SLOVENSKI STANDARD
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Fluid flow in closed conduits - Connections for pressure signal transmissions between primary and secondary elements

Fluid flow in closed conduits -- Connections for pressure signal transmissions between primary and secondary elements

Débit des fluides dans les conduites fermées -- Liaisons pour la transmission du signal de pression entre les éléments primaires et secondaires

Ta slovenski standard je istoveten z: ISO 2186:1973

ICS:

17.120.10 Pretok v zaprtih vodih Flow in closed conduits

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INTERNATIONAL STANDARD ISO 2186

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Fluid flow in closed conduits – Connections for pressure signal transmissions between primary and secondary elements

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2186 was drawn up by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits.*

It was approved in April 1971 by the Member Bodies of the following countries :

Austria	Hungary	Portugal
Belgium	India	South Africa, Rep. of
Chile	Italy	Spain
Czechoslovakia	Japan	Switzerland
France	Korea, Rep. of	United Kingdom
Germany	Netherlands	U.S.A.
Greece	Poland	U.S.S.R.

No Member Body expressed disapproval of the document.

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Fluid flow in closed conduits – Connections for pressure signal transmissions between primary and secondary elements

0 INTRODUCTION

This International Standard relates to the types of pressure difference primary elements for flow measurement, described in ISO/R 541 and ISO/R 781.

The chosen order of presentation follows a logical progression away from the origin of the pressure signal obtained from the primary element, through to the inlet of the secondary device.

It should be noted that in this context a secondary device is defined as a device receiving a differential pressure signal from a primary element and converting it, when necessary with the assistance of auxiliary power, into a signal of a different nature.

Methods of grouping the individual units are presented in a section that shows various types of installation layouts.

1 SCOPE

This International Standard describes means whereby a pressure signal from a primary element can be transmitted by known techniques to a secondary device in such a way that the value of the signal is not distorted or modified even though it may be changed into a signal of a different nature.

2 FIELD OF APPLICATION

This International Standard is concerned only with the pressure difference techniques of flow measurement. It does not consider the characteristics of the secondary devices, and it does not include transducers or other similar instruments. Electrical transmission techniques are not dealt with in this International Standard. Pressure transducers and microdisplacement secondary devices will be the subject of a separate International Standard.

3 REFERENCES

ISO/R 541, *Measurement of fluid flow by means of orifice plates and nozzles.*

ISO/R 781, *Measurement of fluid flow by means of Venturi tubes.*

4 PRESSURE TAPS

4.1 Location of pressure taps in horizontal pipes

The following positions of the wall pressure taps on the straight cylindrical pipe are recommended:

1) Gas : in the vertical meridian plane, upwards (see Notes 1 and 2).

2) Liquids : in a meridian plane with which the horizontal meridian plane is forming an angle not greater than 45° above or below according with the position of the secondary device (see Note 4).

3) Steam : in the horizontal meridian plane.

NOTES

1 The position of dry gas taps may be varied without risk from the position indicated in 4.1.

2 The position of wet gas taps should be vertical if possible to allow draining to occur. They should therefore be less than 45° off the vertical meridian plane.

3 In the case of gently sloping pipelines, i.e. the slope of which can be considered as negligible, it is often possible to maintain the taps on a horizontal plane by varying their individual positions relative to the pipe centre-line. It is particularly desirable that the taps are on a horizontal plane when hot liquid flow is to be measured with a view to avoiding corrections for altitude.

4 Care should be taken when using for liquids, a position in the horizontal meridian plane. If the liquid is clean it is advisable to avoid the risk of gas in the pressure lines by using a tap location below the pipe horizontal meridian plane. If, on the other hand, the liquid has a significant solid content, then a position above the horizontal centre-line is recommended. In neither case should the taps be more than 45° from the horizontal. The case where there is a considerable volume of gas in a liquid line is exceptional, and needs special consideration : a horizontal tap position should be used in conjunction with pipe gas vents and gas collecting chambers in the pressure lines (see section 11).

4.2 Location of pressure taps in vertical pipes

In the case of vertical pipes there are generally no problems as far as the radial position of pressure taps is concerned.

