

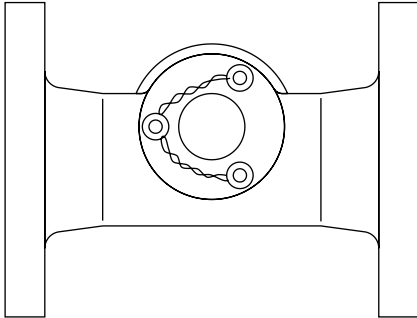
**M111**

**Spiraflo Transducer**

**Installation and Maintenance Instructions**

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1. *Safety information*
2. *General product information*
3. *Technical data*
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M111 transducers*
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# 1. Safety information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions and any National or local regulations. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

## Warning

The M200G system complies with the requirements of Electromagnetic Compatibility Directive 89/336/EEC by meeting the standards of:-

BS EN 50081-1 (Emissions) and

BS EN 50082-1 (Immunity).

The following conditions should be avoided as they may create interference above the limits specified in BS EN 50082-1 if:-

The product or its wiring is located near a radio transmitter.

Cellular telephones and mobile radios may cause interference if used within approximately one metre of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.

## Warning

If the product is not used in the manner specified in this IMI, then the protection provided may be impaired.

## 1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use/application. The products listed below comply with the requirements of the European Pressure Equipment Directive 97/23/EC and carry the CE mark when so required. The products fall within the following Pressure Equipment Directive categories:

	Product	Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
Spiraflo M111	DN40 -	SEP	-	-	
	DN50 - DN100	-	1	-	-

- i) The products have been specifically designed for use on saturated and superheated steam which are in Group 2 of the above mentioned Pressure Equipment Directive. The products' use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.
- ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Determine the correct installation situation and direction of fluid flow.
- iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- v) Remove protection covers from all connections before installation.

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## 1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

## 1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

## 1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

## 1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

## 1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

## 1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

## 1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

## 1.9 Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

## 1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

## 1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

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## 1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

## 1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 230°C (446°F).

Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

## 1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

## 1.15 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

## 1.16 Returning products

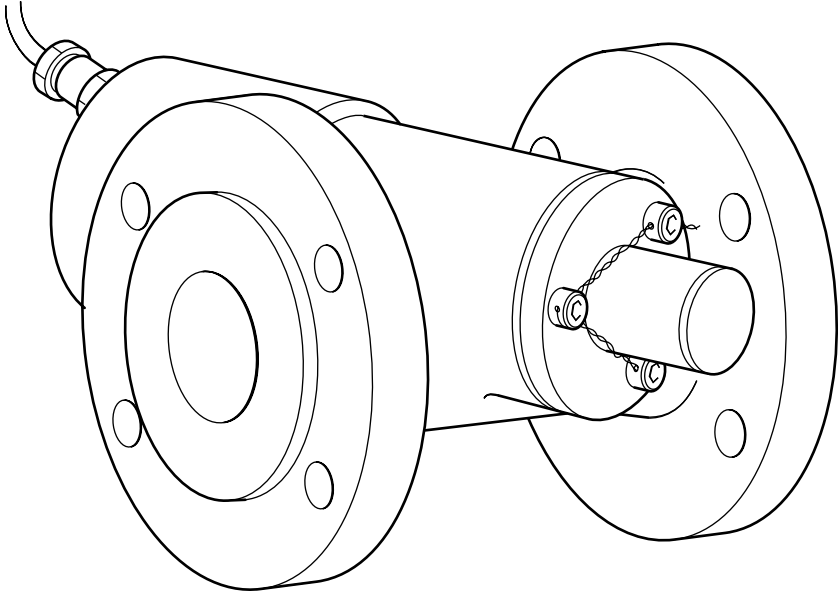
Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

## — 2. General product information —

### 2.1 General information

The M111 Spiraflo transducer has an SG iron body and is designed for dry saturated and superheated steam applications. This manual describes how to mechanically install the M111 Spiraflo transducer.

The Spiraflo transducer is used with an M322 conditioning unit and a M800 flow computer as part of the Spirax Sarco steam flowmetering system. For instructions on installing and commissioning the M322 conditioning unit and M800 flow computer, please see separate literature.



