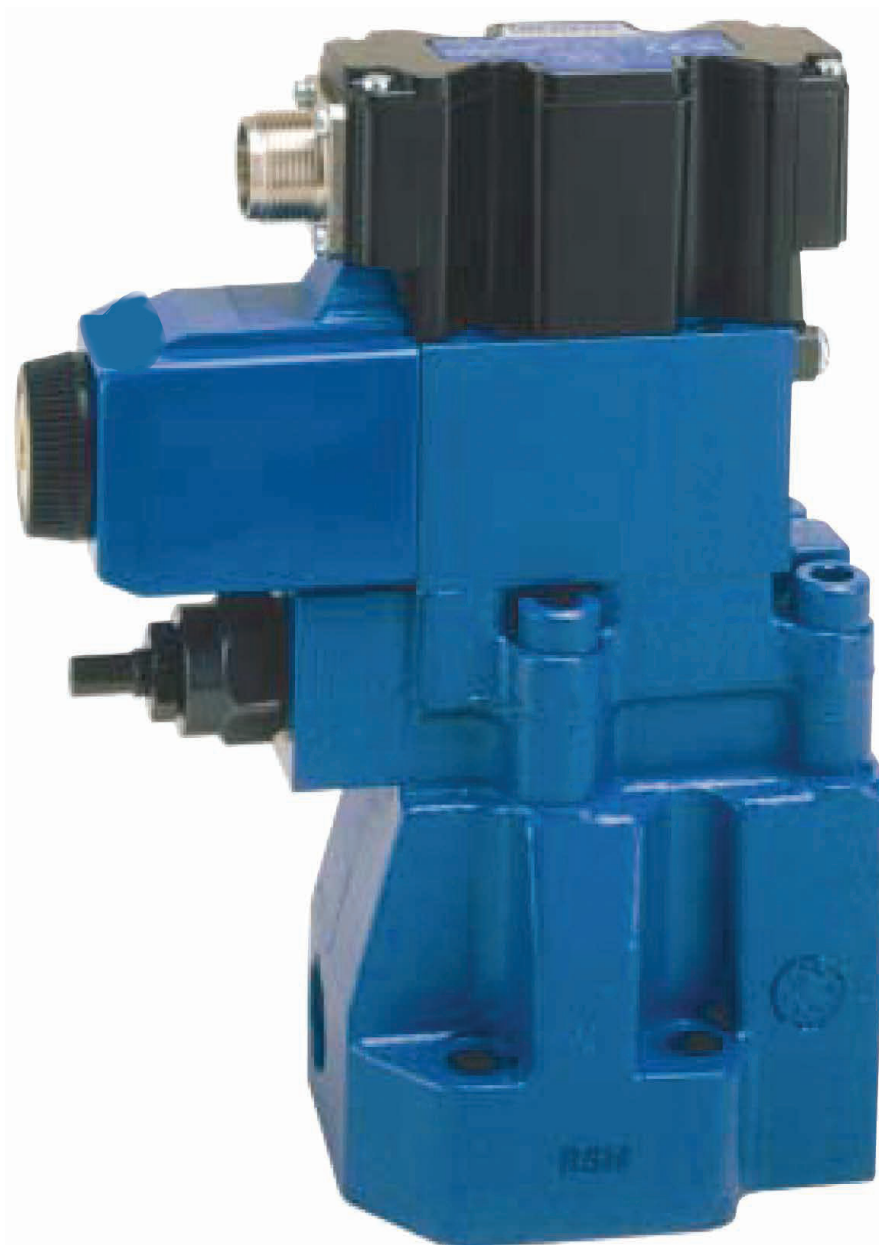


## Installation Guide

AN447083057305en-000101

ENGINEERING  
TOMORROW



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This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 2014/30/EU which repealed Directive 2004/108/EC . For Restriction of Hazardous Substances, complies to (RoHS) Directive 2011/65/EU . For instructions on installation requirements to achieve effective protection levels, see the Installation Wiring Practices for Danfoss' Electronic Products . Wiring practices relevant to this Directive are indicated by  $\Delta$  Electromagnetic Compatibility (EMC) .

# General description

These two-stage pressure relief valves offer extensive application possibilities through their ability to control the pressure setting in proportion to an applied electrical input (up to a pressure limit which is manually adjustable and lockable).

The integral amplifier allows the pressure to be controlled from a low power command signal: either a voltage or current command . The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug . Factory-set adjustments ensure high reproducibility valve-to-valve .

