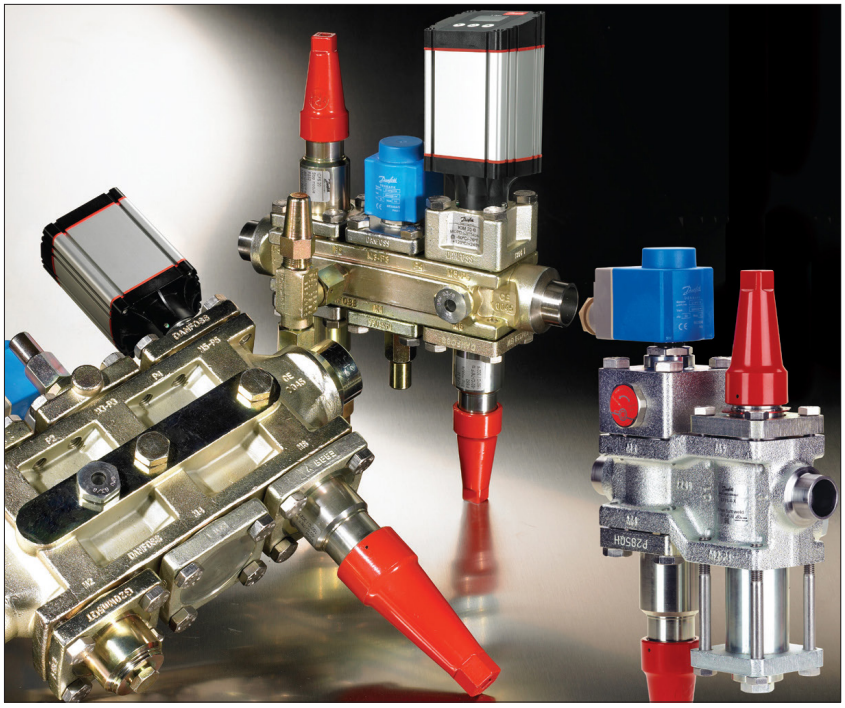
ENGINEERING
TOMORROW

Data sheet

Capacities
Valve Station, type ICF 15, 20, 25



Based on advanced technology the ICF valve station incorporates several functions in one housing, which can replace a series of conventional mechanical, electro-mechanical and electronically operated valves.

This valve station not only provides a number of advantages in the design phase of a refrigeration plant but also in the installation, service and maintenance.

The ICF valve stations are designed for low and high pressure refrigerants and can be used in pumped liquid lines, liquid injection lines and hot gas lines.

Supplied as a complete assembly, it is fully tested at high pressure and its functions are tested under factory controlled conditions.

One code number equals one application solution.

Features

- Designed for industrial refrigeration applications for a maximum working pressure of 52 bar/754 psig.
- Applicable to HCFC, non flammable HFC, R717 (Ammonia) and R744 (CO_2).
  The use of ICF valve stations with flammable hydrocarbons is not recommended.
- Direct weld connections
  (No leaks through flanges)
- Connection types include butt weld and socket weld.
- Low temperature steel housing.
- Low weight and compact design.
- V-port regulating cones on the control modules ensure optimum regulating accuracy particularly at part load.
- *Modular Concept*
  Each housing is available with several different connection types and sizes.
  Valve service is performed by replacing the function module.
- Side ports for the connection of pressure gauges, transmitters, sight glasses, service valve etc.

CE

ICF valve station		
Nominal bore	DN≤ 25 (1 in.)	DN 32-40 (1 ¼ - 1 ½")
Classified for	Fluid group I	
Category	Article 3, paragraph 3	II

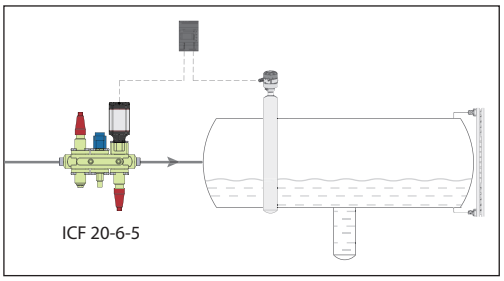
ICF 20 and 25

Liquid injection to separator (Expansion)
Application 5

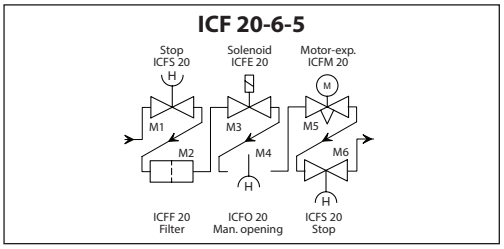
ICF with motorized valve ICM is fundamental to maintain stable liquid level in surge drums and separators. For this application the ICF (20-25)-6-5 is recommended.

