

Data sheet

Pressure regulating valves

Types OFV, OFV-SS



OFV are angle-way pressure regulating valves, which have an adjustable opening pressure and cover the differential pressure range (ΔP): 2 - 8 bar (29 - 116 psi). The valve can be closed manually, e.g. during plant service and have backseating, enabling the spindle seal to be replaced with the valve still under pressure.

The valves are especially designed to prevent fluttering due to low velocity and/or low density. In consequence it is possible to apply the valves with wide fluctuations in capacity demands, i.e. from maximum performance to part load. A flexible O-ring provides perfect sealing over the seat.

Features

- Applicable to HCFC, HFC, R717 (Ammonia) and R744 (CO₂).
- Full temperature range packing gland
- -50/+150°C (-58/+302°F)
- Maximum operating pressure: 40 bar g (580 psig)
- Three functions in one valve. The OFV valve combines the functions of a pressure regulating valve, a check valve and a shut-off valve
- Classification: DNV, CRN, BV, EAC etc. To get an updated list of certification on the products please contact your local Danfoss Sales Company.
- Special features for OFV-SS
 - Low temperature stainless steel housing and bonnet
 - Low temperature packing gland -60/+150°C (-76/+302°F)
 - Maximum operating pressure 52 bar (754 psi g)

Design

Connections

Available with the following connections:

- Welding DIN (EN 10220)
- Welding ANSI (B 36.10 Schedule 80)

Packing gland OFV

The “full temperature range” packing gland consists of a double O-ring sealing arrangement combined with permanent lubrication from a grease reservoir. This ensures perfect tightness throughout the whole range: -50/+150°C (-58/+302°F).

Flexible O-ring provides perfect sealing over the seat.

Packing gland OFV-SS

The stainless steel packing gland comprises a spring loaded seal packing gland which ensures a perfect tightness in the range: -60/+150°C (-76/+302°F).

The packing glands are equipped with a scraper ring to prevent penetration of dirt and ice into the packing gland.

Pressure Equipment Directive (PED)

OFV valves are approved and CE-marked in accordance with the Pressure Equipment Directive - 97/23/EC.

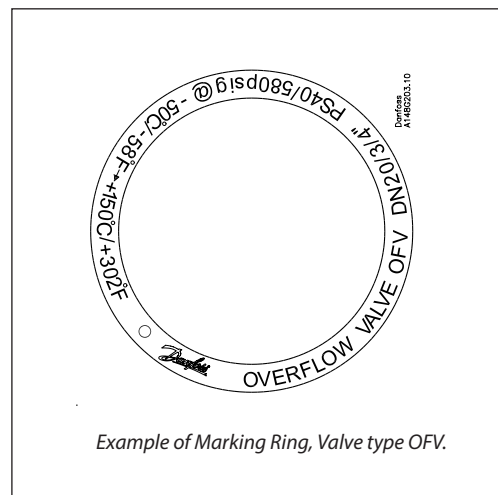
For further details / restrictions - see Installation Instruction

Installation

	OFV
Nominal bore	DN≤ 25 mm (1 in.)
Classified for	Fluid group I
Category	Article 3, paragraph 3



The valve is designed to resist very high internal pressure, but as to the pipe system in general, hydraulic pressure caused by thermal expansions in entrapped refrigerants should be avoided. For further information please see OFV installation instruction.