4.3 Pressure taps and connections

Shape, diameter, length and location of pressure taps should be in accordance with ISO/R 541, clause 6.2; note should be taken in particular of sub-clauses 6.2.1.2 and 6.2.1.6.

There should be no burrs of other irregularities on the inside of the pipe at the connections or along the edge of the hole through the pipe wall. In no case shall any fittings project beyond the inner surface of the pipe wall. Clearly where there is risk of solid or liquid blockage it is advisable to use a large tapping size within the limits given.

4.4 Practical requirements

Some typical arrangements for pressure taps are given in Figure 1, but it should be noted that the information is included for general guidance only.

5 ISOLATING VALVES

5.1 Isolating valves are needed to separate the entire measurement system from the main pipeline when necessary, but they should not affect the pressure signal.

It is recommended that isolating valves should be located immediately following the primary element. If condensation chambers are installed the isolating valves may be fitted immediately following the condensation chambers (see Figure 18).

The final choice both of the valve specification and its location is left to the instrument engineer and/or user. The recommendations given here are therefore subject to alterations which may be necessary in view of the operating conditions and the nature of the fluid.

Practical considerations include :

1) the installations of valves suited to the pipe pressure;

2) careful choice of both valve and packing, particularly in the case of corrosive or dangerous fluids, and with such gases as oxygen;

3) the need to use valves whose design does not affect the transmission of a pressure signal, particularly when that signal is subject to any degree of fluctuation or pulsation.

5.2 Valve passages

It is recommended that the general remarks about constancy of diameter given in section 10 should be used as a guide in this section as well. Thus, every attempt should be made to ensure in the case where the valve is immediately adjacent to the pressure tap that the internal diameter of valve connections and the minimum passage diameter inside the valve should keep a constant value and preferably not be less than the internal diameter of the pressure piping between the pressure taps and the valve, this latter diameter remaining unchanged as well over its whole length.

The valve should be of full bore valve type in order :

1) in the case of liquid flow, to avoid trapping gas bubbles in the valve structure;

2) in the case of gas flow, to avoid trapping liquid in the valve structure.

6 CONDENSATION CHAMBERS

The modern trend in secondary device design is toward the micro-displacement type of differential pressure unit. There are, however, still a range of instruments widely used throughout the world that have a capacity comparable to, but smaller than, the popular mercury U-tube type of device.

It is therefore necessary to consider variations in the capacity of condensation chambers, but it is not recommended that they should be entirely omitted, even when micro-displacement secondary devices are used.

It is suggested that except when used with micro-displacement devices, the shape of the condensation chamber should be as shown in Figure 2. For micro-displacement devices, the condensation chambers may take the form of short lengths of unlagged pipe between the pressure taps and the isolating valves.

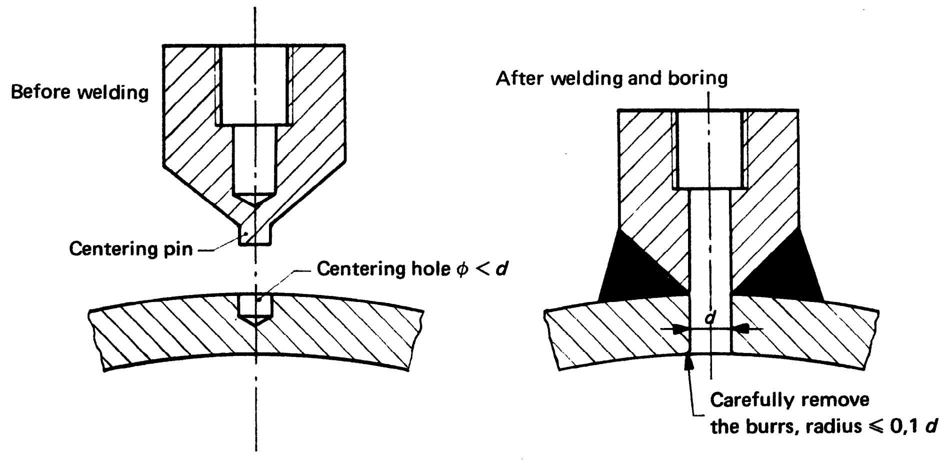
The capacities of the condensation chambers shown in Table 1 can be related both to secondary device maximum displacement at maximum head as well as to steam conditions, as shown in Figure 3. Generally, it is advisable to use condensation chambers that have a capacity two to three times that of the secondary device displacement, particularly when it is known or suspected that large and sudden variations in the flow rate may occur.

