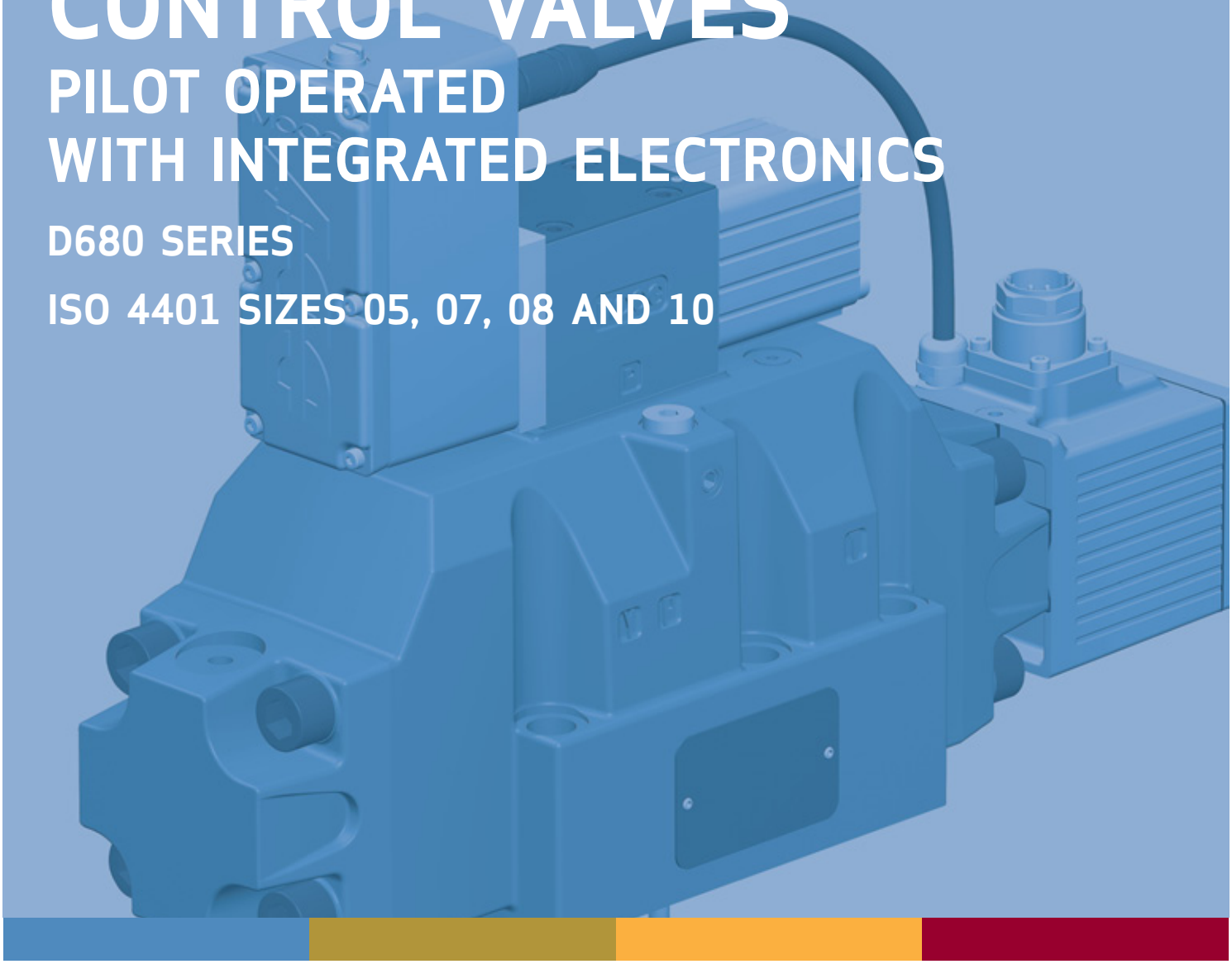
PROPORTIONAL CONTROL VALVES

PILOT OPERATED WITH INTEGRATED ELECTRONICS

D680 SERIES

ISO 4401 SIZES 05, 07, 08 AND 10



Rev. F, July 2023

2-STAGE PROPORTIONAL CONTROL VALVES WITH DIRECT DRIVE PILOT STAGE FOR DEMANDING APPLICATIONS WITH HIGH PRECISION AND DYNAMICS

WHAT MOVES YOUR WORLD

MOOG

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work. Through collaboration, creativity and world-class technological solutions, we help you overcome your toughest engineering obstacles. Enhance your machine's performance. And help take your thinking further than you ever thought possible.

