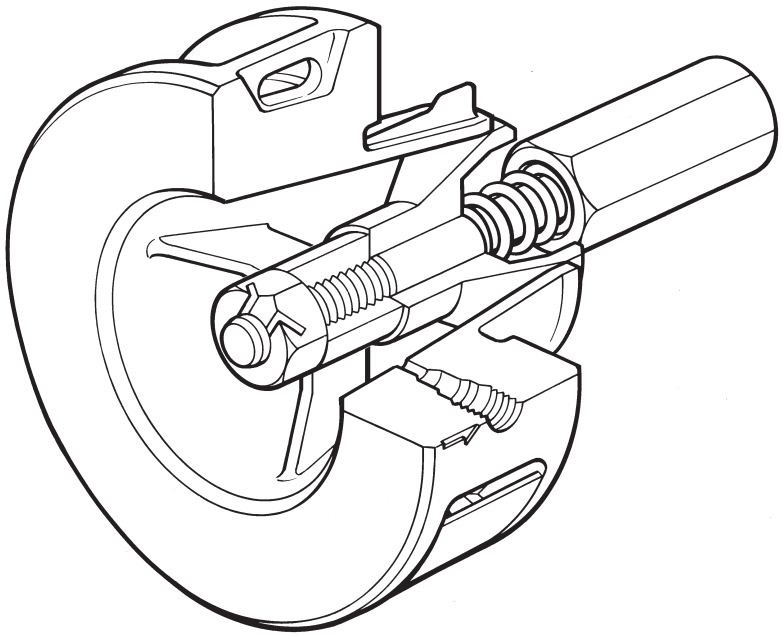
ILVA
Flowmeter

Description

The ILVA flowmeter operates on the spring loaded variable area principle and produces a differential pressure related to the rate of flow. It can be used with most industrial fluids, gases and both saturated and superheated steam. A general description of the ILVA flowmetering system and its associated equipment is given in a separate TI sheet.

Sizes and pipe connections

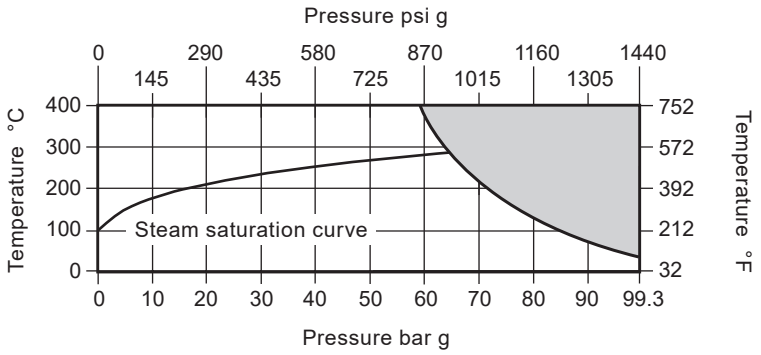
DN50, DN80, DN100, DN150, DN200 (2", 3" 4", 6", 8"). For DN250 and DN300 (10" and 12") sizes see separate literature.
Suitable for fitting between the following flanges:
EN 1092 PN16, PN25 and PN40.
BS 10 Table H.
ASME B 16.5 Class 150, 300 and 600.
JIS 20.
KS 20.
The ILVA flowmeter should be installed in pipework manufactured to BS 1600 or ASME B 36.10 Schedule 40.
For different pipe standards / schedules downstream spool pieces with equivalent internal diameter as in BS 1600 or ASME B 36.10 Schedule 40 should be used. If this is not possible, please contact Spirax Sarco.



Materials

Part	Material
Body	Cast stainless steel S.316 (CF8M / 1.4408)
Internals	431 S29 / S303 / S304 / S316
Spring	Inconel X750

Pressure/temperature limits



The product **must not** be used in this region.

Body design conditions			ASME 600
PMA	Maximum allowable pressure	99.3 bar g @ 38 °C	1440 psi g @ 100 °F
TMA	Maximum allowable temperature	400 °C @ 58.9 bar g	752 °F @ 854 psi g
Minimum allowable temperature		-29 °C	-20 °F
PMO	Maximum operating pressure is dependant on the flange specification		
Minimum operating pressure		0.6 bar g	9 psi g
TMO	Maximum operating temperature	400 °C @ 58.9 bar g	752 °F @ 854 psi g
Minimum operating temperature **Note:** For lower operating temperatures consult Spirax Sarco.		-29 °C	-20 °F
Maximum viscosity			30 centipoise
ΔPMX	Maximum differential pressure	498 m bar	200 in Wg
Designed for a maximum cold hydraulic test pressure of:		149 bar g	2161 psi g