In the case of very high pressure/temperature steam, it is advisable to use a catchpot of approximately the same volume as the condensation chamber, to protect the primary element from damage caused by cool liquid from the pressure piping returning through the primary element as a result of a large and sudden change in flow rate. An example of arrangement is given on Figure 26.

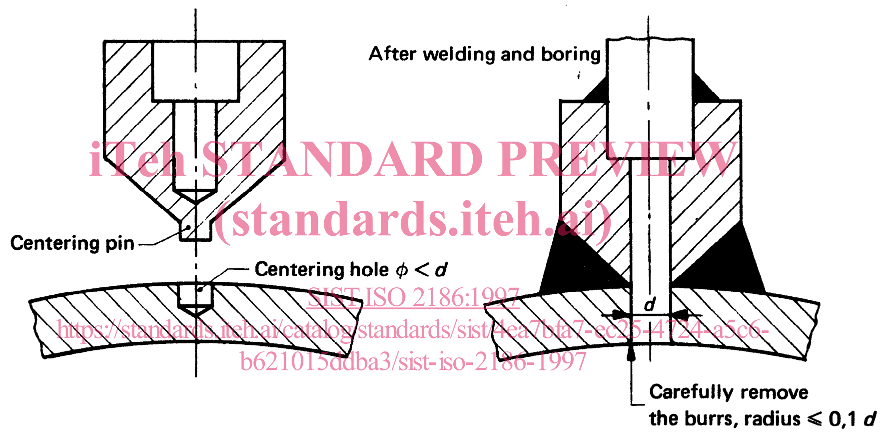
The connecting pipe between the primary element and condensation chamber/catchpot should be either of the same material as the pipeline, or of equivalent specification.

In the case of primary elements and condensation chambers installed in vertical mains, it is necessary to have both condensation chambers installed on the same level, preferably that of the higher tap, and lagged as shown in Figure 20 for example. The bore of the connecting pipe should be large enough to avoid any risk of blockage and secondary device response lag, and the pipe itself should be lagged.

