

Vickers by Danfoss Proportional Directional Valve

KBFD/TG4V-3/5 | KBSDG4V-3/5 | KBHDG5V-5/7/8/10



This product has been designed and tested to comply with the provisions of European Directive 2014/30/EU and Harmonized Standards IEC EN 61326-1: 2021 Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements. Wiring practices relevant to the Directive are indicated by Δ Electromagnetic Compatibility (EMC).

1. Introduction

1.1 When supplied with 24V DC power, the Danfoss KB series of proportional valves allows direction and rate of hydraulic fluid flow in a system to be controlled by a voltage command signal applied directly to the integral amplifier. It is not necessary to make any adjustments to the valve/amplifier assembly prior to putting it into service either on a new installation or when replacing a valve on an existing installation. The KB series of valves includes ISO 03, 05, 07, 08 and 10 models with feedback, to achieve a wide range of flow and performance capability.

1.2 **WARNING** This valve with its integral electronic amplifier was factory tested prior to dispatch for conformance to the cataloged specification and performance data but Danfoss warranty may be nullified by such actions as:

- Dismantling or adjusting of any part of the assembly other than may be indicated in this leaflet.
- Incorrect installation.
- Application of the valve outside its cataloged performance limits.
- Incorrect electrical connections.
- Incorrect electrical control signals.

1.3 Before installing the valve, check that the model designation on the nameplate shows it to be the correct valve for the application.

2. Valve for New Application

2.1 Installation

2.1.1 The valve can be mounted in any attitude but the piping must be arranged to ensure that the valve is kept full of fluid at all times. This applies particularly to port T, and port L if used.

2.1.2 Do not remove the protection pad on the bottom face of the valve until immediately before installation. Take care not to lose the seals from the valve ports. Ensure that the surface on which the valve is to be mounted is clean and free from burrs and damage. This applies also to any intermediate "stacking/sandwich" valves which may be used.

2.1.3 Size 3 valves have a locating pin between ports P & B in their bottom face. This ensures that the valve is correctly oriented on the mounting face, which should contain a mating hole.

2.1.4 Install the valve and any intermediate "stacking/sandwich" valves on the mounting surface and secure them with bolts to class 12.9 (ISO 898) or better. Torque bolts according to the following recommendations. For details of available Danfoss™ subplates and bolt kits see "Subplates & Connection Plates" (GB 2425) and "Fixing Bolt Kits" (GB 2314A).

Valve	Clamping height mm (in)*	Bolts for mounting surface:	
		ISO 4401 (torque)	(ANSI/B93.7M) (torque)
KBFD/TG4V-3 KBSDG4V-3	21 (0.82)	4 x M5-6g (7-9 Nm)	4 x #10-24 UNC 31 (62-76 lbf in)
KBFD/TG4V-5 KBSDG4V-5	30 (1.18)	4 x M6-6g (17-20 Nm)	4 x 1/4"-20 UNC-3A (13-16 lbf ft)
KBHDG5V-5	30 (1.18)	4 x M6-6g (12-14 Nm) Upto 250 bar (18-21 Nm) Upto 315 bar	4 X 1/4"-20 UNC-3A (9-10 lbf ft) Upto 3600 psi (14-16 lbf ft) Upto 4500 psi
KBHDG5V-7	33 (1.3)	4 x M10 (49-59 Nm) + 2 x M6 (9-14 Nm)	4 x 3/8"-16 UNC (36-43 lbf ft) + 2 x 1/4"-20 UNC (7-10 lbf ft)
KBHDG5V-8	42.5 (1.67)	6 x M12 (103-127Nm)	6 x 1/2"-13 UNC (76-93 lbf ft)
KBHDG5V-10	35 (1.38)	6 x M20 (185-220 Nm)	6 x 3/4"-10 UNC-2B (250-300 lbf ft)

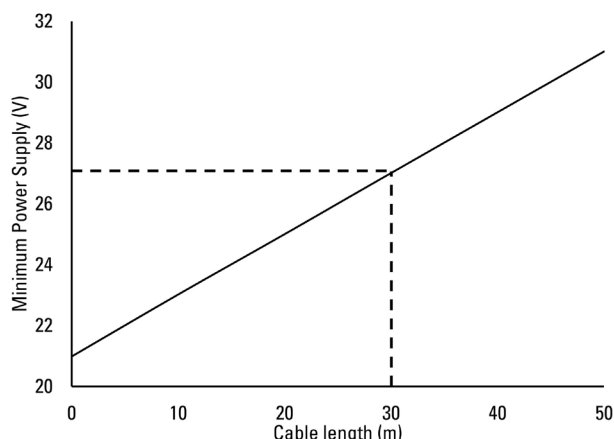
* Minimum actual bolt lengths are the sum of relevant clamping heights plus minimum engagement lengths in ferrous materials. See table below.

