

# Thank You for Attending Today's Webinar



## Your Host

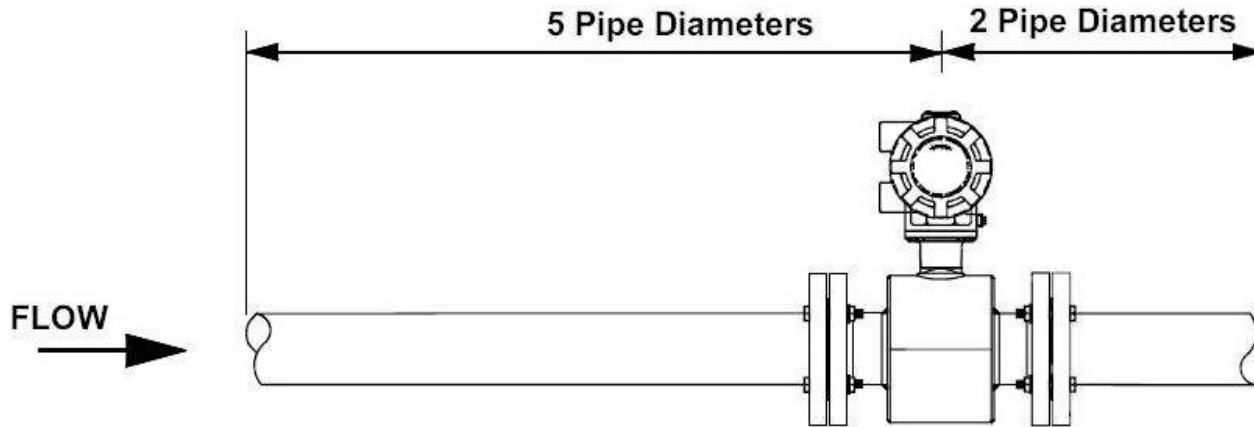
Mike DeLacluyse  
President  
Lesman Instrument Company  
[miked@lesman.com](mailto:miked@lesman.com)



## Today's Featured Speaker

Dan Weise  
Control Product Specialist  
Lesman Instrument Company  
[danw@lesman.com](mailto:danw@lesman.com)

# *Zero Up/Zero Down*



*Minimal  
upstream/downstream  
requirements for Magmeters*

## *Historically*

- To get the rated accuracy from a magmeter, every manufacturer says 5D upstream/3D or 2D or 0D downstream
- Siemens