For threaded connection



For welded connection



Flanged adaptor for low to medium pressure/temperature steam installation

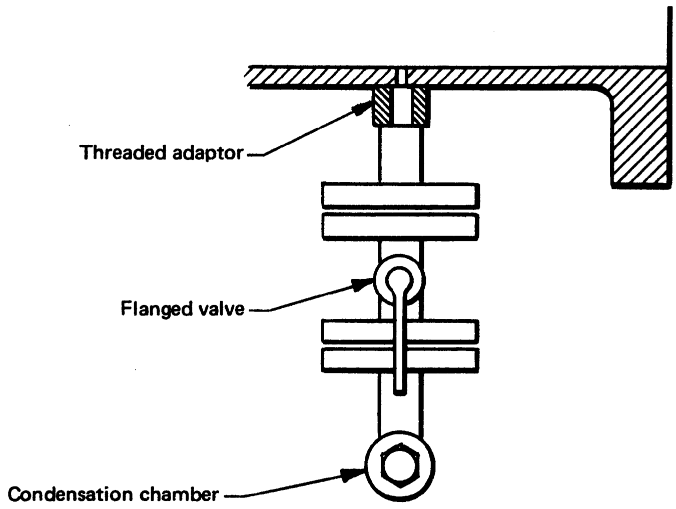
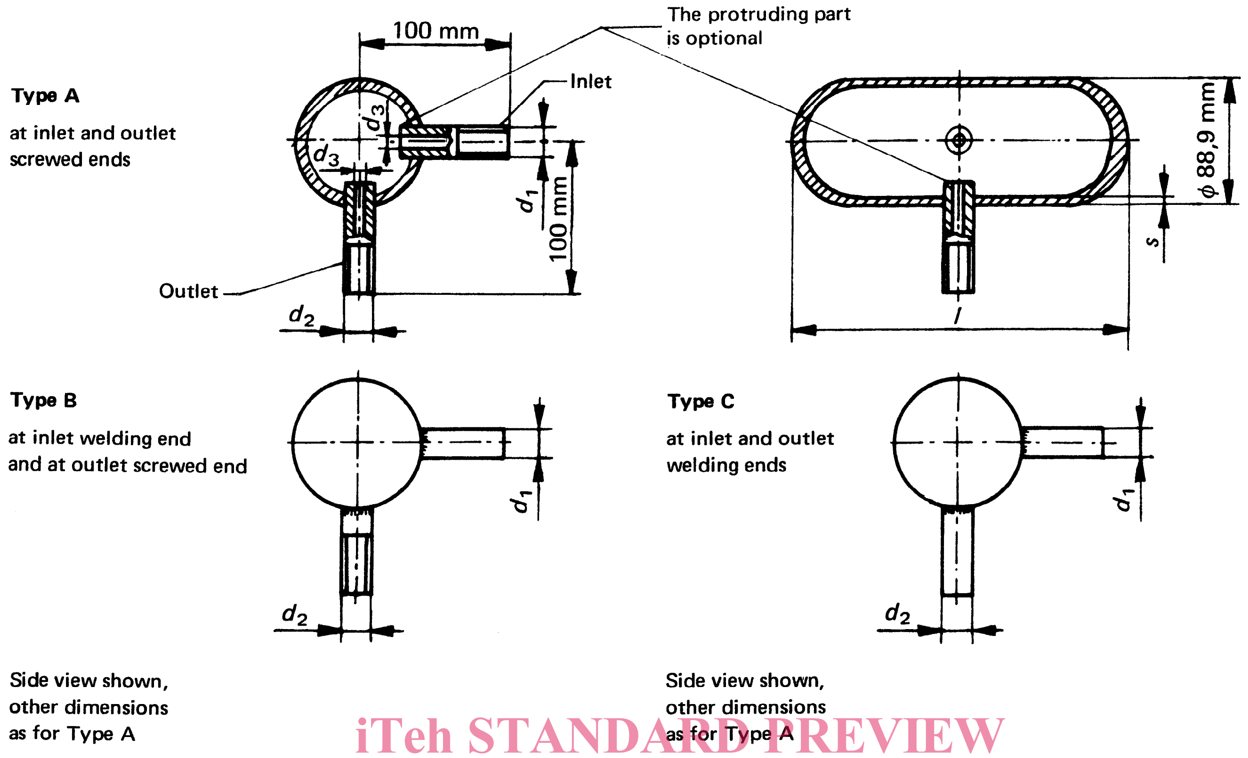


FIGURE 1 — **Typical arrangements for pressure taps**



NOTE — The pipe ends can also be fitted with flanges.

FIGURE 2 — **Condensation chamber characteristics, types A, B and C**

TABLE 1 — **Condensation chamber dimensions**

Size	**Type**	**Inlet d_1** Threaded end	**Inlet d_1** Welded end	**Outlet d_2** Threaded end	**Outlet d_2** Welded end	d_3	l	s	**Capacity**	**Test pressure**
		in	mm	in	mm	mm	mm	mm	cm3 ≈	bar *
1	A	1/2	–	1/2	–	8,7	230	5	800	190
	B	–	21,3	1/2	–					
	C	–	21,3	–	21,3					
2	A	1/2	–	1/2	–	8,7	100	5	250	
	B	–	21,3	1/2	–					
	C	–	21,3	–	21,3					
3	A	5/8	–	5/8	–	8	230	7,1	700	320
	B	–	24	5/8	–					
	C	–	24	–	24					
4	A	5/8	–	5/8	–	8	100	7,1	220	
	B	–	24	5/8	–					
	C	–	24	–	24					
5	C	–	24	–	24	8	230	12,5	600	540
6	C		24	–	24	8	100	12,5	170	

