Measurement Products | Measurement made easy

Swirl flowmeters FS4000
Simply fitting your purpose
Application guide

Power and productivity
for a better world™

Swirl flowmeters
Serving your application

Exceeding your expectations about modern field instruments is our goal:

- Highest reliability
- High accuracy
- High measuring dynamics
- Compact and simple installation
- Lowest costs

Find out on the following pages how ABB's unique swirl flowmeters introduce these advantages to numerous industry applications.
And there are many more: For further information how ABB swirl flowmeters can serve your application just contact us on **www.abb.com/flow**.

Typical swirl flowmeter applications in different industries

1. Power
Steam, natural gas, condensate, boiler feed water, air, biogas

2. Chemical
Steam, process gas, air, acids, solvents, sludge water

3. Oil and gas
Petrochemical raw materials, petrol, ethylene, steam

4. Pulp and paper
Steam, water, natural gas, air

5. Metals and mining
Air, oxygen, burner gas

6. Food and beverage
Carbon dioxide, steam, process air, natural gas, sludge

Burner control in steam production in process power plants

Relevant industries

Steam is used and produced in many industries e.g. for heat exchangers, dryers, evaporators, sterilization in:

- Chemical
- Pulp and paper
- Food and beverage

Application / challenge

- Natural gas measurement for burner control
- Wide flow range required
- Installations can influence flow profile in the device
- Increase burner efficiency for fuel saving

2" (DN50) swirl flowmeter with pressure and temperature measurement: pressure sensor should be installed after the flowmeter. For proper installation see drawing on the right

Why to use ABB swirl flowmeters in this application?

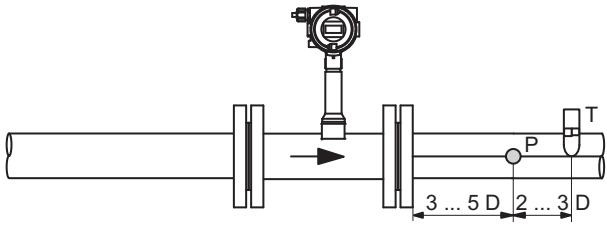
- Digital signal processing for volume flow, totalization and pulse outputs leads to high reliability and flexibility
- Optional integrated temperature compensation
- Lowest installation cost due to minimal up- and downstream sections
- High accuracy in flow measurement leads to energy (cost) savings
- High range ability that extends low flow capability

Your benefit from using swirl technology:

- Save installation effort for pipe reductions as swirl flowmeters match typically to usual flow speed of up to 40 m/sec (120 ft/sec)
- Take advantage of maintenance free design and long term stability

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
DP flowmeter (Orifice plate)	– Higher measuring range – Higher accuracy – Less straight pipe run required
Thermal mass flowmeter	– Less straight pipe run required – Less expensive
Vortex flowmeter	– Higher measuring range – Higher accuracy – Less straight pipe run required – No need for pipe reduction
Coriolis mass flowmeter	– Higher measuring range – Less expensive