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All dimensions in mm (in)

PRODUCT OVERVIEW

The Moog D680 Series Proportional Control Valves are throttle valves for 2-, 3-, 4- and 5-way applications. These valves are suitable for electrohydraulic position, velocity, flow or force control systems, including those with high dynamic response requirements. This product family is equipped with integrated electronics and closed-loop spool position control for the main stage.

The D680 is a two-stage valve with a D633 Direct Drive Valve as a pilot stage. The D633 pilot valve is characterized by its high dynamics and very low leakage. It is suited for very high dynamic requirements, while offering outstanding efficiency. The very high pressure efficiency of the D633 Series makes it the first choice for applications involving low pilot pressures.

The D633 pilot valve is available in two versions: One with open- and one with closed-loop position control for the pilot valve. The open-loop controlled version is controlled by the main stage electronics via a PWM signal. Its spool stroke is proportional to the applied Pulse Width Modulated (PWM) current. The closed-loop controlled version of the D633 is equipped with a position transducer and a separate onboard electronics to control the spool position of the pilot valve. While the open-loop controlled version is more cost efficient, the closed-loop controlled version offers slightly higher dynamics, a better repeatability of the main stage position and a higher resistance against contamination.

With a robust, proven design the Moog D680 Series provides reliable control for injection and blow molding equipment, die casting machines, presses, heavy industry equipment and paper and lumber processing machinery as well as other applications. This product family is easily integrated and configurable to meet your exact application and performance requirements. With a long legacy in hydraulic motion control and application expertise, Moog experts can help you select the version that best meets your needs.

For applications with safety requirements, a fail-safe option is available that guarantees a defined safe spool position to avoid potential damage.

	D681	**D682**	**D683**	**D684**	**D685**	
Valve design	2-stage, pilot-operated					
Size according to ISO 4401	05	07	08		10	
Mounting pattern	ISO 4401-05-05-0-05 with T_1	ISO 4401-07-07-0-05	ISO 4401-08-08-0-05		ISO 4401-10-09-0-05	
Rated flow at Δp_N 5 bar (75 psi)/spool land	30/60/80/2 x 80 l/min (7.9/15.9/21.1/ 2 x 21.1 gpm)	150/250 l/min (39.6/66 gpm)	350 l/min (92.4 gpm)	550 l/min (145.3 gpm)	1,000 l/min (264.2 gpm)	1,500 l/min (396.3 gpm)
Maximum flow[1)]	180 l/min (47.6 gpm)	600 l/min (158.5 gpm)	1,100 l/min (290.6 gpm)	1,500 l/min (396.3 gpm)	3,600 l/min (951 gpm)	
Maximum operating pressure - port P, A, B	350 bar (5,000 psi)					
Step response time for 0 to 100 % stroke	9 to 11 ms	10 to 13 ms	9 to 18 ms	11 to 26 ms	35 ms	40 ms

1) For recommended mean flow velocity of 30 m/s

FEATURES AND BENEFITS

Features	Benefits
D680 Series Proportional Control Valves	
A 2-stage valve design combining a dynamic pilot stage, flow-optimized main stage and integrated electronics	Provides reliable control in many demanding applications with a cost-effective, high-performance valve Ensures maximum flow for the given nominal size Offers more energy efficiency and optimized system sizing
Versions with stub-shaft spool available for the D683 and D684 Series, requiring reduced flow to move the spool faster than standard options	Improves dynamic response and achieve performance characteristics comparable to 3-stage valves
Integrated fail-safe versions available with defined safe spool position	Minimizes need for additional components with integrated fail-safe options Enhances user safety, lowers costs and reduces machine complexity
Pilot stage can handle full system pressure of 350 bar (5,000 psi)	Eliminates the need for additional components to reduce pilot pressure, saves costs and reduces machine complexity
Dual gain and curvilinear spool options available; User accessible electrical null adjust potentiometer	Helps to tune your system and obtain better resolution for many machine applications
Special versions available with a hardened valve housing to reduce wear, decoupled electronics for high shock and vibration environments, and ability to use special fluids	Increases uptime, extends the life of valve and reduces repair costs, ideal for machines used in demanding environments
Direct Drive Pilot Valve	
Direct drive pilot valve with a low internal pilot leakage flow	Reduces system losses, improves efficiency and saves energy, especially for systems with multiple valves
Dynamics of direct drive valve nearly independent of operating pressure	Delivers high dynamics even in systems with low pilot pressure
Excellent dynamics due to high frequency response	Provides higher acceleration, high accuracy and enhanced productivity, ideal for high performance applications
Direct Drive Pilot Valve with Closed-Loop Position Control	
Reach the desired pilot valve‘s spool position even at higher friction with the closed-loop control	Improves contaminaton resistance of the complete valve
Reduced series variation of the pilot valve‘s spool stroke, flow and dynamics	Increases overall dynamic performance, reduces series variation of the dynamic performance, provides higher stability in case of disturbances
Reduced hysteresis of the D633 pilot valve by the closed-loop position control	Rises repeatability and accuracy of the main stage position leading to improved machine performance