Technical data

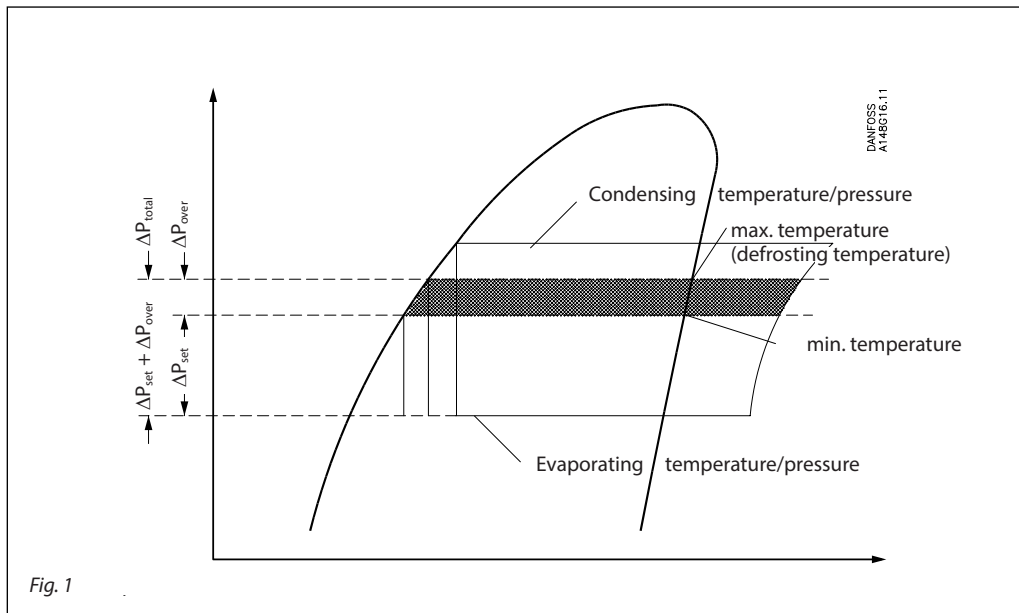
- *Refrigerants*
Applicable to HCFC, HFC, R717(Ammonia) and R744 (CO₂).
- Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- *Temperature range*
OFV: -50/+150°C (-58/+302°F)
OFV-SS: -60/+150°C (-76/+302°F)

- *Pressure range*
Maximum operating pressure:
OFV: 40 bar g (580 psig)
OFV-SS: 52 bar (754 psi g)
Set pressure (Δp):
2 - 8 bar (29 - 116 psi).

Understanding the OFV in practice
(when working in a defrosting application)

How the OFV works
The opening pressure of the OFV can be adjusted to a specific differential pressure ΔP_{set} by turning the spindle. ΔP_{set} indirectly determines the de-

frosting pressure. As illustrated in fig. 1 the OFV will work at a pressure somewhat higher than ΔP_{set} namely the ΔP_{total} which will be situated somewhere in the area marked with grey in fig. 1.



As ΔP_{over} is plant specific, it follows that the total working pressure ($\Delta P_{total} = \Delta P_{set} + \Delta P_{over}$) is plant specific too. By adjusting the opening differential pressure ΔP_{set} it is possible to adjust the working pressure $\Delta P_{set} + \Delta P_{over}$ until you get the required defrosting pressure.

Defrosting pressure \approx Evaporating pressure + $\Delta P_{set} + \Delta P_{over}$.

Important!
The OFV valve is **back pressure** dependent.

Adjusting set pressure

The set pressure is the pressure at which the valve starts to open.

The set pressure is adjustable in the range 2 - 8 bar differential pressure. When the valve is delivered, a distance piece is supplied separately with the valve. The distance piece can be mounted under the spring, thus increasing the initial tension of the spring. Therefore the valve covers the complete range 2 - 8 bar differential pressure, as follows:

- 2 - 6.5 bar differential pressure without distance piece.
- 3.5 - 8 bar differential pressure with distance piece.