Bolt Minimum Engagements

Metric		Inch	
Bolt size	Min. engagement	Bolt size	Min. engagement
M5	10	#10-24	0.39"
M6	10	1/4"	0.39"
M10	13	3/8"	0.52"
M12	16	1/2"	0.63"
M20	35	3/4"	1.38"

2.1.5 Electrical Connections

Before starting to connect cables ensure that all power is switched off. Electrical connections must be made via the 7-pin plug mounted on the amplifier. The recommended cable should have at least 6 cores with pairs of conductors individually screened and an overall braided screen. The maximum recommended cable length is 50 metres. The minimum power supply voltage under full load conditions should be as shown in the following graph. This will ensure that the minimum valve voltage of 21V is maintained at all times.



Command Signals and Outputs, M1

7-pin plug			Flow Direction
Pin D	Pin E		
Positive 0V $U_D - U_E = \text{Positive}$	0V Negative		P to A
Negative 0V $U_D - U_E = \text{Negative}$	0V Positive		P to B

Command Signals and Outputs, M2

7-pin plug			Flow Direction
Pin D	Pin E	Pin B	
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

Command Signals and Outputs, M3

7-pin plug			Flow Direction
Pin D	Pin E		
Positive 0V $U_D - U_E = \text{Positive}$	0V Negative		P to A
Negative 0V $U_D - U_E = \text{Negative}$	0V Positive		P to B

Command Signals and Outputs, M4

7-pin plug			Flow Direction
Pin D	Pin E	Pin B	
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

Command Signals and Outputs, M5

7-pin plug			Flow Direction
Pin D	Pin E	Pin B	
0 to +15 mA	Current return	Power ground	P to A
0 to -15 mA	Current return	Power ground	P to B

Command Signals and Outputs, M6

7-pin plug			Flow Direction
Pin D	Pin E	Pin B	
0 to +20 mA	Current return	Power ground	P to A
0 to -20 mA	Current return	Power ground	P to B

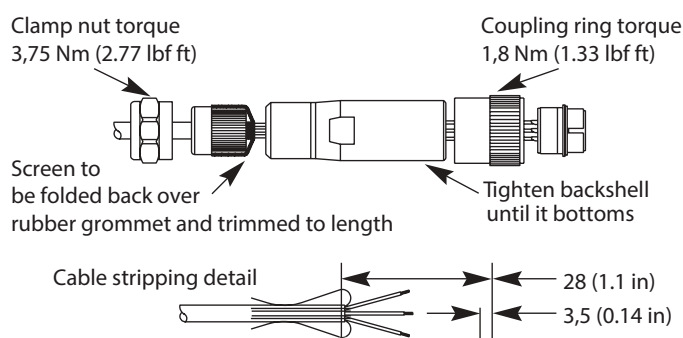
! WARNING

To conform to the requirements of the European Community Directive on Electromagnetic Compatibility (EMC) the valves with integral amplifiers must be fitted with a metal plug. Suitable plugs are:

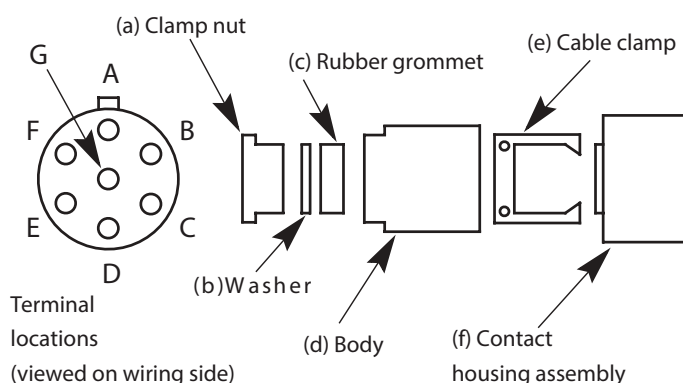
1. Danfoss™ part no. 934939 which also gives environmental protection to IP67 when tightened with a torque of 2-2.5 Nm (1.5-2.0 lbf ft).
2. ITT-Cannon part no.CA06COM-E14SA7S (not available from Danfoss). The plastic plug part no. 694534 is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

Plug Assembly Instructions

The metal 7-pin plug part no. 934939 must be used with this valve to achieve the full EMC specification. The assembly of the plug is as shown in the diagram.