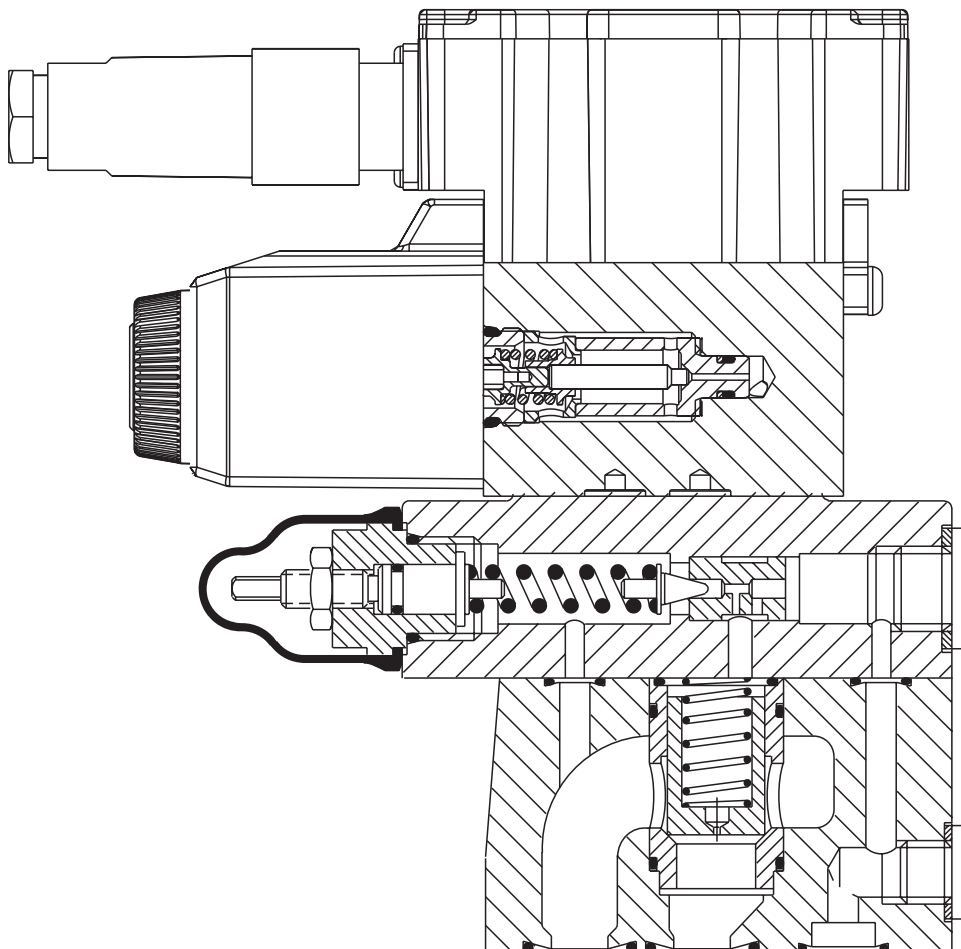
## Basic characteristics

Max . pressure ..... 350 bar (5000 psi)  
Max . flow rate ..... 400 L/min (106 USgpm)

Mounting face to ISO 6264:

For KBCG-6 ..... AR-06-2-A  
For KBCG-8 ..... AS-08-2-A

## Typical section



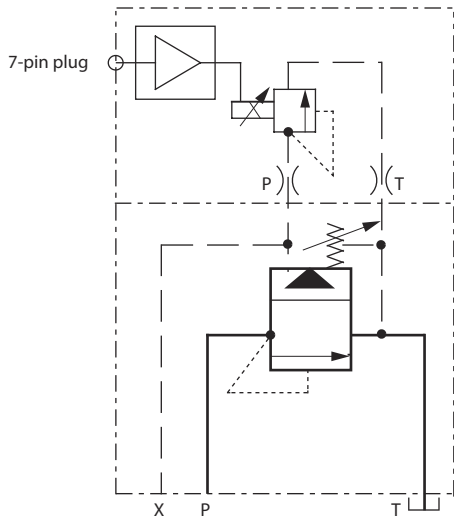
## Features and benefits

- Remote electrical proportional control of pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage elements .
- Low installed cost and space requirement from high power/size ratios (more than double that of many conventional designs) .
- On-board ramp adjustment .

# Functional symbols

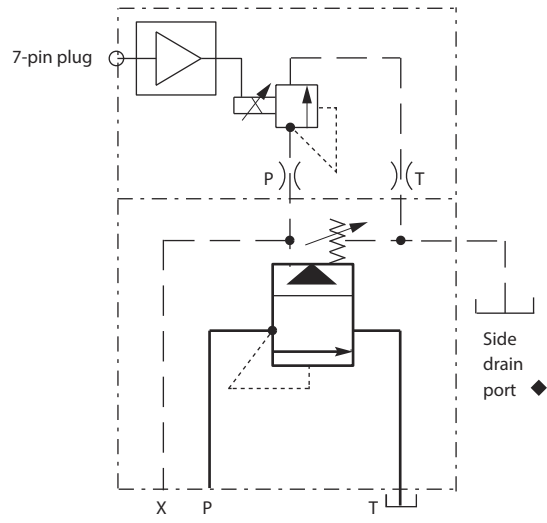
**Manual and electrical pilots internally drained to port T.**

Model code  $\square$  = Blank



**Manual and electrical pilots drained to side drain port  $\blacklozenge$ .**

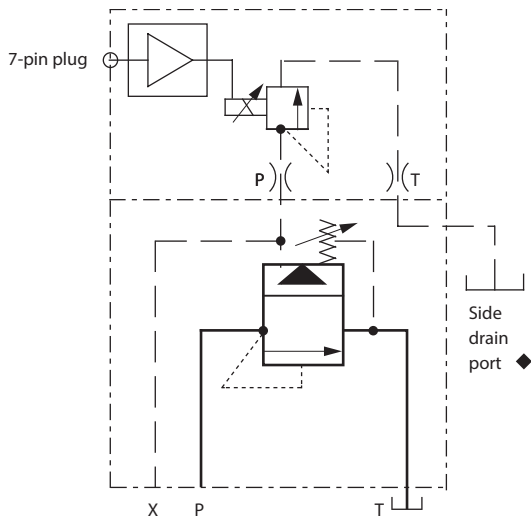
Model code  $\square$  = 1



$\blacklozenge$  Tapped port on side of pilot head .

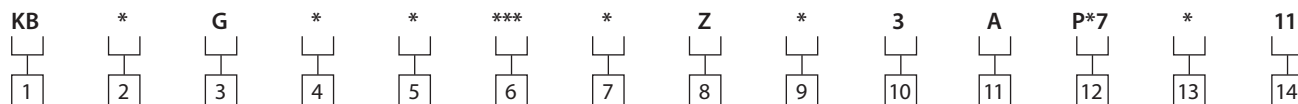
**Manual pilot internally drained to port T; electrical pilot drained to side drain port  $\blacklozenge$ .**

Model code  $\square$  = 3



$\blacklozenge$  Tapped port on side of pilot head .

