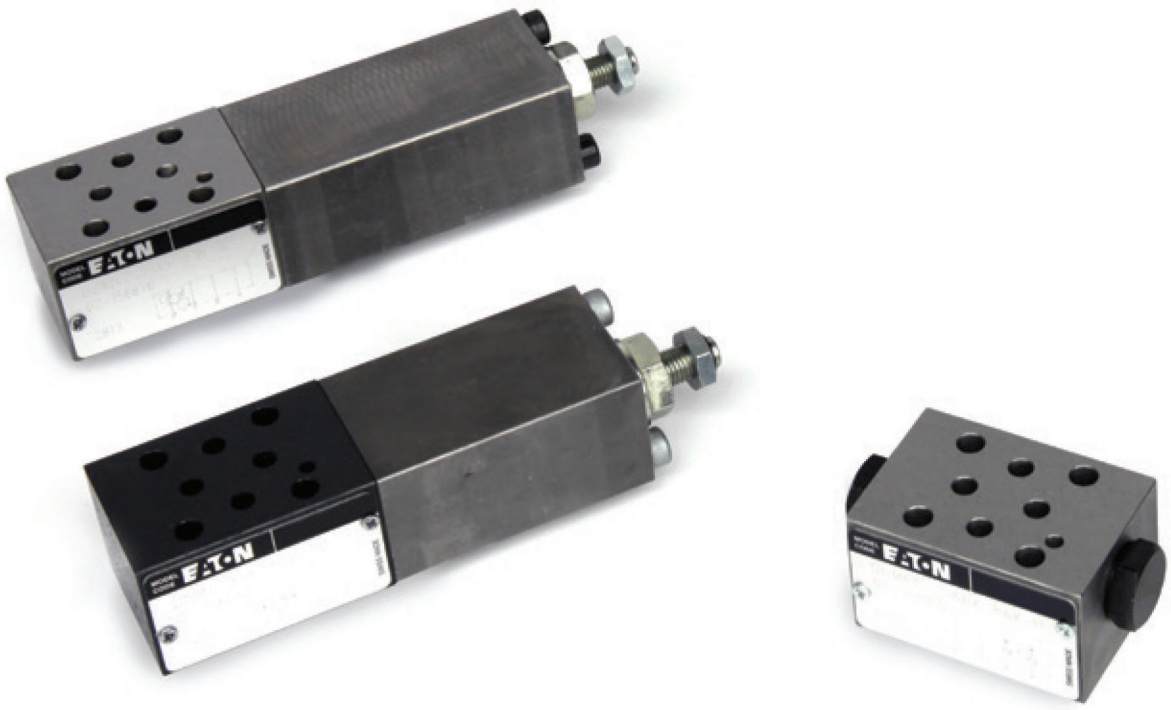
DGM**-2 10 Design

ISO4401 Size 02;
ANSI/B93.7M-D02



Powering Business Worldwide

SystemStak™ Valves

ISO4401 Size 02

Reduce System Space Requirements

SystemStak valves make compact hydraulic systems in which specific function valves are "sandwich' mounted between a directional valve and a standard mounting surface.

The design of this range of small stacking valves is based on the well proven Eaton DGM**-3, size 3 System Stak valves, and offers opportunities for achieving very small, compact control assemblies, especially when used with multi-point subplates.

Reduce Cost

SystemStak valves eliminate intervalve piping and leak-prone tube and pipe connections. Installed cost is less than when using conventional valves.

Easy to Understand, Easy to Design

SystemStak valves have all the internal passages necessary to serve the directional valve mounted on top of them. Mounting surfaces and port patterns are to the international standard: ISO/DIS 4401-02-02.

Rugged and Reliable

Internal working parts are produced from hardened steel and mounted in free machining mild steel bodies. All seals are Viton®.Excellent reliability is ensured. Working parts on most models are accessible without removing valves from an assembled stak.

Viton® is a registered trademark of E.I. DuPont

Valve Placement

SystemStak valves are divided into two groups:

1. Valves acting in the pressure and/or tank lines ("P" and/or "T")

DGMC	Relief valve
DGMDC	Direct check
DGMFD	Flow divider
DGMFN	Flow control
DGMFG	Pressure compensated flow control
DGMR1	Sequence valve
DGMX2	Pressure reducing

The general rule for this group is that the DGMC relief valve be placed nearest the subplate or manifold.

The DGMDC direct check valve should be placed nearest the directional control valve.

The DGMR1 sequence valve should be the farthest valve from the directional valve. The DGMR1 must be mounted directly to a subplate or manifold with a drain port, to externally drain the DGMR1 at the mounting face.

2. Valves acting in the service lines ("A" and/or "B")

DGMC	Relief valve
DGMC2	Dual relief valve
DGMFD	Flow divider
DGMDC	Direct check
DGMPC	Pilot operated check
DGMFN	Flow control
DGMR	Counterbalance

The general rule for this group is that the DGMC system relief valve be the farthest valve from the directional valve. When using a DGMPC with a DDMFN (meter-out), the DGMPC should be nearest the directional valve.

L

Easy to Understand, Easy to Design

SystemStak circuitry is best shown using slightly different symbols than those for traditional valve configurations. Each SystemStak symbol has the same basic form and size as shown in Figure 1.

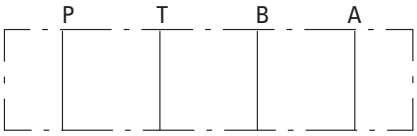


Figure 1.

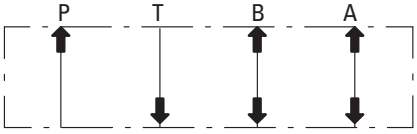


Figure 2.

For ease of understanding, remember the directions of flow for each line, and that all four flow paths pass through each valve (see Figure 2). For clarity, directional valves are drawn vertically in SystemStak circuit diagrams (see Figure 3.)

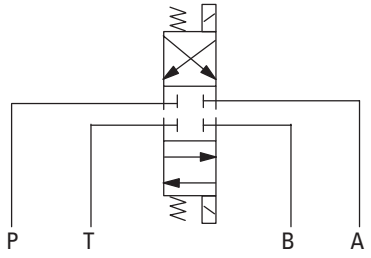


Figure 3.

Each station (valve stack) is a combination of functions. When designing and assembling SystemStak valves, care must be taken to ensure that they interact as required by stacking the functions in the correct sequence (see Figure 4). Relief valves should normally be positioned next to the mounting surface (i.e. at the bottom of the stack). When both a flow control and a pilot operated check valve are required, it is recommended that the flow control valve be between the check valve and the actuator to prevent check valve chatter.

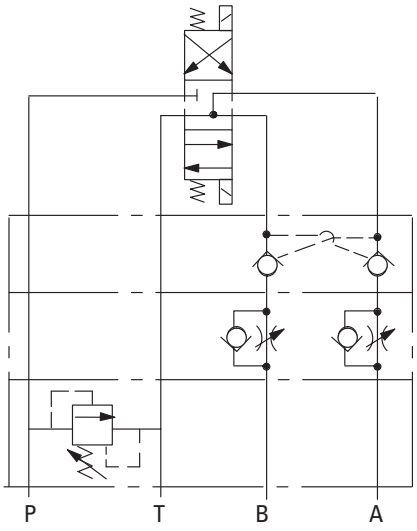


Figure 4.

A combination of directional valve, SystemStak valve(s) and subplate/manifold block (Figure 5 single station subplate and Figure 6 multi station manifold) completes the assembly.

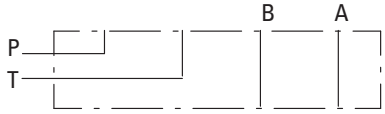


Figure 5.

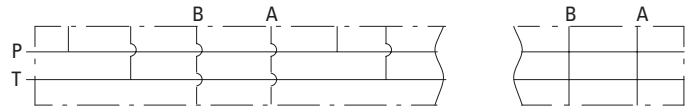


Figure 6.

Figure 7 represents a complete SystemStak system, showing typical use of functions available from this range. The circuit diagram also shows the use of a tapping plate for accessing line pressure readings, and a blanking plate to close off an unused station of a multi-station manifold.

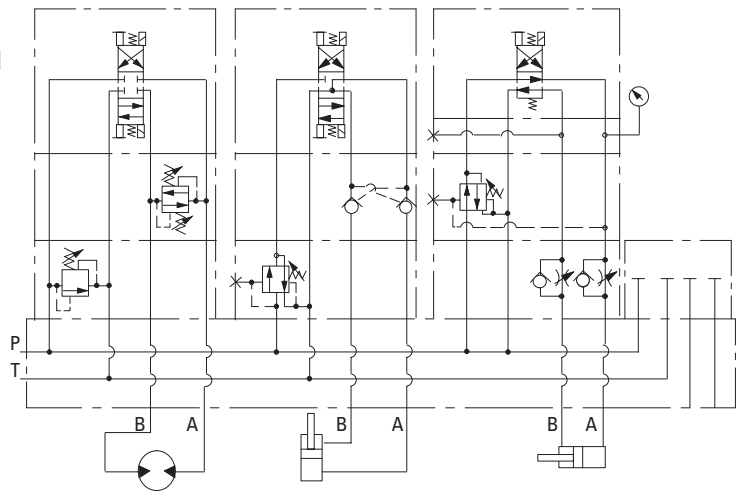
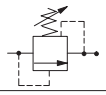
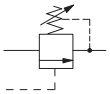
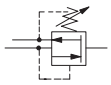
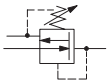
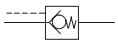
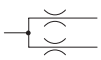


Figure 7.

