MAXIMAR 100
X-RAY UNIT

SUPERFICIAL THERAPY

OPERATION . MAINTENANCE

Direction 11883A

X-RAY DEPARTMENT
GENERAL ELECTRIC
MILWAUKEE 1, WISCONSIN

Code 6-165

IMPORTANT ... X-RAY PROTECTION

X-Ray equipment if not properly used, may cause injury. Accordingly the instructions herein contained should be thoroughly read and understood before you attempt to place this equipment in operation. The General Electric Company, X-Ray Department, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x-radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator or his assistant to take adequate precautions or prevent the possibility of authorized or unauthorized persons carelessly, unwisely, or unknowingly exposing themselves or others to direct or secondary radiation.

It is important that everyone having anything to do with x-radiation be fully acquainted with the recommendations of the National Committee on Radiation Protection as published in the National Bureau of Standards Handbooks, of the American Standards Association, and of the International Commission on Radiation Protection, and take adequate steps to insure protection against injury.

It is assumed that all persons authorized to use the equipment are cognizant of the danger of excessive exposure to x-radiation and the equipment is sold with the understanding that the General Electric Company, X-Ray Department, its agents, and representatives have no responsibility for injury or damage which may result from exposure to x-radiation.

Various protective material and devices are available. It is urged that such materials or devices be used.

MAXIMAR 100 X-RAY UNIT

SUPERFICIAL THERAPY

FOREWORD

The Maximar 100 is a superficial therapy unit of the shockproof type, designed for operation between 30 kvp and 100 kvp. X-ray tube current can be varied between zero and five milliamperes.

The complete Maximar 100 X-Ray Unit will consist of the tube head, cable junction box, and wall-mounted control unit together with a tube column. The tube column can be mounted either on a stationary base or on a side rail. If desired, a table top may be attached to the side rail.

