

STEAM-TURBINE, GAS-TURBINE, AND COMBINED-CYCLE PLANTS AND THEIR AUXILIARY EQUIPMENT

First Results from Operation of the Adler Thermal Power Station Equipped with Two PGU-180 Combined-Cycle Power Units

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Abstract—We present technical characteristics of the equipment used in the PGU-180 power units of the Adler thermal power station (a branch of OGC-2) commissioned in November 2012 after the entire power plant had successfully passed an integrated test, including qualification of the entire power plant's capacity and tests aimed at determining the guaranteed characteristics.

Keywords: combined-cycle power plant, gas-turbine unit, heat-recovery boiler, steam turbine, power unit, cooling tower, startup, circulation water supply, integrated test

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In accordance with the plan of constructing power-generating facilities for providing reliable supply of power and heat to the complex of Olympic Games in the Adler–Krasnaya Polyana region and for covering the shortage of power in the Sochi load center, a decision was made in 2009 to construct in the city of Adler a thermal power station (TPS) with the design electric power capacity equal to 360 MW with the possibility of supplying heat with delivery water in an amount of 949 GJ/h.

In view of stringent requirements imposed on the economic and environmental characteristics of the station and the need to minimize coolant losses, it was decided to use combined-cycle power plants (CCPs) fitted with cogeneration steam turbines. As a result, the project of the Adler TPS incorporated two 180-MW CCPs and a Heller–Forgo dry fan cooling tower.

DESCRIPTION OF THE PGU-180 POWER UNIT MAIN EQUIPMENT

The thermal process circuit of each of two PGU-180 power units installed at the Adler TPS comprises the following equipment:

(i) two AE64.3A gas turbine units (GTU-1 and GTU-2) produced by Ansaldo Energia (Italy) fitted with WY18Z-066 generators (G-11 and G-12 for Unit 1, and G-21 and G-22 for Unit 2);

(ii) two PK-69 horizontal drum-type two-loop heat-recovery boilers (HRB-1 and HRB-2) developed at the Podolsk Machinery Construction Works (ZiO);

(iii) one T-48/62-7.4/0.12 cogeneration steam turbine unit produced by the Kaluga Turbine Works (KTZ) fitted with a TZFP-63-2MUZ generator (G-10 for Unit 1 and G-20 for Unit 2) produced by Elektrosila (a branch of Silovye Mashiny); and

(iv) auxiliary common-unit equipment.

The AE64.3A gas turbine unit. The AE64.3A single-casing single-shaft gas turbine unit consists of a 17-stage axial compressor with a rotary inlet guide vane, an annular combustion chamber, a four-stage turbine, an exhaust diffuser, and auxiliary systems.

Air sucked by the GTU compressor from the atmosphere is purified of dust, moisture droplets, snow, ice, and other mechanical inclusions in a comprehensive air cleaning device (CACD). Air cleaning filters and compressor blades are kept from icing by means of an anti-icing system, which extracts hot air from the compressor ninth stage and recirculates it into the CACD.

The air compression ratio in the compressor is equal to 17. With the GTU running at the nominal load, the air pressure at the compressor outlet may vary from 1.44 to 1.84 MPa; its temperature, from 446 to 349°C; and its flowrate, from 180 to 200 kg/s depending on the outdoor air temperature. The GTU compressor is fitted with antisurge valves installed downstream of the 5th, 10th, and 15th stages, which secure its stable operation in the GTU shaft speedup and run-down modes.

The GTU is fitted with an annular combustion chamber comprising 24 hybrid burners. Each burner