This Manual includes the following Documentation:

Section 1
5929 Information for Assembly and Installation - General Information

Page

Essential Performance for X-Ray Tubes 2
Varex Imaging Locations 2
Definition of Symbols 2
1.0 Introduction 3
1.1 Mounting 3
1.2 Installing High Voltage (HV) Cables 3
1.3 Motor Control Equipment 4
1.4 Anode Stator Heat Contributions to Housing 4
1.5 Anode Stator Operations for Various Techniques 4
1.6 Pre-Operation Checks 5
1.7 X-Ray Tube Conditioning Procedure 5
1.8 Filament Circuits 6
Figure 1-1 Primary Connections 6
Figure 1-2 Connections for Grid Control 6
1.9 Filament Frequency 7
1.10 Filament Stand-By Circuits 7
1.11 Filament Life 7
1.12 Thermal or Pressure Switch 7
1.13 Focal Spot Measurements 7
1.14 Safety and Maintenance Procedures 7

Section 2
4476 Information for Assembly and Installation - Metal Center Section - X-ray Tubes

2.0 Introduction 9
2.1 Stator Cable and Electrical Connection 9
2.2 Center Section Lead Connection 9
Table 2-1 Center Section Connections 10
2.3 Visual Inspection 10
2.4 Break in Procedure 11
2.5 Starting Times and Calibration 11
Figure 2-1 Metal Section X-ray Tube 11

Section 3
3737 Information for Assemblers and Users - X-ray Tube Housing Assemblies

3.0 X-ray Tube Housing Assemblies 12
Table 3-1 Compatible Beam Limiting Devices 13-14
Table 3-2 Diagnostic Source Assembly 15

Prepared in accordance with 21 CFR Subchapter J and IEC 60601-2-28

CE 2797

EC REP

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Essential Performance

According to the particular standard for X-ray tubes, IEC-60601-2-28, X-ray tubes do not have Essential Performance. Clause 201.4.3 states:

"The entity X-RAY TUBE ASSEMBLY itself does not have ESSENTIAL PERFORMANCE. Whether characteristics of an X-RAY TUBE ASSEMBLY must be considered ESSENTIAL PERFORMANCE, depends on the X-ray system and HIGH-VOLTAGE GENERATOR characteristics combined with the X-RAY TUBE ASSEMBLY."

Therefore, it is Varex Imaging's position that X-ray tubes being a component of a system and reliant upon other components for operation do not have Essential performance.

The following information supplements specific product data sheets. Refer questions to:

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For a complete listing of our global offices, visit our website at, www.vareximaging.com

Symbol	Definition
	Beware of Ionizing Radiation
	Protective Earth
	Caution, consult accompanying documents
	Consult instruction for use
	Do not dispose of in trash, recycle
	Temperature limitation
	Manufacturer
	Date of Manufacture
	Meets all applicable European Directives
	Certified by Underwriters Laboratories
	Environment Friendly Use Period

INFORMATION FOR ASSEMBLY AND INSTALLATION
GENERAL INFORMATION

1.0 INTRODUCTION

CAUTION: KEEP THIS INFORMATION WITH THE TUBE UNTIL INSTALLED ON EQUIPMENT.

Consult the equipment manufacturer's instructions to install, test, calibrate or service this tube assembly.

A. This device is intended for use in a controlled environment and can be energized immediately after installation. The limits of the controlled environment are defined in the accompanying documents.

B. Nominal and Maximum voltages are considered the same value for X-Ray Tube Housing Assemblies.

C. Upon receipt of the unit, inspect for damage or breakage. If any damage is noted, report to the carrier by filing a written report. Retain shipping container for use when returning the unit for insert replacement or other reasons.

D. The following information is applicable to conventional four-valve, single phase, 6 or 12 pulse, three phase or DC power supply.

1.1. MOUNTING

WARNING: TO AVOID THE RISK OF ELECTRICAL SHOCK, THIS EQUIPMENT MUST ONLY BE CONNECTED TO A SUPPLY WITH PROTECTIVE EARTH.

A. All Varex Imaging X-ray products have provisions for mounting the unit on OEM equipment. These include trunnion mounting, port plate mounting or by threaded holes in bosses designed for the application. Mount the X-ray product only according to the OEM's procedure. Some applications position the X-ray tube assemblies and accessories over a patient. Varex Imaging recommends that all mounting threaded connectors be traceable as directed by NIST, under authority delegated by the Secretary of Commerce, and pursuant to Section 15 of the Fastener Quality Act, (Pub. L. 101- 592 as amended by Pub. L. 104- 113).

B. Tubes that are mounted by means of the port boss may have an intermediate plate between the port boss and beam limiting device. This plate can be used as one of the spacers necessary to mount the beam limiting device. Steel spacers are supplied with beam limiting devices. If the mounting plate is not made of steel but of a lighter metal such as aluminum, the hole in the aluminum plate must be lined with a minimum of 1 mm of lead.

