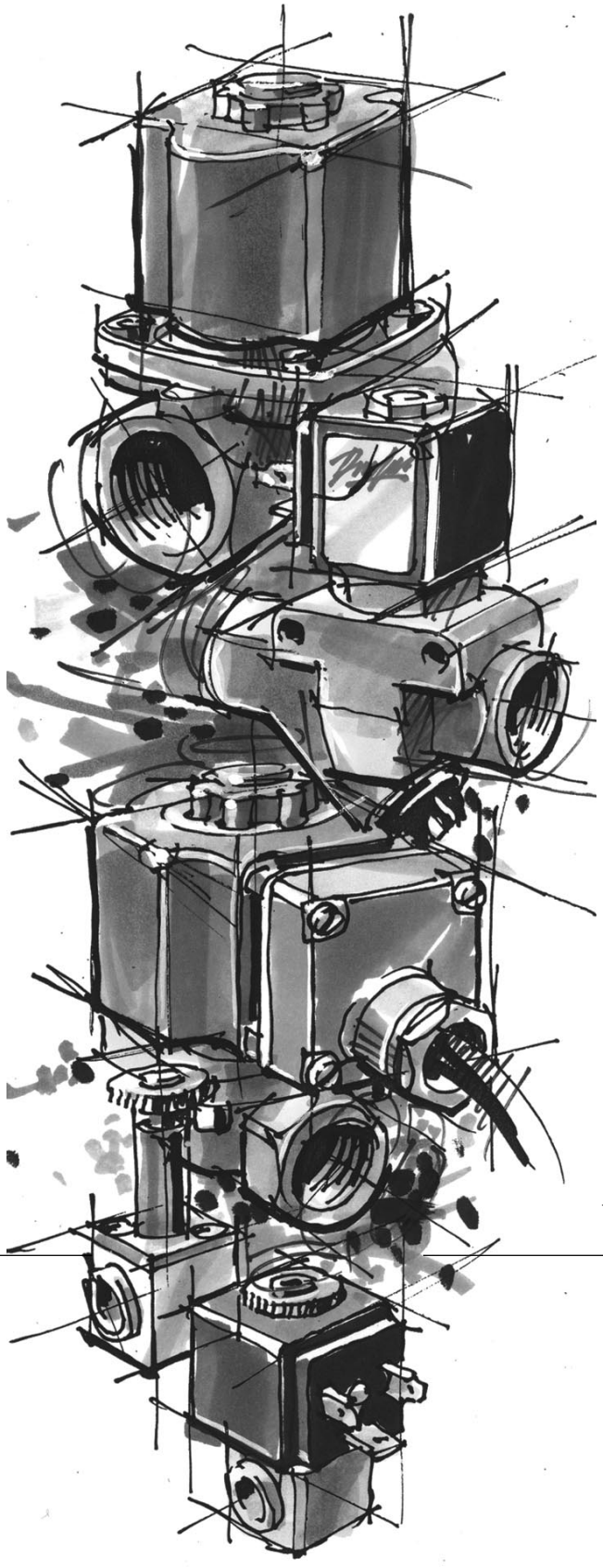
Reference



Valves for industrial purposes
Technical information

January 2000

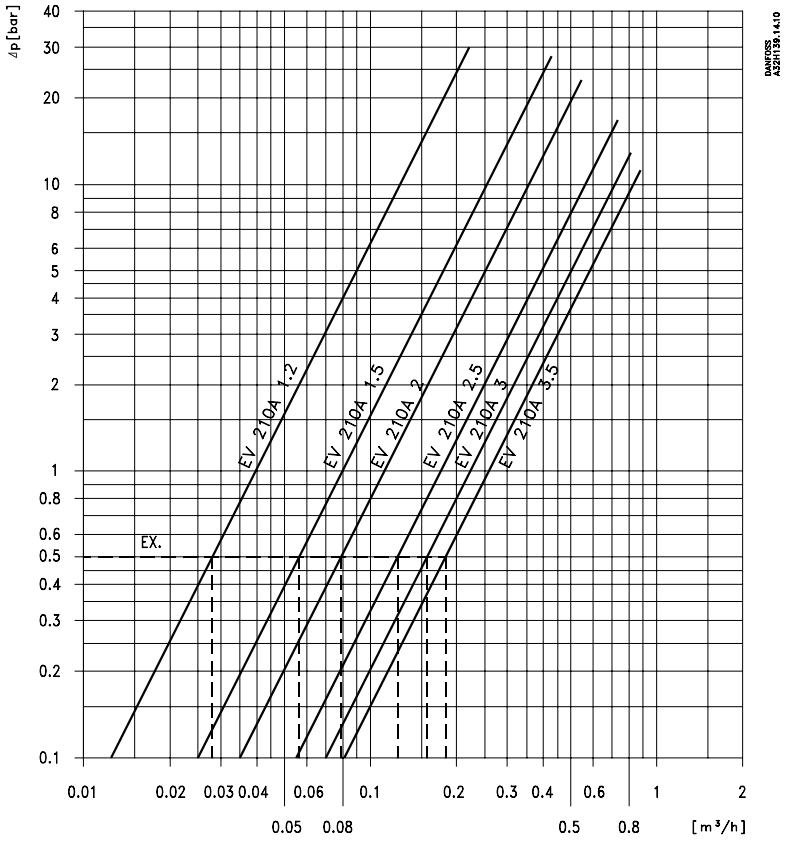
DKACV.PT.600.A1.02
520B0035

for solenoid valves
Type EV210A

Water at higher pressure

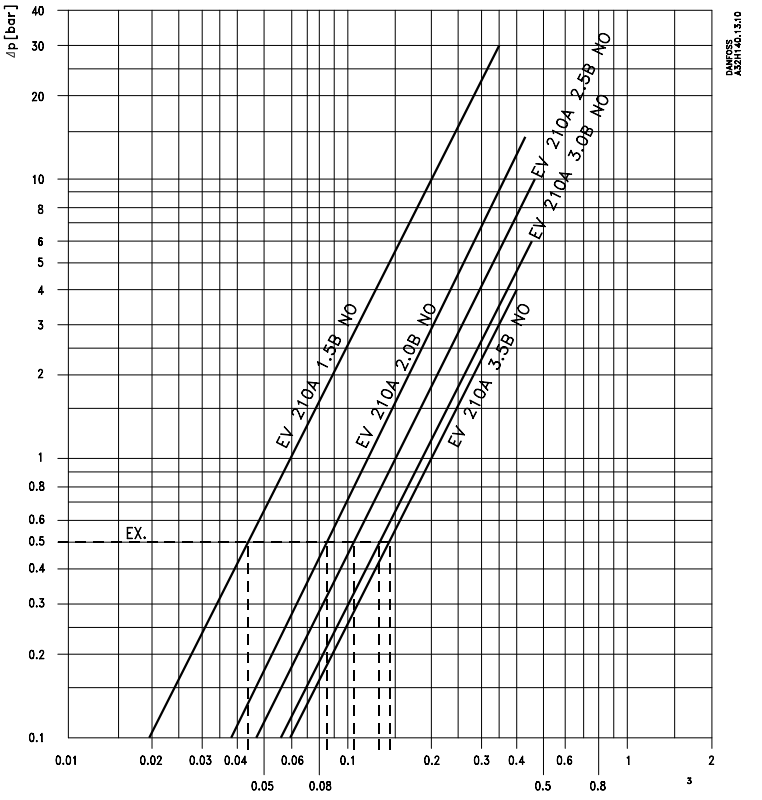
Example

Capacity for EV 210A 2.5B @ differential pressure of 0.5 bar: Approx. **0.12 m³/h**



Example

Capacity for EV 210A 2.5B NO @ differential pressure of 0.5 bar: Approx. **0.11 m³/h**