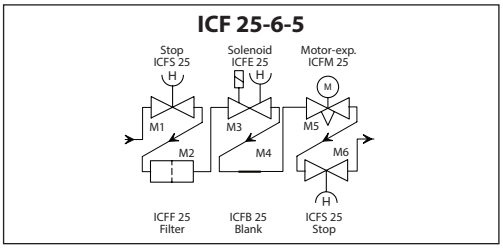
The flexibility of the ICF enables safe operation and efficient operation. This requires slightly sub-cooled or fully saturated liquid. The sight glass provided will help operator determine whether liquid only is flowing through the ICF.

For fail safe operation this type of ICF is equipped with a ICFE solenoid valve in front of the ICM motor operated valve.



Configuration





A simple combination of solenoid valves and motorized valves provide a wide range of capacities for direct expansion

Recommended max. capacities

ICF 20-6 and ICF 25-6; application no. 5 (Liquid injection)

R717

ICF 20-6 / ICF 25-6	ICF 20-6-5MA33		ICF 20-6-5MA		ICF 20-6-5MB66		ICF 20-6-5HMB		ICF 25-6-5MA33	
M3 - Solenoid Module M5 - Expansion Module	ICFE 20 ICM 20A33		ICFE 20 ICM 20A		ICFE 20 ICM 20B66		ICFE 20H ICM 20B		ICFE 25 ICM 25A33	
Max. evaporating capacity @ 75% open expansion	[kW] 71	[TR] 20	[kW] 205	[TR] 58	[kW] 565	[TR] 160	[kW] 730	[TR] 207	[kW] 980	[TR] 278
K_v (C_v) value (complete valve)	m^3/h 0.2	lbs/min 0.23	m^3/h 0.6	lbs/min 0.7	m^3/h 1.4	lbs/min 1.6	m^3/h 2.0	lbs/min 2.3	m^3/h 2.2	lbs/min 2.5

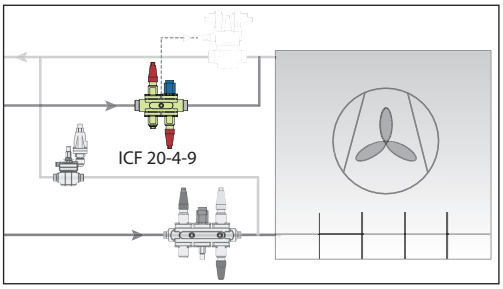
Maximum recommendable capacity. Pipe velocity (1 m/s) used as dimensioning factor.
Stated capacity is obtained with a valve opening ≤ 75% TE = –20 to –30 °C (–4 to –22 °F), TC = +30 °C (86 °F)

Note:
For larger capacities use larger individual weld-in components such as SVA, FIA, ICS or ICM.

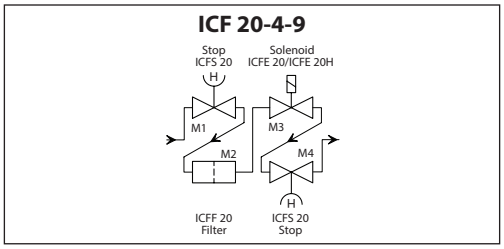
ICF 20 and 25

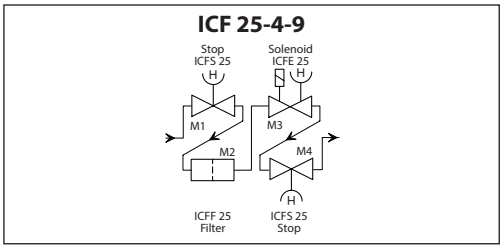
Hot gas defrost
Application 9

The ICF 20-4-9 and ICF 25-4-9 are designed to provide the necessary functions for hot gas defrost on evaporators.



Configuration





The maximum flow is typical for most evaporator applications. Evaporator type, frost thickness in fins and pipes as well as required defrost time may change the recommended model.

