THE INSPECTOR

X-RAY SOURCE

MODEL 200

OPERATOR'S MANUAL

Golden Engineering, Inc.

P.O. Box 185 Centerville, IN 47330 USA (765)855-3493 Fax (765)855-3492

CONTENTS

ITEM **PAGE**

1.0 INTRODUCTION

THE INSPECTOR X-ray source is a complete, single package, portable X-ray device which operates on either AC or from its own self-contained, rechargeable battery pack. The unit incorporates a modular design concept facilitating easy replacement of any of the five functional modules.

The self-contained battery pack feature makes it ideally suited for field use.

THE INSPECTOR is a pulsed X-ray device which produces a pulse of approximately 50 nanoseconds duration, and has a maximum energy of 150 kV. It's major components use solid state circuitry which increases the system's reliability and reduces the power requirements.

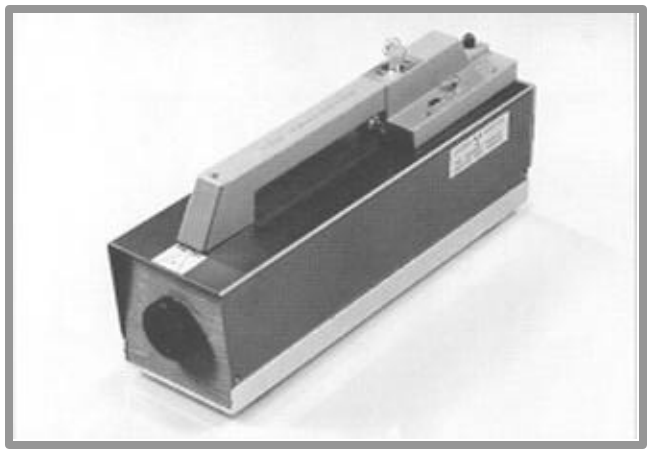


Figure 1

2.0 DESCRIPTION

2.1 This section describes the functional modules and control functions of THE INSPECTOR X-ray source Model 200.

2.2 The X-ray generator consists of two modules. The smaller module located at the nose of the unit is a high voltage charging transformer of approximately 9 kV. It is connected to the control circuitry by a printed circuit connector board and to the second module by a high voltage terminal. The second module (the larger one) is an oil filled high voltage transient generator which develops about 150 kV. The cold cathode X-ray tube is installed inside the unit and is accessible from the front.

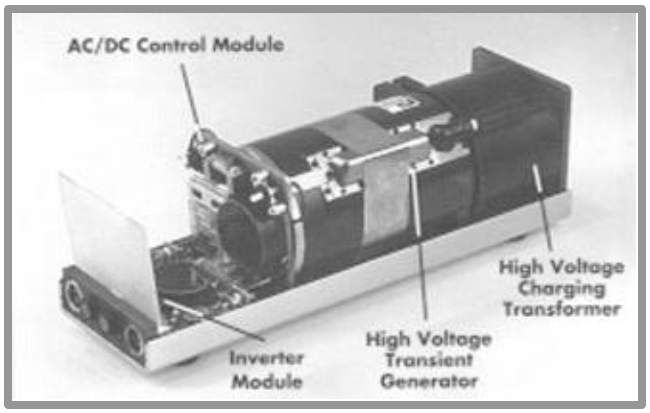


Figure 2

2.3 The inverter Module changes the 29-volt battery supply to pulsating AC to drive the high voltage power supply.

The module plugs into the AC/DC Control Module and has a rear connector panel for the AC Cable and Remote Cable. Two fuses are for the protection of the circuits.

2.4 AC/DC Control. This module automatically selects which power supply is to be used. It also supplies the charging current for the battery pack.

The 115 or 230 volt AC power supply is selected by a switch mounted on the circuit card and is accessed through the battery compartment. Over-voltage protection is provided by two fuses: the GMW1/4 (figure 3) and the 8-amp fuse (figure 5).