Performance

The ILVA is designed to be used in conjunction with linearising electronics such as the range of flow computers or M750 display unit. Alternatively the output signal linearisation can be performed on an EMS / BEMS or equivalent.
Accuracy when used with Spirax Sarco flow computers or M750:
±1% of measured value from 5% to 100% of maximum rated flow.
±0.1% FSD from 1% to 5% of maximum rated flow.
Repeatability better than 0.25%
Turndown: up to 100:1
Caution: Scanner 2000 steam mass flow transmitters are uniquely configured at the factory to work with a single, specific ILVA flowmeter. For correct operation the configured Scanner 2000 transmitter must always be installed with its allocated flowmeter. Labels on the packaging give the serial numbers of the matched products.

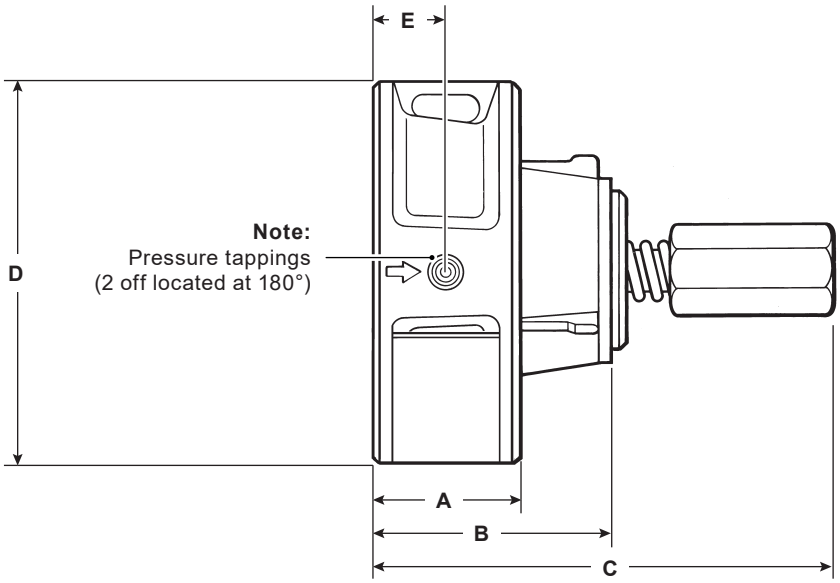
Pressure drop

The maximum pressure drop across the ILVA pipeline unit is 498 m bar (200 ins water gauge) at maximum rated flow.

Flow capacity

To determine the capacity of the ILVA for different fluids, it is necessary to calculate the equivalent water flowrate Q_E (in l/min) as described in Step 1, under the section 'sizing the ILVA' then selecting the appropriate size of flowmeter from the Table under Step 2 overleaf.

Dimensions/weights (approximate) in mm (inches) and kg (lbs)



Size	A	B	C	D	E	Weight
DN50 (2")	35 (1.4)	63 (2.5)	140 (5.5)	103 (4.1)	17.5 (0.7)	2.0 (4.4)
DN80 (3")	45 (1.8)	78 (3.1)	150 (5.9)	138 (5.4)	22.5 (0.9)	3.9 (8.6)
DN100 (4")	60 (2.4)	103 (4.1)	205 (8.1)	162 (6.4)	30.0 (1.2)	8.3 (18.3)
DN150 (6")	75 (3)	134 (5.3)	300 (11.8)	218 (8.6)	37.5 (1.5)	14.2 (31.3)
DN200 (8")	85 (3.3)	161 (6.4)	360 (14.2)	273 (10.7)	42.5 (1.7)	23.6 (52)

Note: Pressure tappings are threaded ¼" NPT

Sizing the ILVA for saturated steam - kg/h

Minimum and maximum flowrates in kg/h at different pressures (bar g)
Note: Maximum steam flowrates are calculated at maximum differential pressure.