C. Mounting instructions are supplied with each beam limiting device that has been certified as compatible with a specific tube housing assembly. These instructions must be followed carefully in order to meet the inherent filtration requirements of the diagnostic source assembly.

D. The tube housing assembly is connected to the grounding circuit with a green/yellow wire supplied for grounding purposes.

1.2 INSTALLING THE HIGH VOLTAGE (HV) CABLES

CAUTION: Refer to HV cable installation procedure provided with the tube or HV cable for proper installation. Refer to product data sheet for operational data and wiring diagrams.

A. Clean cable terminal and receptacle. Be sure rubber compression gasket is in place, if required.

B. Apply thin coat of vapor-proofing compound to the entire surface of the cable terminal insulator using a clean dry applicator. Fully cover the end of the insulator and taper the vapor-proofing compound from pin tips to the end of the insulator, removing all air around pins.

C. Engage contact pins in socket insulator; tighten cable nut. Retighten after calibration.

D. In the event of high voltage cable failure, Varex Imaging recommends replacement of high voltage cables and not re-termination.

1.3 MOTOR CONTROL EQUIPMENT

A. The motor control equipment, whether provided in the X-ray equipment control or separately as a motor starting and operating device must provide for a means of preventing exposure in case the stator cord is open or incorrectly connected to its power source.

Stator Drive Frequency	RPM
50 Hz	2800 - 3000
60 Hz	3400 - 3600
150 Hz	8500 - 9000
180 Hz	9500 - 10,800

1.4 ANODE STATOR HEAT CONTRIBUTIONS TO HOUSINGS

A. In heavy duty and long time fluoroscopic operation, it is necessary to minimize the heat input to the tube housing assembly contributed by the stator power as well as the X-ray tube to prevent housing overheat. Three periods of stator operation must be considered: acceleration of the anode to full speed, maintenance of the anode speed at reduced running voltage, and braking after exposure. The method of calculating this follows:

WATTS = E1 x I1 x t x p.f.
E1 = Applied stator line voltage (between black and white leads)
I1 = Stator Line amperage for E1
t = Time in seconds E1is applied to stator
p.f. = Power Factor (use 0.83 for this circuit)

CAUTION: REMEMBER, THESE WATTS ARE IN ADDITION TO THOSE CONTRIBUTED BY THE X-RAY TECHNIQUES.

CAUTION: AS THE ANODE ASSEMBLY HEATS UP, RUNNING VOLTAGE MUST BE CONSIDERED IN ORDER TO INSURE ADEQUATE ROTATIONAL SPEED.

1.5 ANODE STATOR OPERATION FOR VARIOUS TECHNIQUES

A. Radiography

1. When a radiographic exposure is to be made, the stator is energized and the filament voltage boosted during the time the anode is accelerating to its operational speed. At the end of this time an X-Ray interlock is closed, thus permitting an exposure to be made either manually or automatically. Also, at this time, the voltage across the stator is reduced to a value sufficient to maintain operational speed, reducing power input to the housing. This value is 50-60 volts for 50/60 Hz. and 100-110 volts for 150/180 Hz. operation. On 150/180 Hz., the brake circuit is energized immediately after the exposure. See above.

B. Fluoroscopic Operation

1. Fractional focal spot sizes require anode rotation for fluoroscopic operation, and it is necessary during this type of operation that the stator be operated at a reduced voltage to limit the stator heat to the housing. A motor control should be designed to reduce the stator voltage after the operating speed has been obtained to the values shown in paragraph (A1).

C. Cine Operation

1. Continuous anode rotation is used when Cine operation is being conducted. Use 60 to 300 second holdover when ever 150/180 Hz. is selected to reduce number of time anode rotation accelerates and deaccelerated through Resonance.

D. Spotfilm Operation

1. When spotfilm work is part of the fluoroscopic system, it is recommended that the stator not go through another starting cycle each time a transfer is made from fluoroscopic operation to spotfilm radiography. Use 60 second holdover after 150/180 Hz. selection.

E. Angiography

1. Use 150/180 Hz. for Angiography.

1.6 PRE-OPERATIONAL CHECKS

A. Connections: Insure that all the connections are properly made and tight before applying high voltage to the tube housing assembly.

B. Rotation: Target rotation direction is dependent upon rotor/rotor controller combination.

C. Stator Connection: The correct stator connections can be determined by measuring the current between the black and white leads. The current should be 4.0 Amps nominal with 120 volts - 50/60 Hz and 7.5 Amps nominal with 230 Volts -50/60 Hz. Be advised that the stator may emit some electromagnetic forces (EMF) by nature of its construction. In the system application, Varex Imaging recommends the thorough testing for the EMF from the x-ray tube housing assembly as it may cause interference with other electronic devices.

