

ENGINEERING  
TOMORROW

*Danfoss*

Operating Guide

# How to use **solenoid valves** Making it easy to be efficient

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## Introduction

### **How to use solenoid valves**

This booklet has been compiled to help in the installation of compact and high performance solenoid valves and in locating faults in systems with solenoid valves.

The compact range has small physical dimensions for control of flow where space is limited.

The high performance range is a sturdy and universal valve program for control of flow in industrial plants and within heating and sanitary systems.

Note that this booklet describes only brass solenoid valves. For other types, please contact Danfoss.

If you need help choosing a solenoid valve, visit the online valve selector at [Fluid Controls Quick Selector](#).

### **Flexible and user-friendly**

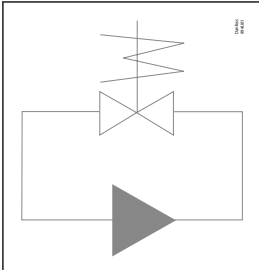
Danfoss solenoid valve bodies and electrical coils are normally supplied separately and then combined together. They are assembled quickly and simply without any tools. This provides optimum product flexibility and availability. If a coil needs replacement it can be done without stopping or draining any system.

The solenoid valves are also available as assembled units if required.

**Product Identification**

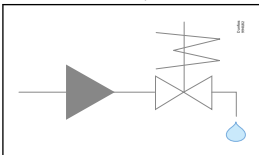
**Choosing the correct solenoid valve**

**Figure 1: Used in Closed circuit system**



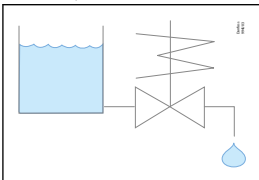
Symbolise valves used in a closed circuit system, typically with low differential pressures.

**Figure 2: Used in Open circuit system**



- Symbolise valves used in an open system. Used typically for drinking water.
- Differential pressure higher than 0.5 bar.

**Figure 3: Used in Drain system**



Symbolise valves used in a drain system.

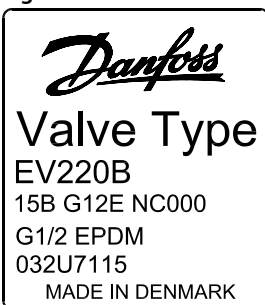
**NOTE:**

For more details see How to choose on page 13

**Option 1: Identification using silver label (← 2011)**

**Illustration 1** shows the label with relevant information that is attached to the coil.

**Figure 4: Illustration 1**



The example here is from an EV220B solenoid valve:

<b>15</b>	15 mm orifice
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## How to use solenoid valves Making it easy to be efficient

<b>B</b>	Brass body material
<b>G 12</b>	ISO 228/1, 1/2 inch connection
<b>E</b>	EPDM seal material
<b>NC</b>	Normally closed

If the the coil label cannot be read, the valve can be identified from the letter/number combination stamped in the valve body.

Figure 5: Example

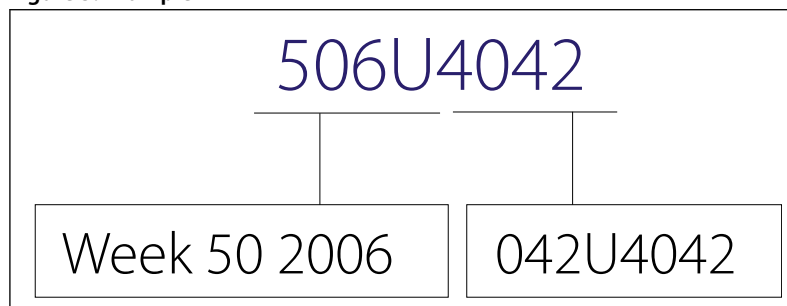
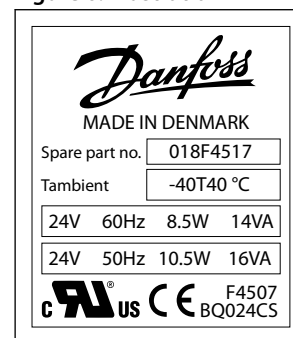


Figure 6: Illustration 2



The coil type (BQ024CS) is printed on the front of the coil as well as voltage (V) and frequency (Hz) - see illustration 2.

### Option 2 (2011 →)

Printing on armature tube replaces silver labels and date / code no. stamping for identification of the valve.

**Type Designation**

EV220B	= Valve type
40	= 40 mm orifice
B	= Brass body material
G 112	= ISO 228/1, 11/2 inch connection
E	= EPDM seal material
NC	= Normally closed
000	= Options
BB230A	= Coil

**Production Time**

0922B	= Week 09 2022 Tuesday
032U7140	= Code Number

**Note down following information**

Valve code no: \_\_\_\_\_

Sparepart no.: \_\_\_\_\_

Table 1: Plug

018Z0081	042N1256	042N1278
		

### **Valve identification problem**

If above mentioned method is not possible, state the following when ordering Danfoss solenoid valves as replacements:

- Application (closed circuit, open system or drain application)?
- Function (Normally open or normally closed)?
- End connection?
- Medium (water, oil, air, etc.)?
- $K_v$  value?
- Coil voltage?
- Alternating (AC) or direct current (DC)?

### **Product selection made easy for installers**

With only a few clicks Danfoss Product Selector can help you find the right product for standard applications.

The tool is developed to help wholesalers, retailers, installers and the end user to clarify their needs within solenoid valves.

With Danfoss' web based tool, you can access anywhere; from your laptop or smartphone, as long as you have internet access.

In the Fluid Controls Quick Selector you only need to know 5 things:

1. Medium
2. System
3. Function
4. Connection size
5. Coil voltage

The Danfoss selector then presents a result for you which can be sent to your email, SMS or be printed out.

Danfoss though recommends OEM-customers, which typically get customized products for their applications, to contact their Danfoss distributor.

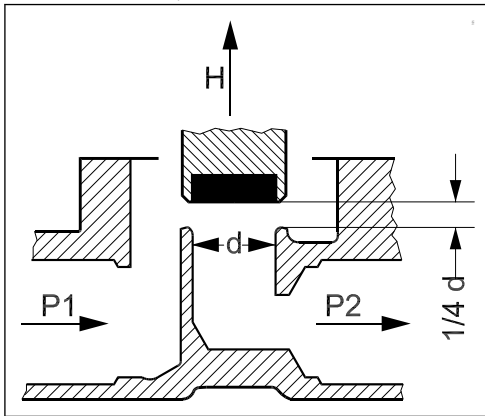
See how easy it is: [Fluid Controls Quick Selector](#)

### **Capacity / $K_v$ - value:**

1. Specifies how many  $m^3$ / hour (capacity) water is passing through the valve at a differential pressure at 1 bar.
2. Is a result of all the different constants coming from shape of orifices, units etc. which are reduced to one new constant, the  $k_v$  - value.
3. Is used to calculate capacity:
4.  $\rho$  = density ( $kg / m^3$ )
5.  $\Delta P = P_1 - P_2$

$$Q = K_v \sqrt{\frac{\Delta P}{\rho}} [m^3/h]$$

Figure 7: Capacity / Kv - value



## Pressure conditions

### Open system (system with drain)

In an open system the pressure conditions are well-defined. This enables clarification as to whether there is sufficient pressure differential to be able to open a servo-operated valve. The following types of valves are well-suited for use in open systems:

- EV210B, EV210BW and EV310B direct-operated solenoid valves
- EV220B, EV220BW, EV221BW and EV225B servo-operated solenoid valves

### Closed circuit (circulating system)

In a closed circuit system the pressure conditions are undefined. Therefore a solenoid valve capable of opening without pressure differential is required.