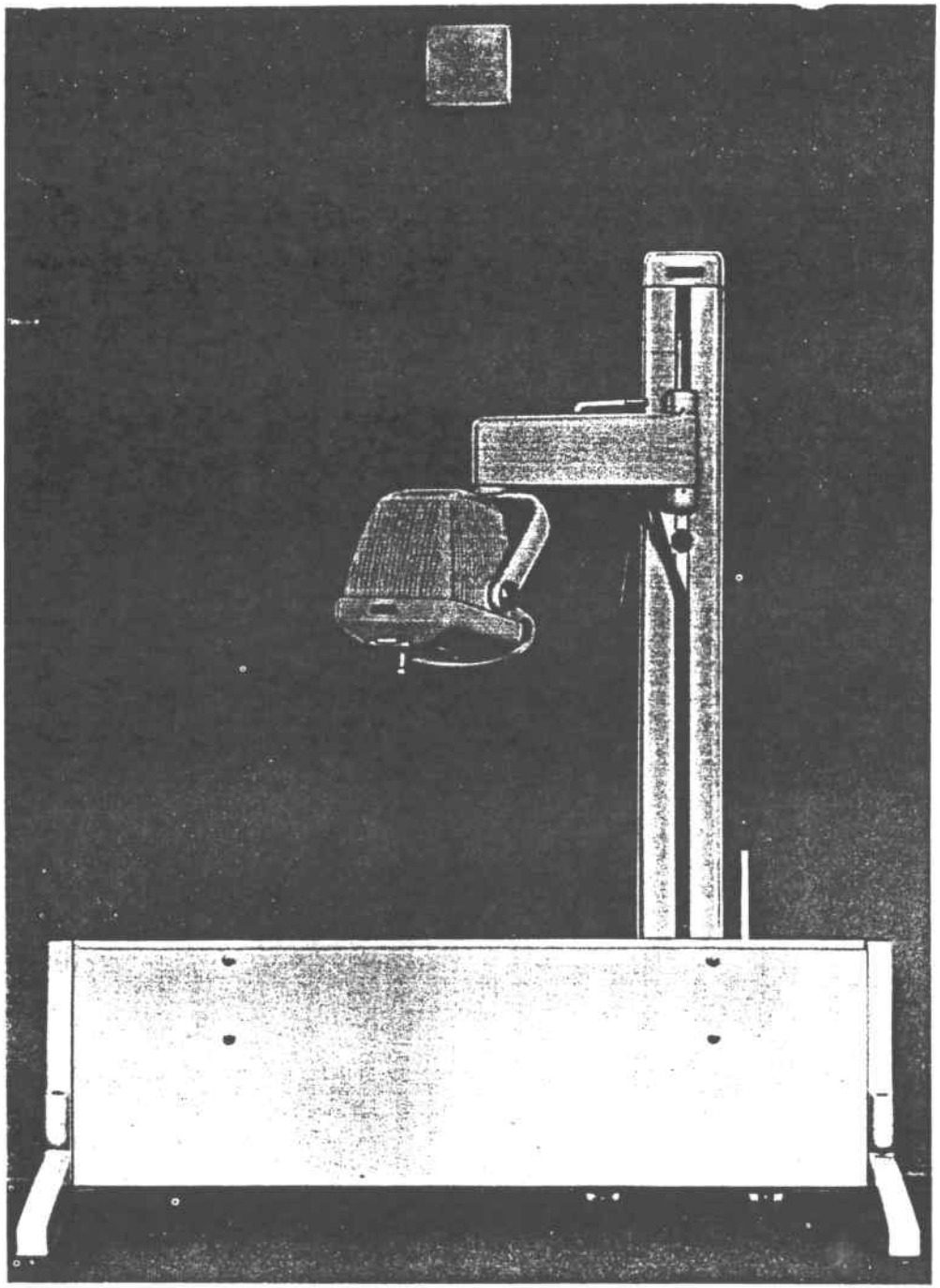
DESCRIPTION OF EQUIPMENT

The X-Ray Tube Head

The Maximar 100 tube head consists of a high voltage transformer, X-ray tube filament transformer, an oil circulator, a Model SRT-1 beryllium-window X-ray tube, thermally operated switch, and a blower assembly. With the exception of the blower, all these items are immersed in insulating oil in a cast aluminum tank. Accessability to the tube unit and other internal components is provided by means of a removable cover.

Immersion of the high-voltage parts in oil and the absence of any exposed low voltage connection shockproofs the tube head, provided that the unit is properly grounded. The tube head has an oil hose which connects to an expansion tank located in the hollow of the central portion of the tube support arm. This tank allows for the expansion and contraction of the oil in the head due to temperature changes caused by variation of the room temperature or by operation of the unit.

Internally mounted in the oil of the tube unit is a thermal cut-off switch, electrically interlocked with the primary circuit of the X-ray unit. In the event the temperature of the oil exceeds the safe value,



THE MAXIMAR 100 WITH SIDE RAIL UNIT
BUT WITHOUT TREATMENT TABLE TOP

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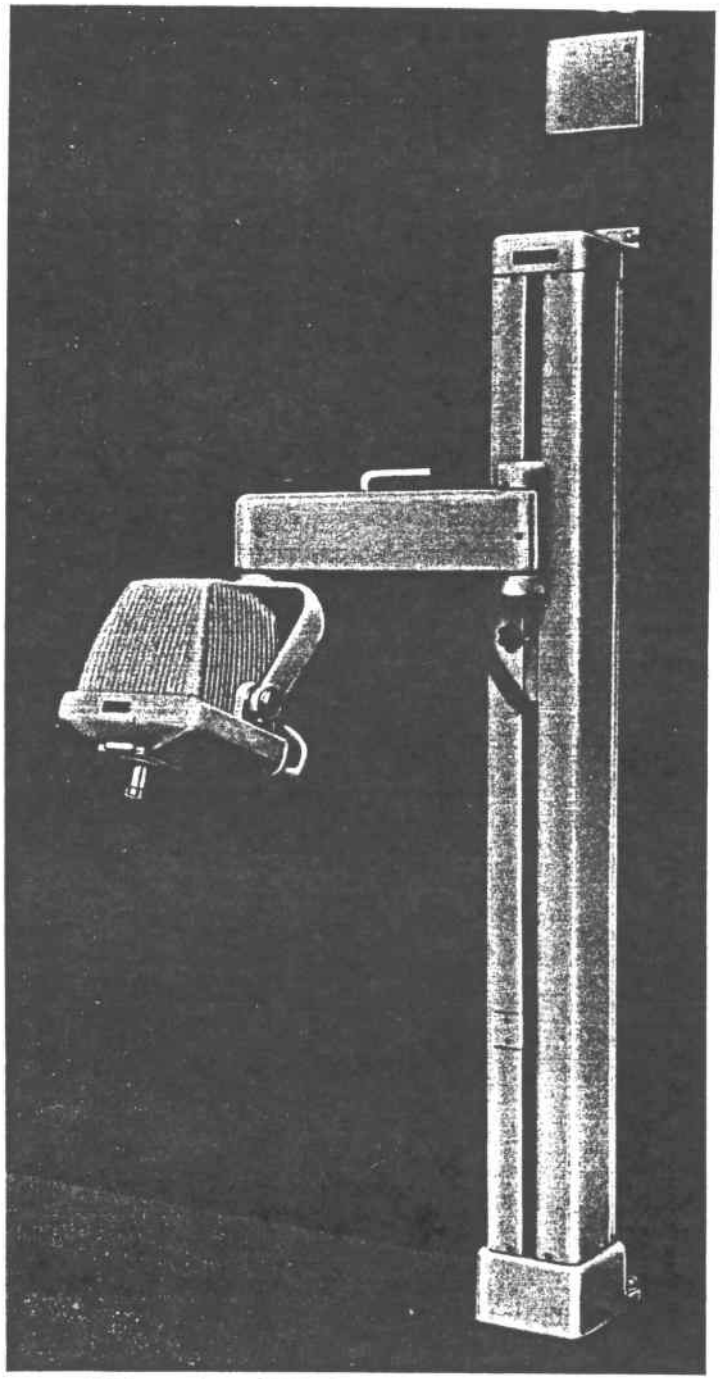


THE MAXIMAR 100 WITH STATIONARY BASE

the thermal switch will open and the tube head will be de-energized.

Cooling is accomplished both by an internal oil circulator and an external blower which is fastened directly to the tube head. Both the air blower and oil circulator begin to operate as soon as the combination line switch and circuit breaker, located on the right hand panel of the control stand, is turned to the ON position.

In the event that a series of treatments is to be given, it is suggested that the circuit breaker be left in the ON position so that the air blower and oil circulator will operate between treatments. This helps to maintain the temperature of the head at low value.

