped with two tubes)
- B - Wrong signal -FIL1 ACK

---

**ACTIONS****A. THERE IS NOT SUPPLY IN FILAMENT BOARD, OR POOR CONNECTION ON THE CATHODE HV CABLE, OR DEFECTIVE FILAMENT TRANSFORMER, OR DEFECTIVE HV SWITCH.****Note** 

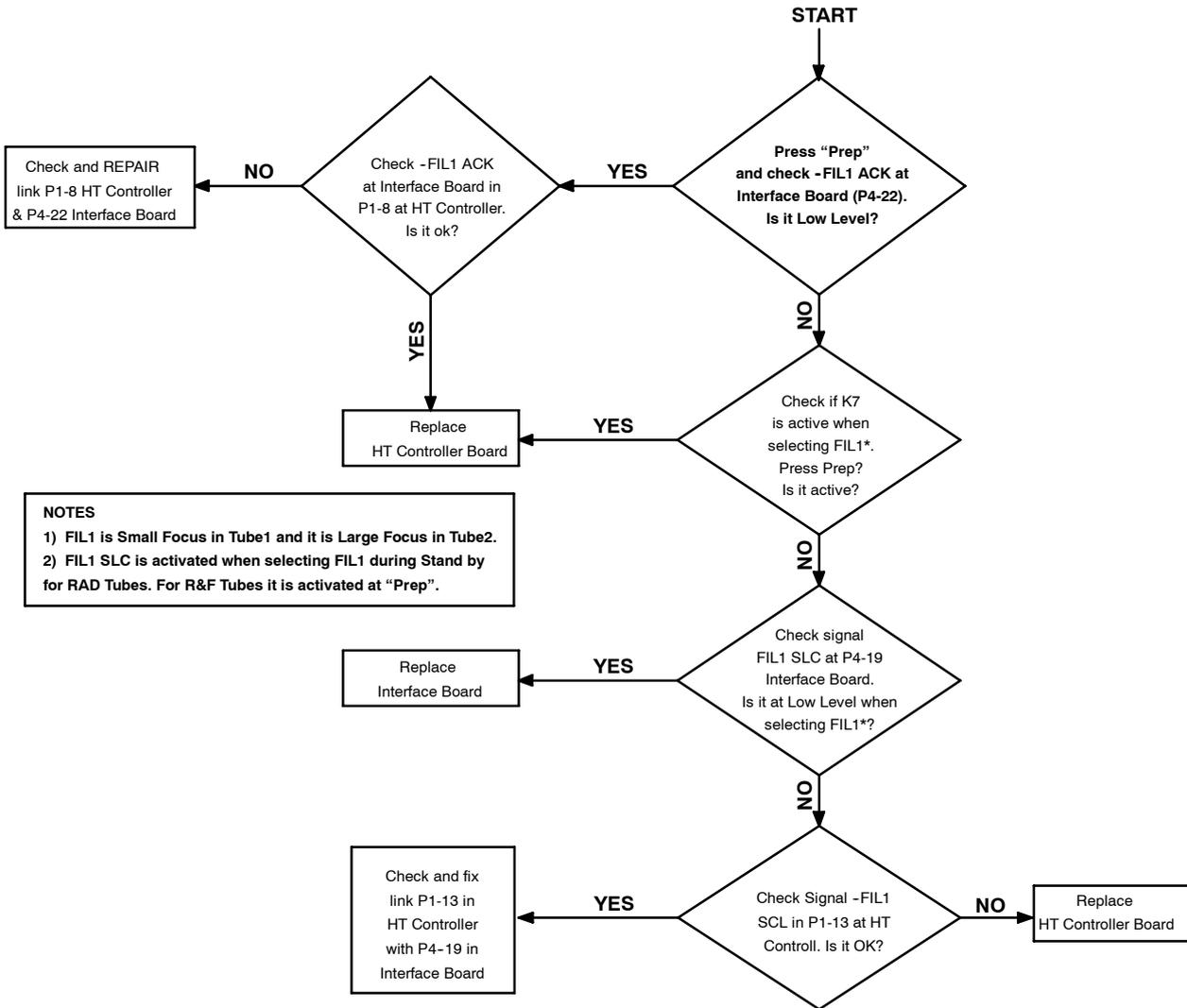
*For Generators with two tubes:*

- if the error appears in both tubes, go to step 1.
- if the error appears in only one tube, interchange HV Cables.
- if error remains when selecting the same tube from Console, replace HV Transformer, if does not appear go to step 8.

1. Check through the X-ray tube window to see if the selected filament is On. Check both circuits to detect which one is causing the error code.
2. If none lit when selected, check in the DC output on the BR1 rectifier (324 Dc approx.) or input voltage (220 VAC approx.). If input voltage is OK and output voltage is not OK, replace rectifier. If it is OK go to step 3.
3. Check if the Led's DS1 and DS2 are lit ON in the Filament Board. If they are not, replace the Board.
4. If everything is OK, check DC voltage between P2-4 and P2-1 (324 DC approx.). If not enough voltage detected, review circuit between BR1 and T2 transformer. Replace Filament Board if defective.
5. If it is OK, check the AC voltage between Pin 4 on connector P3 (on Filament Board Fil. Sup.) and Pins 15 or 16 (depends on filament selection) on connector P4 on Interface Control Board. The range should be between 90 and 200 VAC.
6. If not, check the voltage on Pin 17 of connector P4 at Interface Control Board and Pin 4 of connector P3 at Filament Board, also Check P14 of connector P4. If no voltage present, replace the Interface Control Board.
7. If it is OK, check continuity between HV Transformer connector and Interface Board.
8. If it is OK, check continuity of HV Cable connector (between common C and S (Small Focus) and between common C and L (Large focus). The OHM value should be very low in both cases ( 0.01 approx.)
9. If it is OK, replace the HV Transformer. If it is not OK, check all connections from HV Cable to the tube. Replace cable if necessary.
10. If HV Cable is OK, check tube filaments. Replace Tube if necessary.

**B. WRONG SIGNAL -FIL1 ACK**

Perform the following diagnosis if after pressing "Prep" the Error Code "E15" appears on the Console and after resetting it, the Console displays Error Code "E04".



**ERROR CODE : E16**

<b>DESCRIPTION :</b>	Invalid value of : kVp, mA or kW.
<b>ERROR TYPE :</b>	Informative. Does not allow "Prep" or "Exp".
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	In "Prep"
<b>INFORMATION / SYMPTOM :</b>	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 calibration of Open Loop mA with a technique that overpasses the Generator power kVp/mA.

**ACTIONS**

1. Check switch 5 of SW2 on HT Controller Board (125 kVp in open position and 150 kVp in closed position).
2. Check the software version on U5 of HT Controller Board and U24 of ATP Console Board.
3. Set calibration data manually as per calibration procedure table "mA calibration number change" at calibration section in this manual.

**ERROR CODE : E17**

<b>DESCRIPTION :</b>	Communication error between ATP Console CPU Board and HT Controller Board.
<b>ERROR TYPE :</b>	Fatal Error. Generator opens line contactor that remains in a endless loop.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	Once initialization phase is over at any moment.
<b>INFORMATION / SYMPTOM :</b>	No communication link between Console and Generator Cabinet.

**POSSIBLE CAUSES**

Defective communication cable between Console and Generator Cabinet (J3).

Noise on the bucky circuitry.

Defective HT Controller Board or defective ATP Console Board.

The "Prep" signal from Console to HT Controller is short-circuited to ground.

**ACTIONS**

1. Turn Generator OFF/ON.
2. If E01 appears, follow procedure for E01.
3. If E01 does not appear, it is an intermittent error due an external device, install a R-C filter in the power supply and at bucky start circuitry.
4. If error persists, replace HT Controller or ATP Console Boards.

## ERROR CODE : E18 OR ROTOR ERROR

<b>DESCRIPTION :</b>	Rotor running without order or Rotor error.
<b>ERROR TYPE :</b>	Fatal Error. Generator opens line contactor that remains in a endless loop.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	The X-ray tube is not rotating while "Prep" is active, then the exposures are inhibited or the X-ray tube anode is rotating without Console command.

---

### POSSIBLE CAUSES

Defective relay K1 (solid State) on the low speed module.  
Signal -RTR on HT Controller Board is active.  
Defective HT Controller or Low Speed Control Boards.  
 $\pm$  12 VDC power supplies missing on HT Controller Board.

---

### ACTIONS

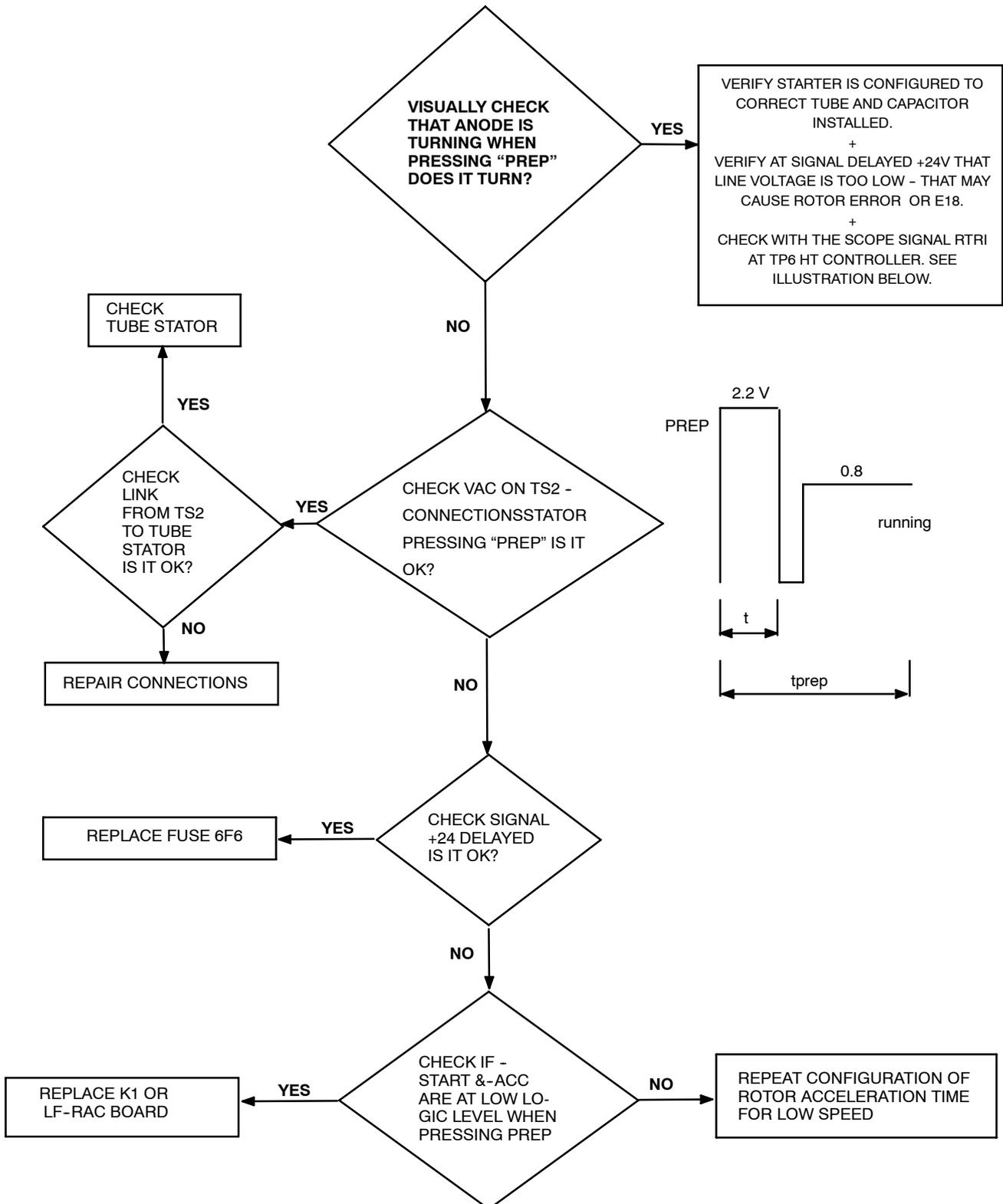
In Stand-by:

1. Check if the signal RTR Test Point (TP6 on HT Controller ) is logic "0". If yes, check if K1 works properly.
2. If it is OK, check if the  $\pm$  12 VDC power supplies are correct.
3. If it is OK, replace the H. T. Controller.
4. If not logic "0" check K1 at Low Speed Module.
5. If K1 defective, replace.