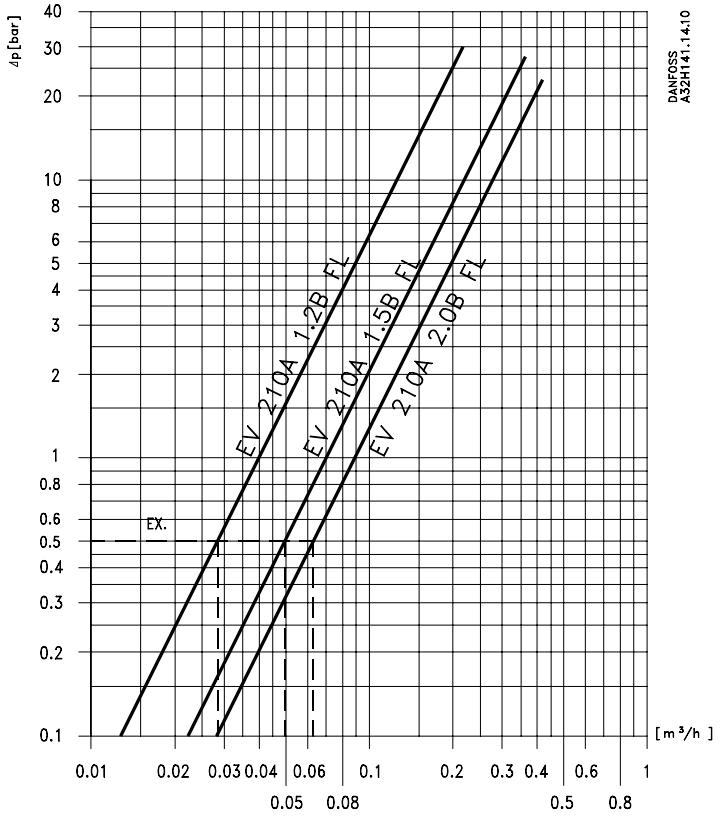


for solenoid valves
Type EV210A

Water at higher pressure

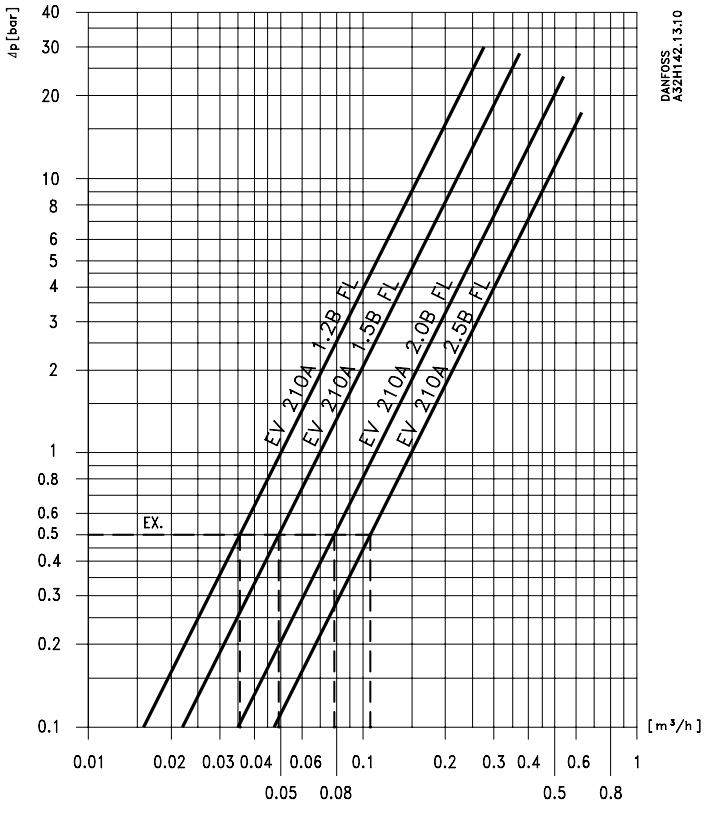
Example

Capacity for EV 210A 1.5B FL 22x22 @ differential pressure of 0.5 bar: Approx. **0.05 m³/h**



Example

Capacity for EV 210A 1.5B FL @ differential pressure of 0.5 bar: Approx. **0.049 m³/h**

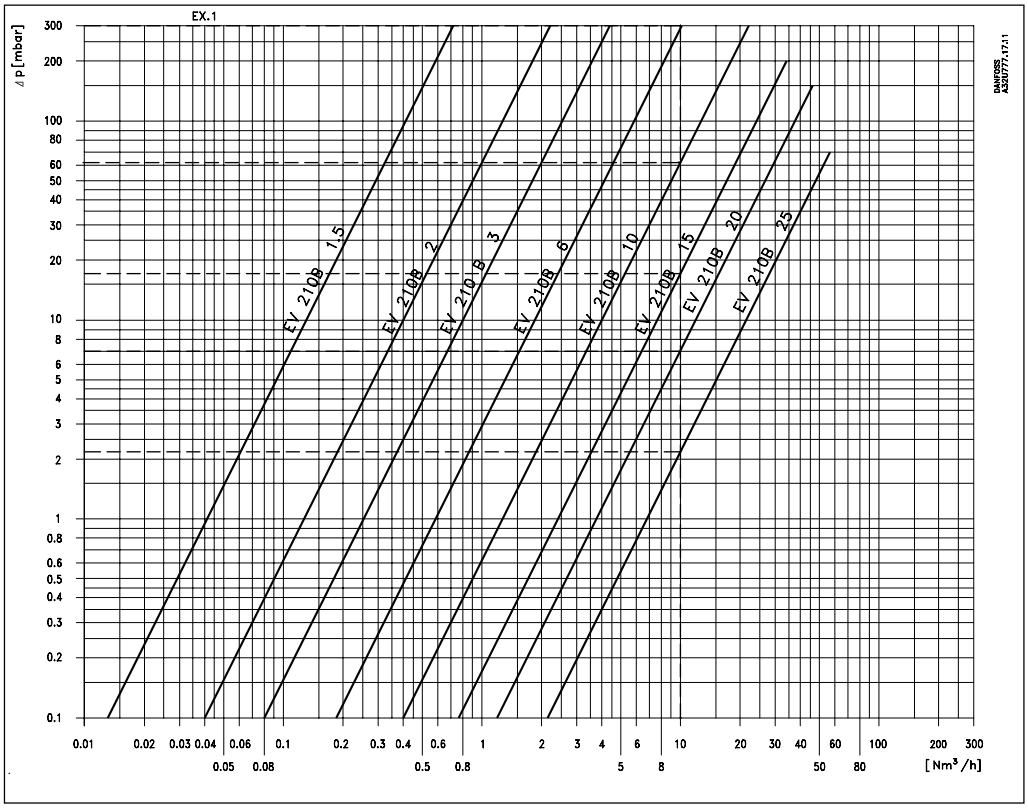


for solenoid valves
Type EV210B

Air at low pressure

Example

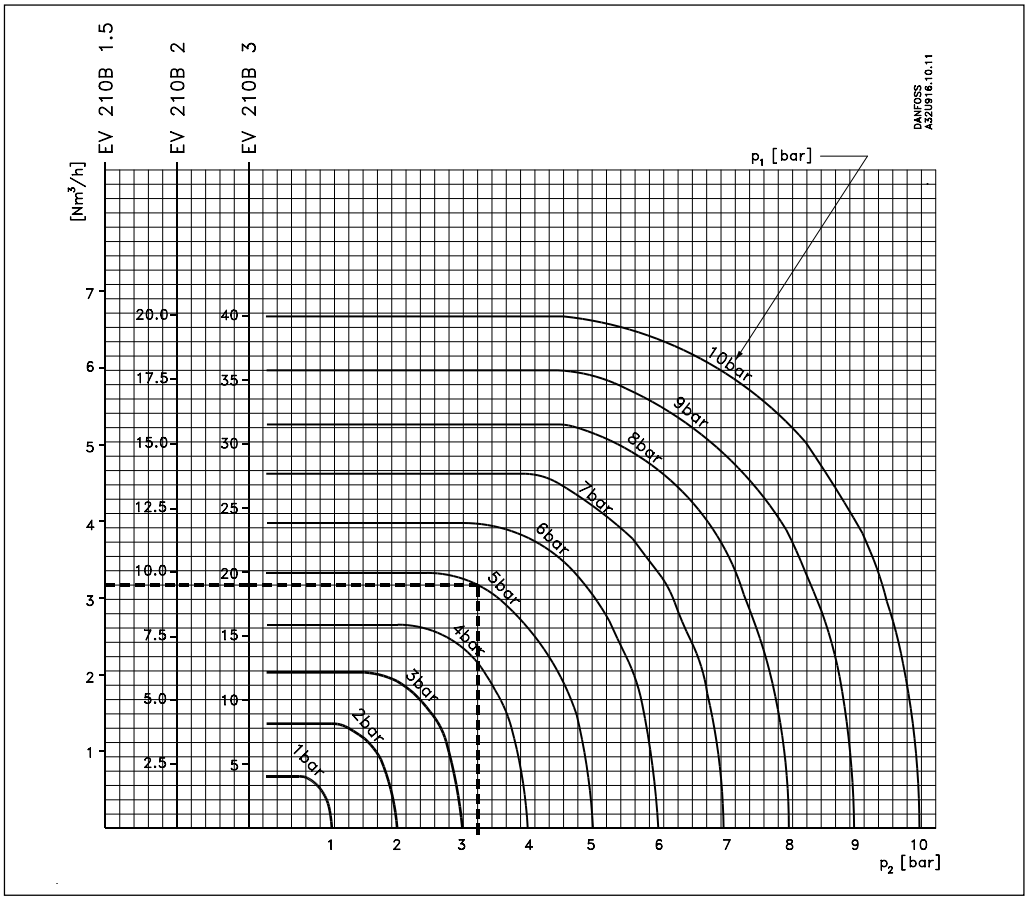
Capacity for
EV 210B 15B @ differential
pressure of 17 mbar:
Approx. **10 Nm³/h**