DESCRIPTION OF OPERATION

Proportional Control Valves

Electric Feedback Valves

The Moog D680 Series Proportional Control Valves are closed-loop hydraulic products that are used in industrial machinery. These valves are electrical feedback valves, which means that the position control loop for the main stage spool, the position transducer and the pilot valve is closed by the integrated valve electronics.

An electric command signal (spool position set point) is applied to the valve electronics. A position transducer (LVDT) measures the actual position of the spool. The electronics compare the spool position and the command signal and control the Pulse Width Modulated (PWM) current to the linear force motor of the Direct Drive Pilot Valve D633. The pilot valve moves the main stage spool to the desired position. Thus, the position of the main stage spool is proportional to the electric command signal.

Main Stage Version

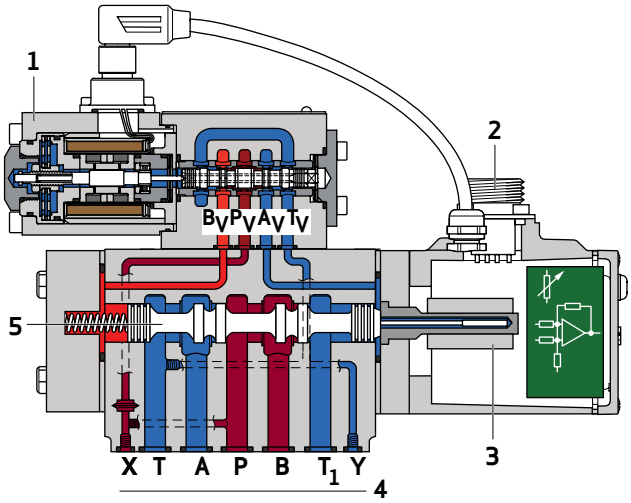
For D683 and D684 (size 08 valves), Moog offers two different versions of the main stage: Standard spool or stub shaft spool.

With standard spools, the main stage spool is directly driven by the pilot oil, which means the whole spool diameter is exposed to the pilot pressure. This leads to high control forces due to the large pressurized area, but it also means that a large amount of pilot flow is needed to move the main stage spool.

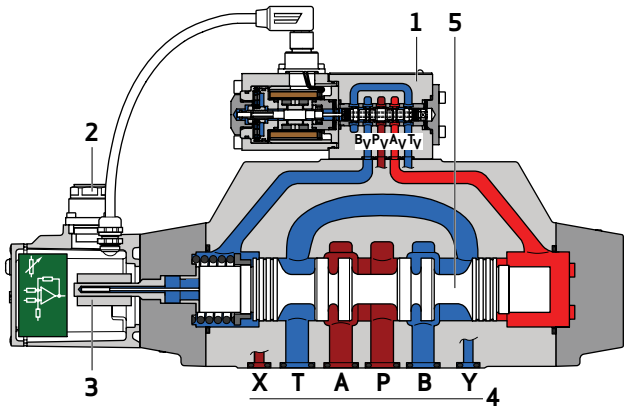
With stub shaft spools, the main stage spool is driven by additional pistons which have a smaller diameter than the main stage spool. This lowers the control forces, but also reduces the amount of pilot flow needed to move the main stage spool.

For the Moog D683 and D684 series valves, the pilot valves for both the standard and the stub shaft spool versions have the same rated flows. This means that the stub shaft version reaches significantly lower step response times for large signal changes.