In "Prep": (Rotor error/E18).

When Console has not " Rotor Error" indication , E18 Appears.

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



#### **ERROR CODE : E19**

<b>DESCRIPTION :</b>	mA detected without "Exp" command.
<b>ERROR TYPE :</b>	Fatal Error. Generator opens line contactor that remains in a endless loop. It is necessary to turn off the equipment.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	In stand-by or during initialization.
<b>INFORMATION / SYMPTOM :</b>	Current in tube without "Prep" command.

---

#### **POSSIBLE CAUSES**

- ± 12 VDC power supplies missing on the H. T. Controller Board.
- Defective H. T. Controller.
- mA signal on H T Controller is active.

---

#### **ACTIONS**

1. Check ± 12 VDC power supplies.
2. Check a logic level "0" in TP5. Check also a level logic "0" in TP13, TP14 connector P4-6 y P4-7.
3. If it is OK, replace the HT Controller or Filament Drive Boards one by one.

#### **ERROR CODE : E20**

<b>DESCRIPTION :</b>	kVp detected without "Exp" command.
<b>ERROR TYPE :</b>	Fatal Error. Generator opens line contactor that remains in a endless loop.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	In stand-by or during initialization.
<b>INFORMATION / SYMPTOM :</b>	kVp detected without "Exp" command.  When E20 appears on Console (E20) means that the error can not be solved without turning off the equipment.

---

#### **POSSIBLE CAUSES**

- 12 VDC power supply missing.
- Defective HT Controller Board.

---

#### **ACTIONS**

1. Check -12 VDC power supply.
2. Check logic level "0" in TP7 and TP11, TP12, P4-1 and P4-2.
3. If it is OK, replace HT Controller Board.

**ERROR CODE : E21**

<b>DESCRIPTION :</b>	Wrong Tube-1 selection.
<b>ERROR TYPE :</b>	Informative. Does not allow working unless the error is solved or other tube is selected.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment mainly after initialization or when changing tube selection.
<b>INFORMATION / SYMPTOM :</b>	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****Only for one tube option (no Compact Generators):**

1. Check signal -HT INTLK on Pin 9 of TB1 in the HV Transformer, it should be 0 VDC on tube 1 selection.
2. If it is not OK, check Pin 9 of TB1 and verify that ground is 0 Ω. If it is not, replace the HV Transformer.
3. If it is OK, check signal -HT LINK on ATP Console Board (J3-13), if not "0" in J3-13, check link between TB1-9 and J3-13, if voltage = "0" and E21 appears, replace ATP Console Board.

**Only for one tube option (Compact Generators):**

1. Check the -HT INTLK in 6J3-13 (Generator Cabinet), it should be "0" VDC on tube 1 selection.
2. If it is not OK, check Jumper between 6J3-13 and 6J3-16 (GND).
3. If 6J3-13 = 0, check 6J3-13 on ATP Console Board.
4. If not "0" in J3-13, check link between TB1-9 and J3-13, if voltage = "0" and E21 appears, replace ATP Console Board.

**Only for two tubes option (no Compact Generators):**

1. Check the -HT INTLK on Pin 9 of TB1 in the HV Transformer, it should be 0 VDC on tube 1 selection.
2. If it is not OK, check between Pin 9 of TB1 and verify that ground is 0 Ω. If not replace the HV Transformer.
3. If it is OK, check 0V at J2-13 on ATP Console.
  - a. If it is not OK, check between J3-13 on ATP and TB1-9.
  - b. If it is OK, replace ATP Console Board.

**Only for two tubes option (Compact Generators):**

1. Check logic "0" in J3-13 on ATP Console Board, if "0" VDC, replace ATP Console Board.
2. If not "0", turn off equipment, disconnect J1 of HV Transformer and check continuity between J1-J and J3-13 on ATP Console Board.
3. If it is not OK, check cable and replace if necessary.
4. If connection is OK, replace HV Transformer.

## ERROR CODE : E22

<b>DESCRIPTION :</b>	Wrong Tube-2 selection.
<b>ERROR TYPE :</b>	Informative. Does not allow working unless the error is solved or other tube is selected.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment mainly after initialization or when changing tube selection.
<b>INFORMATION / SYMPTOM :</b>	Wrong tube 2 selection.

### POSSIBLE CAUSES

The -HT INTLK is not high logic level 5V (tube 2 selection).

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

The -HT INTLK is grounding.

### ACTIONS

#### Only for one tube option (no Compact Generators):

1. Check signal -HT INTLK on Pin 9 of TB1 in the HV Transformer, it should be 5 VDC on tube 2 selection.
2. If it is not OK, check Pin 9 of TB1 and verify that ground is infinite  $\Omega$ . If it is not, replace the HV Transformer.
3. If it is OK, check signal -HT LINK on ATP Console Board (J3-13), if not "1" in J3-13, check link between TB1-9 and J3-13, if voltage = "5" and E22 appears, replace ATP Console Board.

#### Only for one tube option (Compact Generators):

1. Check the -HT INTLK in 6J3-13 (Generator Cabinet), it should be "5" VDC on tube 2 selection.
2. If it is not OK, check that 6J3-13 is not grounding.
3. If 6J3-13 = 5, check 6J3-13 on ATP Console Board.
4. If not "5" in J3-13, check link between TB1-9 and J3-13, if voltage = "5" and E22 appears, replace ATP Console Board.

#### Only for two tubes option (no Compact Generators):

1. Check the -HT INTLK on Pin 9 of TB1 in the HV Transformer, it should be 5 VDC on tube 2 selection.
2. If it is not OK, check between Pin 9 of TB1 and verify that ground is infinite  $\Omega$ . If not replace the HV Transformer.
3. If it is OK, check 0V at J2-13 on ATP Console.
  - a. If J2-13 is not OK, check 5V between J3-13 on ATP and TB1-9.
  - b. If it is OK, replace ATP Console Board.

#### Only for two tubes option (Compact Generators):

1. Check logic "5" in J3-13 on ATP Console Board, if "5" VDC, replace ATP Console Board.
2. If not "5", turn off equipment, disconnect J1 of HV Transformer and check continuity between J1-J and J3-13 on ATP Console Board.
3. If it is not OK, check cable and replace if necessary.
4. If connection is OK, replace HV Transformer.

**ERROR CODE : E23**

<b>DESCRIPTION :</b>	Calibration data not stored
<b>ERROR TYPE :</b>	Indicative although it is almost impossible to find if not provoked.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	When trying to save a calibration data.
<b>INFORMATION / SYMPTOM :</b>	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 continuous or occurs frequently and the communication link between the Generator Cabinet and the Console is too noisy.

---

**ACTIONS**

1. Store data again.
2. Check communication cables.
3. Route communication cables in a different way.

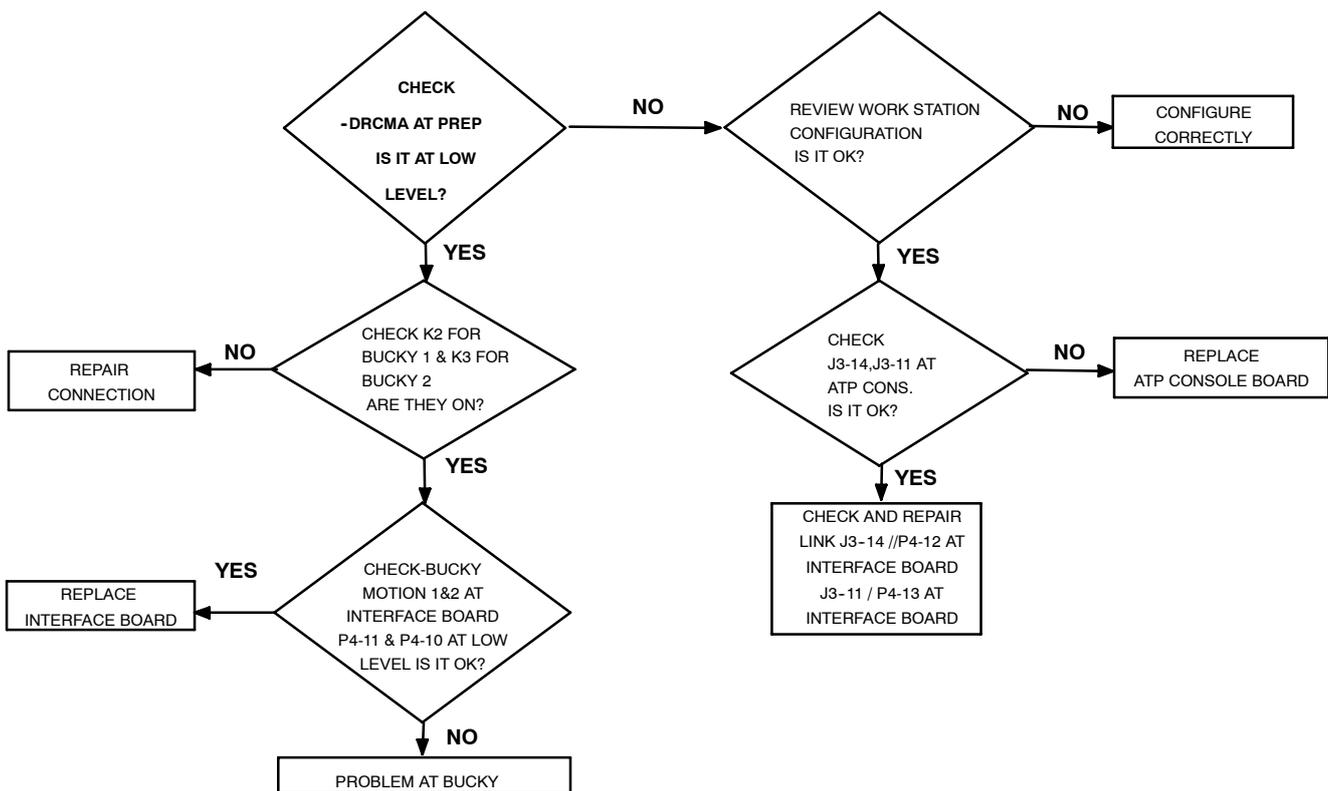
**ERROR CODE : E24**

**DESCRIPTION :** The Bucky has not been detected to be moving.  
**ERROR TYPE :** Indicative. Does not allow exposition.  
**APPLICABLE TO :** All Generators.  
**APPEARS WHEN :** At the beginning of exposition.  
**INFORMATION / SYMPTOM :** Wrong Exposure signal from Buckyies.

**POSSIBLE CAUSES**

- Malfunction of the bucky.
- Wrong wiring of the bucky.
- Wrong bucky selection.

**ACTIONS**



**ERROR CODE : E25**

<b>DESCRIPTION :</b>	Battery failure in Battery Powered Generators.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposition.
<b>APPLICABLE TO :</b>	All Battery Powered Generators.
<b>APPEARS WHEN :</b>	At "Prep" in any Battery Powered Generators and at any moment in Generators with Stand-Alone.
<b>INFORMATION / SYMPTOM :</b>	Battery charge level is momentarily low or some batteries are discharged or damaged.

**POSSIBLE CAUSES**

- Batteries are discharged.
- Some Battery Charger Sector is not working properly or some Batteries are damaged.

**ACTIONS**

**A. PRELIMINARY**

E25 appears when the Generator has not been used for a 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 safe.

**B. BATTERIES FULLY CHARGED AND "E25" APPEARS**

1. Check Corrosion in metal contacts of Batteries.
2. Check charger Leds on Battery Charger. 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 Generator OFF and disconnected from Mains, the voltage to be found is: 26.6 VDC.
  - With Stand-Alone mode, disconnected the Generator from Mains and with the Generator 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 2.6.2 - 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 are OK and batteries voltage is OK but signals are below minimum required (that is -BATST3 is "0", BATST2 is "0" and BATST1 is "1"), check HT Controller Board and Stand-Alone Board, replace the defective Board found.
      - For Generators without Stand-Alone check that signal -BAT FAULT at P5-2 of HT Control Board is at "High Level".  
If -BAT FAULT is at "High Level", replace HT Controller Board.  
If -BAT FAULT is at "Low Level", check J2-2 in Battery Charger Board. If not "Low Level" replace cable. If "Low Level" replace the Battery Charger Board.