Recommended max. capacities

ICF 20-4 and ICF 25-4; application no. 9 (Hot gas)

R717

ICF 20-4 / ICF 25-4	ICF 20-4-9		ICF 20-4-9H		ICF 25-4-9	
M3 solenoid module	ICFE 20		ICFE 20H		ICFE 25	
Max. defrost massflow @ Dp = 1 bar (15 psi)	[kg/h] 148	[lbs/min] 5.4	[kg/h] 210	[lbs/min] 7.7	[kg/h] 490	[lbs/min] 18.0
Equivalent evaporating capacity	[kW] 44.5	[TR] 12.6	[kW] 63.1	[TR] 17.9	[kW] 147	[TR] 41.7
K_v (C_v) value (complete valve)	m^3/h 3.3	lbs/min 3.8	m^3/h 4.2	lbs/min 4.9	m^3/h 9.7	lbs/min 11.3

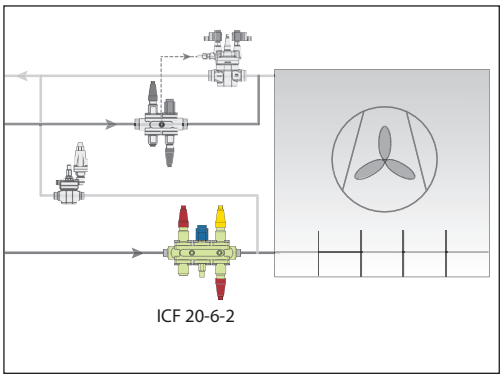
The stated evaporating capacity is based on the following conditions: TE = –30 °C (–22 °F), TC = +30 °C (86 °F)
Defrost conditions: (defrost temperature +10 °C (50 °F) and inlet temperature +40 °C (104 °F))

Note:
Rule of thumb state that $Q_{defrost} \sim 2 \times Q_{evaporating}$.
For larger capacities use larger individual weld-in components such as SVA, FIA, ICS or ICM.

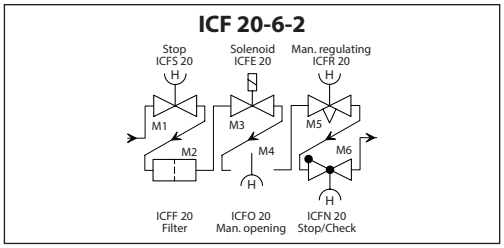
ICF 20 and 25

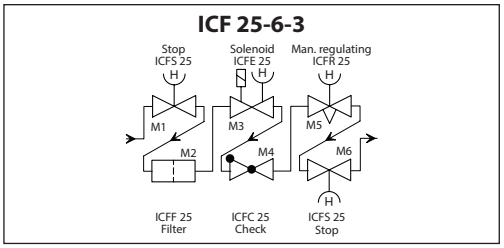
Liquid feed lines
Applications 2 & 3

The ICF 20-6-2(3) and ICF 25-6-2(3) are designed for a typical pumped liquid line in a flooded evaporator system.


ICF 20-6-2

Configuration





The ICF is available with different solenoid and expansion module with different capacities. The below ICF configurations shows the appropriate combination of solenoids and expansion capacity for the given conditions.

Recommended max. capacities

ICF 20-6 and ICF 25-6; application no. 2 and 3 (Liquid feed) @ 70% open reg. module (see flow curves)

R717

ICF 20-6 / ICF 25-6	ICF 20-6-2RA		ICF 20-6-2HRB		ICF 25-6-3RA		ICF 25-6-3RB	
M3 - Solenoid Module M5 - Manual reg. module	ICFE 20 ICFR 20A		ICFE 20H ICFR 20B		ICFE 25 ICFR 25A		ICFE 25 ICFR 25B	
Max. line massflow @ 70% open reg. module*	[kg/h] 1070	[lbs/min] 39	[kg/h] 1620	[lbs/min] 59	[kg/h] 3150	[lbs/min] 116	[kg/h] 5200	[lbs/min] 191
Equivalent evaporating capacity @ N_{circ} = 3:1	[kW] 135	[TR] 38	[kW] 205	[TR] 58	[kW] 395	[TR] 112	[kW] 650	[TR] 185
K_v (C_v) value (complete valve)	m^3/h 2.1	lbs/min 2.4	m^3/h 2.6	lbs/min 3.0	m^3/h 5.3	lbs/min 6.1	m^3/h 7.2	lbs/min 8.4

Maximum recommendable capacity. Pipe velocity (1 m/s) used as dimensioning factor.
Stated equivalent capacity is calculated for n_{circ} = 3:1, valve opening ≤ 70% TE = –30 °C (–22 °F), TC = +30 °C (86 °F)
* See pressure drop versus massflow and opening degree in below curves.

