Part 1

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

1.5.5.9. On necessity of changing the approaches to certification of oil section of direct-flow burners

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A decisive disadvantage of burners of reconstructed KVGM-180 boilers is that they are not certified in the prescribed manner by the industry organizations that have the corresponding permission. Moreover, according to information, gained by the designers of burners, an obstacle to that is unsatisfactory performance at ignition from the cold condition. In this connection it is necessary to note the following.

Stalling characteristics of gas direct-flow burners are almost the same as characteristics of the vortex burners. This is confirmed by the joint trial of direct-flow burners, conducted by employees of the JSC "NPO CKTI" and MPEI at the reconstructed boilers BKZ-210-140F at Nizhegorodskaya SDPP and BKZ-320-140GM at CHPP-9 of the Open JSC "Mosenergo". Therefore, the gas section of burners of these boilers is certified.

Employees of the boiler-and-turbine shop, and adjustment shop of CHPP-25 and MPEI conducted separate tests of direct-flow burners ## 2 and 3 at the reconstructed KVGM-180 boiler. They showed that the separated gas pressure at the burners ## 2 and 3 was about 2,5 kPa at the air pressure before the burners of 1,95 kPa, equal to 1,05 of its nominal value (averaged over all the burners), so the setpoint of the boiler protecting from gas pressure drop was accepted to be 3 ... 4 kPa, that is a common solution, including vortex burners.

Gas ignition of the direct-flow burner, in contrast to the vortex one, occurs from the periphery of the jet due to a presence of a circular vortex, which arises at the end of it. In case it's necessary to reduce the separated gas pressure, it's sufficient to increase the gas flow to the burner cowling, increasing, for example, a number of holes of 5 mm in diameter in the burner shown in Fig. 1.92.

It's more complicated with ignition of direct-flow oil-fired burners when its burning in a cold furnace is not stable and there is an evidence of sooting. This is due to the fact that along the axis of direct-flow jet, the air moves with a maximum velocity, and ignition vortex from oil pulverization is compressed, so when firing the boiler with direct-flow oil-fired burners igniters shall not be extinguished before inclusion in the work of four burners, arranged by two at opposite walls of the reconstructed PTVM boilers and before ignition of four burners of the lower tier of the reconstructed KVGM-180 boiler. In case four burners were in operation, there was a stable oil ignition by tail parts of flames of opposite or adjacent burners.

In the heated furnace with direct-flow burners, evaporation and ignition of the sprayed oil is inside the fresh jet without soot formation, as evidenced by a moderate brightness of the flame. It stabilized at a distance of about 300 ... 400 mm from the burner and ignition starts mainly from the lower part of the jet.

Such oil burning with separation of the flame from direct-flow burner contributes to the fact that nozzles operate for a long time without coking of spray elements. In the vortex burners intensive oil ignition begins almost at the nozzle head, which leads to more frequent cases of their coking. Moreover, in practice there are cases of warping of the blade unit.