DIVA flowmeter

for saturated steam flow measurement

spirax sarco

DIVA the Direct In-line Variable Area flowmeter...

Energy is often treated as an overhead but can represent a considerable part of the cost of production for products and services.

In response to the global Kyoto agreement, many governments are focusing on ways to reduce energy usage and hence emissions; for example, the Climate Change Levy has recently been introduced in the UK. Measures such as these, together with higher energy costs, are persuading industrial and commercial users to turn to improved energy monitoring techniques.

Saturated steam is an important carrier of energy and consequently, is used throughout industry. Companies now recognise the need to measure steam flow. Case studies from the UK Energy Efficiency Office show savings of 5% - 25% are possible when steam flowmeters are used to monitor consumption.

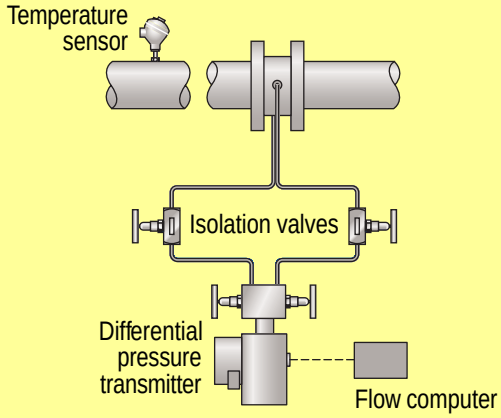
The Spirax Sarco Direct In-line Variable Area flowmeter (DIVA) has been designed as an ideal system for any steam energy management scheme or steam flowmetering application, from monitoring and targeting initiatives to control applications. The contemporary technology and unique operating principle mean it is ideally suited to demanding industrial processes with a low cost of ownership.

The DIVA is an innovative development of the well established family of Spirax Sarco Gilflo flowmeters and the compact ILVA, which have been used in industrial flowmetering applications for more than 25 years.

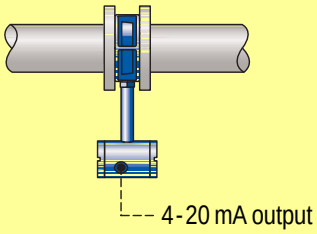
Flowmetering systems will:

- Check on the energy cost of any part of the plant.
- Cost energy as a raw material.
- Identify priority areas for energy savings.
- Enable efficiencies to be calculated for processes or power generation.

Traditional system



DIVA system



The DIVA system will also:

- Provide process control for certain applications.
- Monitor plant trends and identify any deterioration and steam losses.