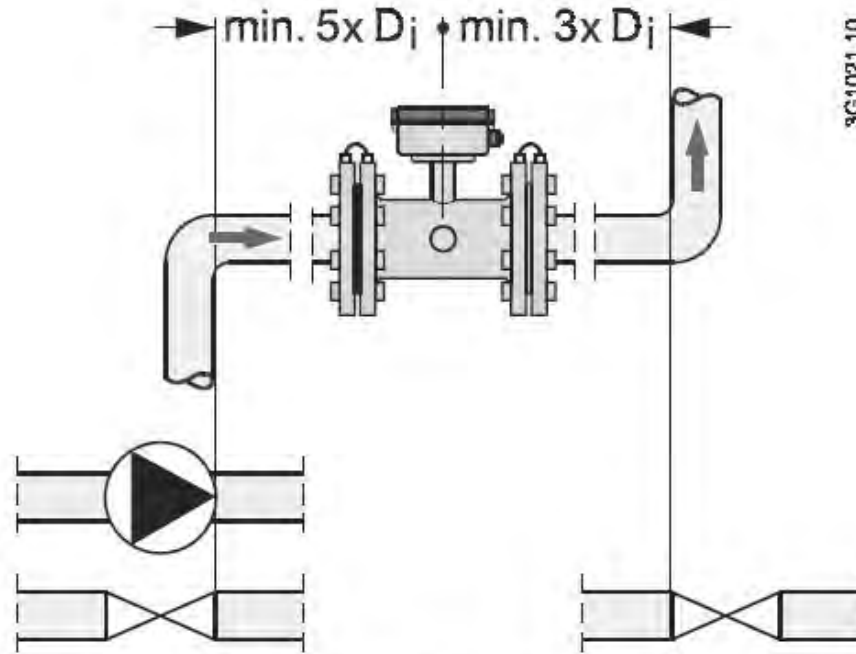
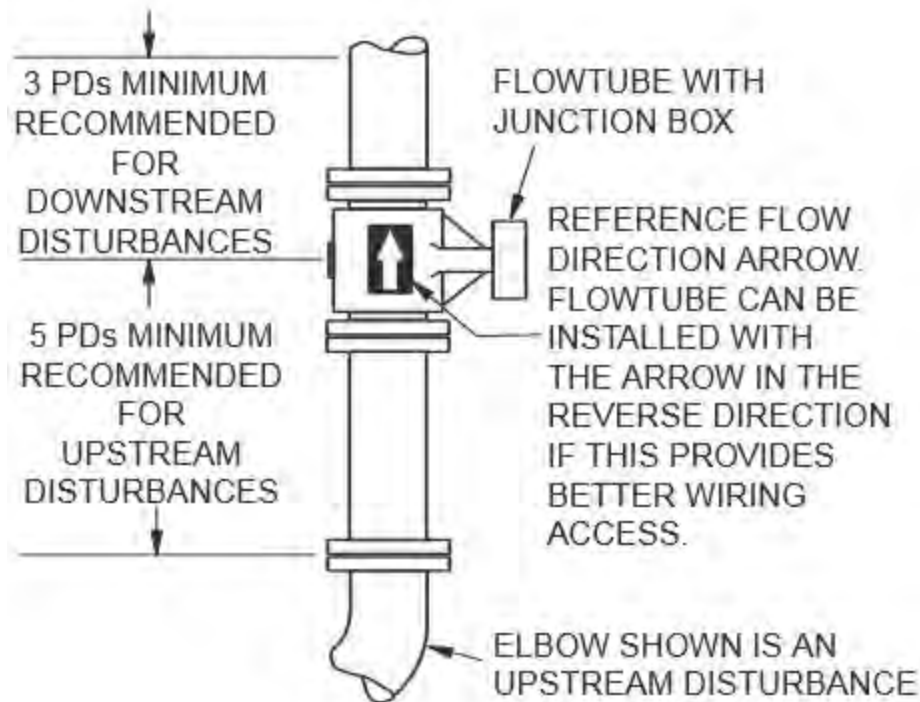