L

Table of Contents

Function	Basic symbol	Basic model	Features	Page
Relief		DGMC	Single, dual and crossport models	3
Pilot relief		DGMC	Pilot operated relief valve	9
Counterbalance		DGMR	Control in port T	11
Sequence		DGMR1	Single port P sequence	11
Reducing		DGMX	Piloted from (and reduced pressure in) port P, A or B	11
Direct check		DGMDC	Single check in any port; dual check in ports A and B only	15
Pilot operated check		DGMPC	Single in port A or B; dual in ports A and B	17
Pressure compensated flow control		DGMFG	Single line, without check valve	20
Flow regulator valves		DGMFN	Flow restrictor	22
Flow divider valve		DGMFD	Divides flow equally	25

L

SystemStak™ Direct Relief Valves

DGMC-2-1* series

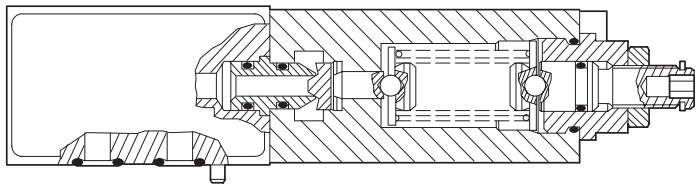
DGMC2-2-1* series

General description

These adjustable direct-acting pressure relief valves limit the maximum pressure in the line(s) controlled by the integral relief valve elements.

Pressure adjustment options are screw/locknut, handknob and micrometer type with keylock.

Typical Sectional View



Model Code

DGM C (2) – 2 – ** – * * (–B* – * *) – 1*

1 2 3 4 5 6 7 8 9 10

1 Model Series
Manifold or gasket mounted

2 Relief valve
C – Pressure relief (single)
C2 – Dual relief

3 Interface
2 – ISO4401-02-02

4 First function
Single relief, or first line of dual models

Code	Pressure limited in	Discharge into	Usage
PT	P	T	Single
AB	A	B	Single or dual with BA
BA	B	A	Single
AT	A	T	Single or dual with BT
BT	B	T	Single

5 Pressure adjustment range
B – 2 – 40 bar (29-580 psi)
C – 30 – 100 bar (435-1450 psi)
F – 70 – 160 bar (1000-2300 psi)
G – 120– 250 bar (1740-3600 psi)

6 Adjustment type
H – Handknob
K – Micrometer withkeylock
W – Screw and locknut

7 Second function
(Omit for single line models)

Code	Pressure limited in	Discharge into	Usage
BA	B	A	Dual with AB
BT	B	T	Dual with AT

8 Pressure adjustment range
B – 2 – 40 bar (29-580 psi)
C – 30 – 100 bar (435-1450 psi)
F – 70 – 160 bar (1000-2300 psi)
G – 120– 250 bar (1740-3600 psi)

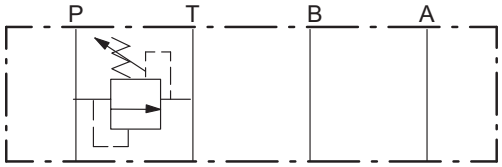
9 Adjustment type
H – Handknob
K – Micrometer with keylock
W – Screw and locknut

10 Design
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

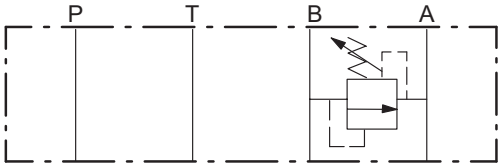
L

Functional Symbols

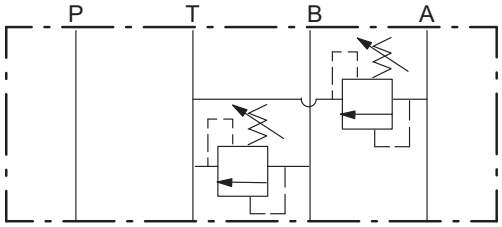
DGMC-2-PT-**



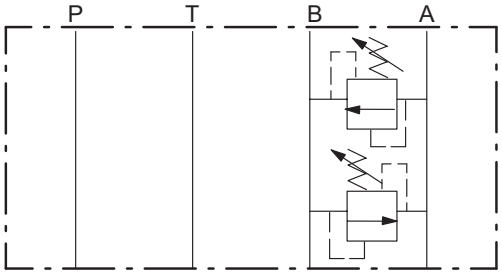
DGMC-2-BA-**



DGMC-2-AT-**-BT-**



DGMC-2-AB-**-BA-**



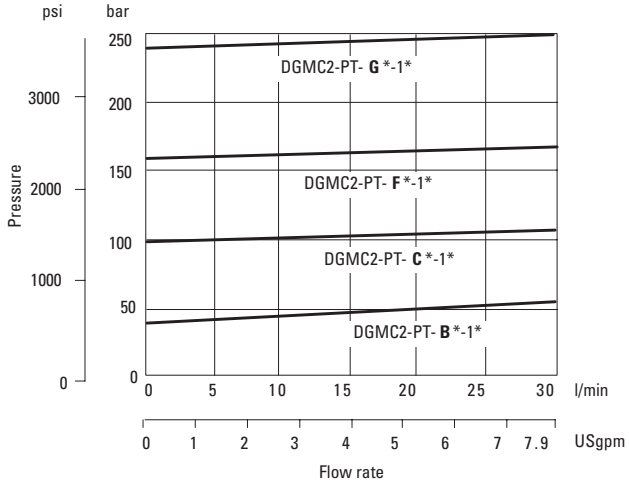
Operating Data

Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate DGMC DGMC2	 0,78 kg (1.7 lb.) 1,21 kg (2.7 lb.)
Mounting attitude	No restrictions.

Performance Data

Pressure Override

Typical performance for PT models at maximum pressure settings with mineral oil at 21 cSt (102 SUS) and at 50°C (122°F).



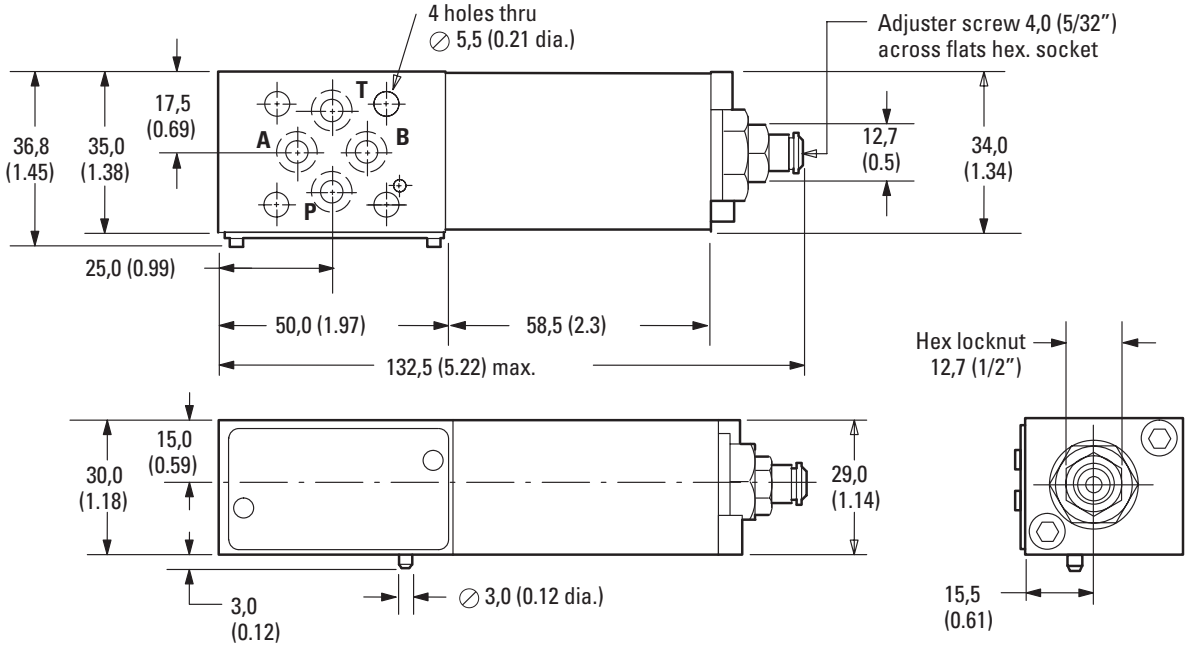
For other viscosities refer to appendix.