### C. LEDs CHECKING 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 Battery Charger Board.

- If it is OK, replace Battery Charger Board.
- If it is not OK, check 24V in J2-7 Line Monitor.
  - If it is OK, repair links between J2-1 of Battery Charger Board & J2-7 of Line Monitor Board.
  - If it is not OK, check 20 VAC between J2-5 and J2-6 at Line Monitor Board.
    - If it is OK, replace Line Monitor Board.
    - If it is not OK, check voltage from 2T1 Battery Charger Transformer to the Line Monitor Board and replace it 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.

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 Battery Charger Board.
- If VAC is not OK, unplug connectors J6 and J4 from the Battery Charger Board and repeat the measure checking VAC from 2T1 Battery Charger Transformer at connectors J6 and J4, 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). Check 2T1 Battery Charger Transformer and replace it if necessary.

#### 3. NONE LED IS ON

Check that Generator is Powered ON.

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

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

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

- Check Line 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 Line Monitor Board according to Power Line Voltage (*refer to Installation chapter in Service Manual*). Measure the Power Line Voltage with a Digitalmeter and adjust VDC on TP2 with POT1 at Line Monitor Board as per the following formula:

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

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

If all Leds are off at 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.

**ERROR CODE : E26**

<b>DESCRIPTION :</b>	Voltage failure in Battery Powered Generators with Stand-Alone.
<b>ERROR TYPE :</b>	Fatal error. System shut down.
<b>APPLICABLE TO :</b>	All Battery Powered Generators with Stand-Alone.
<b>APPEARS WHEN :</b>	At the beginning of exposition.
<b>INFORMATION / SYMPTOM :</b>	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 it is OFF, Stand Alone Board is not powered.
2. Check that DL3 is OFF, if it is ON, a shutdown has occurred.
3. Check that DL5 is OFF, if it is ON, DC is below or over specifications.
4. Check that battery voltage cables connected to HT Controller are not grounded.

**ERROR CODE : E27**

<b>DESCRIPTION :</b>	Failure in Console EPROM. Bad checksum.
<b>ERROR TYPE :</b>	Fatal Error. Generator does not start.
<b>APPLICABLE TO :</b>	All Generators
<b>APPEARS WHEN :</b>	During Console initialization.
<b>INFORMATION / SYMPTOM :</b>	The Console performs a checksum procedure of EPROM when it has been configured to a non-allowed calibration and it has found this value to be incorrect.

**POSSIBLE CAUSES**

The Console has been configured in a non communication mode.  
The non volatile RAM does not calculate and compare the Console checksum.  
The EPROM (U24) has been corrupted.

**ACTIONS**

1. Check if dip-switch SW2 on ATP Console is correctly configured per Service Manual.
2. If error remains, replace the non-volatile RAM (U23) on ATP Console.
3. If error remains, replace the EPROM (U24) on ATP Console.

#### **ERROR CODE : E29**

<b>DESCRIPTION :</b>	“ALL CLEAR” signal not active.
<b>ERROR TYPE :</b>	Indicative. Does not allow “Prep”.
<b>APPLICABLE TO :</b>	Nucletron Generators.
<b>APPEARS WHEN :</b>	When pressing “Prep” in P00 mode.
<b>INFORMATION / SYMPTOM :</b>	Exposure is not allowed.

---

#### **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**

<b>DESCRIPTION :</b>	Relay K1 not active.
<b>ERROR TYPE :</b>	Indicative. Does not allow “Prep”.
<b>APPLICABLE TO :</b>	Nucletron Generators.
<b>APPEARS WHEN :</b>	When pressing “Prep” in P00 or P03 mode.
<b>INFORMATION / SYMPTOM :</b>	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**

<b>DESCRIPTION :</b>	Long exposition is not initiated.
<b>ERROR TYPE :</b>	Indicative. Does not allow long "Exp".
<b>APPLICABLE TO :</b>	Nucletron Generators.
<b>APPEARS WHEN :</b>	During exposition phase in P00 mode.
<b>INFORMATION / SYMPTOM :</b>	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**

<b>DESCRIPTION :</b>	Long exposition is not cut (after 3.2 seconds) as relay K3 was not detected.
<b>ERROR TYPE :</b>	Indicative. Cut exposition at 3.2 seconds of backup.
<b>APPLICABLE TO :</b>	Nucletron Generators.
<b>APPEARS WHEN :</b>	During exposition phase in P00 mode.
<b>INFORMATION / SYMPTOM :</b>	Signal from K3 is not received.

**POSSIBLE CAUSES**

Signal from K3 is not received.  
 Exposure not completed, 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**

<b>DESCRIPTION :</b>	No communication link between Generator and Serial Console or PC Unit.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Serial Console.
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	Serial Communication Error.

---

#### **POSSIBLE CAUSES**

Connecting cable between Console and Generator is loosen or damaged.  
Damaged ATP Console CPU Board or Serial Console.

---

#### **ACTIONS**

1. Check connection cable between connector J7/J8 from ATP Console CPU Board to connector J5 of Compatibility Module (as per Generator model) and then check cable from J5 to Serial Console.
  2. If error remains, check ATP Console CPU Board and Serial Console, replace defective part found.
- 

#### **ERROR CODE : E34 - TECHNIQUE ERROR**

<b>DESCRIPTION :</b>	Technique error.
<b>ERROR TYPE :</b>	Informative without acoustic alarm or Fatal after exposition. It does not allow exposition.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment after parameter selection or after exposition.
<b>INFORMATION / SYMPTOM :</b>	Indicated with warning "Technique error" in Consoles with written indicators. For the rest of Consoles E34 appears in display.

---

#### **POSSIBLE CAUSES**

The calibration for that parameters is wrong.

---

#### **ACTIONS**

1. If it occurs with time parameters close to 1mS, it means that the cable capacity is excessive for a short exposition. Also the calibration for that parameters is wrong. Check Service Manual Section: Exposure Time Adjustment.
  2. If it happens at Fluoroscopy mode with ABC, it means that the equipment is not able to perform that operation. Perform Jumper W1 in Fluoro CPU.
  3. **If it happens after exposition, it means a failure in exposition timer and backup has been cut. Dangerous.** Reset APR and reconfigure values.
-

**ERROR CODE : E35 - DOOR OPEN**

<b>DESCRIPTION :</b>	Door Open.
<b>ERROR TYPE :</b>	Informative. It may inhibit Exposition depending on the configuration of SW1.2 at Console.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	Indicated with warning "Door Open" in Consoles with written indicators. For the rest of Consoles E35 appears in display. Does not allow "Prep" and "Exp".

**POSSIBLE CAUSES**

Door open or cable disconnected or cable not installed.

**ACTIONS**

1. Close door.
2. If that is not the reason for the error, check Jumper TS1-22 & TS1-23. See Installation Manual Section: Door Interlock Signal.

**ERROR CODE : E36 - HEAT UNITS**

<b>DESCRIPTION :</b>	Tube Overheating.
<b>ERROR TYPE :</b>	Informative without acoustic alarm. Does not allow expositions.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	Indicated with warning "Heat Unit" 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 opened due a housing overheating, the thermostat is disconnected, or the thermostat does not exist but the respective signal is not connected to ground. It also may appear during the calibration process due to the high number of starting.

**ACTIONS**

1. Check correct installation of signal Thermostat/Presostat. If tube has not this signal, perform a Jumper of the signal to ground.
2. Wait until temperature is lowered.

#### **ERROR CODE : E37 - TUBE OVERLOAD**

<b>DESCRIPTION :</b>	Tube Overload.
<b>ERROR TYPE :</b>	Informative without acoustic alarm. Does not allow Exposition.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	After "Exp" due to Tube overheating. After changing radiographic parameters. In some Consoles this error may not appear as they are provide with an automatic blocking that disable parameters above tube capacity.
<b>INFORMATION / SYMPTOM :</b>	Indicated with warning "Tube Overload" in Consoles with written indicators. For the rest of Consoles E37 appears in display. Exposures are not allowed.

---

#### **POSSIBLE CAUSES**

1. Parameters selected for a new exposition are above tube capacity. (Heat Units or Rating).
  2. Capacity Line frequency is wrong. (see SW1.1 at Console) or Tube selected in extended position E02 or E18 is not correct.
- 

#### **ACTIONS**

1. Wait for Tube to cool and Heat Units available increase or modify Exposition parameters.
  2. If Heat Units of tube are 100% and E37 or "Tube Overload" warning appear: Check 3024SW1.1 on ATP Console. See Configuration Chapter in Service Manual and Test Switches or verify the X-Ray Type Selection: E02 for Tube 1 and E18 for Tube 2 in Configuration Chapter of Service Manual.
- 

#### **ERROR CODE : E41**

<b>DESCRIPTION :</b>	Dosimeter failure. Communication failure between Tube-1 Dosimeter and Generator.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Dosimeter.
<b>APPEARS WHEN :</b>	Communication error starting the measuring for Tube-1.
<b>INFORMATION / SYMPTOM :</b>	Communication error 18 seconds after Tube-1 selection.

---

#### **POSSIBLE CAUSES**

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

---

#### **ACTIONS**

1. Check cable connections between Dosimeter and System.
  2. Turn Off and On the Generator to reset the Radiation Measuring System.
-

**ERROR CODE : E42**

<b>DESCRIPTION :</b>	Autotest error on Tube-1 Dosimeter.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Dosimeter.
<b>APPEARS WHEN :</b>	Communication error starting the measuring for Tube-1 or during regular operation.
<b>INFORMATION / SYMPTOM :</b>	Communication error 18 seconds after Tube-1 selection. Failure test in Dosimeter.

**POSSIBLE CAUSES**

Error during electronic checking of Counter Module for Tube-1.

**ACTIONS**

1. Check cable connections between Dosimeter and System.
2. Turn Off and On the Generator to reset the Radiation Measuring System.
3. If required, replace Counter Module for Tube-1.

**ERROR CODE : E43**

<b>DESCRIPTION :</b>	Tube-1 Ion Chamber status check error.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Dosimeter.
<b>APPEARS WHEN :</b>	Communication error starting the measuring for Tube-1 or during regular operation.
<b>INFORMATION / SYMPTOM :</b>	Communication error 18 seconds after Tube-1 selection. Wrong Ion Chamber status request.

**POSSIBLE CAUSES**

Error during Ion Chamber checking for Tube-1. Ion Chamber not operative.

**ACTIONS**

1. Check cable connections between Dosimeter and System.
2. Turn Off and On the Generator to reset the Radiation Measuring System.
3. If required, replace Ion Chamber for Tube-1.

#### **ERROR CODE : E44**

<b>DESCRIPTION :</b>	Dosimeter failure. Communication failure between Tube-2 Dosimeter and Generator.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Dosimeter.
<b>APPEARS WHEN :</b>	Communication error starting the measuring for Tube-2.
<b>INFORMATION / SYMPTOM :</b>	Communication error 18 seconds after Tube-2 selection.

---

#### **POSSIBLE CAUSES**

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

---

#### **ACTIONS**

1. Check cable connections between Dosimeter and System.
2. Turn Off and On the Generator to reset the Radiation Measuring System.

#### **ERROR CODE : E45**

<b>DESCRIPTION :</b>	Autotest error on Tube-2 Dosimeter.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Dosimeter.
<b>APPEARS WHEN :</b>	Communication error starting the measuring for Tube-2 or during regular operation.
<b>INFORMATION / SYMPTOM :</b>	Communication error 18 seconds after Tube-2 selection. Failure test in Dosimeter.

---

#### **POSSIBLE CAUSES**

Error during electronic checking of Counter Module for Tube-2.

---

#### **ACTIONS**

1. Check cable connections between Dosimeter and System.
2. Turn Off and On the Generator to reset the Radiation Measuring System.
3. If required, replace Counter Module for Tube-2.

