HYDROMECHANICAL EQUIPMENT OF THE V. I. LENIN
PLYAVIN'SK HYDROELECTRIC STATION

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Layout of Hydromechanical Equipment. The hydromechanical equipment of the Plyavin'sk hydroelectric station is arranged in two groups on the side of the upper and lower pools (Fig. 1). The following mechanisms and equipment are installed in the sluice of each of the 10 units on the upper pool side:

Trash rack made of three normally linked sections. To reduce hydraulic losses the braces, cross bars, and strips are streamlined, and the main and auxiliary cross bars are flared in the direction of the lines of flow in conformity with the results of hydraulic investigations performed by the B. E. Vedeneev All-Union Research Institute of Hydraulic Engineering (VNIIG);

A cover over the shaft of the emergency gate of the spiral casing together with sectional rods for lifting it. The cover is a triangular welded box beam and is intended to protect the spiral casing against entrance of logs, trash, etc., through the gate guides;

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The spillway gate is two-sectional sliding (14.0-10.5-10.0) with a lateral vertical seal of shaped rubber with adjustable pressure installed on stainless steel dowels. During flood discharge all spillway gates can be placed in the guides on cross supports with an intermediate opening of 5 m. To regulate the discharges the gates in sluices 3, 5, and 7 have five-step catches which provide an opening of up to 5 m in steps of 1 m. The gates in guides 8 and 9 are equipped with 7.8 x 2-m valves.

The spiral casing emergency gate is five-sectional sliding (14.0-11.0-10.64): The four lower sections are rigidly welded together, and the fifth is connected with the others on suspension arms which make it possible to lift the upper section 100 mm for filling the spiral casing. The welded construction of the gate represents a three-dimensional rigid "through plate" consisting of sheathing and latticework.

The spillway emergency gate (14.0-12.10-11.25) is similar in design to the spiral casing emergency gate;

The upper pool emergency gate (14.0-41.28-40.64) is installed in the guide of the trash rack. The gate, consisting of four separate sections installed one on the other, is intended for complete damming of the sluice of one unit when repairing the guides, powerhouse retaining wall, etc.

Maneuvering of all equipment of the upper pool is done by two gantry cranes with a lifting capacity of 2 x 210/75 tons by means of pneumatic grabs. One of the cranes is equipped with a bucket mechanism for cleaning the space in front of the trash racks and for lifting the sweepwood and trash that sank here. On the other crane is mounted an additional 25-ton rotating boom crane with a 10-m overhang of the boom for servicing works outside the zone. The gantry cranes are also used for delivering heavy cargo and equipment (transformers, etc.) arriving by railroad at the upper pool to the assembly area through a cargo shaft.

A pneumatic beam with a lifting capacity of 2 x 200 tons is controlled from the crane operator's cabin. The electrical connection of the beam with the crane is accomplished by a multistrand cable wound synchronously with movement of the beam onto a drum installed on the crane carriage. The grab beam signals the landing of the beam on the gate or rack and the engagement or disengagement of the beam. The beam's pneumatic drive consists of eight compressed-air cylinders (150 gage atmosphere), reducers (150/7 gage atmosphere), and solenoid control valves.

To take care of the rarely used repair barriers, emergency gates, and also the spillway gates when they are lifted from the guides during floods, there are five gate storages on the upper pool of the station, two recessed for the two guides on the right bank and three semi-recessed for the three guides on the left bank.

To repair the gates and racks and restore their anticorrosion coatings, on the right bank of the station is an open repair yard where two gates can be repaired simultaneously.

The following equipment is on the lower pool side: two sets of emergency gates for dosing the openings of the draft tubes. The gate (15.25/2 x 6.50-6.50-13.00-12.70) is sliding, four-sectional; the two lower sections are two-span beams resting under pressure on the intermediate pier of the draft tube. The gates of the lower pool are maneuvered sectionally by a gantry crane with a lifting capacity of 2 x 20 tons by means of a mechanical grab beam, which engages the gate at two points.

The main type of anticorrosion coating of the gates and racks is lacquer KhSL in six coats applied on a ground coat of KhS-010 in two coats; 3% aluminum powder is added to lacquer KhSL every other coat. For the surfaces of the racks and gates that are constantly in the water there is an additional application of two coats of antifouling paint KhV-53. The metal surfaces of the guide elements are painted with two coats of red lead in a paint vehicle. At present one of the trash racks is equipped with cathodic protection.

Experience in Operating the Mechanical Equipment. The main scheme of the layout of the hydromechanical equipment (all gates and racks in the upper and lower pools of the station are designed as single-sludge) should be considered apt. This solution has a number of virtues: The number of pieces of mechanical equipment is minimal; the length of the seals on the gates is also minimal, which ensures small leaks and the most favorable operating conditions of the pumps of the dewatering system of the flow part during overhauling of the units, and small time expenditures for maneuvering the working and emergency gates.

The guide cover of the spiral casing emergency gate greatly complicates the use of this gate, especially its prompt use in the case of an emergency, since it is necessary to spend up to 2.5 h on all preliminary operations of lifting the cover from the guide and suspending the rods of the cover in the free guides (the shaft cover cannot be