Installation Dimensions

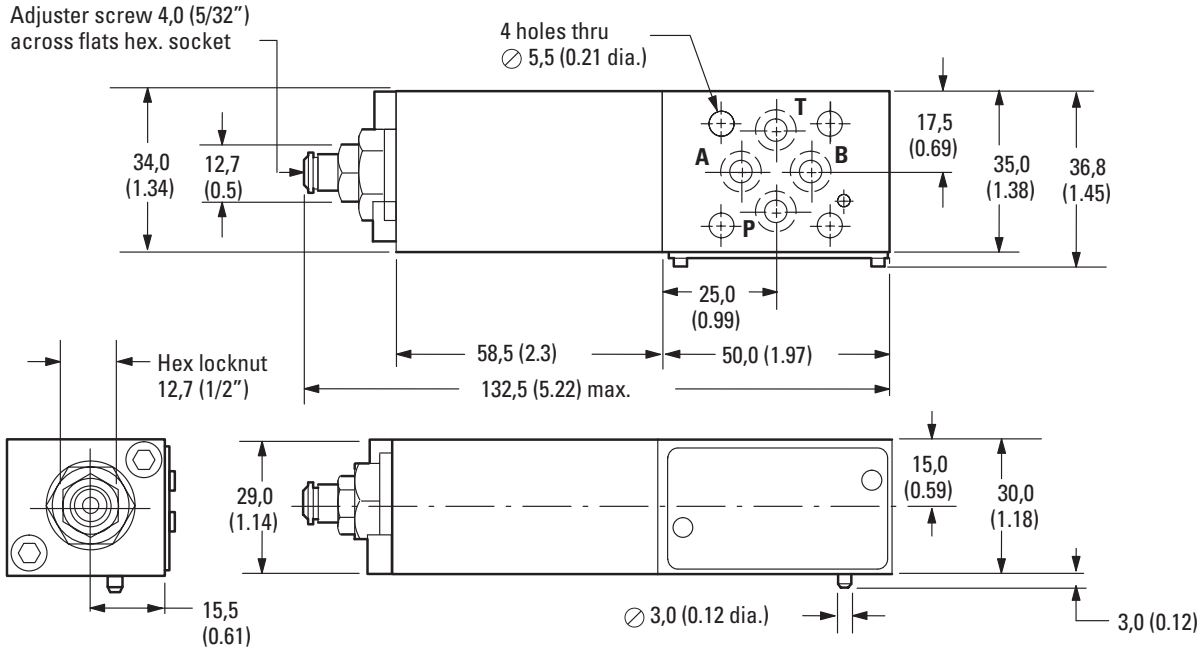
Dimensions shown in mm (inches)

3rd angle projection

DGMC-2-PT-*W-1*
DGMC-2-BT-*W-1*
DGMC-2-BA-*W-1*



DGMC-2-AT-*W-1*
DGMC-2-AB-*W-1*



L

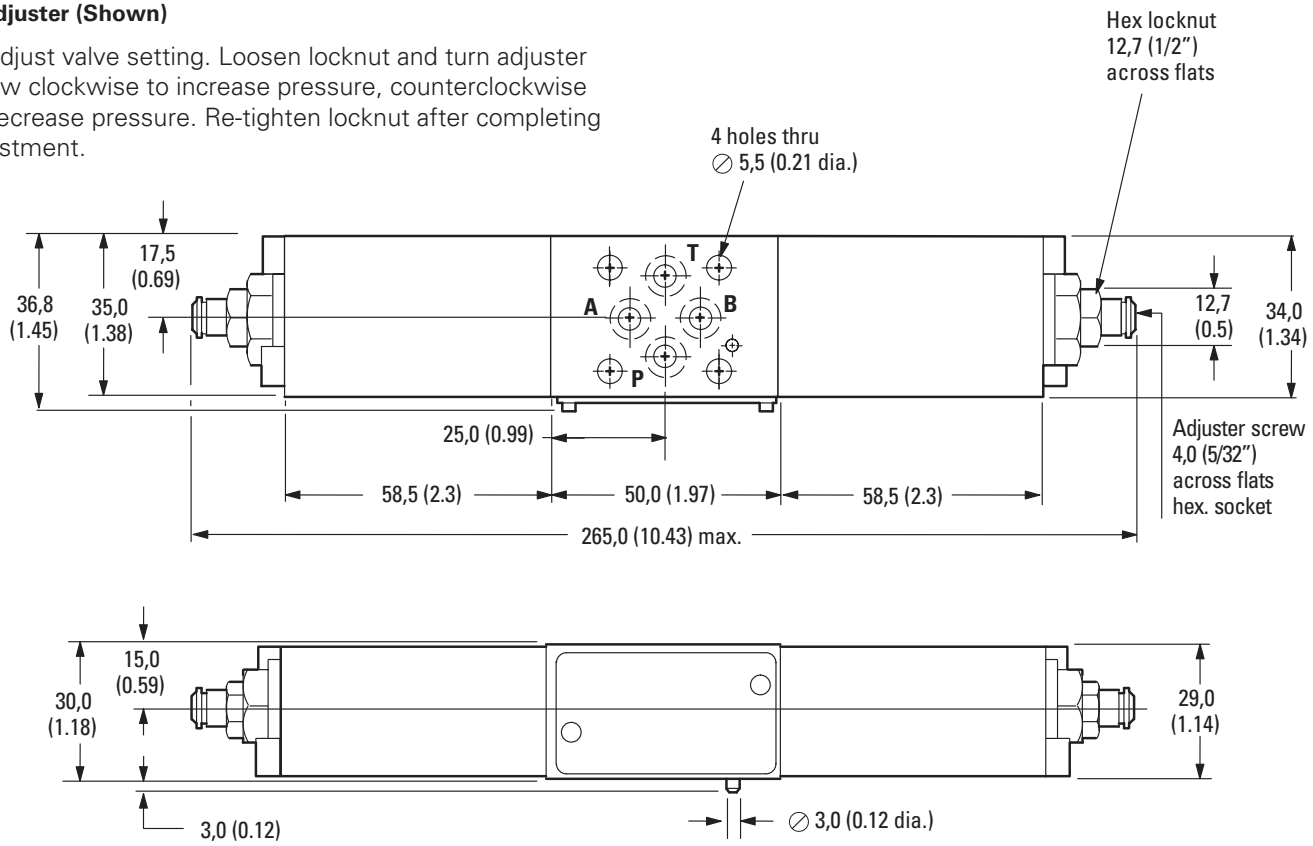
Installation Dimensions

Dimensions shown in mm (inches)

DGMC2-2-AB-*W-BA-*W-1*
DGMC2-2-AT-*W-BT-*W-1*

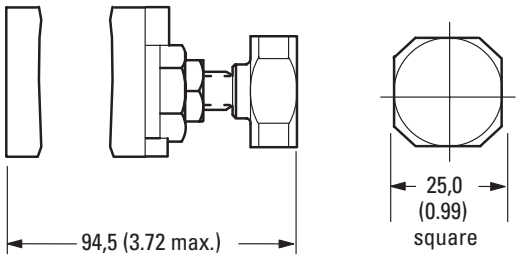
W adjuster (Shown)

To adjust valve setting. Loosen locknut and turn adjuster screw clockwise to increase pressure, counterclockwise to decrease pressure. Re-tighten locknut after completing adjustment.



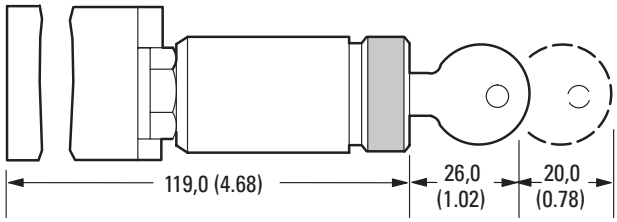
H adjuster

To adjust valve setting. Loosen locknut and turn knob clockwise to increase pressure, counterclockwise to decrease pressure. Re-tighten locknut after completing adjustment.



K adjuster

Key must be inserted and turned to allow valve setting to be adjusted. Turn knob clockwise to increase pressure, counterclockwise to decrease pressure. When key is removed, adjustment mechanism can be freely turned without changing valve setting.



SystemStak™ Pilot Operated Relief Valve

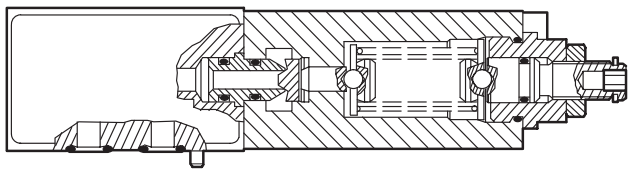
DGMC-2-PT-CH-10 EN81

General description

This adjustable direct-acting pressure relief valve limits the maximum pressure in the line controlled by the integral relief valve element.

Pressure adjustment is by handknob or by remote pilot pressure.

Typical Sectional View



Model Code

DGM C – 2 – PT – C H – 10 – EN81

1 2 3 4 5 6 7 8

1 **Model Series**
Manifold or gasket mounted

2 **Relief valve**
C – Pressure relief (single)

3 **Interface**
2 – ISO4401-02-02

4 **Function**
Single relief

Code	Pressure limited in	Discharge into	Usage
PT	P	T	Single

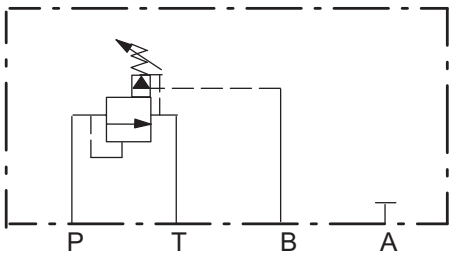
5 **Pressure adjustment range**
C – 30 – 100 bar (435-1450 psi)

6 **Adjustment type**
H – Handknob

7 **Design**
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

8 **Special feature**
EN81 – Remote pilot option

Functional Symbol



L

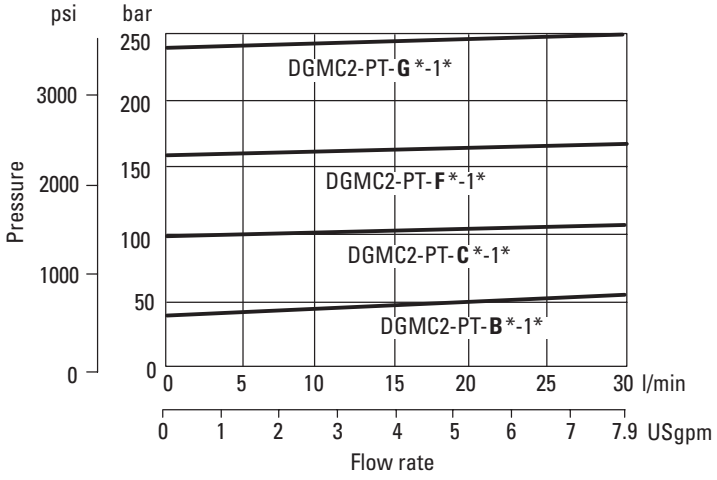
Operating Data

Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate	0,78 kg (1.7 lb.)
Mounting attitude	No restrictions.