Note:
For larger capacities use larger individual weld-in components such as SVA, FIA, ICS or ICM.

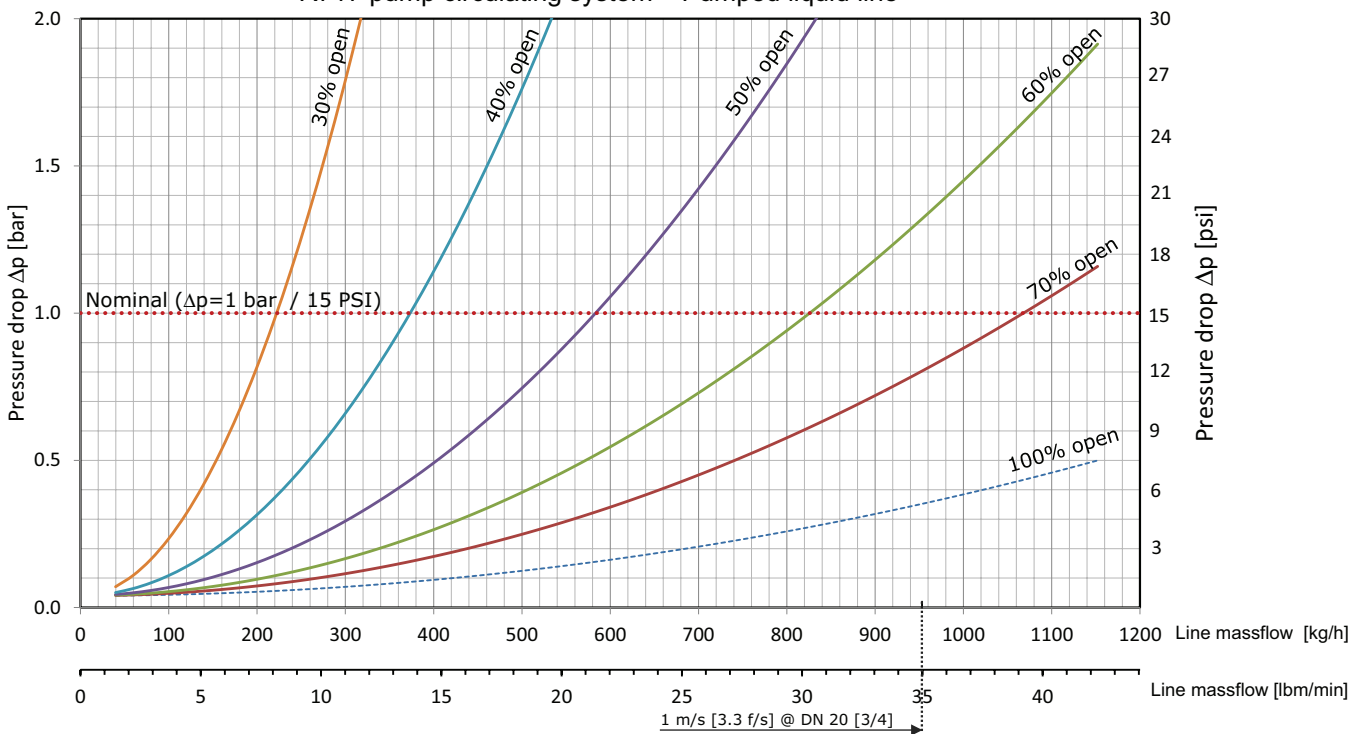
ICF 20 and 25

(Continued)

Practical Rule - Finding massflow:
Multiply Capacity in TR by: 0.343 x recir rate
Multiply capacity in kW by 2.65xrecic rate
Example: 50kW ; recirc rate 4:1: 530kg/h