**ERROR CODE : E46**

<b>DESCRIPTION :</b>	Tube-2 Ion Chamber status check error.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators with Dosimeter.
<b>APPEARS WHEN :</b>	Communication error starting the measuring for Tube-2 or during regular operation.
<b>INFORMATION / SYMPTOM :</b>	Communication error 18 seconds after Tube-2 selection. Wrong Ion Chamber status request.

**POSSIBLE CAUSES**

Error during Ion Chamber checking for Tube-2. Ion Chamber not operative.

**ACTIONS**

1. Check cable connections between Dosimeter and System.
2. Turn Off and On the Generator to reset the Radiation Measuring System.
3. If required, replace Ion Chamber for Tube-2.

**ERROR CODE : E47**

<b>DESCRIPTION :</b>	Capacitors not charged when PREP.
<b>ERROR TYPE :</b>	Informative. Does not allow exposition.
<b>APPLICABLE TO :</b>	Capacitor Generators.
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	Indicated with warning "E47".

**POSSIBLE CAUSES**

No power in line.  
Defective Capacitor or circuit.

**ACTIONS**

1. Press the respective button on the Console to reset the Error indication.
2. Wait one minute for Capacitor Charging before activating "PREP" control.

#### **ERROR CODE : E48**

<b>DESCRIPTION :</b>	Collimator Error.
<b>ERROR TYPE :</b>	Informative. Does not allow exposure.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	Shown as "Technique Error" in Consoles with this light indicator. For the rest of Consoles E48 appears displayed.

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#### **POSSIBLE CAUSES**

Collimator blades closed or in motion during exposure.  
Defective Collimator.

---

#### **ACTIONS**

1. Check collimator blades.
  2. If it is OK, check the TS3-20 is at low level.
    - If it is not at low level : Problem in Collimator.
    - If signal at low level, check J2-6 on ATP Console
      - if it is at low level, replace ATP Console Board
      - If is at high level, check and fix link between J2-6 and TS3-20.
- 

#### **ERROR CODE : E49**

<b>DESCRIPTION :</b>	Exposure Cycle Error.
<b>ERROR TYPE :</b>	Informative. Does not allow exposure.
<b>APPLICABLE TO :</b>	Generators with two X-ray Tubes for RAD only with "Exposure Cycle" feature (a.e. Brandis).
<b>APPEARS WHEN :</b>	Exposure is not performed or it is aborted.
<b>INFORMATION / SYMPTOM :</b>	E49 appears on Console.

---

#### **POSSIBLE CAUSES**

Operator releases "EXP" button before exposure time has ended.  
Exposure order is interrupted.

---

#### **ACTIONS**

1. Press the respective button on the Console to reset the Error indication.
  2. Repeat the exposure.
  3. If error remains, check Handswitch or "EXP" button and replace what is wrong.
-

**ERROR CODE : E50**

<b>DESCRIPTION :</b>	Interrupted Exposure.
<b>ERROR TYPE :</b>	Indicative.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	When operator releases "EXP" button before exposure time has ended.
<b>INFORMATION / SYMPTOM :</b>	E50 appears on Console.

**POSSIBLE CAUSES**

Operator releases "EXP" button before exposure time has ended.

**ACTIONS**

1. Press the respective button on the Console to reset the Error indication.
2. Repeat the exposure.
3. If error remains, check Handswitch or "EXP" button and replace what is wrong.

**ERROR CODE : E51**

<b>DESCRIPTION :</b>	Checksum failure or EPROM corrupted.
<b>ERROR TYPE :</b>	Indicative. System does not allow exposition.
<b>APPLICABLE TO :</b>	Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	After self-test.
<b>INFORMATION / SYMPTOM :</b>	At power On, after the Generator autocheck, E51 is displayed and it is not possible to make Exposures.

**POSSIBLE CAUSES**

DRAC program memory corrupted.

**ACTIONS**

1. Replace U17 on Control DRAC Board.

#### **ERROR CODE : E52**

<b>DESCRIPTION :</b>	Microcontroller RAM failure.
<b>ERROR TYPE :</b>	Indicative. Exposure is not allowed.
<b>APPLICABLE TO :</b>	Generators with DRAC or LV-DRAC
<b>APPEARS WHEN :</b>	After self-test.
<b>INFORMATION / SYMPTOM :</b>	At power On, after the Generator autocheck, E52 is displayed and it is not possible to make Exposures.

---

#### **POSSIBLE CAUSES**

U17 on Control DRAC Board is defective.

---

#### **ACTIONS**

1. Replace U17 on Control DRAC Board.

#### **ERROR CODE : E53**

<b>DESCRIPTION :</b>	Insufficient DC BUS voltage at low level voltage (220 VAC).
<b>ERROR TYPE :</b>	Indicative. System does not allow exposition.
<b>APPLICABLE TO :</b>	Generators with DRAC or LV-DRAC
<b>APPEARS WHEN :</b>	
<b>INFORMATION / SYMPTOM :</b>	E53 is displayed and it is not possible to make Exposures.

---

#### **POSSIBLE CAUSES**

Voltage between J2-1 and J2-2, on Control DRAC Board, is low or absent.

Voltage at TP18 is < 1.1 VDC.

---

#### **ACTIONS**

1. Check VDC on J2-1 and J2-2 on INTERFACE DRAC PCB, it must be higher than 200 VDC.
2. If it is not OK, perform Error 11 checking.
3. If it is OK, check FILT 1, F3 and F4 on INTERFACE DRAC PCB.
4. If it is not OK, replace F3 or F4 or INTERFACE DRAC PCB.
5. If it is OK, Check VDC on J2-1 and J2-2 on Control DRAC PCB.
6. If it is not OK, replace Cable between J2 on INTERFACE DRAC PCB and J2 CONTROL DRAC PCB.
7. If it is OK, replace CONTROL DRAC PCB.

**ERROR CODE : E54**

<b>DESCRIPTION :</b>	Insufficient DC BUS voltage at high level voltage (480 VAC).
<b>ERROR TYPE :</b>	Indicative. System does not allow exposition.
<b>APPLICABLE TO :</b>	Generators with DRAC or LV-DRAC
<b>APPEARS WHEN :</b>	
<b>INFORMATION / SYMPTOM :</b>	E54 is displayed and it is not possible to make Exposures.

**POSSIBLE CAUSES**

Voltage between J2-1 and J2-2, on Control DRAC Board, is low (out of range).  
Voltage at TP18 is < 2.48 VDC.

**ACTIONS**

1. Check VDC on J2-1 and J2-2 on INTERFACE DRAC PCB, it must be higher than 447 VDC.
2. If it is not OK, perform Error 11 checking.
3. If it is OK, check FILT 1, F3 and F4 on INTERFACE DRAC PCB.
4. If it is not OK, replace F3 or F4 or INTERFACE DRAC PCB.
5. If it is OK, Check VDC on J2-1 and J2-2 on ContROL DRAC PCB.
6. If it is not OK, replace Cable between J2 on INTERFACE DRAC PCB and J2 CONTROL DRAC PCB.

**ERROR CODE : E55**

<b>DESCRIPTION :</b>	Excessive DC BUS voltage at 480 or 380 VAC.
<b>ERROR TYPE :</b>	Indicative. System does not allow exposition.
<b>APPLICABLE TO :</b>	Generators with DRAC or LV-DRAC
<b>APPEARS WHEN :</b>	
<b>INFORMATION / SYMPTOM :</b>	E55 is displayed and it is not possible to make Exposures.

**POSSIBLE CAUSES**

Voltage between J2-1 and J2-2, on Control DRAC Board, is high (out of range).  
Voltage at TP18 is > 4.92 VDC.

**ACTIONS**

1. Check the input voltage to the Generator at TS2-20, TS2-21 and TS2-22, it must be according to specifications max. 480 VAC + 10%. If it is not OK, check Input Power Line.
2. If Power Input is OK, check the DC Voltage between J2-1 and J2-2 on ContROL DRAC PCB, it should be less than 890 VDC.
3. If Voltage is < 890 VDC replace CONTROL DRAC PCB.
4. If voltage is > 890 VDC, switch OFF and disconnect J2-1 and J2-2 on ContROL DRAC . Switch ON and measure voltage in DC BUS +/-.
5. If it is OK, replace CONTROL DRAC.
6. If not OK, check Power Module and FILT1 on INTERFACE DRAC PCB. Replace defective part. ( Power Module or FILT1 on INTERFACE DRAC PCB).

#### **ERROR CODE : E56**

<b>DESCRIPTION :</b>	Excessive reference voltage.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	
<b>INFORMATION / SYMPTOM :</b>	E56 is displayed and it is not possible to make Exposures.

---

#### **POSSIBLE CAUSES**

Excessive reference voltage.

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#### **ACTIONS**

1. Check voltage at TP15, it must be 0V.
2. If not 0V, replace CONTROL DRAC PCB.

**ERROR CODE : E58**

<b>DESCRIPTION :</b>	Excessive current in the main winding during acceleration up to 3300 RPM
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at low speed, E58 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Excessive current in the main winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

## ERROR CODE : E59

<b>DESCRIPTION :</b>	Excessive current in the auxiliary winding during acceleration up to 3300 RPM
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at low speed, E59 is displayed and it is not possible to make Exposures.

### POSSIBLE CAUSES

Excessive current in the auxiliary winding is detected.

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

**ERROR CODE : E60**

<b>DESCRIPTION :</b>	Insufficient current in the auxiliary winding during acceleration up to 3300 RPM
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at low speed, E60 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Insufficient current in the auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E61

<b>DESCRIPTION :</b>	Insufficient current in the main winding during acceleration up to 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at low speed, E61 is displayed and it is not possible to make Exposures.

---

### POSSIBLE CAUSES

Insufficient current in the main winding is detected.

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### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E62**

<b>DESCRIPTION :</b>	Excessive current in the main winding during acceleration up to 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at low speed, E62 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Excessive current in the main winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

## ERROR CODE : E63

<b>DESCRIPTION :</b>	Excessive current in the auxiliary winding during acceleration up to 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at high speed, E63 is displayed and it is not possible to make Exposures.

### POSSIBLE CAUSES

Excessive current in the auxiliary winding is detected.

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

**ERROR CODE : E64**

<b>DESCRIPTION :</b>	Insufficient current in the auxiliary winding during acceleration up to 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at high speed, E64 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Insufficient current in the auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E65

<b>DESCRIPTION :</b>	Insufficient current in the main winding during acceleration up to 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During acceleration of the anode at high speed, E65 is displayed and it is not possible to make Exposures.

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### POSSIBLE CAUSES

Insufficient current in the auxiliary winding is detected.

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### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E66**

<b>DESCRIPTION :</b>	Excessive current in the main winding running at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at low speed, E66 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Excessive current in the main winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

## ERROR CODE : E67

<b>DESCRIPTION :</b>	Excessive current in the auxiliary winding running at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at low speed, E67 is displayed and it is not possible to make Exposures.

### POSSIBLE CAUSES

Excessive current in the auxiliary winding is detected.

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

**ERROR CODE : E68**

<b>DESCRIPTION :</b>	Insufficient current in the auxiliary winding running at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at low speed, E68 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Insufficient current in the auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E69

<b>DESCRIPTION :</b>	Insufficient current in the main winding running at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at low speed, E69 is displayed and it is not possible to make Exposures.

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### POSSIBLE CAUSES

Insufficient current in the main winding is detected.

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### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E70**

<b>DESCRIPTION :</b>	Excessive current in the main winding running at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at high speed, E70 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Excessive current in the main winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

## ERROR CODE : E71

<b>DESCRIPTION :</b>	Excessive current in the auxiliary winding running at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at high speed, E71 is displayed and it is not possible to make Exposures.

### POSSIBLE CAUSES

Excessive current in the auxiliary winding is detected.

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2.
5. Check Winding impedance in transformers (main or auxiliary).
6. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
7. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

**ERROR CODE : E72**

<b>DESCRIPTION :</b>	Insufficient current in the auxiliary winding running at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at high speed, E72 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Insufficient current in the auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E73

<b>DESCRIPTION :</b>	Insufficient current in the main winding running at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During running of the anode at high speed, E73 is displayed and it is not possible to make Exposures.

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### POSSIBLE CAUSES

Insufficient current in the main winding is detected.

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### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2, 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse. If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E74**

<b>DESCRIPTION :</b>	Excessive current in the main winding braking at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at low speed, E74 is displayed.

