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Master thesis offered at Siemens Flow Instruments A/S Denmark
&
Chalmers University of Technology
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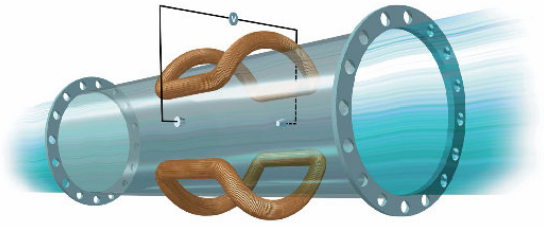
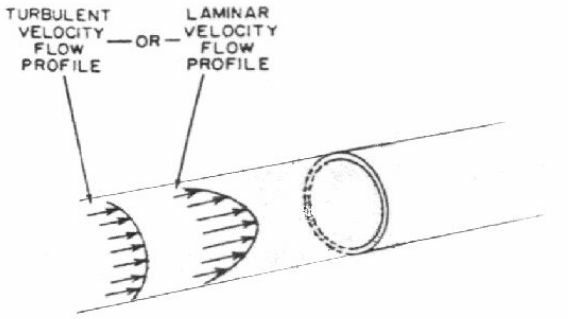
In a conducting (conductivity not lower than $5\frac{\mu S}{cm}$) fluid in a pipe, which runs through a transverse magnetic field, an electromagnetic force is created. The associated potential difference ΔU is approximately proportional to the volumetric flow rate *Q*. In fact in an idealized situation one[1] can for a circular pipe with diameter *D* and cross sectional area *A* show that

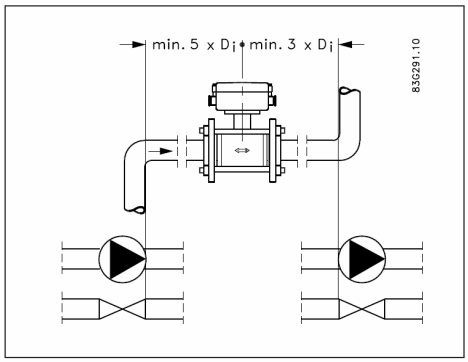
$$\Delta U = \frac{BD}{A}Q$$

where *B* is the field strength of a homogeneously magnetic field perpendicular to the velocity of the fluid. If a measurement of the potential difference is made one has the basic operating principle of an electromagnetic flowmeter (MAG-meter).

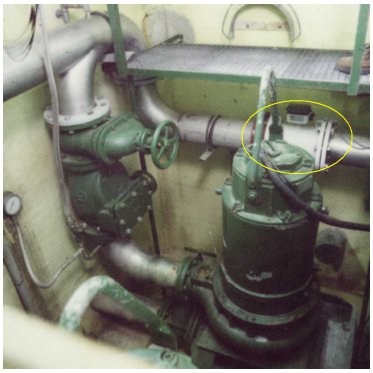




One of the underlying assumptions is that one assumes a fully developed velocity profile of the fluid. And to achieve this in a practical installation, one demand is that the meter is mounted at least 5 times the nominal diameter (DN) from e.g. a tube bend.



Mounting instructions for a MAG-meter near tube bends



A DN200 MAG-meter (yellow circle) installed in a well very close to tube bendings, valves and a pump

However customers not always behave, or are able to behave, as they should. More detailed studies of the performance of MAG-meters in the vicinity these disturbances are needed**.**

[1] Many references exist e.g. "The Derivation and Validation of the Practical Operating Equation For Electromagnetic Flowmeters: Case of Having an Electrolytic Conductor Flowing Through", Aline I. Maalouf, IEEE Sensors Journal 2006.

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Thesis work proposal

Flow profile dependence of performance of Magnetic Flowmetes

At Siemens Flow Instruments A/S we offer one master thesis's (but with two participants) that deals with the above-mentioned disturbances. We propose:

- Experimentally test the performance of a series of MAG-meters according to the standard ISO 9104 (different standardized disturbances of tube bends, valves etc.) at one of our test flow rigs
- Establish and verify CFD-models (Fluent) in connection with excising numerical models made in Matlab. and Vector Fields

The project start-up is around June ´07, with application deadline no later than end of March ´07. Since the testing procedure with respect to ISO 9104 is quite comprehensive, we suggest that the work is done in a group of two. This could also be convenient since there will be some travel activity between Calmers and Siemens Flow in order to visit supervisors etc.

As a master degree student at Siemens you will work in a global company. With almost ½ mill. employees worldwide, Siemens interacts with, and is a part of, nearly every technology you can think of. Dealing with magnetic and coriolis flow measurements, the Siemens Flow Competence Centre is located in Nordborg Denmark, Danfoss Industry Park.

During your stay Siemens pay for your accommodation, either for a student hostel in Nordborg or in Sønderborg. We also pay a salary of 40.000 DDK pr. student and expenses for necessary traveling e.g. visiting supervisor at Chalmers. A typical time span of your thesis work is expected to be around 20 – 23 weeks.

You can get acquainted with the area around Sønderborg by visiting http://www.sonderborg-omraadet.dk/ (in Danish, for UK choose "Discover Sonderborg").

Also feel free to contact Siemens Flow Instruments A/S (Per Møller, Tel.: +45 7488 4827, e-mail: per.moeller@siemens.com, website: www.siemens.com/flow) or Div. of Fluid Dynamics at Chalmers (Lars Davidson, e-mail: lada@chalmers.se).