- EV250B and EV250BW assisted lift servo-operated valve
- EV210B, EV210BW and EV310B direct-operated solenoid valves

## Operating pressure

Valves in the standard range are designed for pressure of max 6–30 bar – the actual figure depends on the type of valve. The product range includes valves for special application, designed for pressures of up to 80 bar. The large standard range combined with these valves enable the use of Danfoss solenoid valves for all types of systems, whether with normal or more extreme inlet pressures.

## Differential pressure/ MOPD

1. Difference between inlet pressure and outlet pressure ( $\Delta P = P_1 - P_2$ ).
2. Max. permissible differential pressure against which the valve can open
3. Also specified as MOPD: Maximum Opening Pressure Differential
4. MOPD specifies the differential pressure value in worst case:
  - 100 % duty rate
  - Maximum medium and ambient temperature
  - Nominal voltage, typically -10%
  - Specified pressure is often limited by endurance demands more than MOPD

## Media conditions

The valves are designed to resist the temperatures normally found in industrial applications.

If the temperature is outside these limits, there is a risk of the valve not functioning correctly because of, for example, rubber materials becoming hard. Exceeding the temperature rating can also result in the shortening of valve life. If the valve is to be used in a special application, with a temperature in excess of the rated limits, there are valves available in the product range which have been designed for use in higher temperature systems.



### The characteristics of the medium

The valves have been designed for use with different media.

In general the following is valid:

- Valves containing EPDM-rubber are suitable for water and steam<sup>(1)</sup>.
- Valves containing FKM rubber are suitable for oil and air.

Incorrect use of valve types:

1. If a valve containing EPDM-rubber is used for a medium containing oil (compressed air normally contains particles of oil from the compressor) the rubber will expand and the valve will not be able to function optimally.
2. A valve containing FKM-/NBR-rubber can be used for water. However for servo-operated valves, the water temperature must be kept below 60 °C for FKM, 90 °C for NBR. If this temperature is exceeded it will have a negative effect on the life of the valve.

### Other media

For slightly aggressive media (e.g. demineralised water) dezincificationresistant brass valves must be used. Stainless steel valves are used for more aggressive media.

### Ambient temperature

The ambient temperature must be within certain limits for the coil to function optimally. See data sheet for coils.

### Water hammer

All piping systems with relatively high flow rates are susceptible to water hammer when a valve is opened or closed. A damped solenoid valve ( eg. EV220B 15–50) should be used if there is a risk of water hammer. After installation the valve can be adjusted for water hammer by changing a replaceable equalizing orifice. See "Spareparts" page 32.

### Filter

In systems with contaminated media there is a risk of moving parts in a valve not working as intended. Dirt is the most common cause of function failure in solenoid valves. To help avoid this problem we suggest the fitting of a filter on the upstream side of the valve.

### Coil voltage and power

It is necessary to know which voltage (Volt AC/DC nominal  $\pm 10\%$ ) is available within an application to select the correct coil. The maximum permissible differential pressure can also be increased by fitting a more powerful coil. The coil power depends on the type of coil (BA, BB, AM etc.).

### Other environmental factors

In wet or very humid environments, coils with IP67 enclosure classification must be used.

### Valve function

Most industrial systems operate with a de-energised closed valve (NC = normally closed). Our valve range also offers de-energised open valves (NO = normally open) for applications requiring this feature.

### Application

It is recommended to use a filter in front of the valve. Recommended filter 50 mesh (297 microns).

In water applications, exercise the valves at least once every 24 hours, meaning change the state of the valve. The valve exercise will minimize the risk of the valve sticking due to calcium carbonate, zinc or iron oxide build-up.

To minimize scaling, and corrosion attack it is recommended that the water passing the valve have the following values:

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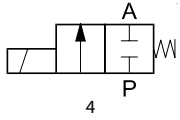
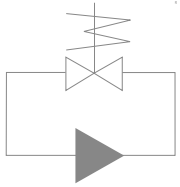
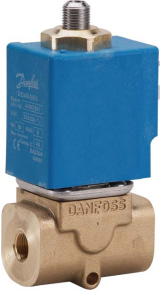
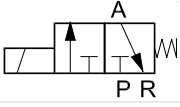
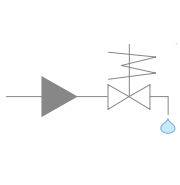

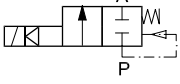
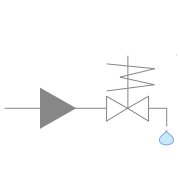
<sup>1</sup> For steam temperatures above 120 °C there is a type of valve especially designed for steam

## How to use solenoid valves Making it easy to be efficient


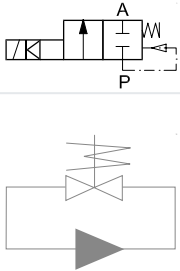

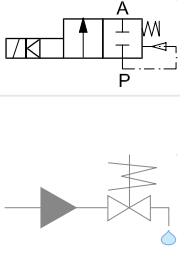
- Hardness 6-18 °dH to avoid scaling (chalk / lime stone build up).
- Conductivity 50 – 800 µS/cm to avoid brass dezincification and corrosion.
- Above 25°C media temperature avoid stagnant water inside the valve to avoid dezincification and corrosion attack.

### Valve overview - High performance (blue) range

Table 2: Valve overview - High performance (blue) range

Coils			Medium			
			Air and neutral gas- ses	Water	Oil	Steam
EV210B/BW		 	✓	✓	✓	
EV310B		 	✓	✓	✓	
EV220B/BW EV221BW		 	✓	✓	✓	

## How to use solenoid valves Making it easy to be efficient

Coils			Medium			
			Air and neutral gases	Water	Oil	Steam
EV250B/BW			✓	✓	✓	✓
EV225B BQ coil			✓	✓	✓	

**NOTE:**

"BW" series is only for drinking water.

**Table 3: Valve overview - High performance (blue) range**

Characteristics		Description
Connection [ISO 228/1]	Function	
G 1/8" - G 1"	NC/NO	EV210B covers a wide range of direct-operated 2/2-way solenoid valves for universal use. EV210B is a real robust valve program with high performance and can be used in all kind of tough working conditions. "EV210BW is a very robust high performance valve program. This valve type is designed with EPDM seal, lead free dezincification resistant ECO brass for drinking water."
G 1/8" - G 3/8"	NC/NO	EV310B is a direct-operated 3/2-way solenoid valve. The valve is especially used in connection with air-operated valves to allow air supply and air relief for the air actuator.
G 1/4" - G 1"	NC/NO	EV220B 6–22 is a direct servo-operated 2/2-way solenoid valve program. This program is especially for OEM applications demanding a robust solution and moderate flow rates. EV221BW 10, 14, 20 and 22 is a direct servo-operated 2/2-way solenoid valve. This valve type is designed with EPDM seal, lead free dezincification resistant Eco brass for drinking water applications.
G 1/2" - G 2"	NC/NO	EV220B/BW 15–50 is a universal indirect servo-operated 2/2-way solenoid valve program. Valve body in brass, eco brass, dezincification resistant brass and stainless steel ensures that a broad variety of applications can be covered.
G 3/8" - G 1"	NC	EV250B with assisted lift is especially to use in closed circuits with low differential pressure, but demanding moderate flow rates. Valve body in DZR brass ensures a long life, even in connection with aggressive steam media. EV250BW is designed with EPDM seal, lead free dezincification resistant Eco brass for drinking water applications.
G 1/4" - G 1"	NC	The EV225B design is based on a PTFE diaphragm and valve body in dezincification resistant brass, ensuring high reliable function and long life even in connection with contaminated steam.