D. Power Cord: Some tube housing assemblies have a five wire power cord with a braided shield, this should be identified and properly attached to the housing assembly before operating. Instructions for attachment are shown on the stator tag. Three of the five wires supply power to the stator and the other two are used for an over-temperature thermal switch.

E. Thermal Switch: The use of the thermal switch is mandatory in a warning circuit or interlock. If the housing should overheat during operation the resulting expansion of oil cannot be completely accommodated by the rubber diaphragm. The risk of injury exists if the diaphragm is ruptured or forces the end cap from its intended position as a result of overHeating.

Note: The thermal switch does not detect or directly measure the anode target temperature.

F. Thermal Switch Connection: The thermal switch must be connected as an interlock to prevent exposure and/or provide a visual or audible warning in an overheated condition. The switch is normally closed but opens when the temperature rises above the housings rated value. Do not connect the thermal switch in series with the stator leads or in any manner beyond their rating.

G. Cooling: Operation of the x-ray tube must cease immediately if the thermal switch opens. A cooling device, such as an air circulator or oil heat exchanger, must be left running if the thermal switch opens. Power to the stator must also be turned off to allow the tube unit to adequately cool. Operation of the tube housing assembly must not be initiated until the thermal switch has returned to the closed position.

1.7 X-RAY TUBE CONDITIONING PROCEDURES

A. Consult the equipment manufacturer's instructions for tube conditioning procedures. the following can be used as a recommendation if no tube conditioning procedures are provided.

B Newly Installed Tubes and Daily Warm-up

1. To season or condition X-ray tube, start with the lowest mA station available on the X-ray control for the large focal spot and make the following exposures:

   Begin with 80 kVp, 1/10 second for three exposures.
   Raise to 100 kVp, same mA and time for three exposures.
   Raise to 125 kVp, same mA and time for three exposures.

2. For a tube rated at 150 kVp, do two additional series of exposures at 140 kVp and 150 kVp. Exposures are to be spaced approximately 20 seconds apart.

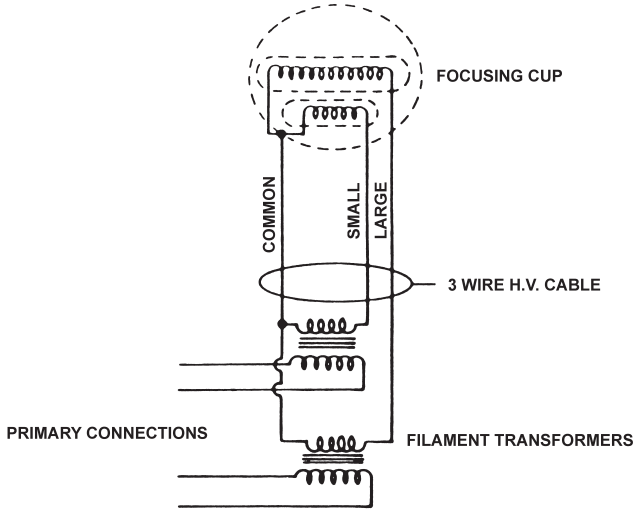
3. For a mammography tube rated to 49 kVp max. follow the above procedure but make exposures at 20, kVp, 35 kVp, and 49 kVp.

4. If disturbances occur, repeat exposures at the kVp until they stop before raising to the next step. Make sure focal spot rating is not being exceeded by consulting the focal spot rating chart prior to exposures.

1.8 FILAMENT CIRCUITS

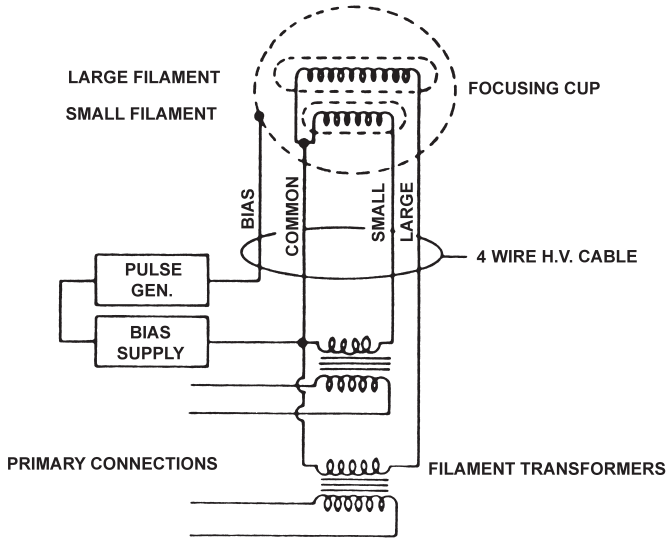
A. Of the two types of filament circuits, the most commonly used is shown in Figure 1-1. The two filaments are connected together at one end and to the focusing cup, thus forming a common lead. This lead and two more, one from each end of the two filaments, are connected to the filament supply transformers through the three-conductor high voltage cable permitting independent control of each filament.

