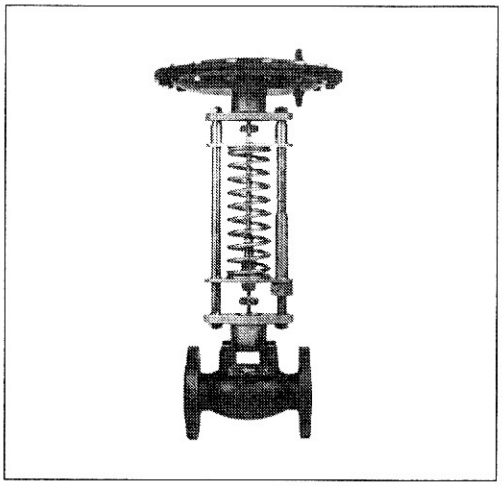
Application



- For block heating, district heating systems and large central heating systems
- Self-acting

Pressure controls can be used as:
- differential pressure controls
- flow limiters
- constant flow controls

IVD-IVF/IVFS controls are self-acting proportional controls for large central heating, district heating and industrial heating systems.
The control consists of IVD control section and single-seated IVF/IVFS valve.

Depending on control spindle orientation, the control can be used as:
1. Differential pressure control or flow limiter. Valve closes on rising differential pressure.
2. Constant flow control. Valve opens on rising differential pressure.

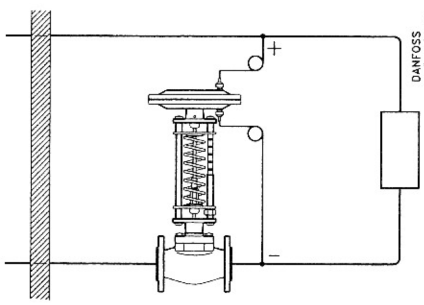
As a differential pressure control IVD-IVF/IVFS maintains constant differential pressure between two measuring points independent of pressure fluctuation and varying flow volume.
As a flow limiter IVD-IVF/IVFS ensures that required max. flow volume is not exceeded.
As a constant flow control IVD-IVF/IVFS ensures that flow volume does not fall below required minimum.
For example, by installing IVD-IVF/IVFS in bypass line between heating system supply and return undesired pressure rises on falling load will be avoided, and flow volume in main line will be held to required minimum (advantageous for pump and boiler).
Used as constant flow control IVDA has a larger setting range than IVD

IVD/IVDA
- Sized for pressure stage PN 16/PN 25

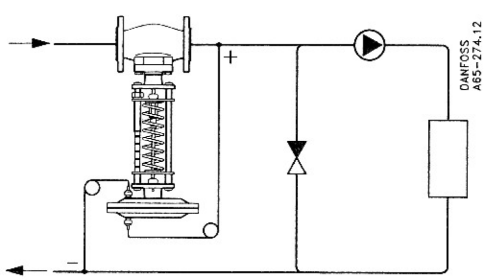
IVF
- Sized for pressure stage PN 16
- Connection flange: DN 15 - DN 50

IVFS
- Sized for pressure stage PN 25
- Connection flange: DN 15 - DN 50

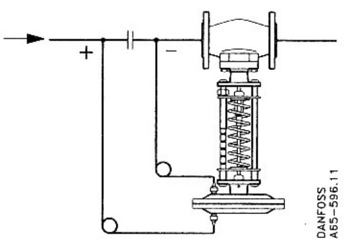
Principle



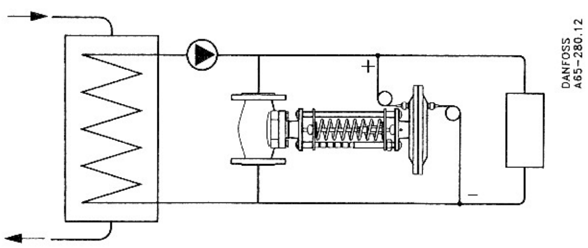
IVD-IVF/IVFS for differential pressure control



IVD-IVF/IVFS for differential pressure control



IVD-IVF/IVFS for flow limiting



IVD/IVDA - IVF/IVFS for constant flow control

Ordering

Control spindle with setting element

Type	Setting range	Comments	Code No. [1] PN 16	Code No. [1] PN 25
IVD	0 - 0.5 bar	0 - 0.2 bar as constant flow control	**065-7280**	**065-7285**
IVDA	0 - 0.5 bar	Constant flow control only	**065-7281**	
IVD	0.2 - 2.5 bar	Differential pressure control only	**065-7284**	**065-7287**