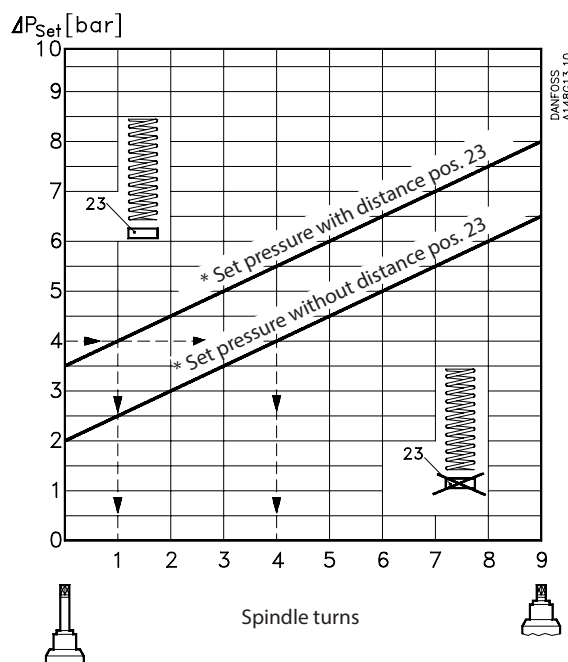
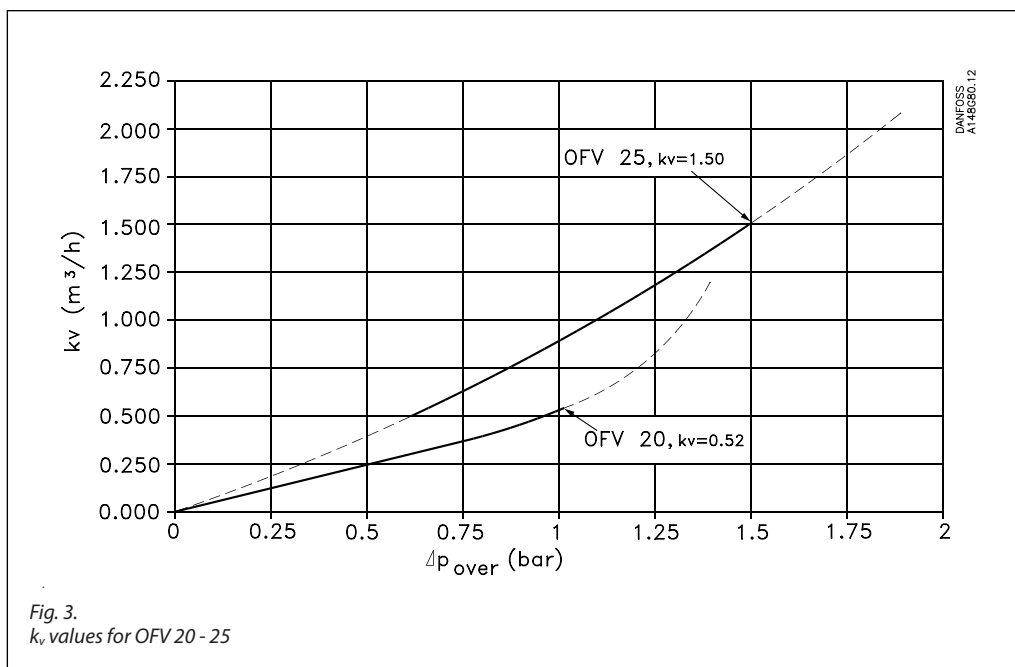


Fig. 2
Set pressure as a function of the spindle turns

* see material specification and installation an maintenance instruction for OFV.

Computation and selection



The capacity of the OFV valves can be calculated by the following formulas:

Liquids without phase change

$$G = k_v \sqrt{\rho \times \Delta P_{total} \times 1000}$$

Liquids with phase change (e.g. pressure control during defrost)

$$G = k_v \times 0.78 \sqrt{\rho \times \Delta P_{total} \times 1000}$$

G: mass flow (kg/h)

k_v : flow rate (m³/h) (the k_v value is dependent on ΔP_{over} , see fig. 3).

ρ : density, liquid (kg/m³)

ΔP_{bar} = differential pressure (bar)

ΔP_{bar} = $\Delta P_{set} + \Delta P_{over}$

Defrosting pressure \approx Evaporating pressure + $\Delta P_{set} + \Delta P_{over}$

Capacity calculation for defrost pressure regulating

Table 1: Max. mass flow (G_{OFV}) for OFV 20 and OFV 25 with R717

Evaporating temperature	-10°C	-20°C	-30°C	-40°C	-50°C
Defrosting temperature	10°C				

OFV 20

Mass flow $G_{OFV 20}$ (kg/h) ($\Delta P_{over} = 1 \text{ bar}$ □ $k_v = 0.52 \text{ m}^3/\text{h}$)	577	661	714	747	768
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OFV 25

Mass flow $G_{OFV 25}$ (kg/h) ($\Delta P_{over} = 1.5 \text{ bar}$ □ $k_v = 1.5 \text{ m}^3/\text{h}$)	1666	1906	2059	2156	2216
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Note: the calculation is based on formula for "liquids with phase change" in the paragraph "Computation and selection".