Assembly instructions of plastic plug part number: 694534



Wiring assembly procedure:

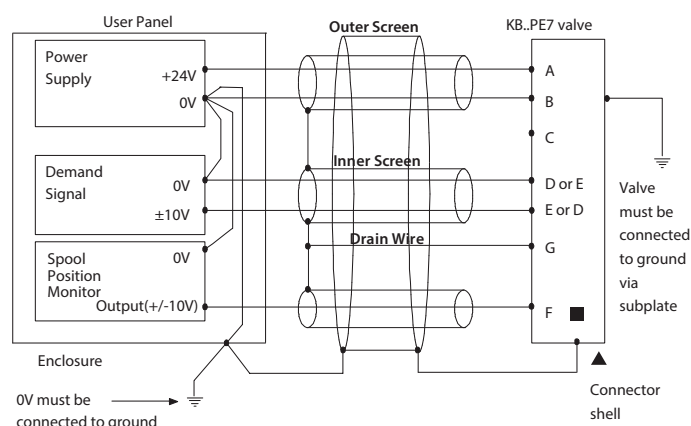
1. Lead the cable through items a, b, c, d and e.
2. Make soldered connections to plug terminals:
 - Pin A- Power supply
 - Pin B- Power 0V
 - Pin C- Enable
 - Pin D- Command signal (see table above)
 - Pin E- Command signal (see table above)
 - Pin F- Output monitor
 - Pin G- Protective ground
3. Push cable-clamp (e) into contact assembly housing (f) and tighten clamp screws.
4. Screw body (d) into (f) and tighten.
5. Push rubber grommet (c) and washer (b) into body (d).
6. Thread clamp nut (a) into body and tighten to firmly clamp the cable.
7. The plug assembly can now be connected to the amplifier.

Connections and Screening

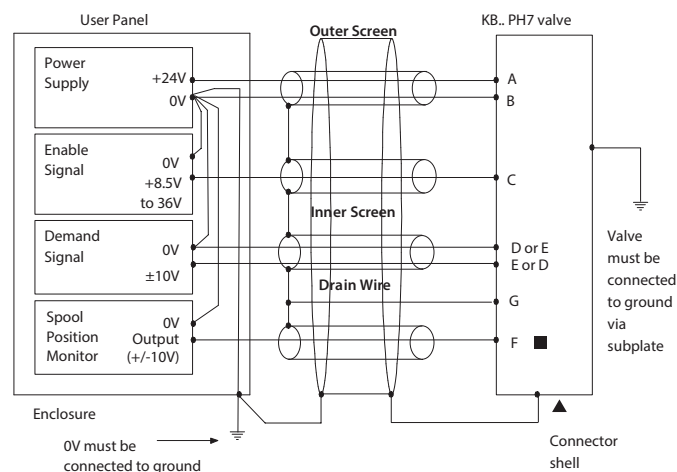
Recommended connection arrangements are shown in following figures.

For more information about these ▲ & ■ symbols, refer to the Symbols section at the end of the wiring diagrams.