Air at higher pressure

Example

Capacity for EV 210B 2B @
inlet pressure (p_1) of 5 bar
and outlet pressure (p_2) of
3.25 bar:
Approx. **9 Nm³/h**

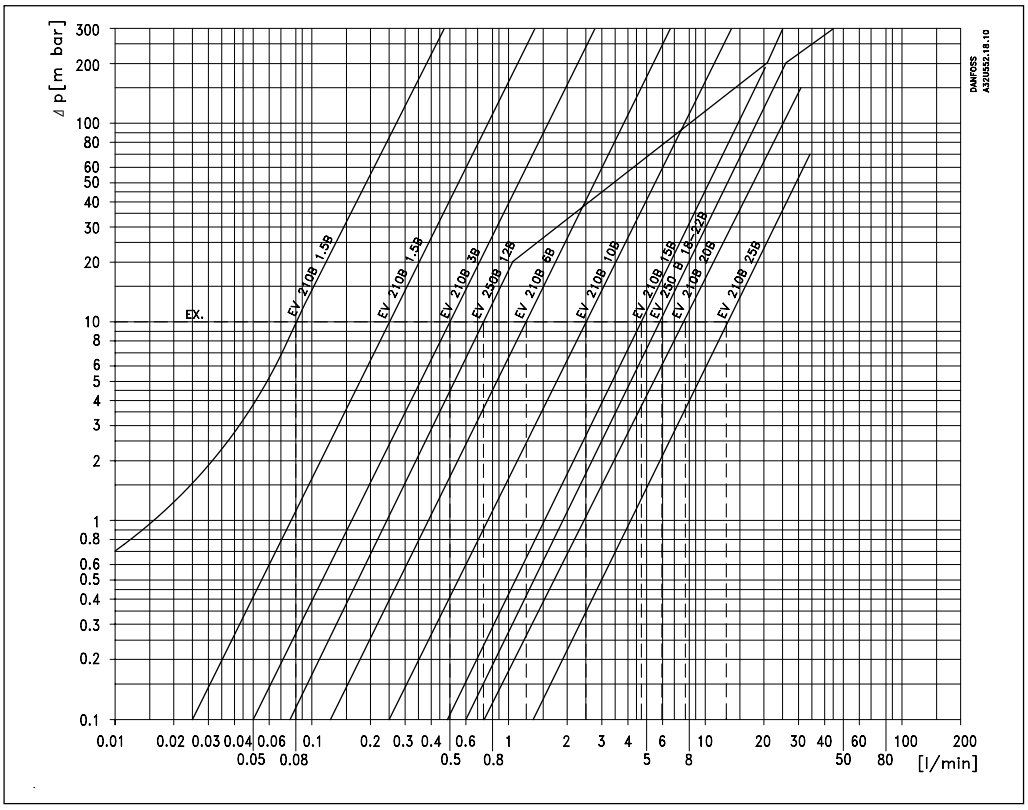


for solenoid valves
Types EV210B and EV250B

Water at low pressure

Example

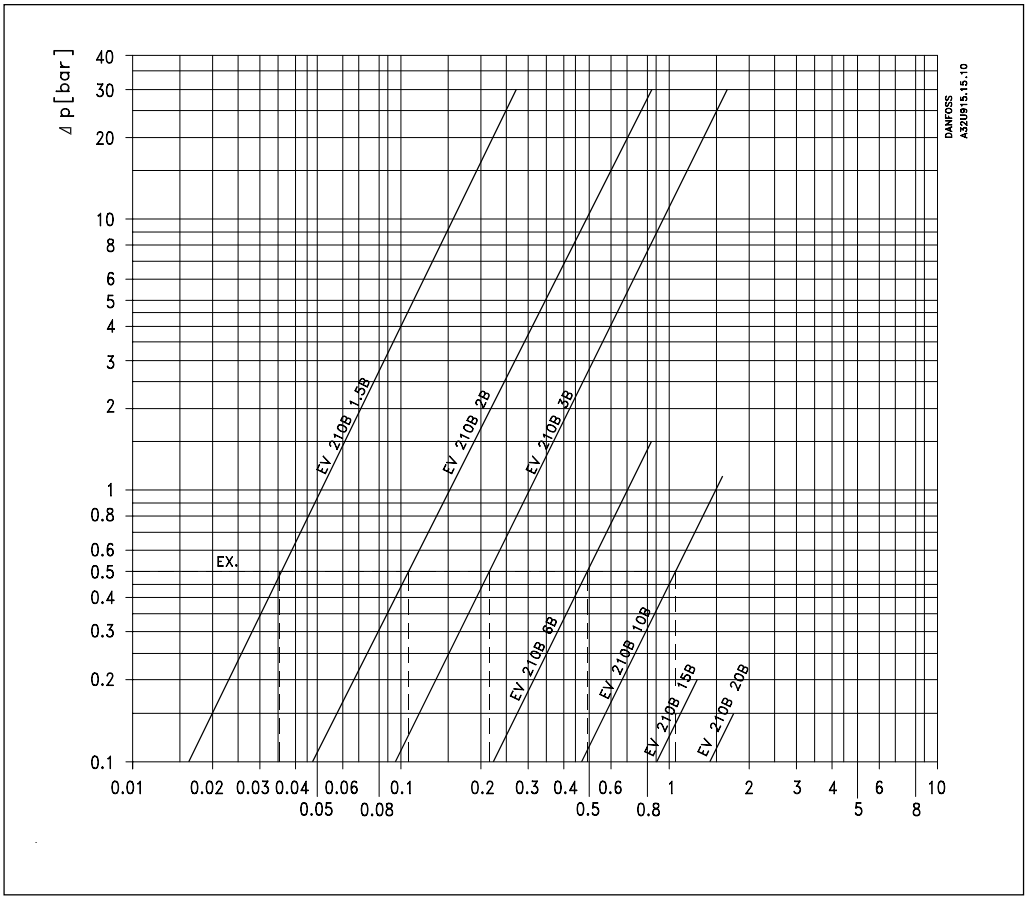
Capacity for EV 210B 1.5B @ differential pressure of 10 mbar:
Approx. **0.08 l/min.**



