System overview

Mass flow measurement grid
Volume flow measurement

LAMTEC

Sensors and systems for combustion engineering

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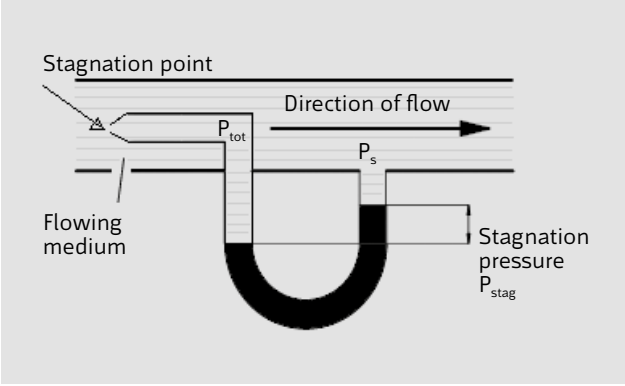
Volume flow measurement using a mass flow measurement grid.

The principle of the mass flow measurement grid follows the Bernoulli energy equation on which the principle of the conservation of energy is based. The entire kinetic flow energy (without friction losses) remains constant as the sum of the dynamic and static pressure. As a differential pressure flow metering method, the mass flow measurement grid records the overall pressure and static pressure of a flowing gas.

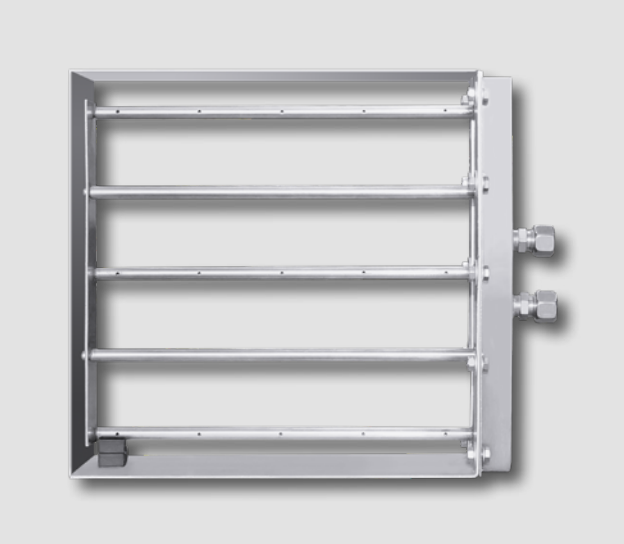
The pressure difference, the dynamic pressure, is a dimension for the flow velocity of the gas. When the pipe diameter is known, the volume flow can be determined by extracting the square root of the measured value.



P_{tot} = overall pressure, P_s = static pressure, P_{dyn} = dynamic pressure (stagnation pressure).

The great advantage of the mass flow measurement grid in comparison with other differential pressure flow metering methods is the arrangement of the measurement above the overall pipe cross-section. Measuring tasks with an unfavourable flow profile can also be performed.

Pipes arranged in parallel with sealed ends form an open grid through the channel cross-section at a right angle to the flow axis. Some pipes are equipped with openings to pick up the overall pressure, whilst others pick up the reference pressure. These two values are combined in one collective pipe and separate adapter each. The pressure difference between these two values results in the output signal. The velocity must lie between 2 and 40 m/s.



Rectangular mass flow measurement grid.

Round mass flow measurement grid.

Advantages in comparison with other measurement methods

In contrast with other integrating measured value transducers (aperture plate, venturi nozzle, etc.), pressure losses through the mass flow measurement grid are very low. The infeed and discharge distances can be kept considerably shorter in the case of the mass flow measurement grid. This has the advantage that long air channel distances are no longer required. Every retrofitting is easy to perform in the case of existing plants.

Mechanical design

The mass flow measurement grid consists of stainless steel. It is completely welded and suited for temperatures up to 400°C. Round designs with and without flanges are available. Rectangular designs generally do not require flanges.

Mounting and maintenance

The mass flow measurement grid works in a completely maintenance-free manner when the air is not polluted. Plants with a quintuple valve block can be backflushed with air. In the case of plants with an increased dust concentration, an access possibility for cleaning should be provided during installation. In the process, solid particles have a negative effect on the measuring precision. mass flow measurement grid should not be used when sticky particles are floating in the air flow.

Differential pressure measuring transducer P26.