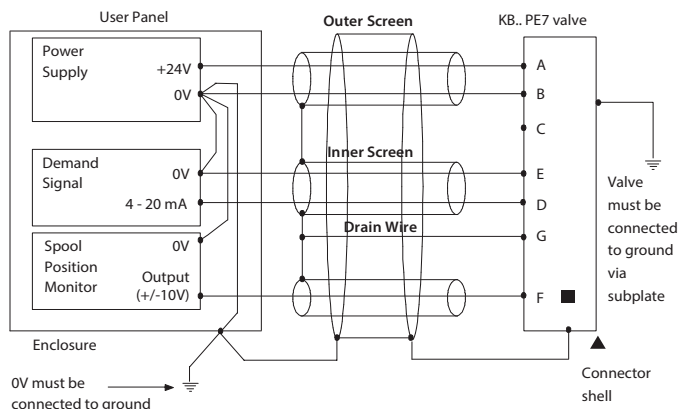
M1 Wiring



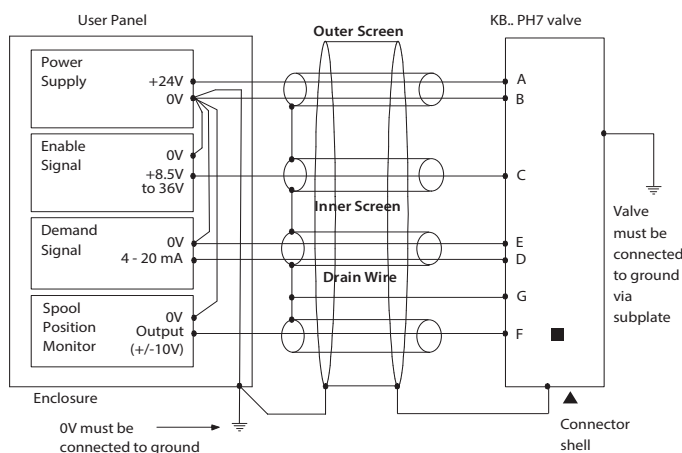
M1 Wiring with enable features



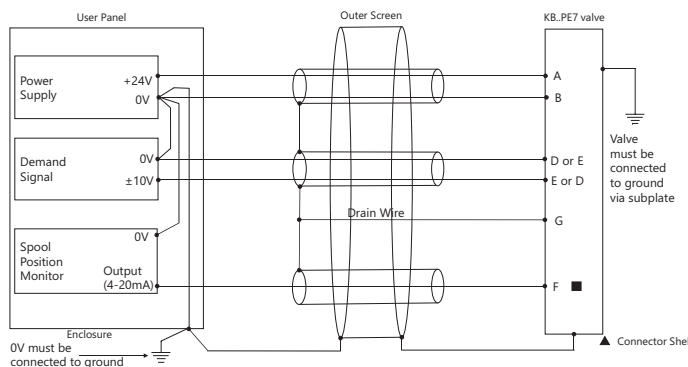
M2 Wiring



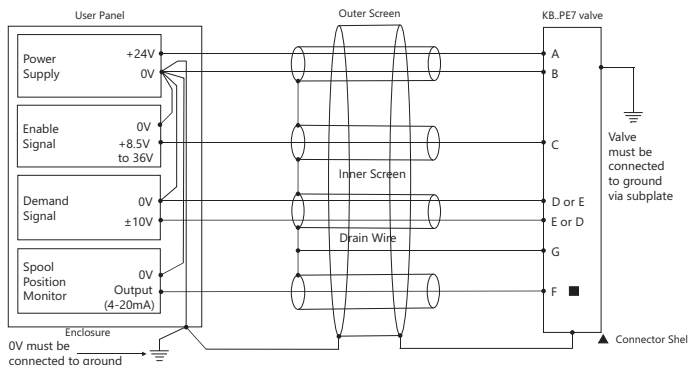
M2 Wiring with enable features



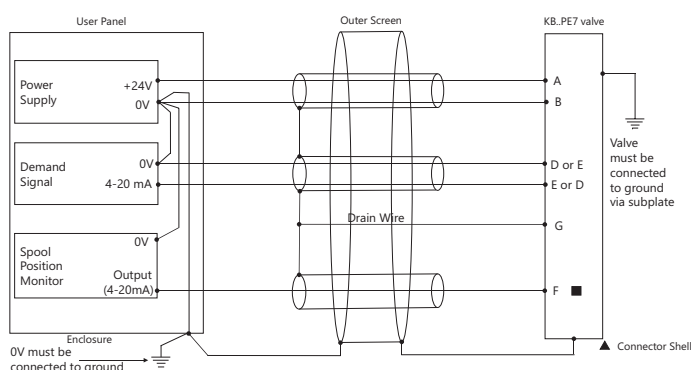
M3 Wiring



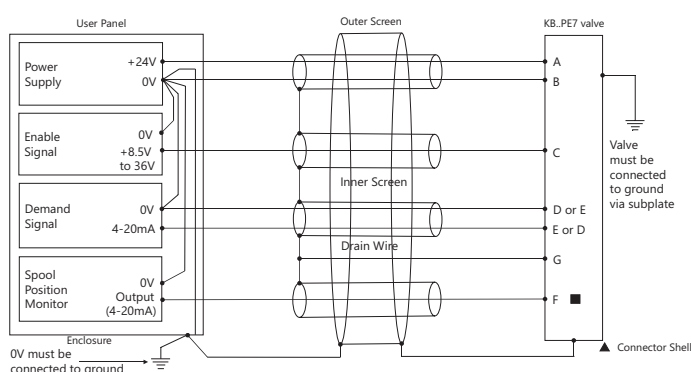
M3 Wiring with enable features



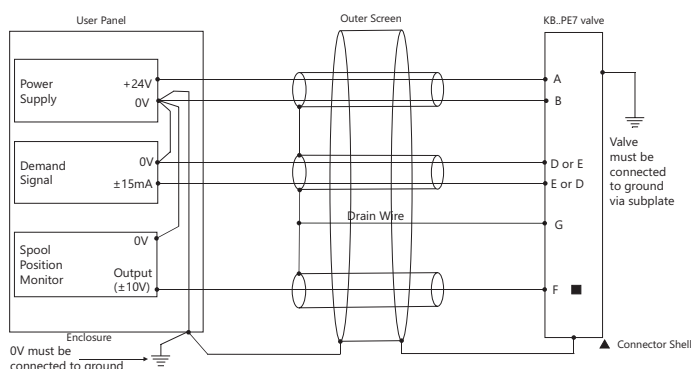
M4 Wiring