# Model codes



<b>1</b>	<b>Valve type</b>	KB	Proportional valve with integral amplifier, B series
<b>2</b>	<b>Type</b>	C	Pressure relief
<b>3</b>	<b>Mounting</b>	G	Subplate mounted
<b>4</b>	<b>Interface - ISO 6264</b>		With B port high pressure inlet, A port reduced pressure outlet 6 AR-06-2-A 8 AS-08-2-A
<b>5</b>	<b>Manual adjustment</b>	W	Screw/locknut
<b>6</b>	<b>Controlled pressure range</b>		Based on inlet pressure of 350 bar (5000 psi) . Note, with 100 bar (1450 psi) inlet the lower limits will be 2-3 bar (30-43 psi) lower 40 6-40 bar (87-580 psi) 100 7,75-100 bar (112-1450 psi) 160 8,5-160 bar (125-2300 psi) 250 8,5-250 bar (125-3625 psi) 350 9-350 bar (139-5000 psi)
<b>7</b>	<b>Drain</b>	Blank	Manual and electrical pilots drain internally to T port 1 Manual and electrical pilots drained to side port drain 3 Manual pilot internally drained to T port, electrical pilot drained to side port drain
<b>8</b>	<b>Manual overrides</b>	Z	No overrides

<b>9</b>	<b>Electrical command options</b>	M1	+/- 10 volts control signal
		M2	4-20 mA control signal
<b>10</b>	<b>Ramps</b>	3	Standard ramp for KBCG-6/8 valve types
<b>11</b>	<b>Command/pressure characteristic</b>	A	Standard
<b>12</b>	<b>Electrical connection</b>	PC7	7 pin connector, without plug supplied
		PE7	7 pin connector, with plug supplied
		PH7	As PE7 but with pin 'C' used for enable signal
		PR7	as PC7 but with pin 'C' used for enable signal
<b>13</b>	<b>Coil rating</b>	H1	24V DC amplifier supply
<b>14</b>	<b>Design number, 1* series</b>	11	Subject to change . Installation dimensions unaltered for design numbers 10 to 19 respectively

## WARNING

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Danfoss, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

# Operating data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)

Maximum pressures:

Ports P and X	350 bar (5000 psi)
Port T in KBCG-*-****-Z valves	2 bar (30 psi)
Port T in KBCG-*-****-1/3-Z valves	350 bar (5000 psi)
Side drain port	2 bar (30 psi)

▲ Back pressure at these ports additive to the pressure setting of the valve.

Rated flow at  $\Delta p = 6$  bar (87 psi):

KBCG-6	200 L/min (52.8 USgpm)
KBCG-8	400 L/min (105.7 USgpm)
Vent flow with valve at rated flow	1 L/min (0.26 USgpm)

◆ See "Venting", page 8.

Pilot control drain flow, when valve is limiting system

pressure, i.e. flow P to T occurring:

KBCG-6	1,3 L/min (0.34 USgpm)
KBCG-8	2,0 L/min (0.53 USgpm)

Coil or amplifier rating	24V x 40W max. (22 to 36V including 10% pk.-to-pk. max. ripple)
--------------------------	---

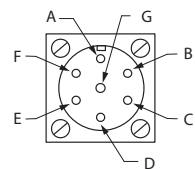
Command signal:

Volts (see model code - 1)	0 to +10V or 0 to -10V
Input impedance	47 k $\Omega$
Common mode voltage to pin B	4V
Current (see model code - 2)	4 to 20 mA
Input impedance	100 $\Omega$

Valve enable signal:

Enable	>9.0V (36V max)
Disable	<2.0V
Input impedance	36 k $\Omega$

7-pin plug connector



View of pins of fixed half

Electromagnetic compatibility (EMC)

Pin Description

- A Power supply positive (+)
- B Power supply 0V and current command return
- C Valve enable (PH7 & PR7)
- D Command signal (+V or current in)
- E Command signal (-V or current GND)
- F Output monitor
- G Protective ground

IEC 61326-2-1 (Electrical equipment for measurement, control and laboratory use)

Conducted Emissions CISPR11 -2015-06 Ed 6.0/EN55011 - Class A, 150kHz to 30MHz

Radiated Emissions CISPR11 -2015-06 Ed 6.0/EN55011 - Class A, 30MHz – 1GHz

RF Continuous Conducted disturbances IEC 61000-4-6, 3Vrms Class A 150 KHz to 80 MHz

RF Electromagnetic Field, 80MHz to 1GHZ, 10V/m; 1.4GHz to 2.7GHz, 3V/m; Meets Criterion A

Surge: IEC 61000-4-5

- DC Power Port :  $\pm 1$ kV
- Signal/Control Port :  $\pm 1$ kV

Electrical Fast Transients IEC 61000-4-4, Class B

- DC Power Port :  $\pm 1$ kV
- Signal/Control Port :  $\pm 0.5$ kV

Electrostatic discharges (ESD) IEC 61000-4-2, Class B

- Air  $\pm 8$ kV
- Contact  $\pm 4$ kV

ROHS Compliance:

Complies with: Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU


Monitor signal (pin F)

