

RHF100/40+

Operating Instruction Manual

Ver. 1.0

This special purpose portable equipment is for diagnostic radiography only.
It is not designed, nor does it meet, the standards for any other use.

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Thank you for purchasing your **RHF100/40+** portable veterinary x-ray unit. We are confident that you will be pleased with the radiographs you make with this model. This excellent unit will give you many years of

reliable service. Please read this manual completely before using your *RHF100/40+*. We always welcome your comments and suggestions.

1.0 NOTICE FOR SAFETY OPERATION

1. Only the person who has license of radiograph (e.g. doctor, X-ray technician, etc.) can operate this equipment.

All kinds of X-ray equipment should be operated by person who has qualification from government.

2. The following precautions must be taken to insure the proper installation;
 - 1) Do not install the equipment to place where is splashed.
 - 2) Do not install the equipment to place where is influenced by atmospheric pressure, temperature, humidity, ventilation, sunshine, dust, air containing salt or sulfur.
 - 3) Pay attention to circumference (e.g., inclination, vibration, shock by transportation, etc.).
 - 4) Do not install in warehouse of chemical products or gas occurrence place.
 - 5) Pay attention to hertz, voltage and current (or power consumption) of power supply.
 - 6) Earth the ground terminal correctly.
3. Before using the equipment, the following precautions must be taken;
 - 1) Check connection of switch, polarity, setting of dials, meters. And confirm the equipment works correctly.
 - 2) Make sure ground terminal is connected correctly.
 - 3) Make sure all cords are connected correctly and safely.
 - 4) Do not use several equipment at once to avoid incorrect diagnosis.
 - 5) Check surroundings of the equipment to avoid patients touch the equipment directly.
 - 6) Check power supply is proper.
4. During use of the equipment, the following precautions must be taken;
 - 1) Save total time of exposure as less as possible.
 - 2) Take care with the equipment and patient fully during taking X-ray.
 - 3) When any problem has occurred especially for patient, stop using the equipment immediately.
 - 4) Pay attention to patients as they never touch the equipment.
5. After use of the equipment, the following precautions must be taken;
 - 1) According to procedures, turn off main power after putting back switches and dials to the initial position.
 - 2) Remove plugs correctly (never pull only cords by force).
 - 3) Pay attention to location of storage.

Do not store to place where is splashed.

Do not store to place where is influenced by atmospheric pressure, temperature, humidity, ventilation, sunshine, dust, air containing salt or sculpture.

Pay attention to surroundings (e.g., inclination, vibration, shock by transportation, etc.)

Do not store in warehouse of chemical products or gas occurrence place.
 - 4) Concerning accessories put them back in order after cleaning up.
 - 5) Clean up equipment for correct work on next time.
6. If there are any troubles, do not operate by yourself. Please leave it and call your dealer for repair.
7. Never modify by yourself.
8. Maintenance
 - 1) Equipment and parts should be checked regularly.
 - 2) When use equipment after a long interval, check whether or not it works correctly and safely.
9. Operate the equipment correctly according to the Instruction Manual.

2.0 INTRODUCTION

RHF100/40+ is constant potential X-ray equipment utilizing the latest high frequency resonant inverter system.

RHF100/40+ has the following special features;

1. By using HIGH FREQUENCY RESONANT INVERTER, output is bigger than conventional model and X-ray tube voltage is constant.
2. Compared with conventional generator, the waveform can be more than 2.5 times of exposure as effective.
3. kV and mA are corrected and stable by automatic feedback circuit.
4. Focal spot size is 1.2 mm only. So, quality of X-ray image is almost the same or better than X-ray image taken by bigger stationary X-ray unit.
5. Very easy to carry by hand because of small size and lightweight.
6. By only connect to wall socket, it becomes ready to exposure.
7. kV can be set each 2 kV from 40 kV to 100 kV. kV, mAs and sec. are indicated on CONTROL PANEL in digital.
8. Five setting data can be memorized by Memory storages system.
9. X-ray exposure can be confirmed by buzzer, X-ray ON lamp.
10. The unit incorporates adjustable Dual Laser Pointers (model LP4) in the light beam collimator to indicate the central ray and the pre-set source-to-image distance (SID).
11. The unit allows you to select either exposure time or mAs display on the control panel.
12. As RHF100/40+ is using high voltage, please read this Instruction Manual carefully prior to operation.