Figure 4-4 Inlet and outlet conditions

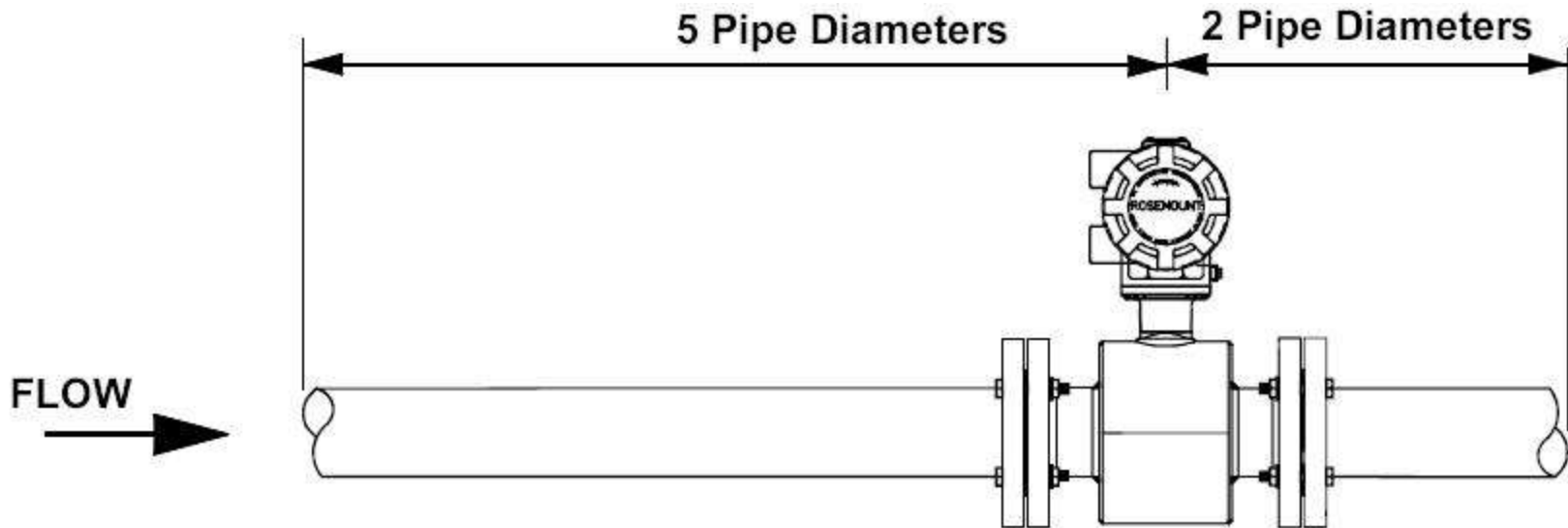
## Historically

- 5D upstream/3D downstream
- Foxboro



*Historically*

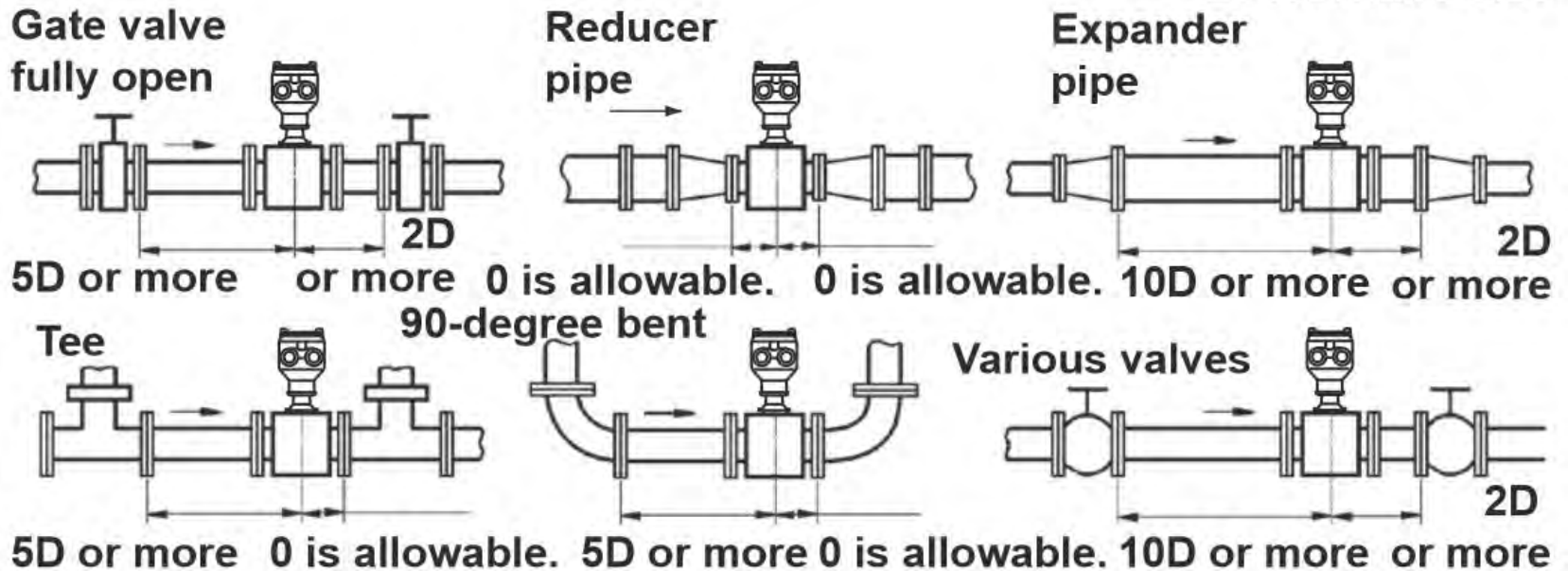
- 5D upstream/2D downstream
- Rosemount



*Historically*

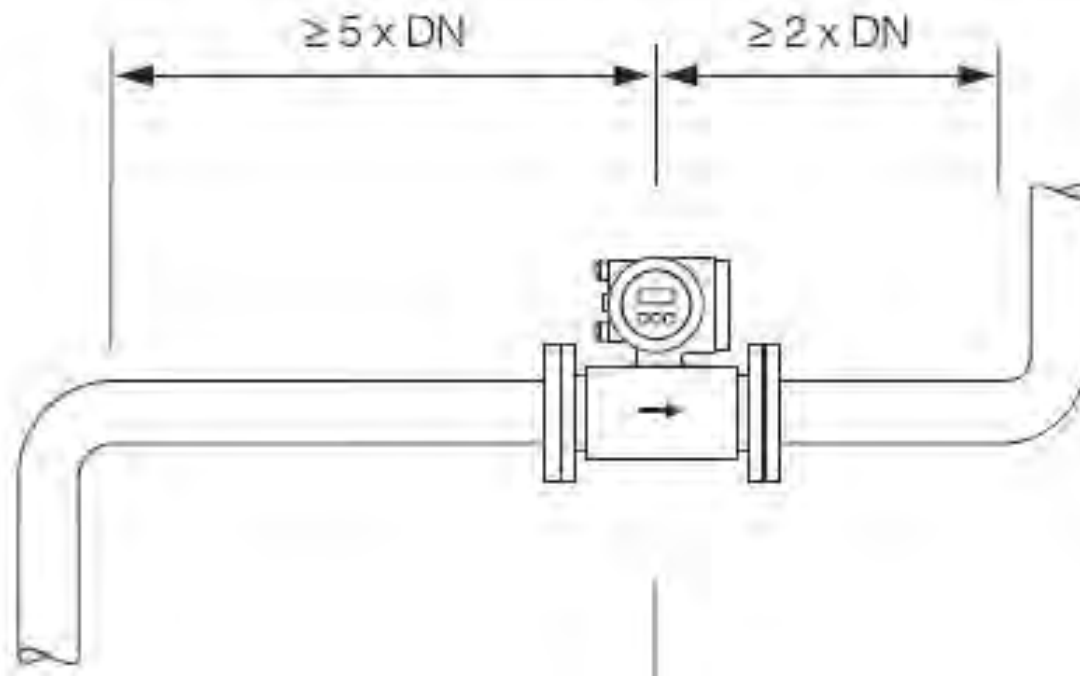
- 5D upstream/0D downstream
- Yokogawa

D: Flowtube Size



## *Historically*

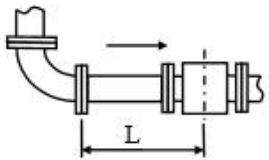
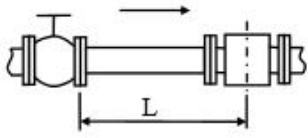
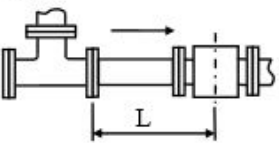
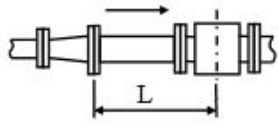
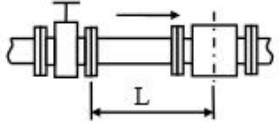
- 5D upstream/2D downstream
- E&H



## Historically

- 5D upstream/0D downstream
- Toshiba

Table 4.2 Required straight pipe length on the upstream side

L=5D	L=10D
<p>(1) 90° bent</p> 	<p>(5) Other valves (not fully opened)</p> 
<p>(2) Tee</p> 	
<p>(3) Diffuser</p> 	
<p>(4) Fully opened sluice valve</p> 	