FIGURE 1-1



B. The second circuit, Figure 1-2, is used for grid control of filament emission which permits pulsing the anode current of the X-ray tube. Here the filaments are completely insulated from the focusing cup and connected to the filament supply transformers through conductors in a four-wire high voltage cable. A negative 1,000 to 3,700 VDC grid voltage is impressed between the focusing cup and the filaments for the purpose of controlling the tube current. A means of cancelling this grid voltage is also provided (noted as a pulse generator in Figure 1-2). When the grid voltage is made sufficiently negative with respect to the filaments, the tube current is cut off and no X-rays are produced.

FIGURE 1-2



C. When this grid voltage is cancelled, the cup becomes the same potential as the filaments and the tube becomes a conventional X-ray tube. X-rays are produced during the duration of zero grid voltage.

1.9 FILAMENT FREQUENCY

A. Filament frequency limit: 0 – 40 kHz (unless stated differently in the product data sheet for a specific application).

1.10 FILAMENT STAND-BY CIRCUITS

A. During conventional radiographic use, a filament standby circuit may be provided. To prevent filament evaporation, filament standby should not exceed 2.5 - 2.8 Amps depending on the tube.

1.11 FILAMENT LIFE

A. Excessive boost times must be avoided in all cases and the charts followed closely to avoid shortening useful life. X-ray tubes used in special applications require lower filament currents to prevent premature filament failure. Review of specific techniques is required in order to insure the applicable tube will meet the expected filament life. In addition, reduction of mA values for radiographic techniques with increased peak kV (within limits) can greatly extend the filament life.

1.12 THERMAL OR PRESSURE FLOW SWITCH (WHERE APPLICABLE)

A. **Use of the thermal or pressure switch is mandatory! The thermal or pressure switch does not detect or directly measure anode target temperature**. The switch must be connected to the interlock system, so when a fault is detected, the system will prevent X-ray exposure, prevent additional stator input energy (heat) and/or provide a visual or audible warning in an overheated condition.

B. If thermal switch opens and pressure/flow switch is closed (or not present), then keep power supplied to the heat exchanger, do not allow X-ray exposures and keep stator power off.

C. If pressure / flow switch opens and the thermal switch is closed, then stop power to heat exchanger, do not allow more X-ray exposures and keep stator power off.

D. If the thermal and pressure / flow switches are wired in series and the signal is open, then stop power to heat exchanger, do not allow any more X-ray exposures and keep stator power off.

E. In all cases stated above (A-D), allow the housing to cool before troubleshoot the system. Ensure the X-ray source and heat exchanger are functioning correctly before re-energizing the system for patient examinations.

1.13 FOCAL SPOT MEASUREMENTS

A. Focal spots meet the requirements of IEC 60336.

1.14 SAFETY AND MAINTENANCE PROCEDURES

PROPER USE OF X-RAY TUBES ARE THE RESPONSIBILITY OF EQUIPMENT MANUFACTURERS AND USERS. CARE MUST BE EXERCISED WHEN INCORPORATING TUBES INTO AN X-RAY SYSTEM TO ENSURE THAT THE SYSTEM EARTH LEAKAGE CURRENT COMPLIES WITH APPROPRIATE END-PRODUCT SAFETY STANDARDS AND RELEVANT LOCAL INSTALLATION REQUIREMENTS. VAREX IMAGING DOES NOT ASSUME RESPONSIBILITY FOR AFTER-SALE OPERATING AND SAFETY PRACTICES. LIMITED LIFE AND RANDOM FAILURES ARE INHERENT CHARACTERISTICS OF X-RAY TUBES.

X-RAY TUBES CONTAIN MATERIAL THAT MAY BE HARMFUL TO THE ENVIRONMENT AND HUMANS. DISPOSE OF X-RAY TUBES IN ACCORDANCE WITH APPLICABLE REGULATIONS. IT IS RECOMMENDED THAT FAILED TUBES BE RETURNED TO THE MANUFACTURER OR AN APPROPRIATE FACILITY TO ENSURE PROPER HANDLING.

ALL PERSONS WHO WORK WITH X-RAY TUBES MUST PROTECT THEMSELVES AGAINST RADIATION EXPOSURE AND POSSIBLE SERIOUS BODILY INJURY.

A. Safety

1. Do not operate this tube except in accordance with the Technical Data Sheet, these precautions and any additional information provided by equipment manufacturers.

2. Ensure that the Thermal and / or Pressure switches are properly connected, operating, and are not bypassed.

3. Preferred method of cleaning tube housing assemblies is with alcohol, methanol or hospital grade disinfectant. X-ray tube assembly is not intended to come into contact with patients.

4. X-Ray tube assemblies are classified as ordinary equipment and not protected against ingress of water.

5. This product is not to be used in the presence of a flammable anesthetic mixture with air or with oxygen or with nitrous oxide.