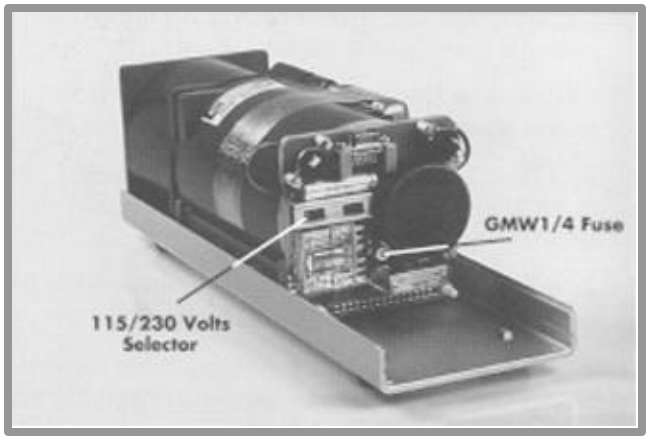


Figure 3

2.5 Control circuitry. The control circuitry consists of two printed circuit assemblies which are mounted inside the handle.

They control the power applied to the high voltage transformer via the relay on the AC/DC control board. The vertical board is essentially a programmable counter that counts the number of X-ray pulses selected, then removes the power to the high voltage transformer.

The delay circuitry, for 15 or 60 second timing, is on the horizontal board, together with the Delay Start Button and the two indicator lamps.

The Master Power ON/OFF Switch is mounted on the vertical board and is key operated.

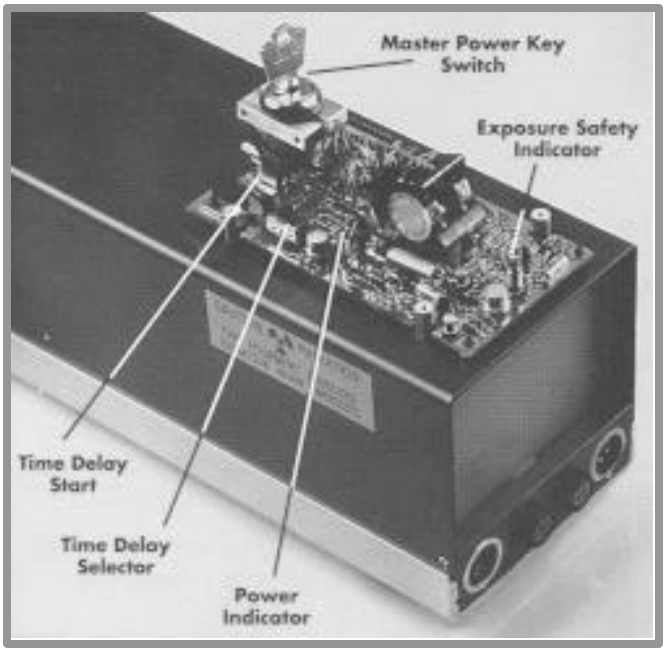


Figure 4

2.6 Controls, Indicators, and Connectors

2.6.1 Master ON/OFF Switch. This is a key-operated switch that controls the power to the unit.

2.6.2 Power Indicator. A red lamp illuminates to show that power has been applied to the unit.

2.6.3 Exposure Selection Switch. This switch selects the number of pulses (from 0 to 99) to effect an X-ray picture.

2.6.4 Time Delay Selector Switch. This is a two-position switch for a delay of 15 or 60 seconds before X-rays are emitted.

2.6.5 Time Delay Start. This push button is located under the handgrip and starts the periods of time delay selected.

2.6.6 Exposure Safety Indicator. This lamp illuminates when either the time delay start button has been activated or when the remote control push button is depressed.

2.6.7 Remote Control Connector. This is a recessed four-pronged connector located on the rear connector panel of the inverter module. This allows operation of the unit from up to 20 feet away by using the control cable.

2.6.8 Power Cord Connector. This is a three-pronged recessed connector, located at the rear panel of the inverter module. The Power Cord is supplied with a USA type molded AC plug, which may be replaced with a suitable connector for different international locations. An appropriate adapter may also be used.

2.6.9 Fuses. 8 amp ABC 8/15 amp ABC 15

2.7 Power Requirements. THE INSPECTOR X-ray Source Model 200 may be operated from either 115 VAC +/- 10% 60 Hz, 230 VAC +/- 10% 50-60hz, or from self-contained rechargeable battery pack. The unit requires approximately 750 watts of power.