Primary terminals for the tube head are provided on the X-ray port cover of the tube head and are concealed by an ornamental cover held in place by four machine screws. Access to these terminals is permitted by removal of machine screws and ornamental cover. The cover is in two sections, one of which conceals the blower assembly, the other covers the bottom of the tube head but permits uninterrupted passage of the X-ray beam.

X-ray protection against all x-radiation except the primary beam and secondary radiation from the object and materials in the path of the primary beam is provided by the construction of the X-ray tube and tube head. At 100 kvp, 5 ma, and with 3 millimeters of added aluminum filter, the radiation intensity outside of the direct beam is less than one percent of that of the direct beam.

To meet the Bureau of Standards Handbook 76 recommendations paragraph 11.2.e, a provision is made in the control to turn off the unit when the treatment room door is opened. Because of the numerous variations in electrical codes governing wiring and room construction, the interlock door switch and associated wiring are to be supplied by the customer.

Model SRT-1 X-Ray Tube

The SRT-1 X-Ray Tube is of the single-focus type with a beryllium window. It is immersed in insulating oil by which it is also cooled, and is mounted in the shockproof tube head.

The oil is circulated in the tube head by an electrically driven pump. The entire tube head is cooled by an air blower unit mounted thereon, which directs a stream of cooling air along the sides of the tube head.

The use of a beryllium window in the X-ray tube results in an inherent filtration which is the equivalent of less than 0.1 millimeters of aluminum. This figure constitutes the entire inherent filtration because there is no insulating oil or other material between the beryllium window and the filter box.

TREATMENT ACCESSORIES

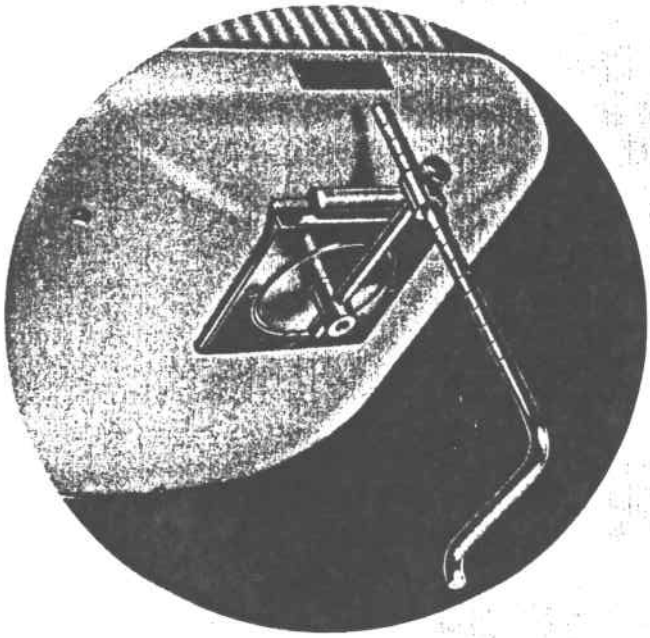
A combination filter box and treatment cone mounting plate is located directly beneath the beryllium window of the X-ray tube. To aid the operator a filter indicating device is a part of this assembly. When no filter is in place, a blinking light on the control unit confirms the fact.

CAUTION: Complete and absolute trust in the filter indicating light is not advised. There is no substitute for a personal, visual inspection to ascertain that a filter is in place when one is needed. A check on the operation of this device should be made at least once each day by first inserting and then removing a filter from the filter box. The filter box is designed to permit the use of one filter at a time. For ease in identifying the thickness of a filter, the color of the handle follows the following code:

Filter Value	*Handle color*
0.25 mm Al	yellow
0.50 mm Al	red
1.00 mm Al	green
2.00 mm Al	blue
3.00 mm Al	white

Circular cones with glass tips, for use in 15 cm focal spot to skin distance technics, are supplied in the following diameters: 1, 1-1/2, 2, 3, 4, and 5 cm. Cones for use in 30 cm focal spot to skin distance technics are supplied with field diameters of 5, 10, 15, and 20 cm. All cones are fastened in place by a slight twist in the clockwise direction.

For other technics without cones two adjustable measuring sticks are provided. One is for use with FSD technics between 15 cm and 30 cm, the other for the range between 30 cm and 60 cm. This device has its use in locating the center of the treatment field as well as in measuring the treatment dis-



MEASURING DEVICE

tance. The holder is inserted in the cone mounting assembly with the arm pointing up or towards the operator as shown in the picture. To lock it in place turn it slightly clockwise until it clicks in place. After positioning the patient, and before treatment begins, the holder with measuring stick is removed by turning it counter-clockwise. Loosen and raise measuring stick to facilitate removal if necessary.

Control Unit

The control unit may be removed from its wall mounting to facilitate certain phases of servicing internal parts. Provision is made for the entrance of line and tube head connections at the back or at the bottom of the control unit, the choice depending upon the installation layout. The recommended entry is through the back.

The control unit consists of the following components:

A. A combination main line switch and overload circuit breaker is located on the right hand side of the control. When the OFF-ON lever is in the ON position, the control unit is energized. When in the OFF position, all power in the control is removed. Should an overload or short circuit condition occur, this switch will open. To reset the lever, it is necessary to push it first to the OFF position, then back to the ON position.