User benefits

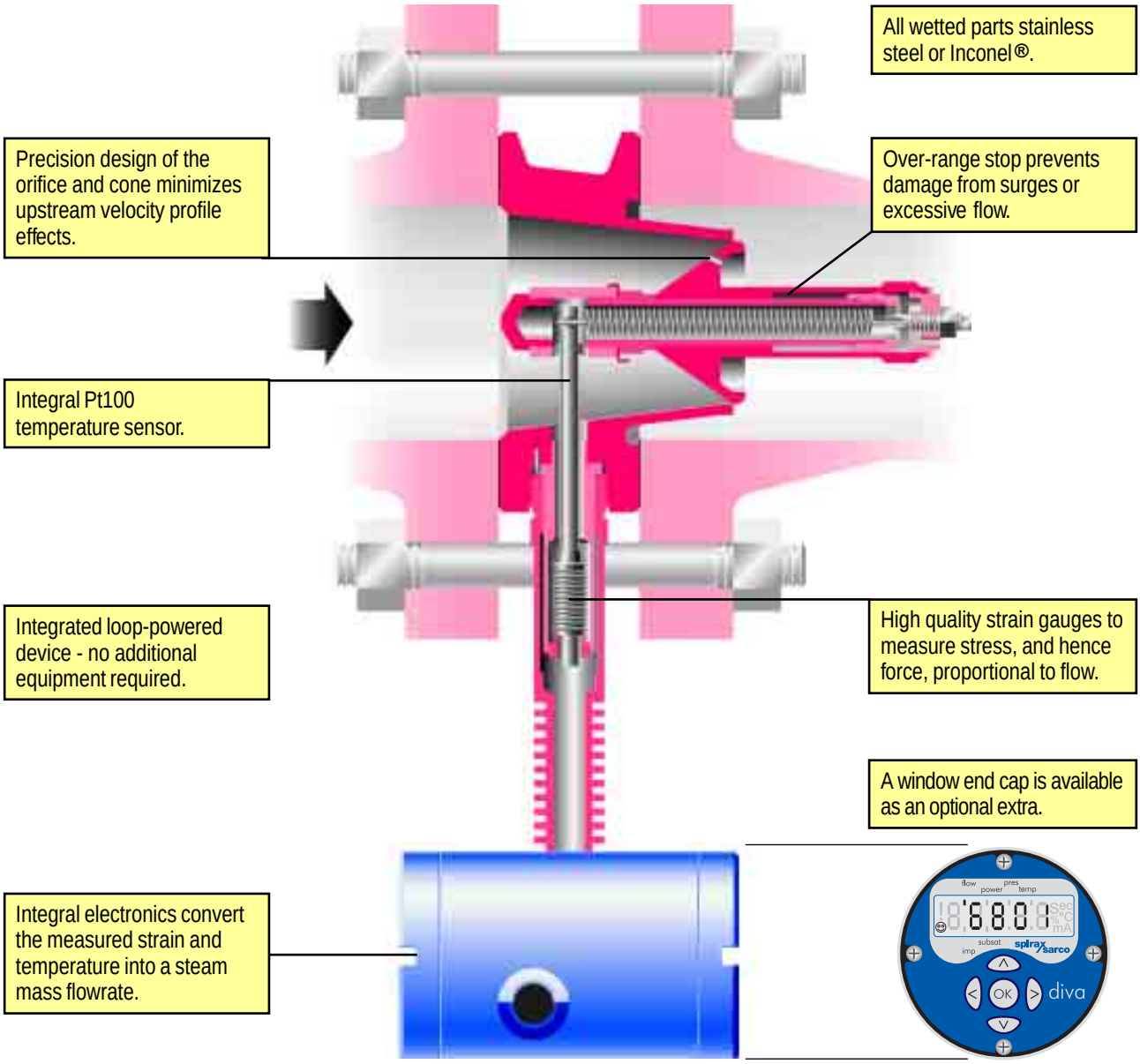
- Low cost integrated unit - No need for additional equipment or differential pressure transmitters.
- No impulse lines - Reducing maintenance, installation costs and potential problems.
- High turndown with high system accuracy and high repeatability - Provides accurate readings over a wide range of flows.
- In-built density compensation and error elimination - Accurate mass flow.
- Compact wafer design - Low cost installation.
- Industry standard - 4-20 mA loop powered.
- Simple digital commissioning via integral display.

How the DIVA flowmeter operates

The DIVA flowmeter operates on the well established spring loaded variable area (SLVA) principle, where the area of an annular orifice is continuously varied by a precision shaped moving cone. This cone is free to move axially against the resistance of a spring.

However, unlike other SLVA flowmeters, the DIVA does not rely on the measurement of differential pressure drop across the flowmeter to calculate flow, measuring instead the force caused by the deflection of the cone via a series of extremely high quality strain gauges. The higher the flow of steam, the greater the force. This removes the need for expensive differential pressure transmitters, reducing installation costs and potential problems.