Correct installation of pressure (P) and temperture (T) sensors



Fuel gas consumption in steam production in power plants

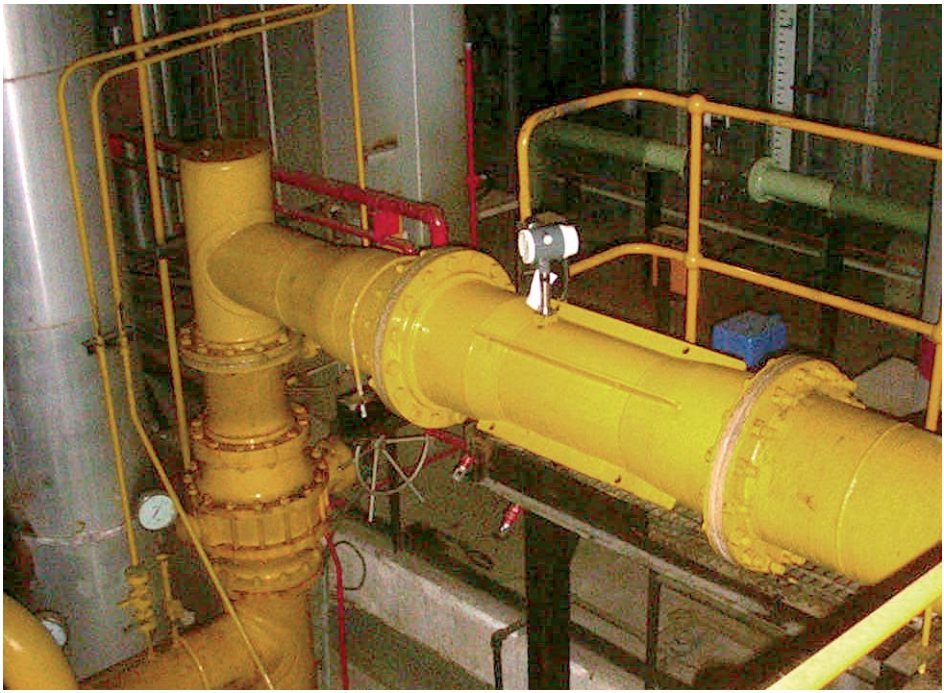
Relevant industries

– Power

Application / challenge

– Natural gas measurement for burner control
– Large pipe sizes require long straight pipe runs for proper flow metering installations
– Often poor gas quality that includes pollutants

16" (DN400) swirl flowmeter installation in smallest space in a power station



Why to use ABB swirl flowmeters in this application?

– Installation conditions have barely any influence on flow results
– Insensitive against dirt and pollution bearing mediums
– Independent from gas quality and gas content
– Great turndown for high flow dynamics

Your benefit from using swirl technology:

– Due to virtually no straight pipe requirements, a normally “impossible” installation position becomes possible
– No maintenance because of no moving parts, high long term stability and accuracy without re-calibration
– High accuracy under demanding installation conditions leads to energy (cost) savings

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB’s swirl flowmeters
DP flowmeter (Orifice plate)	– Higher measuring range – Higher accuracy – Less straight pipe run required
Thermal mass flowmeter	– Less straight pipe run required – Less sensitive for pollution
Vortex flowmeter	– Much less straight pipe run required
Ultrasonic flowmeter	– Less expensive (3 times) – Less straight pipe run required
Turbine flowmeter	– Less sensitive for pollution – Maintenance free design – Less straight pipe run required