### NOTES

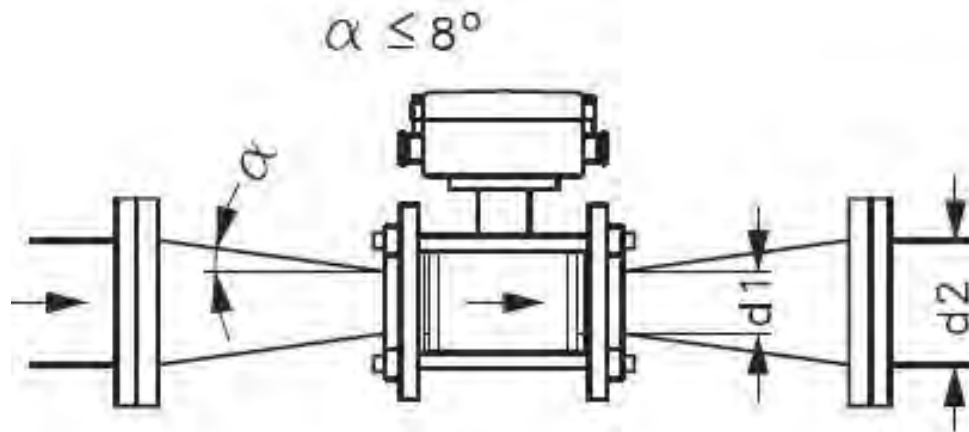
The length of a reducer, if connected, can be counted as a part of the straight pipe length.

No straight pipe length is needed on the downstream side. If a butterfly valve is installed downstream of the detector, do not let the valve plate protrude into the pipe of the detector



## *Everyone agrees*

- Reducers used to increase velocity in a meter run can be close coupled, that is not an issue



- Graphic is right out of the Siemens manual

## *Everyone agrees*

- Some straight run is need to correct for flow profile anomalies/perturbations caused by upstream
  - Tees
  - Elbows

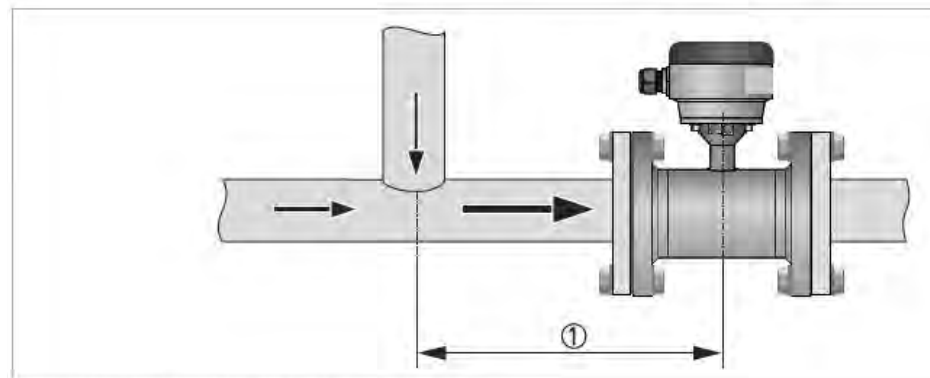


Figure 3-6: Distance behind a T-section

①  $\geq 10$  DN

- Valves should be downstream

## How much error?

- No one ever really said
- Siemens Clamp-on has some correction factors for upstream flow profile anomalies
  - but no correction values listed

Table 5-3 Pipe Configuration Option List Definitions

Options	Definitions
Fully Developed	Fully developed flow, as would be expected for very long straight pipe runs or installation downstream of a flow condition.
1 Elbow	Single 90 degree Elbow upstream of sensor installation.
Dble Elbow+	Double out-of-plane Elbows upstream of sensor installation.
Dble Elbow-	Double in-plane Elbows upstream of sensor installation.
Valve	Not available at this time.
Expander	Pipe expansion upstream of sensor installation.
Reducer	Pipe reduction upstream of sensor installation.
Norm Entry	Not available at this time.
Header Inlet	Header or pipe manifold upstream of sensor installation.
Intrusions	Not available at this time.

## How much error?

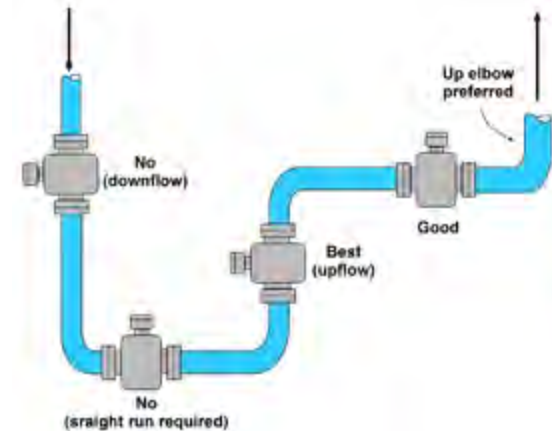
- Flow Control Magazine, 2010

### Flowmeter Piping Requirements

How Much Straight Run Is Enough?