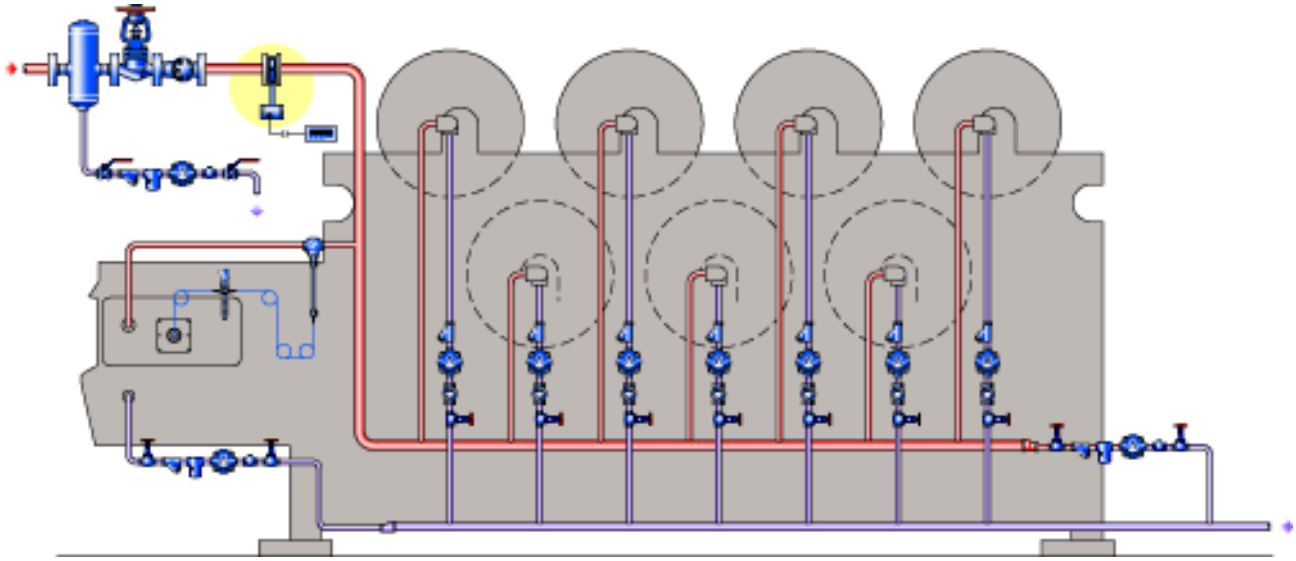
The DIVA has an internal temperature sensor which provides full density compensation for saturated steam applications, removing the need for, and expense of additional sensors.



As standard the DIVA is supplied with an easy to use digital commissioning display.
All programming is via 5 push buttons using a menu driven commissioning sequence.
The display will also report errors detected by the on-board diagnostics program.
Flow, temperature, pressure and power are displayed in metric or imperial units.

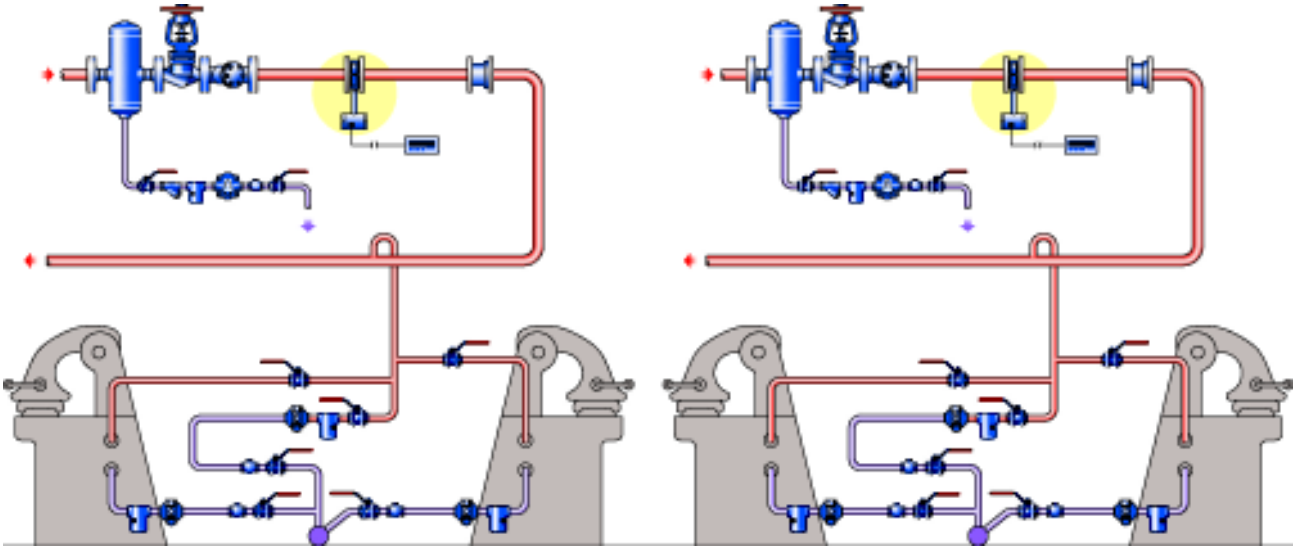
...mass flow without the need for additional equipment !