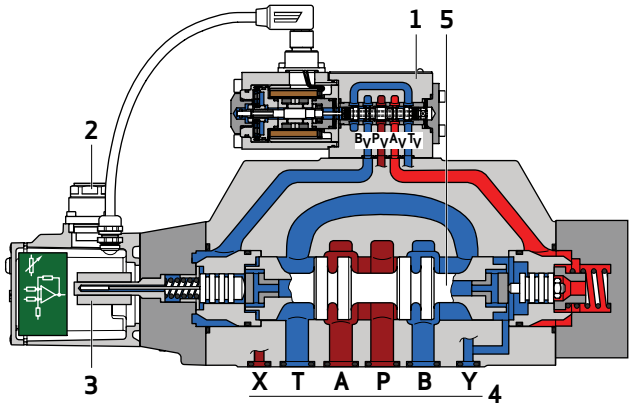
D681 Proportional Control Valve with D633 Pilot Valve



D683/D684 Proportional Control Valve with standard spool



D683/D684 Proportional Control Valve with stub shaft spool



1 Direct Drive Pilot Valve D633
2 Valve connector
3 Position transducer (LVDT)
4 Ports
5 Spool

DESCRIPTION OF OPERATION

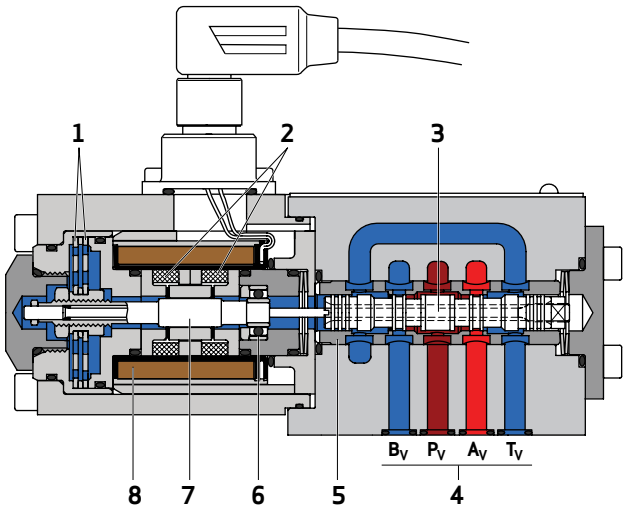
D633 Pilot Valve with Open-Loop Position Control

The pilot valve is a 4/3-way servo valve that is driven by a linear force motor. The linear force motor consists of a coil, permanent magnets, pole pieces, an armature and a centering spring. The armature of the linear force motor is linked to a spool that moves in a bushing inside the pilot valve housing. The spool controls the flow from the pilot pressure port to the control chambers of the main stage spool.

The de-energized position of the pilot valve's spool is determined by the centering springs of the linear force motor. If a Pulse Width Modulated (PWM) current is applied to the coil of the linear force motor, an electromagnetic field is created that superimposes the magnetic field of the permanent magnets. This creates a force on the armature, which causes the armature and thus the pilot valve's spool to be displaced. The direction of the displacement depends on the polarity of the current that is applied. The displacement of the centering spring causes a spring force opposing the direction of movement. Thus, the displacement of the pilot valve's spool is approximately proportional to the applied PWM current.

In the center position, which is defined by the centering spring, the linear force motor does not consume any current. This leads to a low energy consumption if the main stage spool is held at a constant position or during standby periods.

D633 Pilot Valve with Open-Loop Position Control



1 Centering springs
2 Permanent magnets
3 Spool
4 Ports
5 Bushing
6 Bearing
7 Armature
8 Coil

DESCRIPTION OF OPERATION

D633 Pilot Valve with Closed-Loop Position Control

This pilot valve is an enhanced version of the D633 pilot valve with open-loop position control. The basic layout is the same, but has been extended by a position transducer and an integrated electronics to allow a closed-loop position control.

Due to this, the pilot valve has several advantages over the open-loop controlled version: A lower hysteresis, low series variations of spool stroke, flow and dynamics as well as a higher resistance against contamination. All this leads to an improved performance of the overall valve.

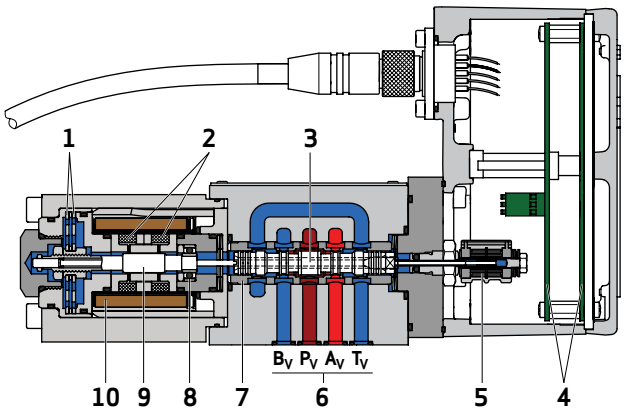
Biased Pilot Valve D633

A biased pilot valve means that the spring centered position of the pilot valve is outside the center position. For D633 pilot valves, this means that in a spring-centered position the pilot valve is about 10 to 20 % opened in either direction P → A or in direction P → B. This design is used to move the main stage spool to a defined end position if the electronic supply fails or is switched off and the pilot supply is still active.