* 1 bar = 10^5 Pa

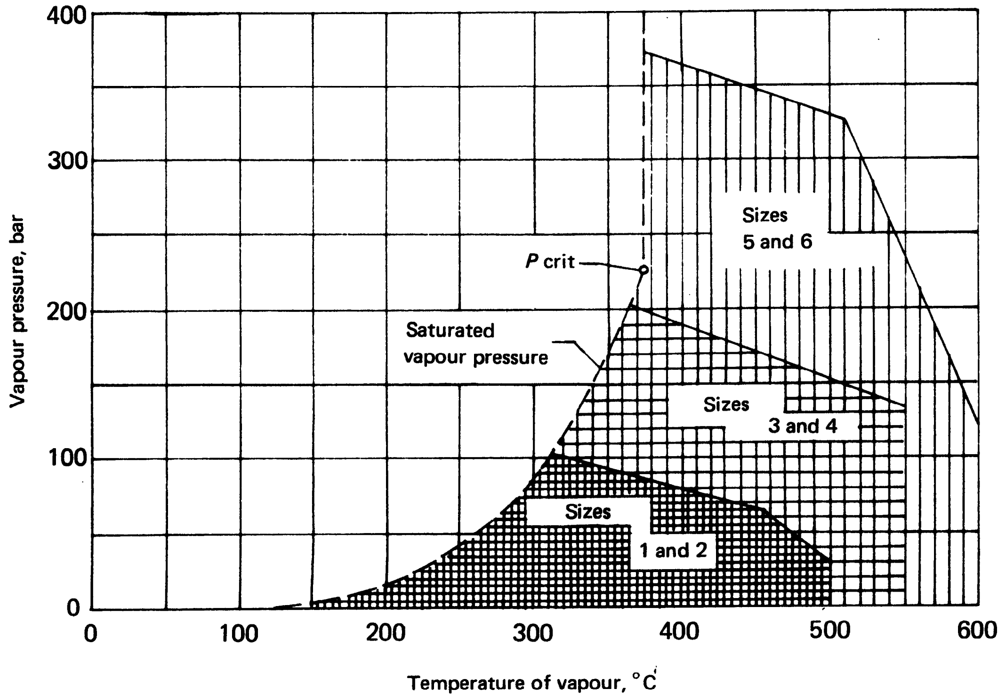


FIGURE 3 – Range of application of condensation chambers

NOTE – A vapour pressure-vapour temperature graph gives the limits within which the condensation chambers can be used. For the calculation of the wall thicknesses the vapour temperature was assumed to be 50 °C lower than the vapour temperature in the mains, since under operating conditions, the temperature in the condensation chambers never exceeds the temperature of the saturated vapour. Only when the pressure lines are blown down, i.e. in the non-pressurised condition, can the temperature in the condensation chambers approach the vapour temperature in the mains. Experiments have shown that the actual difference between the vapour temperature in the mains and temperature in the condensation chambers is greater than 50 °C.

7 GAS COLLECTING CHAMBERS AND SETTLING CHAMBERS

7.1 Gas collecting chambers

7.1.1 *Reasons for use*

In cases where it is thought that gas is present in a liquid that is to be measured, it is necessary to ensure that no gas can collect in the pressure piping between primary and secondary device, particularly when the latter is above the pipeline. Very often this can be avoided by laying the pressure pipes so that there is a continual slope between primary and secondary devices.

However, it is often necessary to arrange the pipe run so that there is a high point at which a gas collecting chamber or a vent valve can be installed as shown on Figure 11. Gas collecting chambers can be provided with either automatic or manual vent valves. The capacity of the chambers tends to vary with characteristics of the installation.

7.1.2 *Description of the technique*

A gas collecting chamber should be provided for each pressure pipe and, conveniently, should be mounted at the highest point of the pipe run, near to the secondary device and at an accessible location.

If the chambers are not provided with automatic vent valves, then a regular maintenance routine should be established for venting at intervals found necessary by experience.

7.1.3 *Drawings and dimensional data*

An example of construction of gas collecting chambers is shown in Figure 4. Although the capacity can be chosen according to requirements, it is recommended that the shape shown on the drawing be retained as well as the position of the inlet, outlet and release connections.