District heating

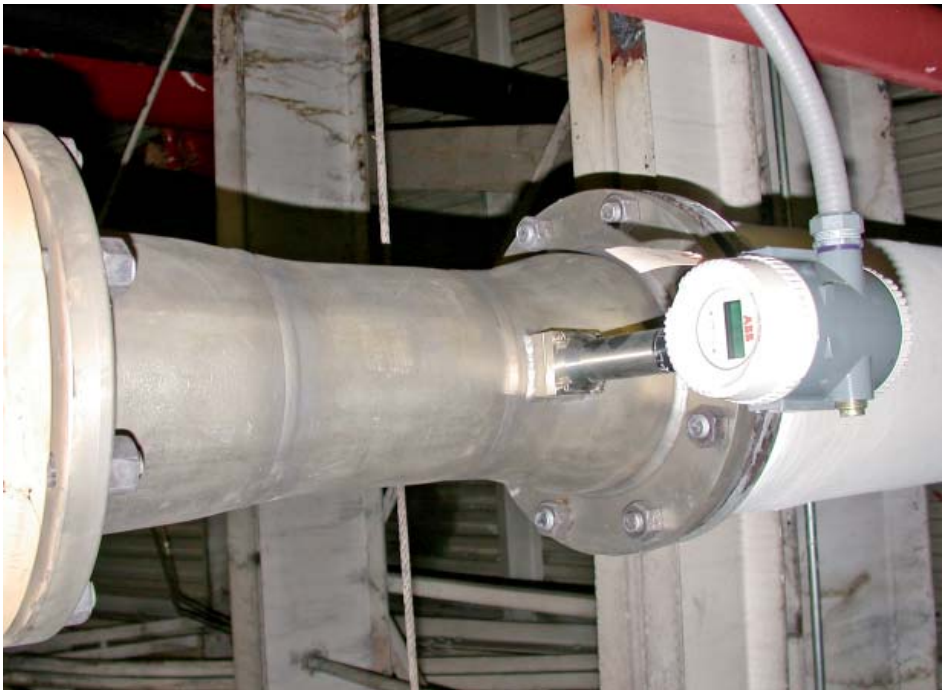
Relevant industries

– Power

Application / challenge

– Increasing energy costs require more transparency in energy measurement calculations
– Existing metering equipment often provides insufficient results for accurate energy billing
– Existing installation footprint often provides constrains for meter installation
– Energy / steam leakages should be detectable

8" (DN200) swirl flowmeter in a steam pipe, not insulated

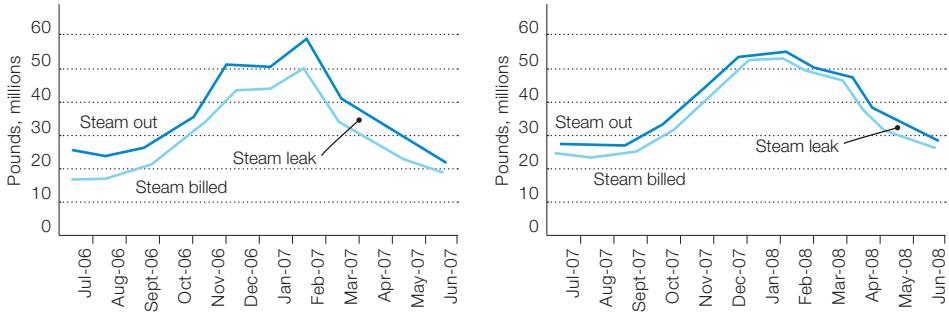


Why to use ABB swirl flowmeters in this application?

– Installable almost everywhere by lowest installation requirements for up- and downstream sections
– Highest accuracy in steam measurement
– Wide measurement span helps to detect energy flow in times of low consumption
– Multiple signal paths for volume flow, totalization and pulse outputs
– Direct mass flow measurement on saturated steam possible

Your benefit from using swirl technology:

– Increased plant efficiency because of more transparency of the heat flows.
– Cost savings for burner fuel from increased plant efficiency
– Leak detection possible due to precise swirl technology



Efficiency before (left graphic) and after (right graphic) installation of swirl flowmeters

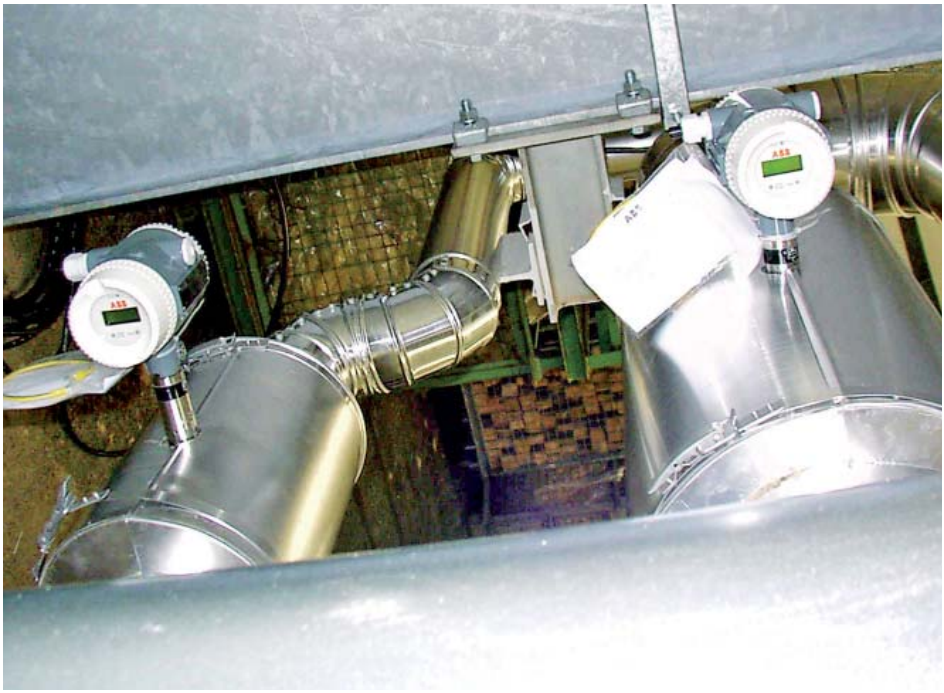
For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
DP flowmeter (Orifice plate)	– Higher measuring range – Higher accuracy – Easier to install in existing footprint
Condensate measurement	– Higher accuracy – Leak detection possible
Vortex flowmeter	– Higher measuring range – Higher accuracy – Easier to install in existing footprint

