P a r t 1

AIR POOL PROTECTION FROM EMISSIONS OF THE POWER INDUSTRY

1.1. Reducing nitrogen oxides emissions

1.1.2. Technological methods to reduce nitrogen oxide formation in the boilers during combustion of different types of organic fuel

1.1.2.1. Regime and commissioning activities to reduce nitrogen oxide emissions

1.1.2.1.3. Burners Out of Service — BOOS

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Method of Burners Out of Service is to use one or more burners (preferably in the upper tier) for supplying only air with redistribution of the fuel loading on the other burners. The diagram in Fig. 1.2 this changing of regime is to move from point *A* to point *Б* (regime *Г*). In the working burners appearing products of incomplete combustion (CO) due to the reducing of excess air, but the oxygen, which entering the chamber with the air through the “idle” burner, provides the afterburning of carbon monoxide CO in the volume of the combustion chamner.

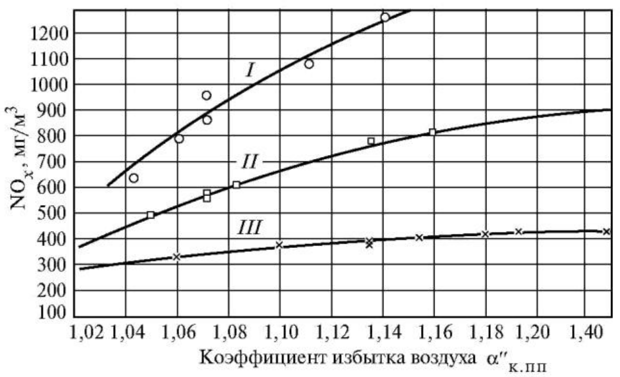

Рис. 1.10. Зависимость выхода оксидов азота от избытка воздуха при разном способе организации топочного процесса.
Паропроизводительность котла $D_{пе}$ = 156…163 т/ч

As an example, consider the graph in Fig. 1.10. It shows dependence of the concentration of NO_x on excess air for convective superheater on the boiler $\alpha''_{c.sh}$ BKZ-160 of Sarovskaya TPP. Boiler loading in all experiments remained approximately constant (156…163 t/h).

Curve *I* characterizes the change in the NO_x concentration in the work of all eight burners, installed near the corners of the combustion chamber in two tiers in height [9]. As can be seen from the graph, even with a moderate excess air ($\alpha_{c.sh}$ = 1,07) the concentration of NO_x is 860…960 mg/m^3 (converted to NO_2 under normal conditions: O_2 = 6 %, 0 °C and 101,3 kPa).

Curve *II* – there are the results if experiments with two burners turned off (diametrically opposite the burner if the upper tier). At the same excess air ($\alpha''_{c.sh}$ = 1,07) NO_x concentration decreased to 560 mg/m^3. Reducing NO_x emissions by 38 % did not affect the efficiency and reliability of the boiler.

At testing a more radical regime, with disable all four burners of upper tiers, to further reduce NO_x emissions (curve *III* in Fig. 1.10).

However, such a regime, as it turns out, can only be used briefly (for example, adverse weather conditions). First, even at $\alpha_{c.sh}$ = 1,06 in the exhaust gases of the boiler appeared carbon monoxide CO. Consequently, the boiler must be operated with a large excess air and hence with higher losses of q_2. Secondly, it turns out that if disable the four burners and maintaining load of flame is drawn into the zone of platen superheater.

For liquidation of this phenomenon it was necessary to raise excess air even more (till $\alpha''_{c.sh}$= 1,18…1,2). Only in this way the temperature of the coil pipes of platen superheater remained constant and the temperature of hot pipes package of convective superheater increased only on 5 °C.

The above three methods to reduce nitrogen oxides emissions due to regime interventions sufficiently effective during natural gas combustion in the boilers.

During solid fuel combustion effect of the introduction of the methods described, at the first, much less, and secondary, these activities can lead to undesirable side effects-state: possible high-temperature corrosion of furnace waterwall; drossing of radiation or pollution of the convective surfaces and etc., so for caol-fired boilers often have to use a technological methods for the suppression of NO_x, which consist in changing of the flame combustion process.