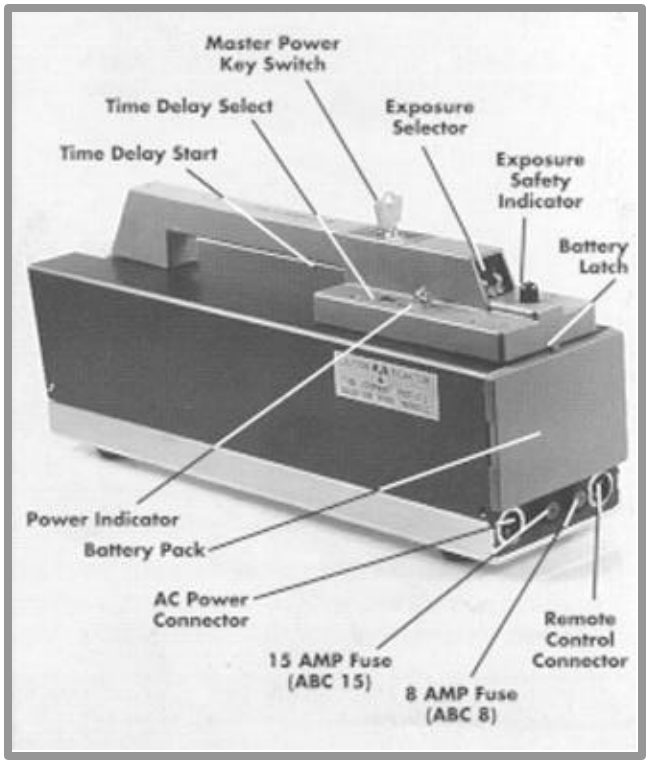


Figure 5

2.8 SYSTEM SPECIFICATIONS*

Size	4.25” (108mm) high x 4.25” (108mm) wide x 15” (381mm) long
Weight	17lbs (7.26kg) without battery 20lbs 8oz (9.3kg) with battery
AC Mode	80-125 V or 160-240 V, 50-60 HZ-switch controlled
DC Mode	29V removable, rechargeable nickel cadmium battery, 2200 pulses per charge
Output Dose	3mR @ 1’/pulse w/filtration equivalent of 2.5mm of aluminum
Pulse Rate	25 pulses per second nominal
Pulse Length	60 nanoseconds
Maximum Pulses	3,600 per hour
Radiation Leakage	2 mR for 100 pulses measured adjacent to side of unit
Exposure Control	Electronic counter provides 1-99 pulses
Source Size	2.2 mm nominal
Time Delay	2-position switch of 15 or 60 seconds delay-allowing time to leave area before X-ray unit fires
Battery Recharge Time	17 hour recharge using built in charger or optional external charger
Unit warranty	1year limited
Tube warranty	90 days or 20,000 pulse