Table 2: Calculating of refrigerant mass flow G_0

Evaporating temperature	-10°C	-20°C	-30°C	-40°C	-50°C
Mass flow G_0 (kg/h)	$2.780 \times Q_0$	$2.712 \times Q_0$	$2.651 \times Q_0$	$2.595 \times Q_0$	$2.544 \times Q_0$

Q_0 : Capacity of the evaporator (kW)

Note: the calculation is based on pump circulating system (Liquid temperature = Evaporating temperature)

Guide line: Defrost capacity $G_{OFV} \sim (2 - 3) \times G_0$

Example:

An evaporator in a refrigerant plant has a capacity of $Q_0 = 150 \text{ kW}$ and a evaporating temperature of -40°C .

The defrosting temperature has to be controlled with an OFV valve.

Table 2: $G_0 = 2.595 \times Q_0 = 389 \text{ kg/h}$

The defrosting capacity in this example is $2.5 \times G_0$.

$G_{OFV} \geq 2.5 \times 389 = 972 \text{ kg/h}$.

OFV 25 is selected ($G_{OFV 25 \text{ max.}} = 2156 \text{ kg/h}$ (table 1)).

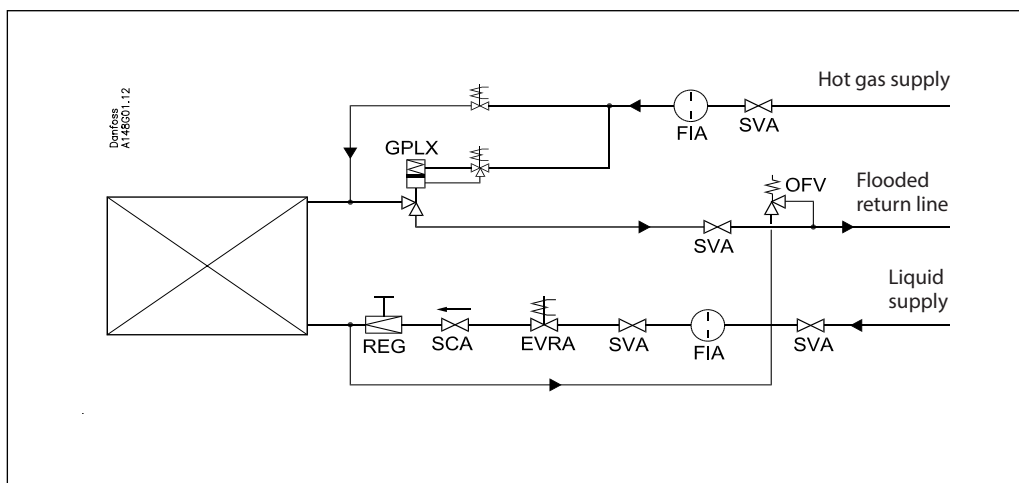
Plant applications

Pressure/temperature control during hot gas defrosting

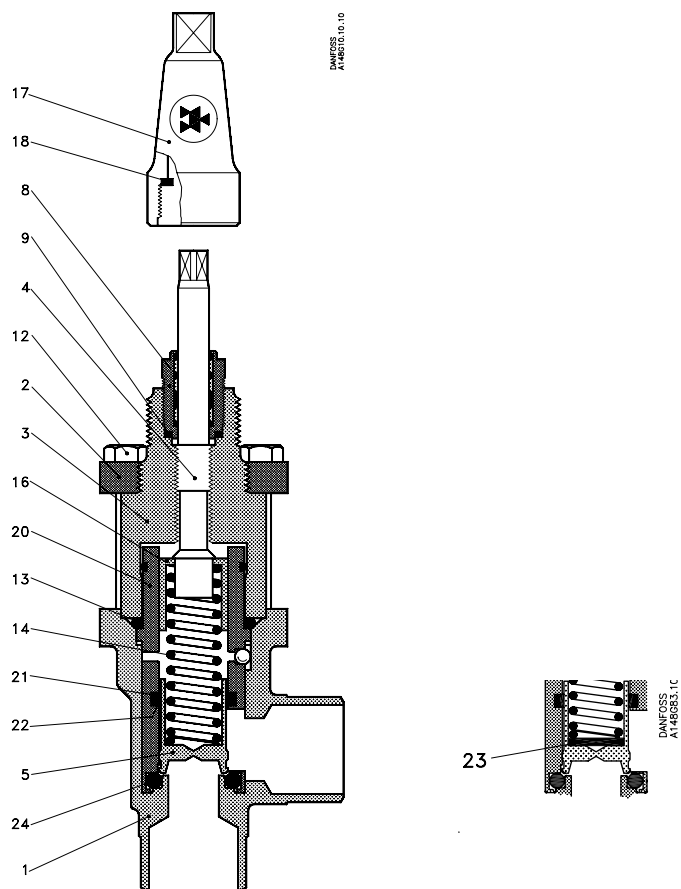
In order to obtain efficient hot gas defrosting the temperature (pressure) must be increased to approx. 10°C (50°F). The OFV is the optimal solution for controlling the defrosting pressure and thus the corresponding temperature. It is recommended to start the defrosting cycle by closing the GPS valve in the liquid supply line and allowing some of the cold liquid contained in the evaporator to return to the liquid separator. Close