**POSSIBLE CAUSES**

Excessive current in the main winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2. If winding in TS2 is not OK, replace TS2.
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
6. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

## ERROR CODE : E75

<b>DESCRIPTION :</b>	Excessive current in the auxiliary winding braking at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at low speed, E75 is displayed.

### POSSIBLE CAUSES

Excessive current in the auxiliary winding is detected.

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2. If winding in TS2 is not OK, replace TS2.
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
6. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

**ERROR CODE : E76**

<b>DESCRIPTION :</b>	Insufficient current in the auxiliary winding braking at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at low speed, E76 is displayed.

**POSSIBLE CAUSES**

Insufficient current in the auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2, 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse. If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E77

<b>DESCRIPTION :</b>	Insufficient current in the main winding braking at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at low speed, E77 is displayed.

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### POSSIBLE CAUSES

Insufficient current in the main winding is detected.

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### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E78**

<b>DESCRIPTION :</b>	Excessive current in the main winding braking at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at High Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at high speed, E78 is displayed.

**POSSIBLE CAUSES**

Excessive current in the main winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2. If winding in TS2 is not OK, replace TS2.
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:
    - P+ and U,V,W in direct and inverse
    - N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
6. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press *"PREP"*
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press *"PREP"*.
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

## ERROR CODE : E79

<b>DESCRIPTION :</b>	Excessive current in the auxiliary winding braking at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at high speed, E79 is displayed.

### POSSIBLE CAUSES

Excessive current in the auxiliary winding is detected.

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2. If winding in TS2 is not OK, replace TS2.
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.
6. Disconnect Stator Cables at X-ray Tube Side but keep cable connected to TS2. Press "PREP"
    - a. If any other Error message appears (Insufficient Current) replace the X-ray Tube.
    - b. If the same error remains, disconnect Stator Cable at TS2 Generator.
    - c. If any other Error message appears (Insufficient Current) replace Stator Cable.
    - d. If Error remains, disconnect Primary at Transformer (Main or Auxiliary) at J1 Connector of Control DRAC and Press "PREP".
    - e. If any other Error message appears (Insufficient Current) replace Transformer.
    - f. If the same error remains, replace CONTROL DRAC PCB.

**ERROR CODE : E80**

<b>DESCRIPTION :</b>	Insufficient current in the auxiliary winding braking at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at high speed, E80 is displayed.

**POSSIBLE CAUSES**

Insufficient current in the auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2, 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse. If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E81

<b>DESCRIPTION :</b>	Insufficient current in the main winding braking at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode acceleration at high Speed.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode at high speed, E81 is displayed.

---

### POSSIBLE CAUSES

Insufficient current in the main winding is detected.

---

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E82**

<b>DESCRIPTION :</b>	Wrong X-ray Tube selection.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	When changing Tube selection.
<b>INFORMATION / SYMPTOM :</b>	Changing the tube selection, E82 is displayed.

**POSSIBLE CAUSES**

No tube selected.

**ACTIONS**

1. Check that the Dip switch 3243-SW4-6 is in on position (tube selection inhibited).
2. Check delayed switch off.

**ERROR CODE : E83**

<b>DESCRIPTION :</b>	Excessive current in DC Brake.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During Anode braking in DC voltage.
<b>INFORMATION / SYMPTOM :</b>	During braking operation of the anode with DC voltage, E83 is displayed.

**POSSIBLE CAUSES**

Excessive current in the main or auxiliary winding is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check CR8, CR9, CR10 and CR11 on INTERFACE DRAC PCB. If any of them is found defective, replace INTERFACE DRAC PCB.
3. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
4. Check correct Isolation between connections Main winding and auxiliary winding in TS2. If winding in TS2 is not OK, replace TS2.

#### **ERROR CODE : E84**

<b>DESCRIPTION :</b>	Incorrect Tube selection signal.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	When changing Tube selection.
<b>INFORMATION / SYMPTOM :</b>	Changing the tube selection E84 is displayed.

---

#### **POSSIBLE CAUSES**

No tube selected. X-Ray selection Signal is not correct on the Control DRAC PCB.

---

#### **ACTIONS**

1. Check that the Dip Switch 3243SW4-6 on the Control DRAC PCB is in ON position.

#### **ERROR CODE : E85**

<b>DESCRIPTION :</b>	Incorrect Tube selection signal.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	When changing Tube selection.
<b>INFORMATION / SYMPTOM :</b>	Changing the tube selection, E85 is displayed.

---

#### **POSSIBLE CAUSES**

No tube selected. X-Ray selection Signal is not correct on the Control DRAC PCB.

---

#### **ACTIONS**

1. Check that the Dip Switch 3243SW4-6 on the Control DRAC PCB is in ON position.

**ERROR CODE : E86**

<b>DESCRIPTION :</b>	Incorrect Tube selection signal.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	When changing Tube selection.
<b>INFORMATION / SYMPTOM :</b>	Changing the tube selection, E86 is displayed.

**POSSIBLE CAUSES**

No tube selected. X-Ray selection Signal is not correct on the Control DRAC PCB.

**ACTIONS**

1. Check that the Dip Switch 3243SW4-6 on the Control DRAC PCB is in ON position.
2. Check the connection of common wire.
3. Check the voltage at TP36 on Control DRAC Board.

**ERROR CODE : E87**

<b>DESCRIPTION :</b>	Insufficient current in common wire during acceleration up to 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During acceleration of Anode at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	E87 is displayed and it is not possible to make Exposures.

**POSSIBLE CAUSES**

Insufficient current in common wire is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main or auxiliary).

5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E88

<b>DESCRIPTION :</b>	Insufficient current in common wire running at 3300 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	Running the Anode at Low Speed.
<b>INFORMATION / SYMPTOM :</b>	E88 is displayed and it is not possible to make Exposures.

---

### POSSIBLE CAUSES

Insufficient current in common wire is detected.

---

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on ContROL DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main or auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E89**

<b>DESCRIPTION :</b>	Insufficient current in common wire during acceleration up to 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	During acceleration of the Anode at High Speed.
<b>INFORMATION / SYMPTOM :</b>	E89 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

Insufficient current in common wire is detected.

**ACTIONS**

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main or auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

**Note** 

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2, 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse. If any defective connection is found, replace CONTROL DRAC PCB.

## ERROR CODE : E90

<b>DESCRIPTION :</b>	Insufficient current in common wire running at 10000 RPM.
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	Running the Anode at High Speed.
<b>INFORMATION / SYMPTOM :</b>	E90 is displayed and it is not possible to make Exposures.

---

### POSSIBLE CAUSES

Insufficient current in common wire is detected.

---

### ACTIONS

1. Check Switches configuration 324SW1 and 3243SW2 on Control DRAC PCB. *Refer to Tube Family Selection in DRAC Documentation.*
2. Check Stator Tube Winding impedance (main or auxiliary) according to the X-ray Tube Stator specifications.
3. Check correct cable connection between Stator and TS2.
4. Check Winding impedance in transformers (main or auxiliary).
5. Turn off Generator, wait 3 minutes and check the PTR1 Module at the CONTROL DRAC PCB in the following way:
  - Connect a Multimeter in Capacitor or Resistor Mode between:  
P+ and U,V,W in direct and inverse  
N- and U,V,W in direct and inverse

#### Note

*In case you decide to measure the Gate signals with the Oscilloscope and the generator Turned On, disconnect cables J2-1 and J2-2 at Control DRAC as these Points are High Voltage with respect to Ground.*

- In the same PCB measure PTR1-2 , 3-4, 5-6, 7-8, 9-10, 11-12 in direct and inverse . If any defective connection is found, replace CONTROL DRAC PCB.

**ERROR CODE : E91**

<b>DESCRIPTION :</b>	Incorrect signal measure in IPRINC (CH2).
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	In Stand-by situation.
<b>INFORMATION / SYMPTOM :</b>	E91 is displayed and it is not possible to make exposures.

**POSSIBLE CAUSES**

The system is detecting current through main wire and it should be zero.

**ACTIONS**

1. Check the voltage at TP1 and TP17 on Control DRAC Board. It should be 0V.

**ERROR CODE : E92**

<b>DESCRIPTION :</b>	Incorrect signal measure in IAUX (CH3).
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	In Stand-by situation.
<b>INFORMATION / SYMPTOM :</b>	E92 is displayed and it is not possible to make Exposures.

**POSSIBLE CAUSES**

The system is detecting current through auxiliary wire and it should be zero.

**ACTIONS**

1. Check the voltage at TP3 and TP16 on Control DRAC Board. It should be 0V.

#### **ERROR CODE : E93**

<b>DESCRIPTION :</b>	Incorrect signal measure in ICOM (CH4).
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	All Generators with DRAC or LV-DRAC.
<b>APPEARS WHEN :</b>	In Stand-by.
<b>INFORMATION / SYMPTOM :</b>	E93 is displayed and it is not possible to make exposures.

---

#### **POSSIBLE CAUSES**

The system is detecting current through main wire and it should be zero.

---

#### **ACTIONS**

1. Check the voltage at TP1, TP3 and TP36 on Control DRAC Board. It should be 0V.

#### **ERROR CODE : E95**

<b>DESCRIPTION :</b>	Rapid Termination
<b>ERROR TYPE :</b>	Indicative. Does not allow exposures.
<b>APPLICABLE TO :</b>	Generators with Rapid Termination application Installed.
<b>APPEARS WHEN :</b>	While Exposure. (after 10ms from exposure or after 10% of the exposure back-up time whatever is first).
<b>INFORMATION / SYMPTOM :</b>	E95 is displayed and it is not possible to make Exposures.

---

#### **POSSIBLE CAUSES**

The selected Ion Chamber or the selected parameters (short backup time) are not appropriate for an exposure with AEC

Switch SW1-3 on ATP Console A3024-XX PCB is in ON position.

---

#### **ACTIONS**

1. Press the respective button on the Console to reset the Error indication.
2. Select appropriate Ion Chamber or modify parameters.
3. if error remains check SW1-3 in ATP Console A3024-XX PCB is in OFF position.

**ERROR CODE : E96**

<b>DESCRIPTION :</b>	Voltage missing at PCB A3517-01.
<b>ERROR TYPE :</b>	Fatal. Does not allow exposures.
<b>APPLICABLE TO :</b>	Capacitor Powered Generators only.
<b>APPEARS WHEN :</b>	At any time.
<b>INFORMATION / SYMPTOM :</b>	E96 appears at console display.

**POSSIBLE CAUSES**

- Failure in Power supply of PCB A3517-01.
- Failure in reference voltage 10V.

**ACTIONS**

1. Turn Off Generator and wait for the DC Link Capacitors to discharge. For that, refer to Capacitor Discharge Procedure.
2. Replace A3517-01 PCB.

**ERROR CODE : E97**

<b>DESCRIPTION :</b>	Voltage in capacitors not balanced.
<b>ERROR TYPE :</b>	Fatal. Does not allow exposures.
<b>APPLICABLE TO :</b>	Capacitor Powered Generators.
<b>APPEARS WHEN :</b>	At any moment.
<b>INFORMATION / SYMPTOM :</b>	E97 appears at Console display.

**POSSIBLE CAUSES**

- 1.- Failure at measurements circuitry of PCB A3517-01.
- 2.- Failure in Resistors 8R1 and 8R3 (voltage regulating resistors).
- 3.- Failure in DC Link Capacitors.

**ACTIONS**

1. For Cause 1: Replace PCB A3517-01.
2. For Cause 2: Replace resistors 8R1 and 8R3.
3. For Cause 3: Replace all DC Link Capacitors.

#### **ERROR CODE : E98**

<b>DESCRIPTION :</b>	Dip Switch 3024SW2-3 on ATP Console Board set for Configuration and Calibration Mode Active.
<b>ERROR TYPE :</b>	Informative. It allows normal operation.
<b>APPLICABLE TO :</b>	All Generators.
<b>APPEARS WHEN :</b>	After turning on the Control Console.
<b>INFORMATION / SYMPTOM :</b>	E98 appears at console display.

---

#### **POSSIBLE CAUSES**

Dip Switch 3024SW2-3 on ATP Console Board set in "ON" position.

---

#### **ACTIONS**

1. Reset the error condition by pressing the respective button on the Console.  
  
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 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 Board in "OFF" (open) position (operation mode).