Performance Data

Typical performance with mineral oil at 21 cSt (102 SUS) and at 50°C (122°F).

For other viscosities refer to appendix.



Performance Characteristic

Flow rate versus pressure for number of turns of adjuster from fully closed position.

Pressure Override

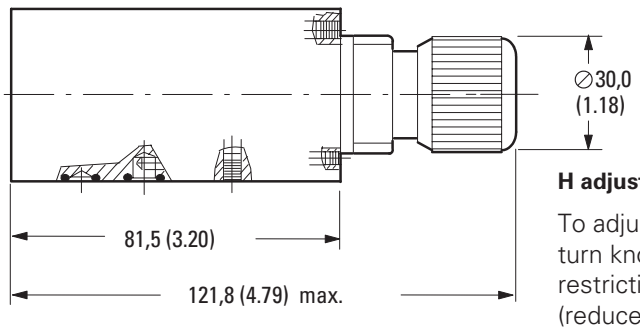
Free flow through check valve with throttle closed and open.

Installation Dimensions

L

Single Function
DGMC-2-PT-CH-10 EN81

Dimensions shown in mm (inches)



H adjuster

To adjust valve setting. loosen locknut and turn knob clockwise to decrease flow (increase restriction), counterclockwise to increase flow (reduce restriction). Re-tighten locknut after completing adjustment.

Counterbalance, Sequence and Pressure Reducing

DGMR(1)-2-1* series
DGMX2-2-1* series

General description

These single stage valves operate by the application of pressure on the end of the valve spool, acting against a spring which is loaded by means of the manual adjustment mechanism.

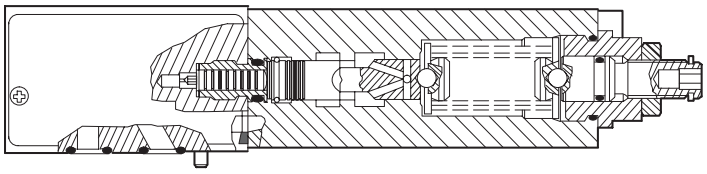
In the counterbalance and sequence valves, the spool is offset by the spring such that flow cannot pass through the valve. When the force exerted by the pilot pressure on the spool end exceeds the force of the main spring, the spool is moved to allow flow through the valve.

In the pressure reducing valve, the flow path is normally open and is closed as the pilot pressure exceeds the manual setting of the valve. Excessive pressure in the reduced pressure line is prevented by a pressure relieving function.

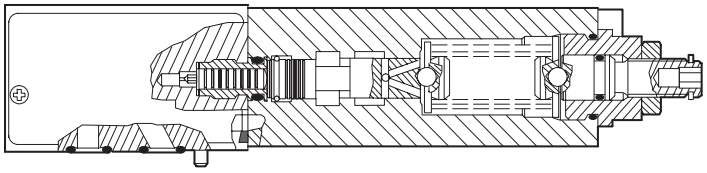
Pressure adjustment options are screw/locknut, handknob and micrometer type with keylock.

Typical Sectional Views

DGMX2-2-P*-*W-10



DGMR1-2-PP-*W-10



Model Code

DGM ** – 2 – ** – * * – 1*

1 2 3 4 5 6 7

1 Model Series
Manifold or gasket mounted

2 Type
R – Counterbalance
R1– Sequence
X2 – Pressure reducing

3 Interface
2 – ISO4401-02-02

4 Function ports

DGMR models only:
TB – Counterbalance control function in "T" port, controlled by pressure in "B" port.

DGMR1 models only:
PP – Sequence control in "P" port, controlled by pressure in "P" port

DGMX2 models only:
PA – Pressure reducing function in line P, piloted from A
PB – Pressure reducing function in line P, piloted from B
PP – Pressure reducing function in line P, piloted from P

5 Pressure adjustment range
A – 2 – 16 bar (29-232 psi)
B – 2 – 40 bar (29-580 psi)
C – 30 – 100 bar (435-1450 psi)
F – 70 – 160 bar (1000-2300 psi)
G – 120 – 250 bar (1740-3600 psi)

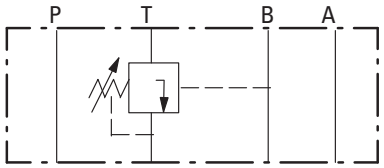
6 Adjustment type
H – Handknob
K – Micrometer with keylock
W – Screw and locknut

7 Design
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

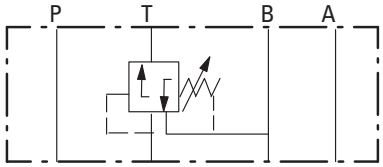
L

Functional Symbol

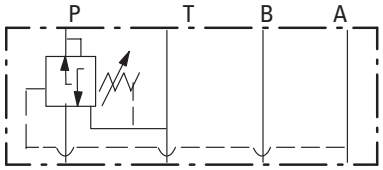
DGMR-2-TB



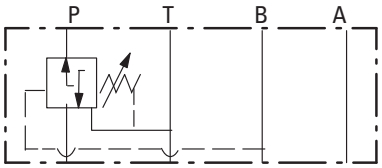
DGMR1-2-PP



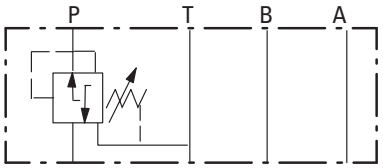
DGMX2-2-PA



DGMX2-2-PB



DGMX2-2-PP



Operating Data

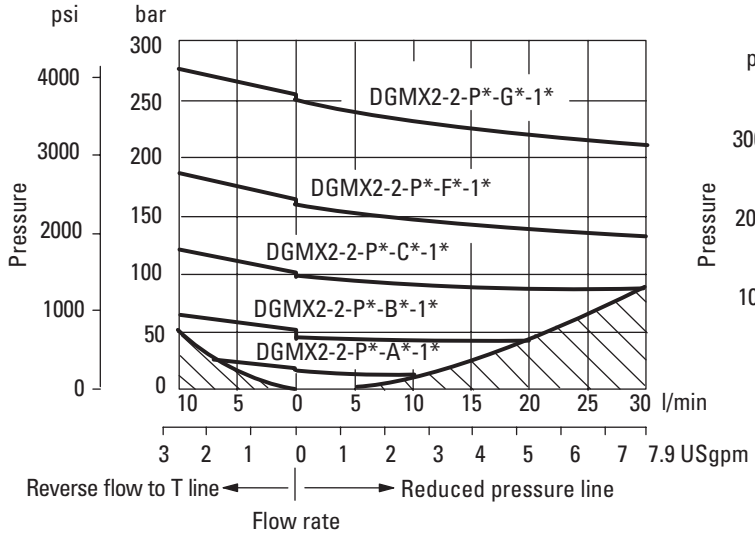
Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate (all models)	0,87 kg (1.9 lb.)
Mounting attitude	No restrictions.

L

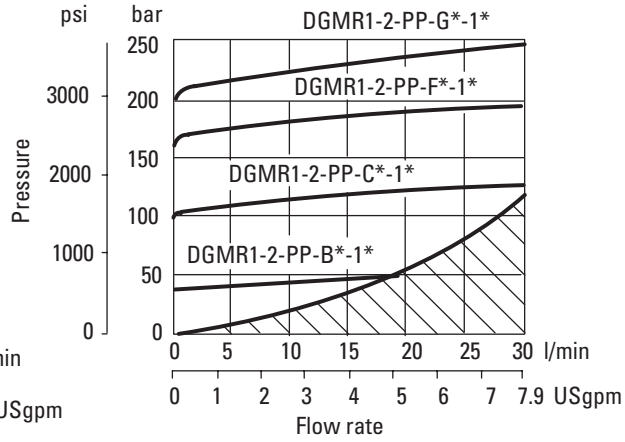
Performance Data

Typical performance with mineral oil at
21 cSt (102 SUS) and at 50°C (122°F).

DGMX2-2-P*

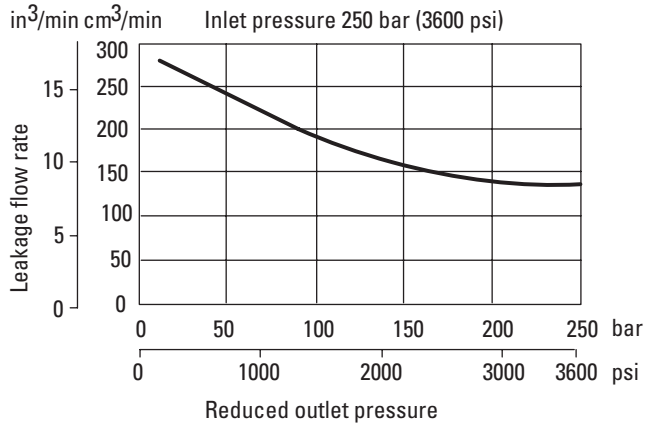


DGMR1-2-PP



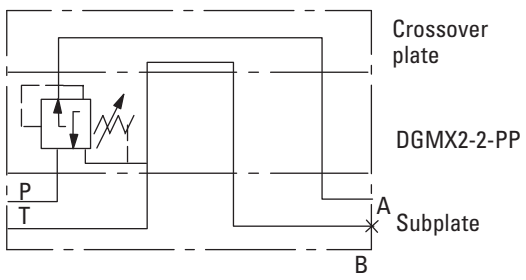
Note: Valves will not function at pressure/flow values in shaded area.

Typical leakage flow from reduced pressure line into T at "dead-head" condition (i.e. no flow required at reduced pressure outlet). This leakage flow must be provided at the inlet line P in order to maintain the reduced outlet pressure.



Note that the effective reduced pressure is the sum of the valve adjustment and any back pressure in line T. The effect is illustrated below.