the GPS valve in the suction line and after a delay open the solenoid valve in the hot gas supply in order to build up the defrosting pressure in the evaporator. When the defrosting pressure reaches the set OFV-pressure, the OFV will open and the defrosting pressure will increase to the working pressure $\Delta P_{set} + \Delta P_{over}$.

After defrosting, it is normal practice to open the GPS in the return line to equalize the pressure to the suction side before opening to the pump side.

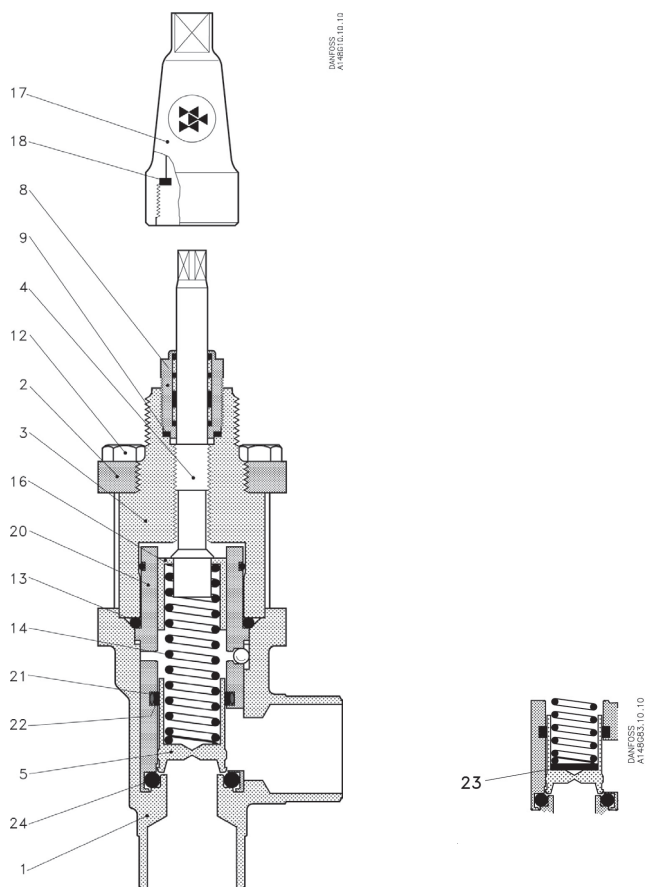


Material specification



No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	P285 QH EN10222-4		LFA350
2	Bonnet, Flange	Steel	P275 NL1 EN10028-3		
3	Bonnet, Insert	Steel			
4	Spindle	Stainless steel	X10 CrNi S18-9 17440	Type 17 683/13	AISI 303
5	Cone	Steel			
8	Packing gland	Steel			
9	Packing washer	Aluminium			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Spring	Steel			
16	Spring washer	Steel			
17	Cap	Aluminium			
18	Gasket for cap	Nylon			
20	Guide piece	Steel			
21	O-ring	Cloroprene (Neoprene)			
22	Sealing ring	PTFE (Teflon)			
23	Distance piece	Steel			
24	O-ring	Cloroprene (Neoprene)			