Typical ap



Plant efficiency

The DIVA can be used to calculate overall plant efficiency, determine when machinery is switched off, when plant is loaded to capacity or when working practices are satisfactory. It will also show the deterioration of plant over time, predicting optimum time for plant cleaning or replacement. It will also establish peak steam usage times or identify sections or items of plant to be major steam users. This may lead to a change in production methods for a more economical use of steam and to ease peak load problems on the boiler plant.



Energy efficiency

The DIVA can be used to monitor the results of energy saving schemes, such as monitoring and targeting, and to compare the efficiency of one piece of plant with another.

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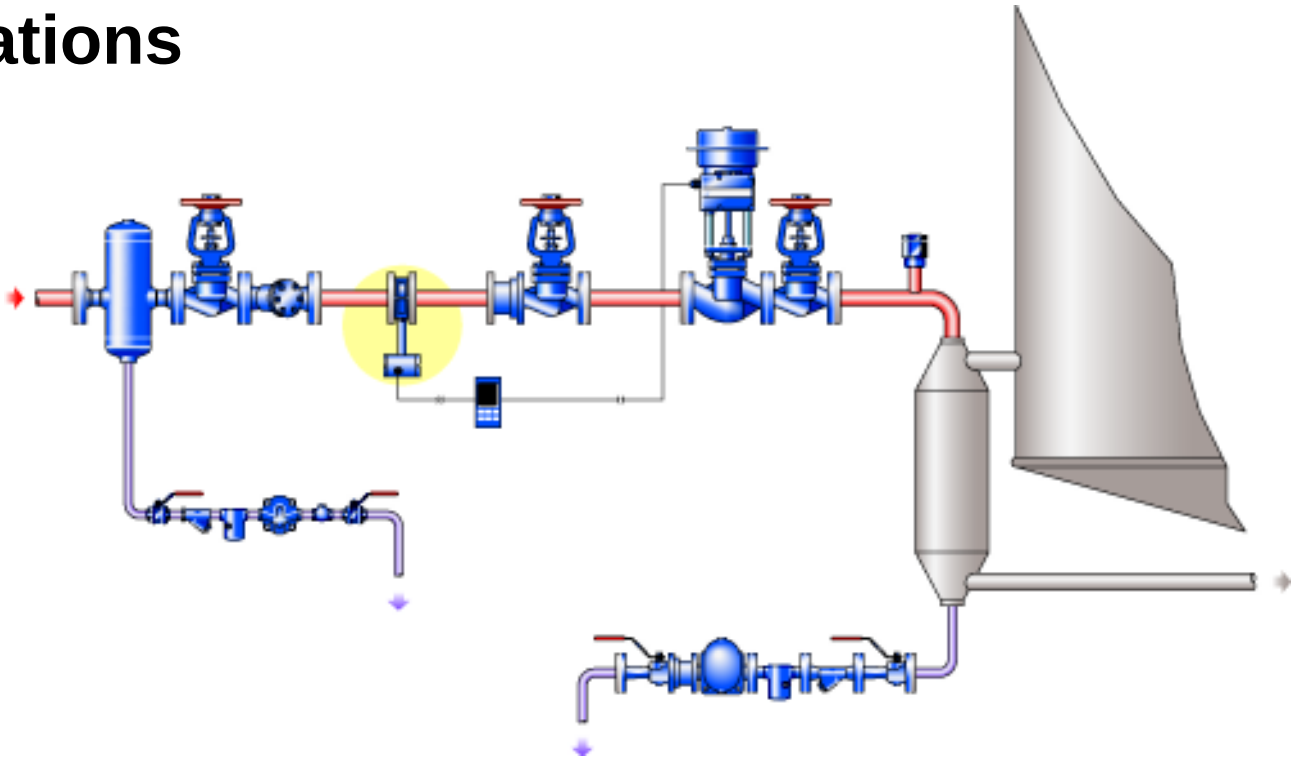
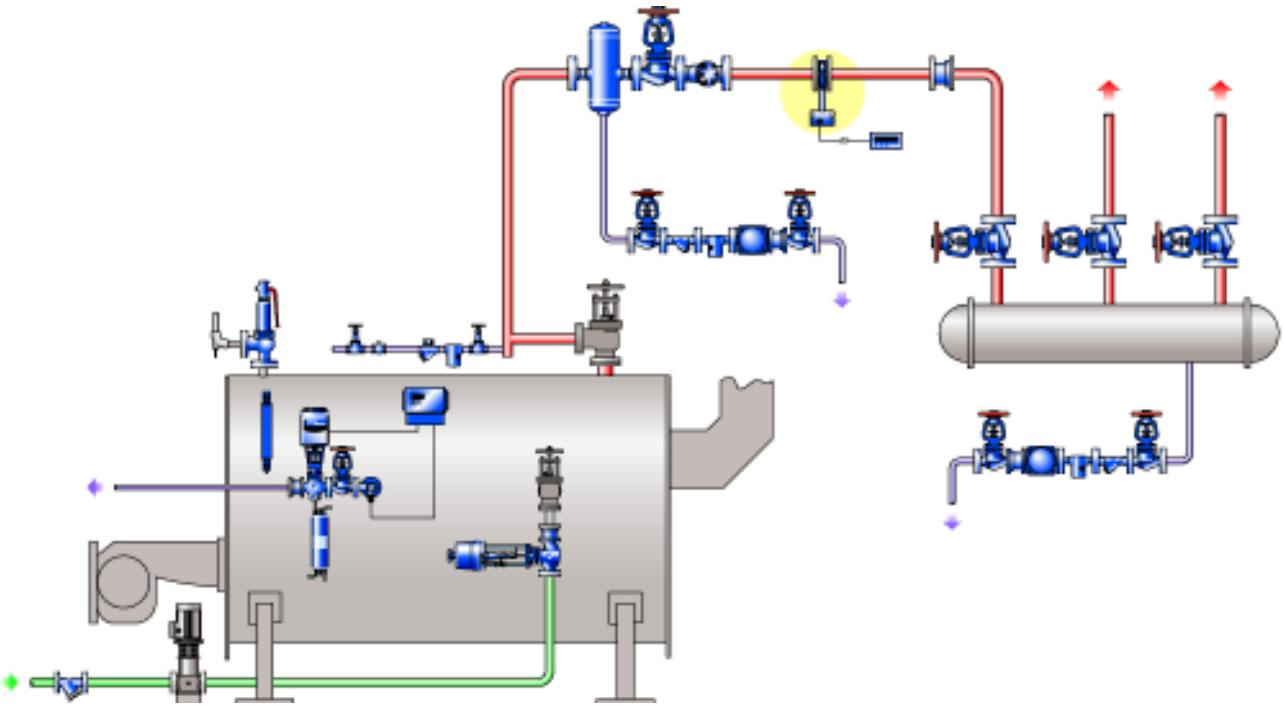


Process control

The DIVA can be used as part of a system to control the supply of the correct quantity of steam to a process. Also, by controlling the rate of increase of flow at start-up, it can be used as an effective slow warm-up device.