7.2 Settling chambers

7.2.1 *Reasons for use*

Settling chambers are often needed for liquid and gas installations.

In the case of liquid flow, they are necessary where there is a considerable amount of entrained solid that can block pressure pipes even if these are laid in accordance with general recommendations.

Settling chambers are most often necessary when the secondary device is below the pipeline.

In the case of gases, settling chambers are advisable when the measured fluid is both dirty and/or wet.

Settling chambers may be found useful for steam installations where pressure pipe scaling can develop.

7.2.2 *Description of the technique*

In all cases the settling chambers should be located at the lowest point of the pipe run.

If the secondary device is above the primary element it is advisable to include gas collecting chambers in the pressure piping system as well as settling chambers in the case of liquid flow.

7.2.3 *Drawings and dimensional data*

A typical design of settling chamber is shown in Figure 5. It is important that sufficient clearance should be available beneath the vessel to allow access to the drain valve.

The valve should preferably be a full bore type so that it can be cleaned and probed if blockage is suspected, or if the chamber is heavily encrusted with deposits.

It should also be noted that pressure holes, pressure pipe bores, and the connections to the settling chambers should be larger for very dirty liquids and gases.

The capacity of the settling chambers should be as large as practically possible or as large as the needs of the installation demand. The proportions given in Figure 5 are typical and should be sufficient for most purposes. However, the frequency of maintenance and the degree of solid and/or condensation entrainment are matters that should decide the size of settling chamber to use.