WARNING: SERIOUS HAZARDS EXIST IN THE OPERATION OF X-RAY TUBES.

a. SHOCK - To avoid the risk of electrical shock, this equipment must only be connected to a supply with protective earth.

b. HIGH VOLTAGE SHOCK – As much as 150,000 volts, and can be lethal. When direct access to receptacles is required, primary circuits must be disabled and capacitors/cables discharged.

c. RADIATION EXPOSURE – When energized, radiation in the x-ray spectra are damaging to human tissue.

d. BERYLLIUM (Be) POISONING – Dust or fumes from Be in metal center sections are highly toxic and can cause serious injury or death. Do not perform operations which produce dust or fumes, such as grinding, grit blasting or acid cleaning.

e. GLASS EXPLOSION – Breaking glass envelopes can cause implosion, resulting in scattering of glass particles. Handle glass tubes carefully.

f. BURNS – Housings containing dielectric oil may reach scalding temperatures. Over heating and resultant rupture can cause serious burns.

B. Maintenance

1. Periodically inspect the X-ray tube for proper function. Check that there are no loose or altered parts. Correct as necessary. Remove high voltage cable terminals, clean receptacle and terminal. If carbon tracks are visible, replace affected parts. Recoat with dielectric compound. Remove any lint and debris that may restrict air flow surrounding the tube unit and that may have gathered on the critical components of the heat exchanger (if included).

Maintenance schedule:
30 days after installation
Every 6 months thereafter

INFORMATION FOR ASSEMBLY AND INSTALLATION
METAL CENTER SECTION X-RAY TUBES

2.0 INTRODUCTION

A. A .010" spark gap at the center section terminal on the housing prevents excessive voltage buildup in the event of an internal sparkover between anode or cathode to center section. Reset if moved from .010". In addition, there is a surge protector inside housing between this fourth terminal and ground for added protection.

B. NEVER operate tube with anode high voltage cable disconnected! Complete destruction of the insert is highly probable. If disconnecting the anode high voltage cable from the tube is required for trouble shooting, consult Varex Imaging for proper procedures.

⚠ **ALWAYS** connect the metal center wire to central ground point (usually H.V. transformer).

2.1 STATOR CABLE AND ELECTRICAL CONNECTIONS: Refer to Product Data Sheet

⚠ **CAUTION:** Do not operate with Red wire of cable disconnected or arcing will occur. With center section properly connected, calibration and operation are same as conventional X-ray tubes.

2.2 CENTER SECTION LEAD CONNECTION

A. Center Section Current

1. Due to the physics of the electrode geometry, cathode current divides between the anode and center section. (Some secondary electrons created at the original impact with the anode are collected at the center section rather than recollected at the anode as in conventional glass tubes.) See Figure 2-1. For MA calibration always use the cathode current values. For example at 80 kV, with 100 MA cathode current, only 90 MA would be collected at the anode and 10 MA would be drawn to the center section. In generators where MA monitoring is in the cathode side of the high voltage generator, the red wire (center section current) may be connected to ground or if a balanced anode and cathode current is required connect red wire to anode side of monitoring circuit (M1 or M2 depending on manufacturer of generator).

2. In generators where MA monitoring is in anode side of the high voltage transformers connect red wire to anode side to add current back into monitoring circuit. With center section properly connected, calibration and operation are as for conventional x-ray tubes.

B. Single Phase Generators

1. Single Phase Generators require an additional consideration over three phase generators. The mA signal at M1 and M2 will be AC, whereas the center section current will be rectified. This requires connecting red wire from center section to a point after bridge rectifier that is normally installed prior to MA meter as shown in Figure 2-1. Ground red wire if MA meter is in cathode side of high voltage transformer.

NOTE: At completion of calibration remove red lead from MA circuit and ground at high voltage transformer.

C. Connect center section (red wire) as outlined in Table 2-1.

1. An alternate procedure listed below may be used in determining the connection point of red wire (also a check to determine if lead is located properly).

a. Three phase generators (See Figure 2-1)

i. Ground red wire.

ii. Make an exposure at 80 kV 200 mA, 0.1 sec and record MAS reading.

iii. Connect red wire to M1 at HV transformer secondary and make same exposure. (Do not change settings from step ii.) Record MAS.

iv. Connect red wire to M2 at HV transformer secondary and make same exposure. (Do not change settings from step ii.) Record MAS.

v. If MAS in steps iii or iv increases over MAS in step ii, connect red wire to the terminal that increased MAS. (Any increase in MAS indicates MA meter is in anode circuit.) If the MAS in steps iii or iv has no change with respect to ii or subtracts from ii then connect center section red wire to ground, or if balanced MA is required connect to terminal that caused no change in MAS reading. (MA meter is in cathode circuit.)

vi. If balanced MA metering is not needed for normal operation it is recommended to ground red lead after calibration of MA.

b. Single Phase Generators (See Figure 2-1)

i. Ground red wire.

ii. Make an exposure at 80 kV 200 MA, 0.1 sec and record MAS reading.

iii. Connect red wire of center section to a point between the bridge rectifier and MA meter as shown in Figure 2-1 and make same exposure as in step ii above.

iv. If MAS reading in step iii is greater than MAS in step ii, MA meter is in anode side of HV transformer secondary. (A decrease in MAS reading indicates MA meter is in cathode circuit. Remove red wire from junction of MA meter and rectifier and reconnect to ground.)