## SECTION 5      CENTRAL LISTING

### 5.1 HT CONTROLLER BOARD

#### 5.1.1 HT CONTROLLER BOARD (A3000-10/20)

JUMPERS / SWITCHES		
JUMPER / SWITCH		DESCRIPTION
SW2	SYSTEM CONFIGURATION AND TEST	8 POSITIONS DIP SWITCH
JP1	A    A3000-10 VERSION B    A3000-20 VERSION	BOARD CONFIGURATION
JP2	A    A3000-10 VERSION B    A3000-20 VERSION	

LEDs		
LED	COLOR	DESCRIPTION
DS1	YELLOW	SERIAL COMMUNICATION LINK DETECTION BETWEEN CONTROL CONSOLE AND POWER MODULE. LED STARTS IN A QUICK FLASHING MODE UNTIL SERIAL COMMUNICATIONS IS RECEIVED FROM THE CONTROL CONSOLE AND, AT THAT TIME, SLOWS TO A STEADY FLASH OF ABOUT 2 PER SECOND.

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
R29	10K, 1/2w	FREQUENCY ADJUSTMENT OF HV INVERTER
R49	20K, 1/2w	FREQUENCY ADJUSTMENT FOR FILAMENT INVERTER
R51	10K, 1/2w	DEAD TIME CONTROL FOR FILAMENT INVERTER

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+12VDC COIL, 1A CONTACT, SPST	-12 VDC SUPERVISOR

## HF Series Generators

### Troubleshooting

#### 5.1.2 HT CONTROLLER BOARD (A3000-30/33/34/35/36 & so)

JUMPERS / SWITCHES		
JUMPER / SWITCH		DESCRIPTION
SW2	SYSTEM CONFIGURATION AND TEST	
		8 POSITIONS DIP SWITCH
JP1	1	COMPATIBLE WITH OLD LOW SPEED STARTER
	2	COMPATIBLE WITH LF-RAC (LOW SPEED STARTER) AND DRAC (HIGH SPEED STARTER)
JP2	1	COMPATIBLE WITH OLD LOW SPEED STARTER
	2	COMPATIBLE WITH LF-RAC (LOW SPEED STARTER) AND DRAC (HIGH SPEED STARTER)
		BOARD CONFIGURATION

LEDs		
LED	COLOR	DESCRIPTION
DS1	YELLOW	SERIAL COMMUNICATION LINK DETECTION BETWEEN CONTROL CONSOLE AND POWER MODULE. LED STARTS IN A QUICK FLASHING MODE UNTIL SERIAL COMMUNICATIONS IS RECEIVED FROM THE CONTROL CONSOLE AND, AT THAT TIME, SLOWS TO A STEADY FLASH OF ABOUT 2 PER SECOND.
DS2	YELLOW	EXPOSURE INDICATOR
DS3	YELLOW	PREPARATION INDICATOR

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
R29	10K, 1/2w	FREQUENCY ADJUSTMENT OF HV INVERTER
R49	20K, 1/2w	FREQUENCY ADJUSTMENT FOR FILAMENT INVERTER

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+12VDC COIL, 1A CONTACT, SPST	-12 VDC SUPERVISOR

## 5.2 FILAMENT CONTROL BOARD

JUMPERS / SWITCHES		
JUMPER / SWITCH	DESCRIPTION	
(for Board A3004-04/05/06/08) JP1   A    A3004-05/06/08 VERSION B    A3004-04 VERSION	BOARD CONFIGURATION. JP1-A FOR NORMAL APPLICATION	
(for Board A3004-09/10/11/12) W1    A    A3004-10/11/12 VERSION B    A3004-09 VERSION	BOARD CONFIGURATION. W1-A FOR NORMAL APPLICATION	

LEDs		
LED	COLOR	DESCRIPTION
DS1 and DS2 (for Board A3004-04/05/06/08)	GREEN	FILAMENT DRIVER STATUS INDICATOR: IF DS1 AND DS2 ARE OFF: POWER SUPPLY IS MISSING IF ONLY ONE LED IS OFF: THE BOARD IS DEFECTIVE
DS7 (for Board A3004-09/10/11/12)	GREEN	FILAMENT DRIVER STATUS INDICATOR: IF DS7 IS OFF: POWER SUPPLY IS MISSING OR THE BOARD IS DEFECTIVE

## 5.3 INTERFACE CONTROL BOARD

JUMPERS / SWITCHES		
JUMPER / SWITCH	DESCRIPTION	
W1   2-1   AUXILARY BUCKY SUPPLY 2-3   NORMAL	EXPOSURE ENABLE, RELAY CAN BE SUPPLIED FROM INTERNAL +24VDC (NORMAL), OR FROM EXTERNAL VOLTAGE (AUXILIARY BUCKY SUPPLY).	
W2   2-1   NORMAL 2-3   LOGIC LINE SYNC	FLUORO EXPOSURE SYNCHRONIZATION WITH AC LINE DIRECTLY (NORMAL), OR THRU A LOGIC CIRCUITRY.	
W3, W4, W5, W6, W7, W8  A    POSITIVE ION CHAMBER SUPPLY B    NEGATIVE PHOTOMULTIPLIER TUBE SUPPLY	THE OUTPUT OF THE PHOTO TUBE/ION CHAMBER HIGH VOLTAGE POWER SUPPLY CAN BE SELECTED AS :  - POSITIVE OUTPUT ( JUMPER POSITION - A ) - NEGATIVE OUTPUT ( JUMPER POSITION - B )	

LEDs		
LED	COLOR	DESCRIPTION
DS1	GREEN	GENERATOR POWER ON INDICATOR

## HF Series Generators

### Troubleshooting

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
R20 <i>(for Board in revision J or higher)</i>	5K, 1/2w	ION CHAMBER POSITIVE HIGH VOLTAGE ADJUST
R29 <i>(for Board in revision lower than J)</i>	5K, 1/2w	ION CHAMBER POSITIVE HIGH VOLTAGE ADJUST

RELAYS			
RELAY		RATING	DESCRIPTION
<i>(for Board in revision J or higher)</i>	<i>(for Board in revision lower than J)</i>		
K1	K1	+6VDC COIL, 7A/250V CONTACT, DPDT	GENERATOR POWER ON
K2	K8	+24VDC COIL, 7A/250V CONTACT, DPDT	DELAYED +24VDC AND +5VDC
K3	K4	+24VDC COIL, 7A/250V CONTACT, DPDT	BUCKY MOTION. BUCKY EXPOSURE ENABLE
K4	K3	+24VDC COIL, 7A/250V CONTACT, DPDT	BUCKY 2 DRIVE
K5	K2	+24VDC COIL, 7A/250V CONTACT, DPDT	BUCKY 1 DRIVE
K6	K6	+24VDC COIL, 7A/250V CONTACT, DPDT	TUBE 1 - TUBE FILAMENT PREHEAT SELECTION
K7	K7	+24VDC COIL, 7A/250V CONTACT, DPDT	SMALL/LARGE FILAMENT SELECTION (RAD)
K8	K9	+24VDC COIL, 7A/250V CONTACT, DPDT	BUS DC DISCHARGE WITH POWER OFF
K9	K5	+24VDC COIL, 7A/250V CONTACT, DPDT	HV TRANSFORMER SOLENOID DRIVE
K10	K10	+24VDC COIL, 7A/250V CONTACT, DPDT	ROOM LIGHT CONTACT

**5.4 LVDC POWER SUPPLY**

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
R12	2K, 1w	+5 VDC ADJUST
R25	2K, 1w	-12 VDC ADJUST
R26	2K, 1w	+12 VDC ADJUST

**5.5 CHARGE/DISCHARGE MONITOR BOARD**

LEDs		
LED	COLOR	DESCRIPTION
DS1	GREEN	CHARGE INDICATOR OF THE HT INVERTER CAPACITORS: LED OFF: NO CHARGE LED ON: CHARGE ACCORDING TO BRIGHTNESS

**5.6 LOCKS BOARD**

FUSES			
FUSE	RATING	NOMINAL	DESCRIPTION
F14	10 A, 250 V, S.B.	24 VAC	LOCKS/LAMP
F15	10 A, 250 V, S.B.	24 VAC	LOCKS/LAMP

5.7 ATP CONSOLE CPU BOARD

JUMPERS / SWITCHES	
JUMPER / SWITCH	DESCRIPTION
JP1 POS A COMM-COL1 POS B COMM-COL0	POSITION "B" FOR APPLICATION MODE.
JP2 POS A PREP-ROW5 POS B PREP-ROW1	
JP3 POS A EXP-ROW4 POS B EXP-ROW0	
JP4 POS A LINE SYNC POS B CAM SYNC	SET ALWAYS IN POSITION "B".
JP5 POS A VD SELECTION POS B IC4 SELECTION POS C PT INPUT SELECT.	POS. A - SELECTION OF IC REFERENCE OUTPUT POS. B - SELECTION OF AEC ION CHAMBER (IC4) OUTPUT (NORMAL MODE). POS. C - SELECTION OF PHOTOMULTIPLIER (PT INPUT) OUTPUT FOR ABC.
JP6 POS A 27C512/27C1001/274001 POS B 27C256	MEMORY SELECTION. SET ALWAYS IN POSITION "A".
JP7 POS A RS485 POS B RS422	JP7, JP8 : POS. A - RS485 SERIAL COMMUNICATION ON J8 CONNECTOR POS. B - RS422 SERIAL COMMUNICATION ON J8 CONNECTOR
JP8 POS A RS485 POS B RS422	
JP9 POS A RS232 POS B RS422 & RS485	JP9, JP10, JP11 : POS. A - RS232 SERIAL COMMUNICATION ON J8 CONNECTOR POS. B - RS422 & RS485 SERIAL COMMUNICATION ON J8 CONNECTOR
JP10 POS A RS232 POS B RS422 & RS485	
JP11 POS A RS232 POS B RS422 & RS485	
JP12 SYSTEM CONFIGURATION	JUMPER FACTORY NOT CONNECTED (SET ONLY FOR A3024-31 BOARD)
JP13 SYSTEM CONFIGURATION	JUMPER ALWAYS FACTORY SET.
JP14 SYSTEM CONFIGURATION	JUMPER FACTORY SET FOR NORMAL MODE. REMOVED FOR MOBILE APPLICATION.
JP15 SYSTEM CONFIGURATION	JUMPERS FACTORY REMOVED FOR NORMAL MODE. SET FOR MOBILE APPLICATION.
JP16 SYSTEM CONFIGURATION	
JP17 SYSTEM CONFIGURATION	
JP18 SYSTEM CONFIGURATION	
JP19 SYSTEM CONFIGURATION	JUMPER FACTORY SET IN "A" POSITION (SER IN "B" ONLY FOR A3024-32 BOARD)
JP21 SYSTEM CONFIGURATION	JP21, JP22 : POS. A - RS485 SERIAL COMMUNICATION ON J8 CONNECTOR POS. B - RS422 SERIAL COMMUNICATION ON J8 CONNECTOR
JP22 SYSTEM CONFIGURATION	
SW1 SYSTEM CONFIGURATION	4 POSITIONS DIP SWITCH
SW2 TEST	4 POSITIONS DIP SWITCH
SW3 SYSTEM CONFIGURATION	8 POSITIONS DIP SWITCH NOT USED - ALL SWITCHES IN "OFF" POSITION
SW4 NOT USED	4 POSITIONS DIP SWITCH NOT USED

LEDs		
LED	COLOR	DESCRIPTION
DS1	YELLOW	WATCH-DOG TIMER OPERATION INDICATOR : LED <b>ON</b> INSURES THE MICROPROCESSOR AND SOFTWARE IS WORKING CORRECTLY
DS2	YELLOW	CONSOLE MICROPROCESSOR OPERATION INDICATOR : LED STARTS IN A QUICK FLASHING MODE UNTIL SERIAL COMMUNICATIONS IS RECEIVED FROM THE HT CONTROLLER AND, AT THAT TIME, SLOWS TO A STEADY FLASH OF ABOUT 2 PER SECOND.