Biased pilot valves are used for all fail-safe functions where the main stage spool position is not in the center position in a failure situation. If the desired spool position in case of a failure is the center position, an unbiased pilot valve in combination with a 4/2-way solenoid valve has to be used. Please refer to the section „Applications with Safety Requirements (Fail-safe)“ for further details on the different fail-safe options.

A biased D633 pilot valve has a rated flow that is about 25 % lower than that of an unbiased D633 pilot valve. Hence, the step response times for Moog D682 to D684 Series Proportional Control Valves with biased pilot valves are slightly slower than with unbiased pilot valves. The different dynamic characteristics of valves with biased and unbiased pilot valves are shown in the technical data section for each valve size.

D633 Pilot Valve with Closed-Loop Position Control



1 Centering springs
2 Permanent magnets
3 Spool
4 Electronics
5 Position transducer (LVDT)
6 Ports
7 Bushing
8 Bearing
9 Armature
10 Coil

DESCRIPTION OF OPERATION

Applications with Safety Requirements (Fail-safe)

When using this product in machines subject to safety regulations, fail-safe versions can ensure that the spool is moved to a defined safe position in the event of a failure. Depending on the application, this safe position can be the center position (for overlapped spools) or one of the end positions P → A or P → B.

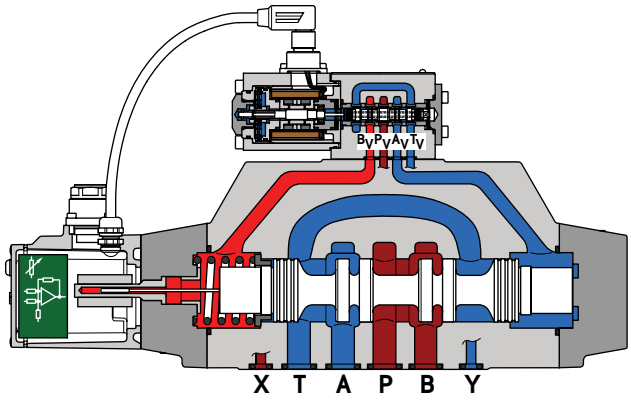
Moog offers several fail-safe options for the D680 Series Proportional Control Valves to suit the needs of different applications.

a) Biased pilot valves and springs to move the main stage spool to an end position (fail-safe functions D and F):
The spring centered position of the D633 pilot valve is either P → A or P → B. Thus, when the electrical power fails and the hydraulic supply is still available, the pilot valve will hydraulically move the main stage spool to its end position P → A or P → B.
In addition, the main stage spool is also equipped with mechanical springs. Thus, if the electric and hydraulic supplies fail, the main stage spool is moved to its end position P → A or P → B by spring force.

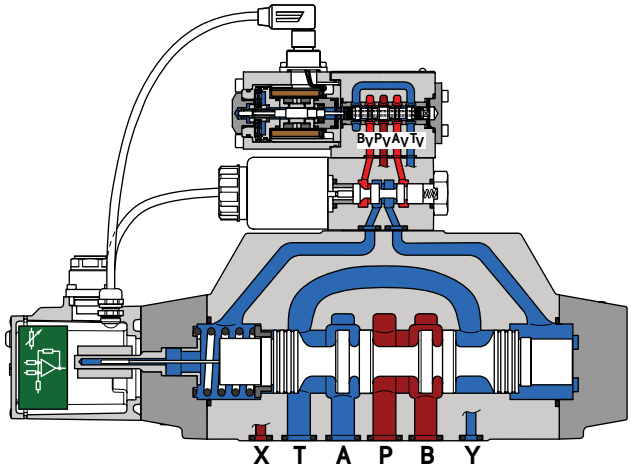
b) 4/2-way solenoid valve to override the pilot valve (fail-safe functions U and W):
A solenoid valve is used to uncouple the pilot valve from the main stage. When the solenoid valve is de-energized, the hydraulic pilot supply is cut off from the main stage and the springs will move the main stage to its defined position. The main spool position is now independent from the command signal and the state of the pilot valve or the integrated valve electronics. Depending on the application, several options for the defined spool position are available: Center position, slightly opened or fully opened to one direction (P → A or P → B).