By Greg Livelli

SEPTEMBER 26, 2010 2 Comments



- Magmeters are relatively insensitive to errors caused by nonsymmetrical velocity patterns or swirl. The general rule of thumb for straight piping is a five-diameter length of piping upstream and three diameters downstream from the meter (measured from the center of the tube). Independent testing has shown that magmeters may be affected by piping effects when the length of upstream straight pipe is less than three pipe diameters. **Errors from piping effects generally run between 0.1 percent and 1.5 percent**, depending on the exact configuration of piping and length of pipe run upstream of the meter.

## *Toshiba bites the bullet*

- *Mount Anywhere* magmeter
- Flange
- Wafer
- Sanitary

**TOSHIBA**

Leading Innovation >>>

Products

▼ Products

▼ Industrial Systems

▼ Instrumentation

▼ Electromagnetic  
Flowmeters

▶ Mount-Anywhere™ Wafer

▶ Flanged Mount Anywhere

▶ Premium Value - Flanged

▶ Flanged (Large) - LF664

▼ Mount-Anywhere™ Sanitary

▶ Fractional

▶ Capacitance Sanitary

▶ Capacitance Severe Service

## *Toshiba bites the bullet*

**Do you have junctions, tees, valves, probes, flanges, elbows, lack of space for straight piping runs or vertical down flow piping? This is no problem for the Mount-Anywhere Magnetic Flowmeter!**

Toshiba's **Mount-Anywhere Magmeter** has saved thousands of customers thousands of dollars in installation cost by reducing or eliminating the cost of wiring, fence, labor, pipe, conduit and space. The Mount-Anywhere characterized coil technology allows flow measurement to **better than 0.5% of rate accuracy only one diameter from the flange of an elbow, valve in line sizes up to 18"**.

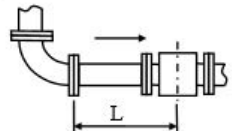
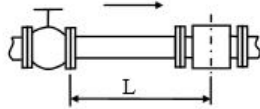
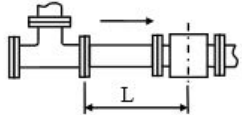
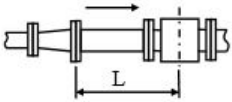
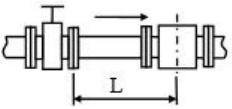
The Mount-Anywhere Magmeter is the world's first and only true-flow, **profile-immune** magmeter. There is **no need to re-pipe** the process or to design long straight runs ahead of time to ensure the magmeter will meet its published accuracy specification. The Mount-Anywhere Magmeter is ideal for use as a universal magmeter with its ability to be installed virtually anywhere in the plant. This model is the successor of LF434/LF620, LF434/LF622.

## *Toshiba bites the bullet*

### (1-a) Ideal Upstream Straight Pipe Length Installation Requirements

If various joints are used upstream of the detector outlet, the straight pipe length as shown in Table 4.2 is required.

Table 4.2 Required straight pipe length on the upstream side

L=5D	L=10D
<p>(1) 90° bent</p> 	<p>(5) Other valves (not fully opened)</p> 
<p>(2) Tee</p> 	
<p>(3) Diffuser</p> 	
<p>(4) Fully opened sluice valve</p> 	

If you want meet the full performance spec, piping need to be ideal meter run dimensions

## *Toshiba bites the bullet*

### (1-b) Optional “Mount Anywhere” Installation

#### **Mount-Anywhere Technology:**

With Toshiba’s unique magnetic field distribution technology, the meter is highly immune to upstream flow disturbances. A minimum of 1D (diameter) length of upstream straight pipe from the flange is required to maintain the performance specification.

#### **NOTE**

The test results were obtained and demonstrated at Toshiba admitted flow calibration facility.



## *Siemens puts on the gloves*

- Siemens takes notice
- Siemens puts their 5100W tube on a flow stand and makes some measurements:

### Results

A reference test was first conducted by installing the MAG 5100 W as recommended by Siemens for the best possible performance, with 5D upstream pipe and 3D downstream pipe from the sensor. The meter was then tested in 6 different configurations that do not meet the suggested installation conditions. Each test was repeated 4 times, and the results were averaged.