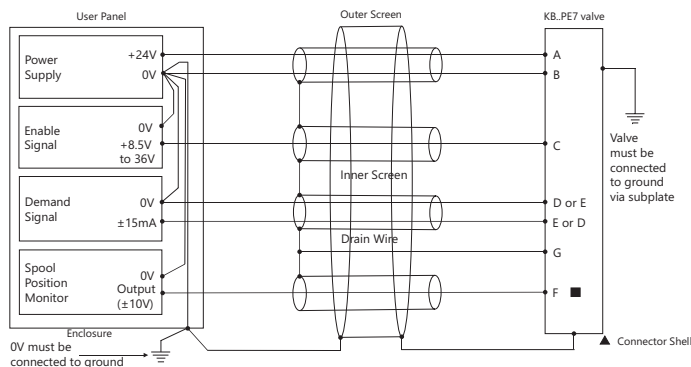
M4 Wiring with enable features



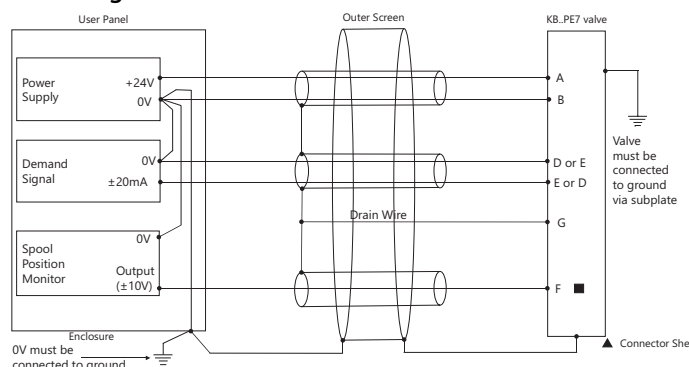
M5 Wiring



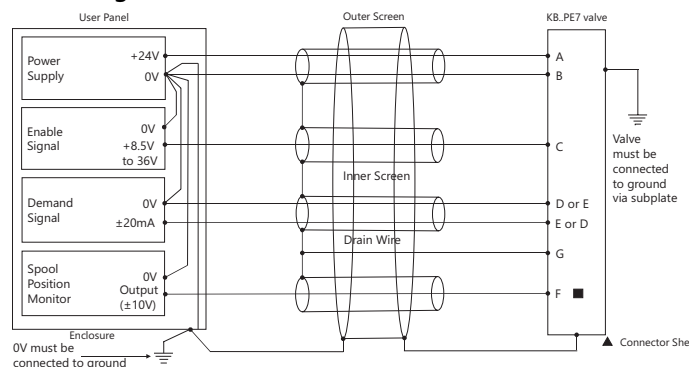
M5 Wiring with enable features



M6 Wiring



M6 Wiring with enable features



▲ **Note:** In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7-pin connector and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potential will result in a screen (shield) ground loop.