## Valve overview - Compact (blue) range

Table 4: Valve overview - Compact (blue) range


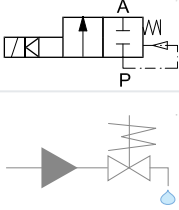
Coils			Medium			
			Air and neutral gases	Water	Oil	Steam
EV220S			✓	✓	✓	

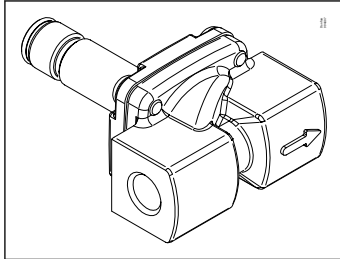
Table 5: Valve overview - compact (black) range

Characteristics		Description
Connection [ISO 228/1]	Function	
G 1/4" - G 2"	NC/NO	EV220S is a range of streamlined compact indirect servo-operated 2/2 way solenoid valves with connections from 3/8" to 3/4", special designed to fit in applications where space is limited. This range has been designed for water and brine applications.

## Installation

### Flow direction

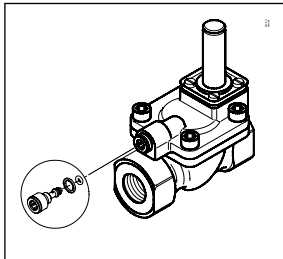
Figure 8: Flow direction



To be able to operate correctly, all solenoid valves must be installed with the arrow cast on the body pointing in the direction of flow.

### Water hammer

Figure 9: Equalizing orifice



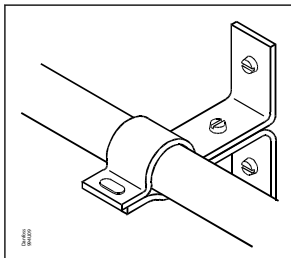
Water hammer is a typical result of high liquid velocity (high pressure and high flow velocity through small pipe diameters).

There are several reasonable solutions to the problem:

1. Reduce the pressure by installing a pressure reduction valve ahead of the solenoid valve. If possible, increase the pipe diameter.
2. Damp the water hammer by installing a flexible hose or flexible buffer ahead of the solenoid valve.
3. Use a solenoid valve of the type EV220B 15 – EV220B 50. The equalizing orifice can be replaced by a version with smaller diameter. This gives a longer closing time (see “Spare parts” and “Opening and closing times”).

### Pipe

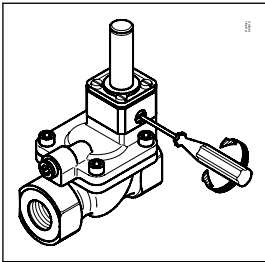
Figure 10: Pipe



The pipes on both sides of the valve must be securely fastened.

## **Test pressure**

Figure 11: Test pressure



When applying test pressure: All valves in the system must be open. There are three ways of doing this:

1. applying voltage to the coil
2. By opening the valves manually (when the manual override accessory is fitted)
3. By connecting the Danfoss permanent magnet (see "Tools", page 42)

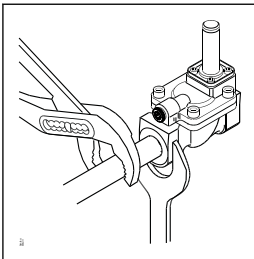
### **NOTE:**

The manual opening unit is not supplied as standard, but as an accessory for EV220B 15 – EV220B 50 valves (see page 33).

Remember to screw the opening unit back (CLOCKWISE) before starting up the system, otherwise the valve cannot close.

## **Tightening up**

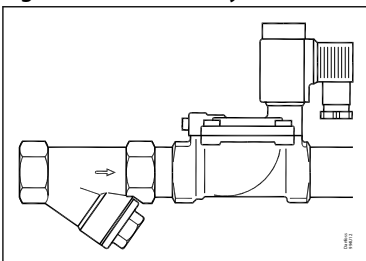
Figure 12: Tightening up



Always use counter-force when tightening up pipe connections, i.e. use a spanner on both the valve body as well as on the pipe connector (as shown).

## **Dirt in the system**

Figure 13: Dirt in the system



Always flush out piping before installing a solenoid valve. If there is dirt in the medium, a filter should be installed ahead of the valve.

## **Installing the coil**

Danfoss recommends that the solenoid valve be installed with coil upwards. This minimises the risk of dirt collecting in the armature tube.

If “clean” media is used, i.e. media containing no dirt particles, the solenoid valve will operate when installed in the orientation as shown below.

## Servo-operated and assisted lift

### servo-operated valves

Figure 14: servo-operated valves

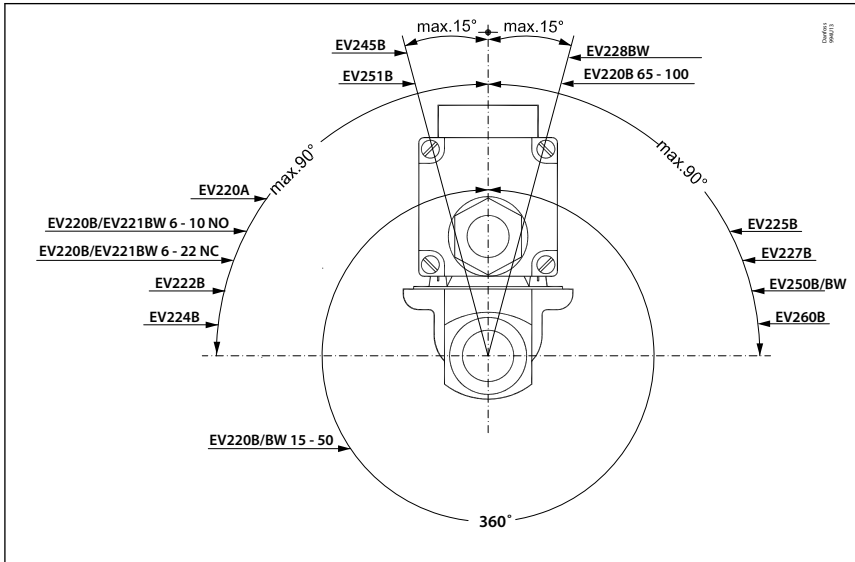
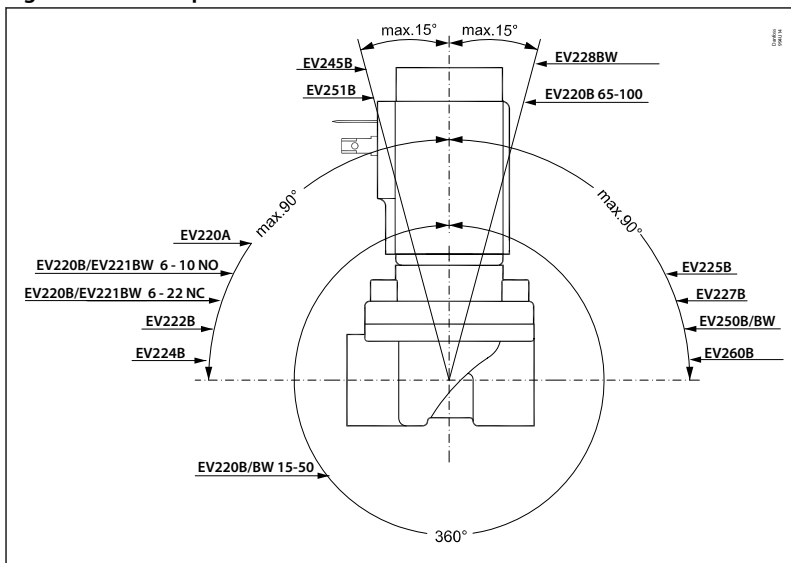


