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1 Product Description

This flow control valve allows the operation of one way applications with constant volume flow requirements and low inertia (e.g. hydraulic motors for power generators) for retrofitting in construction machines. The attachment can be used simultaneously with normal construction machine functions.

1.1 Applications

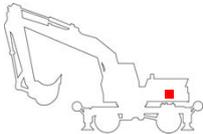


NOTE

In order to avoid hazardous situations, specific attachments in a construction machine must be operated with a strict prioritized flow. The accuracy of the flow should correspond to or exceed the requirements of the attachment. For safety-critical attachments, such as power generators for magnetic grippers, it is recommended to realize the hydraulic operation in a separate hydraulic circuit with an additional pump and this flow control valve. The flow control valve is specifically designed for such applications.

Two apertures to control the required flow to the application hydraulic motor are fitted in the flow control valve. To ensure optimal control, the input flow must be approx. 10% higher than the desired output flow. The output flow is preset at the manufacturing plant.

1.2 Mounting location (Recommendation)



Flow control valves are normally installed close to the hydraulic motor for the attachment.

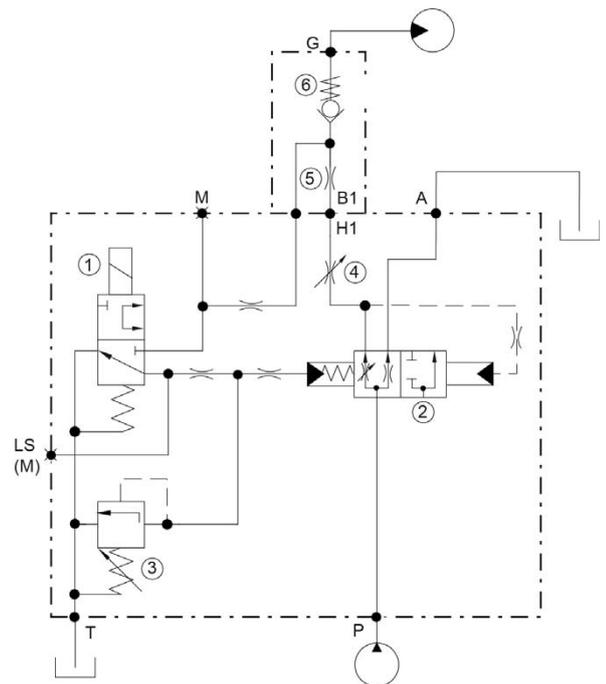
1.3 Function

The flow control valve is electrically actuated (1). When the valve is actuated, a controlled priority flow is divided from the main flow (P) by means of a pressure compensator (2) to operate the attachment (G). The residual flow (A) is returned (port A) into the tank or can be used in another application.

The maximum operating pressure of the attachment is controlled by means of the internal pressure relief valve (3). The pressure relief valve can be adjusted. The pressure relief valve operates according to the pressure cut-off principle and controls when it lowers the output flow (G) again by means of the pressure compensator disk until the set pressure is once again reached. The pressure relief valve must be set so that it does not respond during normal operation, as it will otherwise be impossible to reliably achieve the desired output flow.

The output flow is controlled with precision by means of a double-orifice in the pressure compensator. The first aperture (4) can be adjusted and is used to pre-throttle the flow. The downstream fixed orifice (5) provides fine adjustments to the output flow. The fixed aperture is calculated to provide optimal control over a wide temperature range. The output flow is therefore pre-set at the manufacturing plant and should not be changed at all or only very slightly using the first aperture.

The check valve (6) mounted on the current regulator is used to generate a minimal, internal pressure differential which is necessary for the normal operation of the valve. This required pressure difference is often not reliably generated externally across the entire working range in applications with low inertia, and must therefore be guaranteed internally.