B. The Line Pilot Light on the control unit indicates that the line switch is in the ON position.

C. The Filter Warning Light is a pilot light on the top of the control unit. When it is flashing, it indicates the absence of a filter. A small switch in the filter box assembly is operated when a filter is inserted. This action causes the light to stop flashing. This indicator is only an auxiliary device to indicate that a filter is in place. Operating personnel are advised always to make a personal, visual check to see that a filter is in place when one is required. The ratio between unfiltered and filtered radiation for this unit is very large. Injury to the patient could result if the filter were left out during a treatment requiring a filter.

D. The Lock Switch is a safety device located on the face of the control panel. Because it requires a key to close it, only authorized personnel can operate the unit. The key is removable only in the open position. When this switch is closed, the X-ray tube filament, the motor of the treatment timer and meter lights are energized.

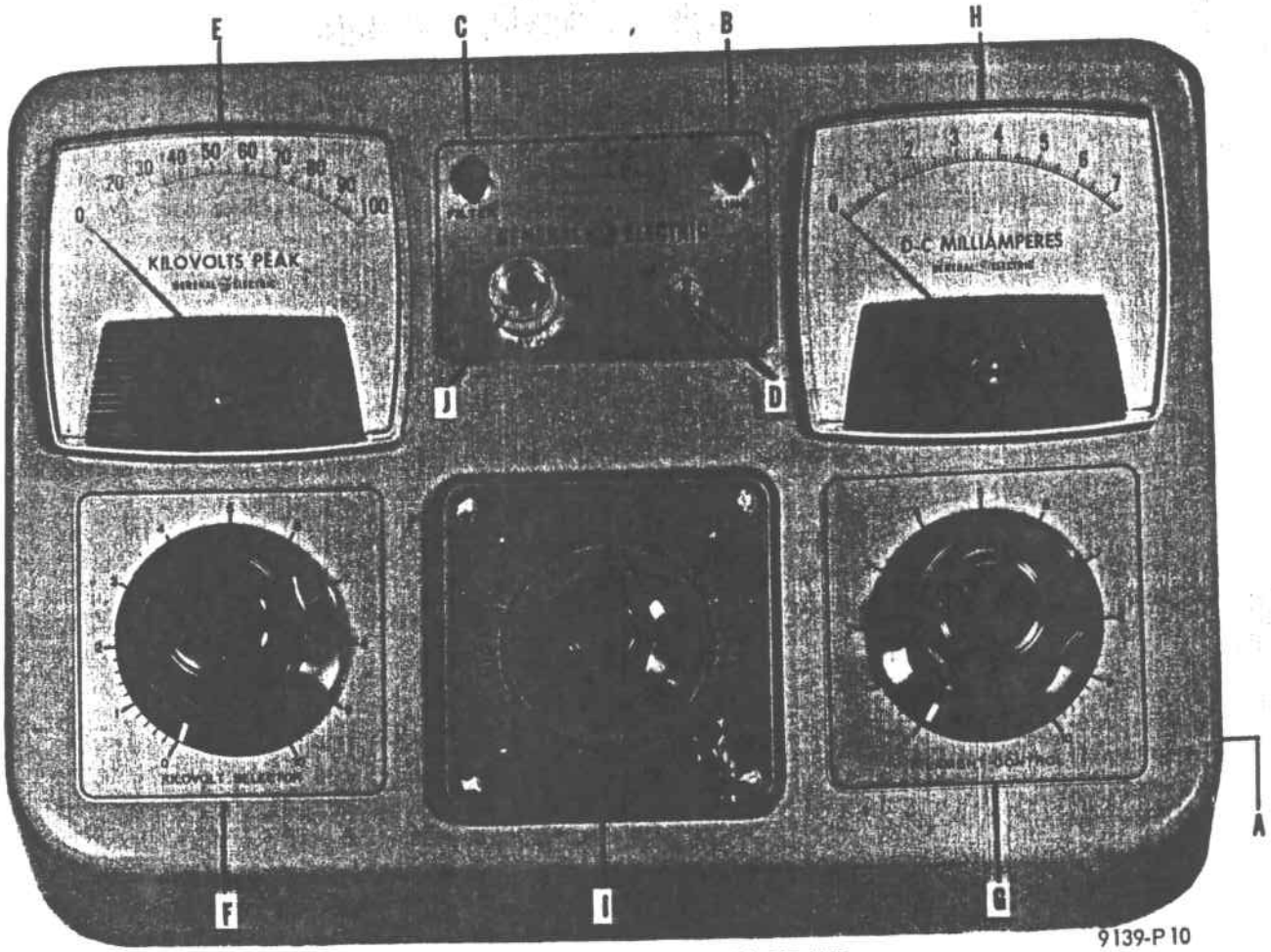
E. The Kilovolts Peak Meter is calibrated directly in kvp.

The unit is electrically capable of operation at kilovoltages below thirty, but operation in that range is not recommended. Operation in that range will require an increased X-ray tube filament current. Furthermore, ordinary line voltage fluctuations cause the X-ray output to vary a large percentage for small changes in kvp.

CAUTION: The filament control setting, which for a particular unit gives 7.5 ma at 20 kvp, should not be exceeded as higher settings may cause premature filament failure. This provision is not to be considered as an endorsement of operation below 30 kvp.

F. Kilovolt Selector. It is possible to readjust the kilovoltage at any time during the treatment to correct for line fluctuations, should any occur. Turning the Kilovolt Selector in the clockwise direction increases the kilovoltage applied to the tube.