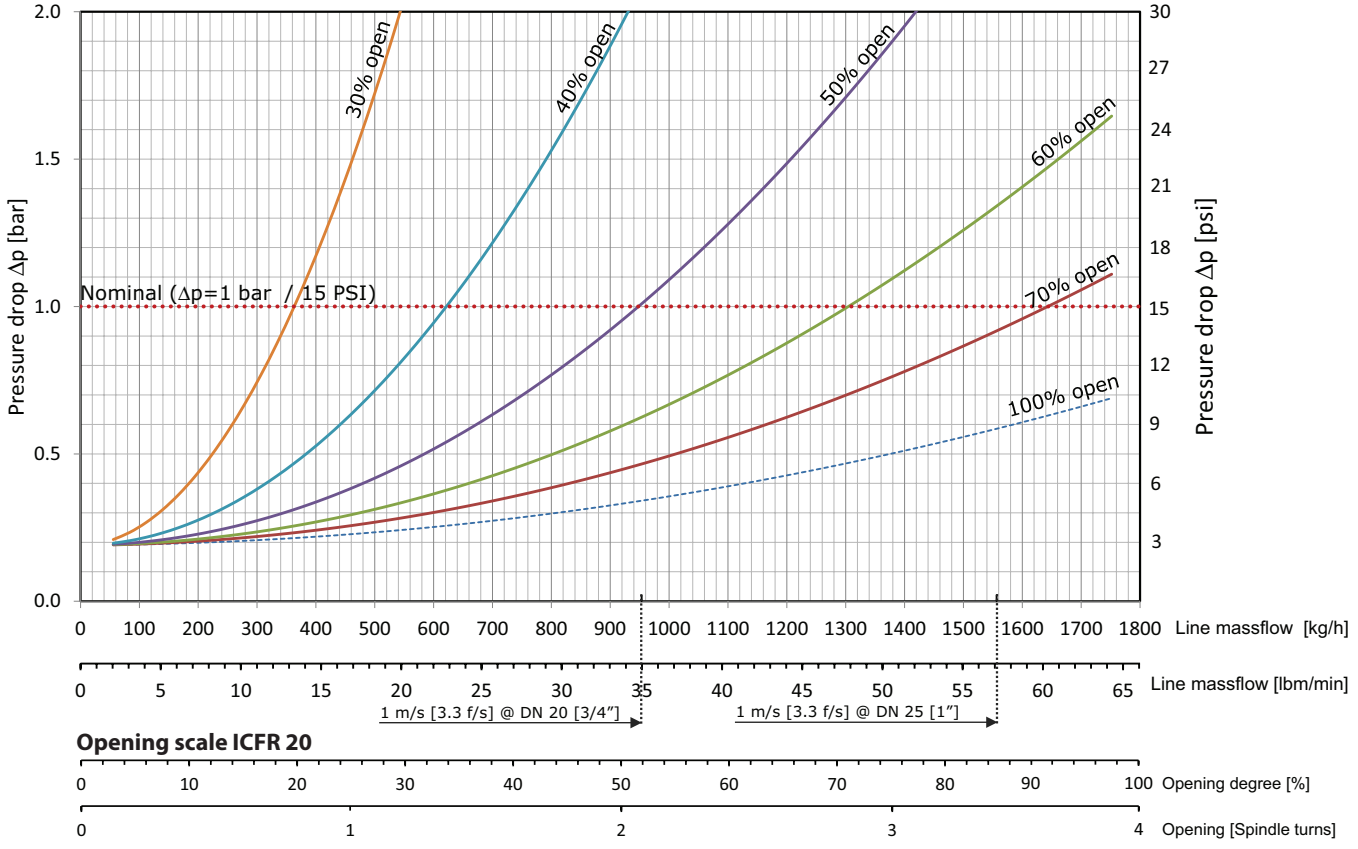
Flow capacity: ICF 20-6-2RA (including ICFR 20A - A cone)

R717 pump circulating system – Pumped liquid line



Flow capacity: ICF 20-6-2HRB (including ICFE 20H and ICFR 20B - B cone)