*Specifications subject to change at manufacturer’s discretion

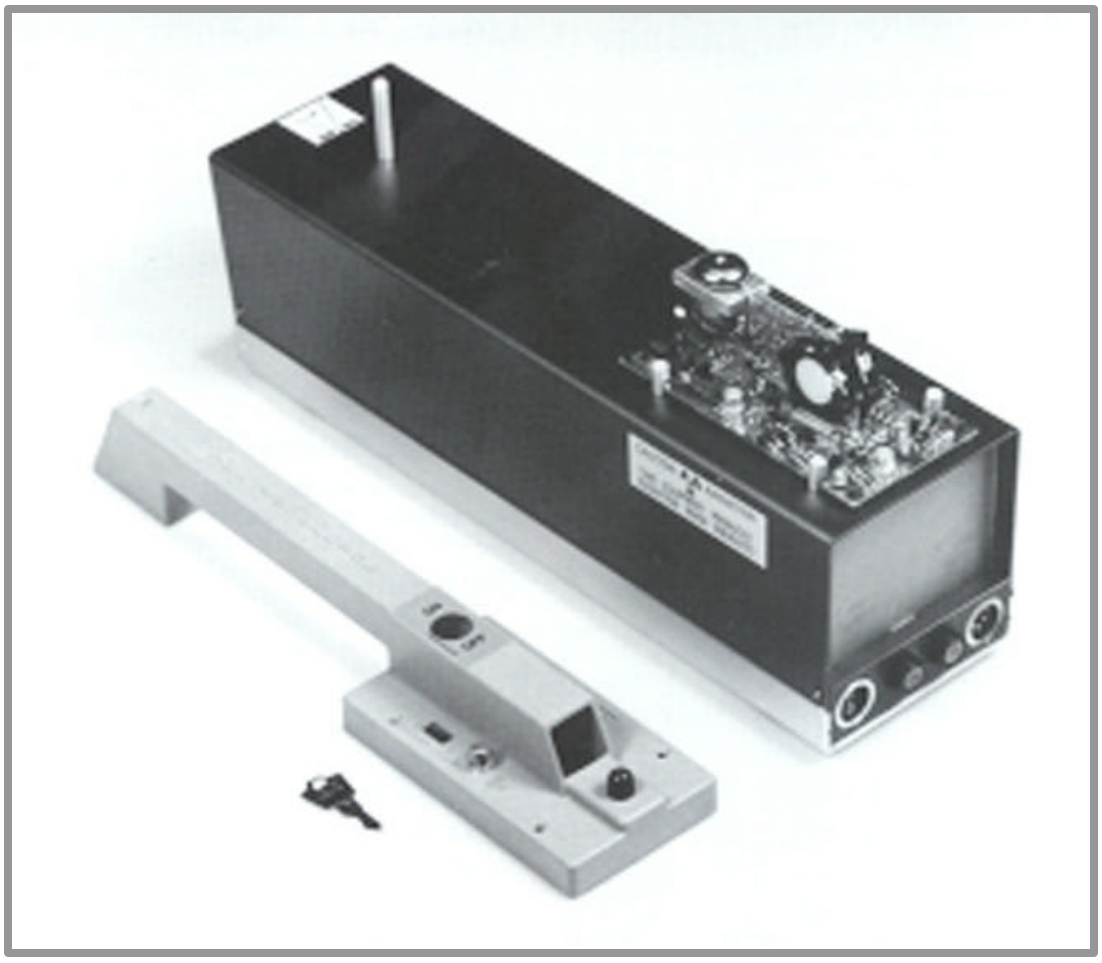


Figure 6

3.0 X-RAY TUBE REPLACEMENT

3.1 X-Ray Tube Replacement. The X-ray tube should give long, trouble-free service under normal use. Should replacement become necessary, simply follow these instructions:

A) Unscrew the plastic nose cap on the front of the unit.

B) Carefully grip the outside perimeter of the tube's end cap and pull the tube free from the contact spring fingers. Be careful not to damage the end cap's center; this is a thin, delicate window.

C) CAUTION: Handle tube only by the metal ring. Do not let hands come in contact with glass. (Acid content in body oils may permanently etch the glass, possibly causing decrease of overall life of tube.) If tubes are handled, use rubber or nylon gloves or paper tissue. Tubes may be cleaned with alcohol.

D) Place the tube on a pad of soft material.

E) Clean the nose cap and examine the "O" ring for possible damage. Replace if necessary. Screw the nose cap onto the cavity until the ring makes contact.

