Combustion under control

This article explains how a single premix unit feeding different burners can improve combustion efficiency.

Premix has been in industrial use over many years in glass forehearths, feeders, melting furnaces and lehrs, and brick firing tunnel kilns. It allows the proportion of air and gas to be precisely regulated by a constant mixer. With simple adjustments, this type of multi-gas equipment obtains a mixture of air and gases for all the burners that heat a given area of a furnace. A single premix unit, composed of a constant mixer and a BZR gas governor, can feed various burners working under the same set of conditions.

The Constan mixer

FIB's Constan mixer is a static device that operates in combination with a BZR gas governor to automatically provide a mixture of air and gas. The ratio between the two constituents remains constant over a range of flow rates varying from 1 to 15. Acting only on the flow of air, it automatically mixes the gas in the correct proportions over the entire range of flows.

The FIB Constan mixer is also a proportional mixer. This means it gives a mixture of constant composition which is independent of the pressure in the collector supplied by the mixer and of the cross-sectional output of the burners, or of the number of burners supplied by this collector.

This means that:

- FIB's Constan mixer can operate at any mixing pressure, so there is no constraint to the operating pressure;
- A number of burners and variations in the flow rates to those burners can be accommodated without the need to adjust the proportions of air and gas that remain constant; and
- The proportions of air and gas supplied by the constant mixer are not affected by the variations in pressure that may occur in a furnace.

Energy savings

If an installation requires a calorific power of 720,000 kcal/h, a capacity that will produce sufficient heat for the process and compensate for various heat losses, the exhaust gases produced will have a temperature of 1100°C.

An installation that is heated by separate air-gas burners is stoichiometrically difficult to control and usually operates with 10% excess air. In these conditions and at that temperature, combustion efficiency is 43%. Thus the required heat production is equivalent to:
720,000 kcal/h ÷ 0.43 = 1,674,418 kcal/h

If a gas such as CH4 is used, the hourly consumption of gas will be:
1,674,418 ÷ 7,561 = 221.45 kcal/Nm
(CH4 gas has a calorific value of less than 7,561 kcal/Nm).

An installation that is heated by FIB premix burners under identical conditions can obtain a stoichiometry using the Constan mixer combined with a BZR gas governor. In this case, combustion efficiency will reach 48%. The quantity of gas needed will be:
720,000 kcal/h ÷ 0.48 = 1,500,000 kcal/h.

The hourly consumption will be:
1,500,000 ÷ 7,561 = 198.38 kcal/Nm,
for a gas economy of 11.6%.

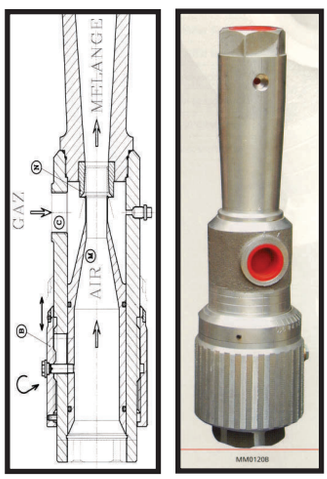
IMP burners

FIB's IMP premix impulsion burners have no flame in the furnace. Complete combustion takes place within the burner block prior to the ejection of the completely burnt hot gases into the furnace cavity. This jet of burnt gas, which moves at a very high speed due to combustion thermal expansion and the narrow burner block exit, aspirates and combines with the existing furnace atmosphere.

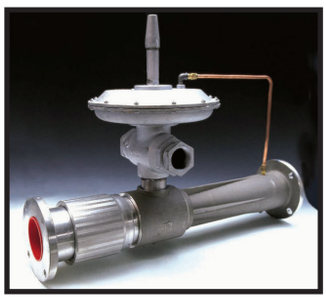
However, since total combustion occurs within the burner block, the mixture of gases produced by the burner jet and those still in the furnace contains no combustible components. No secondary reaction will occur. So if the burner has been adjusted to provide a reducing exhaust into the furnace cavity, the furnace atmosphere will remain reduced. Carburising reactions may be increased in the latter zones of the furnace by injecting, under accurate control, a suitable hydrocarbon that will yield ionised methane.

A carefully controlled and controllable reducing atmosphere can be obtained using premixed impulsion burners.

FIB also produces a wide range of premix burners with features for ignition, flame control and refractory housing for installation on existing furnaces. They cover an output range from 6000 to 440,000 kcal/h per unit, with full combustion in the burner block and flame precluded from the furnace chamber.



▲ *The Constan mixer.*



▲ *FIB's premix heating system.*

▲ *Type IMP burners.*

▼ *FIC offers a range of safety heads.*

Safety heads

FIB has developed a safety head that works as an explosion relief device to discharge the overpressure in the burner manifold, thus avoiding any hazard to the equipment and piping.

FIB safety heads relieve any pressure over 1500 mmWC (1.75psi). There are three sizes of standard models: 1 1/2-inch and 2-inch BSP threaded, 3-inch BSP threaded, and DN80 flanged. TE is the standard model, while TESE has an additional microswitch.

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Infrared sensors for low to mid-temperature applications

Calex Electronics has launched some new additions to the Convir EL and MLE series of infrared temperature sensors. These new units offer millivolt, thermocouple and voltage outputs to complement the existing 4-20mA output versions. They also allow these sensors to tackle almost any low to mid-temperature application.

The 4-20mA output provided by the current generation of EL and MLE sensors is usually the preferred choice because of its low cable cost and high noise immunity. However, when retro-fitting to existing equipment it can sometimes be desirable to have a wider choice of outputs to match the instrumentation that is already in place. So, for example, these new EL and MLE series units can be fitted as direct replacements for other, more traditional thermocouples, making them available to more users.

The first new model available will be the MLE-1 sensor with a 0-50mV output. This will be followed by units with 0-100mV, 1mV/°C, 10mV/°C, 0-5V, J thermocouple and K thermocouple outputs. The new EL units will then be launched, and will be available in the same range of outputs. The choice available will allow the EL and MLE series to make the right connection with all process control and indication equipment currently in use.

The new models will be available at the same cost as the existing EL and MLE units, with the same temperature ranges between –20 to 500°C, and the same accuracy and performance. The only difference is that they will be 4-wire sensors, and will provide different outputs.

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