Technical leaflet
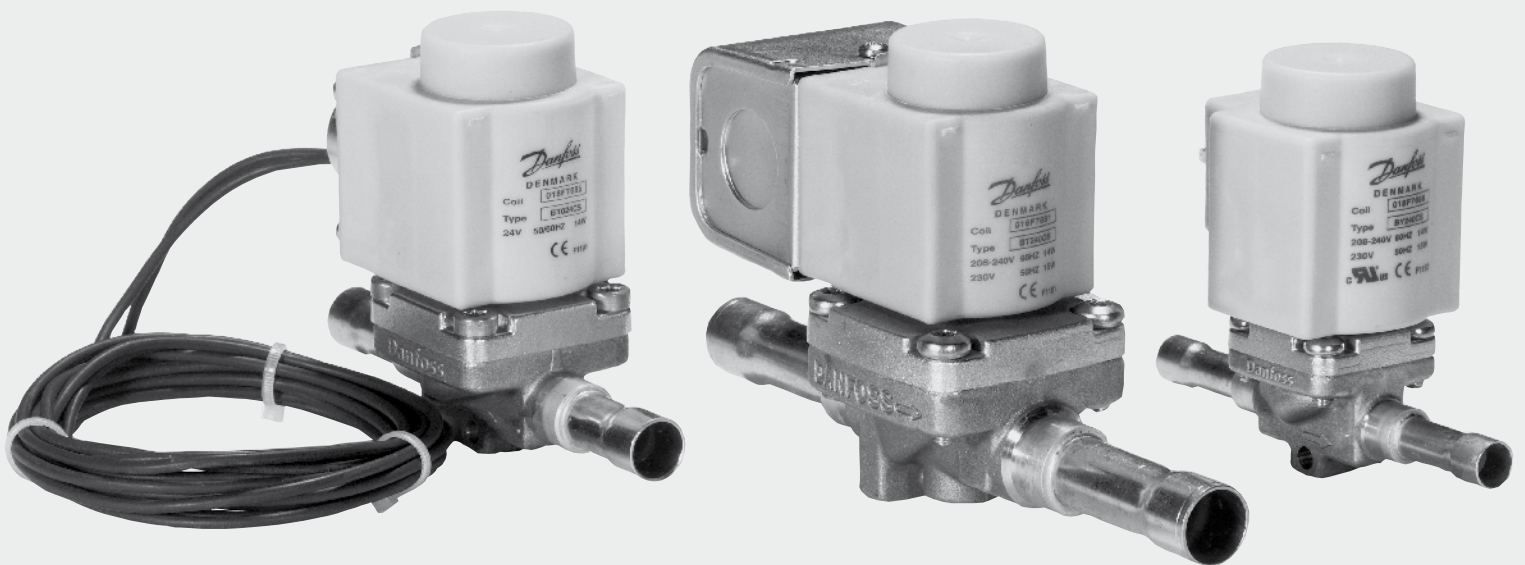# Solenoid valves for R 410A and R744 (C0$_2$)

EVR 2 to 8, EVRH 10 to 22

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Technical Leaflet	Solenoid valves for R410A and R744 (CO$_2$), EVR 2 to 8, EVRH 10 to 22

Introduction

EVR 2, EVR 3, and servo-operated EVR 4 to 8 and EVRH 10 to 22 are high pressure solenoid valves specially designed to meet the requirements of high pressure refrigerants such as R 410A and R 744 (CO$_2$). The EVRH valve can be used for liquid, suction and hot gas lines

Features

- Normally Closed and Normally Open
- Coils for a.c. and d.c. voltages
- Suitable for R 410A and R 744 (CO$_2$)
- Media temperatures up to 221°F

- Design pressure 655 psig
- MOPD up to 350 psi with 14W coil
- Solder connections up to 7/8 inch
- Extended soldering ends
- Solders without dismantling the valve

Approvals

The Low Voltage Directive (LVD) 73/23/EC with amendments EN 60730-2-8.

c(UL)us LISTED UL listed, file MH 7648

Note: These approvals are only recognized when on of the EVR/EVRH series of solenoid valves found in this leaflet is combined with a general purpose coil.

