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

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# Experience Gained at the Ural Turbine Works with Retrofitting Steam Turbine Units for Thermal Power Stations

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**Abstract**—Examples of projects on retrofitting, modernizing, and renovating steam turbine units at thermal power stations implemented with participation of the Ural Turbine Works are given. Advanced construction and layout solutions were used in implementing these projects both on the territory of Russia and abroad.

**Keywords:** steam turbine unit, modernization, retrofitting, pedestal, layout, horizontal delivery-water heater, condenser, generator

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Recent years have seen ongoing modernization and replacement of existing equipment items by new more advanced ones in the electric power industry of Russia and CIS countries. This is primarily due to the fact that more than 60% of high-temperature thermal power equipment, such as boiler houses and steam turbine units (STUs) installed at cogeneration stations and district power stations (referred to henceforth as thermal power stations, TPSs) have worked out its service life.

Low tariffs for energy carriers and long periods of time for which investments in new construction are paid back are factors that compelled TPS owners, as well as the governments of Russia and other countries to take active efforts aimed at retrofitting the existing power stations.

Indeed, retrofitting or modernization is an option that makes it possible to obtain considerable saving of capital investments as compared with construction of new or expansion of existing TPSs. If we take the total costs for constructing a new cogeneration station or expanding an already existing one as 100%, then, according to the data of [1], the distribution of costs among the individual parts of such a project will be as follows: up to 40% for procurement of new equipment, up to 50% for civil construction works, up to 15% for erection works, and 2–3% for the other works.

Hence, by using the existing buildings, pedestals for equipment, crane facilities and replacing only obsolete equipment items by more advanced new ones, it is possible to save around 40–50% of the total sum of money owing to exclusion of civil construction works alone taking into account some additional costs for dismantling the equipment that is subject to replacement.

Retrofitting and modernization are presently implemented in different ways: from partial replacement of assemblies the service life of which cannot be extended to full replacement of power unit equipment.

The Ural Turbine Works (UTZ) participates in activities concerned with modernizing, retrofitting, and renovating STUs produced by UTZ and by other manufacturers, on the territory of Russia and abroad. In our opinion, projects of retrofitting STUs in the existing turbine buildings of TPSs with retaining their dimensions and the majority of building structures, including the crane facility and with the maximally possible use of the existing turbine unit pedestal are the most interesting ones but requiring much effort for their development.

In this article, only a few TPS retrofitting projects developed with participation of the Ural Turbine Works are described.

The cogeneration station of the Ural Carriage Works was the first facility retrofitted with participation of UTZ [2]. The pedestal, which was constructed in the 1930s, supported an AT-25-2 two-cylinder turbine produced by the Leningrad Metal Works (LMZ) and a T2-25-2 generator produced by the Elektrosila Works. The actual state of the pedestal was examined, and it was recognized from the examination results that a new turbine set can be installed on this pedestal. After the overground structure of the pedestal in the turbine part and the upper plate in the generator part had been partially dismantled, and the dismantled components had been replaced by new ones, it became possible to install a new turbine set consisting of a PT-30/35-90/10-5 single-cylinder turbine produced by UTZ and a TFP-25-2U3 air-cooled generator pro-