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+12VDC COIL, 1A CONTACT, SPST	PREP ORDER
K2	+12VDC COIL, 1A CONTACT, SPST	EXP ORDER
K3	+12VDC COIL, 1A CONTACT, SPST	AUTO OFF
K4	+12VDC COIL, 1A CONTACT, SPDT	DIGITAL SYSTEM PREP - EXTERNAL SYNCHRONISM SELECTION

## 5.8 FLUORO CPU BOARD

JUMPERS / SWITCHES	
JUMPER / SWITCH	DESCRIPTION
W1 ABC SELECTION	W1 JUMPER INSTALLED FOR ABC DISABLE W1 JUMPER REMOVED FOR ABC ENABLE
W2 SYSTEM CONFIGURATION	W2 JUMPER ALWAYS INSTALLED

LEDs		
LED	COLOR	DESCRIPTION
DS1	YELLOW	FLUORO MICROPROCCESOR OPERATION INDICATOR : FLASHING WHEN TUBE-2 IS SELECTED AND THERE IS COMMUNICATION WITH CONSOLE CPU BOARD.

## 5.9 FLUORO - RF ADAPTATION BOARD

### 5.9.1 RF ADAPTATION BOARD (A3514-03)

JUMPERS / SWITCHES		
JUMPER	POSITION	DESCRIPTION
JP1, JP3, JP4, JP8, JP9, JP10, JP12, JP13, JP14	Remove all jumpers	230 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Set only JP1, JP8 and JP12	115 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
JP2	Set	Generator +24 VDC for PREP / RAD / FLUORO ORDER
	Removed	External supply for PREP / RAD / FLUORO ORDER
JP5	A	ZOOM 1 output selected from Generator (-9 IN SEL)
	B	ZOOM 1 output selected from Table or external control
JP6	A	ZOOM 2 output selected from Generator (-6 IN SEL)
	B	ZOOM 2 output selected from Table or external control
JP7	A	ZOOM 3 output selected from Generator (-4 IN SEL)
	B	ZOOM 3 output selected from Table or external control
JP11	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP15	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP16	A	EXP ON/END output active for only RAD exposure
	B	EXP ON/END output active for Fluoro and RAD exposure
JP17	A	For EXP ON output active along the RAD exposure
	B	For EXP END output active about 50 ms pulse at the end of the RAD exposure
JP18	A	For ABC Window adjustment
	B	For normal operation
JP19	A	Pulsed Fluoro sync. from the Line sync.
	B	Pulsed Fluoro sync. from the TV Camera sync.
	C	Pulsed Fluoro sync. from an external sync. (digital, etc.)
JP20	A	For ABC OUT signal from the video in
	B	For ABC OUT signal from a negative System ABC signal
	C	For ABC OUT signal from a positive System ABC signal
JP21	A	ABC OUT signal generated from a System ABC signal
	B	ABC OUT signal incoming directly from the System
JP22	Set	When JP21 in position A
	Removed	When JP21 in position B
JP23	Set	Normal position
	Removed	To reduce noise in the ABC circuitry

## 5.9.2 RF ADAPTATION BOARD (A3514-04)

JUMPERS / SWITCHES		
JUMPER	POSITION	DESCRIPTION
JP1, JP3, JP4, JP8, JP9, JP10, JP12, JP13, JP14	Set all jumpers	+24 VDC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Remove all jumpers	230 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Set only JP1, JP8 and JP12	115 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
JP2	Set	Generator +24 VDC for PREP / RAD / FLUORO ORDER
	Removed	External supply for PREP / RAD / FLUORO ORDER
JP5	A	ZOOM 1 output selected from Generator (-9 IN SEL)
	B	ZOOM 1 output selected from Table or external control
JP6	A	ZOOM 2 output selected from Generator (-6 IN SEL)
	B	ZOOM 2 output selected from Table or external control
JP7	A	ZOOM 3 output selected from Generator (-4 IN SEL)
	B	ZOOM 3 output selected from Table or external control
JP11	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP15	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP16	A	EXP ON/END output active for only RAD exposure
	B	EXP ON/END output active for Fluoro and RAD exposure
JP17	A	For EXP ON output active along the RAD exposure
	B	For EXP END output active about 50 ms pulse at the end of the RAD exposure
JP18	A	For ABC Window adjustment
	B	For normal operation
JP19	A	Pulsed Fluoro sync. from the Line sync.
	B	Pulsed Fluoro sync. from the TV Camera video.
	C	Pulsed Fluoro sync. from an external sync. (TV Camera, digital, etc.)
JP20	A	For ABC OUT signal from the video in
	B	For ABC OUT signal from a negative System ABC signal
	C	For ABC OUT signal from a positive System ABC signal
JP21	A	ABC OUT signal generated from a System ABC signal
	B	ABC OUT signal incoming directly from the System
JP22	Set	When JP21 in position A
	Removed	When JP21 in position B
JP23	Set	Normal position
	Removed	To reduce noise in the ABC circuitry
JP24	A	Normal position
	B	For Fluoro order enable

## 5.10 AEC CONTROL BOARD

### 5.10.1 AEC CONTROL BOARD (A3012-01/02/05)

JUMPERS / SWITCHES		
JUMPER / SWITCH	DESCRIPTION	
JP1 A FOR TV CAMERA B FOR PHOTOMULTIPLIER C FOURTH ION CHAMBER & ATS-DIG	A3012-05: JP1-C, JP2-A AND JP4-B FOR FOURTH ION CHAMBER & ATS-DIG A3012-02: JP1-A, JP2-A AND JP4-A FOR ABC WITH TV CAMERA A3012-01: JP1-B, JP2-B AND JP4-A FOR ABC WITH PHOTOMULTIPLIER	
JP2 A FOR TV CAMERA B FOR PHOTOMULTIPLIER		
JP4 A FOR PHOTOMULTIPLIER - AEC B FOR ION CHAMBER - AEC & ATS-DIG		
JP3 A FOR HIGH SENSITIVITY B FOR LOW SENSITIVITY	JP3-A FOR AEC WHEN USING ION CHAMBER WITH HIGH SENSITIVITY JP3-B FOR AEC WHEN USING ION CHAMBER WITH LOW SENSITIVITY	
<p><b>NOTE:</b> HIGH SENSITIVITY IS <math>&gt; 2 \text{ V/mR}</math> (<math>&gt; 0.223 \text{ V}/\mu\text{Gy}</math>) (a.e. Vacutec Ion Chamber)                      LOW SENSITIVITY IS <math>&lt; 2 \text{ V/mR}</math> (<math>&lt; 0.223 \text{ V}/\mu\text{Gy}</math>) (refer to Ion Chamber documentation)</p>		

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
R10	10K, 1/2w	LOW SENSIBILITY ION CHAMBER ADJUSTMENT
R11	10K, 1/2w	KVP DOWN WINDOW REFERENCE FOR ABC
R12	10K, 1/2w	KVP UP WINDOW REFERENCE FOR ABC

## 5.10.2 AEC CONTROL BOARD (A3012-06/07/09)

JUMPERS / SWITCHES			
JUMPER / SWITCH			DESCRIPTION
JP1	A	FOR TV CAMERA	JP1-A FOR ABC WITH TV CAMERA
	B	FOR PHOTOMULTIPLIER	JP1-B FOR ABC WITH PHOTOMULTIPLIER
	C	EXTERNAL kV CONTROL	JP1-C FOR ABC WITH EXTERNAL kV UP & DOWN CONTROL
JP2	A	FOR HIGH SENSITIVITY	JP2-A FOR AEC WHEN USING ION CHAMBER WITH HIGH SENSITIVITY
	B	FOR LOW SENSITIVITY	JP2-B FOR AEC WHEN USING ION CHAMBER WITH LOW SENSITIVITY
JP3	B	FOR NORMAL OPERATION	JP3-B FOR NORMAL OPERATION
JP4	A	FOR NORMAL OPERATION	JP4-A FOR NORMAL OPERATION (Only in A3012-06)
<p><b>NOTE:</b>      <i>HIGH SENSITIVITY IS &gt; 2 V / mR (&gt; 0.223 V / <math>\mu</math>Gy) (a.e. Vacutec Ion Chamber)</i>  <i>LOW SENSITIVITY IS &lt; 2 V / mR (&lt; 0.223 V / <math>\mu</math>Gy) (refer to Ion Chamber documentation)</i></p>			

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
R10	10K, 1/2w	PHOTOMULTIPLIER GAIN ADJUSTMENT FOR CINE MODE
R11	10K, 1/2w	KVP DOWN WINDOW REFERENCE FOR ABC
R12	10K, 1/2w	PHOTOMULTIPLIER GAIN ADJUSTMENT FOR RAD OR DSA MODE
R13	10K, 1/2w	PHOTOMULTIPLIER GAIN ADJUSTMENT FOR FLUORO MODE
R14	10K, 1/2w	KVP UP WINDOW REFERENCE FOR ABC
R22	10K, 1/2w	LOW SENSIBILITY ION CHAMBER ADJUSTMENT
R23	10K, 1/2w	PHOTOMULTIPLIER GAIN ADJUSTMENT FOR DSI MODE

**5.11 AEC ADAPTATION BOARD**

**AEC ADAPTATION BOARD (A3263-03)**

ION CHAMBER TYPE	JUMPERS POSITION		
	JP3, JP4, JP7, JP8	JP1, JP2, JP5, JP6	JP13, JP14, JP15, JP16
IC1 = IC2 = IC3 = IC4	B	B	B
IC1 = IC2 = IC3	B	B	A
IC1 = IC2	B	A	A
IC1 ≠ IC2 ≠ IC3 ≠ IC4	A	A	A

ION CHAMBER OUTPUT	JUMPERS POSITION			
	JP9 (IC1)	JP10 (IC2)	JP11 (IC3)	JP12 (IC4)
NO-OFFSET ADJUSTMENT	A	A	A	A
OFFSET ADJUSTMENT	B	B	B	B
TEST POINT AND POTENTIOMETER (ONLY IF JUMPER IS IN "B" POSITION)	TP1 - R11	TP2 - R8	TP4 - R2	TP12 - R5

## 5.12 LF-RAC BOARD (LOW SPEED STARTER)

JUMPERS / SWITCHES		
JUMPER / SWITCH		DESCRIPTION
TB2 - T1	TUBE 1 STATOR SUPPLY VOLTAGE SELECTION	JUMPER WITH TB1-7, 8, 9 : 330 VAC SELECTION FOR TUBE 1 STATOR JUMPER WITH TB1-4, 5, 6 : 220 VAC SELECTION FOR TUBE 1 STATOR
TB2 - T2	TUBE 2 STATOR SUPPLY VOLTAGE SELECTION	JUMPER WITH TB1-7, 8, 9 : 330 VAC SELECTION FOR TUBE 2 STATOR JUMPER WITH TB1-4, 5, 6 : 220 VAC SELECTION FOR TUBE 2 STATOR
TB3 - T1	TUBE 1 STATOR SHIFT CAPACITOR SELECTION	JUMPER WITH TB1-11, 12, 13 : 30 $\mu$ F SELECTION FOR TUBE 1 AUXILIARY JUMPER WITH TB1-14, 15, 16 : 15 $\mu$ F SELECTION FOR TUBE 1 AUXILIARY
TB3 - T2	TUBE 2 STATOR SHIFT CAPACITOR SELECTION	JUMPER WITH TB1-11, 12, 13 : 30 $\mu$ F SELECTION FOR TUBE 2 AUXILIARY JUMPER WITH TB1-14, 15, 16 : 15 $\mu$ F SELECTION FOR TUBE 2 AUXILIARY
TB4 - T1	TUBE 1 FAN VOLTAGE SELECTION	JUMPER WITH TB1-21, 22, 23 : 115 VAC SELECTION FOR TUBE 1 FAN JUMPER WITH TB1-24, 25, 26 : 220 VAC SELECTION FOR TUBE 1 FAN
TB4 - T2	TUBE 2 FAN VOLTAGE SELECTION	JUMPER WITH TB1-21, 22, 23 : 115 VAC SELECTION FOR TUBE 2 FAN JUMPER WITH TB1-24, 25, 26 : 220 VAC SELECTION FOR TUBE 2 FAN