Water at higher pressure

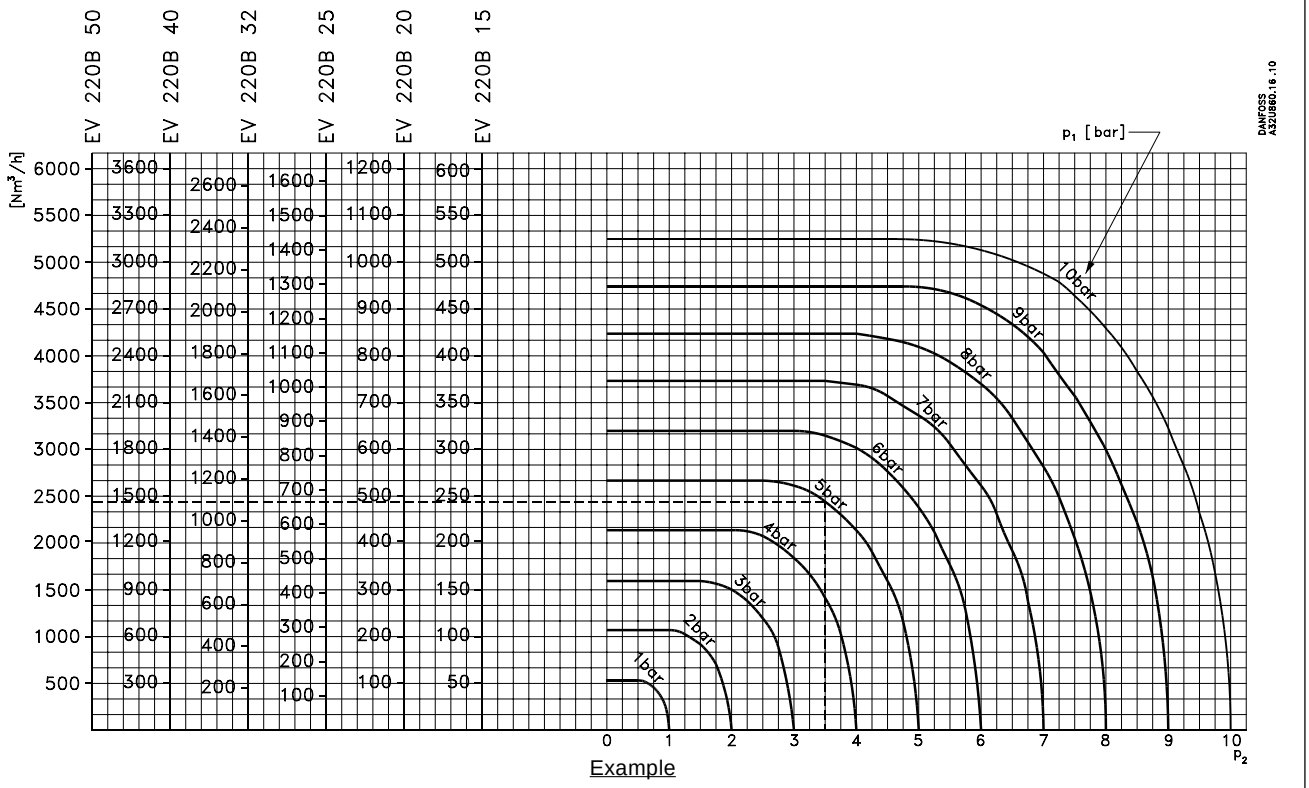
Example

Capacity for EV 210B 3B @ differential pressure of 0.5 bar:
Approx. **0.21 m³/h**



for solenoid valves
Type EV220B

Air at higher pressure



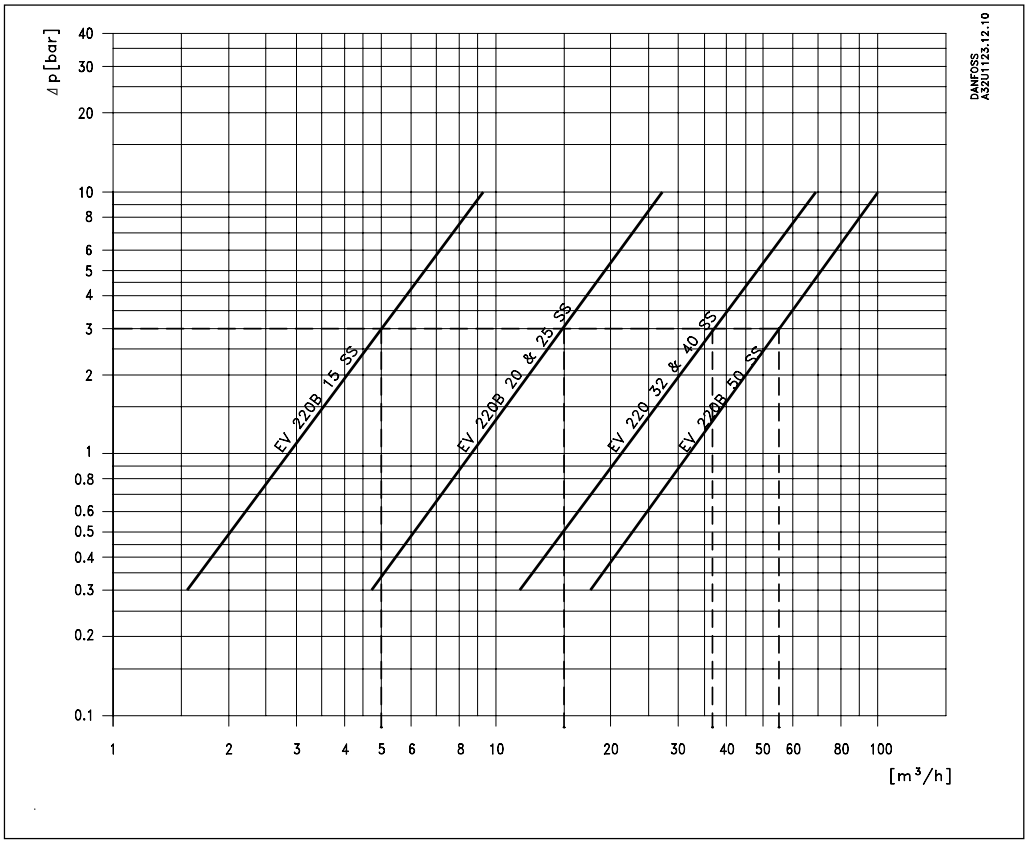
Example

Capacity for EV 220B 15B @ inlet pressure (p_1) of 5 bar and outlet pressure (p_2) of 3.5 bar:
Approx. **245 Nm³/h**