■ Spool position monitor voltage (pin F) will be referenced to the KB valve.

⚠ WARNING: Electromagnetic Compatibility (EMC)

It is necessary to ensure that the unit is wired up as above. For effective protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points.

The metal 7-pin connector part no. 934939 should be used for the integral amplifier. In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc.

Difficult environments could mean that extra screening may be necessary to avoid trip interference. It is important to connect the 0V lines as shown above.

The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines. The enable line to pin C should be outside the screen which contains the demand signal cables.

2.1.6 Power and Signal Levels

Power supply.....24V DC (21 to 36V including 10% peak-to-peak ripple)

Command signal..... M1: ±10V, M2: 4-20mA, M3: ±10V, M4: 4-20mA, M5: ±15mA, M6: ±20mA

Monitor signal..... M1: ±10V, M2: ±10V, M3: 4-20mA, M4: 4-20mA, M5: ±10V, M6: ±10V for full travel of output stage spool; output impedance 10 kΩ for voltage output and upto 250Ω for current output.

2.2 Start-up (Single Stage Valves)

Valve models KBFD/TG4V-3/5 and KBSDG4V-3/5 can be checked for correct electrical functioning without any hydraulic supply.

2.2.1 Switch power on and check that the voltage is within the above specification.

2.2.2 The valve will respond to a command signal and can be monitored via the connection from the plug pin F (for pin F voltages, see 2.1.6).

2.2.3 If monitor signal does not follow command signal, check command signal connections to amplifier.

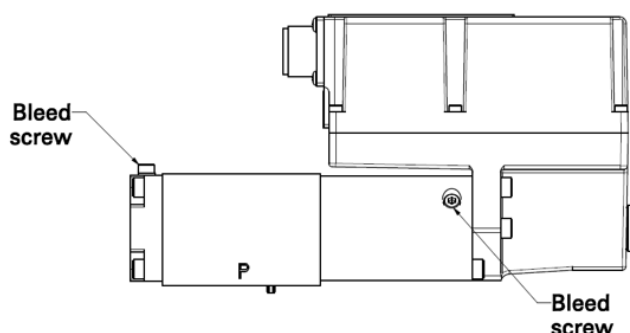
2.2.4 If the valve does not function, check that the external wiring connection between amplifier and LVDT is undamaged and that the LVDT connector plugs are properly mounted. If connections are sound, the valve/amplifier assembly should be replaced and returned to Danfoss Power Solutions for repair.

2.2.5 On the M2 version with 4-20 mA input, to prevent valve electronics shutting down, ensure correct polarity (Pin D positive, Pin E return) and current within a 3.5 to 21 mA range.

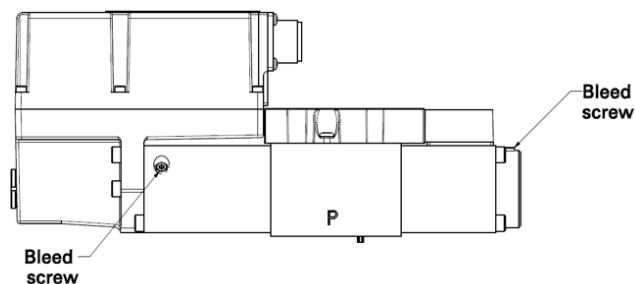
2.2.6 When the valve is working and is fitted correctly, the hydraulic power to the system can be turned on in accordance with the system designer's instructions.

2.2.7 For optimum performance any air should be bled from the valve. If the valve has a pressure of 2 bar (30 psi) or greater in the "T" port, then bleeding can be achieved by slackening the bleed screw(s) and allowing fluid to escape until it is seen to be free of air bubbles. A higher pressure will make the bleeding process faster. If the pressure in the "T" port is too low to bleed the valve an alternative method can be used. Remove the bleed screw(s) completely and pump clean oil into the valve using a suitable force feed oil can until the valve is completely free of air. Replace the bleed screws and torque tighten to 2,5-3,0 Nm (2.0-2.5 lbf ft).