G. The Filament Control, of the rheostat type, controls the temperature of the filament of the X-ray tube. Turning this control knob in a clockwise direction increases the milliamperage through the tube.



THE MAXIMAR 100 CONTROL STAND

H. The Milliameter indicates the amount of current flowing through the X-ray tube.

I. The Treatment Timer can be set for any interval between one second and fifty-five minutes by rotating the minute dial and the second ring to the desired time value. The knob and movable dial with red arrow on its face is mechanically indexed for the purpose of easily positioning it to the minutes indicated on the outer stationary dial.

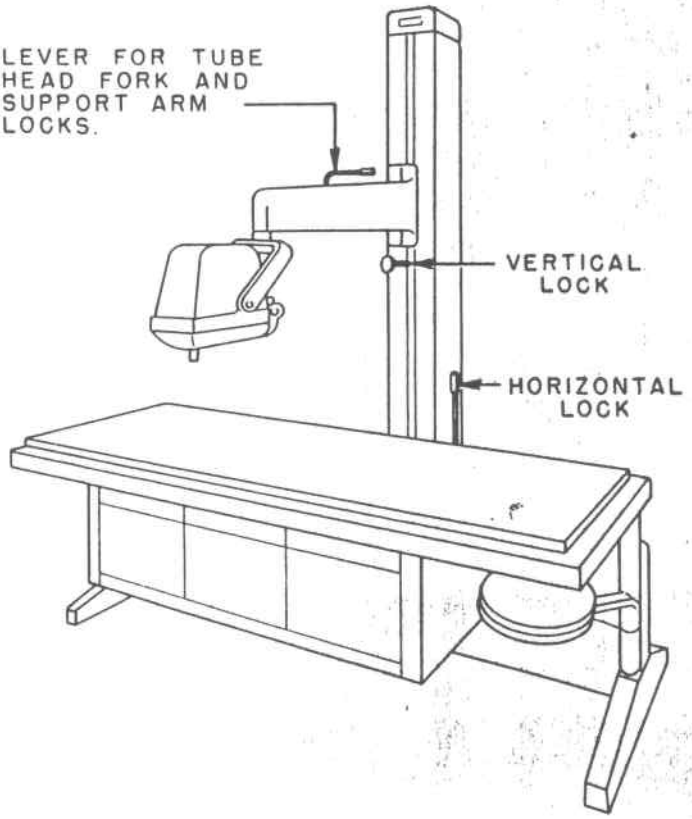
The switch located on the face of the timer proper has OFF and ON positions. When placed in the OFF position, the timer contacts are open. To set the timer, place the lever on the face of the timer in the OFF position.

The movable ring has a thumb clip for positioning the black arrow for settings of additional time in seconds on the same outer dial. Thus, for a 4-1/2 minute exposure, turn the knob until the red arrow is indexed with the notch for the four minute mark on the outer dial. Then, an added thirty seconds is set by moving the outer ring around until the black mark is opposite the thirty second point on the outer dial.

After a prescribed sequence of operations (see below) the lever is moved to the ON position. This movement closes the timer contacts.

The timed interval begins and when the preset time has elapsed the OFF-ON switch will automatically be shifted to the OFF position. The X-ray tube head will be de-energized and the treatment terminated.

J. The X-ray "ON" Switch is used to initiate the X-ray exposure. When the switch is depressed the primary contactor closes to energize the X-ray tube head.



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LOCKING DEVICES

Operation of Locking Devices

There are four mechanical locks which control the movement of the tube stand and tube head. The location and function of each are described below. They are shown on the sketch captioned "Locking Devices".

The locks for both the tube head fork and support arm are operated by a single lever on top of the tube support arm. Move the lever forward to release the locks and move it towards the rear to apply them.

The lock for the vertical travel of the tube head is operated by a knob located just below the tube support arm pivot on the tube stand. Clockwise rotation applies the lock. Counterclockwise rotation releases it.

The lock for horizontal travel of the tube stand is operated by a lever located on the right side of the tube stand at table level. Move the lever forward to release the lock. Move it towards the rear to apply it.

OPERATING PROCEDURE

The following step-by-step procedure should be carefully adhered to in order to obtain the maximum in service and satisfaction from the use of the equipment. Each prescribed step of operation is supplemented by an explanation of the normal result to be expected through that step. In the event of any abnormal results, a representative of the X-Ray Department, General Electric Company should be consulted.

The line safety switch should be equipped with fuses of the proper capacity, viz:

Line Voltage	*Frequency*	*Fuse Size*
100-130 V.	*50 or 60 cycles*	*20 amps.*
190-250 V.	*50 or 60 cycles*	*10 amps.*

Insert the fuses in the line safety switch. Direct the X-ray unit so that radiation is not incident upon operating personnel. Before closing the line safety switch, place the controls as indicated in the following table.

Control	*Position or Reading*
Kilovolt Selector	O
Filament Control	O
Line Switch	OFF
Timer Switch	OFF
Lock Switch	Locked (position where key can be removed)
Timer	Any value other than O

WITHOUT PATIENT IN POSITION

1. Close ***TREATMENT ROOM DOOR*** so as to actuate the ***DOOR INTERLOCK.***

2. Move the ***WALL LINE SAFETY SWITCH*** from ***OFF to ON.*** This provides power to the line terminals of the combination line switch and circuit breaker.