1.4 Characteristics

- Precision flow control, independent of the working pressure of the attachment and main applications across the entire permissible temperature range
- Preset flow for the attachment
- Narrow flow and operating pressure tolerance range even with sharply fluctuating input pressures and pump flows
- For use in all hydraulically-powered applications with low inertia (power generators, compressors, etc.)
- Protection of the consumer against too high pressure independently of flow rate based on the pressure cut-off principle
- Small pressure loss in free-flow

2 Technical Data

Criterion	Units	Value
Installation position		Any
Weight	kg	9.7
Max. input pressure	bar	Port P= 420 , Port G= 320
Adjustable attachment pressure	bar	100-320 preset 250
Preset output flow rate	l/min	see type code
Output flow rate accuracy	%	± 8
Maximum recommended tank pressure (T)	bar	< 1
Maximum input flow rate (P)	l/min	120
Minimum input flow rate (P)		~ 20% above the set output flow rate
Hydraulic fluid		Mineral oil (HL, HLP) conforming with DIN 51524, other fluids upon request
Hydraulic fluid temperature range	°C	-20 to +80
Ambient temperature	°C	< +50
Viscosity range	mm ² /s	2.8 - 500
Contamination grade		Filtering conforming with NAS 1638, class 9, with minimum retention rate $\beta_{10} \geq 75$
Supply voltage	VDC	12 or 24
Voltage tolerances	%	± 10
Solenoid power consumption	W	33
Solenoid flow rate consumption	A	2.9 at 12 VDC, 1.4 at 24 VDC
Solenoid duty cycle	%	100
Protection class according to DIN 40050		IP 65
Current supply		ISO 4400 angle connector or AMP Junior Timer connector

3 Ordering Information

3.1 Type Code

FC1	2G	00H	120	400				01
00	01	02	03	04	05	06	07	08
00	Product group	Flow control valve for one way applications						FC1
01	Design type	For applications with strict flow control precision requirements						2G
02	Connections	Pump (P), output (A), attachment (G) - M27x2 ISO 9974-1						00H
03	Ma. input flow rate	120 l/min						120
04	Max. permissible pressure (P)	420 bar						420
05	Actuation	Electrical switching 12 VDC – connection via ISO 4400 angle plug connection						12S001
		Electrical switching 12 VDC – connection via Junior Timer plug						12S002
		Electrical switching 24 VDC – connection via ISO 4400 angle plug connection						24S001
		Electrical switching 24 VDC – connection via Junior Timer plug						24S002
06	Hydraulic system	2-way flow controller – suitable for closed center systems (load-sensing systems)						CC
		3-way flow controller – suitable for open center systems (throttle, NFC systems, etc.)						OC
07	Output flow rate	Preset 45 l/min to 100 l/min						XXX
08	Check valve	8 bar, M27x2 ISO 9974-1						16

XXX – Permanent preset characteristics XXX – Characteristics adjustable by customer

3.2 Versions currently available

The versions listed below are available as standard. Further versions as part of the options given in the type code can be configured upon request.

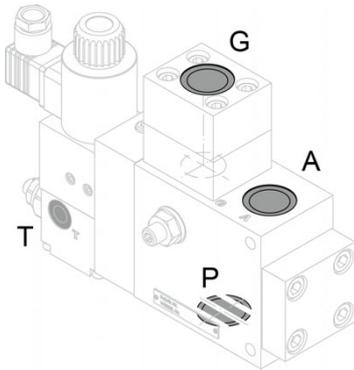
designation	type code	part no.
FC1-2G M27X2 100/45LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -045 -16	235.332.542.9
FC1-2G M27X2 100/50LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -050 -16	235.332.543.9
FC1-2G M27X2 100/57LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -057 -16	235.332.544.9
FC1-2G M27X2 100/69LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -069 -16	235.332.545.9
FC1-2G M27X2 100/80LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -080 -16	235.332.546.9
FC1-2G M27X2 100/85LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -085 -16	235.332.554.9
FC1-2G M27X2 100/90LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -090 -16	235.332.547.9
FC1-2G M27X2 100/96LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -096 -16	235.332.555.9
FC1-2G M27X2 100/100LPM 320BAR 24V	FC1 -2G -00H -120 -320 -24S001 -OC -100 -16	235.332.548.9

4 Description of Characteristics in Accordance with Type Code

4.1 Characteristic 1: Construction way

The valve is designed to operate applications with adjustable flow and limited pressure. During design, particular care has been taken to ensure that the valve provides good control accuracy over a wide working range (flow). It is particularly suitable for use with applications with low inertia (large fluctuation tendency).