[1] Including two impulse tubes and two nipples

IVF and IVFS valves with flanged connection

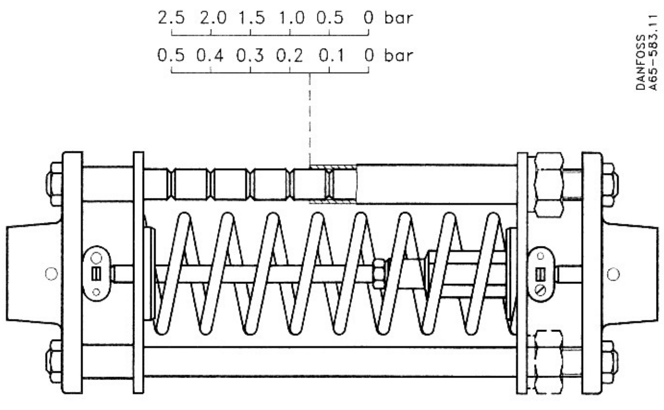
Connection flange DIN 2501	k_v [1]	Δp_{max}	Code No. IVF	Code No. IVFS
15 mm	0.63 m³/h	10 bar	**065-7206**	**065-1210**
15 mm	1.0 m³/h		**065-7208**	**065-1211**
15 mm	2.5 m³/h	8 bar [2]	**065-7212**	**065-1213**
15 mm	4.0 m³/h	8 bar [3]	**065-7215**	**065-1215**
20 mm	6.3 m³/h		**065-7220**	**065-1220**
25 mm	10 m³/h		**065-7225**	**065-1225**
32 mm	16 m³/h		**065-7232**	**065-1232**
40 mm	20 m³/h		**065-7240**	**065-1240**
50 mm	25 m³/h		**065-7250**	**065-1250**

[1] Max. leakage loss with closed valve 0.05 % of k_v.
[2] At settings above 0.1 bar - at settings below 0.1 bar Δp_{max} = 6.3 bar
[3] Valve is pressure-relieved

Accessories and spare parts

Type	Code No.
Impulse tube 1.5 m long (two supplied with each IVD and IVDA	**060-0072**
Brass-dipped nipple For impulse tube line connection (2 nipples included)	**631X4700**
Temperature break Should be used if medium temperature is more than 170 °C	**065-0030**
Teflon ring for valve body gland	**065-0090**
Control diaphragm including gland	**065-7279**
Gland for diaphragm	**065-7278**

Setting

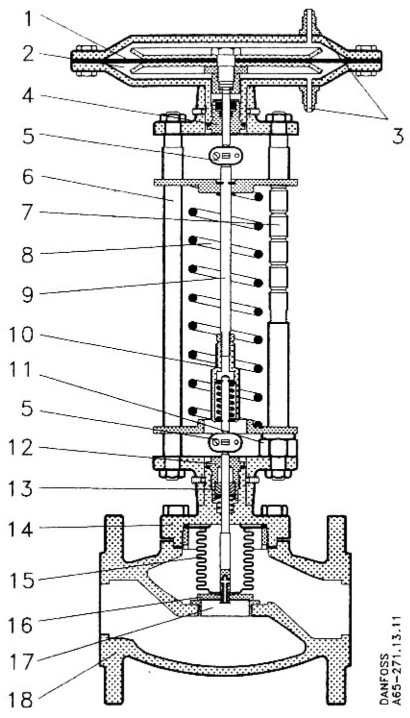


IVD-IVF/IVFS is set by turning setting nut, 12, see "Design". If the system is not equipped with pressure gauges, setting can be carried out using above scale. Values given are indicative only.

Note: Both setting nuts on IVD, 0.2 - 2.5 bar (see "Design", 11) must be set to avoid overload of setting part.

