FLUE GAS DESULFURIZATION

EMERSON

What is Flue Gas Desulfurization (FGD)?

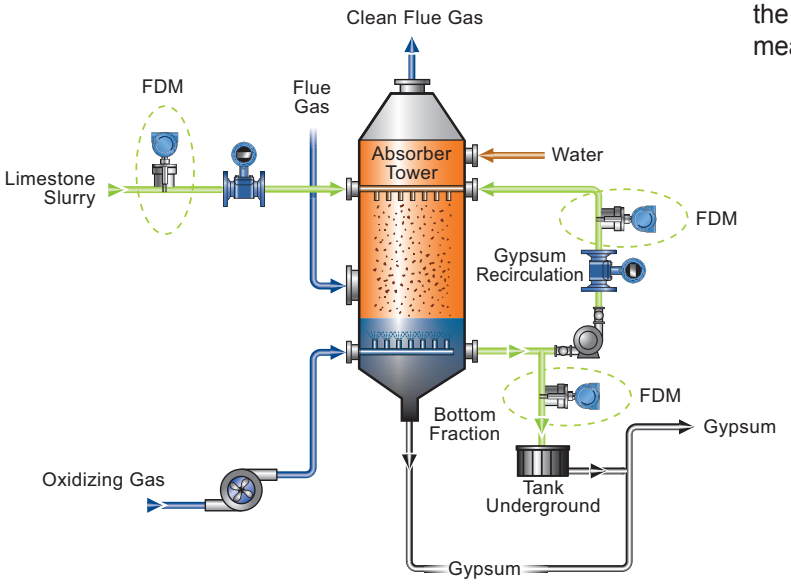
FGD is a set of technologies used to remove Sulfur Dioxide (SO_2) from exhaust flue gases in coal, oil-fired, and waste-to-energy power stations. SO_2 is a pollutant/irritant in air and a major contributor in the creation of acid rain. SO_2 emissions are subject to strict environmental protection regulations.

How does a FGD system work?

Exhaust flue gas is drawn from the boiler and forced into an absorber tower by a booster fan. Once inside the absorber tower, the gas flows upwards through a dense shower of lime or limestone slurry. The slurry absorbs the Sulfur Dioxide (SO_2) in the flue gas. The absorption process converts the lime/limestone into Calcium Sulfite.

Controlling the usage of lime/limestone is critical to both the plant's operating cost and effectiveness in meeting environmental regulatory requirements.

Calcium Sulfite is often converted to gypsum. Density measurement of the gypsum slurry on the output side of the scrubber verifies the ultimate efficiency of the scrubbing process and is also used to prevent blocking of the spray nozzles in the slurry re-circulation process.



How should the FDM be installed for optimum performance?

The correct installation of the FDM in this application is critical. So the following topics/guidelines need to be considered for each installation. MC-001976 'Slurry Installation Best Practices' provides general guidelines for the installation of the FDM in slurry measurement applications, but these guidelines provide additional information specifically related to the installation of the FDM in a Flue Gas Desulfurization process.

Flow Rate / Velocity

It is critical to ensure that the flow velocity be kept high enough to keep the solids in solution, but not too high as this may cause erosion of the FDM wetted parts.

For larger diameter pipes, a **T-Piece** installation can be used. The FDM insertion depth can be selected to suit the flow velocity (see figure 1).

For small diameter pipes, a Free-Stream installation can be used. This option may require the diameter of the pipe to be increased using reducers/expanders to lower the velocity to the desired rate (see figure 2). If this technique is used, there must be 20" (500mm) of upstream straight run to avoid any jetting effect of the slurry. Any jetting effect would result in the FDM measuring a non-representative sample of the slurry.

An ideal solution for measurement of limestone slurry concentration and gypsum slurry density is the Fork Density Meter (FDM).

Figure 1
T-Piece Installation

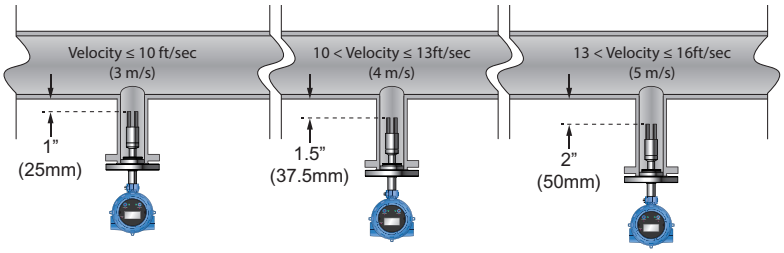
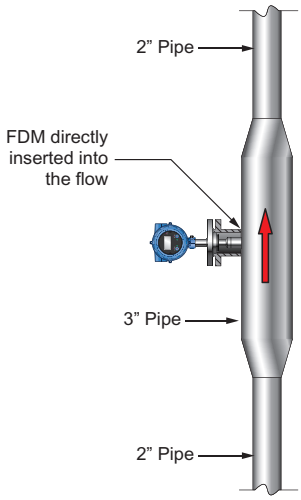