Typical installation



For other viscosities refer to appendix

L

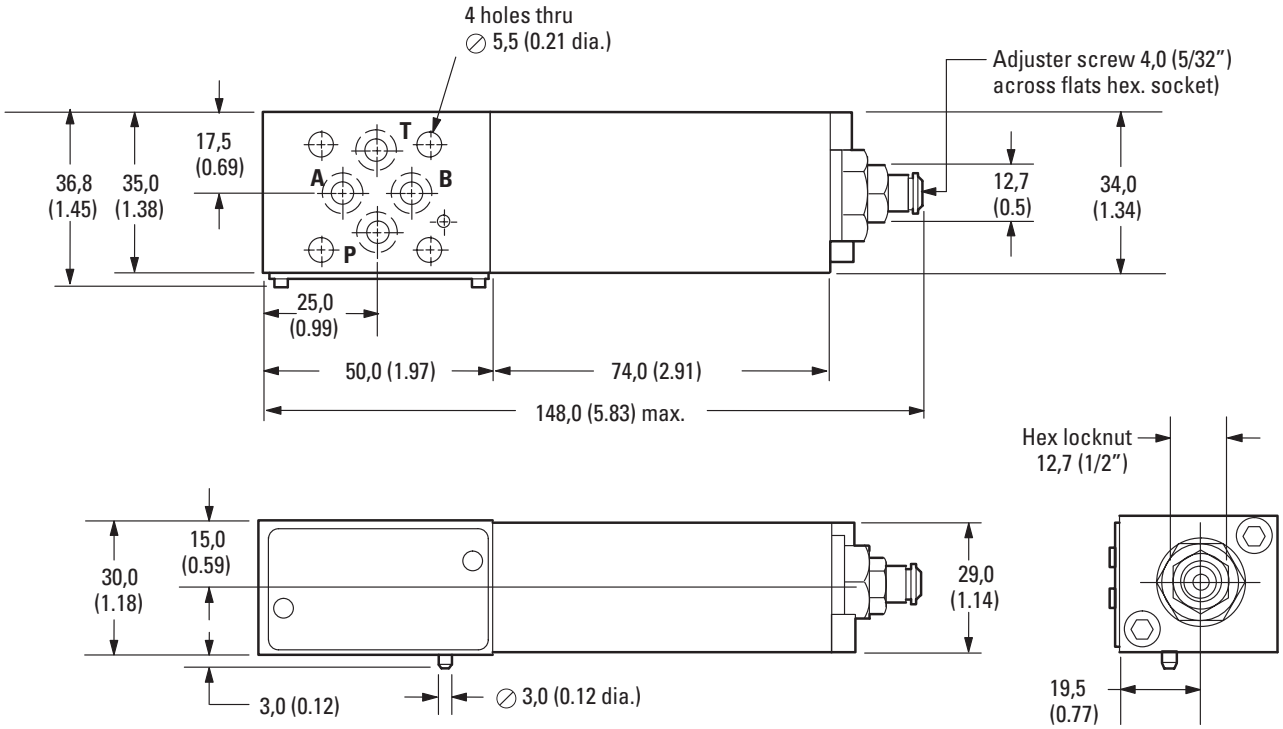
Installation Dimensions

Dimensions shown in mm (inches)

DGMR-TB-*W-1*
DGMR1-PP-*W-1*
DGMX2-P*-*W-1*

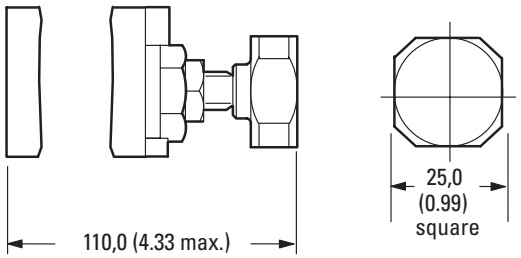
W adjuster (Shown)

To adjust valve setting. loosen locknut and turn adjuster screw clockwise to increase pressure, counterclockwise to decrease pressure. Re-tighten locknut after completing adjustment.



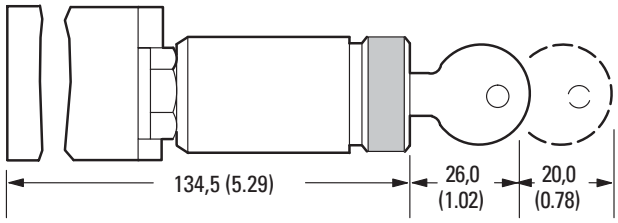
H adjuster

To adjust valve setting. loosen locknut and turn knob clockwise to increase pressure setting, counterclockwise to decrease pressure setting. Re-tighten locknut after completing adjustment.



K adjuster

Key must be inserted and turned to allow valve setting to be adjusted. Turn knob clockwise to increase pressure setting, counterclockwise to decrease pressure setting. When key is removed, adjustment mechanism can be freely turned without changing valve setting.



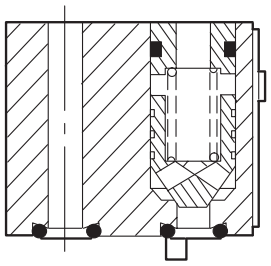
SystemStak™ Direct Check Valves

DGMDC-2, 1* series

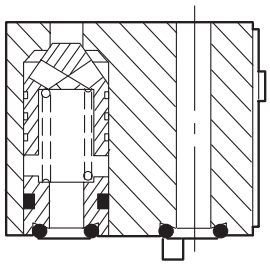
General description

These valves allow free flow in one direction in the line in which the check valve element is located, i.e. either line P or line T. Flow in the opposite direction is not possible.

Typical Sectional Views



DGMDC-2-Y-P*-1*



DGMDC-2-X-T*-1*

Model Code

DGM DC – 2 – * – * * – 1*

1 2 3 4 5 6

1 **Model Series**
Manifold or gasket mounted

2 **Type**
DC – Direct check

3 **Interface**
2 – ISO4401-02-02

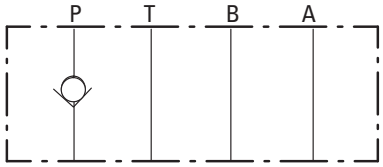
4 **Direction of flow and check location**
X-T – Free flow away from actuator, in line T
Y-P – Free flow towards actuator, in line P

5 **Check valve cracking pressure**
K – 1 bar (14.5 psi)
M – 2,5 bar (36 psi)

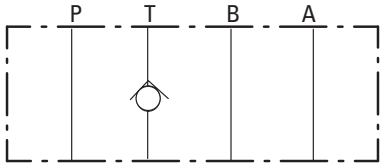
6 **Design**
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

Functional Symbol

DGMDC-2-Y-P*



DGMDC-2-X-T*



L

Operating Data

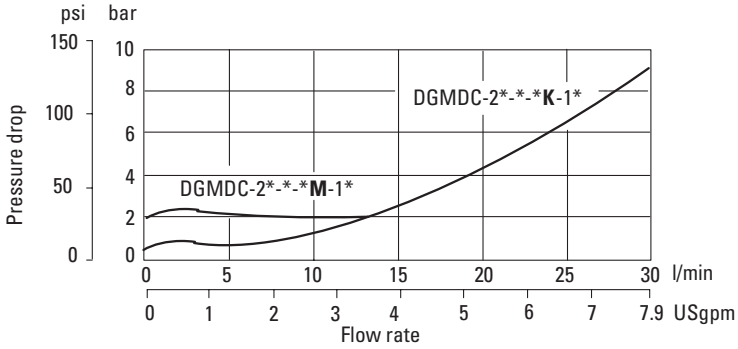
Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate	0,35 kg (0.77 lb.)
Mounting attitude	No restrictions

Performance Data

Typical performance with mineral oil at 21 cSt (102 SUS) and at 50°C (122°F).

Pressure Drop

Free flow through check valve



Internal Leakage Across Closed Check Valve

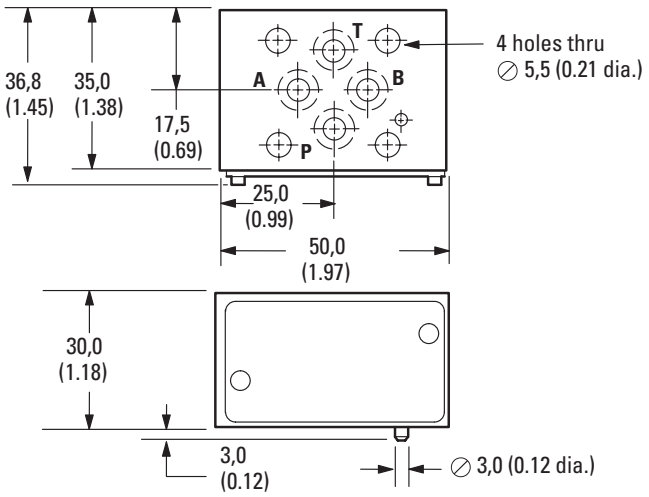
Less than 0,25 cm^3/min (0.015 in^3/min) at 250 bar (3600 psi).

For other viscosities refer to appendix

Installation Dimensions

Dimensions shown in mm (inches)

DGMDC-2-Y-P*-1*
DGMDC-2-X-T*-1*



SystemStak™ Pilot Operated Check Valves

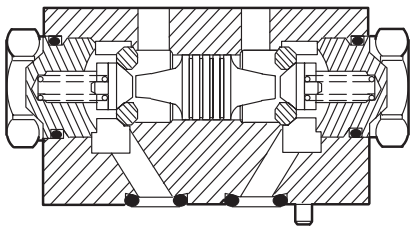
DGMPC-2-1* series

General description

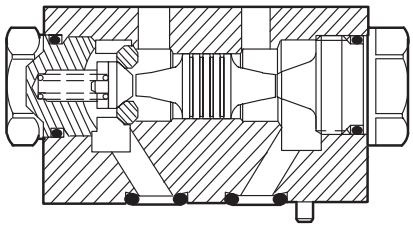
These valves provide pilot operated check functions in one or both service lines (A or B), the operating pilot supply coming from the opposite service line. Thus with pressure in one service line the check valve in the other service line will be open (subject to system/actuator pressures being correct for the valve area ratios). The area ratio of pilot piston to check valve seat is 3,3:1.