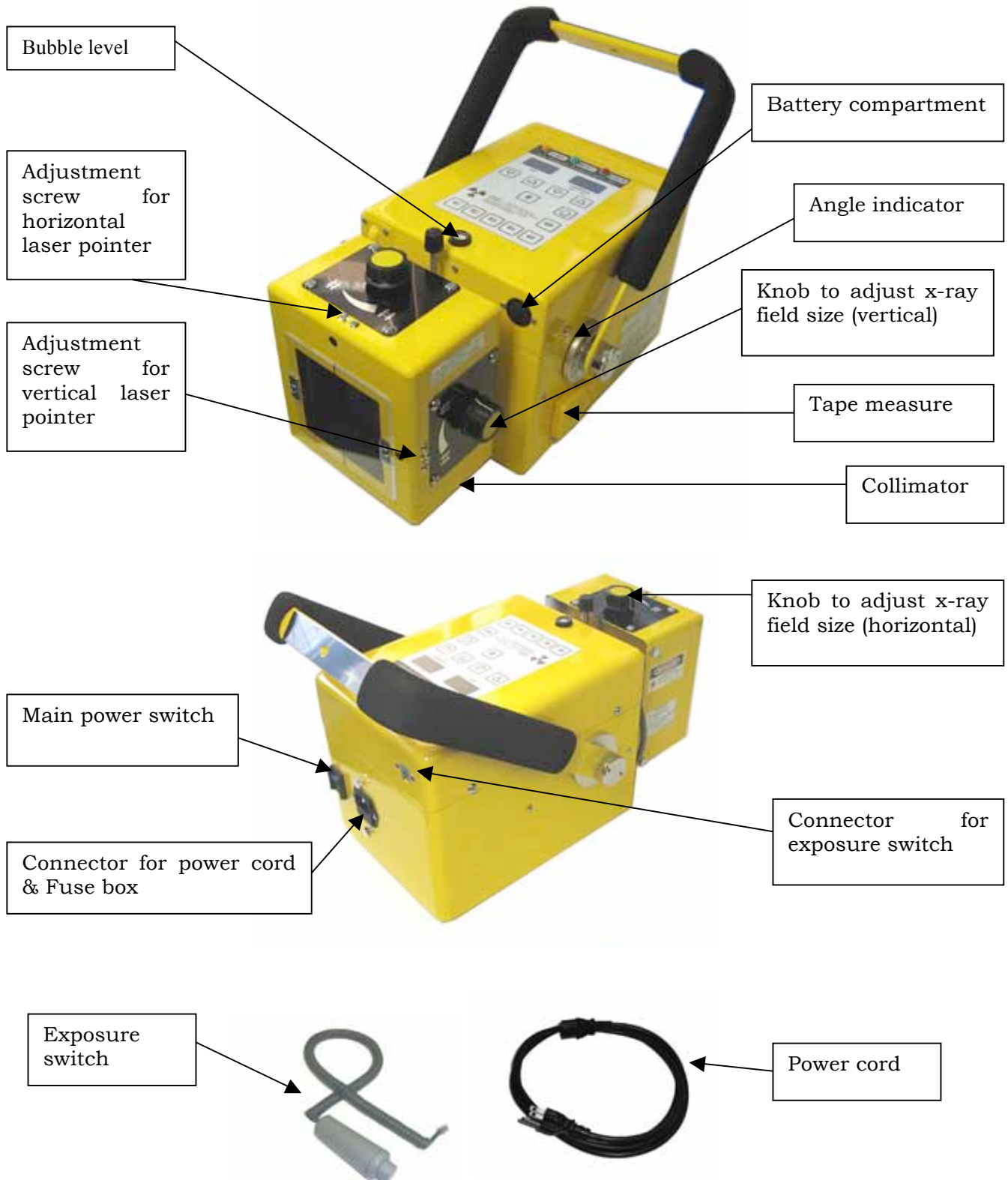
3.0 NOTES TO USERS

1. RHF100/40+ has been developed specially for portable X-ray equipment for radiograph. So, use only for this purpose.
2. Exclusive wall socket of 15A (Minimum) is recommended.
3. Be sure to earth the ground terminal.
4. Use at the place where X-ray is never leaked.
5. During operation, insure that operator is fully protected from radiation.
6. For obtaining good quality of X-ray film, conditions of X-ray film and developer are very important. So, take care of especially temperature and oxidation of developer.
7. It is possible to take X-ray at shorter exposure time by using RARE EARTH FILM SYSTEM.
8. Concerning other notes on operation, please refer the OPERATING PROCEDURES.

