

The invention relates to a process of regulating the fire power in combustion installations, in particular refuse incineration installations, in which the $O_{2\text{-moist}}$ content measured in the smoke gas is used as the upper setpoint value regulating variable for regulating the supply of fuel and optionally the measured mass flow of steam or the furnace space temperature determined in the combustion gas is used as lower setpoint value regulating variable for regulating the supply of primary air.

In a known process of this type (special edition of FORSCHUNG AKTUELL, No. 16-17/volume 4, November 1987, Technical University of Berlin), the combination of thermal measured values, for example furnace space temperature and mass flow of steam and substance measured values, for example $O_{2\text{-moist}}$ content, makes it possible on the one hand, to keep the fire power constant, i.e. to keep the mass flow of steam constant, and on the other hand, to minimize the pollution emissions, i.e. to reduce the pollutants such as carbon monoxide, dust, hydrocarbons and nitrogen oxides, contained in the smoke gas. Using the $O_{2\text{-moist}}$ content as upper regulating variable within such a regulation concept results in a fast responding regulating system.

A disadvantage of this process is the fact that the $O_{2\text{-moist}}$ content yields no defined information about the $O_{2\text{-dry}}$ content and, consequently, about the true excess of air. The measurement of the $O_{2\text{-dry}}$ content of the combustion gas is, however, too slow and too unreliable under the existing operating conditions.

With the $O_{2\text{-moist}}$ content kept constant as upper setpoint value and the mass flow of steam kept constant, a shift in the furnace space temperature is brought about in the event of variations in the moisture content of the smoke gases. In the case of refuse incineration installations, however, these variations in the moisture content of the smoke gases cannot be avoided because of the very variable fuel composition. This may result in a deterioration in the emission figures for the set and desired output.

If, on the other hand, the furnace space temperature is kept constant with $O_{2\text{-moist}}$ content kept constant as upper setpoint value variable, an alteration in the mass flow of steam is produced in the event of variations in the moisture content of the smoke gases, and this may result in a deterioration in the thermal utilization of the whole installation.

Because of the significance of low emission figures for the environment, the substance variable, i.e. the $O_{2\text{-moist}}$ content, has dominance over the thermal variables, namely the mass flow of steam and the furnace space temperature.

The object of the invention is to optimize both the emission figures and the fire power, starting from the two variants of the known processes mentioned at the outset.

This object can be achieved in two ways.

Starting from a process in which the $O_{2\text{-moist}}$ content measured in the smoke gas is used as upper setpoint value regulating variable for regulating the supply of fuel and the measured mass flow of steam is used as lower setpoint value regulating variable for regulating the supply of primary air, the achievement of the object consists in that the predetermined setpoint value of $O_{2\text{-moist}}$ is altered in dependence on the furnace space temperature measured in the smoke gas.

On the other hand, on proceeding from a process in which the $O_{2\text{-moist}}$ content measured in the smoke gas is used as upper setpoint value regulating variable for regulating the supply of fuel and the furnace space temperature ascertained in the smoke gas is used as lower setpoint value regulating variable for regulating the supply of primary air, the achievement of the object consists in the fact that the predetermined setpoint value of $O_{2\text{-moist}}$ is altered in dependence on the measured mass flow of steam.

In carrying out the first variant of the process, two temperature points are specified as limit values, the setpoint value of $O_{2-moist}$ being increased if the upper temperature value is exceeded while the setpoint value of $O_{2-moist}$ is reduced on dropping below the lower temperature limit value. In the first case, therefore, the "apparent" excess of air is increased, while in the second case, the "apparent" excess of air is reduced. Provided the furnace space temperature is within the chosen limit values, however, the setpoint value of $O_{2-moist}$ is not affected.

The procedure in the second variant is similar, there being chosen, instead of two temperature limit values, two limit values of the steam mass flow and if these are exceeded or dropped below, the setpoint value of $O_{2-moist}$ is increased or reduced, respectively. Because of the special significance of the emission figures for the environment, priority is also assigned to the substance values, i.e. the $O_{2-moist}$ setpoint value, in the process according to the invention.

According to a preferred development of the process, a still better regulation accuracy is achieved in that the rate of change of the measured value of temperature or mass flow of steam is taken into account when altering the setpoint value of $O_{2-moist}$. In this embodiment, the differential of the temperature change or of the mass flow of steam change with respect to time is taken into account, so that a change in the setpoint value of $O_{2-moist}$ can be made even before the limit values are reached, as a result of which the operation of the combustion installation takes place still more uniformly because the regulation is more precise.

The invention is explained below by reference to the systems shown, for example, in the drawing.

In the drawing:

Figure 1 shows a regulating system of known type;

Figure 2 shows a first regulation variant according to the invention; and

Figure 3 shows a second regulation variant according to the invention.

