



## ILVA Flowmeter DN250 and DN300

### 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

DN250 and DN300 (10" and 12"). For DN50, DN80, DN100, DN150 and DN200 (2", 3", 4", 6" and 8") sizes see separate literature.

Suitable for fitting between the following flanges:

EN 1092 PN16, PN25 and PN40.

ASME B 16.5 Class 150, 300 and 600.

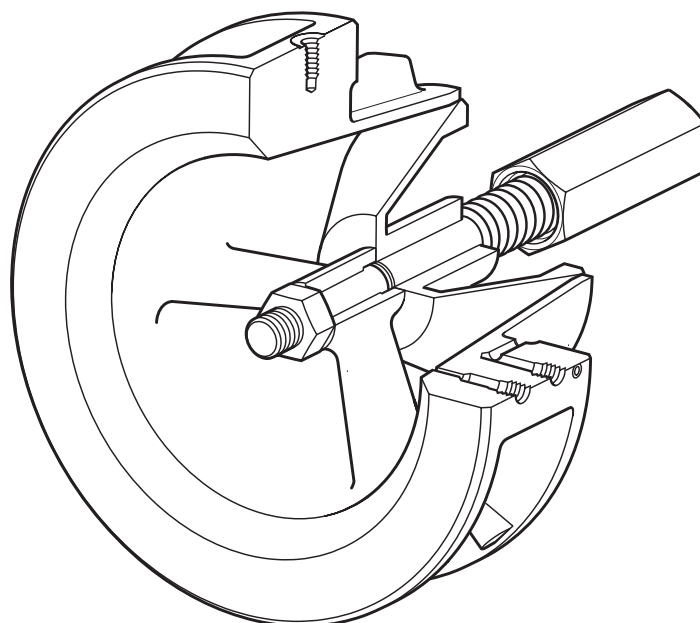
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The ILVA flowmeter should be installed in pipework manufactured to BS 1600 or ASME B 36.10 Schedule 40. For different pipe standards/schedules, downstream spool pieces with an equivalent internal diameter to BS 1600 or ASME B 36.10 Schedule 40 should be used.

If this is not possible, please contact

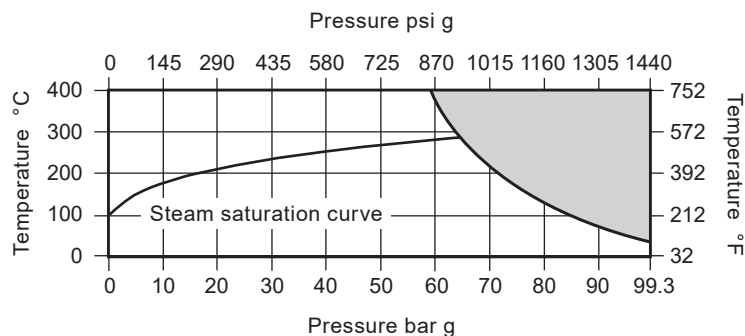
Spirax Sarco Limited.



### 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		-29 °C -20 °F
<b>Note:</b> For lower operating temperatures consult Spirax Sarco.		
Maximum viscosity		30 centipoise
ΔPMX	Maximum differential pressure	498 m bar 7.2 psi
Designed for a maximum cold hydraulic test pressure of:		149 bar g 2161 psi g

## Performance

The ILVA is used in conjunction with linearising electronics such as Spirax Sarco 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:** The Scanner 2000 mass flow transmitters can be configured at the factory to work with a single, specific ILVA flowmeter. For correct operation the configured 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.

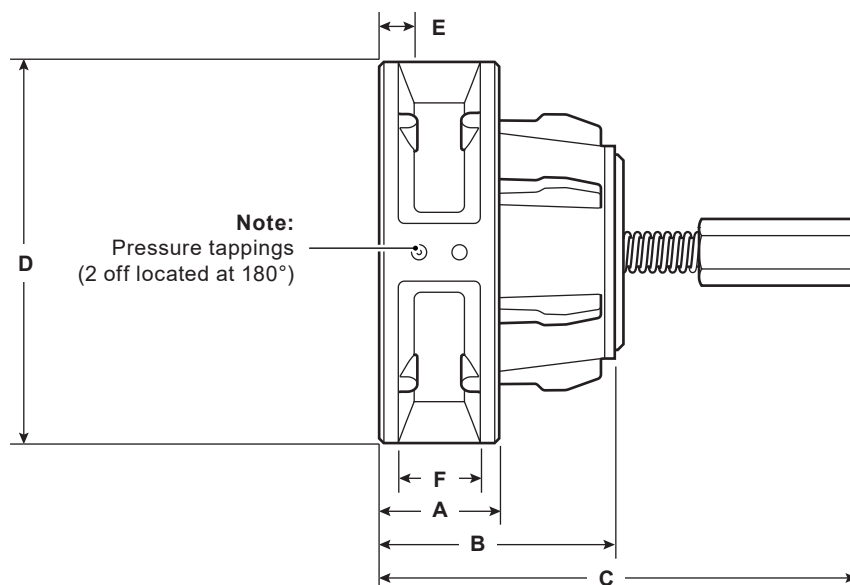
## Flow capacity

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.

## How to order

Example: 1 off Spirax Sarco DN250 ILVA flowmeter for installation between EN 1092 PN40 flanges. The body material is to be 316 stainless steel. The flow medium will be saturated steam at 10 bar g and the maximum flow will be 28 000 kg/h.

