

MEASURING NATURAL GAS IN BOILER AND FURNACE APPLICATIONS

Optimization of a combustion process can result in significant savings in fuel costs. Proper control of the air/fuel ratio to a burner results in the highest possible efficiency - the maximum steam output (or heat generated) for the least fuel consumption. Accurate flow measurement (and the resulting improved control) of the natural gas and combustion air is critical to achieve peak efficiency. A wide variety of flow measurement technologies are used including orifice plates/DP transmitters, vortex, turbine, variable area and thermal mass flowmeters. The critical factors in selecting the best flowmeter for combustion applications are mass measurement, accuracy, repeatability, turndown, installation, safety and reliability. Let's review these areas in more detail:

1. Mass Measurement

Combustion is a chemical reaction; therefore, controlling the air/fuel ratio based on mass is essential. The Fox Thermal Mass Flowmeter provides a direct mass measurement in Standard Cubic Feet per Minute (SCFM) or Pounds Per Hour (lbs/hr). Alternatively, differential pressure type devices (i.e. orifice plate with differential pressure transmitter), vortex, turbine and variable area meters provide only a volumetric flow measurement. With these devices, changes in process pressure or temperature will result in significant measurement error. It is possible to obtain an inferential mass flow measurement by compensating the volumetric flow with pressure and temperature measurement in a flow computer. However, this combination of instruments is expensive to purchase, install and maintain. A direct mass measurement with a Fox Thermal Mass Flowmeter is your best solution.

2. Accuracy, Repeatability, Turndown

The topic of turndown is combined with the discussion of accuracy and repeatability for an obvious reason. If the flowmeter is only accurate over part of the measurement range, your ability to optimize combustion over the entire operating range of the boiler will not be possible. A flowmeter with wide turndown provides accurate and repeatable measurement over the entire operating range of the boiler. Fox Flowmeters are based on Thermal Mass Flow technology that is highly sensitive to gas flow resulting in a turndown up to 1000:1; 100:1 typical. The platinum sensor achieves long-term stability because platinum is one of the most stable materials on earth. Fox delivers accurate and repeatable flow measurement over the full boiler operating range.

3. Installation

Although typically overlooked when assessing the cost versus performance benefits of one flow technology with another, the effort required to install a flowmeter can have a significant impact on the "total installed cost" of a device. Installation of most flowmeter technologies typically requires cutting out a section of pipe and installing flanges and possibly support brackets. Alternatively, use of a Fox insertion style flowmeter is easy and less costly. The insertion flowmeter probe is inserted into the pipe and secured in place with a Fox supplied compression fitting. The pressure rating is 300-500 psig (depending on model). Additionally, there are no moving parts and pressure drop is extremely low. All Fox Models available with insertion probes.

Another issue related to installation concerns upstream and downstream straight pipe requirements. Most technologies, including insertion flowmeters require 10 to 15 diameters of straight pipe upstream of the sensor and 5 to 10 diameters downstream. However, for situations where long, straight pipe runs are not available, Fox offers Models FT2A and FT3 which are available with an inline style that provides a solution. The inline flowmeter contains flow-conditioning plates that eliminate the need for long upstream and downstream straight pipe runs. Fox Models FT2A and FT3 available with inline styles.

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4. Safety and Reliability

The Model FT1 is FM and FMc approved: Class I, Div. 1, Gps B, C, D; Class II, Div. 1, Gps E, F, G; Class III, Div. 1; T4, Ta = -40°C to 70°C; Class I, Zone 1, AEx/Ex db IIB + H2 T4; Gb Ta = -40°C to 70°C; Type 4X, IP66/67.

ATEX (FM16ATEX0013X) approved: II 2 G Ex db IIB + H2 T4; Gb Ta = -40°C to 70°C; IP66/67

II 2 D Ex tb IIIC T135°C Db Ta = -40°C to 70°C; IP66/67.

IECEX (IECEX FMG 16.0010X) approved: Ex db IIB + H2 T4 Gb Ta = -40°C to 70°C; IP66/67, Ex tb IIIC T135°C Db Ta = -40°C to 70°C; IP66/67**

The Model FT2A is FM and FMc approved for Class I, II, III, Division 2, Groups A, B, C, D, E, F, G, T4A hazardous locations.

The Model FT3 is FM and FMc approved for Class I, Div. 1, Gps B, C, D; Class II, Div. 1, Gps E, F, G; Class III, Div. 1; T3C, Ta = -40°C to 70°C; Class I, Zone 1, AEx/Ex d IIB + H2 (T6, T4, or T1*); Ta = -20°C to 70°C; Type 4X, IP67.

ATEX (FM12ATEX0034X) approved for II 2 G Ex d IIB + H2 (T6, T4, or T1*) Gb Ta = -20°C to 70°C; IP67, and II 2 D Ex tb IIIC (T185°C, T135°C, or T450°C*) Db Ta = -20°C to 70°C; IP67.

IECEX (IECEX FMG 12.0010X) approved for Ex d IIB + H2 (T6, T4, or T1*) Gb Ta = -20°C to 70°C; IP67, and Ex tb IIIC (T85°C or T135°C*) Db Ta = -20°C to 70°C; IP67**

* Temperature code ratings for Zones are dependent on external process temperature factors and equipment enclosure configuration. See the FT3 Brochure for specific temperature code ratings.

** The IECEx dust rating does not apply to the Remote Enclosure.

The stainless steel wetted parts can be cleaned for oxygen service.

The Fox Thermal Mass Flowmeter is your best choice in boiler, kiln and furnace applications for measuring natural gas and combustion air.

Fox Model FT2A



Fox Model FT1



Fox Model FT3