**Fig. 1 M111 transducer**

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## 2.2 The Spirax Sarco steam flowmetering system consists of four main units (refer to Figure 2)

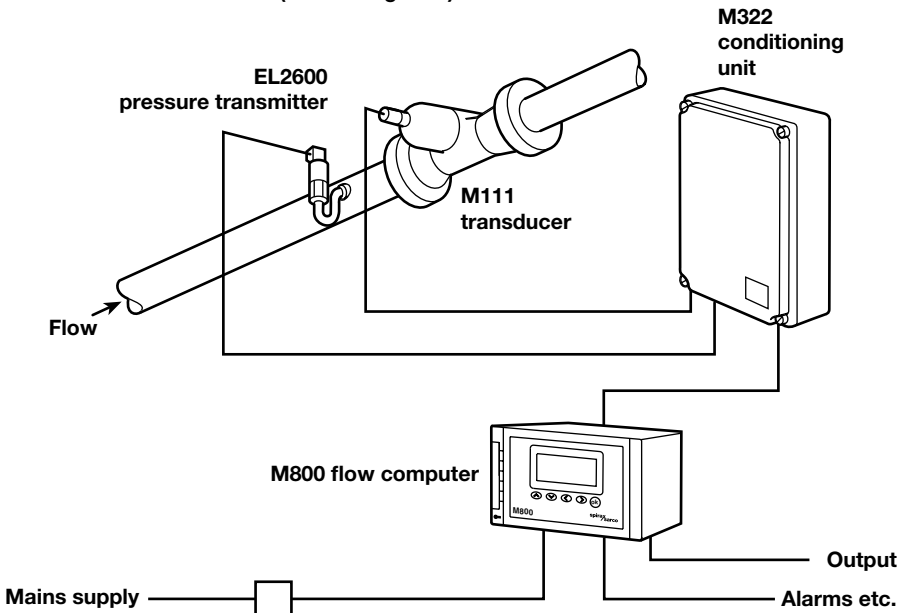


Fig. 2 Spirax Sarco steam flowmetering system, general arrangement

### M111 transducer

This is the unit that is installed in the steam line at the point where the flow is to be monitored. It is designed to operate on dry saturated or superheated steam only. The unit is supplied ready to install between flanges with 2 m (78 inches) of heat resistant 8 core signal cable. In operation it provides electrical outputs relating to the rate of steam flow and the steam temperature to the M322 signal conditioning unit.

### EL2600 pressure transmitter

For superheated steam applications where full density compensation is required, an EL2600 series pressure transmitter is fitted in the steam line upstream of the transducer.

### M322 conditioning unit

This unit is installed adjacent to the M111 transducer. Its function is to accept flowrate, temperature and pressure signals and convert them to digital form for transmission to the M210G flow computer.

### M800 flow computer

This unit accepts signals from the M322 conditioning unit. Its function is to process these signals and display them in the appropriate engineering units. The keyboard enables the operator to select the parameter he wishes to view as well as allowing him access to the numerous facilities available.

# 3. Technical data

## 3.1 M111 transducer

### Description

The transducer is the pipeline unit part of the Spirax Sarco steam flowmetering system. It is intended for use on dry saturated or superheated steam only.

**Note:** 2 m (78") of heat resistant 8 core cable is supplied for connection to a conditioning unit.

**Caution:** Do not cut or lengthen this cable.

### Sizes and pipe connections

DN40, DN50, DN80 and DN100.

Flanged EN 1092 PN25, BS 10 Table H, JIS/KS 10, JIS/KS 20, ANSI B 16.42 Class 150 and 300.

### Pressure / temperature limits

Body design conditions		PN25
Maximum design pressure	25 bar g @ 50°C	(362.5 psi g @ 122°F)
Maximum design temperature	230°C @ 17 bar g	(446°F @ 246.5 psi g)
Minimum design temperature	0°C	(32°F)
Maximum operating pressure for steam service	17 bar g	(246.5 psi g)
Maximum operating temperature	230°C	(446°F)
Minimum operating temperature	120°C	(248°F)

Maximum differential pressure - The differential pressure drop across the unit is typically 0.2 bar g (2.9 psi g) at average flowrates. Less than 0.5 bar g (7.25 psi g) at maximum flow.