Steam distribution
with high flow variety

Relevant industries
– Power

Application / challenge
– Increasing energy costs require more transparency in energy flows
– High differences between summer and winter energy consumption
– Even low energy flow should be monitored and billed

Two swirl flowmeters in steam measurement in split range application, pipes and flowmeters insulated



Why to use ABB swirl flowmeters in this application?

- High measuring spans with stable accuracy over the whole range lead to lowest offset when switching from summer to winter service
- Better consumption transparency because of detection of energy flow in times of lowest consumption
- Installable almost everywhere by lowest installation demands for up- and downstream sections
- Direct mass flow measurement on saturated steam possible
- Multiple signal paths for volume flow, totalization and pulse outputs

Your benefit from using swirl technology:

- High measuring ranges help to save costs because a second flowmeter installation is usually not needed
- Increased energy cost transparency during the entire year or measuring period

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
DP flowmeter (Orifice plate)	– Higher measuring range – Higher accuracy
Vortex flowmeter	– Higher measuring range – Higher accuracy

Steam management
in process plants

Relevant industries

- Power
- Chemical
- Pulp and paper
- Food and beverage

Application / challenge

- One central power plant provides steam to different end users in different lines
- Space constraints can make it impossible to keep required up- and downstream sections

Five 4" (DN100) swirl flowmeter for steam distribution significantly save installation space

Why to use ABB swirl flowmeters in this application?

- Digital signal processing for volume flow, totalization and pulse outputs for highest reliability and accuracy
- Lowest installation demands for up- and downstream sections
- High range ability for high flow dynamics

Your benefit from using swirl technology:

- Direct steam mass flow measurement – no additional temperature sensor installation needed.
- High accuracy over the whole measuring range leads to more cost transparency and energy (cost) savings

For this application you might use another flowmeter...	...but there are convincing arguments pro ABB's swirl flowmeters
DP flowmeter (Orifice plate)	– Higher measuring range – Higher accuracy – Less straight pipe run required
Vortex flowmeter	– Higher measuring range – Higher accuracy – Less straight pipe run required – No need for pipe reduction
Coriolis mass flowmeter	– Higher measuring range – Less expensive – Shorter installation length