Size		Steam pressure bar g										
		1	3	5	7	10	12	15	20	25	30	40
DN50	Maximum	307	427	517	594	693	752	832	952	1 060	1 160	1 341
	Minimum	3	4	5	6	7	8	8	10	11	12	13
DN80	Maximum	1 206	1 675	2 032	2 332	2 721	2 951	3 268	3 740	4 163	4 554	5 265
	Minimum	12	17	20	23	27	30	33	37	42	46	53
DN100	Maximum	2 475	3 435	4 167	4 784	5 581	6 054	6 703	7 671	8 540	9 341	10 800
	Minimum	25	34	42	48	56	61	67	77	85	93	108
DN150	Maximum	5 981	8 301	10 071	11 562	13 487	14 631	16 119	18 538	20 639	22 573	26 101
	Minimum	60	83	101	116	135	146	162	185	206	226	261
DN200	Maximum	11 756	16 317	19 796	22 726	26 509	28 757	31 840	36 437	40 566	44 368	51 301
	Minimum	118	163	198	227	265	288	318	364	406	444	513

How to order

Example: 1 off Spirax Sarco DN150 ILVA flowmeter for installation between flanges to EN 1092 PN40. Body material 316 stainless steel. Flow medium saturated steam at 10 bar g, maximum flow 8 000 kg/h.

Sizing the ILVA flowmeter

In order to determine the flow capacity of a ILVA pipeline unit, it is necessary to calculate the equivalent water flowrate (Q_E) based on the anticipated actual flow (see Step 1). The Table below is used to select the appropriate unit (steam only).

Step 1.

Determine equivalent water flowrate (Q_E) in l/min:-

	Mass flow units	Volumetric units
Liquids	$Q_E = \frac{q_m}{\sqrt{SG}}$	$Q_E = Q_L \sqrt{SG}$
Gases and steam actual flow conditions	$Q_E = q_M \sqrt{\frac{1000}{D_F}}$	$Q_E = Q_F \sqrt{\frac{D_F}{1000}}$
Gases standard conditions	$Q_E = \frac{q_M}{\sqrt{\frac{D_S}{1000} \times \frac{P_F}{P_S} \times \frac{T_S}{T_F}}}$	$Q_E = Q_S \sqrt{\frac{D_S}{1\,000} \times \frac{P_S}{P_F} \times \frac{T_F}{T_S}}$

Where:

Q_E = Equivalent water flowrate (litres/min)

q_m = Mass flowrate (kg/min)

Q_L = Maximum liquid flowrate (litres/min)

Q_S = Maximum gas flowrate at standard conditions (litres/min)

Q_F = Maximum gas flowrate at actual flow conditions (litres/min)

SG = Specific gravity

D_S = Density of gas at standard conditions (kg/m³)

D_F = Density of gas at actual flow conditions (kg/m³)

P_S = Standard pressure: 1.013 bar a, 1.033 kg/cm² a, 14.70 psi a

P_F = Actual flow pressure in same absolute units as P_S

T_S = Standard temperature (K) = °C + 273

T_F = Actual flow temperature (K) = °C + 273

Step 2.

Using the value of Q_E as determined in Step 1, select the correct size of the ILVA flowmeter using the Table below.

In practice, it will often be the line size that determines the choice of the flowmeter.

Flowmeter type	Q_E litres / min		Maximum DP	
	Maximum	Minimum	Wg	m bar
DN50	149	1	200	498
DN80	585	6	200	498
DN100	1 200	12	200	498
DN150	2 900	29	200	498
DN200	5 700	57	200	498

Example: Determine which ILVA pipeline unit is required to measure the flow of compressed air when:
1: Estimated maximum rate of flow = 500 s m³/h at 7 bar g and 20 °C

Note: Standard conditions = 1.013 bar a, 0 °C giving a standard density of 1.29 kg / m³

2: Calculate Q_E from: $$Q_E = Q_S \sqrt{\frac{D_S}{1\,000} \times \frac{P_S}{P_F} \times \frac{T_F}{T_S}}$$

$$Q_E = (500 \times 16.667) \times \sqrt{\frac{1.29}{1000} \times \frac{1.013}{8.013} \times \frac{293}{273}}$$

$$Q_E = 110 \text{ litres/min}$$

So a DN50 ILVA is recommended.
Note: 1 m³/h = 16.667 litres / min

How to order example

1 off Spirax Sarco DN50 ILVA flowmeter suitable for fitting between EN 1092 PN40 connections.

Sizing the Gilflo ILVA for saturated steam - lb/h

Minimum and maximum flowrates in lb/h at different pressures (psi g)

Note: Maximum steam flowrates are calculated at maximum differential pressure.