Design

1. Control diaphragm
2. Diaphragm unit
3. Nipples for impulse tubes
4. Gland
5. Operation unit
6. Stay bolt
7. Setting marking
8. Setting spring
9. Spindle
10. Pressure stem
11. Setting nut
12. Gland
13. Teflon rings
14. Cover
15. Auxiliary bellows
16. Valve plate
17. Valve seat
18. Valve body



IVD-IVF/IVFS assembled as differential pressure control

Materials
Parts in contact with water

IVF

Valve body and cover:	GG-25, DIN 1691, w-no.: 0.6025

IVFS

Valve body and cover:	GGG 40.3, DIN 1693, w-no.: 0.7040

IVF/IVFS

Spindle:	17 CrMo, DIN 17440, w-no.: 1.4122
Valve seat and plate:	17 CrMo, hardened DIN 17440, w–no.: 1.4122
Bellows:	CrNi steel, DIN 17440, w-no.: 1.4301
Diaphragm:	EPDM-rubber
Gland:	PTFE-rings

Installation

The control can be installed in any position in supply or return line, provided flow is always in cast-in arrow direction.

Data

IVD
Max. operating pressure .... 16 or 25 bar [1]
Max. operating temperature .... 180 °C [2]
Connection for
impulse tube .... 7/16–20 UNF flare

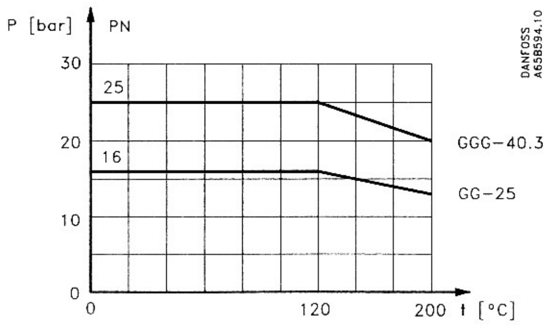
IVD cannot be used as constant flow control in systems where pump pressure is more than 20 kPa (0.2 bar). Consequently you will have to choose IVDA (Code no. 065-7281) at pump pressures above 20 kPa (0.2 bar)

IVF
Max. operating pressure of
flow temperature up to 120 °C .... 16 bar [3]
Max. operating pressure of flow
temp. above 120 °C and steam .... 13 bar [3]
Max. flow temperature .... 180 °C

IVFS
Max. operating pressure of
flow temperature up to 120 °C .... 25 bar [3]
Max. operating pressure of flow
temp. above 120 °C and steam .... 20 bar [3]
Max. flow temperature .... 180 °C

[1] Pressure must be the same on both sides of diaphragm during test
[2] If the impulse tubes are connected to lines in which the temperature of the medium is more than 170 °C, a temperature break must be used - see "Accessories and spare parts", page 2.
[3] According to DIN 4747 and DIN 2401, see diagram