Designed for a maximum cold hydraulic test pressure of 37.5 bar g (543.5 psi g)

### Materials

Body	SG iron	EN-GJS-400-18LT
Internals	Stainless steel	
Gaskets	Exfoliated graphite (EFG)	

## Flow range on saturated steam use

Size	Minimum flow at 1 bar g (14.5 psi g)	Maximum flow (at 35 m/s [115 ft/s] velocity) at 17 bar g (246.5 psi g)
DN40	15 kg/h (33 lb/h)	1 440 kg/h (3 175 lb/h)
DN50	25 kg/h (55 lb/h)	2 250 kg/h (4 961 lb/h)
DN80	60 kg/h (132 lb/h)	5 755 kg/h (12 690 lb/h)
DN100	95 kg/h (209 lb/h)	9 000 kg/h (19 845 lb/h)

See Section 3.2 for flow at intermediate pressures.

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

Size	PN25	BS	ANSI	ANSI	JIS/KS	JIS/KS	B	C	D	E	Weight
	A	10 H A	150 A	300 A	10 A	20 A					
DN40	176	175	175	181	172	176	180	100	76	28	9.5
DN50	180	178	178	184	172	176	180	100	76	28	10.5
DN80	240	236	240	249	228	236	220	152	76	76	25.0
DN100	260	263	260	276	248	260	220	152	76	76	34.5

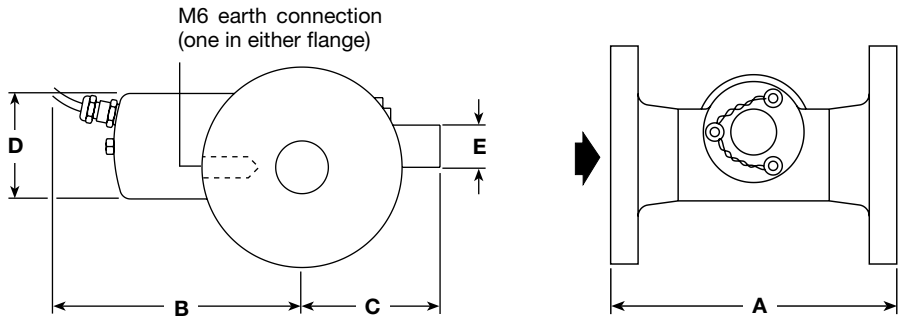


Fig. 3

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

Size	PN25	BS	ANSI	ANSI	JIS/KS	JIS/KS	B	C	D	E	Weight
	A	10 H A	150 A	300 A	10 A	20 A					
DN40	6.9	6.8	6.8	7.1	6.8	6.9	7.0	3.9	3.0	1.1	21.0
DN50	7.0	7.0	7.0	7.2	6.8	6.9	7.0	3.9	3.0	1.1	23.0
DN80	9.4	9.3	9.4	9.8	9.0	9.3	8.6	5.9	3.0	3.0	55.0
DN100	10.2	10.4	10.2	10.8	9.8	10.2	8.6	5.9	3.0	3.0	76.0

## 3.2 Steam flow capacities (saturated steam)

Flowrate kg/h (x 2.2 = lb/h)	Steam pressure (bar g) (x 14.5 = psi g)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<b>DN40</b>																	
a) Maximum	610	740	845	940	1020	1100	1175	1240	1300	1365	1425	1480	1530	1585	1635	1685	1730
b) At 35 m/s velocity	180	260	350	420	500	580	660	740	820	900	970	1050	1120	1200	1275	1350	1440
c) Minimum	15	18	21	23	25	27	29	31	33	34	36	37	38	40	41	42	43
<b>DN50</b>																	
a) Maximum	955	1155	1320	1470	1600	1720	1830	1940	2035	2130	2225	2310	2395	2475	2555	2630	2705
b) At 35 m/s velocity	280	410	540	660	790	910	1030	1150	1275	1400	1520	1640	1760	1870	1990	2100	2250
c) Minimum	25	28	33	37	40	43	46	48	51	53	56	58	60	62	64	66	68
<b>DN80</b>																	
a) Maximum	2445	2955	3380	3755	4095	4400	4690	4960	5215	5460	5690	5915	6130	6335	6540	6730	6920
b) At 35 m/s velocity	720	1050	1375	1695	2010	2330	2640	2945	3265	3580	3885	4195	4490	4800	5105	5415	5755
c) Minimum	60	74	84	94	102	110	117	124	130	136	142	148	153	158	163	168	172
<b>DN100</b>																	
a) Maximum	3820	4615	5285	5870	6395	6880	7330	7750	8150	8530	8895	9240	9575	9900	10215	10515	10815
b) At 35 m/s velocity	1125	1640	2145	2645	3140	3640	4125	4600	5100	5590	6070	6555	7020	7495	7980	8460	9000
c) Minimum	95	115	132	147	160	172	183	194	204	213	222	231	239	247	255	263	270