Costing and custody

The DIVA's high system accuracy and turndown means it is ideally suited to measure the flow of steam, and thus the cost of steam, either centrally or at major steam-using centres. Steam can be costed as a raw material at various stages of the production process thus allowing the true cost of individual product lines to be calculated.

Sizing the DIVA flowmeter for saturated steam - capacities kg/h

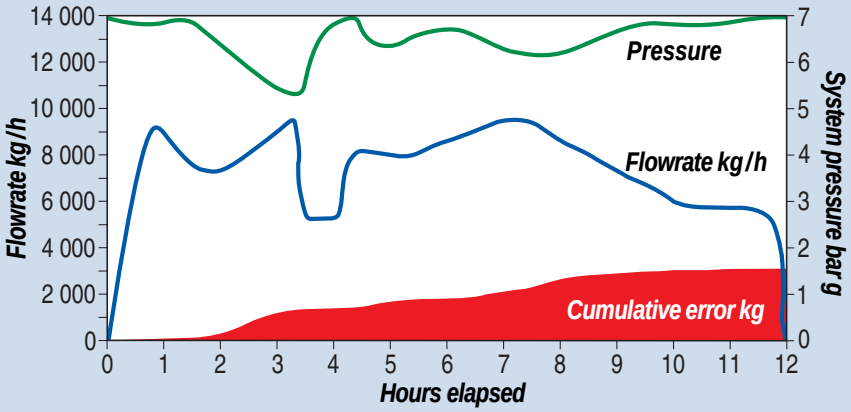
Steam pressure bar g		3	5	7	10	12	15	20	25	30	32
DN50	Maximum horizontal flow	759	960	1 126	1 335	1 458	1 626	1 871	2 094	2 296	2 374
	Minimum horizontal flow	20	25	28	33	36	40	46	51	56	58
DN80	Maximum horizontal flow	1 973	2 482	2 901	3 434	3 746	4 173	4 799	5 369	5 884	6 082
	Minimum horizontal flow	44	54	62	73	79	87	100	111	121	125
DN100	Maximum horizontal flow	3 275	4 030	4 661	5 469	5 945	6 600	7 563	8 442	9 238	9 544
	Minimum horizontal flow	68	83	95	111	121	134	153	171	186	193

Note: Minimum measurable flowrate is 2% of maximum horizontal flow. For vertical flow capacities please contact Spirax Sarco.

Density compensation

It is rare for the pressure in a steam system to remain absolutely constant. Unless this variation is taken into account, flow measurement errors will occur. The integral automatic density compensation provided by the DIVA flowmeter eliminates these errors and ensures accurate flowmetering whatever the steam pressure.

The example shown is for a metering system ***without*** density compensation and set at 7 bar g. By the end of the day significant errors can arise.



Errors associated with flowmeters ***without*** density compensation.

System uncertainty

The DIVA steam flowmeter has a system uncertainty in accordance with IS0 17025, of:

¡ ± 2% of actual flow to a confidence of 95% (2 standard deviations) over a range of 10% to 100% of maximum rated flow.

¡ ± 0.2% FSD to a confidence of 95% (2 standard deviations) from 2% to 10% of the maximum rated flow.