Positioning

The grid is provided with an arrow that indicates the direction of flow. The differential pressure connection for the differential pressure measuring transducer is implemented using a threaded sleeve G1/4", which must be equipped with the proper connection depending on the impulse line used (e.g., screwed pipe connection d 12 mm).

Impulse backflow unit.

Measuring transducer

The measuring transducer converts the existing differential pressure into an electrical variable. According to design, this is 0 ... 20 mA, 4 ... 20 mA, or 0 ... 10 V. In combination with the mess flow measurement grid, any commercial measuring transducer with a measuring range from ± 0 to 10 mbar can be used.

Variants/temperature range/measuring media

Three installation variants are provided: Flange connection, welded-in design, or terminal connection for "Jacob pipe." The temperature range lies between -20 and

Advantages:

- Volume flow measurement of gaseous media in channels, especially supply air for combustion systems
- Volume flow measurement possible for exhaust gases using optional materials
- Very low pressure losses in comparison with conventional technology
- Small infeed and discharge distances, thus retrofitting possible in existing plants. Long air channels no longer required.
- Consists of stainless steel
- Basic temperature range up to 400°C
- Maintenance-free in non-polluted air
- Rectangular and round designs available
- In case of an increased particle load backflushable (optional)
- Connection to differential pressure measuring transducer via impulse line or according to customer needs

400 °C. Temperature ranges going beyond these values are available upon request. Non-aggressive, non-explosive, gaseous media with a known density can be used as measuring media.

Technical information

The system pressure lies between –0.5 and +0.5 bar (underpressure/overpressure). The measuring precision is specified at ≦1% of the measured value. The measuring precision is described as follows:

- Compared mass flow measurement grid on the test rig ≦1% of measured value
- Calculated mass flow measurement grid ≦5% of measured value
- Calibrated mass flow measurement grid on site ≦2% of measured value

The pressure loss is calculated according to the specific variable and specified in the order documentation.

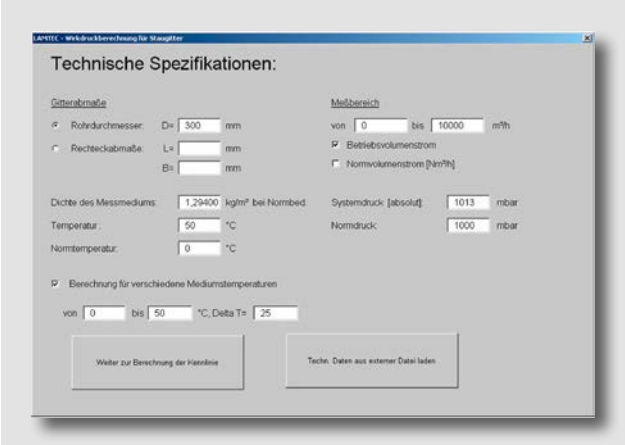
Overview of infeed distances

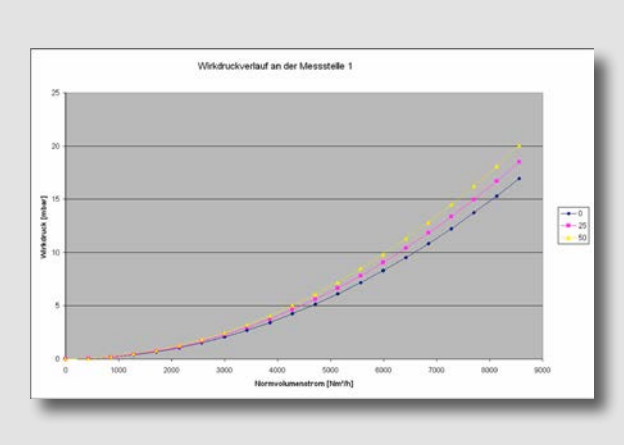
Type of obstacle	Tolerance ± 1% Infeed distance D	Tolerance ± 3% Infeed distance D	Tolerance ± 5% Infeed distance D
Rectangular deflection	6	5	3
Bend 90°, radius 1 D or smaller	5	4	2
Bend 30°	3	2	1
Counter-rotating mulitleaf damper	4	3	2
Slow regeneration	2	1	1
Sudden regeneration	3	1	1

This tolerance data refers to the measured value.

Design software

The design software calculates the differential pressure curve specifically for each variable. For this purpose, the grid geometry, measuring medium (density), temperature, and system pressure must be known. The software calculates the operating volume flow from the measured differential pressure. This can also be output as the standard volume flow when the temperature of the measuring gas is known.





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Publication No. DLT8005-20-aEN-002