Typical Sectional Views

DGMPC-2 Dual Function



DGMPC-2 Single Function



Model Code

DGM PC – 2 – ** * (– *) – 1***

1 2 3 4 5 6 7 8

1 **Model Series**
Manifold or gasket mounted

2 **Type**
PC – Pilot operated check

3 **Interface**
2 – ISO4401-02-02

4 **Function**
AB – Check in line A, pilot operated from line B
BA – Check in line B, pilot operated from line A (single function model only)

5 **Check valve cracking pressure**
K – 1 bar (14.5 psi)
M – 2,5 bar (36 psi)

6 **Second function of dual models**
BA – Check in line B, pilot operated from line A
Omit for single function models

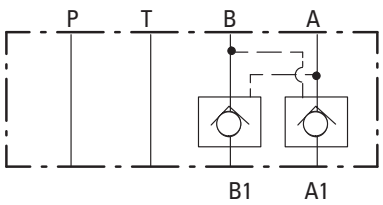
7 **Check valve cracking pressure**
(Second function of dual models)
K – 1 bar (14.5 psi)
M – 2,5 bar (36 psi)

8 **Design**
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

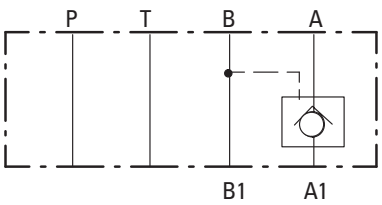
L

Functional Symbols

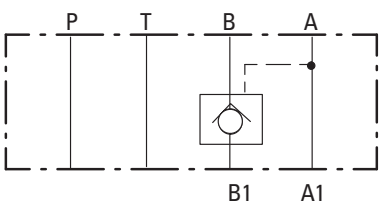
DGMPC-2-AB*-BA*-1*



DGMPC-2-AB*-1*



DGMPC-2-BA*-1*



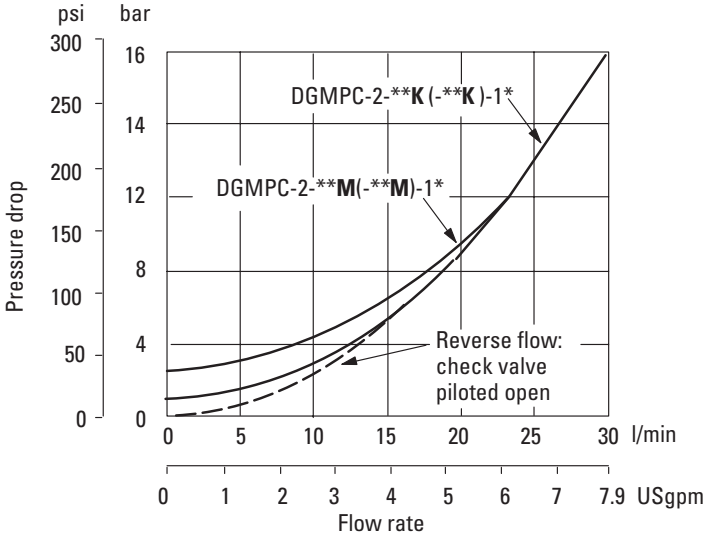
Operating Data

Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate	0,39 kg (0.86 lb.)
Mounting attitude	No restrictions.

Performance Data

Typical performance with mineral oil at 21 cSt (102 SUS) and at 50°C (122°F).

Pressure Drop



For other viscosities refer to appendix

Pilot Pressures

Area ratio, pilot piston to check valve = 3,3:1
Formula for calculating pilot pressure required to open valve:

$$\text{To open valve in line A: Pressure at B1} = \frac{p_A + p_C - p_{A1}}{\text{Area ratio factor}} + p_{A1}$$

$$\text{To open valve in line B: Pressure at A1} = \frac{p_B + p_C - p_{B1}}{\text{Area ratio factor}} + p_{B1}$$

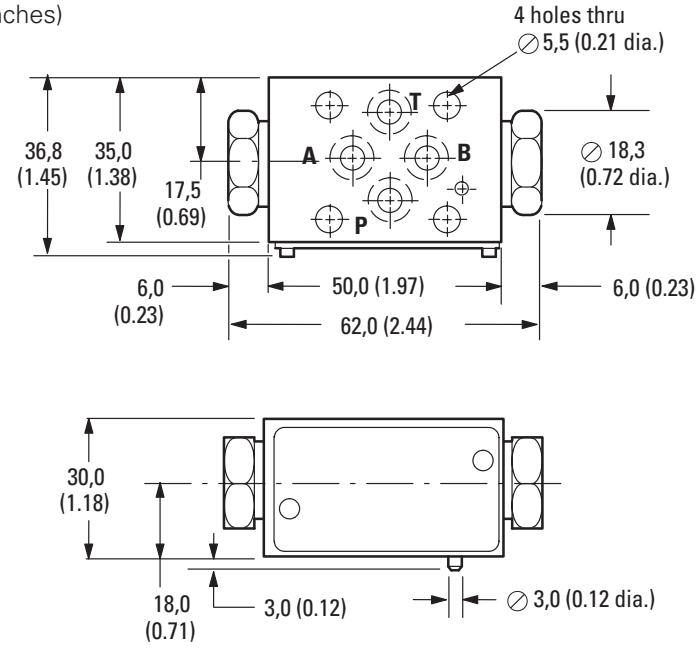
Where
p_A = Pressure at A
p_C = Cracking pressure
p_{A1} = Pressure at A1
p_B = Pressure at B
p_{B1} = Pressure at B1
A, B, A1, B1 = Service line location; Refer to functional symbols.

Installation Dimensions

Dual Function Models

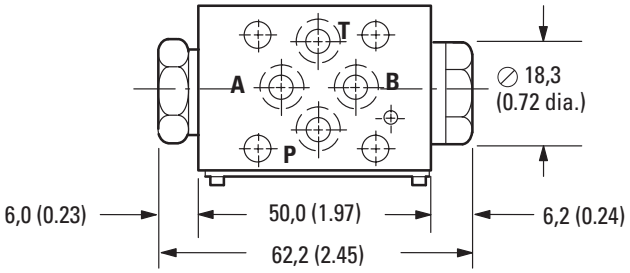
DGMPC-2-AB*-BA*-1*

Dimensions shown in mm (inches)



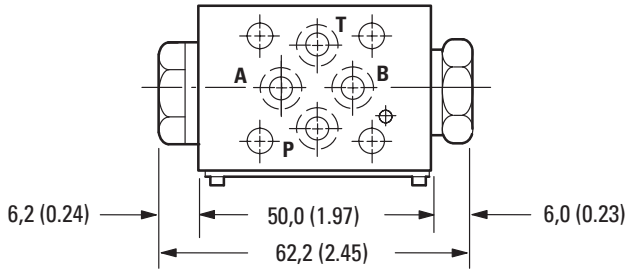
Single Function Models

DGMPC-2-AB*-1*



Single Function Models

DGMPC-2-BA*-1*



L

SystemStak™ Pressure Compensated Flow Control Valve

DGMFG-2-Y-PH-10 series

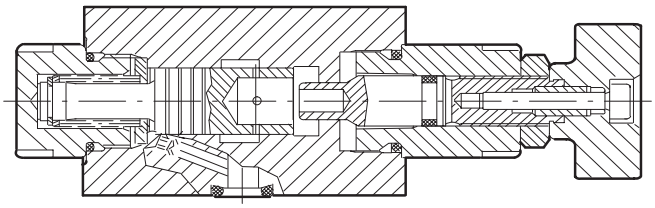
General description

These valves regulate flow by means of an adjustable orifice. Flow through the valve is pressure compensated.

Currently this function is available in a single line version, without check valve.

Adjustment option is only available with handknob. Please contact your Eaton representative for availability of other options.