1.7 V/amp solenoid current

Output impedance

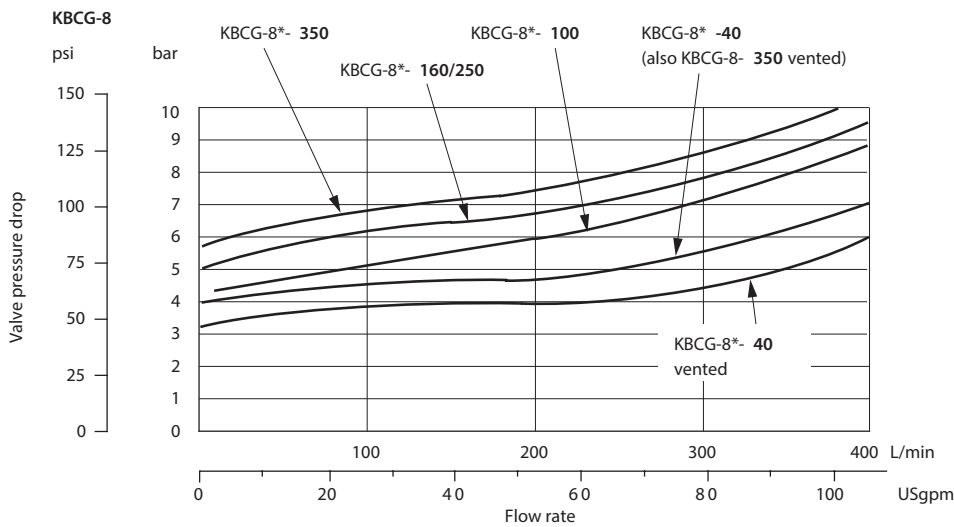
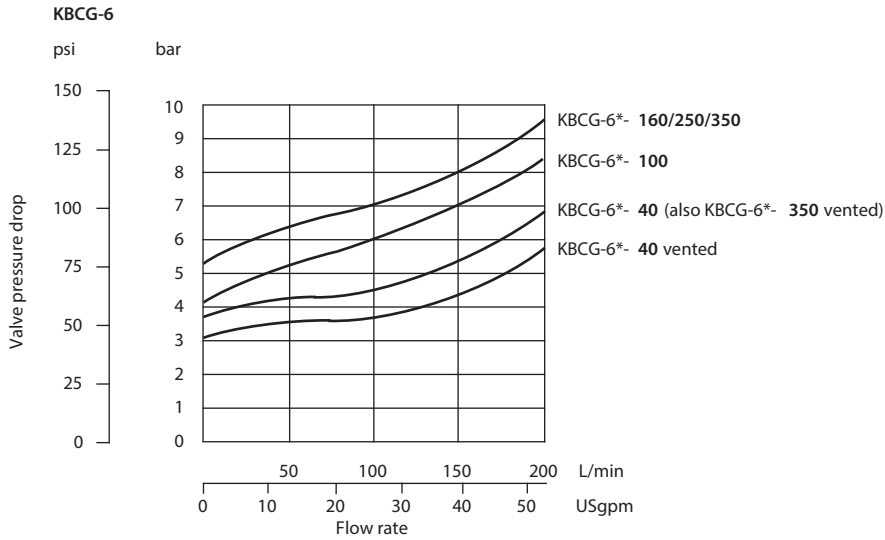
10 k $\Omega$

# Operating data

Pressure gain	See graph
Factory setting - Maximum with 100% command signal.	
Pressure override when relieving and when off-load	See graphs
Linearity, between 10% and 100% of rated pressure:	
KBCG-6 models at 100 L/min (26 USgpm)	<6%
KBCG-8 models at 200 L/min (52 USgpm)	<6%
Hysteresis	<6% (with factory-set dither)
Repeatability	<1.3% of rated pressure
Reproducibility, valve-to-valve (at factory settings):	
Pressure at 100% command signal	≤5%
Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 529, Class IP67
Mass (weight):	
KBCG-6	5,36 kg (11.8 lb)
KBCG-8	6,26 kg (13.8 lb)
Supporting products:	
Auxiliary electronic modules (DIN-rail mounting):	
EHA-CON-201-A-2* Signal converter	See catalog 2410B
EHD-DSG-201-A-1* Command signal generator	See catalog 2470
EHA-RMP-201-A-2* Ramp generator	See catalog 2410B
EHA-PID-201-A-2* PID controller	See catalog 2427
EHA-PSU-201-A-10 Power supply	See catalog 2410B
Subplates, size 03	See catalog 2425
Mounting bolt 	See catalog 2314A
<p><b>Note:</b> If not using Vickers™ by Danfoss recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.</p>	
Mounting attitude	No restriction, provided that the valve is kept full of fluid through port T.

# Performance data

Data is typical with oil at 36 cSt (168 SUS) and at 50°C (122°F)



## Pressure override, off-load

Graphs show the minimum pressures obtainable:

- With 0 mA current to the solenoid coil
- When the valve is vented (see following explanation)

## Venting

When the vent port X (or alternative vent port in the valve body) is connected to the reservoir via a suitable 2-way pilot valve, the mainstage of the relief valve opens to allow full flow from P to T at low pressure drop. The minimum pressure drop is obtained when the pilot valve is also de-energized. The total pressure drop through the venting 2-way valve and pipework is additive to the pressure at P.

While the valve is vented the system pressure cannot be controlled via the proportional solenoid.

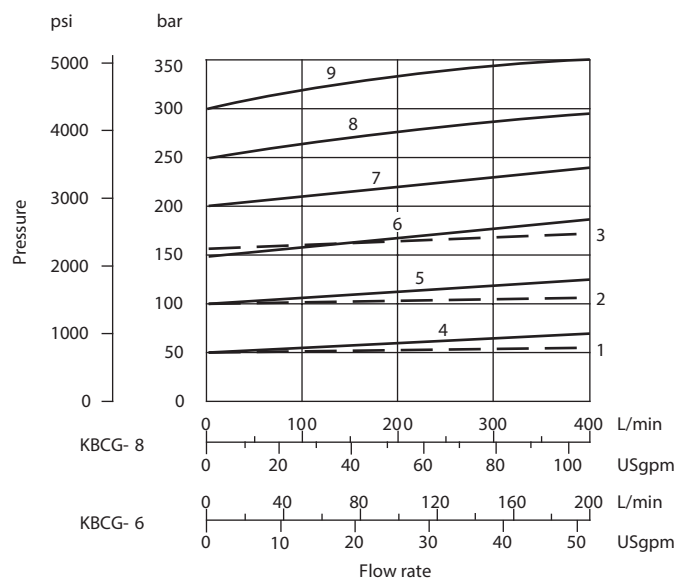
This control feature is frequently used during off-load periods in machine cycle times. If lower off-load system pressures are required then additional full flow unloading valves are recommended, e.g. Vickers™ by Danfoss CV series cartridge valves

Note: All valves are with pilot valve de-energized.