3. Move the ***COMBINATION LINE SWITCH AND CIRCUIT BREAKER*** from the ***OFF*** to ***ON position.***

The red pilot light for the line switch will go on; the auto-transformer is energized; the air

circulator and oil circulator in the tube head will begin to operate. If the filter is not installed, the filter light will blink.

4. Check the operation of the ***FILTER INDICATING LIGHT*** by first inserting and then removing the filter.

   A small switch is located in the filter box assembly. As long as there is no filter in place the switch closes the flasher circuit and the filter indicating light will blink. Insertion of a filter opens this switch, thus turning off the light. There is no substitution for a personal, visual check to determine the presence or absence of a filter. ***CAUTION: Because the difference between filtered and unfiltered radiation is great, injury to the patient is possible if treatment with no filter takes place, i.e., when the treatment technic calls for a filter to be used.***

5. Insert the ***LOCK SWITCH KEY*** and unlock the switch.

   The kvp meter will indicate kvp if the kilovolt selector has been set. The filament of the X-ray tube will be energized. ***CAUTION! filament evaporation takes place all the time that the filament is energized.*** To obtain maximum life do not unnecessarily burn filament during long standby periods. The timer motor will start. Actual timing will not begin until the X-ray ***"ON"*** button has been depressed.

6. Adjust the ***KILOVOLT SELECTOR*** until the ***KVP METER*** approximates the desired value.

   A primary voltage is selected which will result in the kvp indicated.

7. The ***FILAMENT CONTROL*** should be positioned at zero. Check.

   With a zero setting the filament control is positioned for maximum resistance. Effectively this setting reduces the tube current to a minimum.

8. Set the red and black arrows of the ***TREATMENT TIMER*** for an interval of five minutes.

   This is in preparation for a 5 minute initial "warm-up" period.

9. Move the ***OFF-ON*** switch on the ***TREATMENT TIMER*** to the ***ON*** position.

   When the exposure is initiated by the X-ray ***ON*** switch the timer clutch will be engaged and the five minute timing interval set in step 8 will begin.

10. When the ***X-RAY ON*** switch is depressed it will initiate the X-ray exposure.

    The primary contactor closes to energize the tube head.

11. Adjust both the ***KILOVOLT SELECTOR*** and the ***FILAMENT CONTROL*** until the desired values are obtained.

12. The ***TREATMENT TIMER*** will automatically terminate the X-ray exposure at the end of the five minute interval. Should it become necessary for any reason to terminate the exposure before the end of the five minute interval, move the ***OFF-ON*** switch on the timer to the ***OFF*** position.

    When the timed interval is terminated the timer contacts will open and in turn they will open the contactor circuit. For succeeding treatments during the day the aforementioned initial five minute warm-up period will not be necessary.

WITH PATIENT IN POSITION

13. Close the ***TREATMENT ROOM DOOR*** so as to actuate the ***DOOR INTERLOCK.***

14. Set the arrows of the ***TREATMENT TIMER*** for the desired interval.

15. Move the ***OFF-ON*** switch on the ***TREATMENT TIMER*** to the ***ON*** position.

16. Depress the ***X-RAY ON SWITCH.*** Readjust the kilovoltage and milliamperage, if necessary, to the desired values.

17. When the treatment time has elapsed, the ***TREATMENT TIMER OFF-ON*** switch will automatically move to the ***OFF*** position.

18. Turn the ***FILAMENT CONTROL*** to the zero position. This action will aid to conserve the filament life of the X-ray tube.

19. Turn the ***LOCK SWITCH KEY*** to the ***OFF*** position and remove the key from the lock. When

the lock is in the ***OFF*** position and the key is removed from the lock the unit becomes inoperable.

20. If it is desired to give a series of treatments, leave both the ***LINE SAFETY SWITCH*** and the ***COMBINATION LINE SWITCH AND CIRCUIT BREAKER*** in the ***ON*** position. At the conclusion of a series of treatments, let the air circulator remain on for at least two minutes. Then move both switches to the ***OFF*** position.

Cooling of the tube head is accomplished by means of the air and oil circulators. Operation of the circulators between treatments results in an effectively longer duty cycle.

MAINTENANCE PROCEDURES

CAUTION: This equipment is electrically safe when used according to instructions. Only properly trained and qualified personnel should be permitted access to the internal parts. In any event be sure the line safety switch is opened before access to any internal parts is attempted.

The Air Blower

The bearings of the air blower should be oiled once every six months. The air blower housing must be removed to oil these bearings. Fill each bearing with a good grade mineral oil. Replace blower housing.

GENERAL ELECTRIC SERVICE AVAILABLE

General Electric Company, X-Ray Department, and its associates, maintain a world wide organization of stations from which the assistance of skilled technicians, especially trained in X-ray problems, may be obtained. You are invited to consult with the nearest General Electric Company, X-Ray Department, representative whenever problems arise.

Available to G-E X-ray equipment owners is an exclusive program – Planned Maintenance Service (PMS). It provides for regularly scheduled checks, including replacement of parts as required, and emergency service, free of labor charges – all at a fixed rate plus the cost of the parts. This program will insure dependable performance of your unit, reduce to a minimum the downtime due to inopportune breakdowns, and extend equipment life. Your G-E Representative will be glad to discus this plan with you.