NOTE: RATING CHARTS AND RADIATION OUTPUT ARE BASED ON CATHODE CURRENT. THE RED WIRE IS CONNECTED TO GROUND AND MA METERING IS IN ANODE SIDE. ADD 12% TO MA READINGS FOR TRUE TUBE CURRENT.

TABLE 2-1

CENTER SECTION CONNECTIONS FOR B-160, B-170, B-180, B-200, B-400, B-500 SERIES OF TUBE HOUSING ASSEMBLIES (Three Phase Generators)

MA Monitoring Circuit	Connect Red Lead (Center Section) To
In cathode side (balanced monitoring not required)	Separate ground
In cathode side (balanced monitoring required)	Anode side of high voltage transformer MA circuit
In anode side of generator (balanced monitoring required or not required)	Anode side of high voltage transformer MA circuit

(Single Phase Generators)
See Section 2.2 (B)

2.3. VISUAL INSPECTION

A. Due to the nature of the device, typical inspection of filaments and anode rotation is not possible, since the port is opaque. Be certain that connections are connected to stator power source as outlined in Stator Cable and Electrical Connections in the Product Data Sheet.

2.4 BREAK-IN PROCEDURE

A. Warm-up exposure 200 MA, 80KV, 2 Sec. 6 times (5 sec. between exposures)

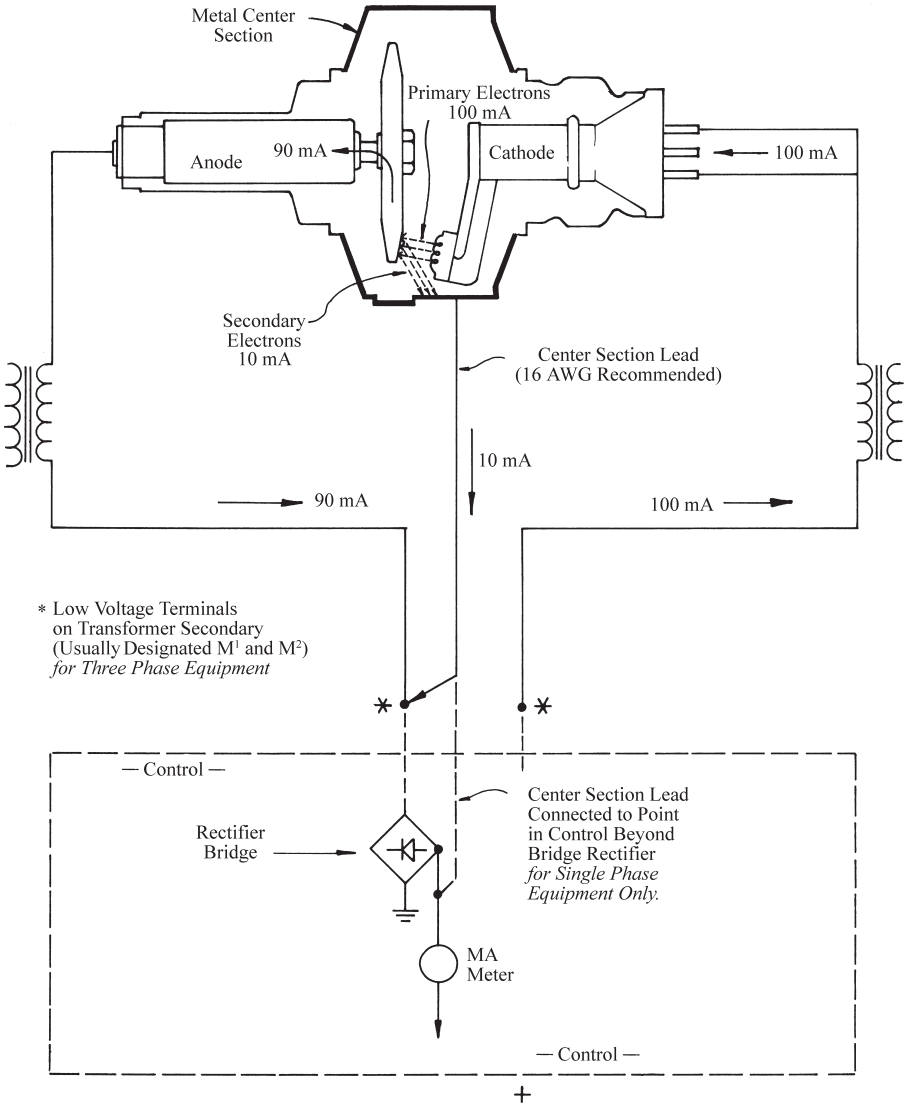
B. Three 300 MA, 0.1 Sec. exposures, from 90-120 KV at 10 KV intervals.

