Process stability in aeration control
Part 5: Precise flow metering – base for precise control

If flow meter readings are used as an input value in control loops, accuracy (but minimum depending on type of algorithm repeatability) is of especial importance. In [1] the different technologies available on the market and suited for this application described in detail.

Thermal dispersion technology is suited especially well, because the accuracy is high even at low flow and pressure drop of the sensor is negligible. Thermal mass flow meter measure directly in dry gases, the flow rate at standard conditions according to DIN 1343, unaffected by gas pressure and temperature. But flow profile at the installation point must be regular, unaffected by pipe fittings like elbows and T-pieces, as well as ON/OFF- and control valves. This means depending on the pipe layout there are special requirements on straight inlet and outlet pipe run. If the straight pipe run is not sufficient, the accuracy of the flow meter can become very poor. If the signal is used for control purpose also the result can become affected.

Typically, the existing straight pipes are not sufficient. Flow conditioner can help to improve flow situation.

But flow conditioner need a minimum air speed to influence the upstream flow situation. And flow conditioner create a pressure drop, which will lead to an increased header pressure and so cause additional operation costs.

Each flow meter needs a calibration prior to delivery, considering actual operating conditions (e.g. piping layout, gas composition, pipe diameter, pipe orientation and flow direction, etc). Calibration means a comparison to a standard (custody transferred) flow meter, calculation of correction factors and save the factors in each instrument.

Flow meter specialists have a special test bench, to built up the installation situation in a straight pipe for calibration, but also can take customized pipe sections to measure and compensate flow profile influences – due to piping and/or flow conditioner.

Furthermore, calibration of flow meter placed directly upstream of a control valve becomes possible. Correction factors or matrix can be put into external electronics to get best accuracy of flow reading.

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In big pipes also multiple sensors placed with different insertion depths can be helpful to increase accuracy of flow reading.

Anyhow knowing details about installation situation and considering if possible, all these factors during calibration incl. compensation of flow profile distortions is the base for a precise flow measurement. Precise flow measurement is an essential prerequisite for a stable and precise control of air flow to the various aeration tanks.

Literature:

[1] DWA-M 264: Gasdurchflussmessungen auf Abwasserbehandlungsanlagen (EN: Gas flow measurements in sewage treatment plants). Beuth Verlag, Mai 2015

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