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



Size	A	B	C	D	E	F	Weight
<b>DN250 (10")</b>	104 (4.1)	204 (8.0)	444 (17.5)	330 (13.0)	35 (1.4)	35 (1.4)	41.5 (91.5)
<b>DN300 (12")</b>	120 (4.7)	250 (9.8)	530 (20.9)	385 (15.2)	42.5 (1.7)		67 (148)

**Note:** Pressure tapplings are threaded 1/4" NPT

## 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.

## Sizing (metric)

### ILVA flowmeter minimum and maximum saturated steam flowrates in kg/h

#### Notes:

1. These capacities are based on a differential pressure across the flowmeter of 498 m bar H<sub>2</sub>O (200 Inches).
2. Minimum flow is 1% of maximum (100:1 turndown).
3. The table below is a guide only.

Size			Q <sub>E</sub>	Steam pressure bar g									
				1	3	5	7	10	12	15	20	25	30
DN250	Max	7 750	15 985	22 185	26 915	30 899	36 043	39 099	43 292	49 541	55 155	60 325	69 758
	Min	78	160	222	269	309	433	391	433	495	552	603	698
DN300	Max	10 975	22 637	31 417	38 115	43 758	51 042	55 369	61 307	70 157	78 107	85 428	98 778
	Min	110	226	314	381	438	510	554	613	702	781	854	988

## 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	$Q_E = Q_S \sqrt{\frac{D_S}{1000} \times \frac{P_F}{P_S} \times \frac{P_F}{T_S}}$	$Q_E = Q_S \sqrt{\frac{D_S}{1000} \times \frac{P_S}{P_F} \times \frac{T_F}{T_S}}$

#### 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/m<sup>3</sup>)  
 $D_F$  = Density of gas at actual flow conditions (kg/m<sup>3</sup>)  
 $P_S$  = Standard pressure: 1.013 bar a, 1.033 kg/cm<sup>2</sup> 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	Max. $Q_E$ litres/min	Max. pressure drop Wg
DN250	7 750	200
DN300	10 975	200

Example: Determine which ILVA pipeline unit is required to measure the flow of compressed air when:

1: Estimated maximum rate of flow = 28 000 s m<sup>3</sup>/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/m<sup>3</sup>

2: Calculate  $Q_E$  from:  $Q_E = Q_s \sqrt{\frac{D_s}{1\,000} \times \frac{P_s}{P_F} \times \frac{T_F}{T_s}}$

$$Q_E = (28\,000 \times 16.667) \times \sqrt{\frac{1.29}{1\,000} \times \frac{1.013}{8.013} \times \frac{293}{273}}$$

$$Q_E = 6\,174 \text{ litres/min}$$

So a DN250 ILVA is recommended.

**Note:** 1 m<sup>3</sup>/h = 16.667 litres/min

## How to order example

1 off Spirax Sarco DN250 ILVA flowmeter suitable for fitting between EN 1092 PN16 connections.

## Sizing (imperial)

### ILVA flowmeter minimum and maximum saturated steam flowrates in lb/h

#### Notes:

1. These capacities are based on a differential pressure across the flowmeter of 200 inches H<sub>2</sub>O.
2. Minimum flow is 1% of maximum (100:1 turndown).
3. The table below is a guide only.

Size		Q <sub>E</sub>	Steam pressure psi g										
			15	44	73	102	145	174	218	290	383	435	580
10"	Max	2407	33786	47675	57708	66128	76959	83379	92162	105216	116909	127654	147172
	Min	21	334	476	578	661	769	833	919	1052	1168	1276	1473
12"	Max	2900	48782	67514	81723	93464	108983	118075	130514	148999	165558	114638	208414
	Min	29	487	675	820	939	1091	1179	1303	1490	1658	1808	2083

## 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<sub>E</sub>) 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<sub>E</sub>) in U.S. GPM:

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

**Liquids** or

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

- Q<sub>E</sub> = equivalent flow rate of water at 70 °F (U.S. GPM)  
m = maximum flow rate of service liquid (lb/hr)  
D<sub>E</sub> = density of water at calibration (62.305 lb/ft<sup>3</sup>)  
D<sub>L</sub> = density of service liquid (lb/ft<sup>3</sup>)  
Q<sub>L</sub> = maximum flow rate of service liquid (U.S. GPM)

$$Q_E = \sqrt{D \times \frac{P_F}{P_S} \times \frac{T_S}{T_F}} \times \frac{(0.0158 \times m)}{1}$$

**Gases** or

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

- Q<sub>E</sub> = 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/ft<sup>3</sup>)  
P<sub>F</sub> = flowing pressure of gas (psi a)  
P<sub>S</sub> = standard atmospheric pressure (14.7 psi a)  
T<sub>S</sub> = standard absolute temperature (520 °R)  
T<sub>F</sub> = flowing temperature of gas (°R = °F + 460)  
Q<sub>G</sub> = maximum flow rate of gas (SCFM)

### Steam

- $$Q_E = (0.0158) \times m \sqrt{v}$$
- Q<sub>E</sub> = 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 (ft<sup>3</sup>/lb)

## 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	Max. $Q_E$ GPM	Max. pressure drop Wg
10"	636	200
12"	766	200