GENERAL ELECTRIC X-RAY TUBE WARRANTY

This warranty is supplied separately.

GENERAL ELECTRIC COMPANY

X-RAY APPARATUS WARRANTY

General Electric Company makes the following warranty with respect to X-ray apparatus, supplies and accessories which bear the General Electric trademark. This warranty does not include X-ray tubes, Kenotrons or other electronic tubes.

The Company warrants to the Purchaser that the apparatus, supplies or accessories to be delivered hereunder, will be free from defects in material, workmanship and title and will be of the kind and quality designated or described in the contract. The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral or implied (including any warranty of merchantability or fitness for purpose). If it appears within 6 months from the date of shipment by the Company that the apparatus, supplies or accessories delivered hereunder do not meet the warranties specified above and the Purchaser notifies the Company promptly, the Company shall thereupon correct any defect, including non-conformance with the specifications, at its option, either by repairing any defective part or parts or by making available at the Company's plant, a repaired or replacement part or additional supplies of an equal amount. If the Company installs the apparatus, said 6 months shall run from the completion of installation provided same is not unreasonably delayed by Purchaser or Purchaser's Agent. The conditions of any test shall be mutually agreed upon and the Company shall be notified of, and may be represented at, all tests that may be made. The liability of the Company to the Purchaser (except as to title) arising out of the supplying of said apparatus, supplies or accessories, or it or their use, whether on warranty, contract, negligence, or otherwise, shall not in any case exceed the cost of correcting defects in said apparatus, accessories or supplies as herein provided and upon the expiration of 6 months, all such liability shall terminate. The foregoing shall constitute the sole remedy of the Purchaser and the sole liability of the Company.

With respect to products and supplies to be delivered hereunder which do not bear the General Electric trade-mark, the Company acts solely as a distributor or reseller. The Company makes no warranty or representation, either express or implied concerning such products or supplies. The Company makes no warranty of merchantability or fitness for purpose. The liability of the Company to the Purchaser arising out of the sale or supplying of such products or supplies, whether on warranty, contract, negligence, or otherwise, shall not in any case exceed the cost of replacing defective product and supplies and upon expiration of 6 months, all such liability shall terminate. The foregoing shall constitute the sole remedy of the Purchaser and the sole liability of the Company.

