

Electrolux

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CRYOGENIC COOLING SYSTEMS OF TRANSPORT REFRIGERATORS FOR FOOD PRODUCTS

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In the preservation of agricultural products, an important role is played by refrigeration transport, carrying out the intercity, interregion, and interrepublic exchange of assorted products and their delivery to the consumer. In the last decade, systems for the cooling of refrigerators by liquid nitrogen have been widely adopted abroad. As is shown by foreign experience and by work carried out in the All-Union Scientific-Research Institute of the Cold-Storage Industry (VNIKhI), the "Gellimash" Scientific-Production Association, and the Physicochemical Institute of Low Temperatures of the Academy of Sciences of the Ukrainian SSR, cooling systems using liquid nitrogen have a number of significant advantages in comparison with machine and other cooling systems.

The low boiling point of liquid nitrogen (-196°C) at atmospheric pressure makes it possible to obtain practically any given rates of cooling of vessels before the start of the transport of previously cooled products and after opening of the doors. The time required to attain working conditions ($+5$ to -20°C) is shortened to 10-15 min from the 5-6 h, characteristic for machine-cooling methods.

The replacement of atmospheric air by nitrogen assures a high sanitary state of the loads and makes it possible to slow down the natural oxidation of the products and to retain the structure of the crates and a good commercial appearance of the products. In refrigerators with nitrogen cooling, losses of meat products are decreased by 3-4 times, and the length of their storage is increased by 2-3 times.

Among the operating advantages of systems of liquid-nitrogen cooling there must be mentioned the simplicity of the equipment and its servicing, high reliability, noiselessness, the absence of machines, as well as of problems in thawing and the removal of moisture, and the small operating cost (with taking account of the cost of the nitrogen).

Refrigerators with nitrogen cooling can be arbitrarily subdivided into the following types with respect to the kind of transportation: small-capacity trucks (up to 2 tons) for the intercity transport of small batches of quick-spoiling products from bases to the commercial network and to feed enterprises; refrigeration trucks for the intercity transport of fruits, vegetables, and meat (in sacks, etc.); containers for the transport of products by different modes of transportation (automobile, railroad, river, sea); special refrigeration cars for rail transport.

The "Gellimash" Scientific-Production Association together with a number of organizations (VNIKhI, the Erevan Automobile Plant, VNIPTmash, Giprodizlorod, the "Teplotrsbor" Special Construction and Design Bureau) over the course of a number of years have been carrying out work on the building of liquid-nitrogen cooling systems for refrigerators of the above-listed types. Up to the present time, three cooling systems, characterized by a considerable degree of universality and a high degree of standardization, have been developed, built, and tested. All the systems have an identical fundamental scheme, eliminating the use of pumps for feeding the liquid and blowers for equalizing the temperature over the volume of the truck. In this way simplicity of the scheme, reliability, and an increase in the service life are achieved.

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