2.5. STARTING TIMES AND CALIBRATION

A. Same as for conventional tubes. (Note MA monitoring in 2.2 (A) Center Section Current.)

FIGURE 2-1

METAL SECTION X-RAY TUBE



2

INFORMATION FOR ASSEMBLERS AND USERS
X-RAY TUBE HOUSING ASSEMBLIES

(Prepared in accordance with 21 CFR Subchapter J and IEC 60601-2-28)

IMPORTANT NOTICE: It is essential that this housing assembly be installed only with beam limiting devices listed in Table 3-1 whenever the housing is used on certified equipment purchased and installed after August 1, 1974.

The housing mounting face and collimator must fit together with no space between the mating surfaces. Lead lining may be required. See Table 3-2 for specific compatible combinations of adapter plates and beam limiting devices or consult Varex Imaging or the equipment manufacturer.

When operated above 50 kV, a minimum of 2.0 mm aluminum equivalent additional filtration is required. The beam limiting devices in Table 3-1 meet these requirements.

Equipment must be installed to indicate when the X-ray field is perpendicular to the image receptor and indicate the SID. Consult the equipment manufacturer if any doubt exists.

CAUTION: This X-Ray tube housing assembly produces X-ray radiation when energized. Refer to system documentation for proper safety cautions! When properly assembled with compatible beam limiting device, this assembly will meet radiation emitting product standards. NEVER remove any part of the housing or beam limiting device. NEVER readjust any part of the beam limiting device unless under the direction of the original assembler.

Safety and Maintenance Procedures: See Section 1.12

See Product Data Sheet for:
- Maximum rated tube potential
- Leakage technique factors
- Minimum permanent filtration
- Ratings and cooling curves

TABLE 3-1
Listing of Compatible Beam Limiting Devices and Tube Housing Assemblies
(X indicates compatibility according to 21 CFR Subchapter J)

Original Manufacturer	Beam Limiting Device Description	VAREX IMAGING X-RAY TUBE HOUSING ASSEMBLIES																
		B-100	B-130/B-130H	B-135H	B-145A	B-150/B-150H	B-155/B-155H	B-160/B-160H	B-165/B-165H	B-180/B-180H	B-185H	B-200H	B-260H	B-520H	DX60/DX70	Diamond	Emerald	Sapphire
Adec	Collimator		x	x		x		x		x								
Bennett	D60SA/D-50M															x	x	
Bennett	D70-A															x		x
CGR	Palno Rapid Cone	x																
CGR	X-act Automatic Collimator	x	x	x		x	x	x	x	x								
CGR	X-act Manual	x	x	x		x	x	x	x	x				x				
CGR	Shuttern Assembly	x	x	x		x	x	x	x	x								
Dialex	Collimator	x	x	x		x	x	x	x	x								
Eureka	Linear I, II, III, FR, FS, FSF															x	x	x
Eureka	Linear iV	x	x	x		x	x	x	x	x						x	x	x
Eureka	MC-150															x	x	x
Fischer	Collimator	x	x	x		x												
G.E.	Sentry III Colimator	x	x	x		x	x	x	x	x								
Katum	Fixed Field Chest Collimator	x	x	x		x	x	x	x	x								
Litton	D-Cone																	
Litton	Xerographic Cone																	
Litton	Spot Cone																	
Lyons	Cone	x	x	x		x	x	x	x	x								
Lyons	Beam Limiting	x	x	x		x												
Machlett	Collimaster A-50/150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster A-150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster C-50/150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster A-150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster M-50/100	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster M-150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Duocon M-50/150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Duocon M-150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Duocon S-150	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster C-FSR	x	x	x		x	x	x	x	x					x	x	x	x
Machlett	Collimaster C-FSR/DI	x	x	x		x	x	x	x	x					x			
Machlett	Collimaster R-SPF	x	x	x		x	x	x	x	x					x			
Machlett	Collimaster R-SP 150/Man	x	x	x		x	x	x	x	x								
Machlett	Collimaster R-SP 150/Mot	x	x	x		x	x	x	x	x								
Machlett	PBL II	x	x	x		x	x	x	x	x								
Machlett	Collimaster A (UT)															x	x	x
Machlett	Collimaster C-UT 150	x	x	x		x	x	x	x	x						x	x	x
Machlett	PBL II 150															x	x	x