Figure 2
Free-Stream Installation
Vertical Pipe with
Concentric Reducers

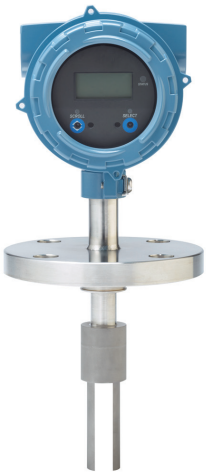


Flow Velocity	Free-Stream
Min	0.3m/sec (1ft/sec)
Max	0.6m/sec (2ft/sec)

FDM Fork Tine Orientation

Gap between the FDM fork tines must always be vertical:

- Solids drop down
- Entrained gas will go up



Fork Density Meter

Direct Insertion Density Meter

Main Process Pipe Diameter

3” (DN80) and above – Vertical and Horizontal Pipeline

We recommend that for ≥ 3” (DN80) pipelines, the FDM should be mounted in a T-Piece installation. The T-Piece should be 3” (DN80) and must be mounted at an angle to ensure that it will self-drain. Flow velocity as low as 1.0m/s is acceptable, and preferred velocity is 3m/sec. Care should be taken at flow velocities of 5m/sec as there is an increased risk of the T-Piece clogging. Additional cleaning may be required.

Viscosity of the slurry should not exceed a maximum of 500cP to ensure proper product refreshment in the T-Piece.

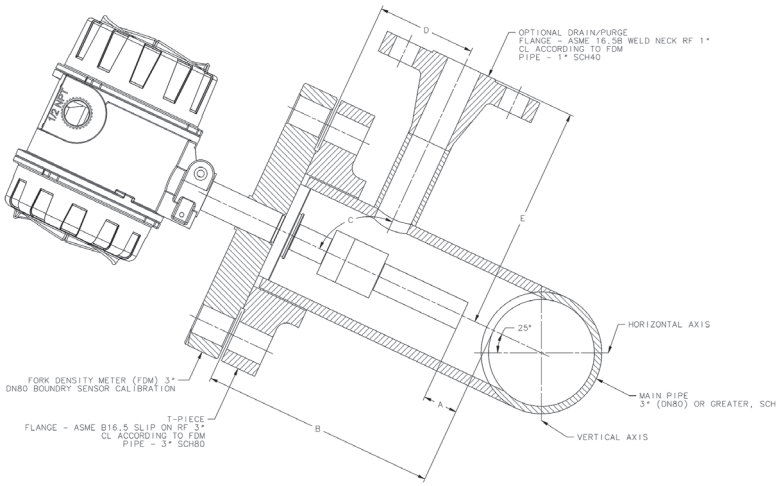
It is recommended that a purge/drain connection located on the upper part of the T-Piece (horizontal installation) or on the side of the of the T-Piece (vertical pipe). The use of a purge connection will allow for easy flushing if and when required.

2” (DN50) 2.5” (DN65) – Vertical and Horizontal Pipeline

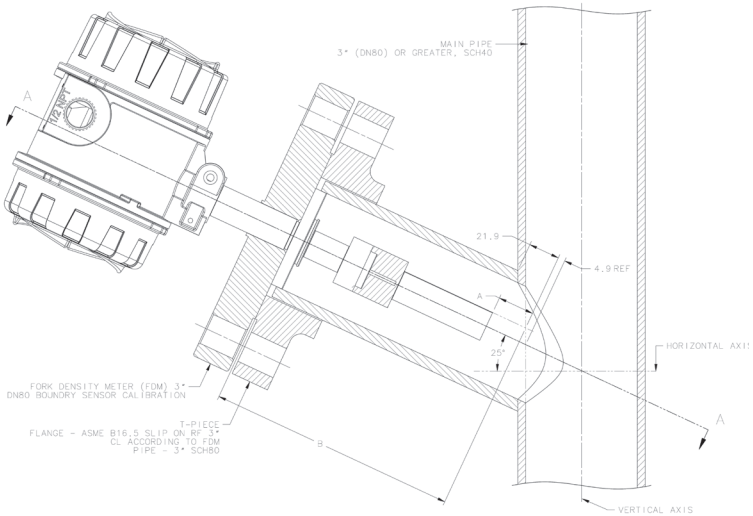
In some applications, the main pipe diameter may only
be 2” (DN50) or 2.5” (DN65). In this instance we recommend that the FDM be mounted in a **Free-Stream** installation. Minimum flow velocity is 0.3m/sec. The maximum flow velocity should be no greater than 0.6 m/s, so the pipe may have to be expanded. For a horizontal pipe, eccentric reducers should be used, while for vertical pipes, concentric reducers should be used.