LEDs		
LED	COLOR	DESCRIPTION
DS1	YELLOW	ROTOR ACCELERATION STATUS INDICATOR
DS2	YELLOW	TUBE 2 SELECTION INDICATOR
DS3	YELLOW	ROTOR BRAKE STATUS INDICATOR
DS4	YELLOW	ROTOR CURRENT STATUS INDICATOR : HIGH BRIGHTNESS WHEN THE ROTOR ACCELERATION, AND NORMAL BRIGHTNESS IN THE ROTOR RUN STATUS

FUSES			
FUSE	RATING	NOMINAL	DESCRIPTION
F1	6 A, 250 V, S.B.	220 VAC	ROTOR

RELAYS		
RELAY	RATING	DESCRIPTION
K1 / KACC	+24VDC COIL, 7A/250V CONTACT, 2 Fom C	ROTOR ACCELERATION
K2 / KCT	+24VDC COIL, 7A/250V CONTACT, 3 Form C	TUBE 2 SELECTION (FROM HT CONTROLLER)
K3 / KBR	+24VDC COIL, 7A/250V CONTACT, 2 Fom C	ROTOR BRAKE
K4 / KCTR	+24VDC COIL, 7A/250V CONTACT, 4 Form C	TUBE 2 SELECTION (COILS)
K5 / KCTRR	+24VDC COIL, 7A/250V CONTACT, 3 Form C	TUBE 2 SELECTION (FANS & HV TRANSF-SWITCH)

### 5.13 LV-DRAC (HIGH SPEED STARTER)

#### 5.13.1 DELAYED SWITCH-OFF BOARD

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+12VDC COIL, 1A CONTACT, SPST	SWITCH-OFF DELAYED
K2	+12VDC COIL, 1A CONTACT, SPST	SWITCH-OFF MAINTAINED

#### 5.13.2 CONTROL DRAC BOARD

JUMPERS / SWITCHES	
JUMPER / SWITCH	DESCRIPTION
SW1 SYSTEM CONFIGURATION	8 POSITIONS DIP SWITCH
SW2 SYSTEM CONFIGURATION	8 POSITIONS DIP SWITCH
SW3 SYSTEM CONFIGURATION	8 POSITIONS DIP SWITCH
SW4 SYSTEM CONFIGURATION	8 POSITIONS DIP SWITCH

LEDs		
LED	COLOR	DESCRIPTION
DL1	RED	ERROR STATUS
DL2 (flashing)	YELLOW	CODE STATUS
DL3 (ON)	YELLOW	READY
DL4 (ON)	YELLOW	TUBE 1 SELECTED
DL5 (ON)	YELLOW	TUBE 2 SELECTED
DL6 (ON)	YELLOW	DC BRAKE
DL7 (ON)	YELLOW	BUS DC+
DL8 (ON)	YELLOW	BUS DC-

RELAYS		
RELAY	RATING	DESCRIPTION
RL2	+12VDC COIL, 1A CONTACT, SPST	READY

**5.13.3 INTERFACE DRAC-HF BOARD**

LEDs		
LED	COLOR	DESCRIPTION
DS1	GREEN	BUS DC

FUSES			
FUSE	RATING	NOMINAL	DESCRIPTION
F1	0.5 A, 250 V, S.B.	220 VAC	220 SUPPLY
F2	0.5 A, 250 V, S.B.	220 VAC	220 SUPPLY
F3	15 A, 250 V, S.B.	220 VAC	BUS DC-
F4	15 A, 250 V, S.B.	220 VAC	BUS DC+

**5.13.4 DRAC MISCELLANEOUS**

RELAYS			
RELAY		RATING	DESCRIPTION
K1	RELAY	+24VDC COIL, 7A/250V CONTACT, 3 Fom C	TUBE 1 SELECTED
K3	CONTACTOR	+24VDC COIL, 15A/250V CONTACT, 3NA	DC BRAKE
KT1	CONTACTOR	+24VDC COIL, 15A/250V CONTACT, 3NA	TUBE 1 SELECTED

**5.14 CABINET MISCELLANEOUS FOR LINE POWERED GENERATORS**

<b>FUSES</b>			
<b>FUSE</b>	<b>RATING</b>	<b>NOMINAL</b>	<b>DESCRIPTION</b>
F2	1.5 A, 250 V, S.B.	220 VAC	220 VAC SUPPLY LOCATION - RECTIFIER PANEL
F3	50 A, 600 V, S.B.	LINE	LINE - L1 LOCATION - CABINET FRAME
F4	50 A, 600 V, S.B.	LINE	LINE - L2 " "
F5	50 A, 600 V, S.B.	LINE	LINE - L3 " "
F6	3 A, 250 V, S.B.	19 VAC	+24V SUPPLY LOCATION - RECTIFIER PANEL
F7	3 A, 250 V, S.B.	10.4 VAC	+12V UNR SUPPLY " "
F8	3 A, 250 V, S.B.	115 VAC	115 VAC SUPPLY " "
F9	0.4 A, 250 V, S.B.	220 VAC	220 VAC LVDC LOCATION - FRONT PANEL
F12	10 A, 250 V, S.B.	LINE	INPUT TRANSFORMER LOCATION - BACK PANEL
F13	10 A, 250 V, S.B.	LINE	INPUT TRANSFORMER " "
F14	10 A, 250 V, S.B.	LINE	LINE OUTPUT - U LOCATION - CABINET FRAME
F15	10 A, 250 V, S.B.	LINE	LINE OUTPUT - V " "
F16	10 A, 250 V, S.B.	LINE	LINE OUTPUT - W " "

*NOTE. - FUSES F14, F15, F16 ARE ONLY INSTALLED IN VERTICAL GENERATOR CABINET, NEVER IN COMPACT MODEL.*

<b>RELAYS</b>		
<b>RELAY</b>	<b>RATING</b>	<b>DESCRIPTION</b>
K1	SOLID STATE RELAY	+24VDC INPUT, 10A/250V OUTPUT ROTOR START RELAY
K3		110VAC COIL, 12A/250V CONTACT, 4PDT POWER INPUT RELAY
K5	CONTACTOR	+24VDC COIL, 50A/600V CONTACT, 3 POLE LINE CONTACTOR
K6	CONTACTOR	+24VDC COIL, 50A/600V CONTACT, 3 POLE CHARGE CONTACTOR

## 5.15 BOARDS RELATED TO BATTERY POWERED GENERATORS

### 5.15.1 BATTERY CHARGER BOARD (A3285-02)

LEDs		
LED	COLOR	DESCRIPTION
DS1	YELLOW	BATTERY TEST
DS6 TO DS20	GREEN	CHARGE VOLTAGE (VDC) PRESENT

RELAYS		
RELAY	RATING	DESCRIPTION
K1 TO K8	+24VDC COIL, 5A CONTACT, SPST	ISOLATION OF CHARGE SECTORS FROM BATTERIES DURING PREP.

FUSES		
FUSE	RATING	DESCRIPTION
F7 TO F21	2 A, 250 V, S.B.	PROTECTION OF BATTERY CHARGER SECTORS

### 5.15.2 ISOLATED STAND-ALONE CONTROL BOARD (A3138-01)

JUMPERS / SWITCHES		DESCRIPTION
JP1	SYSTEM CONFIGURATION	ALWAYS SET POSITION 2-3 (60 Hz)
JP5	TEST	ALWAYS INSERTED. ONLY USED FOR IGBT TESTING WITHOUT POWER SUPPLY.

LEDs		
LED	COLOR	DESCRIPTION
DL1	GREEN	BKP MAINS. VOLTAGE TEST
DL2	YELLOW	+15 VDC SUPPLY PRESENT
DL3	RED	BATTERY FAILURE DETECTED
DL4	GREEN	+15 VDC PRESENT IN POWER ON
DL5	YELLOW	U10 MICROPROCESSOR CHECK

## HF Series Generators

### Troubleshooting

#### 5.15.3 ENERGY GUARD BOARD (A3264-01)

JUMPERS / SWITCHES	
JUMPER / SWITCH	DESCRIPTION
SW1 (PUSH-BUTTON)	USED TO DISCHARGE THE ENERGY GUARD CIRCUIT PREVIOUS TO MANIPULATE THIS BOARD

LEDs		
LED	COLOR	DESCRIPTION
DS1	GREEN	+15 VDC SUPPLY PRESENT

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+12VDC COIL, 8A CONTACT	PROTECTION AGAINST BATTERY DISCHARGE
K2	+12VDC COIL, 8A CONTACT	PROTECTION AGAINST BATTERY DISCHARGE

#### 5.15.4 LINE MONITOR BOARD (A3139-01)

JUMPERS / SWITCHES	
JUMPER / SWITCH	DESCRIPTION
SW1 SYSTEM CONFIGURATION	4 POSITIONS WIRE-JUMPER REGARDING TO POWER LINE INPUT (110, 208, 230, 240 VAC)

LEDs		
LED	COLOR	DESCRIPTION
DL1	YELLOW	U3 MICROPROCESSOR CHECKING
DL2	RED	MAX. - LIGHTS WHEN VDC IS HIGHER THAN MAXIMUM VDC SET WITH POT1
DL3	RED	MIN. - LIGHTS WHEN VDC IS LOWER THAN MINIMUM VDC SET WITH POT1

POTENTIOMETERS		
POTENTIOMETER	RATING	DESCRIPTION
POT1	10K, 1/2w	VDC ADJUSTMENT FOR CHECKING THE POWER LINE INPUT

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+24VDC COIL, 10A CONTACT	PRECHARGE OF ENERGY GUARD BOARD AND +24 VDC TO DS1 OF BATTERY CHARGER BOARD
K2	+12VDC COIL, 5A CONTACT	LINE MONITOR BOARD PRECHARGE

**5.16 BOARDS RELATED TO CAPACITOR ASSISTED GENERATORS**

**5.16.1 CAPACITOR CHARGER BOARD (A3517-02)**

<b>JUMPERS / SWITCHES</b>	
<b>JUMPER / SWITCH</b>	<b>DESCRIPTION</b>
JU2 TO JU6	SELECTION OF CURRENT TO CHARGE CAPACITORS

<b>LEDs</b>		
<b>LED</b>	<b>COLOR</b>	<b>DESCRIPTION</b>
D2	GREEN	400 VDC PRESENT (BETWEEN 0-400 VDC CIRCUIT SECTOR)
D3	GREEN	400 VDC PRESENT (BETWEEN 400-800 VDC CIRCUIT SECTOR)
D48	GREEN	INDICATOR OF CAPACITOR BLOCK DISCHARGE
D49	GREEN	INDICATOR OF CAPACITOR BLOCK DISCHARGE

**5.16.2 LINE SELECTOR BOARD (A3525-03)**

<b>JUMPERS / SWITCHES</b>	
<b>JUMPER / SWITCH</b>	<b>DESCRIPTION</b>
W1	POSITION "A" FOR APPLICATION MODE.

<b>LEDs</b>		
<b>LED</b>	<b>COLOR</b>	<b>DESCRIPTION</b>
DS1	YELLOW	INDICATOR OF RELAY K2 ACTIVATED - 100 VAC LINE
DS2	YELLOW	INDICATOR OF RELAY K3 ACTIVATED - 110 VAC LINE
DS3	YELLOW	INDICATOR OF RELAY K4 ACTIVATED - 208 VAC LINE
DS4	YELLOW	INDICATOR OF RELAY K5 ACTIVATED - 230 VAC LINE
DS5	YELLOW	INDICATOR OF RELAY K6 ACTIVATED - 240 VAC LINE
DS6	YELLOW	INDICATOR OF RELAY K7 ACTIVATED - 120 VAC LINE

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+5 VDC COIL, 5A CONTACT	SWITCH ON
K2 TO K7	+5 VDC COIL, 5A CONTACT	LINE SELECTOR

FUSES		
FUSE	RATING	DESCRIPTION
F1	100 mA, 250 V, S.B.	PROTECTION OF T1 TRANSFORMER

**5.16.3 BRAKE BOARD (A3567-04)**

RELAYS		
RELAY	RATING	DESCRIPTION
K1	+24VDC COIL, 12A CONTACT	0 VAC RTN SWITCH TO LF-RAC
K2	+24VDC COIL, 12A CONTACT	LOCK CONTACTS

FUSES		
FUSE	RATING	DESCRIPTION
F1, F2	10 A, 250 V, S.B.	PROTECTION OF COLLIMATOR LAMP

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