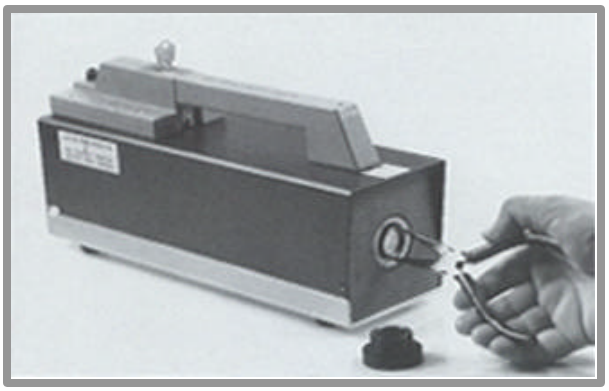


Figure 7

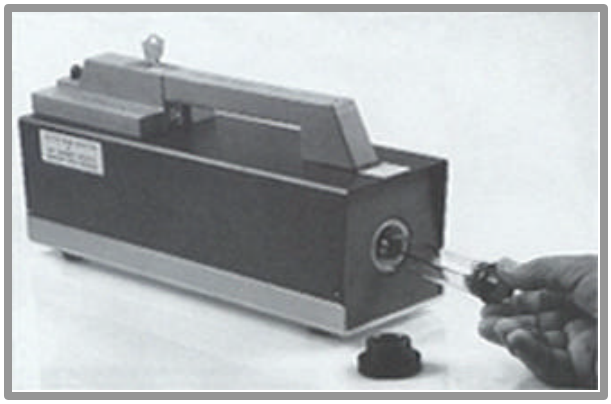


Figure 8

4.0 OPERATING INSTRUCTIONS

4.1 IT SHALL BE THE RESPONSIBILITY OF THE USER TO ASSURE THAT ALL X-RAY EQUIPMENT BE OPERATED ONLY BY PERSONS WHO ARE COMPETENT IN ITS SAFE USE. IT IS IMPORTANT FOR THE OWNER TO ESTABLISH SAFETY GUIDELINES AND OPERATIONAL RESTRICTIONS BASED ON INDIVIDUAL CONDITION AND NEEDS.

4.2 Operating Precautions.

4.2.1 Any individual who could be exposed to radiation from the XR200 should be issued a personal radiation device such as a film badge and/or a pocket dosimeter.

4.2.2 Always stand at a safe distance from the X-ray source. Even though the X-ray beam angle is only 40°, all personnel should remain at least 20 feet behind the X-ray unit while it is pulsing.

4.2.3 Turn the Master Power Key Switch to the OFF position after each exposure.

4.2.4 Review and follow all applicable state and federal regulations.

4.3 Operating Procedures

(CAUTION: Make certain that an X-ray tube is properly installed in the tube chamber. Failure to have an X-ray tube installed will result in over-voltage which may cause X-ray generator failure.)

4.3.1 DC Mode Procedures

4.3.1.1 Prepare the object to be radiographed and verify that the film is placed in position.

4.3.1.2 Check that the battery pack is installed.

4.3.1.3 Dial the number of pulses required to radiograph the object on the Exposure Control (see figure 5).

Option A-Remote Hand Switch Operation.

4.3.1.4A Connect the Remote Control Cable to the four-pin connector on the rear of the panel.

4.3.1.5A Verify the exposure area is clear of all personnel.

4.3.1.6A Turn Master Power Key Switch to the "ON" position and note that the power indicator lamp is illuminated.

4.3.1.7A Depress and hold the hand switch down until the unit has completed the exposure. The exposure lamp will extinguish.

4.3.1.8A Turn the Master Power Key Switch to the "OFF" position.

Option B-Timer Delay Operation. (Remote Control Cable removed.)

4.3.1.4B Set the Timer Delay to the required delay time, 15/60 seconds.

4.3.1.5B Verify the exposure area is clear of all personnel.

4.3.1.6B Turn Master Power Key Switch to the "ON" position and note that the power indicator lamp is illuminated.

4.3.1.7B Depress the Start Button and observe that the Exposure Lamp is illuminated. When the exposure is complete, the lamp will extinguish.

4.3.1.8B Turn the Master Power Key Switch to the "OFF" position.

4.3.2 AC Mode Operations

4.3.2.1 Set the AC Voltage Select Switch, accessible through the battery compartment, to 115 or 230 volts.

4.3.2.2 Connect the power cable to the recessed three-prong plug on the rear of the unit.

NOTE-AC OPERATION CAN BE ACCOMPLISHED WITH OR WITHOUT THE BATTERY PACK INSTALLED.

4.3.2.3 The remainder of the AC mode procedures are the same as DC mode procedures.

4.3.3 Duty Cycle Warning. Up to 200 pulses may be used without rest. After every 200 pulses, the operator should allow a rest period of 4 minutes. This a light duty machine. It is not made to pulse continuously.