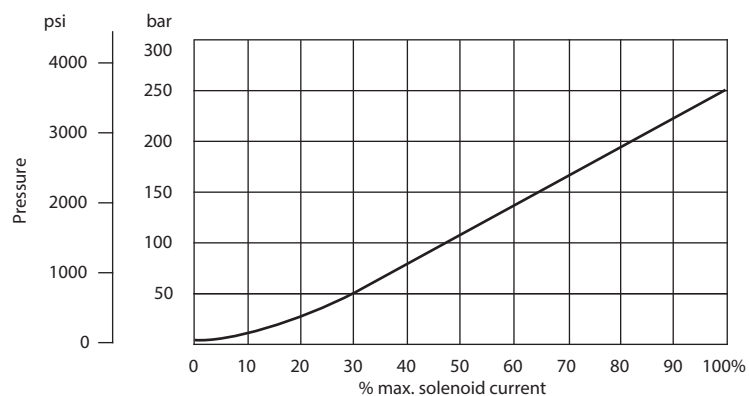


# Performance data

## Pressure override when relieving



Model	Curve number								
	1	2	3	4	5	6	7	8	9
KBCG-**-40	.								
KBCG-**-100	.	.							
KBCG-**-160	.	.	.						
KBCG-**-250				.	.	.	.	.	.
KBCG-**-350				.	.	.	.	.	.



Valve size	Test conditions: Trapped volume	Flow rate	Step size: Pressure demand	Response Time (ms)
6	2,0 liters (0.53 USg)	100 L/min (26 USgpm)	0 to 100%	100
			100% to 0	70
			25 to 100%	40
			100 to 25%	50
8	4,0 liters (1.06 USg)	200 L/min (52 USgpm)	0 to 100%	110
			100% to 0	70
			25 to 100%	50
			100 to 25%	65

## Pressure gain

Typical pressure versus command signal response of KBCG-6-250 model .

## Step response

KBCG models with factory-set gain .

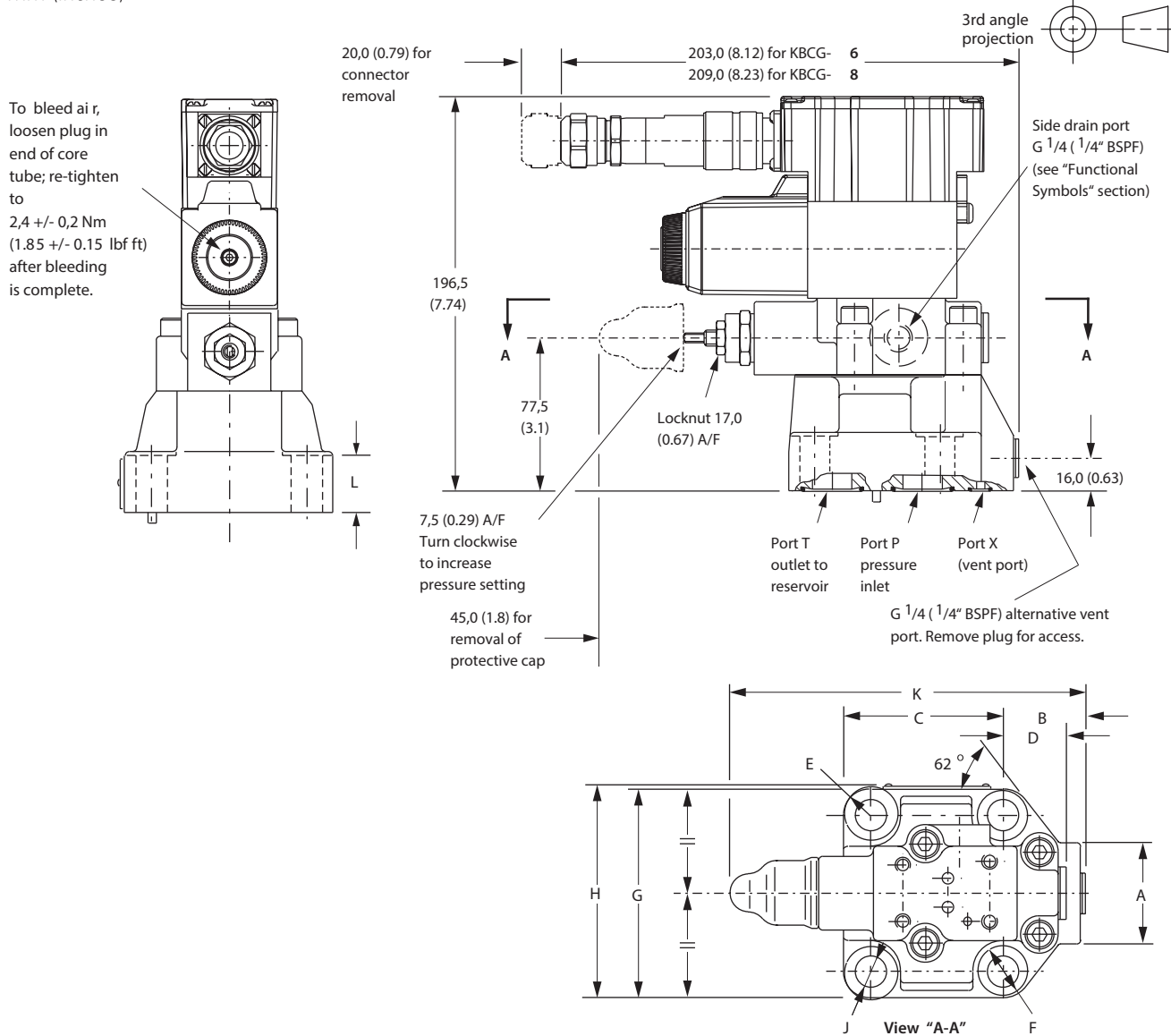
Test method

1. Trapped volume between pump and test valve, as in table .
2. Flow rate set at pump, as in table .
3. Response = time from step input signal until pressure reaches 90% of step change, as measured by transducer .

