AUTOMATED STATION FOR POLLUTANT EMISSION CONTROL

Description
The automated station pollutant emission control (ASPC) station is designed for continuous monitoring of oxygen (O₃), carbon dioxide (CO₂), carbon monoxide (CO), nitrogen oxides (NOₓ), sulfur dioxide (SO₂), and methane (CH₄) in various power-engineering processes with simultaneous measurement of temperature and pressure in the flue duct and calculation of the air-to-fuel ratio. The station allows effective solution of fuel combustion control problems, optimization of operation modes, and determination of environmental parameters of fuel-driven facilities at a qualitatively new level.

ASPC consists of measuring and recording units. The measuring block incorporates a PEM-2M optical absorption gas analyzer and an electric chemical oxygen analyzer. The data from the measuring block are fed to the recording block through a serial interface. The measured results are promptly processed and documented in detail. WINDOWS-based software allows presentation of the data in the form of tables and diagrams. The gas circuit changer allows connection of up to 6 sampling points using only one ASPC.

![Fig. 1. Overall view of the ASPC.](image)

Figure 1 shows the ASPC installed at the TS-1 power station in Novosibirsk. The modified PEM-2M gas analyzer, the connection system for the gas circuit, the gas circuit changer, the cooling water supply system, and the electric circuits for connecting the gas analyzer are mounted inside the box.

Technical specifications
Operation conditions:
- temperature of the ambient medium from 5 to 45 °C;
- relative humidity of air up to 80% at t = 35 °C;
- atmospheric pressure from 91 to 105 kPa;
- temperature of flue gases at the probe inlet from 0 to 600 °C;
- sampling flow rate through the probe not lower than 1.0 ± 0.1 liter/min

Measured gas components and ranges of concentrations:
- CO₂ - 0-18 vol. %;
- CO - 0-2000 ppm;
- SO₂ - 0-2000 ppm;
- NO - 0-2000 ppm;
- NO₂ - 0-2000 ppm;
- O₂ - 0-21 vol. %.

Basic relative error limit ± 10%.
Warm-up time greater than 40 min.
Total cycle measuring time greater than 15 min.
All types of fuel (solid, liquid, gaseous).
Supply voltage – 220 V, voltage frequency – (50 ± 1) Hz.
Power consumption – 400 W.
Ambient temperature – 5÷45 °C.
Temperature of flue gases – 0÷600 °C.
Probe length – according to specification requirements.
Length of the test sample transportation line – up to 60 m.
Operation mode – round-the-clock computer-based monitoring.

The fact that flue gases contain CO is one of the main reasons for the increase in fuel cost. Continuous monitoring of flue-gas composition allows real-time control of the boiler unit and maintaining an optimal value of the fuel-to-air equivalence ratio, which enables plants to save fuel.

**Technical appraisal and economic benefits**
- Continuous simultaneous measurement of concentrations of various gases;
- Measurement of extreme concentrations of flue gases;
- Reporting data on hazardous emissions with the help of the data acquisition and processing system;
- Saving of fuel;
- Real-time control of combustion behavior in fuel-driven facilities.

At present, the overwhelming majority of power plants are not equipped by stationary flue-gas control systems. The proposed control station facilitates efficient operation of boiler units and saves fuel.

**Application areas**
Control stations for pollutant emission of flue gases at cogeneration plants, state regional power plants, boiler houses, and engineering processes at industrial plants.

**Development stage**
ASPCs successfully operate at Power plant Nos. 1 and 2, and Cogeneration plant No 3 (Novosibirsk), Surgut state regional power plant No 1, Belovsk state regional power plant No 1, and “Altaikoks” (Zarinsk).

**Patent situation**
ASPC is certified (RU.C.31.001.A No 8327). The Serial Number in the State Register of Instruments is 19341 – 00.

**Commercial offers**
Production and procurement contract.

**Estimated cost**
Delivery of the station, assembling, programmable controller, and software – 15,000 euros.

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