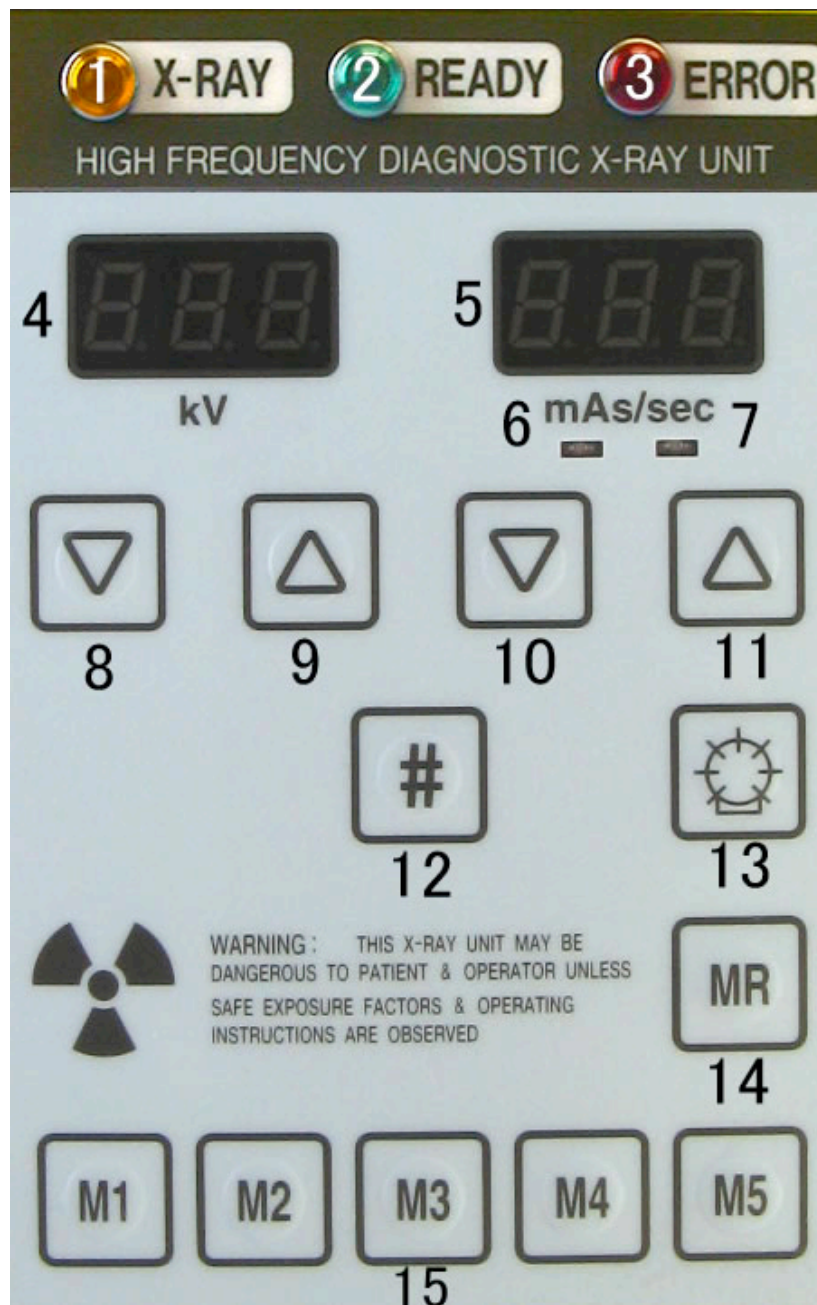
4.0 COMPONENTS

	<u>Q'ty</u>
1. X-ray equipment	1 set
2. Power cord	1 pc
3. Hand switch & cord (exposure)	1 pc
4. Instruction manual	1 pc
5. Spare Fuse	4 pcs