4.4 Battery Charging. The power source for the DC mode is a 29-volt, nickel-cadmium battery. The life of a fully charged battery should be approximately 2000 pulses at 68°F before requiring a recharge. Nickel cadmium batteries of this type, however, do not remain charged during storage.

The battery pack is easily removed from the X-ray source by grasping the recessed portion of the cartridge and pulling, while pressing down the molded retaining clip. (see figure 9)

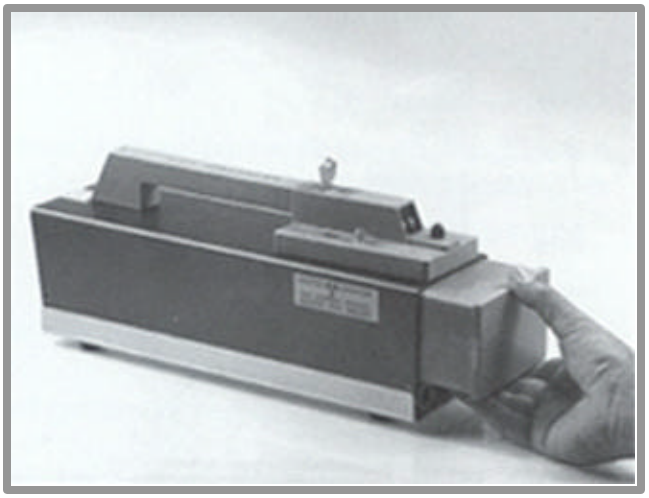


Figure 9

To assure proper performance, the battery should be brought up to a full charge at least once a week. This will require 17 hours for a fully discharged battery.

THE INSPECTOR X-ray Source Model 200 has a built-in charger which operates whenever the AC power cord is plugged in to a service outlet. For safety reasons, the Master Power Key Switch should be kept in the "OFF" position during this process.

For easier battery maintenance and storage, the Battery Charger/Conditioner Model 2100 is highly recommended.

5.0 MAINTENANCE

5.1 Preventative Maintenance.

The following suggestions will help maintain top performance.

5.1.1 X-Ray Dose Measurement. Check the X-ray dose of each new tube to establish the average dose for that particular tube. The average X-ray dose can be obtained using a dosimeter, such as Victoreen Model 541R (200 mR or equivalent).

With the dosimeter located 1 foot from the front of the case 9and in line with the center of the CAP TUBE HOUSING), the reading for 30 pulses should be 90 +/-10 mR.

It is desirable to periodically measure the output dose to verify system performance.

CAUTION: Due to the short pulse width, Geiger Mueller counters cannot detect X-rays emitted from THE INSPECTOR X-ray source Model 200. We recommend using ionization chambers such as the Victoreen 660 with 660-I probe or Victoreen 541-R pocket dosimeter. Film badges are also sensitive to the INSPECTOR radiation.

5.2 Unscheduled Maintenance

BEFORE ATTEMPTING TO SERVICE THIS EQUIPMENT, CONSULT A QUALIFIED TECHNICIAN, OR CALL THE MANUFACTURER'S SERVICE DEPARTMENT: (765)855-3493.

5.2.1 Tools Required

1/16", 5/64", 3/32", & 9/64" Hex Drivers

1/4" Nut Driver

5.2.2 Module Removal

In all cases, the unit must be disconnected from the AC source and the battery pack removed.

5.2.2.1 Control and Logic. (Part #1502)

5.2.2.1.1 Remove the four #4 flat head socket screws and the single #6 at the front.

5.2.2.1.2 Lift off the handle, taking care not to damage Exposure Safety Lamp.

5.2.2.1.3 Remove the four #4 hex nuts clamping the board to the case top.

5.2.2.1.4 Remove the printed circuit module.

5.2.2.2 Inverter. (Part #1450)

5.2.2.2.1 Remove the four #4 flat head socket screws located around the rear connector panel.

5.2.2.2.2 Insert the AC cord into its connector, but DO NOT connect it to an AC outlet.

5.2.2.2.3 Insert the remote cable into its connector

5.2.2.2.4 Use the connectors as handgrips to pull the module straight out of the rear of the unit. It will slide out because its circuit board is supported in slots. Do not use the hinged door as a grip. You will damage the hinge.