Oxygen measurement

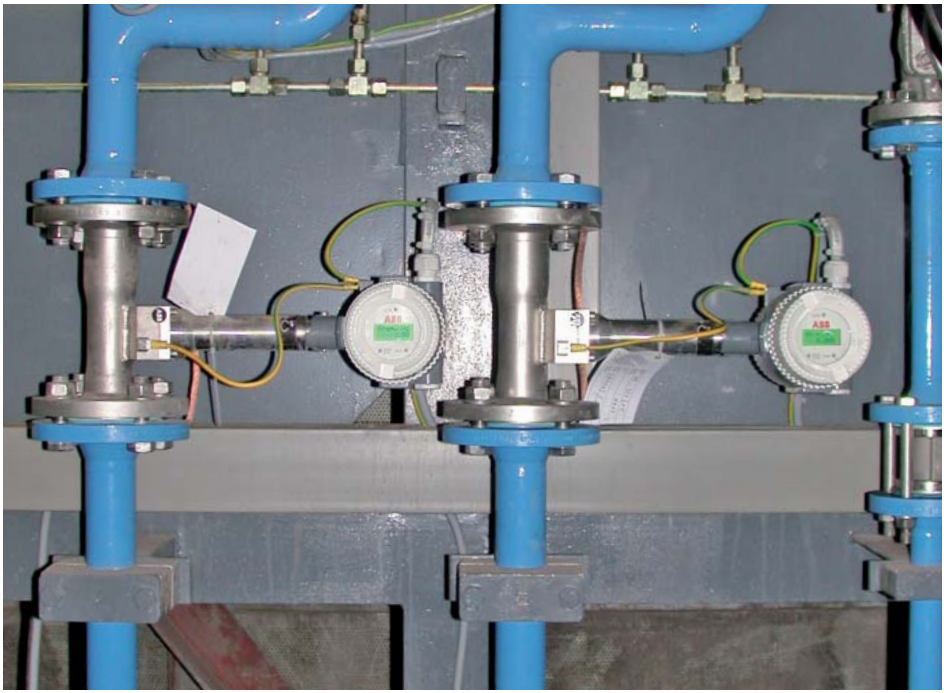
Relevant industries

– Metals

Application / challenge

– Oxygen measurement with high varying flow rates requires very high measuring span of up to 1:50
– A small oxygen flow has to keep the oxygen lance free during the time only the burner is working
– Full range is necessary when the oxygen beam is working

Two 2" (DN50) swirl flowmeters installed in an oxygen pipe



Why to use ABB swirl flowmeters in this application?

- Superior high measuring dynamics make it possible to reach required turn down ratio with adequate measurement uncertainty within one device
- Highest reliability due to digital signal processing for volume flow, totalization and pulse outputs
- Increared accuracy because of integrated temperature compensation
- Installable almost everywhere because of lowest installation demands for up- and downstream sections

Your benefit from using swirl technology:

- High long term stability and reliability because of maintenance free measuring system
- No need for re-calibration

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
Thermal Mass flowmeter	– Less straight pipe run required – Higher measuring range because of high pressure
Vortex flowmeter	– Higher measuring range – Higher accuracy – Less straight pipe run required – No need for pipe reduction
Turbine flowmeter	– No moving parts – No maintenance
Coriolis mass flowmeter	– Less expensive – Same measuring range

Dual sensor applications

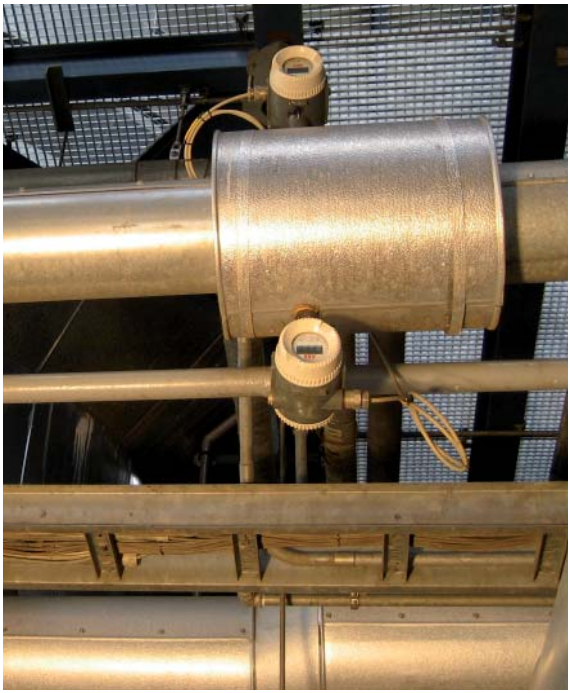
Relevant industries

- Chemical
- Oil and gas

Application / challenge

- 2-out-of-3-measurements for triple validation, i.e. dual-sensor-device and seperate single-sensor
- For installations with extremly high plant availability requirement

Dual sensor device insulated in conventional sensor layout



Dual sensor swirl flowmeter with 120° sensor layout

Why to use ABB swirl flowmeters in this application?