Water at higher pressure

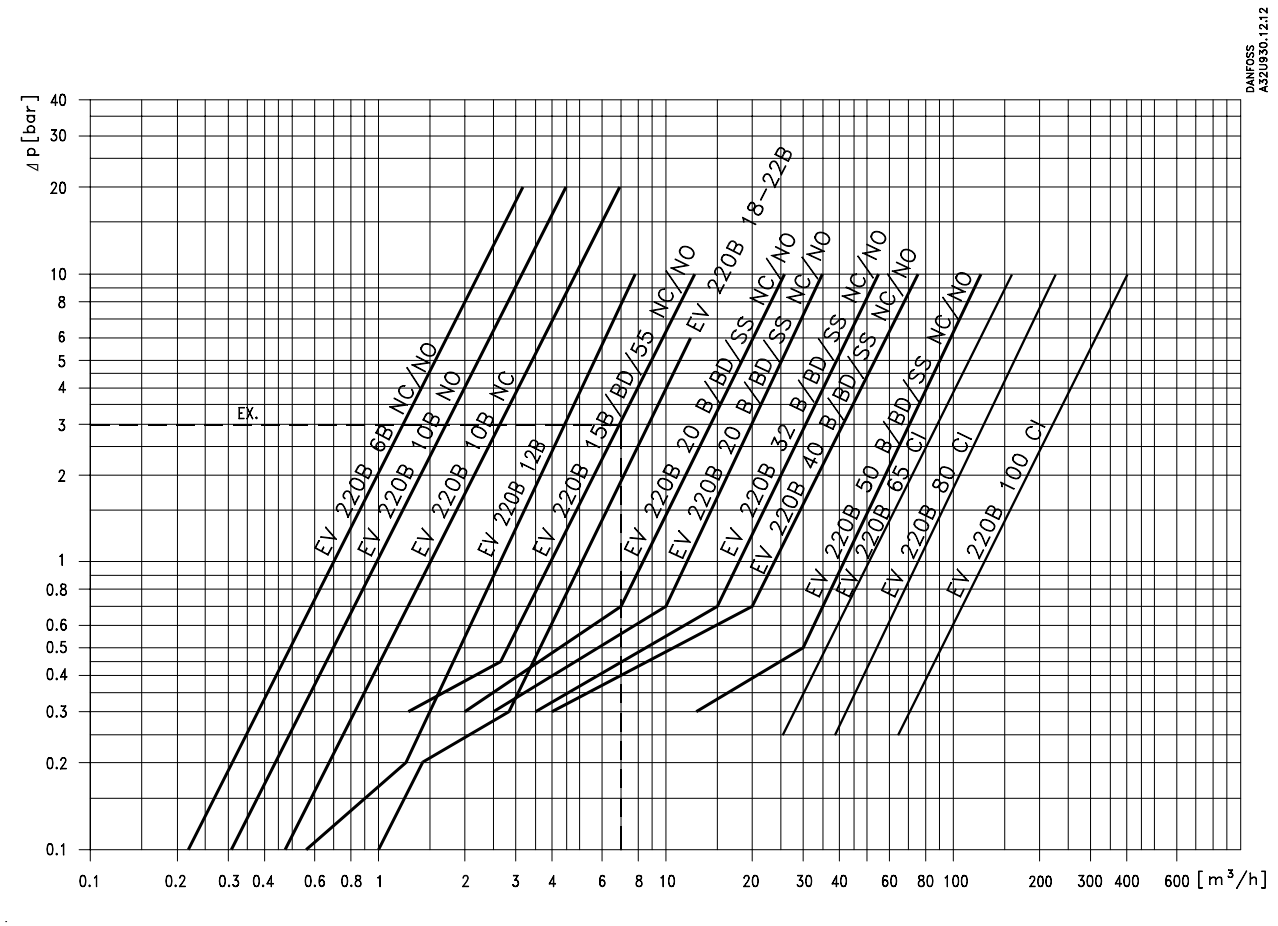
Example

Capacity for EV 220B 20B @ differential pressure of 3 bar:
Approx. **15 m³/h.**



for solenoid valves
Types EV220B and EV250B

Water at higher pressure

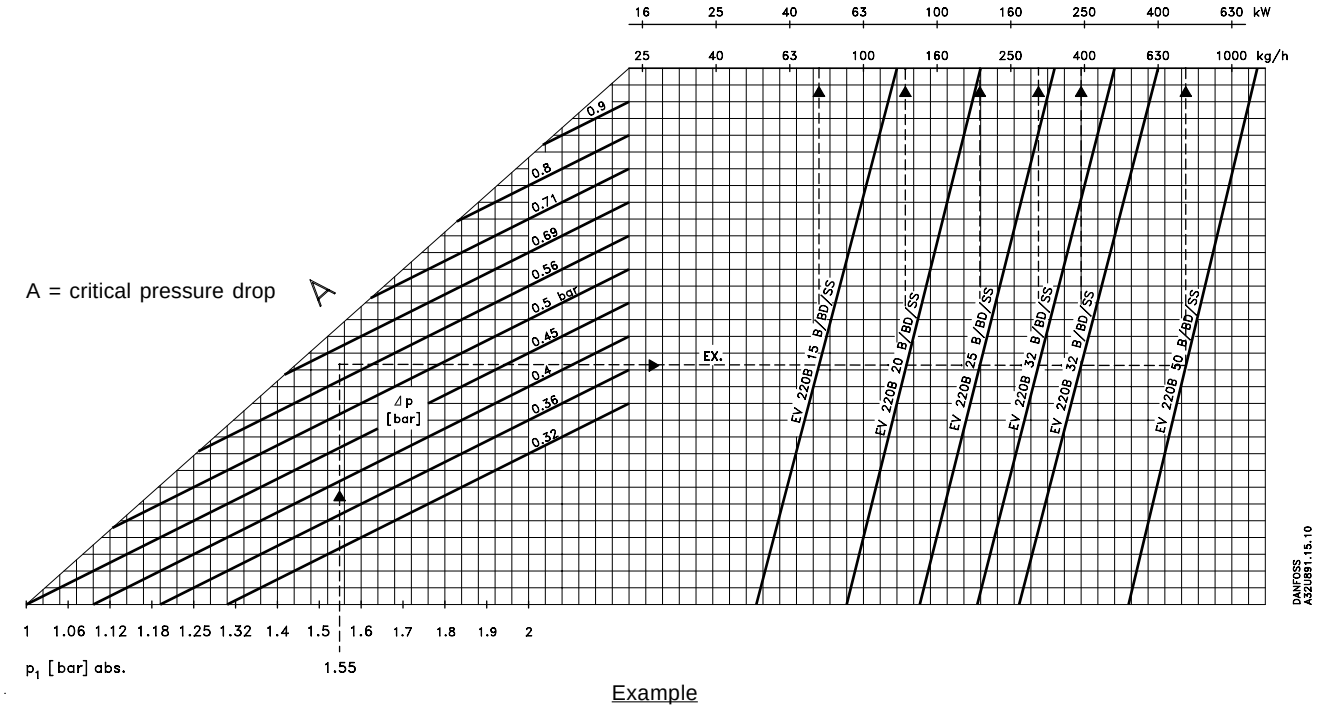


Example

Capacity for EV 220B 15B @ differential pressure of 3 bar: Approx. **7 m³/h.**

for solenoid valves
Types EV220B and EV225B

Steam



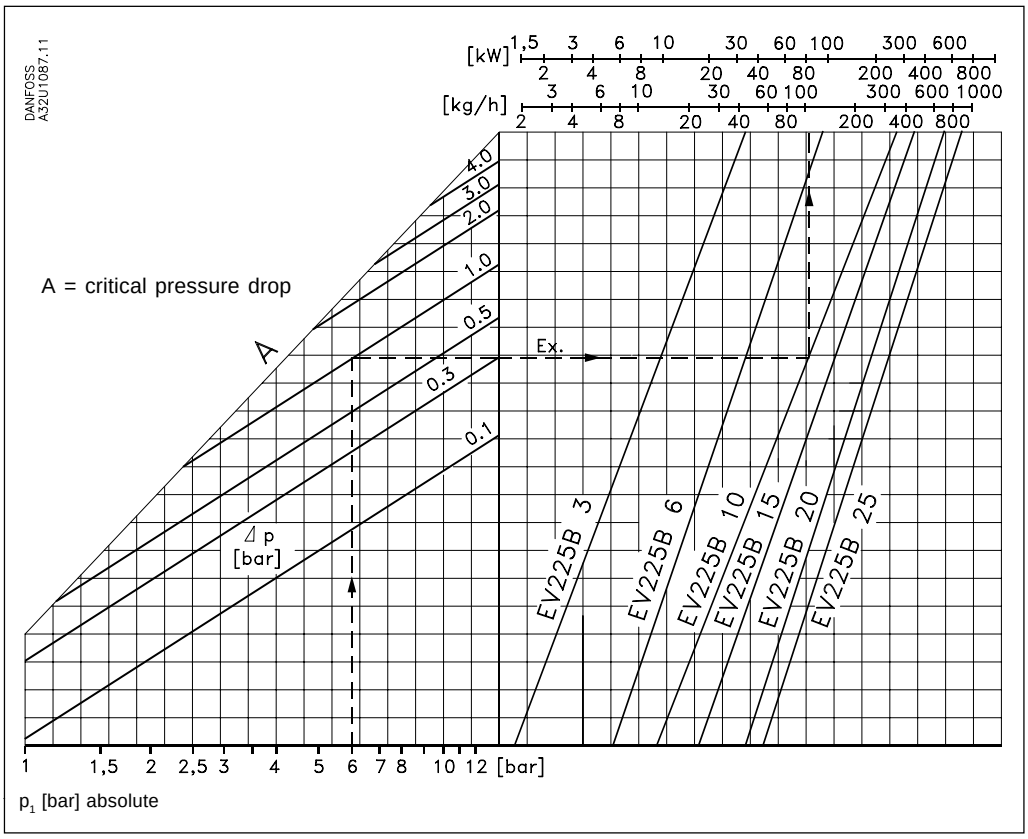
Example

Capacity for EV 225B 10 BD @ inlet pressure [p_1] of 1.55 bar absolute; differential pressure af 0.6 bar:
Approx. **300 kg/h / 200 kW**

Steam

Example

Capacity for EV 225B 10 BD @ inlet pressure [p_1] of 6 bar absolute;
differential pressure af 1 bar:
Approx. **100 kg/h / 80 kW**