Material specification



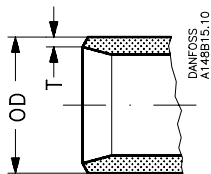
OFV-SS 20 - 25 (3/4 - 1")

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Stainless steel	X5CrNi18-10 EN10088		AISI 304
2	Bonnet, Flange	Stainless steel	X5CrNi18-10 EN10088		AISI 304
3	Bonnet, Insert	Stainless steel			
4	Spindle	Stainless steel	X8CrNiS18-9 DIN 17440	Type 17, 683/13	AISI 303
5	Cone	Steel	9SMn28	Type 2	1213
8	Packing gland	Stainless steel			
9	Packing washer	Non asbestos			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Spring	Steel			
16	Spring washer	Steel	Steel		
17	Spindle seal cap	Aluminium			
18	Seal cap gasket	Nylon			
20	Guide piece	Steel			
21	O-ring	Cloroprene (Neoprene)			
22	Sealing ring	PTFE (Teflon)			
23	Distance piece	Steel			
24	O-ring	Cloroprene (Neoprene)			

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Connections

DIN

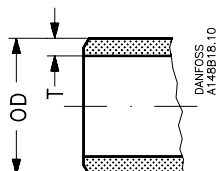


Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v -angle m ³ /h		C_v -angle USgal/min	
20	3/4	26.9	2.3	1.059	0.091			0 - 0.52		0 - 0.60	
25	1	33.7	2.6	1.327	0.103			0 - 1.50		0 - 1.74	

Welding DIN (EN 10220)

20	3/4	26.9	2.3	1.059	0.091			0 - 0.52		0 - 0.60	
25	1	33.7	2.6	1.327	0.103			0 - 1.50		0 - 1.74	

ANSI

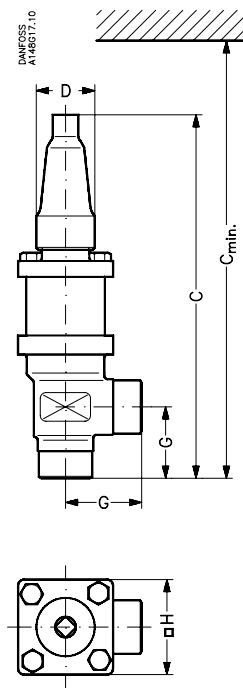


Welding ANSI (B 36.10 Schedule 80)

20	3/4	26.9	4.0	1.059	0.158			0 - 0.52		0 - 0.60	
25	1	33.7	4.6	1.327	0.181			0 - 1.50		0 - 1.74	

Dimensions and weights

OFV 20 - 25



Valve size			G	C	C_{min}		$\varnothing D$	$\square H$	Weight
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OFV 20 - 25

OFV 20 (3/4 in.)	mm		45	230	290		38	60	2.0 kg
	in.		1.77	9.1	11.4		1.5	2.4	
OFV 25 (1 in.)	mm		45	230	290		38	60	2.0 kg
	in.		1.77	9.1	11.4		1.5	2.4	

Specified weights are approximate values only.

Ordering
How to order

The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range.

For further information please contact your local Danfoss Sales Company.

Example for type codes

OFV 25 D 1 3 3

Type codes

Valve type	OFV	Over Flow Valve
Nominal size in mm	20 25	DN 20 DN 25
Connections	A D	Welding branches: ANSI B 31.5 schedule 80 Welding branches: DIN 2448
Valve housing	1	Angle flow
Materials	3	Housing: P285 QH, Bonnet: P275 NL1
Other equipment	3	Cap, short spindle with Chloroprene (Neoprene) O-ring

Important!

Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Opening differential pressure

2-8 bar (29-116 psi):

Size		Type	Code No.
mm	in		
20	¾	OFV 20 A 133	2412+185
20	¾	OFV 20 D 133	2412+183
20	¾	OFV-SS 20 D ANG OVER FLOW VALVE 52BAR	148G3194
25	1	OFV 25 A 133	2412+186
25	1	OFV 25 D 133	2412+184
25	1	OFV-SS 25 D ANG OVER FLOW VALVE 52BAR	148G3195