- Two completely independent sensors and electronics offer highest flexibility
- Same installation length as single sensor
- All sensor / transmitter options of single sensor device available for dual sensor
- Highest analogy of both sensor signals
- Shortest installations by lowest demands for up- and downstream sections for two devices in line

Your benefit from using swirl technology:

- Triple validation with one installation possible: three sensors plus three transmitters in one spool piece offers a 2-out-of-3 evaluation without any additional pipe work
- Flexible sensor installation, for example in corners
- Higher plant availability and reliability because of multi-sensor device

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
Vortex flowmeter	– Triple sensor device possible – Less straight pipe run required, especially, when 2 or 3 sensors have to be installed in one line

High pressure gas measurement

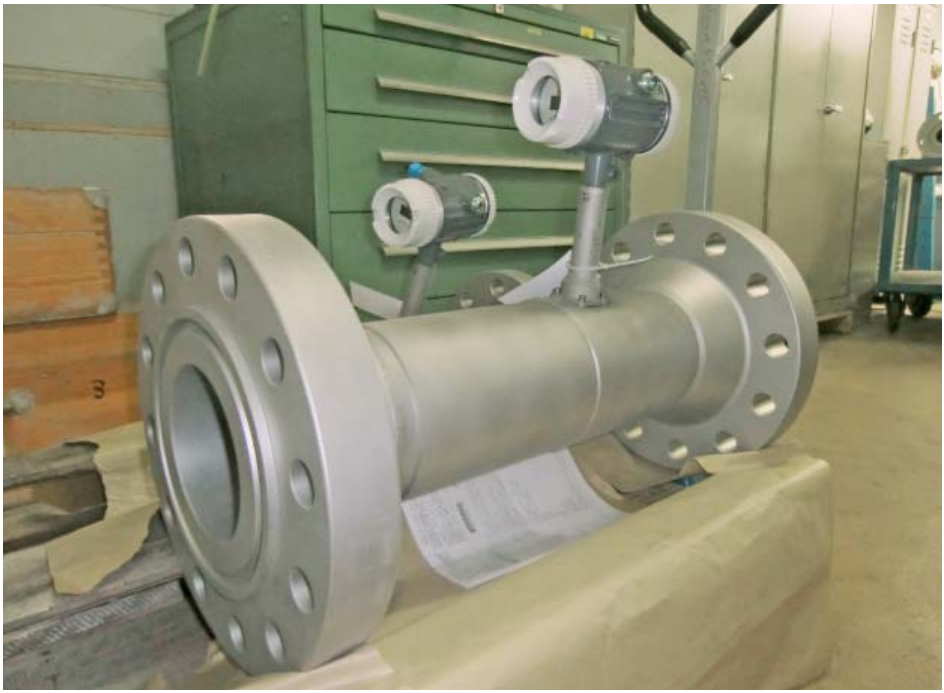
Relevant industries

– Chemical
– Oil and gas

Application / challenge

– Gas measurements under high pressure in oil and gas
– High safety demands for welding, material and testing
– Often special material required

6" (DN150) swirl flowmeter with ASME class 900 RTJ flanges



Why to use ABB swirl flowmeters in this application?