* When used in Spectrum Table with Spectrum 70150

TABLE 3-1 (continued)
Listing of Compatible Beam Limiting Devices and Tube Housing Assemblies
(X indicates compatibility according to 21 CFR Subchapter J)

Original Manufacturer	Beam Limiting Device Description	VAREX IMAGING X-RAY TUBE HOUSING ASSEMBLIES															
		B-100	B-130/B-130H	B-135H	B-145A	B-150/B-150H	B-155/B-155H	B-160/B-160H	B-165/B-165H	B-180/B-180H	B-185H	B-200H	B-260H	B-520H	DX60/DX70	Diamond	Emerald	Sapphire
Machlett	Cut 150 MF with XMS mounting Bracket A-6647-1																	x
Machlett	Cut 150 MF with XMS mounting Bracket A-66649-1															x	x	
MECALL	Manual CT003.A	x	x	x		x	x	x										
MECALL	Automatic CT010.A	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT3030	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT011	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT4030	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT013	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT004	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT2030		x	x		x	x	x	x	x	x							
MECALL	Automatic CT030		x	x		x	x	x	x	x	x							
MECALL	Automatic CT1030	x	x	x		x	x	x	x	x	x							
MECALL	Automatic CT5000	x	x	x		x	x	x	x	x	x							
Philips	Automatic Collimator	x	x	x		x	x	x	x	x		x						
Philips	Collimator		x	x		x	x	x	x	x								
Picker	Vector/Classic UT Collimator	x	x	x		x	x	x	x	x								
Picker	Collimator II/III	x	x	x		x	x	x	x	x								
Picker	Manual	x	x	x		x	x	x	x	x								
Picker	Round Field Collimator		*	*		*	*	*	*									
Picker	Galaxy Table Shutter Assy	x	x	x		x	x	x	x									
Picker	Starlight Shutter Assy	x	x	x		x	x	x	x									
Ralco	Motorized R-800 Series Collimator	x	x	x		x	x	x	x	x	x				x			
Ralco	Motorized R-400 Collimator	x	x	x		x	x	x	x	x	x				x			
Ralco	RT 300/ML															x	x	x
Ralco	R 503 MP	x	x	x	x	x		x								x	x	x
Shimadzu	RF-30 Collimaster		x	x		x	x	x	x	x								
Siemens	Motorized Collimator	x	x	x		x	x	x	x	x					x			
Siemens	Manual Collimator	x	x	x		x	x	x	x	x								
Storz	9505	x	x	x	x	x		x								x	x	x
Toshiba	TF 20 Collimaster	x	x	x		x	x	x	x	x		x						
Toshiba	TF-20-ML-1 LTF															x	x	x
Xre	Collimator										x			x				

* When used in Spectrum Table with Spectrum 70150

TABLE 3-2
Diagnostic Source Assembly
Adaptor Plate Compatibility Listing

Adaptor Plate	Combination of x-ray tube and beam limiting device with compatible specified adapter plate. (When used in diagnostic service assemblies.)																								
	B-100	B-130/B-130H	B-135H	B-145	B-150/B-150H	B-155/B-155H	B-160/B-160H	B-165/B-165H	B-180/B-180H	B-185H	B-190H	B-200H	B-260H	Machlett Collimaster A150, A50/150	Machlett Collimaster C150, C50/150	Machlett Collimaster M150, M50/150	Machlett Duocon M150, M50/150	Machlett Duocon S150	Toshiba TF-20 ML-1	Lyons Cone	Picker 2123	Katumn CM/107	Diamond	Emerald	Sapphire
Continental Plate 1-5236-123-03	X	X			X		X		X	X	X	X	X	X	X	X	X	X							
Continental Plate 5236-123-03 with 5236-123-08	X	X			X		X		X					X	X	X	X	X					X	X	X
Katum CM-115\ Tube Carriage	X	X			X		X		X					X	X	X	X	X				X	X	X	X
Katum Region X-40 Tube Mount	X	X			X		X		X					X	X	X	X	X							
Liebel Florsheim P/N 229130	X	X			X		X		X																
Lyons 100-3 Mounting Plate	X	X			X		X		X											X			X	X	X
Memco Mounting Plate B-1057	X	X			X		X		X												X				
Picker Pedestal Bracket P/N 53922	X	X			X		X		X												X				
Picker “Saturn C” Arn D-10-1537-002	X	X			X		X		X												X				
Picker Mounting Plate 90415	X	X			X		X		X												X				
Spectrum P/N 70150	X	X			X		X		X					X	X	X	X	X			X		X	X	X
Standard-Plattform P/N 958550	X	X			X		X		X					X	X	X	X	X							
Xonics A-968550-Z	X	X			X		X		X					X	X	X	X	X					X	X	X
Pausch 325366T	X	X			X		X												X				X	X	X
Fischer 63710G	X	X			X																				

3

Note: Document originally drafted in the English language.