Figure 15: servo-operated valves



## Direct-operated valves

Figure 16: Direct-operated valves

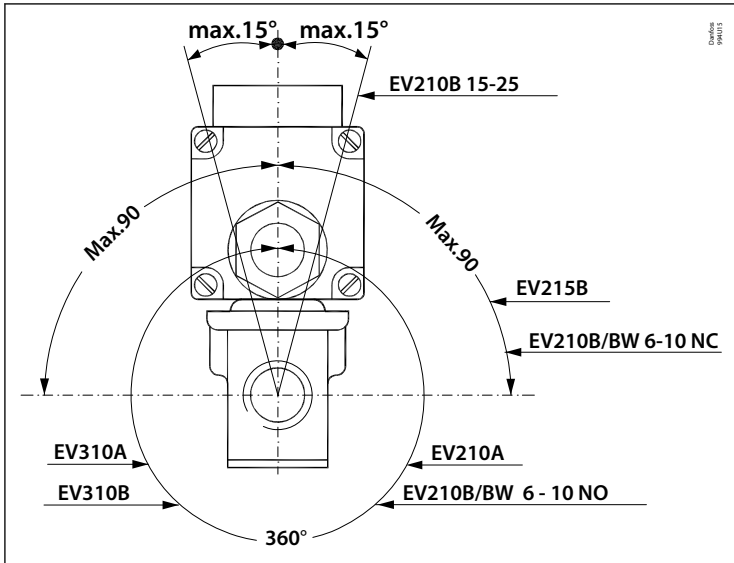
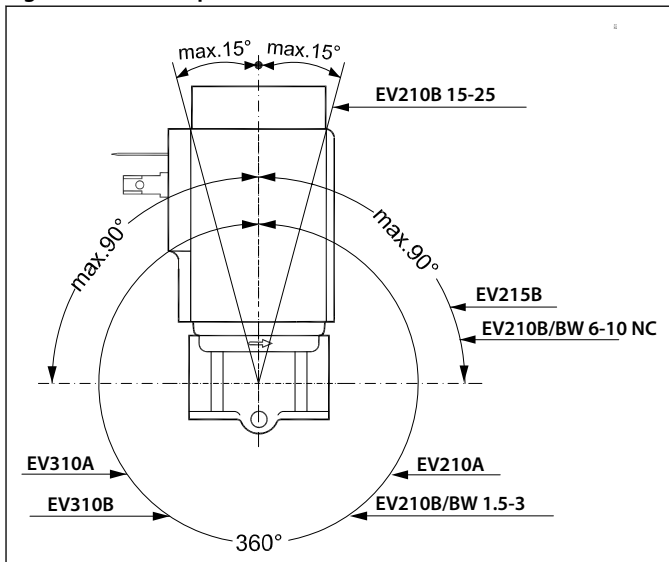


Figure 17: Direct-operated valves



## Coil

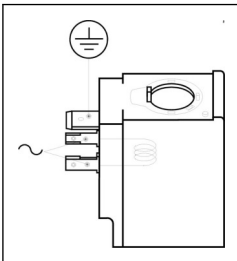
Figure 18: Coil



Check to ensure that the coil operating voltage is correct (see text on coil, in "Volt"). Also ensure that the data is correct (voltage and frequency) and matches the supply. If the two sets of data do not correspond, the coil might burn out. As far as possible, always choose single-frequency coils; they give off less heat than double-frequency versions.

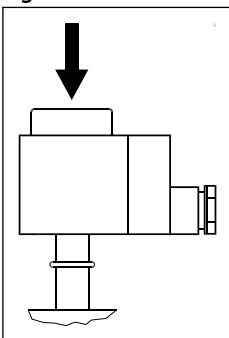


Figure 19: Coil



The coil has three pins. The middle pin is marked according to the illustration (left) and must be used for earthing. The two other pins are coil terminals and either can be used for the phase or neutral supply. The terminals can be used respectively for phase and neutral as required.

Figure 20: Coil

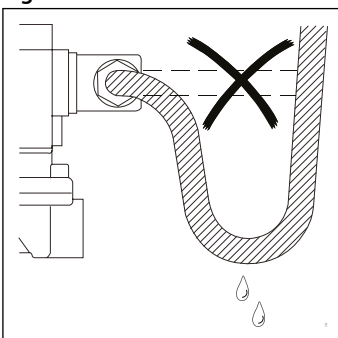


Please note for high performance range! When mounting the clip-on coil, simply press it gently onto the armature, until it clicks into place. An O-ring should be fitted over the armature tube before fitting the coil.

Cable entries must always be screwed in correctly.

### **Cable connection**

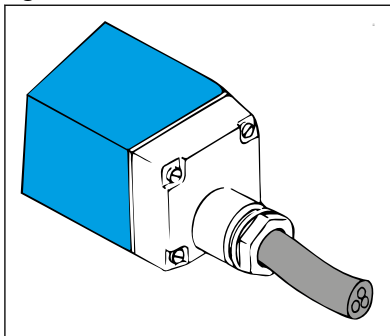
Figure 21: Cable connection



The cable must be installed as shown in the illustration to avoid water running into the terminal box.

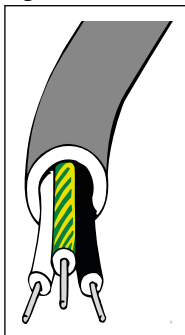
## Cable

Figure 22: Cable



To avoid moisture penetrating in the terminal box, the whole cable diameter must be secured in the entry. For this reason, always use round cables as they are the only type that can be effectively sealed.

Figure 23: Cable



**NOTE:**

The colours on the cable leads. Yellow/green is always earth. The other leads should be for the phase and neutral supply.

## Coil replacement

Figure 24: Coil replacement

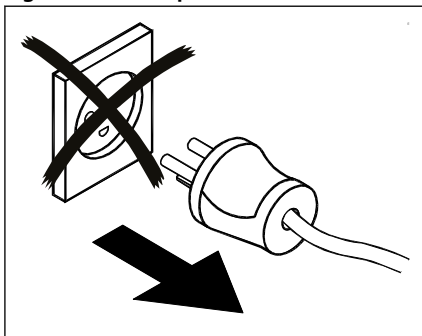
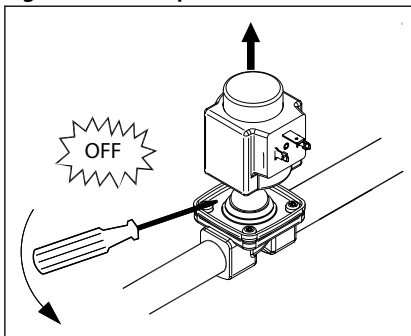


Figure 25: Coil replacement



Please note for clip-on coils: When replacing a coil, use a screwdriver to lever it from the armature.

**CAUTION:**

Before removing a coil, voltage must be disconnected, otherwise the coil will burn out.

## Operation

### Opening and closing times

#### Closing times and water hammer

With the larger valves, very short closing times can cause water hammer.

The EV220B servo-operated valves have damped closing and fulfil EN60730-2-8 specifications.

The table gives the opening/closing times of the various types, but it must be emphasised that tube dimensions / lengths and differences in operating conditions - especially pressure - can cause deviations from the values given.

#### High performance (blue) range

**Table 6: High performance (blue) range**

Type	Opening [ms]	Closing [ms]
EV210B/BW 1.5	10	20
EV210B/BW 3	20	20
EV210B/BW 6	20	20
EV250B/BW 12	100	100
EV250B/BW 18	150	100
EV250B/BW 22	150	100
EV220B/BW 10	50	300
EV220B/BW 12	60	300
EV220B/BW 15	40	350
EV220B/BW 20	40	1000
EV220B/BW 25	300	1000
EV220B/BW 32	1000	2500
EV220B/BW 40	1500	4000
EV220B/BW 50	5000	10000
EV221BW 10	50	300
EV221BW 14	60	300
EV221BW 20	200	500
EV221BW 22	200	500
EV310B 2	10 - 20	10 - 20

#### Compact (blue) range

**Table 7: Compact (blue) range**

Type	Opening [ms]	Closing [ms]
EV220S 10	50	300
EV220S 13	100	400
EV220S 14	200	500
EV220S 17	200	500
EV220S 22	200	500
EV220S 32	2500	4000
EV220S 40	4000	6000
EV220S 50	5000	10000

#### Changing opening and closing times

Please note for high performance type.