### Notes:

- Performance can be guaranteed within maximum and minimum flowrates, in accordance with specified accuracy **but** where velocities exceed 35 m/s (x 3.28 = ft/s) there is a real risk of erosion, not only in the flowmeter transducer but in associated pipework and fittings. is **not** recommended that a flowmeter is selected to operate at flowrates **continuously** resulting from a velocity in excess of 35 m/s. Zero flow will be indicated if the flowrate drops below the minimum value.
- For superheated steam flow capacities, the following formula can be used:

$$q_{fm} = \frac{AV}{v} \quad \text{Where: } A = \text{pipe cross sectional area in sq. metres, } V = \text{flow velocity in m/s (35 m/s maximum recommended),}$$

$$v = \text{specific volume of superheated steam and } q_{fm} = \text{flowrates in kg/h.}$$

### 3.3 EL2600 pressure transmitter

**Note:** The EL2600 pressure transmitter is only necessary for use on superheated steam applications where full density compensation is required.

#### Description

The EL2600 is a transmitter which is designed for general industrial use. It is designed to be installed where the ambient temperature does not exceed 80°C (176°F).

#### Example pressure ranges available bar g (psi g)

0 - 2.5 (0 - 36)	0 - 4 (0 - 58)	0 - 6 (0 - 87)	0 - 10 (0 - 145)	0 - 16 (0 - 232)	0 - 25 (0 - 362)
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#### Technical data

<b>Accuracy</b>	±0.5% span at reference conditions
<b>Temperature rating</b>	80°C (176°F) ambient, 100°C (212°F) process
<b>Enclosure rating</b>	IP65
<b>Process connection</b>	¼" NPT
<b>Supply</b>	24 Vdc standard (10-30 Vdc operable)
<b>Output</b>	4-20 mA (reverse polarity, overvoltage, and short circuit protected)

#### Dimensions/weight (approximate) in mm and kg

A	B	C	D	Weight
97	57 ±3	28	48	0.2

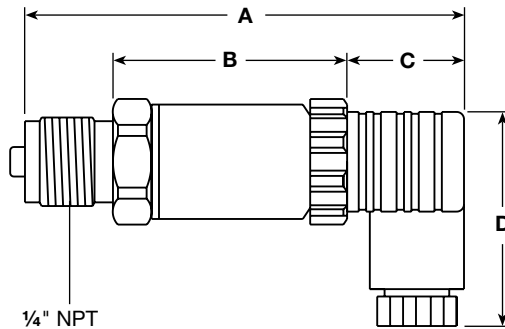


Fig. 4

# 4. Mechanical installation

## M111 transducer

### 4.1 Location

In order that the steam flowmetering system can perform to specification, it is very important to choose the location for the transducer with care. Several factors will affect the performance and reliability of the flowmeter. Additionally, good steam engineering practice should always be followed.

### 4.2 Points to consider for installation

**Note:** See Figure 5. The numbers on the drawing correspond to the notes below:

- 4.2.1 To comply with the electromagnetic compatibility directive 89/336/EEC it is important that the pipeline unit is earthed to the pipework. Connecting both flanges (using the two M6 drilled earth connections) to the pipework flange bolts, or separate earth via braided earth wires can achieve this.
- 4.2.2 Ensure all pipework is adequately supported and properly aligned. This will help prevent waterlogging during shutdown period and possible problems on start-up.
- 4.2.3 Where a pipe reduction is is required, this should be achieved using eccentric reducers.
- 4.2.4 The minimum recommended lengths of straight pipe are 6 D upstream and 3 D downstream of the transducer.
- 4.2.5 Take care to observe correct direction of flow as shown by the arrow on the transducer. The unit must be installed with the electronics housing and spring housing in the horizontal plane and with the electrical boss at the top.