Technical data (US units)

Type	Opening differential pressure Δp [psig] (with standard coil)			C$_v$ value [gal/min]
	Min. ODP	MOPD		
		14 W a.c.	20 W d.c.	
EVR 2	0	350	260	0.19
EVR 3	0	300	260	0.32
EVR 4	0.7	300	260	0.7
EVR 6	0.7	300	260	0.92
EVR 6 NO	0.7	300	300	0.92
EVR 8	0.7	300	260	1.3
EVRH 10	0.7	300	260	2.2
EVRH 15	0.7	300	260	3.0
EVRH 18	0.7	300	260	3.9
EVRH 20	0.7	300	190	5.8
EVRH 22	0.7	300	190	6.9

Ordering

Solenoid valve – Normally Closed (NC) – Soldering ODF without coil

Type	Required coil type	in.	Code no.
EVR 2		1/4	032F7100
EVR 3		1/4	032F7105
EVR 3		3/8	032F1157
EVR 4		3/8	032F7110
EVR 4		1/2	032F7111
EVR 6		3/8	032F7115
EVR 6	a.c./d.c.	1/2	032F1162
EVR 6		5/8	032F7117
EVR 8		1/2	032F7121
EVR 8		5/8	032F7122
EVRH 10		1/2	032G1077
EVRH 15		5/8	032G1078
EVRH 18			
EVRH 20	a.c.	7/8	032G1079
EVRH 20	d.c.	7/8	032G1080
EVRH 22	a.c.	7/8	032G1330

Solenoid valve – Normally Open (NO)

Type	Required coil type	in.	Code no.
EVR 6	a.c./d.c.	3/8	032F1164
EVRH 10		1/2	032F1329

Coils: See "Coils for solenoid valve"

DKRCC.PD.B00.B3.22 / 520H4539

Capacity, R410A (US units)

Liquid capacity Q$_o$ tons   **R410A**

Type	Liquid capacity Q$_o$ tons at pressure drop acroee valve p psi						
	1	**2**	**3**	**4**	**5**	**6**	**7**
EVR 2	0.56	0.78	**0.96**	1.1	1.23	1.35	1.46
EVR 3	0.98	1.37	**1.68**	1.93	2.15	2.36	2.55
EVR 4	2.12	2.98	**3.65**	4.2	4.69	5.14	5.55
EVR 6	2.79	3.92	**4.8**	5.52	6.16	6.75	7.3
EVR 8	3.94	5.54	**6.78**	7.8	8.7	9.54	10.3
EVRH 10	6.63	9.31	**11.4**	13.1	14.6	16	17.3
EVRH 15	9.07	12.7	**15.6**	17.9	20	21.9	23.7
EVRH 18	11.83	16.6	**20.3**	23.4	26.1	28.6	30.9
EVRH 20	17.5	24.5	**30**	34.5	38.5	42.2	46.6
EVRH 22	20.82	29.4	**36**	41.4	46.2	50.6	54.8

Capacities are based on:
liquid temperature t_l = 100°F
Evaporating temperature t_e = 40°F
Superheat 10°F

