

Wet Gas Flow Measurement in Vertical Pipe

Application Note Case Study ANCS 002

Problem

A major power plant customer needs to measure flow rate from a reactor within a 20 inch [495 mm] pipe. The pipe from the reactor is a vertical pipe with the flow going down, and the gas to be measured is extremely wet. Flow conditions are at dew point and it is literally "raining" in the pipe. To avoid major re-design of the reactor's piping, they desired a single installation point for a flow meter; however, this was directly after an elbow so provided almost no straight-run required by flow meters. Gas was mixed composition of nitrogen, carbon dioxide and oxygen.

Flow Conditions

- Pipe diameter: 20 " [495.5 mm]
- Flow rate: 0 lb/hr to 97,000 lb/hr [0 kg/hr to 44 000 kg/hr]
- Temperature: 86 °F to 122 °F [30 °C to 50 °C]
- Pressure: 0.06 psi(g) [0.004 bar(g)]
- Media composition: CO₂ 11 %; N₂ 76.5 %; O₂ 7.2 % + water vapor
- Straight-run: 10d total and immediately after elbow

Solution

Install a flow meter suitable for operation in wet gas, calibrated for the specific gas mix and conditions, and install a flow conditioner immediately after the elbow. Use an FCI constant power technology thermal dispersion mass flow meter with its special rain shield sensor head, along with Vortab[®] VIP flow conditioner installed 3d downstream of the elbow and the flow meter installed 3d downstream from VIP.

FCI Model ST98 Flow Meter with rain shield sensor and calibration for use with VIP

FCI Model ST100 Flow Meter with rain shield sensor and calibration for use with VIP

Vortab Model VIP Insertion Plate Flow Conditioner

Benefits

- Significant cost and time savings by not having to re-engineer system to remove water vapor.
- Significant cost and time savings by not having to re-engineer system for more straight-run.
- Installation cost savings with simple insertion-type flow meter.



FCI ST100;
rain shield
sensor head
cover