5.0 MAIN PARTS OF RHF100/40+



6.0 CONTROL PANEL OF RHF100/40+



1. X-ray Indicator
2. Ready Indicator
3. Error Indicator
4. kV Indicator
5. Exposure time (sec)/mAs Indicator
6. mAs Indicator
7. sec Indicator
8. kV Adjustment Button (-)
9. kV Adjustment Button (+)
10. sec/mAs Adjustment (+)
11. sec/mAs Adjustment (-)
12. Shift Button
13. Collimator light switch
14. Memory Storage Button
15. Memory Recall Buttons (M1 to M5)

7.0 LASER ALIGNMENT INSTRUCTIONS

Before using the Dual Laser Pointers, you must adjust the position of the two laser beams to indicate the central ray of the x-ray unit at the source-to-image-distance (SID) you typically use. The adjustments can be made with a phillips (+) screw driver.

Set up the x-ray unit indoors at the SID you typically use, pointing to a wall or x-ray cassette. Use the tape measure attached to the x-ray unit to confirm the correct SID.

The adjustment screws for the two laser beams are on the top and side of collimator. (See photo below)

Connect the main power cord to the x-ray unit and to an electrical outlet with the same voltage for which your x-ray unit is rated. Turn on the MAIN POWER SWITCH. Turn on the collimator light and laser beams together by pressing the COLLIMATOR LIGHT ON BUTTON on the control panel, or the first stage of the EXPOSURE SWITCH. Make sure that the cross hair projected by the collimator lamp indicating the central ray is visible at this SID.

Use the screwdriver to turn the adjustment screw for each laser beam to calibrate its position on the wall or x-ray cassette at your typical SID. One laser projects a horizontal beam (--). The other laser projects a vertical beam (|).

One screw adjusts the laser beam UP and DOWN. Turning this screw clockwise adjusts the laser beam DOWN. (The adjustment screw is located on the side of the collimator.)

The other screw adjusts the laser beam RIGHT and LEFT. Turning this screw clockwise adjusts the laser beam LEFT. (The adjustment screw is located on the top of the collimator.)

When you have finished adjusting the position of the laser beam, a laser cross (+) will be visible on the wall or x-ray cassette, superimposed on the cross hairs projected by the collimator lamp.

NOTE: The Laser Pointers have been adjusted at the factory to the central ray at a SID of 70 cm. The range of available adjustment of the Laser Pointers is 50cm – 100cm SID.

WARNING: DO NOT LOOK DIRECTLY INTO THE COLLIMATOR WHEN THE DUAL LASER POINTERS ARE ENERGIZED. PERMANENT EYE DAMAGE MAY RESULT.



8.0 OPERATING PROCEDURES

Connection

Connect POWER CORD and EXPOSURE CORD to main body. Connect POWER CORD PLUG to grounded electrical outlet of proper voltage, amperage, and hertz. Check the rating label on your unit to confirm the proper input voltage.

Operation

1. Press MAIN POWER SWITCH on the rear panel to the on position. Each digital display on the control panel will illuminate. The RHF100/40+ is now ready to use.

CAUTION

DO NOT SWITCH THE MAIN POWER ON AND OFF QUICKLY IN A SHORT TIME WHEN TURNING ON AGAIN AFTER TURNING OFF, WAIT FOR AT LEAST 1 MINUTE. OTHERWISE THE HIGH FREQUENCY INVERTER CANNOT WORK PROPERLY.