R717 pump circulating system – Pumped liquid line



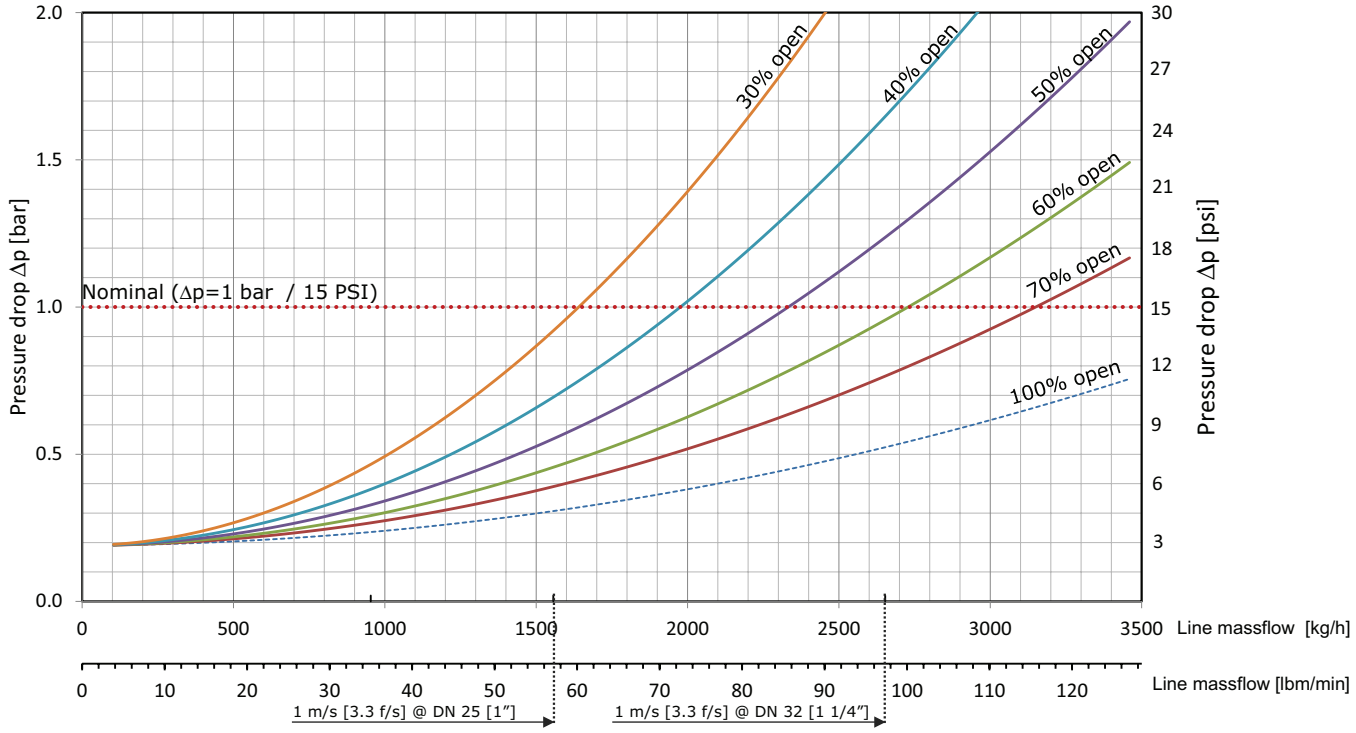
Note: The stated pressure drop shown is for the whole ICF.

ICF 20 and 25

(Continued)