Typical Sectional Views



Model Code

DGMFG – 2 – Y – P H – 10

1 2 3 4 5 6

1 **Model Series**
Directional valve, gasket mounted, pressure compensated flow control

2 **Interface**
2 – ISO4401-02-02

3 **Direction of flow control (with respect to machine actuator)**
Y – Meter-out control

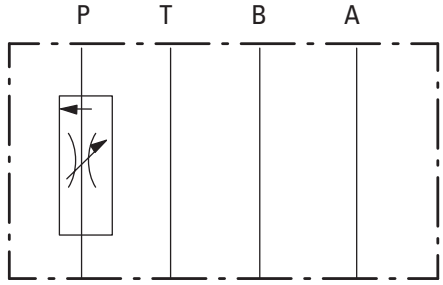
4 **Location of control function**
(single model)
P – Line P (single model)

5 **Adjustment type**
H – Handknob

6 **Design number**

Functional Symbol

DGMFG-2-Y-PH-10



Operating Data

Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate	0,42 kg (0.93 lb.)
Mounting attitude	No restrictions

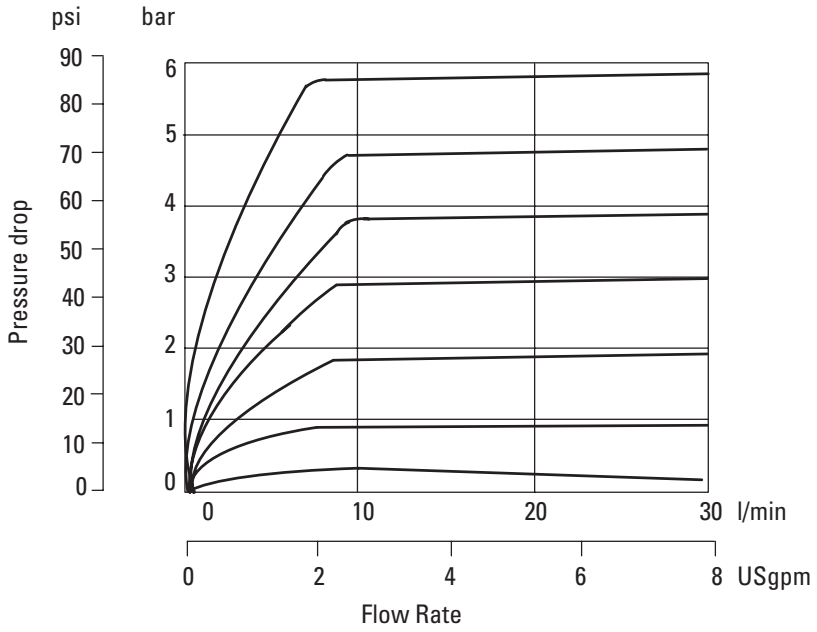
Performance Data

Typical performance with mineral oil at 21 cSt (102 SUS) and at 50°C (122°F).

Control characteristics

For other viscosities refer to appendix.

Flow rate versus pressure Drop



Installation Dimensions

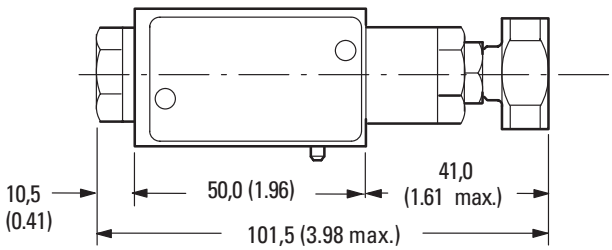
Dimensions shown in mm (inches)

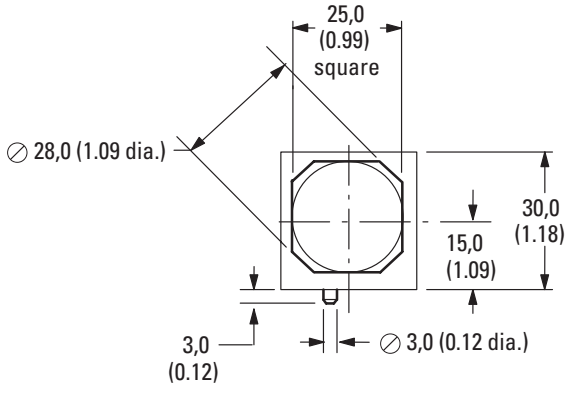
H adjuster (shown)

To adjust valve setting. loosen locknut and turn knob clockwise to decrease flow (increase restriction), counterclockwise to increase flow (reduce restriction). Re-tighten locknut after completing adjustment.

Single Function

DGMG-2-Y-PH-10





L

SystemStak™ Flow Regulator Valves

DGMFN-2-1* series

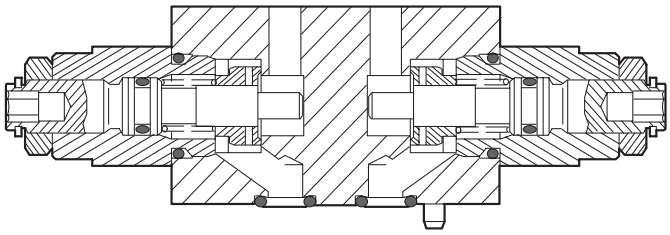
General description

These valves regulate flow by means of an adjustable orifice. Flow through the valve at any setting of the orifice is dependent upon pressure drop.

Dual service-line models with integral non-return valves provide for meter-in or meter-out control; single line versions of these are available. Additionally there is a single line model, without check valve, for controlling flow in line P.

Adjustment options are screw/locknut, handknob or micrometer with keylock.

Typical Sectional Views



Model Code

DGM FN – 2 – * – * * (–* *) – 1*

1 2 3 4 5 6 7 8 9

1 **Model Series**
Manifold or gasket mounted

2 **Type**
FN – Flow restrictor

3 **Interface**
2 – ISO4401-02-02

4 **Direction of flow control (with respect to machine actuator)**
X – Meter-in control, applicable to lines A and B.
Y – Meter-out control, applicable to lines A and B.
Z – Meter-in control, line P only.

5 **Location of control function**
(single model or first line of dual model)
A – Line A (single model or first line of dual model)
B – Line B (single model only)
P – Line P (single model only)

6 **Adjustment type**
H – Handknob
K – Micrometer with keylock
W –Screw and locknut

7 **Control in second line**
A – Line B (use for dual models with "A" specified at 5)
Omit for single function models

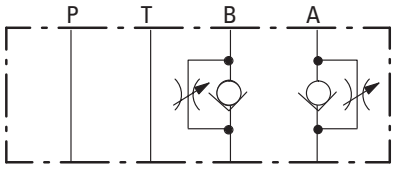
8 **Adjustment type**
(Omit for single models)
H – Handknob
K – Micrometer with keylock
W –Screw and locknut

9 **Design**
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

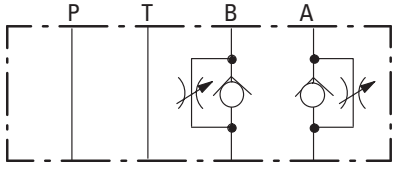
L

Functional Symbols

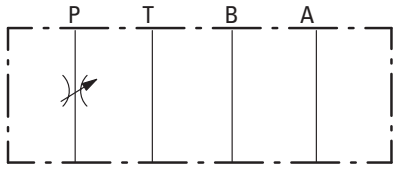
DGMFN-2-X-A*-B*



DGMFN-2-Y-A*-B*



DGMFN-2-Z-P*



Operating Data

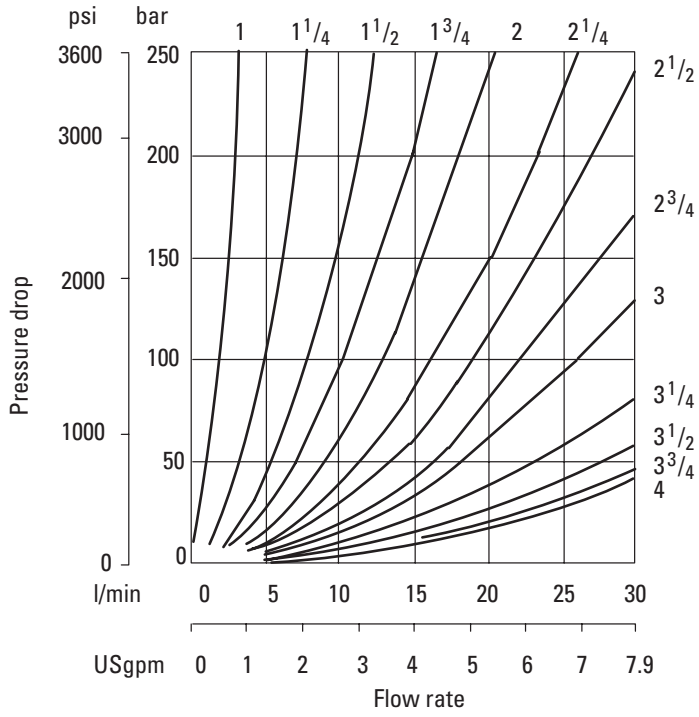
Maximum flow rate	30 l/min (7.9 USgpm)
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate	0,42 kg (0.92 lb.)
Mounting attitude	No restrictions

Performance Data

Typical performance with mineral oil at 21 cSt (102 SUS) and at 50°C (122°F).

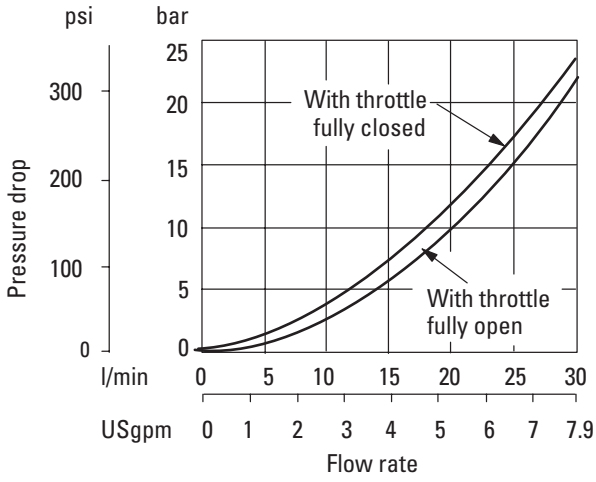
Control characteristics

Flow rate versus pressure drop for number of turns of adjuster from fully closed position.



Pressure Drop

Free flow through check valve with throttle closed and open.



For other viscosities refer to appendix.