# Installation dimensions

## KBCG-6/8 models

Dimensions are shown in mm (inches)

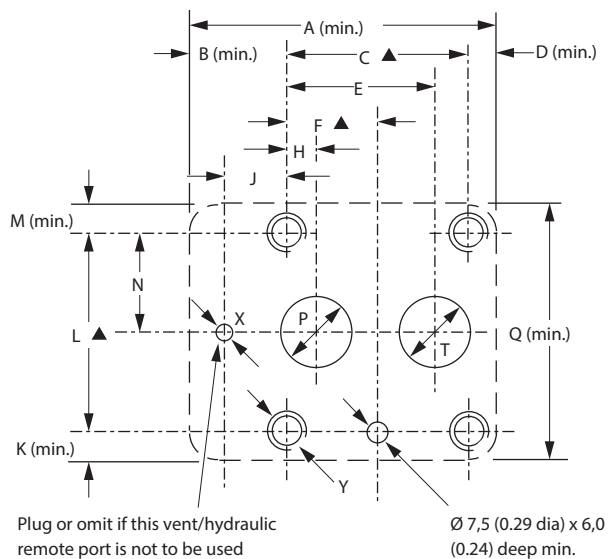


### WARNING

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Danfoss, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Model	A	B	C	D	E RAD	ØF (DIA)
KBCG-6	58,0 (2.3)	35,0 (1.4)	68,0 (2.7)	35,0 (1.4)	12,0 (0.5)	20,0 (0.78)
KBCG-8	42,0 (1.7)	39,0 (1.54)	83,0 (3.3)	30,0 (1.2)	16,0 (0.63)	26,0 (1.02)
Model	G	H	ØJ (DIA)	K	L	
KBCG-6	79,0 (3.1)	82,0 (3.23)	13,5 (0.53)	176,0 (7.0)	20,0 (0.78)	
KBCG-8	103,0 (4.1)	106,0 (4.2)	17,0 (0.7)	183,0 (7.2)	25,0 (1.0)	

# Installation dimensions



## Mounting surfaces,

ISO 6264

AR-06-2-A

AS-08-2-A

When a subplate is not used, a raised pad must be provided for mounting. The pad must be flat within 0,001 mm/100 mm (0.0001"/10") and smooth within 0,8 µm (32 µin). Dimensional tolerances are ±0,2 mm (±0.008") except where indicated.

Port functions:

P = Pressure inlet

T = Outlet to reservoir

X = Vent, or remote control port

Size	A	B	C	D	E	F	H	J	K	L
AR-06	80 (3.2)	13,1 (0.5)	53,8 (2.12)	13,1 (0.5)	47,5 ◆ (1.87)	22,1 (0.87)	22,1 ◆ (0.87)	0	13,1 (0.5)	53,8 (2.12)
AS-08	118 (4.7)	35,0 (1.4)	66,7 (2.63)	16,3 (0.7)	55,6 (2.19)	33,4 (1.35)	11,1 (0.44)	23,8 (0.94)	16,0 (0.63)	70,0 (2.76)

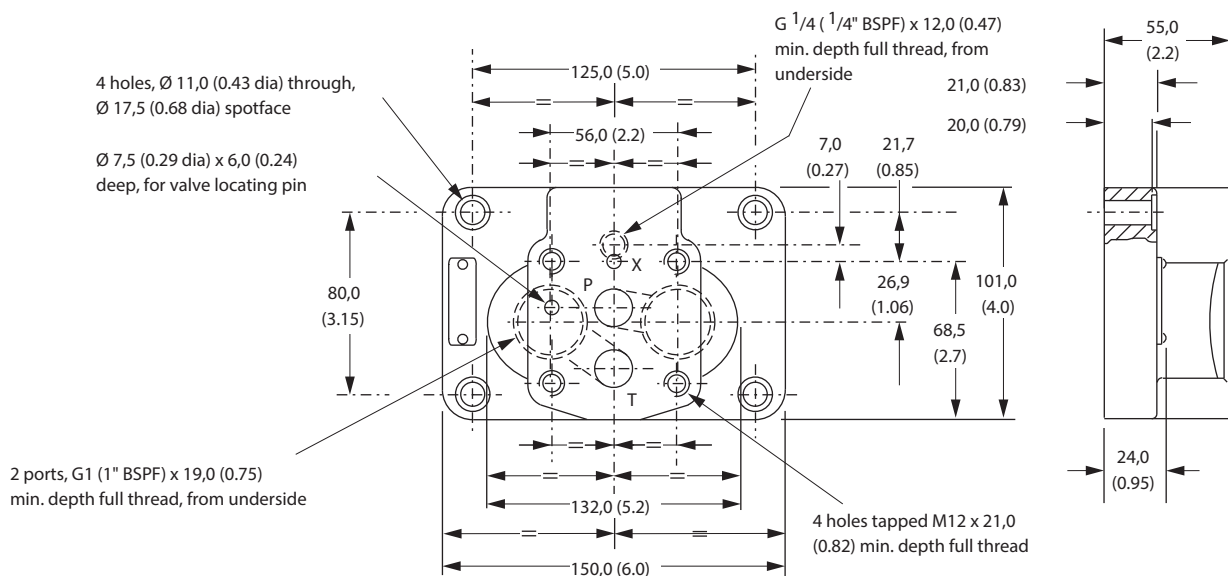
Size	M	N	ØP (DIA)	Q	ØT (DIA)	ØX (DIA)	Y Thread x Min. Full thread Depth
AR-06	13,1 (0.5)	26,9 (1.06)	14,7 (0.58)	80 (3.2)	14,7 (0.58)	4,8 (0.19)	M12 x 21 (7/16" UNF x 0.8)
AS-08	16,0 (0.63)	35,0 (1.38)	23,4 (0.92)	102 (4.0)	23,4 (0.92)	6,3 (0.25)	M16 x 30 (5/8" UNF x 1.2)