5.2.2.3 AC/DC Control. (Part #1430)

5.2.2.3.1 Remove the X-ray tube and safely store.

5.2.2.3.2 Unscrew the four #4 flat head socket screws located at the bottom corners of the cover.

5.2.2.3.3 Pull off the cover, complete with the handle.

5.2.2.3.4 Remove the Inverter Module.

5.2.2.3.5 Turn the unit over (base up) and remove the four remaining #4 flat head socket screws.

5.2.2.3.6 Lift off the Base Plate Assembly.

5.2.2.3.7 The AC/DC Control Module can now be removed by removing the four #4 cap head screws. Note the loose mounting bracket on the bottom two holes of the card.

5.2.2.4 High Voltage Charging Transformer. (Part #1400)

5.2.2.4.1 Remove the X-ray tube and safely store.

5.2.2.4.2 Remove the cover assembly.

5.2.2.4.3 Remove the Inverter Module.

5.2.2.4.4 Remove the Base Plate Assembly.

5.2.2.4.5 Slide off the nose cover plate.

5.2.2.4.6 Remove the two #8 socket head bolts clamping the transformer to the Transient Generator.

5.2.2.4.7 Carefully slide the High Voltage Charging Transformer off the lead nose piece.

5.2.2.5 High Voltage Transient Generator. (Part #1470)

5.2.2.5.1 Remove the X-ray tube and safely store.

5.2.2.5.2 Remove the cover assembly.

5.2.2.5.3 Remove the Inverter Module.

5.2.2.5.4 Remove the Base Plate Assembly.

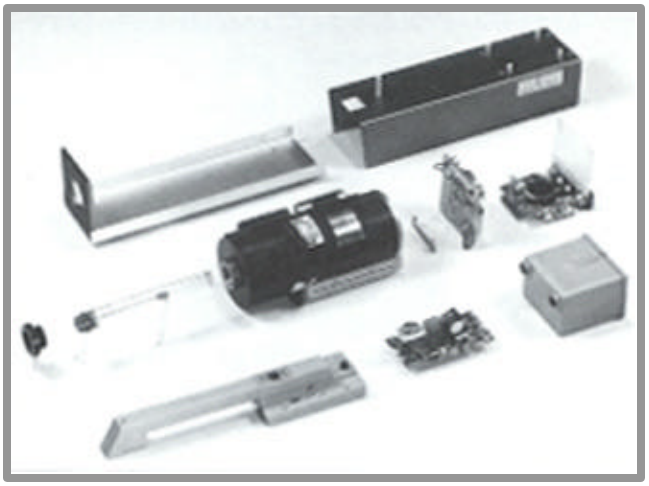
5.2.2.5.5 Remove the AC/DC Control Module.

5.2.2.5.6 Remove the High Voltage Charging Transformer.

5.2.2.5.7 Remove the Printed Circuit Connector Board.

CAUTION:

DO NOT disassemble the High Voltage Generator.



6.0 TROUBLE SHOOTING

THE INSPECTOR X-ray Source should never be operated without either an X-ray tube or a shorting strip in the tube cavity. For testing purposes it is preferable to use a shorting strip to prevent unnecessary radiation emission. The shorting strip is a 1/2" wide x 6" long piece of copper connected from tube spring connector to nose cone.

Before testing and repairing the X-ray unit, be sure that a well-charged battery is installed in the unit.

The X-ray unit produces very high voltage (150,000 volts DC). The handle may be safely removed for work on the counter board without exposure to the high voltage. The top case, however, should NOT be removed, except by a qualified technician.