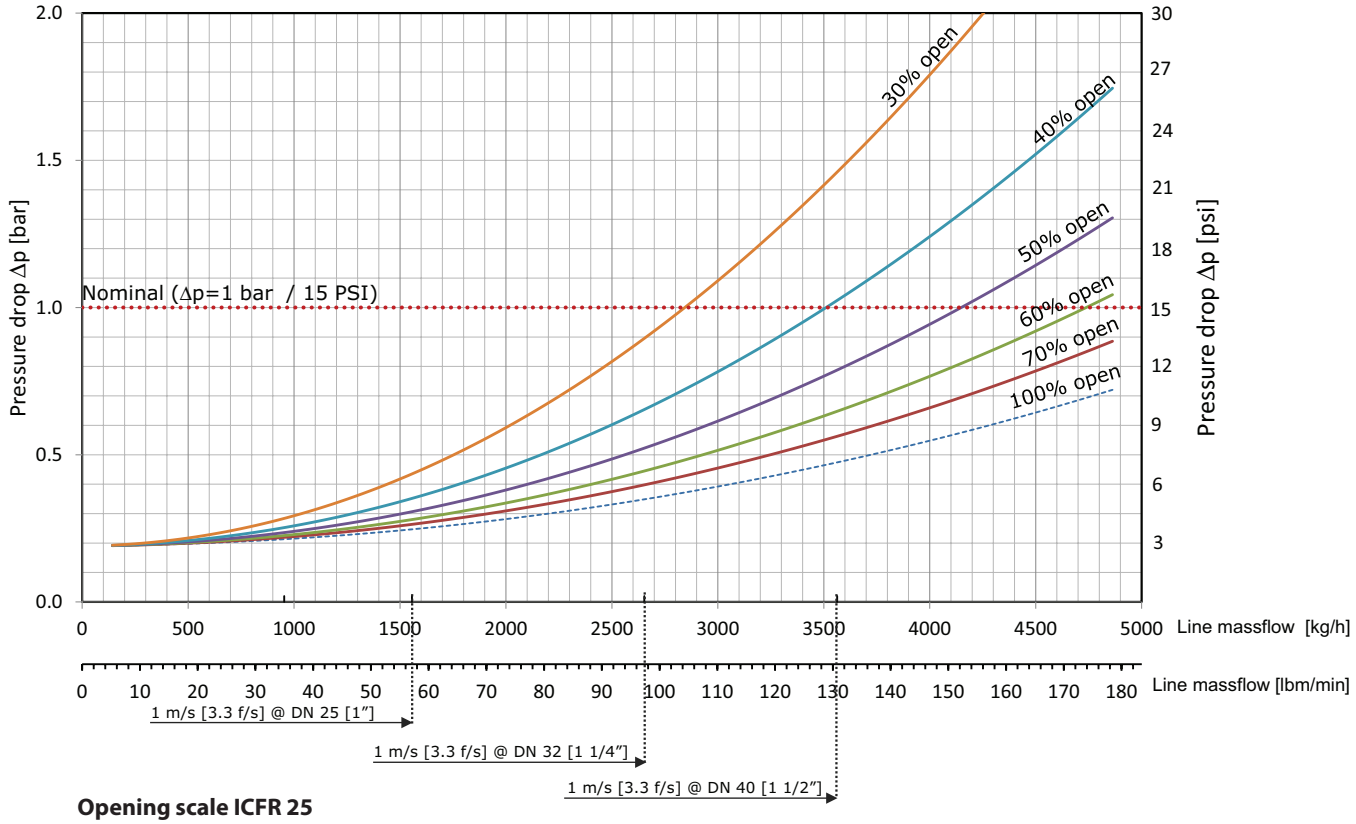
Flow capacity: ICF 25-6-3RA (including ICFR 25A - A cone)

R717 pump circulating system – Pumped liquid line



Flow capacity: ICF 25-6-3RB (including ICFR 25B - B cone)

R717 pump circulating system – Pumped liquid line

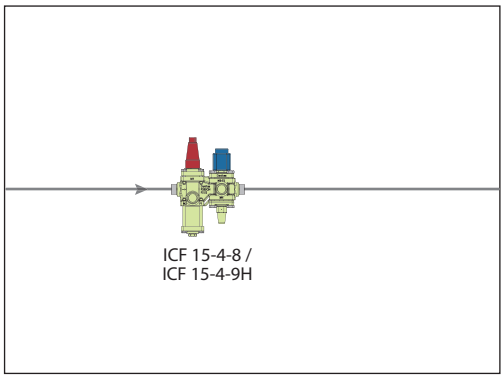


Note: The stated pressure drop shown is for the whole ICF.

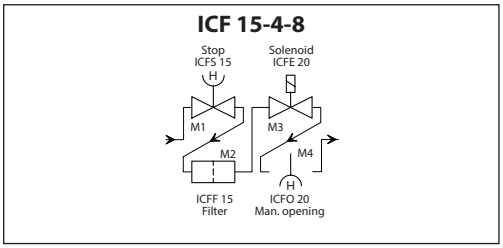
ICF 15

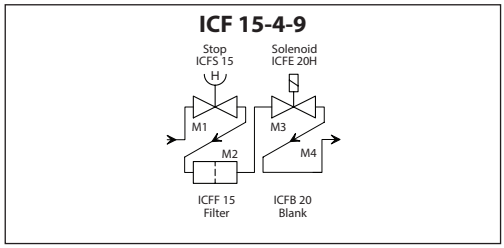
Common solenoid
Application 8 & 9

The ICF 15-4-8 and 15-4-9H are designed for both Hot gas lines and Liquid lines in most common refrigeration plants



Configuration





The generic configuration consists of the shown functions. The 2 different capacities shown in the tables below are achieved by 2 variants of the solenoid valve module ICFE 20 and ICFE 20H.