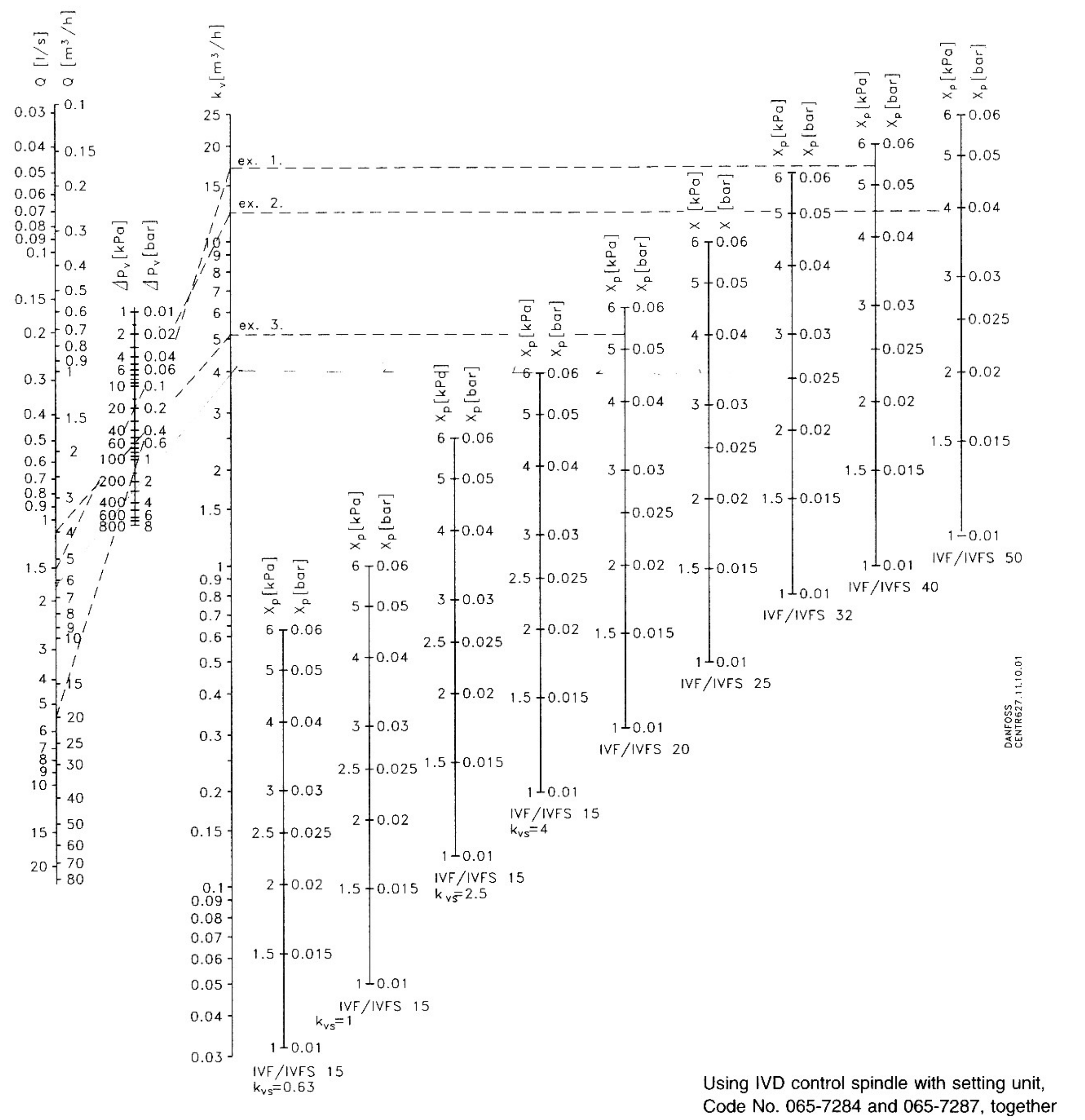
When IVD/IVF-IVFS is applied in systems using steam as medium, below conditions must be fulfilled:
Pure chloride (Cl^-): .... < 10 mg/l
Pure oxygen (O_2): .... < 0.02 ppm



Pressure and temperature diagram according to DIN 4747 and DIN 2401

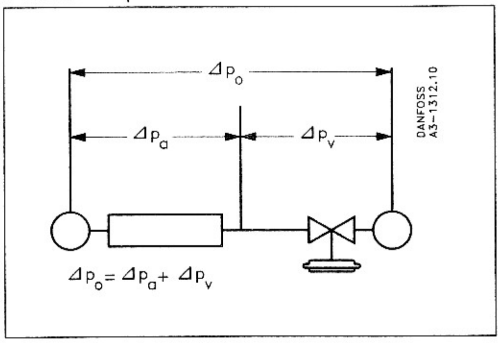
Sizing

IVD/IVDA-IVF/IVFS diagram



Using IVD control spindle with setting unit, Code No. 065-7284 and 065-7287, together with above IVF/IVFS valves, determined X_P-value must be multiplied by 5.

Example 1
Differential pressure control

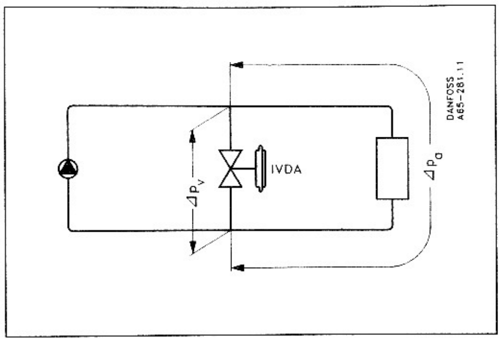


Given
Q = 20 m³/h (5.5 l/s)
Δp_0 = 160 kPa (1.6 bar)
Δp_a = 20 kPa (0.2 bar)
Δp_v = 160 – 20 = 140 kPa
(1.6 – 0.2 = 1.4 bar)

Required
Correct valve size
Proportional band X_P

Method
Connect points Q = 20 m³/h and Δp_v = 140 kPa (1.4 bar). Intersection with k_v-axis will give the necessary k_v-value of 17 m³/h. From this point, take a line horizontally to the right to intersect X_P-axis and find valve size, here IVF/IVFS 40.
The control has X_P-value of 5.5 kPa (0.055 bar), i.e. differential pressure across systems must rise to 25.5 kPa (0.255 bar) before valve closes.