EV220B 15 – EV220B 50 closing times can be changed by replacing the equalizing orifice at the inlet side of the valve (see "Water hammer" page 17, and "Spare parts" page 32). To decrease water hammer, choose a smaller equalizing orifice.

## How to use solenoid valves Making it easy to be efficient

The table shows the opening and closing times depending on the equalizing orifice chosen (standard times marked in bold). The times stated cover water as a medium, and are for guidance only. Tube dimensions / lengths and operating conditions, for example differential pressure, may influence the values.

**Table 8: Changing opening and closing times**

Orifice		EV220B 15		EV220B 20		EV220B 25		EV220B 32		EV220B 40		EV220B 50	
mm	Grooves	open	close	open	close	open	close	open	close	open	close	open	close
0.5	1	0.04	0.35	0.04	1.0	0.11	3.0	1.6	6.0	1.3	8.0	3.4	40.0
0.8	2	0.04	0.3	0.04	0.5	0.3	1.0	1.0	2.5	1.5	4.0	3.6	11.0
1.2	3	0.04	0.12	0.04	0.25	0.30	0.5	1.2	1.0	1.5	2.0	5.0	10.0
1.4	4	0.04	0.1	0.06	0.18	0.30	0.4	1.0	0.8	2.0	1.5	5.2	6.5

## Troubleshooting

### Fault location

**Table 9: Symptom: Solenoid valve does not open**

No voltage on coil	<p>Check whether valve is de-energised open or closed (NO or NC):</p> <ol style="list-style-type: none"> <li>1. Use a magnetic detector</li> <li>2. Lift coil slightly and note whether it offers resistance against lifting</li> </ol> <p><b>NOTE:</b> Never remove a coil with voltage applied - it may burn out. Check relay contacts. Check lead connections. Check fuses.</p>
Incorrect voltage / frequency	Check to make sure the coil's electrical requirements are the same as the installation supply. Measure the operating voltage at the coil. Permissible voltage variation: ±10% for dual frequency; DC and NO applications +10% / -15% for AC on single frequency voltages. If necessary, replace coil with correct version.
Coil burnt out	See page 31.
Diff. pressure too high	Check coil data. If necessary, replace coil with correct version. Reduce differential pressure, e.g. by limiting inlet pressure.
Diff. pressure too low	Check coil data and differential pressure. If necessary, replace coil with correct version.
Damaged / bent armature tube	Replace valve.
Dirt at diaphragm <sup>(2)</sup>	Clean diaphragm. If necessary, replace defective component(s) <sup>(1)</sup> .
Dirt in valve seat / dirt in armature / armature tube <sup>(2)</sup>	Clean valve; if necessary, replace defective component(s).
Corrosion	Replace defective component(s) <sup>(1)</sup> .
Components missing after valve dismantling	Fit missing component(s) <sup>(1)</sup> .

<sup>(1)</sup> See "Spare parts" page 32

<sup>(2)</sup> If there is repeated build up of dirt in the armature / armature tube, consider the installation of an isolating diaphragm kit, if applicable (see "Spare parts" page 32)

**Table 10: Symptom: Solenoid valve partly opens**

Probable cause	Remedy
Differential pressure too low	Check valve data, incl. differential pressure. Replace valve with correct version.
Damaged or bent armature tube	Replace valve.
Dirt at diaphragm	Clean diaphragm. If necessary, replace defective component(s) <sup>(1)</sup> .
Dirt in valve seat / dirt in armature / armature tube <sup>(2)</sup>	Clean valve, if necessary, replace defective component(s).
Corrosion	Replace defective component(s) <sup>(1)</sup> .
Components missing after valve dismantling	Fit missing component(s) <sup>(1)</sup> .

**Table 11: Symptom: Solenoid valve does not close/partly closes**

Probable cause	Remedy
Voltage remains on coil	<p>First lift coil slightly and note whether it offers resistance.</p> <p><b>NOTE:</b> Never remove a coil with voltage applied - it might burn out.</p> <ul style="list-style-type: none"> <li>• Check wiring diagram and wiring.</li> <li>• Check relay contacts.</li> <li>• Check lead connections.</li> </ul>
Dirt in or closed pilot orifice / equalizing piece	<ul style="list-style-type: none"> <li>• Clean orifice with needle or similar (max. dia. 0.5 mm). Blow clean with compressed air.</li> <li>• If necessary, replace defective component(s).</li> </ul>
Manual opening unit cannot be screwed back after use. <ul style="list-style-type: none"> <li>• Pulsation in pressure line.</li> <li>• Differential pressure too high in open position.</li> <li>• Pressure on outlet side periodically higher than pressure on inlet side.</li> </ul>	<p>Check position of opening unit and adjust as necessary.</p> <ul style="list-style-type: none"> <li>• Check valve data.</li> <li>• Check pressure and liquid flow.</li> <li>• Replace valve with one more suitable.</li> <li>• Check rest of installation.</li> </ul>
Damaged / bent armature tube	Replace valve.
Defective valve plate, diaphragm or valve seat	Check pressure and liquid flow. Replace defective component(s) <sup>(1)</sup> .
Diaphragm upside down	Check correct installation of valve <sup>(1)</sup> .
Dirt in valve seat/dirt in armature tube	Clean valve; if necessary, replace defective components.

## How to use solenoid valves Making it easy to be efficient

Probable cause	Remedy
Corrosion, pilot / main orifice	Replace defective components.
Valve installed wrong way round	Check liquid flow direction and make sure the arrow is pointing in the same direction.
Components missing after valve dismantling	Fit missing component(s) <sup>(1)</sup> .

**Table 12: Symptom: Solenoid valve making noise**

Probable cause	Remedy
Hum	Hum caused by AC frequency can be removed by changing to coil with rectifier (see page 23).
<ul style="list-style-type: none"> <li>• Water hammer when valve opens</li> <li>• Water hammer when valve closes</li> </ul>	See "Installation".
Differential pressure too high and / or pulsation in pressure line	<ul style="list-style-type: none"> <li>• Check valve data and differential pressure.</li> <li>• Check pressure and liquid flow.</li> <li>• Replace with more suitable valve.</li> <li>• Check rest of installation.</li> </ul>

**Table 13: Symptom: Coil burnt - cold with voltage on**

Probable cause	Remedy
Incorrect voltage / frequency	<ul style="list-style-type: none"> <li>• Check coil data.</li> <li>• If necessary, change to correct coil type.</li> <li>• Check wiring diagram and wiring.</li> <li>•</li> </ul> <p>Check maximum voltage variation: Permissible voltage variation: ±10% for dual frequency; DC and NO applications +10% / -15% for AC on single frequency voltages</p>
Coil short-circuit (could be moisture in coil)	<ul style="list-style-type: none"> <li>• Check rest of installation for possible short-circuiting.</li> <li>• Check lead connections at coil.</li> <li>• When fault has been found, replace coil. (See also "Coil" in section "Installation").</li> <li>• Consider fitting a 'clip-on' style coil with additional sealing O-ring (for high performance range only).</li> </ul>
Armature sluggish 1. Damaged / bent armature tube 2. Damaged armature 3. Dirt in armature tube	<ul style="list-style-type: none"> <li>• Replace defective component(s).</li> <li>• Remove dirt.</li> </ul>
Temperature of medium too high	<ul style="list-style-type: none"> <li>• Check valve and coil data in relation to installation specification.</li> <li>• Change to suitable coil or valve.</li> </ul>
Ambient temperature too high	<ul style="list-style-type: none"> <li>• If possible, move valve to colder surroundings.</li> <li>• Check valve and coil data in relation to installation specification.</li> <li>• Increase ventilation around valve and coil.</li> </ul>