▲ Tolerance on bolt and pin locations ±0,1 mm (±0.004").

◆ These ISO standard dimensions can be used, but improved flow paths to and from valve are obtained by using 48,0 (1.89) instead of 47,5 (1.87), and 22,6 (0.89) instead of 22,1 (0.87).

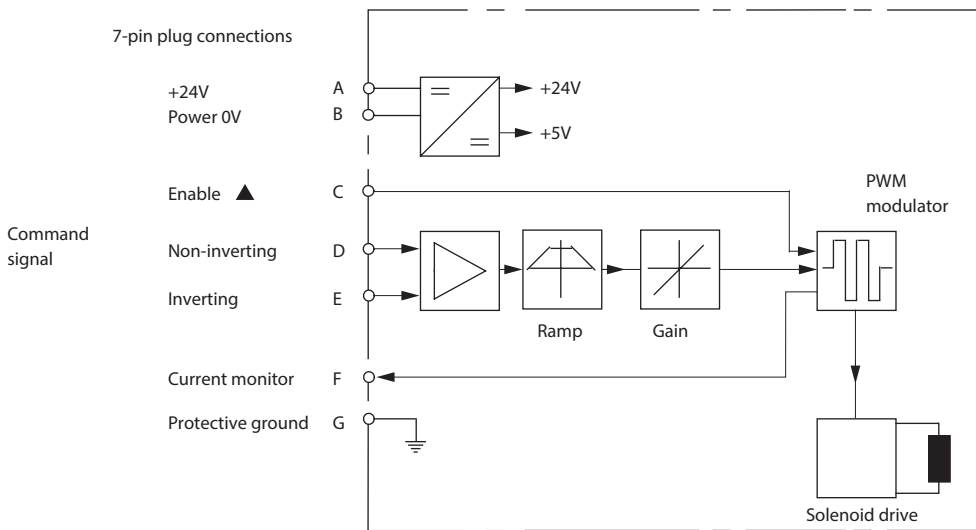
● ISO standard does not give UNC bolt sizes. These are recommended equivalents to metric sizes specified in the standard.

## CGVM-6-10-R Subplate



# Electrical information

## Block diagram



▲ In valves with PH7 or PR7 type electrical connection .

## Wiring

Connections must be made via the 7-pin plug mounted on the amplifier . Recommended cable sizes are:

### Power cables

For 24V supply:  
0,75 mm<sup>2</sup> (18 AWG) up to 20m (65 ft)

1,00 mm<sup>2</sup> (16 AWG) up to 40m (130 ft)

### Signal cables

0,50 mm<sup>2</sup> (20 AWG)

### Screen (Shield)

A suitable cable should have at least 6 cores with pairs of conductors individually screened and an overall screen . Cable outside diameter 8,0-10,5 mm (0.31- 0.41 inches) . See connection diagrams on next page .



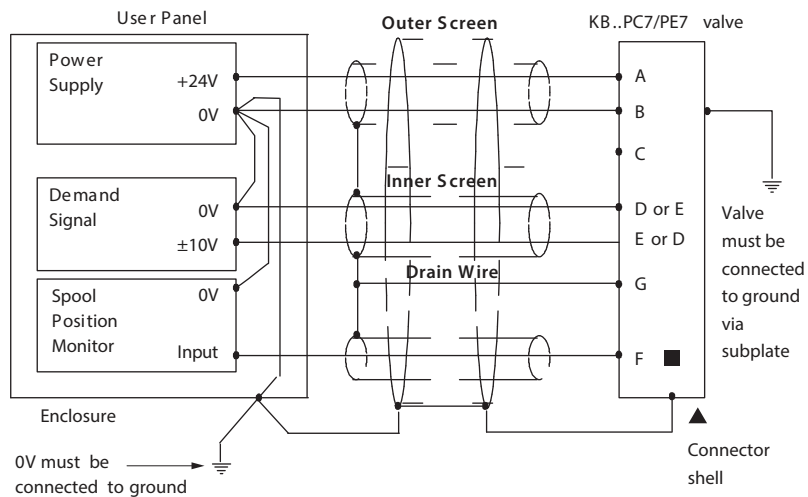
## WARNING

All power must be switched off before connecting or disconnecting any plugs.