Size		Steam pressure psi g							
		15	**50**	**75**	**100**	**150**	**200**	**400**	**600**
2"	**Maximum**	682	988	1153	1299	1549	1764	2451	3009
	Minimum	7	10	12	13	15	18	25	30
3"	**Maximum**	2677	3877	4528	5103	6081	6926	9627	11815
	Minimum	27	39	45	51	60	69	96	118
4"	**Maximum**	5492	7953	9288	10466	12473	14206	19747	24236
	Minimum	55	79	93	105	125	142	197	242
6"	**Maximum**	13273	19220	22448	25295	30144	34333	47723	58571
	Minimum	132	192	224	252	301	343	477	585
8"	**Maximum**	26088	37778	44121	49718	59249	67483	93801	115123
	Minimum	261	377	441	497	592	674	938	1151

How to order

Example: 1 off Spirax Sarco 2" Gilflo ILVA flowmeter suitable for fitting between ASME B 16.5 Class 150 flanges.

Sizing the ILVA flowmeter

In order to determine the flow capacity of a ILVA pipeline unit, it is necessary to calculate the equivalent water flowrate (Q_E) based on the anticipated actual flow (see Step 1). The Table below is used to select the appropriate unit (steam only).

Step 1.

Determine equivalent water flowrate (Q_E) in U.S. GPM:

Liquids

$$Q_E = \frac{m}{500}\sqrt{\frac{D_E}{D_L}}$$

or

$$Q_E = Q_L\sqrt{\frac{D_E}{D_L}}$$

Q_E = equivalent flow rate of water at 70 °F (U.S. GPM)

m = maximum flow rate of service liquid (lb/hr)

D_E = density of water at calibration (62.305 lb/ft³)

D_L = density of service liquid (lb/ft³)

Q_L = maximum flow rate of service liquid (U.S. GPM)

Gases

$$Q_E = \sqrt{D \times \frac{P_F}{P_S} \times \frac{T_F}{T_S}}$$

or

$$Q_E = (0.948) \times Q_G\sqrt{D \times \frac{P_F}{P_S} \times \frac{T_F}{T_S}}$$

Q_E = Equivalent water flowrate (litres / min)

m = maximum flow rate of service liquid (lb/hr)

D = gas density at 14.7 psi a, 520 °R (60 °F) (lb/ft³)

P_F = flowing pressure of gas (psi a)

P_S = standard atmospheric pressure (14.7 psi a)

T_S = standard absolute temperature (520 °R)

T_F = flowing temperature of gas (°R = °F + 460)

Q_G = maximum flow rate of gas (SCFM)

Steam

$$Q_E = (0.0158) \times m\sqrt{v}$$

Q_E = water equivalent flow rate at 70 °F (U.S. GPM)

m = maximum flow rate of steam (lb/hr)

v = specific volume of steam at normal pressure and temperature (ft³/lb)

Step 2.

Select from the table below the Gilflo ILVA meter with a maximum Q_E that closely matches (but exceeds) the application Q_E determined in step 1.

In practice, it will often be the line size that determines the choice of the flowmeter.

Meter size	Q_E US Gal/min		Maximum DP
	Maximum	Minimum	ins Wg
2"	40	0.4	200
3"	158	1.6	200
4"	317	3.2	200
6"	781	7.8	200
8"	1535	15.4	200

How to order example

1 off Spirax Sarco DN50 ILVA flowmeter suitable for fitting between EN 1092 PN40 connections.

Safety information, installation and maintenance

For full details see the Installation and Maintenance Instructions supplied with the product.

Installation note

The following main points are given here for guidance:

1. The ILVA should be mounted with a minimum of 6 straight pipe diameters upstream and 3 downstream. No valves, fittings or cross sectional changes are permitted within these pipe lengths. Where an increase in nominal pipe diameter is required upstream of the flowmeter, the length of straight pipe should be increased to 12 diameters. Similarly, where a ILVA is installed downstream of two 90 degree bends in two planes, a pressure reducing valve or a partially open valve, 12 upstream pipe diameters should be allowed.
2. It is important that the internal upstream and downstream diameters of pipe are smooth. Ideally seamless pipes should be used. It is recommended that slip-on flanges be used to avoid any intrusive weld beads on the internal diameter of the pipe.
3. Care should be taken to install the ILVA concentrically in the line. If this is not done, flow measurement errors may occur.
4. The ILVA should be mounted horizontally. For vertical installations, consult Spirax Sarco.
5. For steam applications, good basic steam engineering practices should be followed:
   - Correct line drainage through adequate trapping.
   - Good alignment and support of associated pipework.
   - Line size changes achieved by the use of eccentric reducers

Maintenance note

There are no user serviceable parts in the ILVA. A visual check together with confirmation that the orifice/cone reference dimension is within tolerance is possible.