These versions of Moog Proportional Control Valves are equipped with an additional logic output at the 11-pole + PE connector to monitor if the valve is in the safe position. For details refer to the section “Background - Electronics Logic Functions“.

D683/D684 Valve with Spring to Move the Main Stage to an End Position



D683/D684 valve with integrated 4/2-way solenoid valve for applications with safety requirements



Please note:

- If the movement of an actuator is blocked in the center position, the main spool has to be equipped with a sufficient overlap (>= ±10 %).
- All valves that include a 4/2-way solenoid are equipped with 11-pole + PE connectors.
- Although the solenoid valve is wired via the 11-pole + PE connector, it has to be operated independently and is not connected to the integrated valve electronics.
- To reduce the fail-safe switching time to the center position, it is advised to both switch off the supply of the 4/2-way valve and the enable signal at the same time. This does not apply if the defined position is the fully opened position.
- For certain safety requirements, it might be necessary to additionally monitor the position of the 4/2-way solenoid valve. For these applications, monitored versions of the 4/2-way solenoid valves are available upon request.

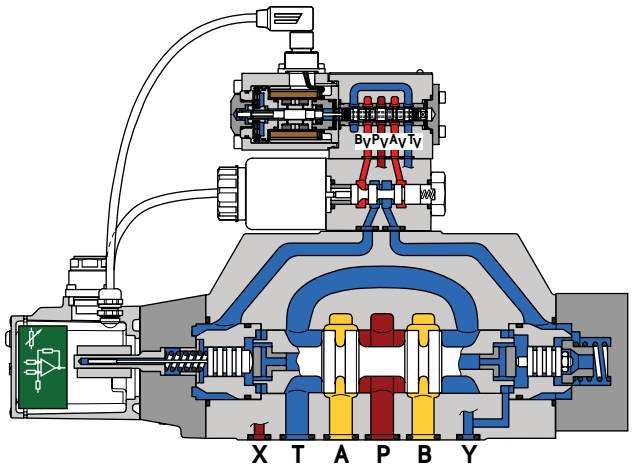
DESCRIPTION OF OPERATION

Applications with Safety Requirements (Fail-safe)

Selecting the Fail-safe Function for Applications with Safety Requirements

The valve series D680 is offered with various fail-safe functions. The behavior of the valve in a fail-safe situation depends on the fail-safe function selected, the pilot valve and the actual pilot pressure, the electrical supply of the valve electronics and the 4/2-way valve. The tables provide further details to help select the best fail-safe function for your machine.
The spool positions of the main stage in the event of a failure of valve electronics, control pressure or power supply are described below.

D683/D684 Valve with Integrated 4/2-way Solenoid Valve



Fail-safe function	Spool position of the main stage	Pilot pressure 1) 2)	Valve electronics	4/2-way valve
F	Normal operation	On	On	–
	End position P → B and A → T	On	Off	–
	Undefined	Off	On	–
	End position P → B and A → T	Off	Off	–
D	Normal operation	On	On	–
	End position P → A and B → T	On	Off	–
	Undefined	Off	On	–
	End position P → A and B → T (D681: 20 % P → A and B → T)	Off	Off	–
W	Normal operation	On	On	On
	Defined center position	On	On	Off
	Undefined	On	Off	On
	Defined center position	On	Off	Off
	Undefined	Off	On	On
	Defined center position	Off	On	Off
	Undefined	Off	Off	On
	Defined center position	Off	Off	Off
U	Normal operation	On	On	On
	Defined center position or defined P → B and A → T	On	On	Off
	End position P → B and A → T	On	Off	On
	Defined center position or defined P → B and A → T	On	Off	Off
	Undefined	Off	On	On
	Defined center position or defined P → B and A → T	Off	On	Off
	Defined center position or defined P → B and A → T	Off	Off	On
	Defined center position or defined P → B and A → T	Off	Off	Off

1) System pressure for internal pilot connection

2) Pressure „off“ means without pressure (<<1 bar). For higher pressures the spool position of the main stage is undefined. Pressure „on“ means a pilot pressure of at least the value caculated according to the procedure given in the section „Pilot Pressure and Flow Calculation“. For lower pressures the spool position of the main stage is undefined.