Rated capacities for ICF 15

Type	Rated capacity [1] [kW]												K_v	C_v
	Liquid				Suction vapour				Hot gas					
	R717	R22	R134a	R404A	R717	R22	R134a	R404A	R717	R22	R134a	R404A	m^3/h	gal/min
ICF 15-4-8	252	54.3	48.9	36.9	11.6	6.1	4.5	5.3	63.0	23.7	19.6	21.0	3.2	3.7
ICF 15-4-9H	350	75.5	68.0	51.3	16.1	8.5	6.3	7.4	87.6	32.9	27.2	29.2	4.2	4.9

[1] Rated liquid and suction vapour capacity is based on evaporating temperature t_e = -10°C, liquid temperature ahead of valve t_l = +25°C, and pressure drop across valve Δp = 0.15 bar.

Rated hot gas capacity is based on condensing temperature t_c = +40°C,
pressure drop across valve Δp = 0.8 bar,
hot gas temperature t_h = +65°C,
and subcooling of refrigerant Δt_{sub} = 4 K.

Capacity

Capacities are based on liquid temperature t_l = +25°C ahead of valve, evaporating temperature t_e = −10°C, and superheat 0 K.

Liquid capacity Q_l kW

R 717 (NH_3)

Type	Liquid capacity Q_e kW at pressure drop across valve Δp bar				
	0.1	0.2	0.3	0.4	0.5
ICF 15-4-8	211	300	366	426	476
ICF 15-4-9H	-	225	399	519	617

Capacities are based on liquid temperature t_l = +25°C ahead of evaporator.
The table values refer to the evaporator capacity and are given as a function of evaporating temperature t_e and pressure drop Δp across valve.
Capacities are based on dry, saturated vapour ahead of valve.
During operation with superheated vapour ahead of valve, the capacities are reduced by 4% for each 10 K superheat.

Suction vapour capacity Q_e kW

R 717 (NH_3)

Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		−40	−30	−20	−10	0	+10
ICF 15-4-8	0.10	6.3	8.3	10.6	13.1	16.0	19.3
	0.15	7.5	10.0	12.8	16.0	19.5	23.5
	0.20	8.5	11.4	14.7	18.4	22.4	27.0
ICF 15-4-9H	0.10	Not suitable					
	0.15						
	0.20						

Capacity
(continued)

R 717 (NH_3)

Hot gas capacity Q_h kW

Type	Pressure drop across valve Δp bar	Hot gas capacity Q_e kW Evaporating temp.t_e =–10°C. Hot gas temp. $t_h = t_c + 25$°C.Subcooling Δt_{sub}=4K Condensing temperature t_c °C				
		+20	+30	+40	+50	+60
ICF 15-4-8	0.10	19.6	21.1	22.5	23.7	24.6
	0.20	27.6	29.6	31.6	33.4	34.9
	0.40	38.7	41.8	44.5	47.0	49.2
	0.80	53.9	58.4	62.3	66.0	69.3
	1.60	73.5	80.4	86.5	92.0	96.7
ICF 15-4-9H	0.10	-	-	-	-	-
	0.20	20.3	22.0	23.2	24.2	25.2
	0.40	46.8	50.5	53.5	56.0	59.0
	0.80	75.0	81.0	86.5	91.2	95.5
	1.60	103.3	112.5	121.0	124.5	135.0

An increase in hot gas temperature t_h of 10 K, based on $t_h = t_c$ +25°C, reduces valve capacity approx. 2% and vice versa.

A change in evaporating temperature t_e changes valve capacity; see correction factor table below.

Correction factor

When sizing valves, the table value must be multiplied by a correction factor depending on evaporating temperature t_e.

t_o °C	–40	–30	–20	–10	0	+10
R 717 (NH_3)	0.89	0.91	0.96	1.0	1.06	1.10

R 717 (NH_3)

Hot gas capacity G_h kg/h

Type	Hot gas temperature t_h°C	Condensing temperature t_k°C	Hot gas capacity G_h kg/h at pressure drop across valve Δp bar						
			0.5	1	2	3	4	5	6
ICF 15-4-8	90	25.0	142.0	196.9	270.4	315.7	347.0	368.2	379.8
		35.0	159.4	221.6	305.0	363.4	407.4	440.0	462.8
		45.0	177.1	248.7	344.1	410.5	463.5	507.6	541.7
ICF 15-4-9H		25.0	182.8	277.0	379.5	448.6	499.2	536.1	562.0
		35.0	205.3	311.3	430.0	514.5	577.0	629.0	668.2
		45.0	226.5	344.2	480.4	578.5	654.8	718.8	771.7

An increase in hot gas temperature t_h of 10 K reduces valve capacity approx. 2% and vice versa.