4.2 Characteristic 2: Connections

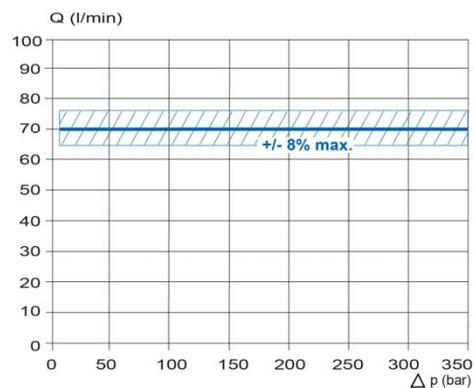
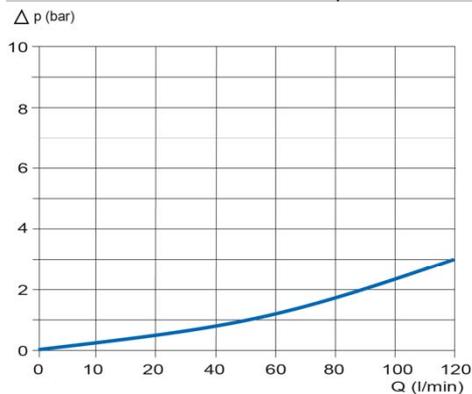


Connection	Connection sizes
A, G, P	M27x2 ISO 9974-1
M, LS	M14 x 1.5 ISO 9974-1
T	G ¼ (ISO 1179-1)

4.3 Characteristic 3: Input flow rate

The maximum input flow is 120 l/min.

4.3.1 Pressure loss in relation to input flow rate

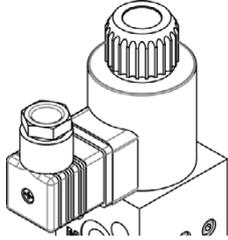


4.4 Characteristic 4: Maximum permissible pressure

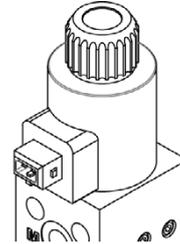
The maximum permissible input (P) and output (A) pressure of the flow control valve is 420 bar

4.5 Characteristic 5: Actuation

The operated consumer can be switched on / off electrically with the valve.



Connector plug: 12S001 / 24S001



Connector plug: 12S002 / 24S002

4.6 Characteristic 6: Hydraulic system

CC hydraulic system

On valves which are pre-fitted for closed centre hydraulic systems (Option: CC, 2-way flow controller) (bypass installation), output line A is closed off and a connection is provided for output LS. This option is only available upon request (see type code). This installation enables the parallel operation of applications, but has energy disadvantages.

OC hydraulic system

On valves which are pre-fitted for open center systems (Option: OC, 3-way flow controller), output line A is open and the LS connection is closed off. In this design, the remainder of the input flow is led onward. Parallel application operation is not possible.

For safety-critical attachments, such as power generators for magnetic grippers, it is recommended that hydraulic operation be performed as a 3-way flow controller (OC) within a separate hydraulic circuit with an additional pump and this flow control valve.

4.7 Characteristic 7: Output flow rate

The output flow is preset at the manufacturing plant by means of a fixed aperture mounted in the check valve and should not be changed at all using the setting screw (1) or if necessary, only very slightly. Versions with different preset flows are available (see type code). Further versions for different output flow rates can be provided upon request.