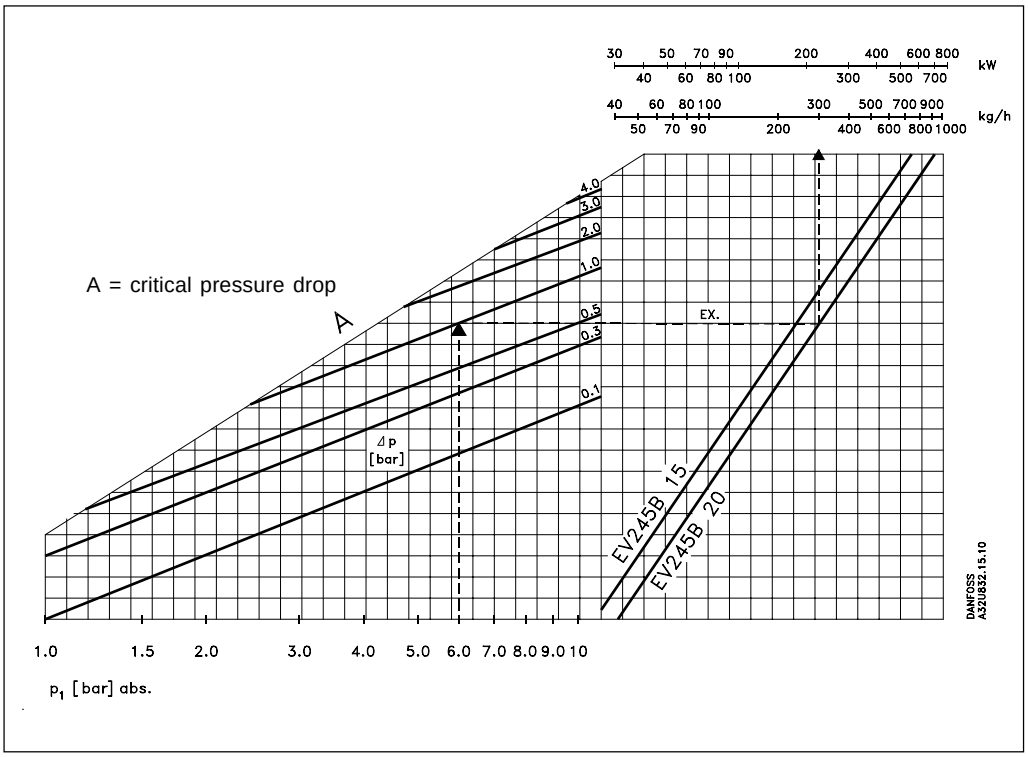


for solenoid valves
Types EV245B and EV260B

Steam

Example

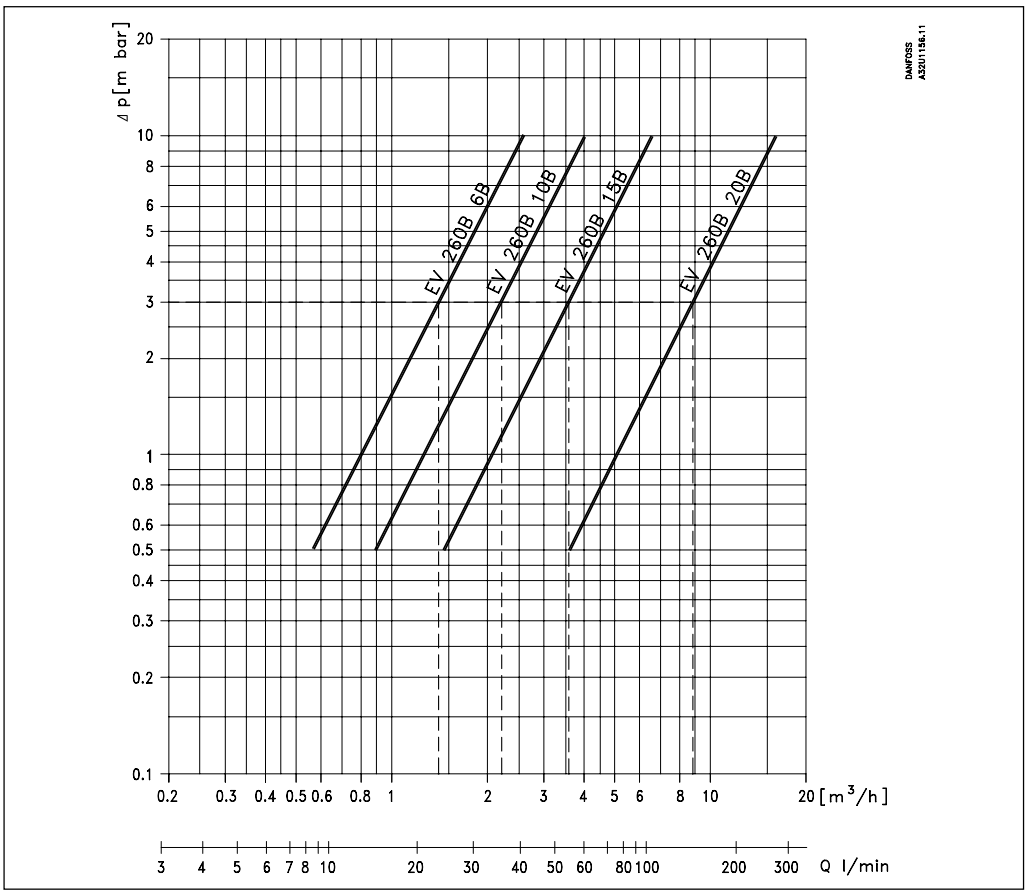
Capacity for EV 245B 20 B @ inlet pressure [p_1] of 6 bar absolute;
differential pressure af 1 bar:
Approx. **300 kg/h.**



Water at fully opened valve

Example

Capacity for EV 260B 10B @ differential pressure of 3 bar:
Approx. **2.2 m³/h**



Calculation of flow quantities

		Calculaton of k_v value k_v [m³/h]	Calculaton of flow quantity Q [m³/h] G [kg/h]	Calculaton of pressure drop Dp [bar]
Liquids		$k_v = Q \times \sqrt{\frac{\rho}{\Delta p}}$	$Q = k_v \times \sqrt{\frac{\Delta p}{\rho}}$	$\Delta p = \rho \times \left(\frac{Q}{k_v}\right)^2$
Gases	$p_2 \rangle \frac{p_1}{2}$ $\Delta p \langle \frac{p_1}{2}$	$k_v = \frac{Q_n}{514} \times \sqrt{\frac{\rho_n \times T_1}{\Delta p \times p_2}}$	$Q_n = 514 \times k_v \times \sqrt{\frac{\Delta p \times p_2}{\rho_n \times T_1}}$	$\Delta p = \frac{\rho_n \times T_1 \times Q_n^2}{p_2 \times (k_v \times 514)^2}$
	$p_2 \langle \frac{p_1}{2}$ $\Delta p \rangle \frac{p_1}{2}$	$k_v = \frac{Q_n}{257 \times p_1} \times \sqrt{\rho_n \times T_1}$	$Q_n = 257 \times k_v \times p_1 \times \frac{1}{\sqrt{\rho_n \times T_1}}$	
Steam	$p_2 \rangle \frac{p_1}{2}$ $\Delta p \langle \frac{p_1}{2}$	$k_v = \frac{G}{31.6} \times \sqrt{\frac{v_2}{\Delta p}}$	$G = 31.6 \times k_v \times \sqrt{\frac{\Delta p}{v_2}}$	$\Delta p = \left(\frac{G}{k_v}\right)^2 \times \frac{v_2}{1000}$
	$p_2 \langle \frac{p_1}{2}$ $\Delta p \rangle \frac{p_1}{2}$	$k_v = \frac{G}{31.6} \times \sqrt{\frac{2 \times v^*}{p_1}}$	$G = 31.6 \times k_v \times \sqrt{\frac{\Delta p}{2 \times v^*}}$	
Water +5 to +30°C $\rho \approx 1$ kg/m³		$k_v = \frac{Q}{\sqrt{\Delta p}}$	$Q = k_v \times \sqrt{\Delta p}$	$\Delta p = \left(\frac{Q}{k_v}\right)^2$
Air +20°C $\rho \approx 1$ kg/m³	$p_2 \rangle \frac{p_1}{2}$ $\Delta p \langle \frac{p_1}{2}$	$k_v = \frac{Q_n}{\sqrt{\Delta p \times p_2} \times 26.4}$	$Q_n = 26.4 \times k_v \times \sqrt{\Delta p \times p_2}$	$\Delta p = \left(\frac{Q}{k_v}\right)^2 \times \frac{1}{p_2 \times 699}$
	$p_2 \langle \frac{p_1}{2}$ $\Delta p \rangle \frac{p_1}{2}$	$k_v = \frac{Q_n}{p_1 \times 13.2}$	$Q_n = k_v \times p_1 \times 13.2$	

k_v	m³/h	Valve capacity
Q	m³/h	Volume flow
Q_n	m^3_n/h	Volume flow (0°C, 760 mm Hg)
p_1	bar (abs)	Pressure before valve
p_2	bar (abs)	Pressure after valve
Δp	bar	Pressure drop across valve
G	kg/h	Mass flow
ρ	kg/dm³	Density of medium
ρ_n	kg/m^3_n	Normal density (0°C, 760 mm Hg)
t_1	°C	Temperature of medium supplied to valve
T_1	K	273 + t_1 = absolute temperature of medium supplied to valve
v_2	m³/kg	Specific volume (from steam table) at condition P_2 and t_1
v*	m³/kg	Specific volume (from steam table) at condition $\frac{p_1}{2}$ and t_1