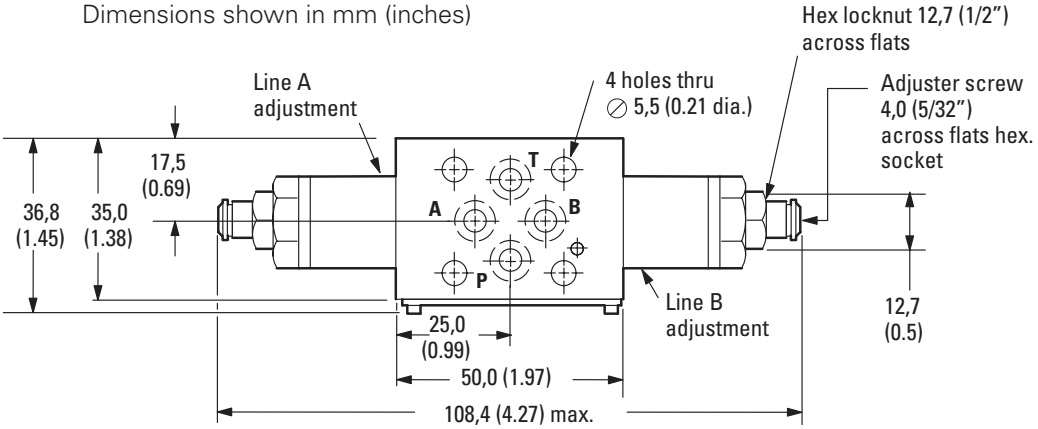
L

Installation Dimensions

Dual Function

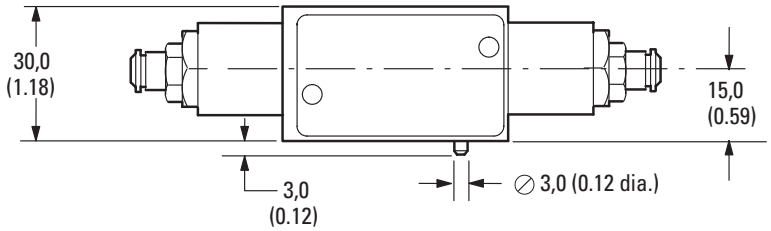
DGMFN-2-X-A*-B*-1*
DGMFN-2-Y-A*-B*-1*

Dimensions shown in mm (inches)



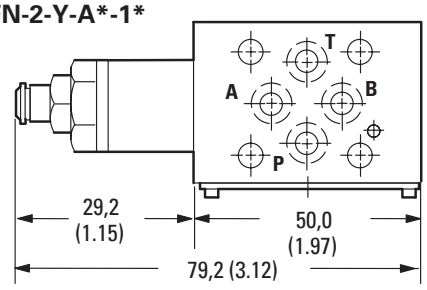
W adjuster (Shown)

To adjust valve setting. loosen locknut and turn adjuster screw clockwise to decrease flow (increase restriction), counterclockwise to increase flow (reduce restriction). Re-tighten locknut after completing adjustment.



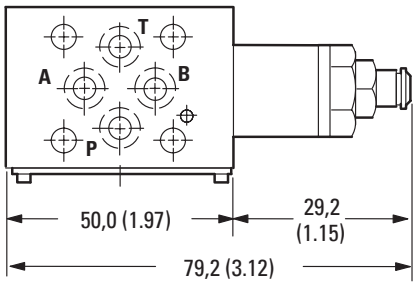
Single Function

DGMFN-2-X-A*-1*
DGMFN-2-Y-A*-1*



Single Function

DGMFN-2-X-B*-1*
DGMFN-2-Y-B*-1*
DGMFN-2-Z-P*-1*

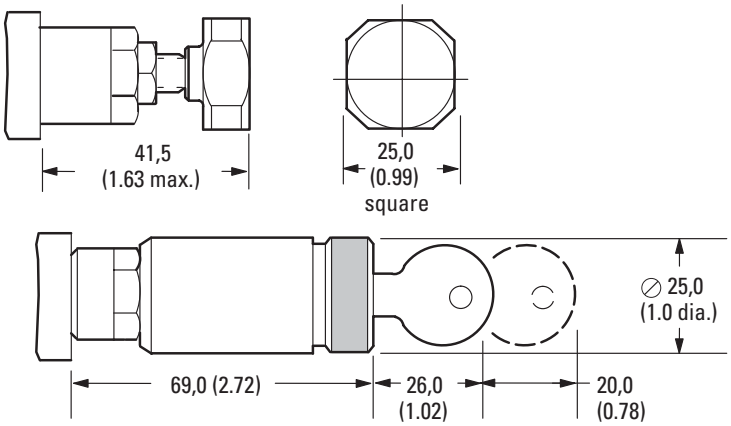


H adjuster

To adjust valve setting. loosen locknut and turn knob clockwise to decrease flow (increase restriction), counterclockwise to increase flow (reduce restriction). Re-tighten locknut after completing adjustment.

K adjuster

Key must be inserted and turned to allow valve setting to be adjusted. Turn knob clockwise to decrease flow (increase restriction), counterclockwise to increase flow (reduce restriction). When key is removed, adjustment mechanism can be freely turned without changing valve setting.



SystemStak™ Flow Divider Valve

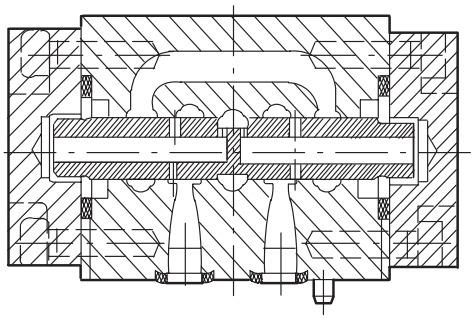
DGMFD-2-10 series

General description

This flow dividing valve divides flow equally between the "A" port and the "B" port with flow generated in "P" port.

Note - The flow divider valve should not be applied where cylinder synchronization is important.

Typical Sectional View



Model Code

DGM FD – 2 – P – AB 10

1 2 3 4 5 6

1 **Model Series**
Manifold or gasket mounted

2 **Type**
FD – Flow divider

3 **Interface**
2 – ISO4401-02-02

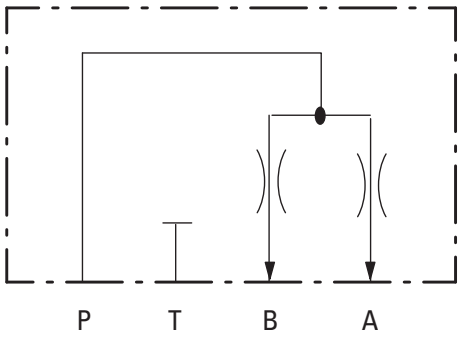
4 **First function**
P – Flow from "P" port

5 **Flow division**
AB – Flow split between ports "A" and "B"

6 **Design**
Subject to change. Installation dimensions unchanged for design numbers 10 thru 19.

Functional Symbols

DGMFD-2-P-AB-10



L

Operating Data

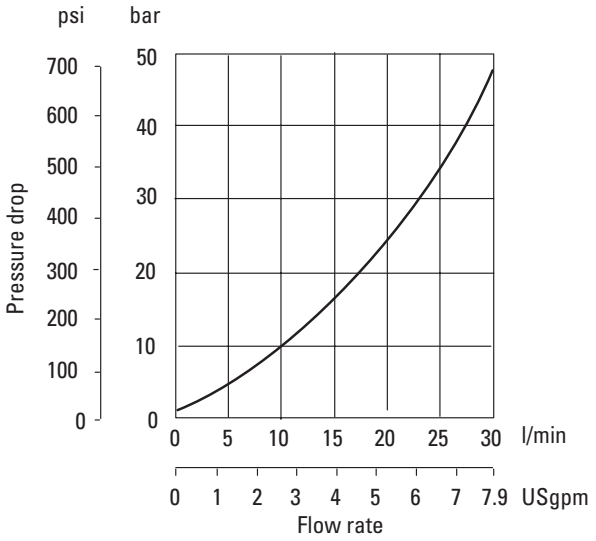
Maximum flow rate	30 l/min (7.9 USgpm)
Flow variation (between A & B ports)	± 10%
Maximum operating pressure	250 bar (3600 psi)
Hydraulic fluids	Refer to appendix
Filtration requirements	
Temperature limits	
Mass, approximate	0,58 kg (1.30 lb.)
Mounting attitude	No restrictions

Performance Data

Typical performance with mineral oil at 30 cSt (140 SUS) and at 50°C (122°F).

For other viscosities refer to appendix

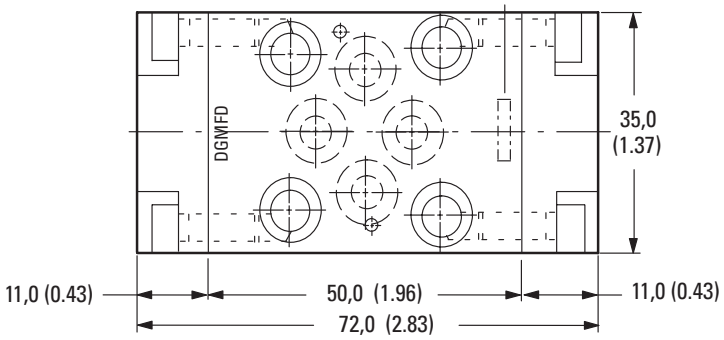
Pressure Drop



Installation Dimensions

DGMFD-2-10 series
Flow Divider

Dimensions shown in mm (inches)



Eaton
Hydraulics Business USA
14615 Lone Oak Road
Eden Prairie, MN 55344
USA
Tel: 952-937-9800
Fax: 952-294-7722
www.eaton.com/hydraulics

Eaton
Hydraulics Business Europe
Route de la Longeraie 7
1110 Morges
Switzerland
Tel: +41 (0) 21 811 4600
Fax: +41 (0) 21 811 4601

Eaton
Hydraulics Group Asia Pacific
Eaton Building
4th Floor, No. 3 Lane 280 Linhong Rd.
Changning District
Shanghai 200335
China
Tel: (+86 21) 5200 0099
Fax: (+86 21) 5200 0400

Powering Business Worldwide

Printed in USA
Document No.: E-VLVI-SS001-E1
October 2015