Testing conditions	
Meter	MAG 5100 W sensor (DN100) with MAG 5000 transmitter
Medium	Water
Water Temperature	70 ±2 °F
Water Pressure	14.5 ±0.5 PSI
Flow Rate	308.2 ±2 gpm
Water Conductivity	80±2 µS/cm

## *Siemens puts on the gloves*

- Note that Siemens test used the MAG 5000, not the higher accuracy MAG 6000
- MAG 5000 rated 0.4% accuracy
- MAG 6000 rated 0.2% accuracy



Testing conditions	
Meter	MAG 5100 W sensor (DN100) with MAG 5000 transmitter
Medium	Water
Water Temperature	70 ±2 °F
Water Pressure	14.5 ±0.5 PSI
Flow Rate	308.2 ±2 gpm
Water Conductivity	80±2 µS/cm

## *Siemens puts on the gloves*

Test: Reference conditions: 5D Up/3D Down  
Error: 0%



Reference test: 5D upstream and 3D  
downstream  
Relative error: 0%

## *Siemens puts on the gloves*

Test: Gate Valve Close-Coupled: 0D Up  
Error: 0.33%



Test: Gate valve mounted in front of meter  
with valve 100% open Relative error: 0.33%

## *Siemens puts on the gloves*

Test: Tee close-Coupled: 0D Up  
Error: 0.48%



Test: T-connection section in front of meter  
Relative error: 0.48%

## *Siemens puts on the gloves*

Test: 2 Tees, 2 90 Deg Elbows: 0D Up  
Error: 0.46%



Test: 2 90° elbows and 2 T-connections with  
meter oriented at 0° Relative error: 0.46%

## *Siemens puts on the gloves*

Test: 2 Tees, 2 90 Deg Elbows: 0D Up (meter rotated 90 Deg)  
Error: 0.44%



Test: 2 90° elbows and 2 T-connections with  
meter oriented at 90° Relative error: 0.44%

## *Siemens puts on the gloves*

Test: Four 90 Deg Elbows: 0D Up  
Error: 0.87%



Test: 4 90° elbows with meter oriented at 90°  
Relative error: 0.87%



## *Siemens puts on the gloves*

Test: Four 90 Deg Elbows: 0D Up (meter rotated 90 Deg)  
Error: 0.42%



Test: 4 90° elbows with meter oriented at 0°  
Relative error: 0.42%

## *The Claim*

### OD up – OD down

straight run of pipe. Based on its demonstrated ability to perform in non-ideal conditions, the **MAG 5100W has received MI-001 custody transfer approval for installation with OD upstream pipe and OD downstream pipe from the sensor.**

brochure PIFL-00093-0115

## Who did the test?

- Toshiba tested it themselves. Uh-huh . .

### **Mount-Anywhere Technology:**

With TOSHIBA's unique magnetic field distribution technology, the meter is highly immune to upstream flow disturbances.

A minimum of 1D (one diameter) length of upstream straight pipe from the flange is required to maintain the performance specification.

**Note:** The test results were obtained and demonstrated at TOSHIBA's flow calibration facility, Fuchu Japan.

- Siemens used an outside agency:

But its versatility doesn't end there. A series of tests were conducted by a Globally Accredited Agency which proved that the MAG 5100 W is capable of exceptional accuracy even in non-standard configurations with insufficient straight run of pipe. Based on its demonstrated

## *MI-001 approval*

Some jargonese in the brochure: MI-001

straight run of pipe. Based on its demonstrated ability to perform in non-ideal conditions, the **MAG 5100W has received MI-001 custody transfer approval for installation with OD upstream pipe and OD downstream pipe** from the sensor.