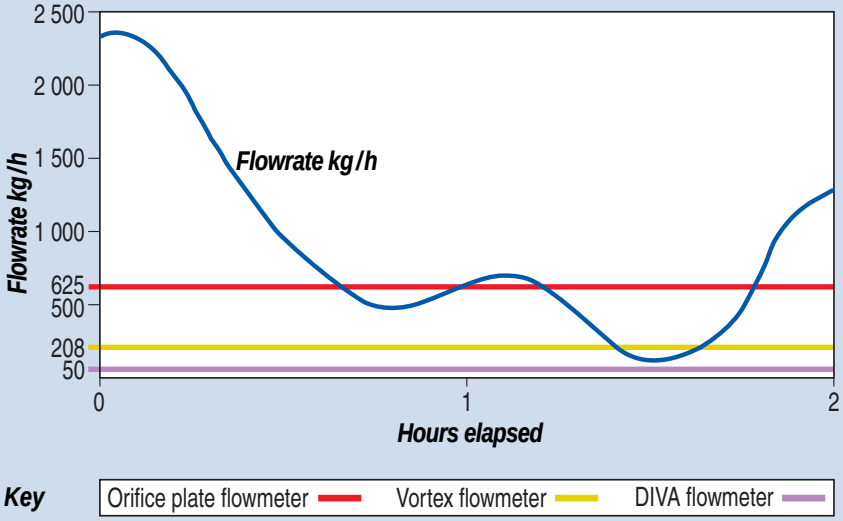
As the DIVA is a self-contained unit the uncertainty quoted is for the complete system. Many flowmeters claim a pipeline unit uncertainty and for a true system uncertainty, the individual uncertainty values of any associated equipment,†such as DP cells, need to be taken into account.

The importance of turndown

The turndown of a flowmeter is the ratio of the maximum to minimum flowrate over which it will meet its specified performance, or its operational range. The DIVA flowmeter has a high turndown ratio of up to 50:1, i.e. an operational range of up to 98% of its maximum flow.

In steam systems, load variations can lead to wide variations in flow, from standing or weekend loads up to the maximum demands of the process. It is essential for the flowmeter to be able to cope with this. The chart compares the minimum flowrates that can be measured for typical flowmeters with a maximum flow of 2500 kg/h. Flows below the minimum reading will be lost or at best inaccurate.

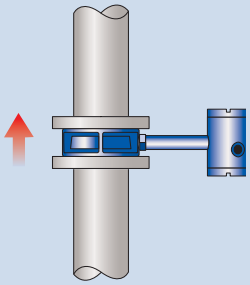
The DIVA flowmeter can achieve turndown ratios of up to 50:1, ensuring that the flow information gathered is accurate whatever the process conditions.



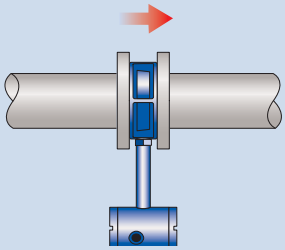
Minimum measurable flowrates, based on a practical steam velocity of 35 ms^{-1}

Flow orientations

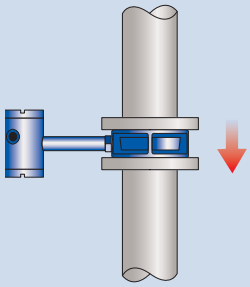
The DIVA can be installed in any of the following orientations:



Flow orientation: vertically upwards
Turndown up to 30:1
Pressure limitation 11 bar g



Flow orientation: horizontal
Turndown up to 50:1
Pressure limitation 32 bar g



Flow orientation: vertically downwards
Turndown up to 50:1
Pressure limitation 11 bar g

Associated equipment

If desired, the DIVA can output a 4-20 mA signal to a Spirax Sarco M750 display unit for remote indication of flowrate and totals. The M750 provides the loop power for the DIVA and is available with 4-20 mA retransmission or pulsed output. See separate literature for details.

Calibration information

It is important that any flowmeter is calibrated accurately. DIVA flowmeters are calibrated on a high accuracy flow facility at Spirax Sarcoís flowmeter manufacturing facility in Cheltenham, UK. Designed and built by Spirax Sarco engineers in conjunction with the UK National Engineering Laboratories, it ensures that every flowmeter meets the highest possible standards of accuracy.

The facility is capable of calibrating flowmeters of between DN50 and DN300 and has a total flow capacity of 19 000 litres of water per minute.

Gravimetric and transfer standard electromagnetic flowmeters are used.

All flow data is electronically archived for future reference / recalibration.