Correction factors for liquid temperature t_l
When liquid temperature t_l ahead of the expansion valve is other than 100°F, adjust the table capacities by multiplying them by the appropriate correction factor found in the following table:

t_l°F	80	90	100	110	120
Factor	1.10	1.05	1.00	0.95	0.90

Suction vapour capacity. Q$_0$ **R410A**

Type	Pressure drop Δp [psi]	Suction vapour capacity Q0 tons at evaporating temperature t_e °F							
		-40	**-20**	**0**	**10**	**20**	**30**	**40**	**50**
EVR 2	1	0.04	0.05	0.07	0.07	0.08	0.09	**0.10**	0.11
	2	0.06	0.07	0.09	0.11	0.12	0.13	0.14	0.16
	3	0.07	0.09	0.12	0.13	0.14	0.16	**0.18**	0.19
EVR 3	1	0.07	0.09	0.12	0.13	0.14	0.16	0.18	0.20
	2	0.10	0.13	0.16	0.18	0.21	0.23	0.25	0.28
	3	0.12	0.16	0.20	0.23	0.25	0.28	0.31	0.34
EVR 4	1	0.15	0.20	0.25	0.28	0.31	0.35	**0.39**	0.43
	2	0.22	0.28	0.36	0.40	0.45	0.49	0.55	0.60
	3	0.27	0.35	0.44	0.49	0.55	0.61	0.67	0.74
EVR 6	1	0.20	0.26	0.33	0.37	0.41	0.46	**0.51**	0.56
	2	0.29	0.37	0.47	0.53	0.59	0.65	0.72	0.79
	3	0.35	0.46	0.58	0.65	0.72	0.80	0.88	0.97
EVR 8	1	0.28	0.36	0.46	0.52	0.57	0.64	**0.71**	0.78
	2	0.41	0.52	0.66	0.74	0.82	0.91	1.01	1.10
	3	0.49	0.64	0.81	0.91	1.01	1.12	1.23	1.36
EVRH 10	1	0.48	0.62	0.79	0.89	0.98	1.09	**1.20**	1.33
	2	0.68	0.88	1.12	1.25	1.39	1.54	1.70	1.87
	3	0.84	1.08	1.37	1.54	1.71	1.89	2.09	2.30
EVRH 15	1	0.66	0.85	1.09	1.21	1.35	1.50	**1.65**	1.81
	2	0.93	1.21	1.53	1.72	1.91	2.11	2.33	2.56
	3	1.14	1.48	1.88	2.10	2.33	2.59	2.85	3.14
EVRH 18	1	0.86	1.11	1.42	1.57	1.76	1.95	**2.15**	2.35
	2	1.21	1.57	1.99	2.24	2.48	2.74	3.03	3.33
	3	1.48	1.92	2.44	2.73	3.03	3.37	3.71	4.08
EVRH 20	1	1.27	1.64	2.09	2.33	2.59	2.88	**3.17**	3.49
	2	1.79	2.32	2.95	3.30	3.67	4.06	4.48	4.93
	3	2.20	2.85	3.61	4.04	4.49	4.98	5.49	6.04
EVRH 22	1	1.51	1.95	2.49	2.77	3.08	3.43	**3.77**	4.15
	2	2.13	2.76	3.51	3.93	4.37	4.83	5.33	5.87
	3	2.62	3.39	4.29	4.81	5.34	5.92	6.53	7.19

Note: Bold figures refer to rated capacity

The table values refer to evaporator capacity and are given as a function of evaporating temperature t_e and pressure drop Δp across the valve. Capacities are based on liquid temperature t_l = 100 °F ahead of the expansion valve and superheat t_s = 7°F. For each additional 10°F of superheat, the table capacities must be reduced by 2%.

Correction factors for liquid temperature t_l
When liquid temperature t_l ahead of the expansion valve is other than 100°F, adjust the table capacities by multiplying them by the appropriate correction factor found in the following table:

t_l°F	80	90	100	110	120
Factor	1.10	1.05	1.00	0.95	0.90

Capacity R410A US unit

Hot gas capacity Q$_h$ tons

type	pressure drop p [psi]	Evaporating temp. t$_e$=+40 °F. hotgas temp. t$_h$=t$_c$+40 °F. subcooling t$_u$=10 °F	
		Condensing temperature t$_c$ °F	
		+70	+100
EVR 2	2	0.19	**0.20**
	5	0.30	0.31
	10	0.42	0.44
	15	0.52	0.54
	20	0.60	0.62
	25	0.67	0.69
EVR 3	2	0.33	**0.34**
	5	0.52	0.54
	10	0.74	0.76
	15	0.90	0.94
	20	1.04	1.08
	25	1.16	1.21
EVR 4	2	0.72	**0.75**
	5	1.13	1.17
	10	1.61	1.65
	15	1.97	2.02
	20	2.27	2.33
	25	2.54	2.60
EVR 6	2	0.94	**0.98**
	5	1.49	1.55
	10	2.11	2.19
	15	2.59	2.68
	20	2.98	3.10
	25	3.34	3.46
EVR 8	2	1.31	**1.37**
	5	2.08	2.17
	10	2.95	3.06
	15	3.62	3.75
	20	4.17	4.33
	25	4.67	4.84
EVRH 10	2	2.24	**2.33**
	5	3.54	3.68
	10	5.02	5.20
	15	6.14	6.36
	20	7.08	7.36
	25	7.92	8.22
EVRH 15	2	3.07	**3.18**
	5	4.85	5.03
	10	6.86	7.11
	15	8.40	8.70
	20	9.69	10.00
	25	10.8	11.2
EVRH 18	2	3.99	**4.13**
	5	6.31	6.54
	10	8.92	9.24
	15	10.9	11.3
	20	12.6	13.0
	25	14.0	14.6
EVRH 20	2	5.90	**6.12**
	5	9.32	9.68
	10	13.2	13.7
	15	16.1	16.7
	20	18.6	19.3
	25	20.8	21.6
EVRH 22	2	7.02	**7.28**
	5	11.1	11.5
	10	15.7	16.3
	15	19.2	19.9
	20	22.1	23.0
	25	24.7	25.7

Hot gas capacity values in the table are given as a function of condensing temperature t$_c$ and pressure drop across the valve ∆p.
Capacities are based on gas superheated 40°F above condensing temperature,

$$(t_h = t_c + 40°F)$$

For each additional 10°F of superheat above 40°F, the table capacities must be reduced by 1%.
In a hot gas defrost circuit, evaporator temperature affects valve capacity.

When the evaporator temperature differs from +40°F, adjust the table capacities by multiplying them by applying a correction factor from the following table.

Correction factors for t$_h$ and t$_c$

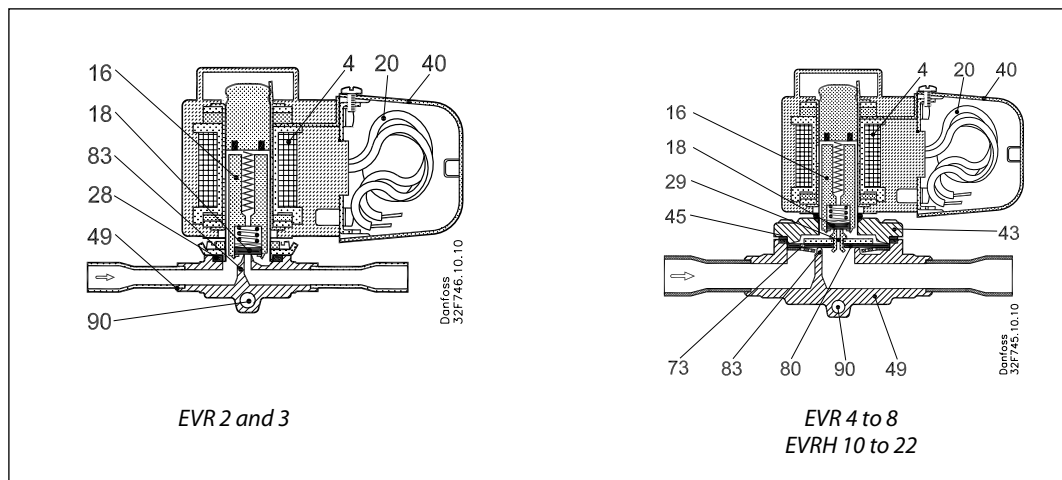| t$_i$°F	-40	-20	0	20	40	50
Factor	1.18	1.14	1.09	1.04	1	0.97

Note: The MOPD is depending on the choise of coil, please refer to page 4.