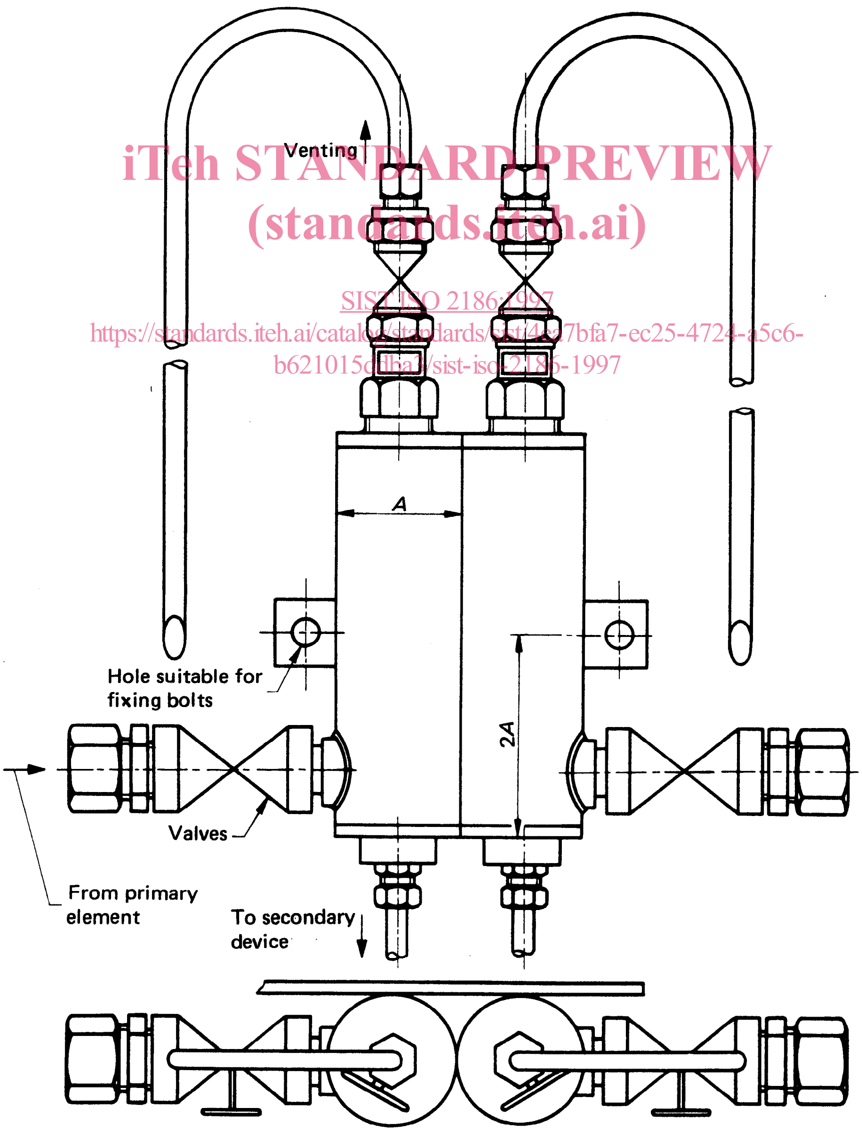


FIGURE 4 — **Arrangement of wall mounted gas collecting chambers and valves**

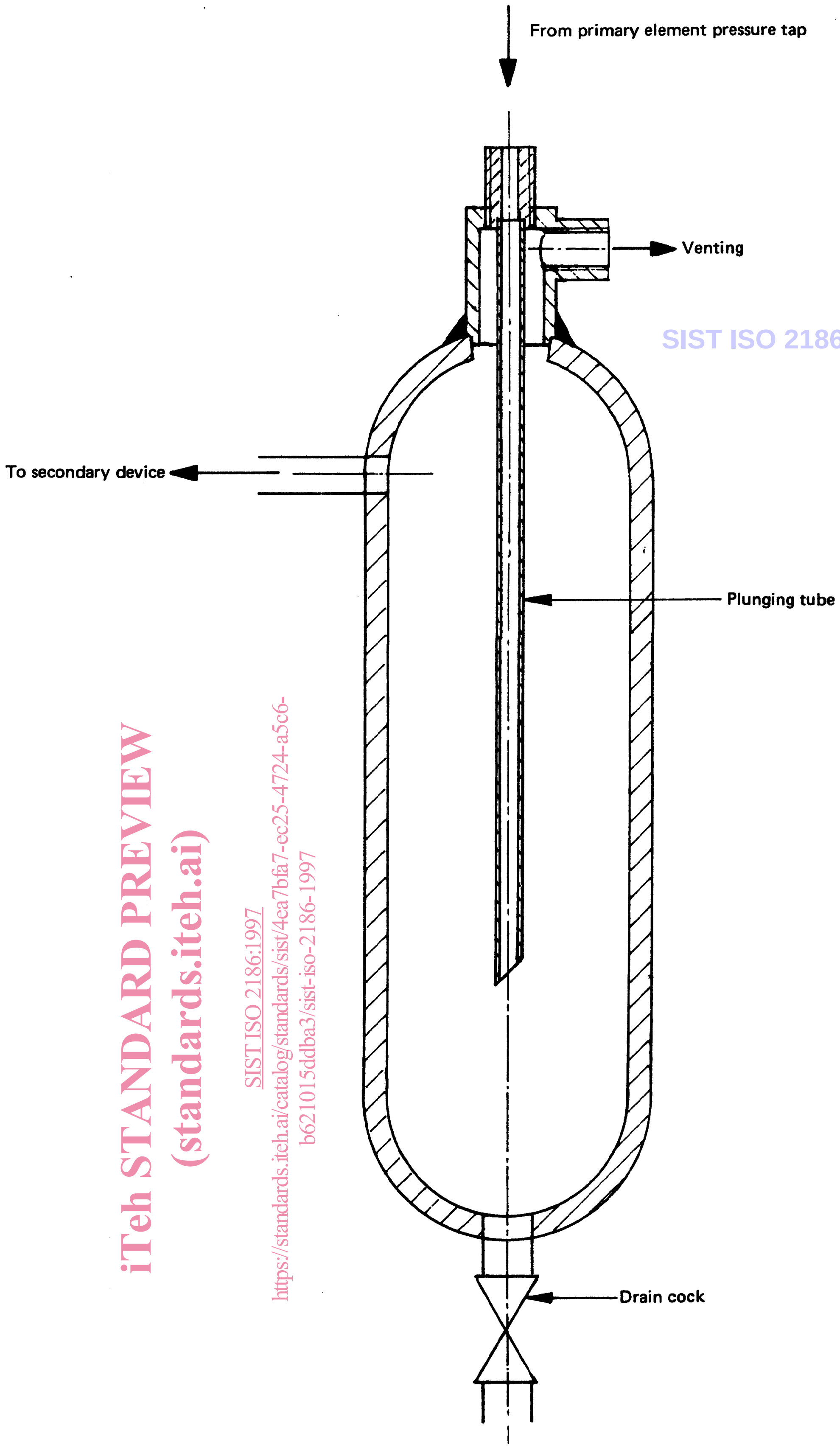


FIGURE 5 — **Settling chamber**

8 SPECIAL TECHNIQUES USED AS PROTECTION AGAINST VERY COLD AMBIENT CONDITIONS

In the cases where pressure pipes contain water it is possible to protect them against frost by the use of heating elements such as electrical tapes or steam coils.

The exact use of these techniques depends on the particular location, and advice cannot be generalized. It is important to ensure that the heating is controlled, uniform, and of equal amount to each pressure pipe and any auxiliary unit included in the pipe run. Where possible the pressure pipes should be run and lagged together, but care should be taken not to overheat liquids in the pipes since this may cause vaporization.

It may be noted that the same techniques are useful when warm or hot viscous fluids are metered, to prevent coagulation or blockage in cold pressure pipes and any other narrow passages.

9 SEALING CHAMBERS AND PURGE SYSTEMS

9.1 Sealing chambers

9.1.1 *Sealing chambers without partition*

Sealing chambers containing a liquid which separates the metered fluid from the fluid in the meter may be employed where :

- the metered fluid is corrosive;
- the metered fluid is likely to congeal, freeze or condense in the connecting pipes;
- the metered fluid is very viscous;
- deposits are likely to occur in the connecting pipes or in the meter, etc.

It must, however, not be forgotten that the pipes connecting pressure taps and sealing chambers will not be protected by the use of a sealing fluid.

The sealing fluid should not mix or react with the metered fluid or the manometric fluid and should differ in density from both fluids by an amount sufficient to ensure a stable interface.

Sealing chambers should be installed at the same level and as close as possible to the pressure taps. When there is a risk of congealing, freezing or condensation of the metered fluid, the connections from the pressure taps should be included in a pocket with the pipe lagging or be provided with supplementary heating. This might be provided as well for sealing chambers, if they are employed for liquefiable fluid flow measurements.