Figure 1 explains the known processes described at the outset. According to the latter, to regulate the fire power of an combustion installation 1 comprising a furnace and a boiler, the $O_{2\text{-moist}}$ content measured in the smoke gas 2 is used as upper regulating variable 7, which is fed to a regulator which, if said regulating variable deviates from a certain standard-value bandwidth, acts on the feed device for charging the furnace with fuel and/or on the stoking-grate drive.

At the same time, the mass flow of steam $\dot{m}_0$ leaving the boiler is measured at 4 and this regulating variable 10 is fed to a further regulator 5 which, if the measured value deviates from a specified standard-value bandwidth of the mass flow of steam, acts on the devices provided for adjusting the volume of incineration air such as, for example, ventilator drive and regulating valves in the air distribution system.

The disadvantages of this regulating process have been explained at the outset.

In a first variant of the regulating process according to the invention, which is shown in Figure 2, both the furnace space temperature, as regulating variable 6, and also the $O_{2\text{-moist}}$ content, which is designated as measured value 7, is [sic] ascertained in the smoke gas leaving the furnace 1. Both values 6 and 7 are fed to a regulator 8. Starting from an operating procedure to be regarded as particularly beneficial or ideal, the measured $O_{2\text{-moist}}$ content is regarded as setpoint value. If an alteration now occurs in the furnace space temperature, this change having to be above a specified tolerance limit, the set point value of $O_{2\text{-moist}}$ is altered by the regulator 8. In this

operation, if the upper tolerance limit of the temperature value is exceeded, the setpoint value of $O_{2\text{-moist}}$ is increased, whereas if the lower temperature tolerance limit is dropped below, the set point value of $O_{2\text{-moist}}$ is reduced. This modified setpoint value of $O_{2\text{-moist}}$ is then fed as regulating variable 9 to the regulator 3 which alters the supply of fuel by acting on the feed device and/or by altering the grate speed by acting on the stoking-grate drive. In contrast to the known process shown in Figure 1, the regulator 3 is supplied not with the measured $O_{2\text{-moist}}$ value, but with a setpoint value of $O_{2\text{-moist}}$ corrected in dependence on the furnace space temperature.

Simultaneously, as is also the case in the process explained in Figure 1, the mass flow of steam m_0 measured at 4 is fed as regulating variable 10 to the regulator 5 which, as in the known process, monitors the combustion air supply.

In the second variant of the regulating process according to the invention, which is explained in Figure 3, again starting from an operating state regarded as ideal, the measured $O_{2\text{-moist}}$ measured value is used as setpoint value. This measured value is also determined in the smoke gas 2, which leaves the combustion installation 1 comprising a furnace and a boiler. Said measured value 6 is fed to the regulator 8. Simultaneously, the regulator 8 is supplied with the mass flow of steam m_0 measured at 4 as regulating variable 10. The regulator 8 now alters the regulating variable 6 if the mass flow of steam leaves a specified standard-value bandwidth, and specifically, if the upper mass flow of steam limit value is exceeded, the setpoint value of $O_{2\text{-moist}}$ is increased and if the mass flow of steam limit value is dropped below, the set point value of $O_{2\text{-moist}}$ is reduced and is fed as corrected regulating variable 11 to the regulator 3 which, in the event of a corresponding deviation in the setpoint value of $O_{2\text{-moist}}$, alters the supply of fuel and/or the combustion grate speed. The furnace space temperature measured in the smoke gas is fed as lower regulating variable 12 to the

regulator 5, which monitors the volume of the incineration air supplied.

Patent Claims

1. Process for regulating the fire power of combustion installations, in particular refuse incineration installations, in which the $O_{2\text{-moist}}$ content measured in the smoke gas is used as the upper setpoint value regulating variable for regulating the supply of fuel and the measured mass flow of steam is used as the lower setpoint value regulating variable for regulating the supply of primary air, characterized in that the predetermined setpoint value of $O_{2\text{-moist}}$ is altered in dependence on the furnace space temperature ascertained in the combustion gas.
2. Process for regulating the fire power of combustion installations, in particular refuse incineration installations, in which the $O_{2\text{-moist}}$ content measured in the smoke gas is used as the upper setpoint value regulating variable for regulating the supply of fuel and the furnace space temperature ascertained in the smoke gas is used as the lower setpoint value regulating variable for regulating the supply of primary air, characterized in that the predetermined setpoint value of $O_{2\text{-moist}}$ is altered in dependence on the measured mass flow of steam.
3. Process according to Claim 1 or 2, characterized in that the rate of change of the measured value of temperature or mass flow of steam is taken into account when altering the setpoint value of $O_{2\text{-moist}}$.