Temperature conversion tables

°C	K	°F
–50	223	–58.0
–49	224	–56.2
–48	225	–54.4
–47	226	–52.6
–46	227	–50.8
–45	228	–49.0
–44	229	–47.2
–43	230	–45.4
–42	231	–43.6
–41	232	–41.8
–40	233	–40.0
–39	234	–38.2
–38	235	–36.4
–37	236	–34.6
–36	237	–32.8
–35	238	–31.0
–34	239	–29.2
–33	240	–27.4
–32	241	–25.6
–31	242	–23.8
–30	243	–22.0
–29	244	–20.2
–28	245	–18.4
–27	246	–16.6
–26	247	–14.8
–25	248	–13.0
–24	249	–11.2
–23	250	–9.4
–22	251	–7.6
–21	252	–5.8
–20	253	–4.0
–19	254	–2.2
–18	255	–0.4
–17	256	1.4
–16	257	3.2
–15	258	5.0
–14	259	6.8
–13	260	8.6
–12	261	10.4
–11	262	12.2
–10	263	14.0
–9	264	15.8
–8	265	17.6
–7	266	19.4
–6	267	21.2
–5	268	23.0
–4	269	24.8
–3	270	26.6
–2	271	28.4
–1	272	30.2
0	273	32.0

°C	K	°F
1	274	33.8
2	275	35.6
3	276	37.4
4	277	39.2
5	278	41.0
6	279	42.8
7	280	44.6
8	281	46.4
9	282	48.2
10	283	50.0
11	284	51.8
12	285	53.6
13	286	55.4
14	287	57.2
15	288	59.0
16	289	60.8
17	290	62.6
18	291	64.4
19	292	66.2
20	293	68.0
21	294	69.8
22	295	71.6
23	296	73.4
24	297	75.2
25	298	77.0
26	299	78.2
27	300	80.6
28	301	82.4
29	302	84.2
30	303	86.0
31	304	87.8
32	305	89.6
33	306	91.4
34	307	93.2
35	308	95.0
36	309	96.8
37	310	98.6
38	311	100.4
39	312	102.2
40	313	104.0
41	314	105.8
42	315	107.6
43	316	109.4
44	317	111.2
45	318	113.0
46	319	114.8
47	320	116.6
48	321	118.4
49	322	120.2
50	323	122.0

°C	K	°F
51	324	123.8
52	325	125.6
53	326	127.4
54	327	129.2
55	328	131.9
56	329	132.8
57	330	134.6
58	331	136.4
59	332	138.2
60	333	140.0
61	334	141.8
62	335	143.6
63	336	145.4
64	337	147.2
65	338	149.0
66	339	150.8
67	340	152.6
68	341	154.4
69	342	156.2
70	343	158.0
71	344	159.8
72	345	161.6
73	346	163.4
74	347	165.2
75	348	167.0
76	349	168.8
77	350	170.6
78	351	172.4
79	352	174.2
80	353	176.0
81	354	177.8
82	355	179.6
83	356	181.4
84	357	183.2
85	358	185.0
86	359	186.8
87	360	188.6
88	361	190.4
89	362	192.2
90	363	194.0
91	364	195.8
92	365	197.6
93	366	199.4
94	367	201.2
95	368	203.0
96	369	204.8
97	370	206.6
98	371	208.4
99	372	210.2
100	373	212.0

°C	K	°F
105	378	221.0
110	383	230.0
115	388	239.0
120	393	248.0
125	398	257.0
130	403	266.0
135	408	275.0
140	413	284.0
145	418	293.0
150	423	303.0
155	428	311.0
160	433	320.0
165	438	329.0
170	443	338.0
175	448	347.0
180	453	356.0
185	458	365.0
190	463	374.0
195	468	383.0
200	473	392.0
205	478	401.0
210	483	410.0
215	488	419.0
220	493	428.0
225	498	437.0
230	503	446.0
235	508	455.0
240	513	464.0
245	518	473.0
250	523	482.0
255	528	491.0
260	533	500.0
265	538	509.0
270	543	518.0
275	548	527.0
280	553	536.0
285	558	545.0
290	563	554.0
295	568	563.0
300	573	572.0
310	583	590.0
320	593	608.0
330	603	626.0
340	613	644.0
350	623	662.0
360	633	680.0
370	643	698.0
380	653	716.0
390	663	734.0
400	673	752.0

$K = °C + 273$

$°F = (°C \times {}^{9}/_{5}) + 32$

$°C = (°F - 32) \times {}^{5}/_{9}$

Pressure conversion tables

bar	N/cm²	MPa	Psi
0.1	1	0.01	1.422
0.2	2	0.02	2.844
0.3	3	0.03	4.266
0.4	4	0.04	5.688
0.5	5	0.05	7.110
0.6	6	0.06	8.532
0.7	7	0.07	9.954
0.8	8	0.08	11.378
0.9	9	0.09	12.798
1.0	10	0.10	14.220
1.5	15	0.15	21.330
2.0	20	0.20	28.440
2.5	25	0.25	35.550
3.0	30	0.30	42.660
3.5	35	0.35	49.770
4.0	40	0.40	56.880
4.5	45	0.45	63.990
5.0	50	0.50	71.100
5.5	55	0.55	78.210
6.0	60	0.60	85.320
6.5	65	0.65	92.430
7.0	70	0.70	91.540
7.5	75	0.75	106.650
8.0	80	0.80	113.760
8.5	85	0.85	120.870
9.0	90	0.90	127.980
9.5	95	0.95	135.090
10.0	100	1.00	142.200
11.0	110	1.10	156.420
12.0	120	1.20	170.640
13.0	130	1.30	184.860

bar	N/cm²	MPa	Psi
14	140	1.4	199.08
15	150	1.5	213.30
16	160	1.6	227.52
17	170	1.7	241.74
18	180	1.8	255.96
19	190	1.9	270.18
20	200	2.0	284.40
21	210	2.1	298.62
22	220	2.2	312.64
23	230	2.3	327.06
24	240	2.4	341.28
25	250	2.5	355.50
26	260	2.6	369.72
27	270	2.7	383.94
28	280	2.8	398.16
29	290	2.9	412.38
30	300	3.0	426.60
35	350	3.5	497.70
40	400	4.0	568.80
45	450	4.5	639.90
50	500	5.0	711.00
55	550	5.5	782.10
60	600	6.0	853.20
65	650	6.5	924.30
70	700	7.0	995.40
75	750	7.5	1066.50
80	800	8.0	1137.60
85	850	8.5	1208.70
90	900	9.0	1279.80
95	950	9.5	1350.90
100	1000	10.0	1422.00

1 kg/cm² = 0.981 bar 1 bar 10 N/cm² 1 bar = 0.1 MPa 1 bar 14.22 psi

Capacity conversion tables

l/min	m³/h	l/min	m³/h	l/min	m³/h	l/min	m³/h	l/min	m³/h
0.1	0.006	18	1.080	48	2.881	190	11.404	380	22.809
0.2	0.012	19	1.140	49	2.941	195	11.704	390	23.409
0.3	0.018	20	1.200	50	3.001	200	12.004	400	24.009
0.4	0.024	21	1.260	55	3.301	205	12.304	410	24.609
0.5	0.030	22	1.320	60	3.601	210	12.604	420	25.210
0.6	0.036	23	1.380	65	3.901	215	12.905	430	25.810
0.7	0.042	24	1.440	70	4.201	220	13.205	440	26.410
0.8	0.048	25	1.500	75	4.501	225	13.505	450	27.010
0.9	0.054	26	1.560	80	4.801	230	13.805	460	27.611
1.0	0.060	27	1.620	85	5.102	235	14.105	470	28.211
1.5	0.090	28	1.680	90	5.402	240	14.405	480	28.811
2.0	0.120	29	1.740	95	5.702	245	14.705	490	29.411
2.5	0.150	30	1.800	100	6.002	250	15.006	500	30.012
3.0	0.180	31	1.860	105	6.302	255	15.306	510	30.612
3.5	0.210	32	1.920	110	6.602	260	15.606	520	31.212
4.0	0.240	33	1.980	115	6.902	265	15.906	530	31.812
4.5	0.270	34	2.040	120	7.202	270	16.206	540	32.413
5.0	0.300	35	2.100	125	7.503	275	16.506	550	33.013
6.0	0.360	36	2.160	130	7.803	280	16.806	560	33.613
7.0	0.420	37	2.220	135	8.103	285	17.106	570	34.213
8.0	0.480	38	2.280	140	8.403	290	17.407	580	34.813
9.0	0.540	39	2.340	145	8.703	295	17.707	590	35.414
10	0.600	40	2.410	150	9.002	300	18.007	600	36.014
11	0.660	41	2.461	155	9.303	310	18.607	650	39.015
12	0.720	42	2.521	160	9.603	320	19.207	700	40.016
13	0.780	43	2.581	165	9.904	330	19.807	750	45.018
14	0.840	44	2.641	170	10.204	340	20.408	800	48.019
15	0.900	45	2.701	175	10.504	350	21.008	850	51.020
16	0.960	46	2.761	180	10.804	360	21.608	900	54.021
17	1.020	47	2.821	185	11.104	370	22.208	1000	60.024