2. Select the kV output by pressing the arrows below the kV display to choose the range of 40kV to 100kV, as desired. Increments are 2kV.
3. Set the exposure time for the view to be taken, and the imaging medium used. Press the arrows below the sec. display to choose the exposure time between 0.01 and 1.5 second exposures. The display can be changed between mAs and sec. selected by pressing the shift button (#) and pressing the down arrow (▽) below the kV display.
4. Use the retractable tape measure to position the RHF100/40+ at the proper source-image distance (SID) for the image to be taken.
5. Turn on the collimator light by pressing the button on the control panel. The light will remain on for approximately 45 seconds, and then automatically turn off. The shutters of the collimator can be adjusted at any time with the 2 knobs on the collimator. The size of radiation field will only be projected on the image receptor when the light is on.
6. Position the patient. Adjust the collimator position so the cross hair projected by the collimator light is aligned with the anatomical point of interest and the center of the image receptor. Collimate the size of the light field so that it stays within the dimensions of the image receptor.

7. Radiography

Make sure that ERROR INDICATOR is off.

The exposure switch has 2-stage button.

The first stage pre-heats the filament of the x-ray tube. When this stage alone is depressed and held, the "READY" indicator will light after 2.5 seconds, indicating the filament was heated and the unit is ready to generate x-rays.

The second stage initiates the x-ray exposure for the time set in the sec display. When the second stage is fully depressed, x-ray will be emitted, the X-RAY indicator will light, and an audible signal will be heard. **PRESS AND HOLD THE FIRST AND SECOND STAGE BUTTONS TOGETHER UNTIL THE EXPOSURE HAS TERMINATED.** This is a "dead man" exposure switch -- x-ray exposure will terminate immediately as a safety feature when the buttons are released.

It is possible to depress the two stage buttons simultaneously. When this is done, there is approximately a 2.5 second delay before the timed x-ray exposure begins.

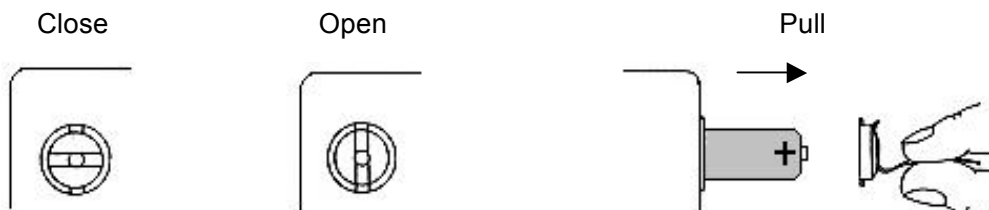
8. After each exposure, release the exposure buttons. The RHF100/40+ is now ready for the next exposure.

Error lamp will blink if the exposure switch is released before the set exposure time. To reset the error lamp, turn off the main power switch, and turn on again after 60 or more seconds.

Operation Note: To insure maximum life of x-ray tube and to avoid interruption of operation, do not exceed duty cycle of 1:60.

9. When you are finished using the RHF100/40+, turn off the main power switch. All of the indicators on the control panel will turn off after several seconds.
10. Five different exposure technique settings can be stored in memory for quick recall on the RHF100/40+. To store a technique setting, press the Memory Storage button MR then press Memory Recall button M1. This will store the technique setting displayed in memory position M1. Repeat this process for storing the different technique settings in M2-M5 as desired. Stored technique settings can be easily recalled by simply pressing M1-M5.
11. Memory Storage uses two (2) size AA alkaline batteries inside Battery Compartment, located on the back side of equipment. Open the Battery Compartment using a coin, turning the compartment lid counterclockwise 90°. If there are no batteries in the Battery Compartment, use some adhesive tape to help you remove the compartment lid.

Insert two (2) size AA alkaline batteries in the Battery Compartment, with the + end toward the Battery Compartment lid. Reattach the Battery Compartment lid and lock it with a coin, turning it clockwise 90°.



9.0 PRECAUTIONS IN USE OF X-RAY DEVICE

Attentions in using X-ray tube :

In the case the x-ray unit is not use for a while, the aging is needed for the x-ray tube.

After long storage, inside gas from the components of x-ray tube would release into the tube, which may leads to abnormal discharges. To reduce exposure problems and prolong X-ray tube life span, perform below warm up procedures:

1. Perform below procedures if X-ray devise is idle (more than 1 week).
First, make sure the collimator is fully closed and no un-necessary people stand close to the X-ray devise.

1-1. Set to Lowest kV, Exposure Time = 0.2 sec. Take 5 exposures, each interval = 12 sec.