## Ordering

### Seal material

Table 14: Media table

Seal material [°C]	EPDM <sup>(2)</sup>	FKM	PTFE
Medium			
Water / glycols	- 30 – 140	0 – 60 0 – 100 <sup>(*)</sup>	-
Oil	-	0 – 100	-
Air	-	0 – 100	-
Steam	-	-	up to 185

<sup>(\*)</sup> Direct-operated valves

- <sup>(2)</sup> • 0 to 90 for drinking water valve "BW" series  
• EV228BW EPDM 0-70 °C (RISE 0-60 °C)

### Coil

Table 15: BB coils (IP67)

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
10 W without cable plug	220 – 230 V AC / 50 Hz	018F7351
10 W without cable plug	110 V AC / 50-60 Hz	018F7360
10 W without cable plug	24 V AC / 50 Hz	018F7358
18 W without cable plug	24 V AC	018F7397
Cable plug for BB coils		042N1256

<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

Table 16: BE coil (IP67)

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
10W with terminal box	220 – 230 V AC / 50 Hz	018F6701
10W with terminal box	115 V AC / 50 Hz	018F6711
10W with terminal box	48 V AC / 50 Hz	018F6709
10W with terminal box	24 V AC / 50 Hz	018F6707
18W with terminal box	24 V AC	018F6757

<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

Table 17: BG coils (IP67)

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
20 W with terminal box	24 V AC	018F6857

<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

Table 18: BQ coil

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
10W without cable plug	230 V AC / 50 Hz	018F4511
10W without cable plug	110 V AC / 50 Hz	018F4519
10W without cable plug	24 V AC / 50 Hz	018F4517
Cable plug for BQ coils		042N0156

<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

For installations sensitive to noise

Table 19: BN coil (hum-free, IP67)

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
20 W with 1 m cable	220 – 230 V AC / 50-60 Hz	018F7301

<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

Figure 26: Coil family



Table 20: AM coils (IP00-IP65)

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
7.5 W without cable plug	110 V AC / 50/60 Hz	042N0845
7.5 W without cable plug	220–230 V AC / 50/60 Hz	042N0840
9.5 W without cable plug	24 V DC	042N0843
Cable plug for AM coils		042N1256

<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

Table 21: AS/AZ coils (IP00-IP67)

Coil consumption	Supply voltage / frequency <sup>(1)</sup>	Code number
9.5W without cable plug	24V AC / 50/60Hz	042N7608
8.0W without cable plug	230V AC / 50/60Hz	042N7601
6.0W without cable plug	12V DC	042N7616
18 W without cable plug	24 V DC	042N7617
Cable plug for BB coils		042N1256

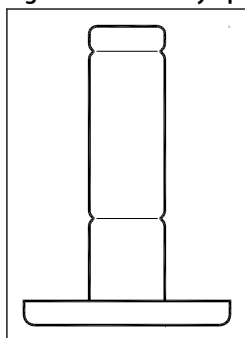
<sup>(1)</sup> For other voltages or coil types, see coil data sheet.

## Spare parts high performance range

### Normally open components (NO)

The set contains locking button and nut for coil, normally open assembly kit (armature and armature tube) and an O-ring.

Figure 27: Normally open components





**Table 22: Normally open components (NO)**

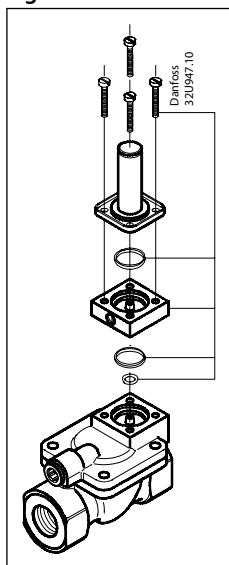
Type	Code number	
	FKM seal material <sup>(1)</sup>	EPDM seal material <sup>(1)</sup>
EV210B 1.5 – EV210B 4.5 NO	032U2004	032U2005
EV220B 6 NO	032U0166	032U0165
EV220B 10 NO	032U0167	-
EV220B 15 – EV220B 50 NO	032U0295	032U0296

<sup>(1)</sup> See page 23 for description of seal materials

NO components are also available for Danfoss valves with other seal materials.

### Manual override unit tool operated

**Figure 28: Manual override unit tool operated**



The manual opening unit for EV220B 15 – EV220B 50 can be used to open and close the valve in the event of power failure or when applying test pressure.

**Table 23: Manual override unit tool operated**

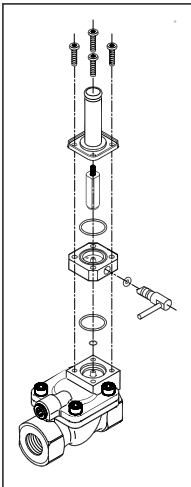
Material	Media temperature [°C]	Code number
Brass, size DN 15–32, seal NBR	-10 – 90	032U0150
Brass, size DN 40–50, seal NBR	-10 – 90	032U0260
Stainless steel, seal NBR	-10 – 90	032U0149

**Figure 29: Manual override unit tool operated**



## Manual override unit hand operated

Figure 30: Manual override unit hand operated



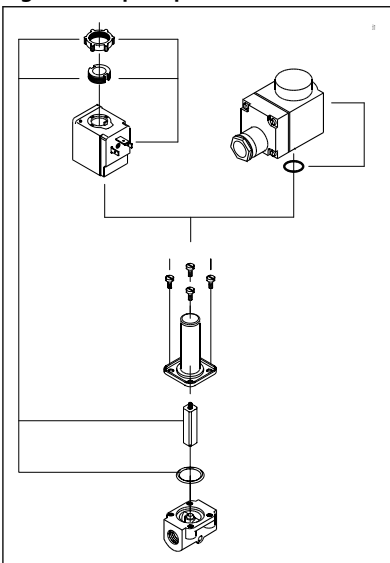
Used for manual override in event of power failure.

Table 24: Manual override unit hand operated

Material	Media temperature [°C]	Code number
Stainless steel, seal EPDM	-30 – 120	032U7390

## Spare parts set for EV210B NC

Figure 31: Spare parts set for EV210B NC



### The spare parts set contains:

- Locking button
- Nut for coil
- Armature with valve plate and spring
- O-rings

Table 25: EPDM versions

Type	Code number
EV210B 6, EV210B 8, EV210B 10	032U2006

**Table 26: FKM versions**

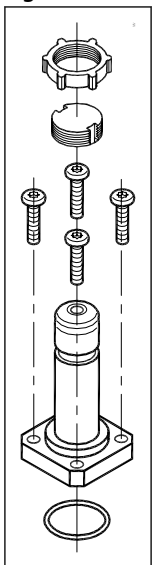
Type	Code number
EV210B 1.5 – EV210B 4.5	032U2003
EV210B 6, EV210B 8, EV210B 10	032U2011

**i NOTE:**

See page 22 for description of seal materials

**Isolating diaphragm kit for EV210B 1.5 – EV210B 4.5 NC – EV220B 50 NC**

**Figure 32: Isolating diaphragm kit**



Avoids build up of contaminants that can block movement of the armature. Permits use of more aggressive media that would normally attack the armature. Gel filled; guarantees operation after long periods on inactivity.