The general arrangements of sealing chambers are shown in Figures 6 and 7.

The interface between the metered and the sealing fluids should be at exactly the same level in both sealing chambers when there is no flow.

The filling level is determined by means of purge valves and where possible it is desirable to install visual means which allow constant control of the interface.

The sealing fluid fills the pressure pipes between the sealing chamber and the meter.

For guidance, suitable sealing chamber dimensions for industrial meters are about 100 mm diameter and 250 to 300 mm long.

Where micro-displacement devices are used the sealing chamber can be eliminated or replaced by a pipe.

In all cases, the sealing chamber capacity should be larger than the maximum volume of measuring liquid displaced in the meter. When designing sealing chambers it should be carefully checked that their inside diameters remain constant over the effective working area.

The meter reading should be corrected to take account of the displacement of the (sealing fluid/metered fluid) interface in the sealing chamber.

This correction will be of greatest importance when the difference in density is greatest between the sealing and metered fluids. When micro-displacement devices are used this correction is negligible.

Method by which differential pressure may be calculated when sealing chambers are used with a U-tube type of meter is given in Annex A.

9.1.2 *Sealing chambers with partitions*

When the physical and chemical characteristics of the metered fluid are such that a suitable sealing fluid cannot be found, sealing chambers with partitions may be used.

Diaphragm and bellows units are the simplest form of partition generally used.

It is necessary to ensure that both sealing chambers have the same stress/displacement characteristic.

The volumetric displacement of the sealing fluid over the full scale range of the meter should be greater than the maximum volume displaced by the meter itself.

Gas venting systems should be used on both sides of the partition.

In general the remarks in 9.1.1 apply equally to sealing chambers with partition.

In the cases where sealing chambers with partition are used it is normal for the manufacturer of such units to provide the relationship between input and output signals.