From the 5100W spec sheet:

Custody Transfer Approvals

OILM R 49

MI-001

PTB K7.2 (Germany)

BEV OE12/C040 (Austria)

## *MI-001 approval*

From 5100W spec:

### **MAG 5100 W (7ME6520) with MAG 6000 CT (Revenue program) MI-001**

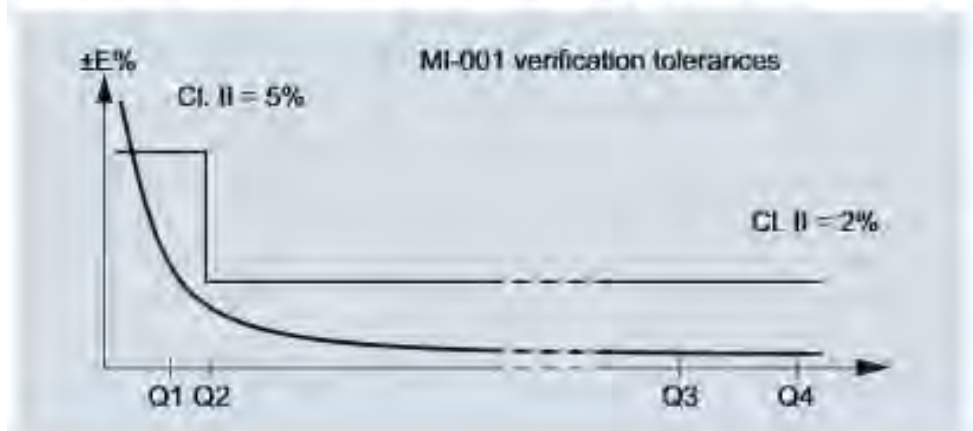
MAG 5100 W CT program is type approved according to international water meter standard OIML R 49. Since the first November 2006 the MI-001 water meter directive is in force, which means that all water meters can be sold across the EU borders if the water meters contain a MI-001 label.

The MAG 5100 W MI-001 verified and labeled products are a Class II approval according to Directive 2004/22/EC of the European Parliament and Council of March 31, 2004 on measuring instruments (MID), Annex MI-001 in the sizes from DN 50 to DN 300 (Article No. 7ME6520).

The MID certification is obtained as a modul B + D module approval according to the above mentioned directive.

Module B : Type approval according to OIML R 49

Module D : Quality insurance approval of production



## *MI-001 approval*

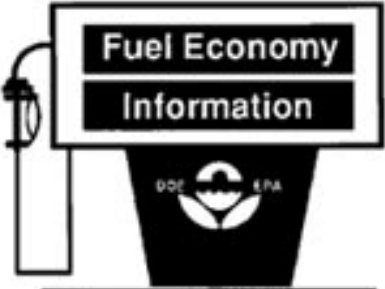
Chris Cotellese (Siemens) explains MI-001:

- MI-001 is a European Revenue program Annex from the international water meter standard OIML R 49 for custody transfer.
- Siemens offers a bit about it in the catalog under MAG8000 CT (7ME6820 Series).
- Some customers here in the US accept it as an international / global standard, some don't and want to see NTEP approval from our own government. Siemens does not have NTEP on MAGs, but it is coming on Coriolis FC400 Series meters.
- It basically states that it complies with not-so-great accuracy at the low velocity end, but gets better in spec in the mid-low to maximum ranges.

# Your Mileage may Vary

No guarantees

Compare this vehicle to others in the **FREE FUEL ECONOMY GUIDE** available at the dealer.

<p><b>CITY MPG</b></p> <p><b>23</b></p> <p>Actual Mileage will vary with options, driving conditions, driving habits and vehicle's condition. Results reported to EPA indicate that the majority of vehicles with these estimates will achieve between 19 and 27 mpg in the city and between 26 and 35 mpg on the highway.</p>	 <p><b>Fuel Economy Information</b></p> <p>DOD EPA</p>	<p><b>HIGHWAY MPG</b></p> <p><b>30</b></p> <p>For Comparison Shopping, all vehicles classified as <b>COMPACT</b> have been issued mileage ratings ranging from 11 to 31 mpg city and 16 to 41 mpg highway.</p>
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1993 CANARY 2.0 LITER  
L4 ENGINE FUEL INJECTED  
AUTO 3 SPD TRANS CATALYST  
FEEDBACK FUEL SYSTEM

Estimated Annual Fuel Cost:  
\$850

## *Can you live an error of this magnitude?*

Test: Four 90 Deg Elbows: 0D Up (meter rotated 90 Deg)

**Error: 0.42%**



Test: 4 90° elbows with meter oriented at 0°  
Relative error: 0.42%



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