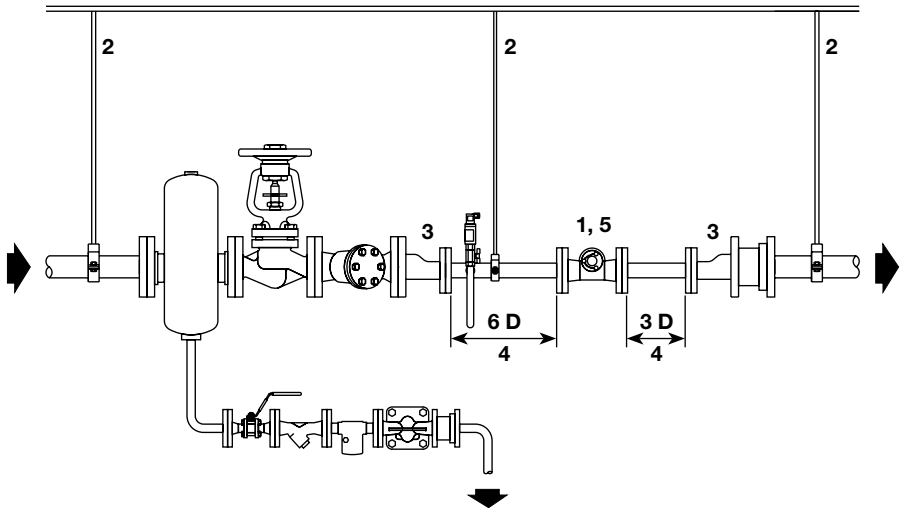
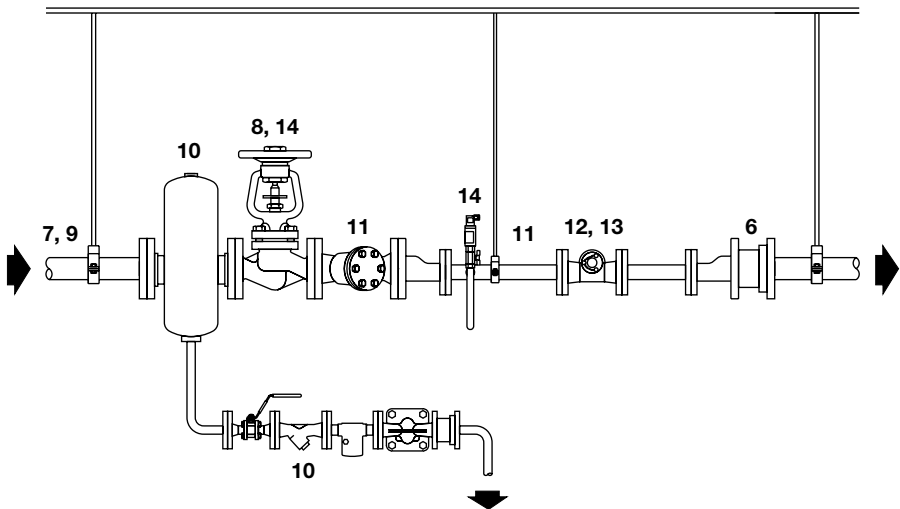