4.8 Characteristic 8: Check valve

The check valve mounted on the flow control valve is used to generate a minimal, internal pressure loss which is necessary for the normal operation of the valve. This pressure difference is often not reliably generated externally across the entire working range in applications with low inertia, and must therefore be guaranteed internally.

The flow control valve is fitted with a check valve preset to 8 bar and a M27x2 ISO 9974-1 threaded connection to output G.

5 Installation

5.1 General remarks

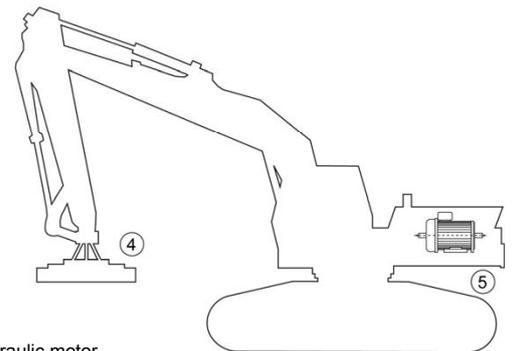
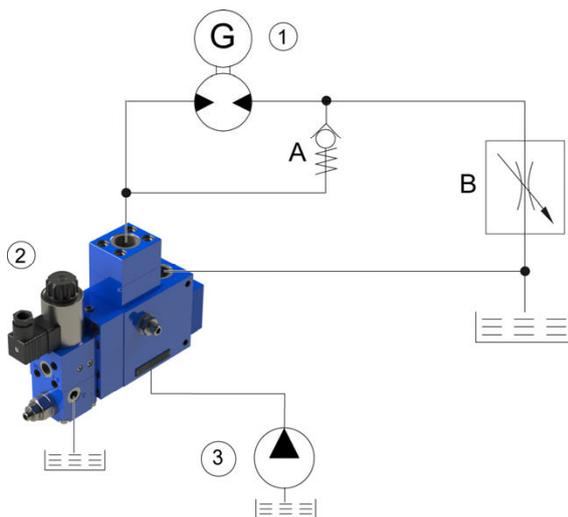
- Observe all installation and safety information of the construction machine manufacturer.
- Only technically permitted changes are to be made on the construction machine.
- The user has to ensure that the device is suitable for the respective application.
- Application exclusively for the range of application specified by the manufacturer.
- Before installation or dismantling, the hydraulic system is to be depressurized.
- Settings are to be made by qualified personnel only.
- May only be opened with the approval of the manufacturer, otherwise the warranty is invalidated.

5.2 Connection suggestion



For safety-critical attachments, such as power generators for magnetic grippers, it is recommended that hydraulic operation be controlled in a separate hydraulic circuit with an additional pump and this flow control valve. The flow control valve is specifically designed for such applications.

A suction valve (A) to prevent cavitation and a throttle valve (B, set to 30 - 50 bar) are provided in the return line of the hydraulic motor (1) as additional components in hydraulic circuits of this kind. The throttle valve dampens the entire system. The used hydraulic motor must be compatible for return line throttle control.



- 1 - Generator with hydraulic motor
- 2 - Flow control valve - generator drive
- 3 - Additional pump for flow control valve Generator drive
- 4 - magnetic system
- 5 - Generator