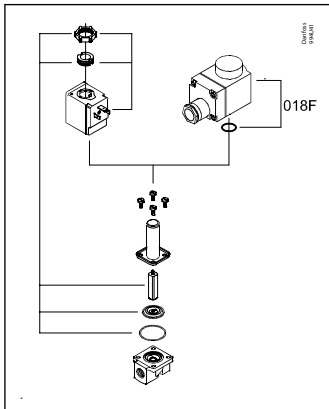
**Table 27: Isolating diaphragm kit**

Seal material	Media temperature [°C]	Code number
EPDM <sup>(1)</sup>	-20 – 50	042U1009
FKM <sup>(1)</sup>	0 – 50	042U1010

<sup>(1)</sup> See page 22 for description of seal materials

**Spare parts set for EV220B 6 – EV220B 12 NC**

**Figure 33: Spare parts set**



**The spare parts set contains:**

- Locking button
- Nut for coil
- Armature with valve plate and spring
- Diaphragm
- 2 O-rings

**Table 28: EPDM versions**

Valve type	Code number
EV220B 6 NC	032U1062
EV220B 10 NC	032U1065
EV220B 12 NC	032U1068

Spare parts sets are also available for Danfoss EV220B valves with other seal materials (see page 23 for description of seal materials)

### Spare parts set for EV220B 15 – EV220B 50

The spare parts set contains:

- Locking button and nut for the coil
- Armature with valve plate and spring
- O-ring for the armature tube
- Spring and diaphragm
- 2 O-rings for the pilot system
- O-ring and gasket for the equalizing orifice
- Equalizing orifice

**Table 29: EV220B 15 – EV220B 50**

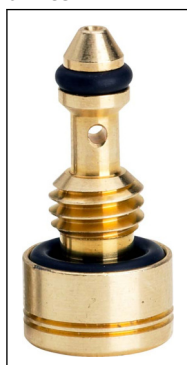
Type	Seal material	Code number
EV220B 15	EPDM <sup>(1)</sup>	032U1071
EV220B 20	EPDM <sup>(1)</sup>	032U1073
EV220B 25	EPDM <sup>(1)</sup>	032U1075
EV220B 32	EPDM <sup>(1)</sup>	032U1077
EV220B 40	EPDM <sup>(1)</sup>	032U1079
EV220B 50	EPDM <sup>(1)</sup>	032U1081

<sup>(1)</sup> See page 22 for description of seal materials

Spare parts sets are also available for Danfoss EV220B valves with other seal materials.

### Equalizing orifice

**Figure 34:**  
Equalizing orifice



**The kit comprises:**

An equalizing orifice includes 2 O-rings. The valves closing time can be changed by installing an equalizing orifice of a size which deviates from the standard valve:

- A shorter closing time is obtained with a larger orifice (the shorter closing time, the greater risk of water hammering)
- A longer closing time is obtained with a smaller orifice.

See also “Opening and closing times”, page 25.

**Table 30: Equalizing orifice**

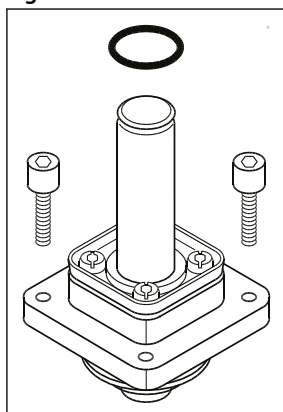
Equalizing orifice size [mm]	Seal material	Applicable in	Code number
0.5	EPDM <sup>(1)</sup>	EV220B 15 EV220B 20	032U0082
0.8	EPDM <sup>(1)</sup>	EV220B 25 EV220B 32 EV220B 40	032U0084
1.2	FKM <sup>(1)</sup>	EV220B 25 EV220B 32	032U0085
1.2	EPDM <sup>(1)</sup>	EV220B 50	032U0086
1.4	FKM <sup>(1)</sup>	EV220B 40 EV220B 50	032U0087

<sup>(1)</sup> See page 22 for description of seal materials

Equalizing orifice sets are also available for Danfoss EV220B valves with other seal materials.

### Spare parts set for EV250B 12 – EV250B 22 NC EPDM seal material

**Figure 35: EPDM seal material**



**The spare parts kit comprises:**

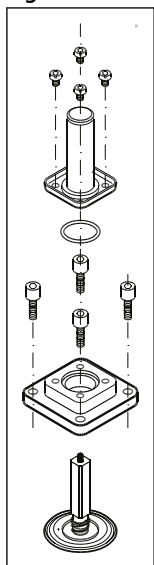
1. O-ring for coil
2. 4 screws
3. Complete NC actuator unit with diaphragm, assist spring, armature, closing spring, cover and armature tube

**Table 31: EPDM seal material**

Valve type	Code number
EV250B 10 – EV250B 12 BD	032U5315
EV250B 18 – EV250B 22 BD	032U5317

## Spare parts set for EV250B 12 – EV250B 22 NC FKM seal material

Figure 36: FKM seal material



### The spare parts kit comprises:

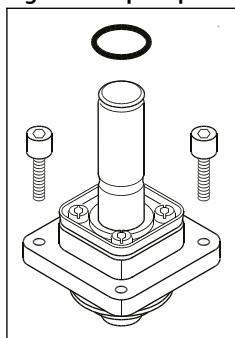
1. O-ring between armature tube and cover
2. Service element consisting of an armature with valve plate and spring fitted on the diaphragm

Table 32: EV250B 10 – EV250B 12 BD

Valve type	Code number
EV250B 10 – EV250B 12 BD	032U5271
EV250B 18 – EV250B 22 BD	032U5273

## Spare parts set for EV250B 12 – EV250B 22 NO

Figure 37: Spare parts set



### The spare parts kit comprises:

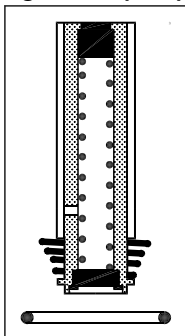
1. O-ring for coil
2. 4 screws
3. Complete NO actuator unit with diaphragm, assist spring, NO armature unit and cover

Table 33: Spare parts set

Valve type	Seal material	Code number
EV250B 10 – EV250B 12 BD	EPDM	032U5319
EV250B 18 – EV250B 12 BD	FKM	032U5320
EV250B 10 – EV250B 22 BD	EPDM	032U5321
EV250B 10 – EV250B 22 BD	FKM	032U5322

## Spare parts kit for EV310B

Figure 38: Spare parts kit for EV310B



### The spare parts kit comprises:

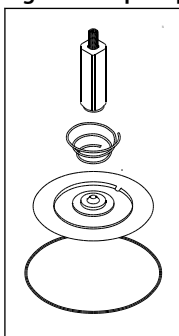
- Armature with mounted spring

Table 34: Spare parts kit for EV310B

Type	Seal material	Code number
NC	FKM	032U2033
NO	FKM	032U2035

## Spare parts kit for EV225B 6 – EV225B 25

Figure 39: Spare parts kit



### Spare parts kit for EV225B comprises:

- Armature with valve plate and spring
- Closing spring
- Diaphragm
- O-ring

Table 35: Spare parts kit

Type	Code number
EV225B 6 – EV225B 10	032U3171
EV225B 15	032U3172
EV225B 20 – EV225B 25	032U3173

## BQ, high performance coil for steam valve

Figure 40: BQ coil



Table 36: Coil for BQ high performance steam valve

Coil consumption [W] AC	Supply voltage [V]/ frequency [Hz]	Code number
10	230 / 50	018F4511
10	24 / 50	018F4517
10	110 / 60	018F4519