Fig. 5 Mechanical installation - points to consider

**Note: See Figure 6. The numbers on the drawing correspond to the notes below:**

- 4.2.6** It is advisable to fit a check valve downstream of the transducer to avoid possible damage by reverse flow which often occurs in steam systems during shutdown or steam draw off upstream of the transducer. At least 3 pipe diameters should remain between the transducer and the check valve.
- 4.2.7** Take care not to install the transducer in close proximity to a pressure reducing valve or other active equipment as this may cause inaccuracies and/or other possible transducer damage.  
If this cannot be avoided then the minimum recommended lengths of straight pipe should be increased to at least 25 diameters upstream and 20 diameters downstream.
- 4.2.8** Similarly do not install the transducer downstream of a partially open stop valve.
- 4.2.9** Avoid installing the transducer downstream of an actuated valve which could cause rapid flow variations which in turn could cause transducer damage.
- 4.2.10** A separator should always be fitted upstream of the transducer to remove entrained water droplets from the steam. Dry steam is needed for accurate flowmetering. The separator should be drained using a float trap set.
- 4.2.11** A full flow strainer with 100 mesh stainless screen may be fitted to prevent dirt and scale reaching the transducer. This is especially advisable on old or dirty systems where dirt or corrosion is present.
- 4.2.12** Ensure gasket faces do not protrude into the line.
- 4.2.13** Lagging of the transducer is not recommended, especially the domed cover.
- 4.2.14** A bellows sealed stop valve may be fitted upstream of the transducer.
- 4.2.15** For superheated steam applications where full density compensation is required, the EL2600 series pressure transmitter should be installed - see Section 5.



**Fig. 6 Mechanical installation - points to consider**

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## **IMPORTANT**

**For applications on superheated steam, significant quantities of moisture/condensate will be present under start-up conditions. For this reason consider using the ancillaries shown on pages 9 and 10, i.e. traps, stop valves and strainers.**

### **4.3 Maintenance**

The Spirax Sarco M111 transducer is a calibrated and sealed unit with no user-serviceable parts. Units requiring service or recalibration should be returned to:-

Returns Investigation Department  
Spirax Sarco Ltd  
Runnings Road, Kingsditch Trading Estate,  
Cheltenham, Glos  
GL51 9NX

# 5. Mechanical installation

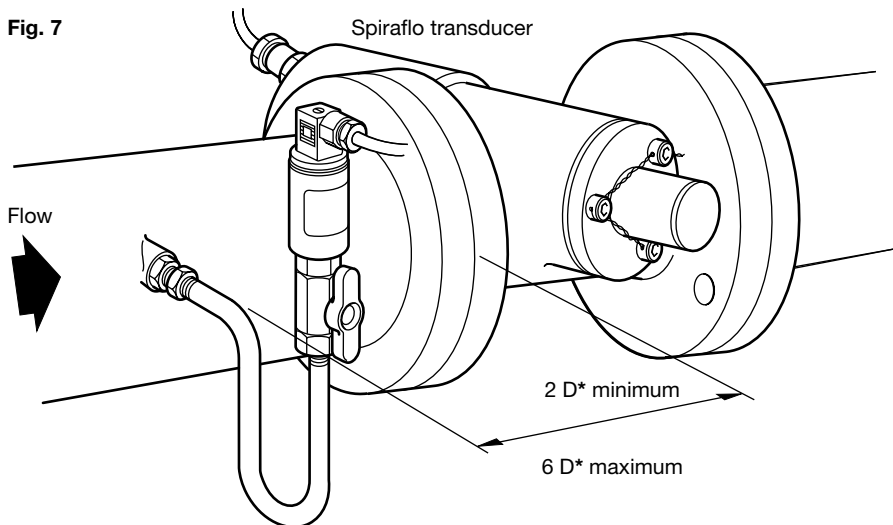
## EL2600 pressure transmitter

Full Installation and Maintenance details of the EL2600 pressure transmitter are included with the unit.

### 5.1 Location

The pressure transmitter should be mounted as shown below.

Fig. 7



**\*Note:** D = diameter of steam flowmeter (e.g. when using a DN50 M111 transducer)

### 5.2 Installation

Ideally the EL2600 pressure transmitter should be mounted vertically. The EL2600 pressure transmitter and 'U' syphon assembly is extremely simple to install as all critical dimensions are incorporated into the 'U' syphon.

**Note 1:** It is important that the EL2600 pressure transmitter is not lagged to avoid excessive heat build-up.

**Note 2:** Cabling should be installed in accordance with BS 6739 - Instrumentation in Process Control Systems: Installation design and practice or local equivalent.

**Caution:** To avoid permanent damage to the EL2600 by live steam, the 'U' syphon must be filled with clean water before initial start-up.