Example 2
Constant flow control



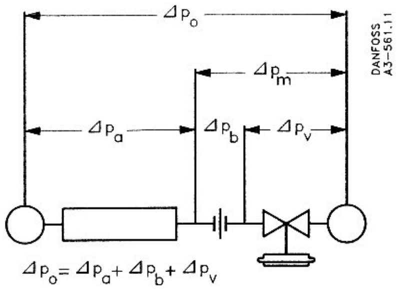
Given
Q_a = 7 m³/h at max. load
Δp_a = 15 kPa (0.15 bar) at max. load

Required
With closed radiator valves, max. Δp_a must be limited to 20 kPa (0,20 bar).
Pump characteristic indicates that Q = 5.5 m³/h at Δp_a = 20 Kpa (0.20 bar) (permissible system pressure rise)

Method
Connect points Q = 5.5 m³/h and Δp_v = 20 kPa (0.20 bar). Intersection with k_v-axis will give the necessary k_v-value of valve ≈ 12 m³/h. From this point, take a line horizontally to the right to intersect X_P-axis and find valve size with $X_P \leq 20 - 15 = 5$ kPa (0.05 bar), here both IVF/IVFS 40 and IVF/IVFS 50 have $X_P \leq 5$ kPa (0.05 bar).

Choose the smallest valve, i.e. IVD-IVF/IVFS 40. At max. load, i.e. Δp_a = 15 kPa (0.15 bar), valve will be closed.
At min. load valve will open so that pressure rises only to permissible value of 0.20 bar and passes 5.5 m³/h.

Example 3
Flow limitation



$\Delta p_o = \Delta p_a + \Delta p_b + \Delta p_v$

Δp_a = differential pressure across system
Δp_b = differential pressure across restrictor
Δp_v = differential pressure across valve
Δp_m = differential pressure across flow limitation

Sizing is determined on the basis of measurement across restrictor with fixed or adjustable k_v-value.

Given
$Q = 4\ m^3/h$ (required max. flow)
$\Delta p_m = \Delta p_b + \Delta p_v = 1$ bar (differential pressure across restrictor and pressure controller)

Required
a) Restrictor k_v-value
b) Valve size (pressure control)
c) Control accuracy

a) Restrictor value
At pressure drop across restrictor $\Delta p_b = 0,4$ bar, the restrictor k_v-value is calculated as follows:

$$k_v = \frac{Q}{\sqrt{\Delta p_b}} = \frac{4}{\sqrt{0.4}} \approx 6.3\ m^3/h$$

b) Valve size
Pressure drop across valve $\Delta p_v = \Delta p_m - \Delta p_b = 1 - 0.4 = 0.6$ bar in the sizing diagram. Connect points $Q = 4\ m^3/h$ and $\Delta p_v = 0.6$ bar. Intersection with k_v-axis will give the necessary k_v-value of valve $\approx 5.2\ m^3/h$. From this point take a line horizontally to intersect X_P-axis and find valve size IVF 20 with $X_p = 0.053$ bar.

c) Control accuracy
Control accuracy depends on the differential pressure across restrictor and valve Δp_m being constant. At a certain differential presure increase the control accuracy can be expressed as a excess of required flow.