Capacity R744 (CO$_2$)

With CO$_2$ EVRH valves can only be used in subcritical applications.
For CO$_2$ capacity tables, refer to DIR-Calc, Coolselector or contact your local Danfoss office.

Design and Function

4. Coil
16. Armature
18. Valve plate/ Pilot valve plate
20. Ground terminal
28. Gasket
29. Pilot orifice
40. Protective cap, Junction box
43. Valve cover
45. Valve cover gasket
49. Valve body
73. Equalization port
80. Diaphragm and servo piston
83. Valve seat
90. Mounting hole

EVR 2 and 3

EVR 4 to 8
EVRH 10 to 22

There are two EVRH solenoid valve designs:
1. Direct operation
2. Servo operation

1. Direct operation
EVR 2 and 3 are direct operated. The valve opens for full flow when the coil is energized and the armature (16) moves up.
This means that the valve operates with a min. differential pressure of 0 psig.
The teflon valve plate (18) is fit directly onto the armature (16).
Inlet pressure acts from above on the armature and on the valve plate. Inlet pressure, spring force and the weight of armature act to close the valve when power to the coil is interrupted.
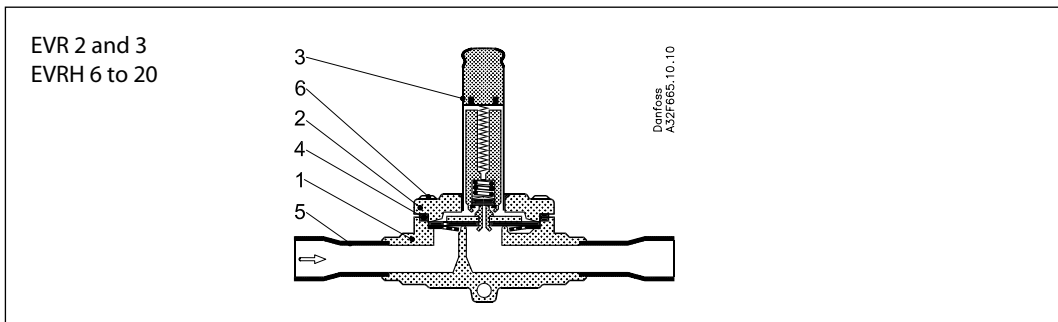
2. Servo operation
EVR 4 to 8 and EVRH 10 to 22 are servo operated and have a "floating" diaphragm (80). The stainless steel pilot orifice (29) is located in the center of the diaphragm. The teflon pilot valve plate (18) is fitted directly to the armature (16).

When there is no power to the coil for NC valves, the main orifice and the pilot orifice are held closed by the weight of the armature, the armature spring force, and the pressure differential between outlet and inlet.