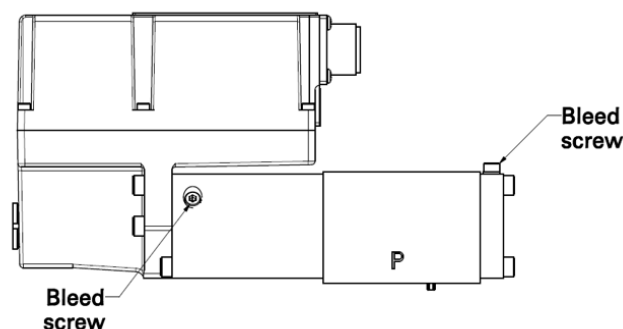
KBSDG Valves



KBFDG Valves



KBFTG Valves



2.3 Start-up (2 Stage Valves)

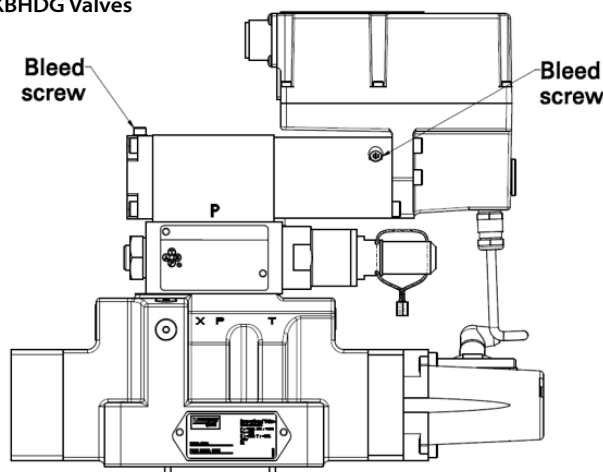
All the procedures for single-stage valves from 2.2 above can be applied to 2-stage valves provided that the valve is supplied with hydraulic pilot pressure (without pilot pressure, the valve main-stage spool will remain in its center position).

2.3.1 Pilot pressures, at port X for "external pilot supply" ("EX" in valve model code) or port P for "internal pilot supply" ("X" in valve model code)

KBHDG5V models..... 50 bar (725 psi) minimum

2.3.2 For optimum performance any air should be bled from the valve. If the valve has a pressure of 2 bar (30 psi) or greater in the "X" port, then bleeding can be achieved by slackening the bleed screw(s) and allowing fluid to escape until it is seen to be free of air bubbles. A higher pressure will make the bleeding process faster. If the pressure in the "X" port is too low to bleed the valve, an alternative method can be used. Remove the bleed screw(s) completely and pump clean oil into the valve using a suitable force feed oil can until the valve is completely free of air. Replace the bleed screws and torque tighten to 2,5-3,0 Nm (2.0-2.5 lbf ft).

KBHDG Valves



3. Replacing on Existing Systems

3.1 Installation

3.1.1 The following are advisory and may not be applicable to specific systems or applications. The user may need to establish procedures to suit the application.



WARNING: Before removing an existing valve:

- Turn off all electrical power.
- Relieve hydraulic pressure. Accumulators must either be isolated from the system by suitable valves or the hydraulic fluid discharged to the reservoir.
- Overhead or positive head reservoirs must be isolated from the system by suitable valves.
- Lower all vertical cylinders.
- Block any cylinders whose movement could generate pressure.

3.1.2 Disconnect electrical plug from the valve.

3.1.3 Before removing valve make provision to prevent any hazard arising from fluid that will drain from exposed mounting surfaces.

3.1.4 Unscrew the valve mounting bolts, removing these and the valve. Keep the valve mounting surface clear of any contamination whilst draining all fluid from it. If returning the valve to Danfoss Power Solutions for repair, fit the protection plate from the new valve after ensuring that all fluid has been drained.

3.1.5 As 2.2 or 2.3

3.1.6 Install the new valve using the existing bolts and electrical plugs if in good condition. If not, refer to sections 2.1.4 and 2.1.5 respectively.

3.2 Re-start-up

3.2.1 Restore the application to its state immediately prior to section 3.1.1.

3.2.2 Proceed as for new valve (section 2.2 or 2.3).