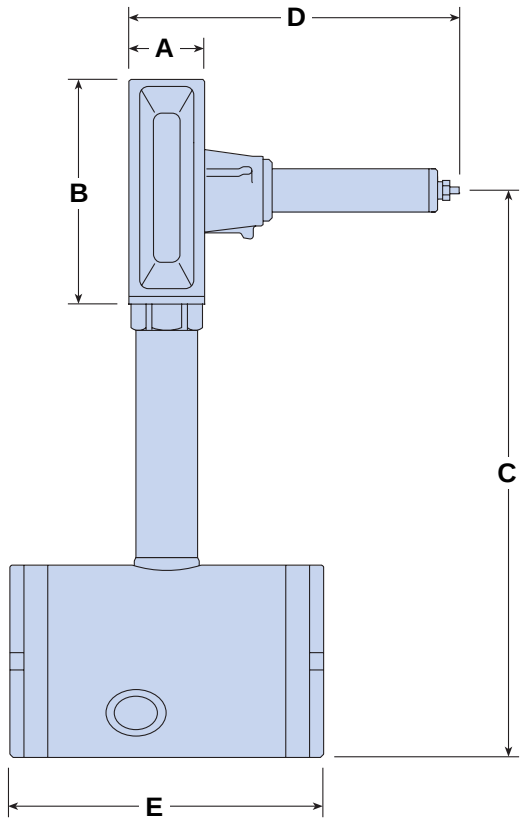
Sophisticated clamping arrangements ensure the flowmeters are concentric to the all 316L stainless steel pipework ensuring highly accurate calibration. The upstream and downstream pipework straight runs are well in excess of standard recommended lengths.

Note: Full calibration documentation is supplied as standard with every flowmeter.

Flowmeter calibration rig, Spirax Sarco, Cheltenham, UK.

Technical data

Operating principle	Spring loaded variable area with strain measurement	
Limiting conditions	***Horizontal flow***	Maximum operating pressure 32 bar g @ 239 C
	Vertical flow	Maximum operating pressure 11 bar g @ 188 C
Measurable fluids	Saturated steam	
Sizes available	DN50, DN80 and DN100	
Flange specifications	Sandwich design, suitable for installation between the following flanges: EN 1092 PN16, PN25 or PN40 BS 10 Table H ANSI B 16.5 class 150 or 300 JIS 20 KS 20	
Electrical connections	***Standard*** M20 x 1.5	***Available to order*** " NPT
Materials of construction	***Body and internals***	Stainless steel
	Spring	Inconel® X750 (or equivalent)
	Housing	Aluminium HE30
Window end cap	Available as an optional extra	
Installation	***Below 11 bar g*** - Any flow orientation	***Above 11 bar g*** - Horizontal flow lines only
Power supply	Loop powered nominal 24 Vdc	
Turndown	Up to 50:1	
Outputs	4 - 20 mA (directly proportional to mass flowrate)	
	Pulsed output (per mass or energy unit)	
System uncertainty in accordance with ISO 17025	± 2% of actual flow between 10% and 100% of maximum rated flow	
	± 0.2% of FSD for flows from 2% to 10% of maximum rated flow	
Unrecovered pressure drop	Less than 750 mbar at maximum flowrate for the DN50 and less than 500 mbar for the DN80 and DN100	



Dimensions and weights approximate in mm and kg

Size	*A*	*B*	*C*	*D*	*E*	*Weight*
DN50	35	103	265	155	145	3.35
DN80	45	138	285	150	145	5.25
DN100	60	162	315	205	145	8.20

How to order

Example: 1 off Spirax Sarco DN100 DIVA flowmeter for installation between EN 1092 PN40 flanges. For use on saturated steam at 10 bar g, maximum flow 5 469 kg/h. Complete with M750 display unit with 4 - 20 mA output.

In addition to the DIVA flowmeter range, Spirax Sarco can provide flowmeters such as the ILVA for fluids other than steam or higher pressure applications. Please contact us for further details.

Some of the products may not be available in certain markets.

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