A – Suction valve
B – Adjustable pressure valve ~20 – 50 bar

NOTE

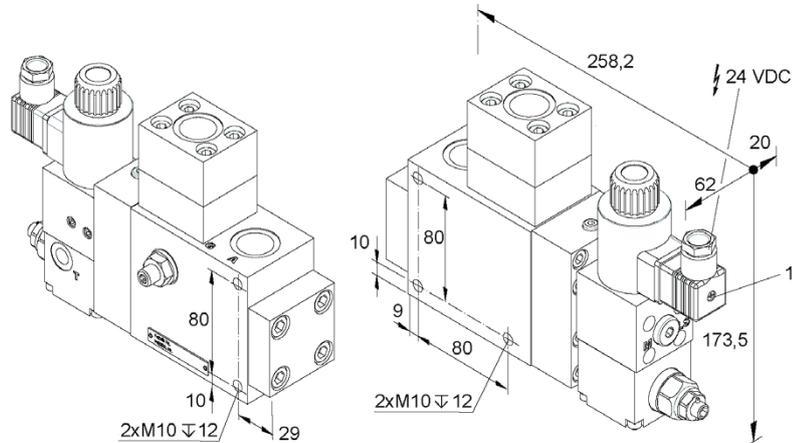


The included connection recommendations are not guaranteed. The functionality and the technical specifications of the machine must be checked. It must be ensured that the machine is suitable in terms of technology and safety for the operation of the attachment.

5.3 Installation - space

- Observe the connection labels.
- Observe the strength category and torque of the mounting bolts.
- Do not damage seals and flange surface.
- Air must be exhausted from the hydraulic system.
- Ensure that the support element is level.
- Ensure that the valve is not bent during installation.
- Ensure that there is sufficient free space for setting and installation work.

- a. Install the flow control valve on the support element using M10 bolts.
- b. Make electrical connections.
- c. Secure connector with screw (1).

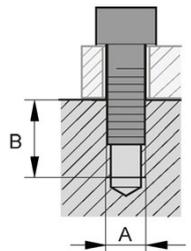


CAUTION! Hydraulic hoses must not come into contact with the flow control valve as they will suffer thermal damage.



5.3.1 Tightening torque

read (A)	Strength class	Thread depth (B)	Tightening torque (Nm)
M10	8,8	12	48



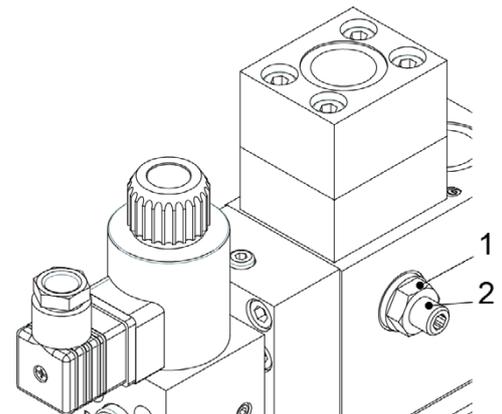
Attention: Tightening torques must be observed. Torque wrench needed.

5.4 Setting the output flow (G)



WARNING Any change to the preset flow can lead to increased flow inaccuracies across the temperature range.

- a. Undo the counter-nut (1).
- b. **To increase the flow rate:** Turn the set-screws (2) counter-clockwise.
To reduce the flow rate: Turn the set-screws (2) clockwise.
- c. Tighten the counter-nut (1).
- d. Check tightness.



5.5 Setting the pressure relief for the attachment



ATTENTION During operation, the valve can heat up to the oil temperature.



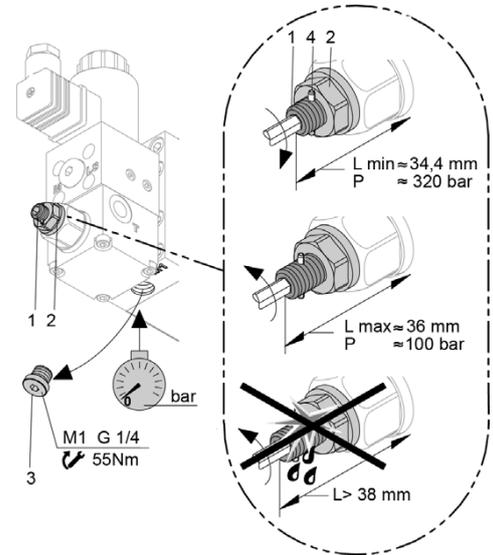
CAUTION! Do not unscrew the set-screw (1) more than 38 mm out of the housing. Do not loosen the screw-plug (3) while the flow control valve is under pressure.