SIZE 05 - D681 WITH OPEN-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm^2/s (32 cSt) and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external	
Mounting pattern	ISO 4401-05-05-0-05 with T_1	
Installation position	Any	
Weight	8 kg (17.6 lb)	
Weight including fail-safe valve	9.7 kg (21.4 lb)	
Storage temperature range	-40 to +80 °C (-40 to +176 °F)	
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)	
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz	
Shock resistance	50 g, 6 directions	

Hydraulic Data

Operating pressure pilot valve		
Minimum pressure	10 bar (145 psi) above T or Y	
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)	
Maximum pressure Y port[3)]	70 bar (1,000 psi)	
Maximum operating pressure of main stage		
Port P, A, B	350 bar (5,000 psi)	
Port T at Y internal[3)]	70 bar (1,000 psi)	
Port T at Y external	250 bar (3,625 psi)	
Rated flow at Δp_N 5 bar (75 psi)/spool land	30/60/80/2 x 80 l/min (7.9/15.9/21.1/2 x 21.1 gpm)	
Maximum flow	180 l/min (47.6 gpm)	
Main stage leakage flow (≈ zero lap)	1.8 l/min (0.48 gpm)	
Pilot leakage flow	0.4 l/min (0.1 gpm)	
Pilot flow for 100 % step	6.0 l/min (1.6 gpm)	6.5 l/min (1.7 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.	
Temperature range	-20 to +80 °C (-4 to +176 °F)	
Viscosity range		
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm^2/s (cSt)	
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm^2/s (cSt)	
Recommended cleanliness class according to ISO 4406[4)]		
For functional safety	18/15/12	
For longer service life	17/14/11	

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 05 - D681 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	11 ms	
Threshold, typical	< 0.1 %	
Threshold, maximum	< 0.2 %	
Hysteresis, typical	< 0.1 %	
Hysteresis, maximum	< 0.2 %	
Null shift at ΔT = 55 K (131 °F)	< 1.5 %	
Sample deviation of rated flow	±10 %	

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[7)]	0.3 A
Maximum current consumption dynamic[7)]	1.2 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

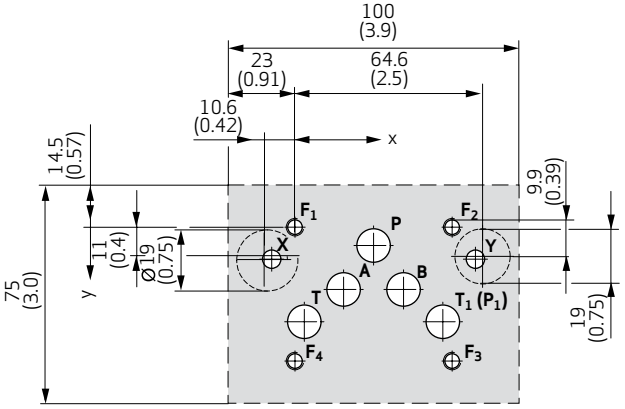
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 05 - D681 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must comform to
ISO 4401-05-05-0-05.
Clamping length minimum 100 mm (3.94 in)

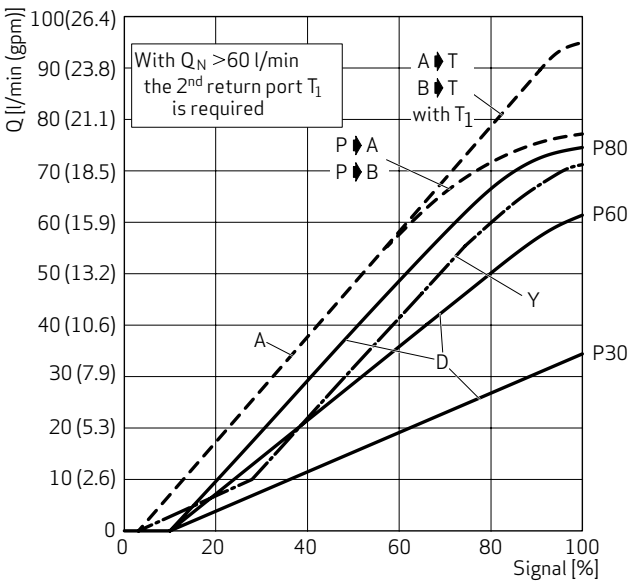
- For valves of 4-way design with Q_N> 60 l/min (15.9 gpm) and for 2/2-way design the second tank port T_1 is required.
- For the 5-way design type B80... T_1 becomes P_1.
- For a maximum flow rate, the ports P, T, T_1, A and B should be provided with a diameter of 11.5 mm (0.45 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness R_a better than 0.8 µm (0.0000314 in).