If the main pipe has to be expanded to DN80 (3”), the T-Piece cannot be used as there will be inadequate turbulence to ensure a good mixing in the T-Piece. The Free-Stream installation should still be used. Although this installation has the advantage of being self-cleaning, once installed, the FDM will require a simple field calibration.

T-Piece Installation



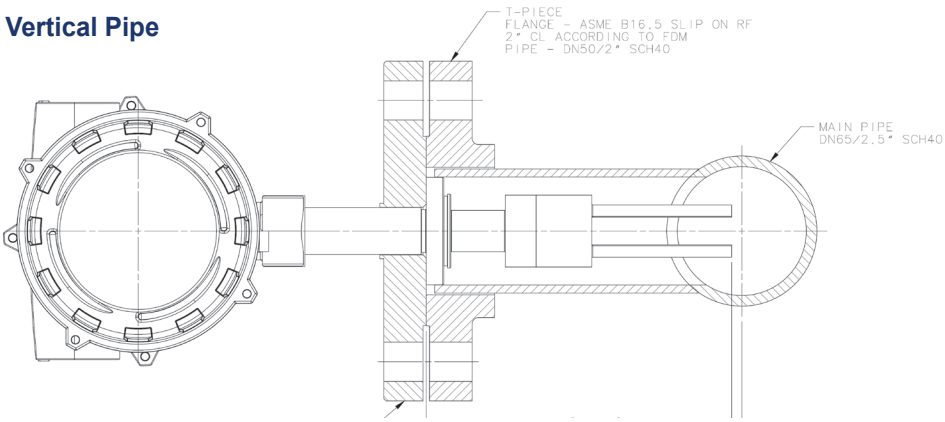
Horizontal Pipeline



Vertical Pipeline

Free-Stream Installation

Vertical Pipe



Free-Stream **Horizontal Pipe** dimensions are identical, but FDM is rotated through 90° so that vibrating tines are vertical

Installation Summary

INSTALLATION TYPE SUMMARY - BEST PRACTICES						
Pipeline Size	**Recommendation**	**Installation**	**Orientation**	**Flow Velocity**	**Field Calibration required**	**Comments**
<2"						Unlikely, but too small for FDM installation
2"	Optional	Free-Stream	Vertical or Horizontal	Min 0.3 m/sec (1ft/sec) Max 0.6 m/sec (2ft/sec)	Yes	Expand pipe to 2.5" or 3" to reduce velocity if necessary
2.5"	Optional	Free-Stream	Vertical or Horizontal	Min 0.3 m/sec (1ft/sec) Max 0.6 m/sec (2ft/sec)	Yes	Expand pipe to 3" to reduce velocity if necessary
≥3"	**Preferred**	**T-Piece**	**Vertical**	Min 1m/sec (3ft/sec) Nominal 3m/sec (10ft/sec) Max 5m/sec (16ft/sec)	No	Preferred flow velocity is 3m/sec (10ft/sec)
≥3"	Optional	T-Piece	Horizontal	Min 1m/sec (3ft/sec) Nominal 3m/sec (10ft/sec) Max 5m/sec (16ft/sec)	No	Preferred flow velocity is 3m/sec (10ft/sec)

About Micro Motion

For over 35 years, Emerson's Micro Motion has been a technology leader delivering the most precise flow, density and concentration measurement devices for fiscal applications, process control and process monitoring. Our passion for solving flow and density measurement challenges is proven through the highly accurate and unbeatable performance of our devices.

Emerson Automation Solutions
Micro Motion Inc.
7070 Winchester Circle
Boulder, Colorado USA 80301
T: +1 800 522 6277
T: +1 (303) 527 5200
www.Emerson.com

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