- Installable almost everywhere by lowest installation demands for up- and downstream sections
- Superior high measuring dynamics and lower pressure loss compared to reduced vortex flowmeter
- Simple and robust sensor design without any moving parts leads to high long term stability for reliable measurements
- Digital signal processing for volume flow, totalization and pulse outputs
- Available in different materials like Hastelloy C, Duplex, Super-Duplex

Your benefit from using swirl technology:

- Cost savings for high pressure piping because of more compact installations
- Highest reliability even in challenging applications
- Maintenance free measuring system
- Tailored solutions with special process connections and special materials

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
DP flowmeter (Orifice plate)	– Higher measuring range – Higher accuracy – Less straight pipe run required
Turbine flowmeter	– Less straight pipe run required – Less sensitive for pollution – Maintenance free design
Vortex flowmeter	– Higher measuring range – Higher accuracy – Less straight pipe run required – No need for pipe reduction
Coriolis mass flowmeter	– Less expensive at same performance level

Digester gas treatment and measurement

Relevant industries

– Power

Application / challenge

– Digester gas measurement at lowest pressure
– Dirty, wet and sometimes aggressive gas with changing methane content

6" (DN150) swirl flowmeter in outdoors biogas application

Why to use ABB swirl flowmeters in this application?

- Unique swirl technolgy excellently manages polluted and wet raw gas before treatment
- Digital signal processing for highly reliable volume flow metering and totalization
- Integral compensation of temperature saves additional installation costs
- With IP67 / NEMA 4X housing ideally suited for outdoors installation

Your benefit from using swirl technology:

- Installable almost everywhere because of lowest installation demands for up- and downstream sections
- Robust, maintenance free design
- Immune to wet and aggressive biogas contents
- Insensitive against pollution

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
Thermal mass flowmeter	– Less straight pipe run required – Less sensitive against moisture, pollution, and agressive gas content – Higher accuracy as swirl flowmeters are independent of gas mixture
Vortex flowmeter	– Higher measuring range – Higher accuracy – Less straight pipe run required – No need for pipe reduction

Aircraft fuel measurement

Relevant industries

– Oil and gas downstream

Application / challenge

– Aircraft filling with Jet A1
– Large volume flow of non-conductive fluid
– High accuracy required

8" (DN200) swirl flowmeter in airport installation for Jet A1 measurement

Why to use ABB swirl flowmeters in this application?

– Highest accuracy for non-conductive fluids at lowest cost
– Highly reliable volume flow metering, internal totalization and control of external totalizer by pulse output
– Integral compensation of temperature impact can increase accuracy for computed mass flow
– With IP67 / NEMA 4X housing ideally suited for outdoors installation

Your benefit from using swirl technology:

– Installable almost everywhere because of lowest installation demands for up- and downstream sections
– Get high accuracy at much lower cost compared to other applicable measuring principles
– Fits ideally in existing line size, low pressure loss compared to other principles

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
Vortex flowmeter	– Higher measuring range – Higher accuracy – Less straight pipe run required
Coriolis mass flowmeter	– Less expensive, especially in larger sizes

Phenol and polycarbonate production

Relevant industries

– Oil and gas downstream
– Petrochemical

Application / challenge

– Steam, hot water, phenolic products
– Non-conductive fluids in laser pipes
– High accuracy of 0.5% required
– Only very limited upstream space available

8" (DN200) swirl flowmeter with low space requirements

Why to use ABB swirl flowmeters in this application?

– Highest accuracy for non-conductive fluids at lowest cost, in this case 8" (DN200) and 12" (DN300) meters
– Installable almost everywhere because of lowest installation demands for up- and downstream sections
– Highly reliable volume flow metering, internal totalization and control of external totalizer by pulse output

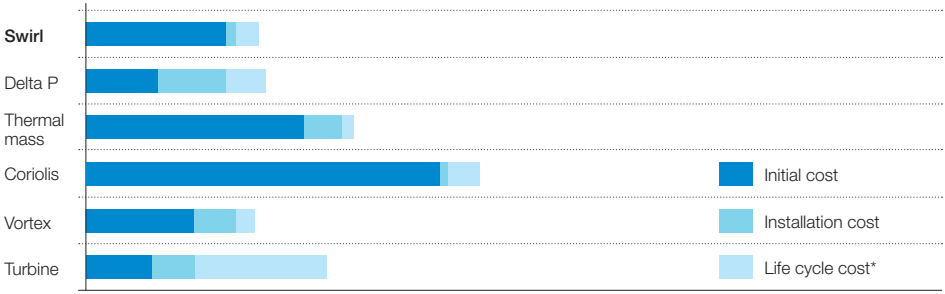
Your benefit from using swirl technology:

– No need for long straight pipe runs, as demanded by other flowmeters
– Get high accuracy at much lower costs compared to all other applicable measuring principles
– It typically fits ideally in existing line size without the need for pipe change
– Handling and commissioning like a standard vortex meter

For this application you might use another flowmeter…	…but there are convincing arguments pro ABB's swirl flowmeters
Vortex flowmeter	– Much less straight pipe run required – Higher accuracy
Coriolis mass flowmeter	– Less expensive especially in these large sizes
Turbine flowmeter	– Less sensitive for pollution or gas bubbles – Maintenance free design – Less straight pipe run required

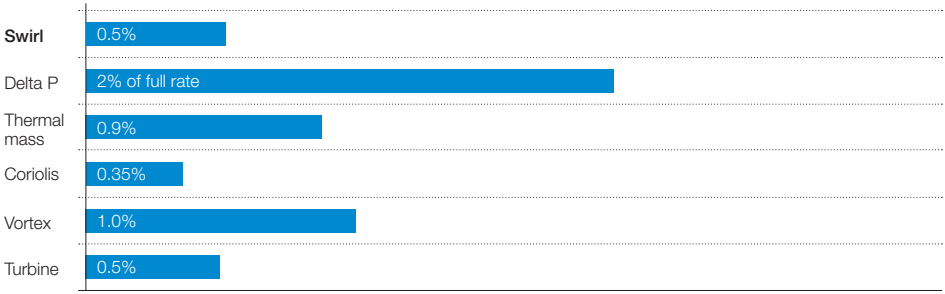
Technology

Cost of ownership for 5 years



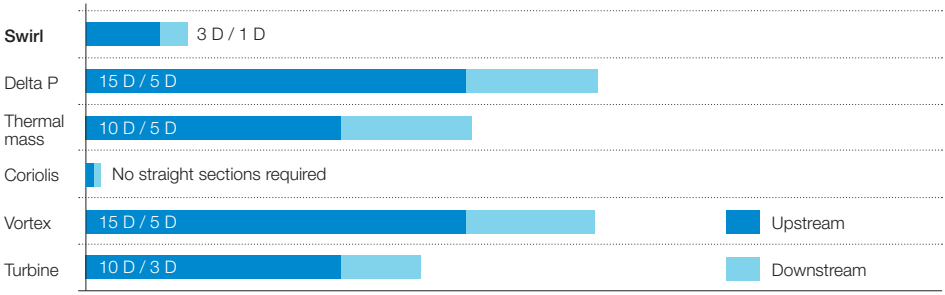
* Including energy cost for pressure loss and maintenance cost

Measurement uncertainty*



* For steam and gas applications

Pipe length needed for straight pipe run



D = Nominal diameter

Technical data

The most important data at a glance	
Accuracy for liquids	± 0.5% of rate
Accuracy for gases and steam	± 0.5% of rate
Process connection	Flange design
Meter sizes	DN15 (1/2") – DN400 (16")
Media temperature	-55…280 °C (-67…536 °F)
Pressure rate (std.)	PN40 / ASME class 150/300
Pressure rate (max.)	PN160 / ASME class 900
Media viscosity	max. 30 cP
Required straight pipe runs	Upstream/downstream
- After a reduction	3 x DN / 1x DN
- After elbows (3 dimensions)	3 x DN / 1x DN
- After a control valve	5 x DN / 1x DN
Ex approvals	ATEX, IECEx zone 1/2 and 21/22
	cFMus class 1 div. 1
	NEPSI zone 1/2
Communication protocols	HART, PROFIBUS PA, FF

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