1-2. Set to highest kV, Exposure Time = 0.2 sec. Take 2 exposures, at interval = 12 sec.

By following 1-1 & 1-2 warm up procedures, the X-ray devise can be kept in optimal operating condition.

2. First time use, or devise is idle for more than a month, refer to below warm up procedures. First, make sure the collimator is fully closed and no un-necessary people stand close to the X-ray devise.

2-1. Set to Lowest kV, Exposure Time = 0.2 sec. Take 10 exposures, each interval = 12 sec.

2-2. Set to Medium kV, Exposure Time = 0.2 sec. Take 10 exposures, each interval = 12 sec.

2-3. Set to Highest kV, Exposure Time = 0.2 sec. Take 5 exposures, each interval = 12 sec.

By following 2-1~2-3 warm up procedures, the X-ray devise can be kept in optimal operating condition.

X-ray Tube operating environment: 10~40°C,700~1060hPa. If the X-ray devise has stored beyond such range, make sure the unit is sit in long enough for all components are within operating range. Then perform above warm up procedure 2.

10.0 ERROR INDICATOR

RHF100/40+ has an ERROR INDICATOR. If the ERROR INDICATOR is on, stop exposing and follow the step below. The unit has malfunctioned and x-ray cannot be generated.

If ERROR INDICATOR is lit even after the EXPOSURE SWITCH is released, it means an unusual situation has occurred. Turn off the MAIN POWER SWITCH, wait 3 minutes, then start procedures over again.

If the ERROR INDICATOR remains on, contact your dealer for service.

11.0 SPECIFICATIONS

Rating

Nominal Line voltage	Single-phase, 200VAC-240VAC, 50/60Hz
Safety operating line voltage (no load)	Single-phase, 180VAC-264VAC, 50/60Hz
Line voltage regulation	4%
Apparent resistance of supply mains	0.65ohms
Maximum Standby Input current	0.20A
Protection against electrical shock	Type B, Class I
Mode of operation	Continuous operation with intermittent loading
Duty cycle	1 : 60 (1 sec. On, 60 sec. Off)
Fuse	8A @ AC250VDC

X-ray Generator

Generator system:	60kHz resonate high frequency inverter system
Output range	40 to 60kVDC@ 40mA 62 to 70kVDC@ 35mA 72 to 80kVDC@ 30mA 82 to 100kVDC@ 25mA
Exposure timer	0.01-0.4 sec. 0.01 sec.step, 40 steps 0.4-1.0 sec. 0.02 sec.step, 30 steps 1.0-1.5 sec. 0.05 sec.step, 10 steps (total: 80 steps)
Electric power	2.5 kW@ 100kVDC, 25mA
Maximum deviation from fixed factors	Tube potential $\pm 10\%$ Tube current $\pm 10\%$ Exposure time $\pm(10\%+1 \text{ msec})$
Leakage technique factors	0.41 mA @ 100kV 0.41 mA is a maximum rated continuous current for 25 mA with duty cycle 1:60
Inherent filtration	2.2 mm Al equivalent
Total filtration	2.7 mm Al equivalent (with collimator)

X-ray Tube

Manufacturer	TOSHIBA
Type	D-124
Focal Spot	1.2 mm
Anode heat storage	20 kHU
Target material	tungsten
X-ray tube inherent filtration	at least 0.8mmAl

Collimator (Beam Limiting Device)

Manufacturer	Mikasa X-ray Co., Ltd.
Type	R-200V (L03)
Filtration	0.5mmAl

Dimension and weight	240mm (W) x 360mm (L) x 196mm (H) 11.2kgs
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Environmental conditions for transport and storage

Ambient temperature range	10 - 40°C
Relative humidity range (including condensation)	30% -75%
Atmospheric pressure range	700hPa -1060hPa

Warm up procedure

It is imperative that this equipment should follow this warm up procedure after transport or storage under -30°C. The equipment should be operated only after 12 hours of warm up storage at 10~40°C. No exposure should be made during this warm up period.

Cooling procedure

It is imperative that this equipment should follow this cooling procedure after transport or storage above 70°C. The equipment should be operated only after 12 hours of cooling storage at 10~40°C. No exposure should be made during this cooling period.