

**AIR PROTECTION FROM POWER INDUSTRY EMISSIONS****1.5. Technologies of organic fuel combustion at TPPs with the lowered level of harmful emissions into atmosphere****1.5.5. Efficient reduction of nitrogen oxide emissions in the boiler furnaces by means of aerodynamic optimization of the staged fuel combustion**

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**Introduction**

For the last 30 years personnel of Boiler Plants and Ecology in Power Engineering Department of the Moscow Power Engineering Institute – MPEI (TU) in collaboration with the staff from thermal power plants and design organizations have been widely implementing the methods of staged combustion of gas, oil and coal. For that purpose more than 100 power and water-heating boilers of different types were reconstructed. The main goal of this activity was to improve dependability and efficiency of boilers as well as to reduce nitrogen oxide emissions into atmosphere. The gained great experience testifies that the universal way to reach a complex goal is an optimization of flame body aerodynamics, especially, in a zone of interaction of furnace gases with air jets.

Before carrying out the projects on reconstruction of boilers according to the isothermal modeling procedure [1] variable, bench-top and calculative studies of the furnace aerodynamics were conducted. During the studies location of burners and nozzles as well as their angles of slope were changed. Only configuration options, which meet the certain requirements, were considered for the design. These requirements include: a maximum length of the flame body development, including in the post-combustion zones, reliable mixing of furnace gases and air jets, no zones of extra dynamic pressure of the combustion jets on the screen walls

of the furnace, distribution of the flame body core, etc. Besides, thermal and aerodynamic calculations of the air flow duct of the boiler under reconstruction were held.

Recently considering the results of modeling aerodynamic studies of the furnace, variable zone to zone and verifying calculations of the furnace were made under the program, developed by an assistant professor U.M. Tretyakov in accordance with recommendations [2,3]. Based on these calculations, an extent of fuel burning out, temperature characteristics of the flame body in the furnace zone and combustion parameter M, characterizing location of the nominal flame core in the furnace, were determined. In accordance with a semi-empirical method of U.M. Lipov [4], evaluation of NO<sub>x</sub> formation levels in zones and at the furnace output of boilers subjected to reconstruction, was made.

MPEI employees controlled operational design work and boilers reconstruction, they also took part in adjusting the furnaces and other equipment in collaboration with power plant regime groups and adjustment organizations.

The gained experience of NO<sub>x</sub> emission reduction by means of implementing the staged combustion methods, that allow to improve dependability, ecological and economical effectiveness, can be interesting for boiler manufactures, thermal power plants, branch scientific, design and adjustment organizations.