When current is applied to the coil, the armature is drawn up into the magnetic field and opens the pilot orifice. This relieves the pressure above the diaphragm and the space above the diaphragm becomes open to the outlet side of the valve. The differential pressure between inlet and outlet sides then acts to move the diaphragm away from the main orifice, which opens it for full flow. A minimum differential pressure is necessary to open the valve and keep it open. For EVR 4 to 8 and EVRH 10 to 22 valves this differential pressure is 0,7 psig.
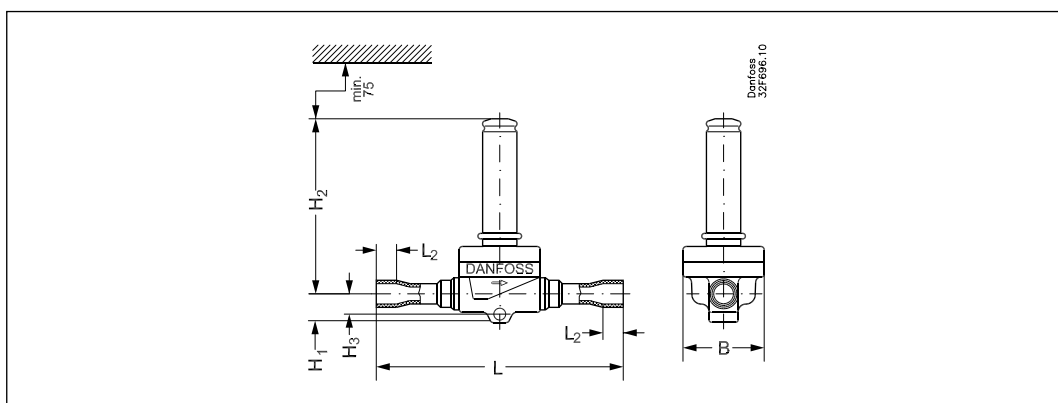
When current to the coil is interrupted, is switched off, the pilot orifice closes. The equalization ports (73) in the diaphragm allow pressure above the diaphragm to rise to the level of the inlet pressure, and the diaphragm closes the main orifice.

Material specifications

EVR 2 and 3
EVRH 6 to 20

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A32F665.10.10

No.	Description	Solenoid valve Type	Material	Analysis	Mat. no.	W. no.	DIN	EN
							Standard	
1	Valve body	EVR 2 to 8 and EVRH 10 to 22	Brass	CuZn40Pb2	CW617N	2.0402	17672-1	12165
2	Cover	EVR 2 to 8	Stainless steel	X5CrNi18-10		1.4301		10088
		EVRH 10 to 22	Brass	CuZn40Pb2	CW617N	2.0402	17672-1	12165
3	Armature tube	EVR 2 to 8 and EVRH 10 to 22	Stainless steel	X2CrNi19-11		1.4306		10088
5	Gasket	EVR 2 to 8 and EVRH 10 to 22	Rubber	Cr				
7	Solder tube	EVR 2 to 8 and EVRH 10 to 22	Copper	SF-Cu	CW024A	2.0090	1787	12449
8	Screws	EVR 2 to 8 and EVRH 10 to 22	Stainless steel	A2-70			3506	

Dimensions and weight

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32F696.10

Type	Solder connection [in.]	H1 [in.]	H2 [in.]	H3 [in.]	L [in.]	L2 [in.]	B [in.]	Weight [lbs]
EVR 2	1/4	9/16	2 1/2	5/16	4	9/32	1 5/16	
EVR 3	1/4	9/16	2 1/2	5/16	4	9/32	1 5/16	
	3/8	9/16	2 1/2	5/16	4 5/8	5/16	1 5/16	
EVR 4	3/8	9/16	2 3/4	3/8	4 1/4	5/16	1 5/16	
	1/2	9/16	2 3/4	3/8	5	3/8	1 5/16	
EVR 6	3/8	9/16	2 3/4	3/8	4 1/4	5/16	1 5/16	
	1/2	9/16	2 3/4	3/8	5	3/8	1 5/16	
	5/8	9/16	2 3/4	3/8	6	1/2	1 5/16	
EVR 8	1/2	9/16	2 3/4	3/8	5	3/8	1 5/16	
	5/8	9/16	2 3/4	3/8	6	1/2	1 5/16	
EVRH 10	1/2	5/8	3	7/16	5	3/8	1 13/16	
EVRH 15	5/8	3/4	3 1/4		6 15/16	1/2	2 3/16	
EVRH 18		3/4	3 1/4				2 3/16	
EVRH 20	7/8	25/32	3 7/16		7 1/2	5/8	2 13/16	
EVRH 22	7/8	25/32	3 7/16		7 1/2	5/8	2 13/16	