m³/h = l/min × 0.06 l/min × 16.67

Viscosity conversion table

Centistokes cSt [mm²/S]	°Engler [°E]	Saybolt Universal Secondo [SSU]	Redwood Seconds n. 1 [SRW n. 1]
1	1	-	-
12	2	65	55
22	3	100	90
30	4	140	120
38	5	175	155
45	6	210	185
60	8	275	245
75	10	345	305
90	12	415	370
115	15	525	465
150	20	685	610
200	26	910	810
300	39	1385	1215
400	53	1820	1620
500	66	2275	2025
750	97	3365	2995
1500	197	6820	6075

Steam tables

Overpressure (P_e)		Absolute pressure(P)		Temperature (t_s)
[bar]	[kPa]	[bar]	[kPa]	[°C]
		0.01	1	7.0
		0.05	5	32.9
		0.1	10	45.8
		0.2	20	60.1
		0.3	30	69.1
		0.4	40	75.9
		0.5	50	81.3
		0.6	60	86.0
		0.7	70	90.0
		0.8	80	93.5
		0.9	90	96.7
0.0	0	1.0	100	99.6
0.1	10	1.1	110	102.3
0.2	20	1.2	120	104.8
0.3	30	1.3	130	107.1
0.4	40	1.4	140	109.3
0.5	50	1.5	150	111.4
0.6	60	1.6	160	113.3
0.7	70	1.7	170	115.2
0.8	80	1.8	180	116.9
0.9	90	1.9	190	118.6
1.0	100	2.0	200	120.2
1.5	150	2.5	250	127.4
2.0	200	3.0	300	133.5
2.5	250	3.5	350	138.9
3.0	300	4.0	400	143.6
3.5	350	4.5	450	147.9
4.0	400	5.0	500	151.8
4.5	450	5.5	550	155.5
5.0	500	6.0	600	158.8

Overpressure (P_e)		Absolute pressure(P)		Temperature (t_s)
[bar]	[kPa]	[bar]	[kPa]	[°C]
6	600	7	700	165.0
7	700	8	800	170.4
8	800	9	900	175.4
9	900	10	1000	179.9
10	1000	11	1100	184.1
11	1100	12	1200	188.0
12	1200	13	1300	191.6
13	1300	14	1400	195.0
14	1400	15	1500	198.3
15	1500	16	1600	201.4
16	1600	17	1700	204.3
17	1700	18	1800	207.1
18	1800	19	1900	209.8
19	1900	20	2000	212.4
20	2000	21	2100	214.9
24	2400	25	2500	223.9
25	2500	26	2600	226.0
29	2900	30	3000	233.8
30	3000	31	3100	235.7
39	3900	40	4000	250.3
40	4000	41	4100	251.8
49	4900	50	5000	263.9
59	5900	60	6000	275.6
69	6900	70	7000	285.8
79	7900	80	8000	295.0
89	8900	90	9000	303.3
99	9900	100	10000	311.0
149	14900	150	15000	342.1
199	19900	200	20000	365.7
220.2	22020	221.2	22120	374.15

for solenoid valves

Water approvals for de-energized closed (NC) valves

Denmark - VA:
EV210B 1.5
EV220B 6, 10, 12, 15, 18, 20

Switzerland - SVGW:
EV220B 6, 10, 12, 15, 18, 20, 25, 32, 40, 50

United Kingdom - WRc:
EV210B 1.5, 2, 3
EV220B 6, 10, 12, 15, 18, 20, 25, 32, 40, 50
EV250B 12, 18, 22
WRc approval for valve types EV210A, EV310A and EV220A 11B pending.

Electrical approvals

[1]) With a special 9.5 W ac High Performance coil
[2]) The approval applies only to de-energized closed (NC) valves.

Canada and USA - UR/CSA: [2])
EVI 1.5 U, 2 U, 3 U
EVSI 6 U, 10 U, 12 U, 15 U, 18 U, 20 U 22 U,
EVSI 25 U, 32 U, 40 U, 50 U
EVSI 12, 18, 22

Valve range with UL-approval (listed) available. Please contact Danfoss for literature no. DKACV.PD.300.B and North American catalogue.

Denmark - DEMKO: [2])
Compact coils in Ex version EEx m II T4 are approved for application in zone 1 areas in accordance with EN 50014 including AMD 1-5 and EN 50028.

Ship approvals

Norway - DnV:
EV210B 1.5 , 2, 3, 6, 10
EV220B 6, 10, 12, 15, 18, 20
EV220B 25, 32, 40, 50
EV250B 12, 18, 22 with 10 W ac Compact coil

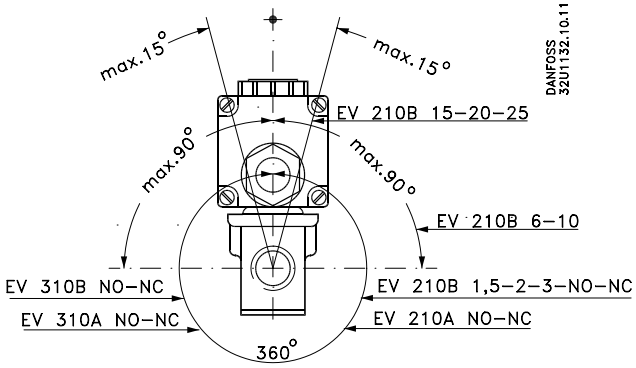
Russia - Maritime Register of Shipping:
EV210B 1.5, 2, 3
EV220B 6, 10, 12, 15, 18, 20, 25, 32, 40, 50 with 10 W ac Compact coil

of solenoid valves

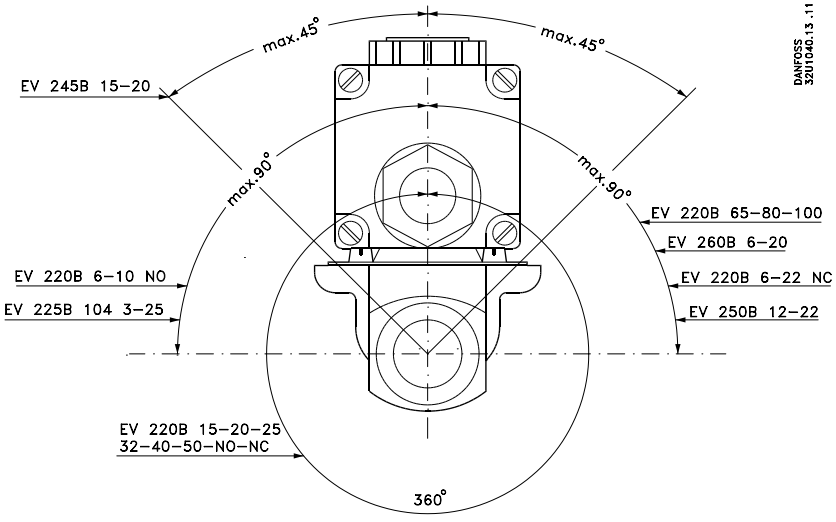
1. **Note!** Solenoid valves should preferably be installed with the coil upwards.
2. The pipes must always be flushed clean of impurities before the solenoid valve is mounted.
3. In case the medium might contain impurities, a filter must be fitted ahead of the solenoid valve.
4. Solenoid valves should be installed in such a matter that they are not exposed to direct sprays of water, unless the electrical connections have suitable protection.

Direct-operated valves

Although Danfoss solenoid valves can function with clean media when installed according to the illustrations, installation with the coil upwards is preferred.



Servo-operated and assisted lift servo-operated valves



DK-6000 Kolding
Denmark