# Electrical information

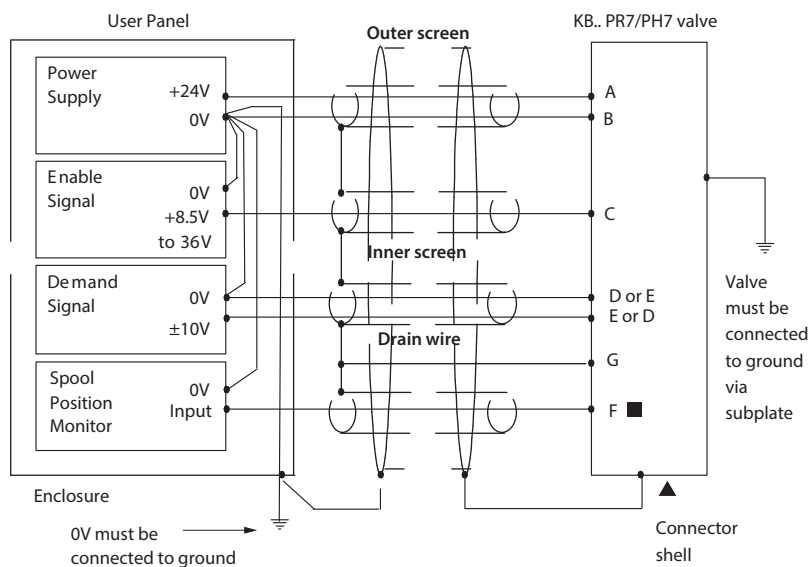
## Voltage input (M1) wiring

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



## Wiring connections for M1 valves with enable feature

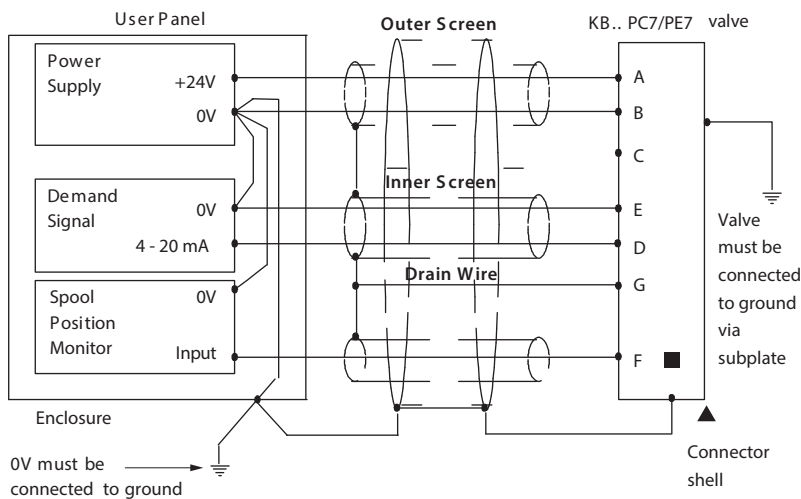
**Note:** ▲ In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground . Proper earth grounding practices must be observed in this case, as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



# Electrical information

## Current input (M2) wiring

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

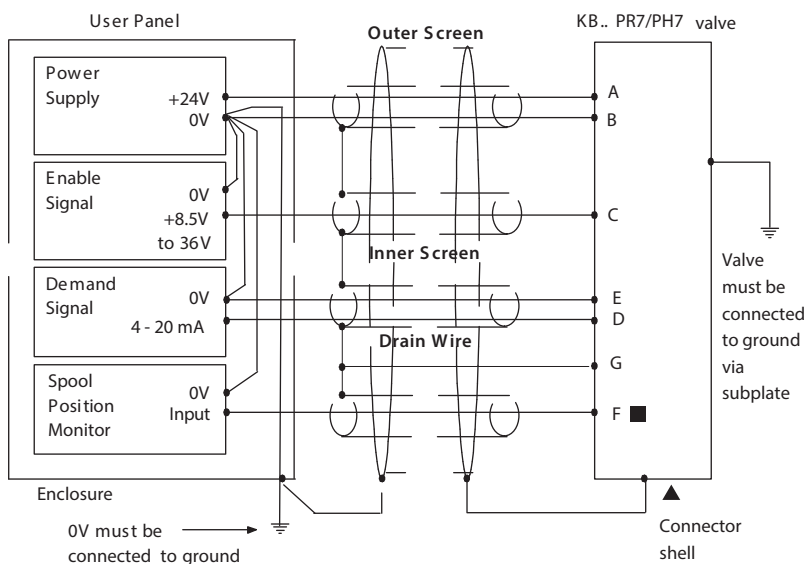


## **⚠ WARNING**

**Electromagnetic Compatibility (EMC)**  
It is necessary to ensure that the valve is wired up as above. For effective protection the user 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 sources 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 the 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.

## Wiring connections for M2 valves with enable feature

**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 potentials will result in a screen (shield) ground loop.



# Further information

## Hydraulic fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils ... LHM  
Non-alkyl based phosphate esters ..... L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS) . For further technical information about fluids see 694 .

## Contamination control requirements

Recommendations on contamination control methods and the selection of products to control fluid condition are included in publication 9132 or 561, "Guide to Systemic Contamination Control" . The book also includes information on the concept of "ProActive Maintenance" . The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

For products in this catalog the recommended levels are:

Up to 210 bar (3000 psi) ..... 18/16/13  
Above 210 bar (3000 psi) ..... 17/15/12

## Installation and start-up guidelines

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid .

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw . This task is easier if the valve has been mounted base downwards . Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed .

## Temperatures

For petroleum oil:  
Min ..... -20°C (-45°F)  
Max ..... +70°C (158°F)

For fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Danfoss representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids" .

Ambient for:  
Valves at full performance specification: -20 to +70°C (-4 to +158°F) .

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response .

Storage:  
-25 to +85°C (-13 to +185°F)

## Seal kits

Pilot valve:  
KBCG-3 ..... 02-145869  
Mainstage valves:  
KBCG-6 ..... 614824  
KBCG-8 ..... 614931

#### Products we offer:

- Cartridge valves
- DCV directional control valves
- Electric converters
- Electric machines
- Electric motors
- Gear motors
- Gear pumps
- Hydraulic integrated circuits (HICs)
- Hydrostatic motors
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- PLUS+1® controllers
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- PLUS+1® software services, support and training
- Position controls and sensors
- PVG proportional valves
- Steering components and systems
- Telematics

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