TECHNOLOGY

PRODUCTION OF FUELS FOR MARINE ENGINES.
THE VANINO PORT UNIT

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A particular feature of this plant is that in refining crudes of very different composition – West Siberian and Sakhalin, produced on the shelf, it provides for the entire assortment of commercial product of the required quality.

The products of the plant that satisfy the RFP are:

• L, Z, and A diesel fuel according to GOST 305–82;
• marine diesel according to TU 38.1011255–89;
• fuel for stationary power plants in the north (SPPN) according to TU 38.101567–87;
• TSM marine fuel for diesel units according to TU 38.101567–87;
• SVL, SVT, and SVS fuel for marine power plants according to TU 38.1011314–90;
• high end-point fuel (HEPF);
• heating oil according to TU 38.101656–87;
• F-5, 40, and 100 boiler fuel according to GOST 10585–75.

The plan for the plant was developed and “turnkey” implemented by Kedr-89 SIC. The working documents were drawn up at Ukreneftekhimproekt Open Joint-Stock Company (Kiev), the basic process equipment – fractionation towers, reheating furnace, heat-exchange equipment, air-cooling equipment, electric dehydrators, tanks, etc. – were manufactured at Penzhkhimmas OJSC (Penza).

The plant includes: a crude oil dehydration and electric desalting unit (EDU); a diesel fuel, marine fuel, bunker fuel, and boiler fuel production unit; a flare unit of the ground type; a reagent storage and preparation unit; a general plant facilities unit (production of nitrogen, industrial air, air for the measuring and testing system, etc.).

A diagram of the plant is shown in Fig. 1.

The plant is equipped with modern high-efficiency equipment. Valve trays of new designs are used in fractionation towers K-1, K-1/1, K-1/2, and K-2, and two-pass trays with trapezoidal valves distinguished by a wide range of stable operation are used in the atmospheric tower above the feedstock input. Slot trays, highly recommended for low steam and high liquid stream loads, are used in the stripping zone of atmospheric tower K-1. The K-1/1 and K-1/2 stripping towers are equipped with VAKUPAK structured packing with very low pressure loss, and the light diesel fuel cut is stripped in tower K-1/1 by the steamless method.

Stabilization tower K-2 is provided to ensure controllable naphtha saturated vapor pressure; partial debutanizing of naphtha is conducted there. Heat is delivered to the tower still with a horizontal thermal siphon. Hot atmospheric resid from the bottom of tower K-1 is used as the heat carrier. Air coolers are used for vapor
condensation. Uncondensed gases from the reflux tanks in towers K-1 and K-2 are delivered as fuel to reheating furnace P-1.

The reheating furnace, which has a square section in the plan (width: 10.1 m, length: 12.5 m), was developed at Kedr-89 SIC. With respect to the operating scheme, it is of the vertical-flare type: the convection chamber is positioned above the radiation chamber with removal of products of combustion into the stack installed on the furnace. The radiant coil is in the form of a horizontal square double helix and the feedstock stream is ascending. For utilization of stack gas heat, a steam superheater is installed in the convection chamber.

The pipe material is 15X5M steel. The internal diameter is 159 mm for the feedstock coil pipes, 108 mm for the steam superheater pipes, and the wall thicknesses are respectively 8 and 6 mm. The thermal insulation of the furnace is made of light heat-resistant concrete in the form of panels welded to the framing posts and to each other.

There are six GMG-3 gas-liquid burners on the furnace bottom. In refining West Siberian crude, hydrocarbon gas is used as the furnace fuel, while atmospheric resid is used in refining Sakhalin crude.

The plant is equipped with a modern distribution control system.

The measuring and testing system includes circuits for regulating heating of the feedstock, controlling the combustion process, and emergency lockdown. Automatic switching of the reserve drive in breakdowns and self-starting after brief power outages are provided for the most important positions.

Discharges from the safety valves on the equipment are directed to the flare. The flare unit includes: a cooler-condenser, flare gas separator, shaft and cap with gas pilot burner, and automatic ignition system with a remote electric fuze unit.

A flare of the ground type was used for the first time in domestic practice. A feature of the flare design consists of placement of the flare shaft and cap inside the pipe – a screen that protects from radiation and decreases the heat flux density, which allowed reducing the flare height and path length.

To protect the plant equipment from corrosion, a comprehensive system was developed using physical and chemical methods, including crude oil pretreatment and chemical reagent preparation and feed units.

The crude oil is prepared for refining – desalination to 3 mg/liter and dehydration to 0.1 wt. % – in serially connected electric dehydrators E-1 and E-2. To reduce fresh water consumption for washing the crude and discharge of polluted water, water from electric dehydrator E-2 is recycled to electric dehydrator after the EDU. A demulsifier is fed into the feedstock pump suction line to increase the efficiency of separation of