## BR, high performance marine coil

Figure 41: BR marine coils



Table 37: BR, High performance coils

Type	Tambient	Supply voltage	Voltage variation	Frequency	Power consumption		Code no.
	[°C]	[V]		[Hz]	[W]	[VA]	
BR024CS	-25 – 50	24	±10%	50	14	26	018F4722
		24	±10%	60	12	21	
BR120CS	-25 – 50	110	±10%	50	14	27	018F4723
		110 – 120	±10%	60	14	27	
BR230CS	-25 – 50	220 - 230	±10%	50	16	31	018F4720
			±10%	60	13	24	
BR024DS	-25 – 50	24	±10%	DC	16		018F4721



Spare parts kit for EV220S 10 – EV220S 50 NC/NO

Table 38: Spare part kits EV220S DN10 to DN17

Type	Armature kit				Diaphragm kit	
	NC		NO		NC/NO	
	EPDM	FKM	EPDM	FKM	EPDM	FKM
Spare Part EV220S 10	042U2096	042U2097	042U2098	042U2099	042U2104	042U2105
Spare Part EV220S 13					042U2106	042U2107
Spare Part EV220S 14					042U2108	042U2109
Spare Part EV220S 17					042U2110	042U2111
Spare Part EV220S 22					042U2112	042U2113
Spare Part EV220S 32					042U2114	042U2115
Spare Part EV220S 40					042U2116	042U2117
Spare Part EV220S 50					042U2118	042U2119
	<ol style="list-style-type: none"> <li>1. 2 x Screws</li> <li>2. Washer</li> <li>3. Armature tube</li> <li>4. Armature + spring</li> <li>5. O-ring</li> </ol>		<ol style="list-style-type: none"> <li>1. 2 x Screws</li> <li>2. Washer</li> <li>3. Armature tube</li> <li>4. O-ring</li> <li>5. Spring</li> <li>6. Armature</li> <li>7. Pin peek</li> <li>8. Spring</li> <li>9. Pin peek</li> <li>10. Disk</li> </ol>		<ol style="list-style-type: none"> <li>1. O-ring</li> <li>2. Spring</li> <li>3. Diaphragm</li> </ol>	

### Spare part kits DN 1.5 to DN 6

**Table 39: Spare part kits DN 1.5 to DN 6**

Type	Actuator kit NC	Actuator kit NO
EV210BW DN 1.5 - 4.5	132U8002	132U8003
EV210BW DN 6	132U8006	
	<ol style="list-style-type: none"> <li>1. 4 x Screws</li> <li>2. Armature tube</li> <li>3. Armature + spring</li> <li>4. O-ring</li> </ol>	<ol style="list-style-type: none"> <li>1. 4 x Screws</li> <li>2. NO actuator kit</li> <li>3. O-ring</li> </ol>

### Spare part kits DN10 - DN22

**Table 40: Spare part kits DN10 - DN22**

Type	Actuator kit NC	Actuator kit NO	Actuator kit NC	Actuator kit NO
	Sealing			
	EPDM			
EV221BW DN 10	132U8010	132U8011		
EV221BW DN 14			132U8014	132U8013
EV221BW DN 20			132U8022	132U8023

## How to use solenoid valves Making it easy to be efficient

Type	Actuator kit NC	Actuator kit NO	Actuator kit NC	Actuator kit NO
	Sealing			
	EPDM			
EV221BW DN 22			<p>132U8022</p>	<p>132U8023</p>
	<ol style="list-style-type: none"> <li>4 x Screws</li> <li>O-ring</li> <li>Armature tube</li> <li>Armature + spring</li> <li>O-ring</li> <li>Diaphragm</li> </ol>	<ol style="list-style-type: none"> <li>4 x Screws</li> <li>O-ring</li> <li>NO unit</li> <li>O-ring</li> <li>Diaphragm</li> </ol>	<ol style="list-style-type: none"> <li>4 x Screws</li> <li>O-ring</li> <li>Armature tube</li> <li>Armature + spring</li> <li>Diaphragm</li> </ol>	<ol style="list-style-type: none"> <li>4 x Screws</li> <li>O-ring</li> <li>NO unit</li> <li>Diaphragm</li> </ol>

### Spare part kit DN15-50 in EPDM and stainless steel

Table 41: Spare part kit DN15-50 in EPDM and stainless steel

Type	Actuator kit NC for EV220BW	Actuator kit NO for EV220BW	Actuator kit UN for EV228BW	Diaphragm kit for EV220/EV228BW
EV220/EV228BW DN 15	132U8080	132U8081	132U8082	132U8016
EV220/EV228BW DN 20	132U8080	132U8081	132U8082	132U8021
EV220/EV228BW DN 25	132U8080	132U8081	132U8082	132U8026
EV220/EV228BW DN 32	132U8080	132U8081	132U8082	132U8033
EV220/EV228BW DN 40	132U8080	132U8081	132U8082	132U8041

Type	Actuator kit NC for EV220BW	Actuator kit NO for EV220BW	Actuator kit UN for EV228BW	Diaphragm kit for EV220/EV228BW
EV220/EV228BW DN 50	132U8080	132U8081	132U8082	132U8051
	<ol style="list-style-type: none"> <li>1. O-ring</li> <li>2. 4 x Screws</li> <li>3. Armature tube</li> <li>4. Armature with spring</li> <li>5. O-ring</li> </ol>	<ol style="list-style-type: none"> <li>1. O-ring</li> <li>2. 4 x Screws</li> <li>3. NO unit</li> <li>4. O-ring</li> </ol>	<ol style="list-style-type: none"> <li>1. O-ring</li> <li>2. 4 x Screws</li> <li>3. Armature tube</li> <li>4. Armature with spring</li> <li>5. O-ring</li> </ol>	<ol style="list-style-type: none"> <li>1. 4 x Screws</li> <li>2. 2 x O-rings</li> <li>3. Equalizing orifice</li> <li>4. Closing spring</li> <li>5. Diaphragm</li> <li>6. 2 x O-ring</li> </ol>

## Tools

### Magnetic field indicator

Figure 42: Magnetic field indicator



This handy key ring tool reacts to magnetic fields from solenoid valves. Place the indicator close to the coil, and the red-white disc will prove the coil to be active by rotating.

## Permanent magnet

Figure 43: Permanent magnet



With this tool it is possible to operate solenoid valves without wiring up the electrical coil.

Please contact your local Danfoss office to obtain these popular tools.

## Certificates, declarations and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

### Directives, approvals and certificates

In accordance with

- Low Voltage Directive 2014/35/EU
- EN60730-1
- EN60730-2-8
- Pressure Equipment Directive 2014/68/EU
- RoHS Directive 2011/65/EU

### Drinking water approvals

Figure 44: Rise



Valves are certified by RISE, notified body 1002. Valid in Denmark and Sweden. In accordance with Boverket Building Regulations (BBR 21, 2014-06-17) Certificate number SCO155-18

Figure 45: SINTEF



Valves are certified by SINTEF. Valid in Norway. In accordance with NKB Product rules nr. 13, pkt. 3.2 – 3.6 :

- NT VVS 100, pkt. 6.4.2 & 6.4.8
- EN ISO 6509

Figure 46: DTI



Inspection by DTI

Figure 47: ACS



Valves are certified by Carso according to ACS guidelines, Circulaire 2002/571.

Figure 48: PZH



Hygienic certificate B-BK-60210-1275/19. Issued by Polish National Institute of Public health (PZH).

## How to use solenoid valves Making it easy to be efficient

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Wetted materials in accordance with 4MS (4 member states Germany, Holland, France and UK), DVGW, BWGL, KTW and W270.

**Figure 49: WRAS**



Valves are examined, tested and found, when correctly installed, to comply with the requirements of the United Kingdom Water Supply (Water Fittings) Regulations and Scottish Water Byelaws."

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