NOTE

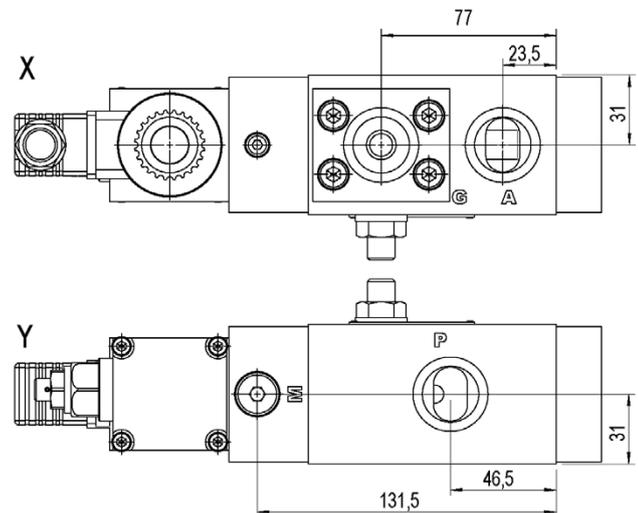
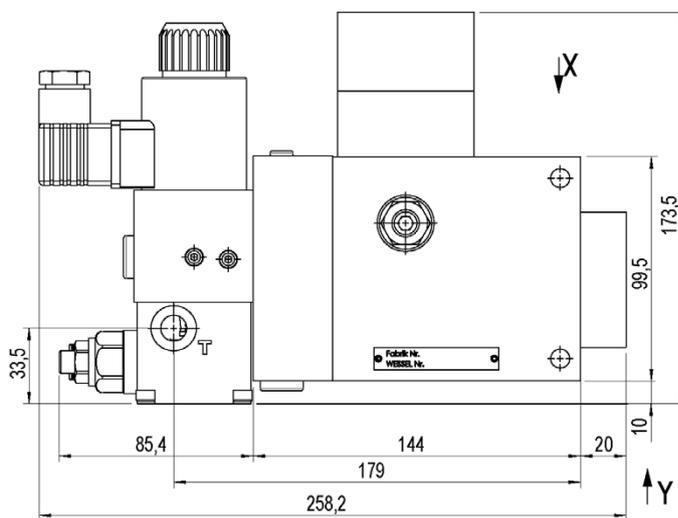
The counter-nut (2) is to be replaced after being used five times.

The maximum operating pressure of the attachment can be set between 100 – 320 bar.
The factory setting is 250 bar.

- a. Ensure that the flow control valve is not under pressure
- b. Remove the screw-plug (3)
- c. Connect the pressure gauge
- d. Switch on the hydraulics
- e. Undo the counter-nut (2)
- f. Adjust the maximum operating pressure of the attachment: **Increase:** Turn the set-screw (1) to the right. The maximum set-screw depth is restricted by the pin (4). **Reduce:** Turn the set-screw (1) to the left.
- g. Tighten the counter-nut (2)
- h. Switch off the hydraulics
- i. Depressurize the flow control valve
- j. Remove the measurement device
- k. Screw the screw-plug (3) back in. Torque 55 Nm
- l. Check tightness



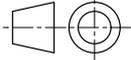
5.6 Dimensions



6 Notes, Standards and Safety Requirements

6.1 General remarks

- The views in drawings are shown in accordance with the European normal projection variant



- A comma (,) is used as a decimal point in drawings
- All dimensions are given in mm

6.2 Standards

The following standards must be observed when installing and operating the valve:

- DIN EN ISO 13732-1:2008-12, Temperatures on accessible surfaces

7 Accessories

- Junior Timer plug part number 340.305.900.6
- Conversion set "hydraulically operated" 770.000.021.8
- Conversion set "permanently connected" 770.000.022.8