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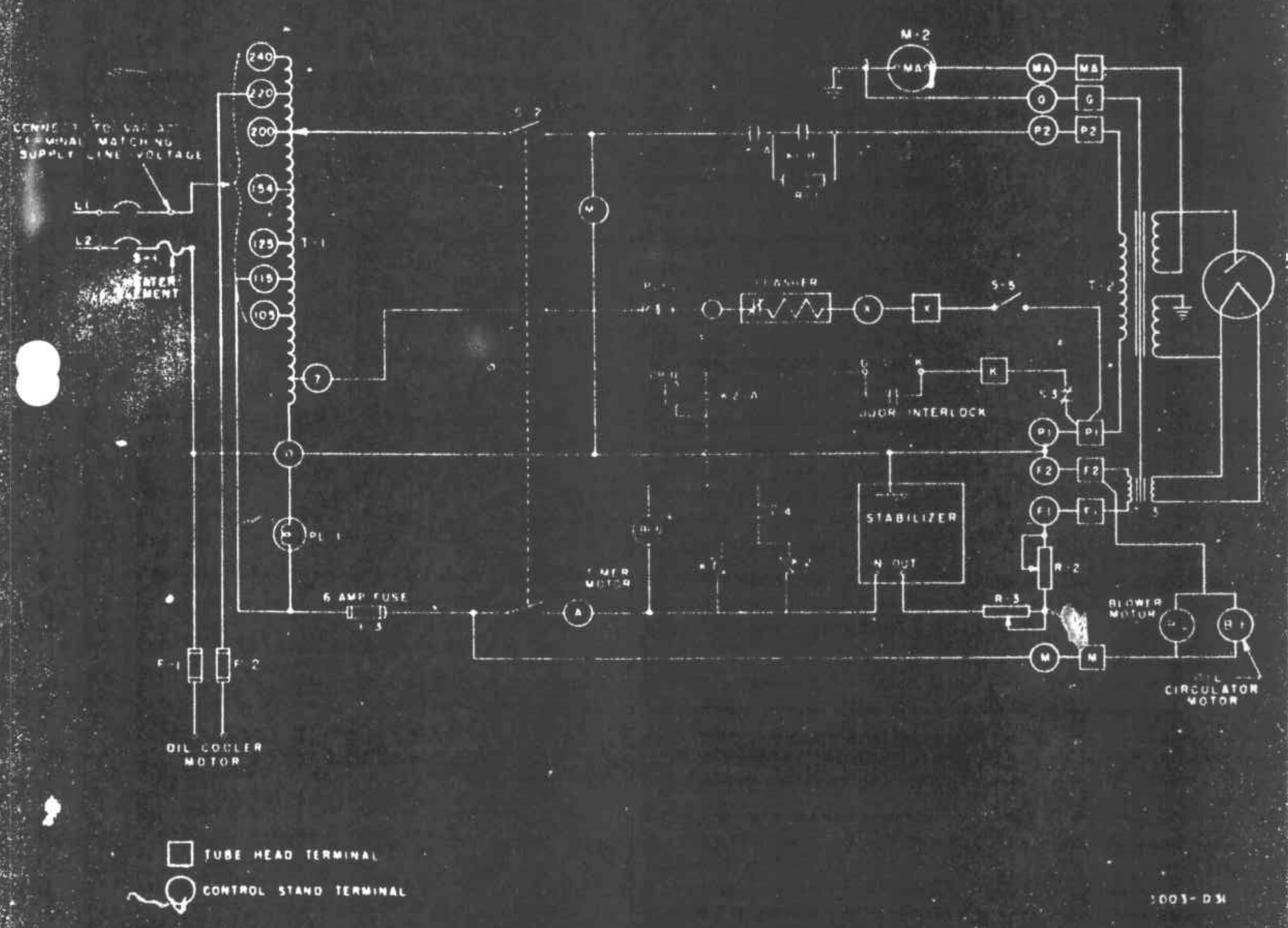
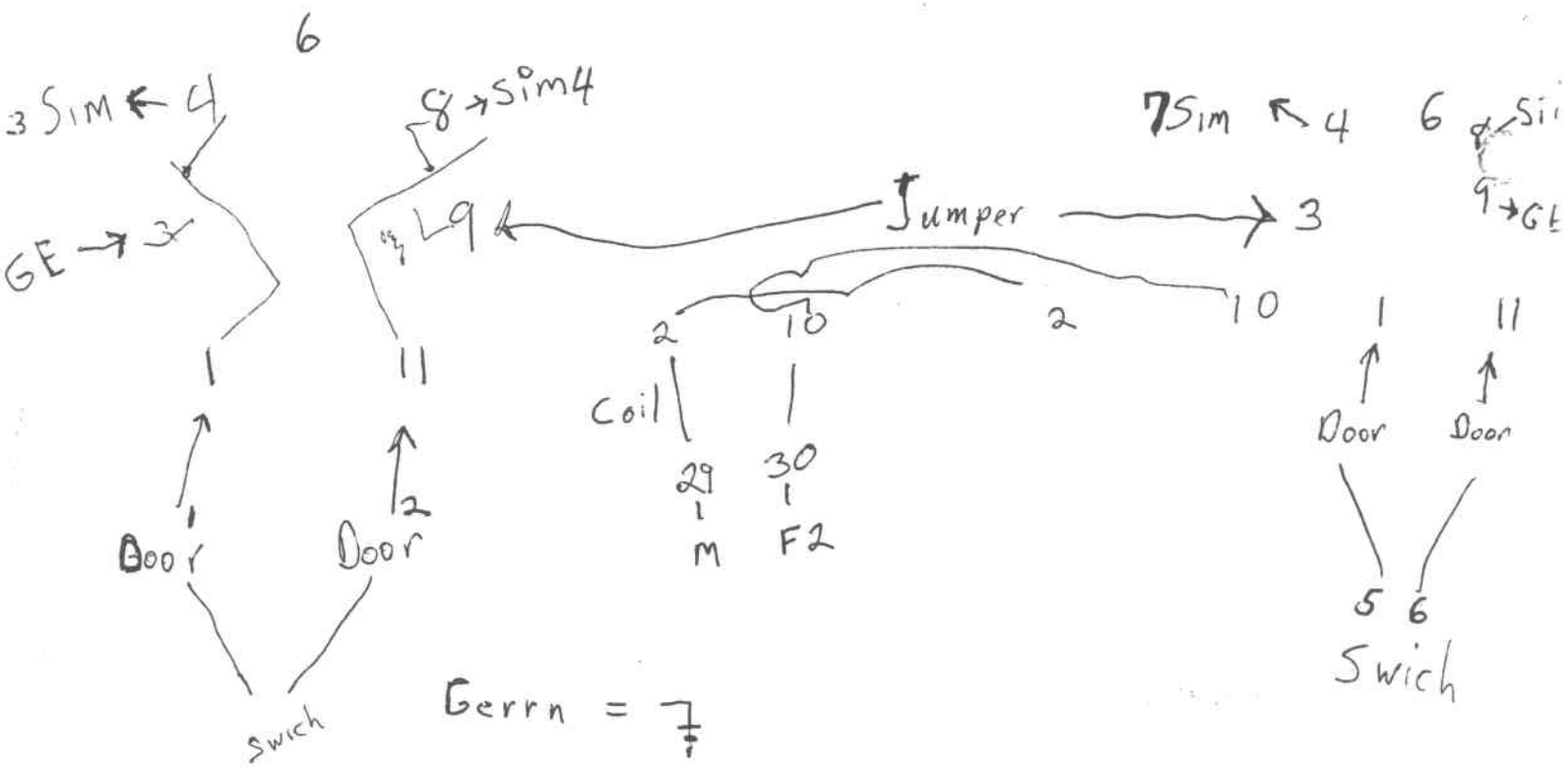
... use any wire size less than #12 ... for all ... conductors will be satisfactory ... wire be used. (The use of standard wire ... of solderless lugs.

1-1/4 inch long.

19. Leave the vertical carriage at the top of the column ... the bottom of the column so that the cable has tension ... order at this point because of the weight of the counter...



MAXIMAR 100



Gerrn = ⏚

K = 34

P1 = #10 Red

P2 = #10 Blue

F1 = 36

F2 = 37

M = 39

MA = 33

X = 35

Red Light Hot = 28

Neutral = 27