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Scientific and Production Complex of Linear Accelerators and Cyclotrons

NPK "LUTS" NIEFA

LINEAR ELECTRON ACCELERATOR UELR-10-10S

The linear electron accelerator, model UELR-10-10S, is intended for the use as a source of ionizing radiation in the system intended for the radiation sterilization of medical products, other radiological technology processes and researches with a scanned beam of accelerated electrons.



PARAMETERS OF ACCELERATED ELECTRON BEAM

Nominal energy of accelerated electrons, MeV	10
Energy adjustment range, MeV	8-11
Interval of energy adjustment, MeV	1
Average electron beam power in nominal mode, kW	10
Repetition rate of electron beam current pulses, 1/s	12.5, 25, 50, 150, 300
Average power of electron beam, kW	10
Scanning length in 200 mm from extraction window foil, mm	800
Energy spread of the accelerated electron beam for 10 MeV, %	± 3
Short-term and long-term stability of electron beam energy, not more then, %	3
Radiation field uniformity along the scanning length, %	± 5
Scanning frequency of electron beam, 1/s	1-5

LIST OF EQUIPMENT

Description	Dimensions (length×width×height)	Mass
	mm	kg
Cabinet of power supply system	650 × 250 × 800	70
Irradiator	800 × 1200 × 3580	450
Klystron module	800 × 800 × 920	350
Cabinet of pulse power supply system	1350 × 1250 × 2180	650
Cabinet of high voltage power supply system	1580 × 950 × 1660	900
Control system cabinet	615 × 680 × 1770	250
Heat exchanger of irradiator	1205 × 605 × 780	200
Heat exchanger of klystron	1205 × 605 × 780	200
Fore-vacuum pump	600 × 600 × 700	

The equipment of the accelerator is made as several separate modules: the accelerating unit including the electron source, beam current regulator, focusing system, ion high-vacuum pumps, components of waveguide line, sensors of beam current and beam position, scanning and extraction is mounted on a metallic frame in one module, irradiator.

The irradiator is installed vertically above the product transport transport system (conveyer).

RF generator consists of high voltage transformer, high voltage rectifier, klystron module and cabinet of pulse power supply system (Klystron modulator).

Control system cabinet houses control system of accelerator. Computer of control system disposed separately.

Two water-to-water heater exchangers with tubings compose water cooling system of irradiator and Klystron module.

Fore-vacuum trolley TVP-K is a sideline product.

Delivery system includes interconnection cables and connectors, set of spare parts for one year running and technical documentation.

Electrons are emitted by an electron source and a beam of electrons is accelerated in the accelerating diaphragmed waveguide by means of electromagnetic wave. In the process of acceleration the electrons move in diaphragmed waveguide synchronously with frequency of electromagnetic field.

An amplifier klystron KIU-147A operating in the pulsed mode at a frequency of 2856 MHz is a source of electromagnetic energy necessary to feed accelerating waveguide.

The beam of accelerated electrons is a sequence of current pulses of 15μs duration. Each pulse is a sequence of HF pulses with 2856 MHz frequency. Average current of accelerated electrons may be changed by changing pulse repetition frequency. Beam of accelerated electrons is scanned by beam scanning system and then the beam comes from vacuum to atmosphere through Ti foil of outlet window of vacuum chamber of beam scanning system. Scanning length in 200 mm from extraction window foil is 800 mm. Energy adjustment range 8 to 11 MeV. For prompt measuring of electrons energy the movable current collector is used which is positioned behind the outward flange of outlet window

The accelerating structure is a chain of coupled resonators operating in the standing wave mode. It realized electron trapping in accelerating mode, electron bunching, process of acceleration and RF focusing. RF energy is transmitted into the accelerating structure through the vacuum HF window, wave mode transformer located in the middle of the diaphragmatic structure.

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