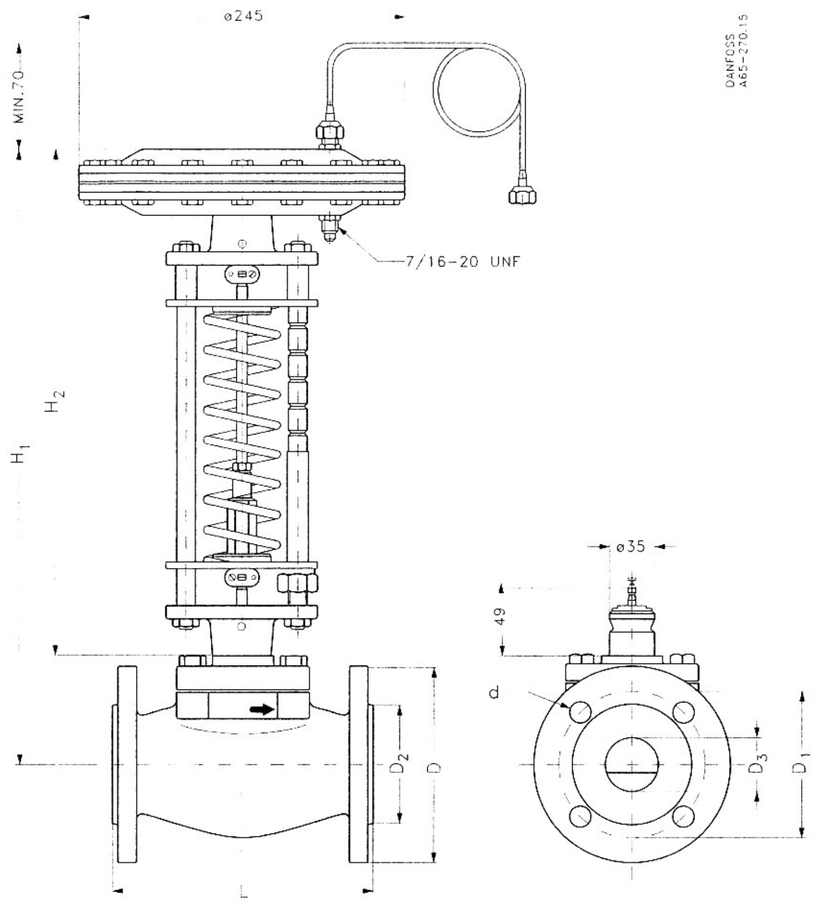
Example: At a doubled differential pressure across restrictor and valve, i.e. $\Delta p_m = 2$ bar, the major part of the pressure increase, i.e. 1 bar, will be used by the IVF-valve, i.e. $\Delta p_v = 0.6 + 1 = 1.6$ bar. The diagram includes the new k_v-value of the valve = 3 m^3/h (not shown), i.e. a IVF 20 valve has a X_P = 0.038 bar. Thus the pressure increase across the restrictor $\Delta X_P = X_{P1} - X_{P2} = 0.053 - 0.038 = 0.015$ bar has increased the restrictor flow as follows:

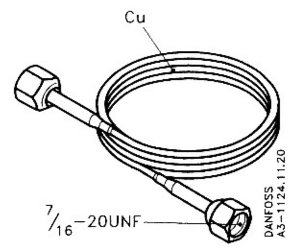
$$\Delta Q = \left(\sqrt{\frac{\Delta p_{b2}}{\Delta p_{b1}}} - 1\right) \times 100\ [\%]$$

$(\Delta p_{b2} = \Delta p_{b1} + \Delta X_P = 0.4 + 0.015 = 0.415$ bar$)$

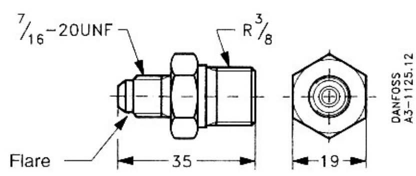
$$\Delta Q = \left(\sqrt{\frac{0.415}{0.4}} - 1\right) \times 100 = 1.9\%$$

Dimensions





Impulse tube



Nipple
Code No. 631X4700

IVF-IVFS

Type		IVD/IVDA 0 - 0.5 bar		IVD 0 - 2.5 bar								
		H_1	H_2	H_1	H_2	L	D	D_1	D_2	D_3	d	Weight kg
IVF/IVFS 15	mm	433	370	511	448	130	95	65	45	15	14	6.4
IVF/IVFS 20	mm	433	370	511	448	150	105	75	58	20	14	7.0
IVF/IVFS 25	mm	433	370	511	448	160	115	85	68	25	14	7.6
IVF/IVFS 32	mm	455	370	533	448	180	140	100	78	32	18	11.1
IVF/IVFS 40	mm	455	370	533	448	200	150	110	88	40	18	11.9
IVF/IVFS 50	mm	455	370	533	448	230	165	125	102	50	18	13.4

Danfoss A/S
DK-6430 Nordborg
Denmark
Tel.: +45 74 88 22 22
Telefax: +45 74 49 09 49
Telex: 50 599 danfss dk