SYMPTOM	TEST	ACTION
No "Power ON" light when AC connected	Check AC voltage 8 amp ABC (right) Check AC fuse Check GMW 1/4 fuse	Replace fuse Replace fuse
No "Power ON" light in battery mode	Check battery voltage Check DC fuse 15 amp ABC (left)	Charge/replace battery Replace fuse
X-ray "ON" lamp not lit, but operating correctly	Check bulb	Replace bulb
X-ray "ON" lamp lights, but X-ray does not fire	Check GMW 1/4 fuse	Replace fuse
No X-ray output, but otherwise operating correctly	Visually inspect tube	Replace tube
Black picture, but X-ray operating correctly	Check if paper envelope removed In dark place, fire X-ray at opened cassette. Greenish light should show on cassette screen.	Remove envelope from film negative Replace tube if no green light
No operation in AC or DC mode	Check all three fuses	Replace fuses Replace key switch
Continuous counting	Check key switch	Replace counter board or return unit
Oil leaking from unit		Return unit for repair
Battery not taking charge	Check battery Read voltage on charging terminals	Replace battery If OK, replace battery If no voltage, replace fuses
Fuses keep blowing	Read voltage on charging terminals	Return for repair

INSTRUCTIONS FOR REPAIR

1. In most cases we offer a two or three day turn around for repair.
2. When returning a unit for repair, include a brief description of problem incurred.
3. Remove battery before shipping unit. Battery may be returned in package with X-ray unit.
4. Remove tube before shipping unit. If tube is to be checked, pack separately and mark FRAGILE GLASS.
5. Be sure unit is securely packaged for shipment.
6. Return address: Golden Engineering, Inc., 6364 Means Road, Centerville, IN 47330

7.0 WARRANTY

7.1 CERTIFICATION OF WARRANTY

Unit Serial Number _____

Date Delivered _____/_____/_____

7.1.1 Unit Warranty

Golden Engineering, Inc. warrants THE INSPECTOR® X-ray Source Model 200, made and sold by it or its authorized representatives to be free of defects in materials and workmanship for a period of twelve (12) months from the date of shipment to the end user. To make a claim under this limited warranty, customer must ship the entire unit (or the component believed to be defective) to Golden Engineering, post-paid. Golden Engineering, Inc. assumes no liability for units or components shipped until they are actually in the custody of Golden Engineering, Inc. Provided Golden Engineering, Inc. in its sole discretion, is satisfied that the defect is not the result of abuse, misuse, accident, modification or improper disassembly or repair, Golden Engineering, Inc. will repair or replace the defective component(s) at its own expense. Golden Engineering, Inc. reserves the right to use reconditioned and remanufactured components that meet original specifications. The unit or component will be return shipped to customer at customer's expense. THIS EXPRESS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AND GUARANTEES, EITHER EXPRESS OR IMPLIED OR CREATED BY OPERATION OF LAW.

7.1.2 X-Ray Tube Warranty

Golden Engineering, Inc. (Manufacturer) warrants each new X-ray tube to be free from defects in workmanship or material under normal use for ninety (90) days from the date of delivery to the end user, or 20,000 pulses, whichever event shall first occur. Should the tube fail within the ninety (90) day warranty period, a pro-rated adjustment will be made when returned. Written notice of any claimed defect must be given to the manufacturer within thirty (30) days after such defect is first discovered. Transportation charges covering the return of the defective tube will be at the manufacturer's expense. This warranty is valid except when the tube has been subjected to misuse, accident, improper installation, or operation outside the conditions prescribed in the operating manual.

Pro-Rated Adjustment Formula

$$\frac{\text{Days of Service} \times \text{List Price of X-Ray Tube}}{90 \text{ Days}} = \text{Cost of Replacement}$$

SPARE PARTS LIST FOR THE INSPECTOR X-RAY SOURCE MODEL 200

ITEM	PART#
Transformer	1400
Head Generator	1470
Relay Board SN 0010-0999	1430A
SN 1000 to Present	1430B
Inverter Board SN 0010-0999	1450A
SN 1000-1771	1450B
SN 1772 to Present	1450C
Counter Board	1502
Handle	1480
Case, Upper	1485
Case, Lower	1490
Case Front Plate	1495
Door Assembly	1455
Tripod Mounting Plate	1492
Collimator	1473
Remote Cable	1460
110V Power Cable SN 0010-1771	1465A
SN 1772 to Present	1465AA
110V Power Cable SN 0010-1771	1465B
SN 1772 to Present	1465BB
Battery	1075
Tube	1520
Key	1499
Lamp	1531
Small Parts Kit (2 each-fuses, bulbs, keys, "O" rings)	1487