

80 KW INDUSTRIAL ELECTRON ACCELERATORS
BASED ON RECTIFIER

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The Novosibirsk Institute of Nuclear Physics designs and manufactures industrial accelerators of the ELV family based on high-voltage rectifier. At the Institute a set of unified assemblies and units has been designed allowing the accelerators to have the following parameters:

energy of accelerated electrons 0.4-2.0 MeV
beam power up to - 80 kW.

In the paper presented here the parameters and the design of particular versions of the ELV-type accelerators are described. In addition, the block diagram and the possibilities of computer control system of ELV-type accelerators are given.

The parameters of ELV-type electron accelerators are given in Table 1. Our Institute manufactured more than 30 accelerators of the ELV-type. Most of them are installed in the industrial radiation - technological lines, and a few accelerators are in operation over 15 years.

The ELV-type accelerators are direct-acting continuous-duty high-voltage accelerators. Each of them consists of (Fig. 1): high-voltage rectifier, accelerating tube, injection and focusing system, vacuum system, the system of extraction beam into atmosphere, control system (mini-computer control in envisaged) and supplementary units and blocks. The accelerating voltage generator is a coreless step-up transformer with a sectionalized secondary coil. The secondary (high-voltage) coil of the transformer consists of standard coils which are identical in all versions of ELV-type accelerators. AC voltage applied to each coil is converted to DC voltage with doubling scheme. All the components of doubling scheme are mounted into the coil forming the standard unit rectifying section (Fig. 2). The high voltage rectifier of ELV-type accelerators is a set of these standard rectifying sections.

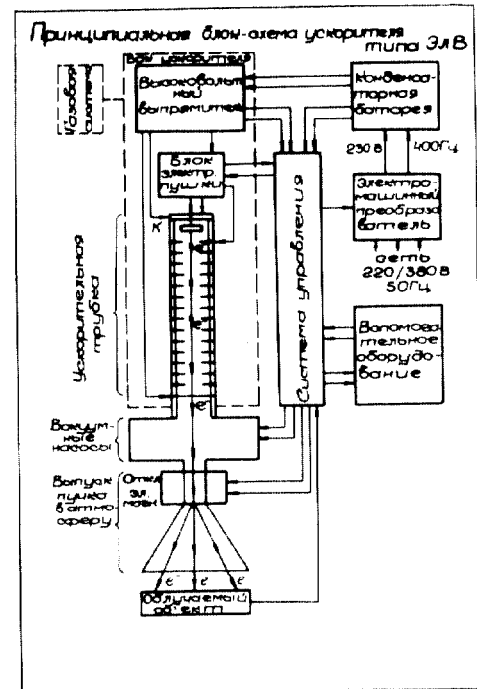


Fig. 1.



Fig. 2.

All the systems of accelerators are unified making the service operations very simple.

The accelerating tube is built in the column of rectifying sections. The electrical field gradient in acceleration system is

about 1 MV/M. There are three type of accelerating tybe:

- electrodes are connected with ceramic by thermodiffusion welding;
- electrodes are glued with ceramic by PWA;
- electrodes are "freezed" - into ceramic.

The accelerating tube is shown in Fig.3.

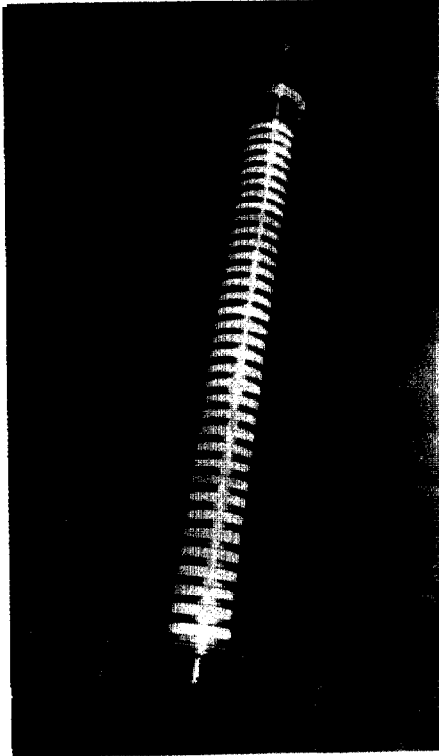


Fig. 3.

Both the rectifier and accelerating tube are housed in a tank filled-in with SF₆ gas. Typically the ELV-type accelerators are designed for installation in vertical position. However, accelerators for installation in horisontal position are available. The accelerators are designed for round-the clock operation with switching off all systems for days off.

The time required to attain rated operating conditions after a short idle time is 5 min, after a long idle time is 1 hour, and after an idle time requiring filling-in with gas of vacuum system - 4 hours. The scheduled maintenance time does not exceed 10% of the calender time.

The accelerators are powered from 220/380 v AC mains at 50 Hz.

The control system based on mini-computer enables one:

- to switch the accelerator on, to bring the accelerator to rated operating conditions, to switch the accelerator off;
- to check the serviceability of all the systems of accelerator during its operation and prior to switching on;
- to provide the visual indication, on RGB-display and terminal, of the basic parameters of the accelerator system;
- to modify and improve the control program.

The ELV-type accelerators are used on radiation-technological lines for:

- radiation modification of polyethylene-insulated cables and hook-up wires;
- manufacturing the heat-shrincable products;
- desinsectization of grain;
- production of artificial leathers;
- production of silicon insulation materials.

Table 1.

BASIC PARAMETERS OF ELV-TYPE ACCELERATORS

Accelerator model	Nominal control range of energy, MeV	Max beam current, mA
ELV-0,5	0,3 - 0,7	30
ELV-1	0,4 - 1,0	50
ELV-2	0,8 - 1,5	25
ELV-3	0,4 - 0,7	100
ELV-4	1,0 - 1,5	40
ELV-6	0,8 - 1,2	70
ELV-8	1,2 - 2,0	50