SELF CONTAINED
X-RAY BLOOD IRRADIATOR



SOCIETY FOR APPLIED MICROWAVE ELECTRONICS ENGINEERING AND RESEARCH
R&D laboratory of Ministry of Electronics and Information Technology,
Govt. of India, IIT Campus, Powai, Mumbai : 400076, India
Tel. +91-22-2572-4699 | E-mail : dg@sameer.gov.in | Website : www.sameer.gov.in

SELF CONTAINED X-RAY BLOOD IRRADIATOR

The Self Contained X-Ray Blood Irradiator is a medical device which uses x-rays to irradiate blood to prevent the risk of Transfusion Associated-Graft Versus Host Disease (TA-GVHD) during transfusion. The device can deliver the clinically recommended central dose of 25 Gy (minimum) in about 6 minutes. The cellular blood components are irradiated prior to transfusion to prevent the proliferation of viable T lymphocytes which are the immediate cause of TA-GVHD. It is a completely self-shielded system and does not require any special radiation shielded facility. The American Association of Blood Banks (AABB) recommends a dose of 25 Gy to the central area of the component with no portion receiving <15 Gy.

- No radioactive gamma sources involved



- No nuclear disposal requirements



- No additional safety equipment for laboratory staff



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TECHNICAL SPECIFICATIONS

PHYSICAL DIMENSIONS

WEIGHT: 1000 kg

DIMENSIONS: 1240(L)x1510(H)x1090(D) mm

ELECTRICAL REQUIREMENTS

380-440 V AC,

50/60 Hz three phase,

40A maximum

IRRADIATION

BLOOD IRRADIATION GUIDELINE: Min 15 Gy,

Central Dose Min 25 Gy, Max 50 Gy

AVERAGE DOSE RATE: ≈ 5.2 Gy/min

TIME FOR 31 ± 2 Gy (at center):

6 mins at 5.2 Gy/min

DOSE UNIFORMITY: ≈ 1.6 – 1.7

COOLING

Self-contained cooling system

no external water supply required

RADIATION PROTECTION

Lead shielding, alarm and safety interlocks

LEAKAGE: Less than 1μSv/hr measured at 5 cm from the external surface

PHOTON ENERGY

Max energy 225 keV

(effective 65-85 keV)

Bremsstrahlung Radiation

CANISTER FEATURES

CANISTER MATERIAL: Air-equivalent material

CANISTER DIAMETER: 120 mm

CANISTER LENGTH: 120 mm

CAPACITY: 2 Blood Bags (350 mL each)

WARRANTY

Two years after system installation

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SUBSYSTEMS

- **X-RAY TUBE**

  The X-Ray tube is the X-Ray source for blood irradiation. X-rays are a form of ionizing radiation used for the inactivation of T-lymphocytes in donor blood to prevent the risk of TA-GVHD during transfusion. X-Rays are produced by directing an electron beam on a Tungsten target, the electrons interact with the nuclei of the target atoms and emit x-rays.

  X-Ray Tube: Comet MXR 225/26

  Tube Voltage: Adjustable between 160-225kV Tube Current: adjustable up to 20mA

  Target: Tungsten Radiation coverage: 40 degrees

  The tube is housed inside a shielding to prevent any leakage radiation

- **IRRADIATION CHAMBER**

  The blood irradiation takes place inside the irradiation chamber, it houses the canister assembly which holds blood bags during irradiation. The irradiation chamber is self-shielded, it has lead walls that prevent any scattered or leakage radiation from escaping during the irradiation process. The radiation shielded irradiation chamber together with the tube shielding make the system self-contained, thus no additional safety equipment is required for the operating staff, the leakage radiation is within the prescribed AERB permissible limit of less than 1µSv/hr measured at any point 5 cm from the external surface.

- **HV GENERATOR**

  The High voltage generator converts low voltage to high voltage required for x-ray tube operation.

- **CHILLER**

  The chiller cools the x-ray tube preventing heating and damage during and between exposures. It needs Demineralized water, operates at a pressure of 50-70 psi and has water temperature between 10 to 30°C.

- **CONTROL PANEL & INTERLOCKS**

  The control panel lets the user interact with the system through the GUI, it consists of controls to adjust various operating parameters and displays the irradiation status. The control unit monitors the health of the system and has necessary interlocks for machine and personnel safety. Blood bags are scanned before irradiation using an attached barcode scanner and a database is maintained.

- **CANISTER ASSEMBLY & DOSIMETRY PHANTOMS**

  The system consists of two canisters- the regular use canister which holds the blood bags during the irradiation and another canister which holds the dosimetry phantoms during the dosimetry procedure. The canisters are made of air-equivalent material. The canister rotates at a pre-decided speed to ensure maximum dose uniformity. Two customized PMMA phantoms are provided for routine dosimetry and Quality Assurance. Film dosimetry is done using the PMMA phantoms and point dosimetry is done at the center of the canister filled with blood bags using ionization chamber.

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