Designation		P	A	B	T	T_1 (P_1)	X	Y	F_1	F_2	F_3	F_4
Size Ø	**mm**	11.5	11.5	11.5	11.5	11.5	6.3	6.3	M6	M6	M6	M6
	in	0.45	0.45	0.45	0.45	0.45	0.25	0.25	M6	M6	M6	M6
Position X	**mm**	27	16.7	37.3	3.2	50.8	-8	62	0	54	54	0
	in	1.063	0.657	1.469	0.126	2	-0.315	2.441	0	2.126	2.126	0
Position Y	**mm**	6.3	21.4	21.4	32.5	32.5	11	11	0	0	46	46
	in	0.248	0.843	0.843	1.28	1.28	0.433	0.433	0	0	1.811	1.811

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

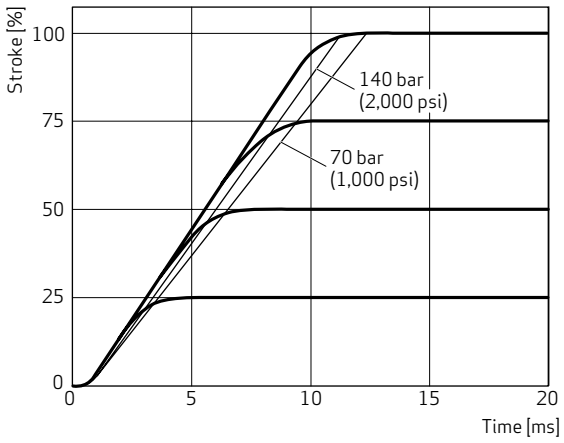


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 05 - D681 WITH OPEN-LOOP CONTROLLED PILOT VALVE

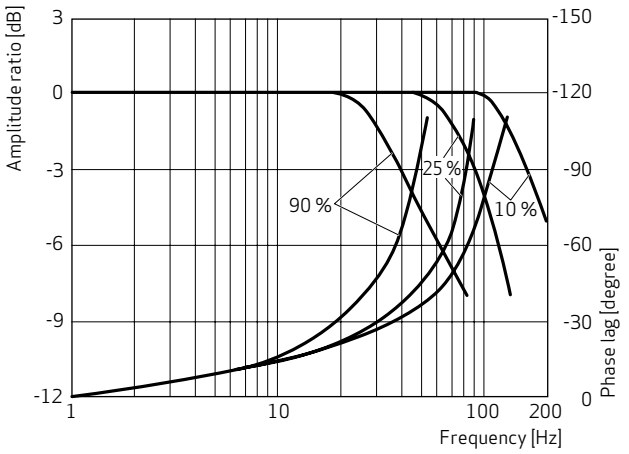
Step Response

With pilot valve D633 unbiased

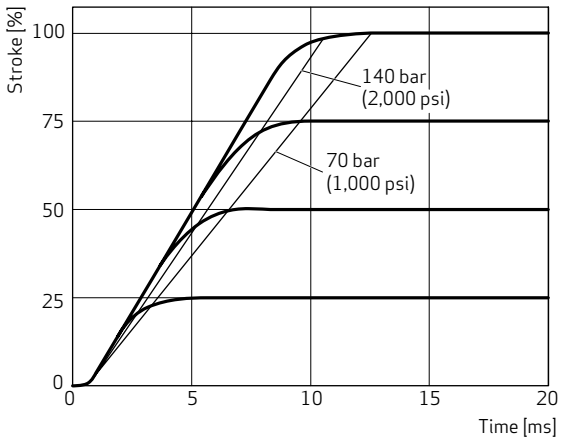


Frequency Response

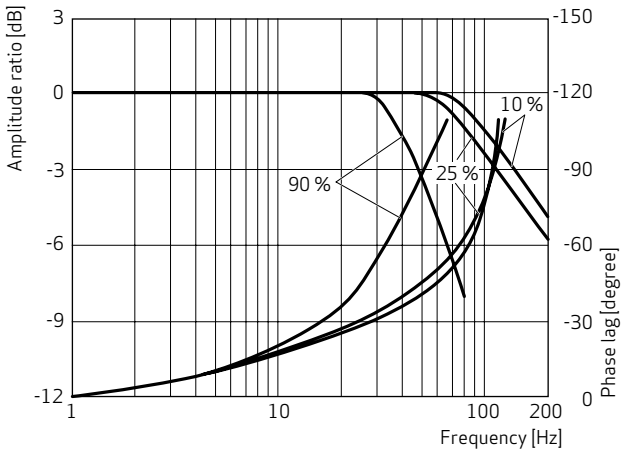
With pilot valve D633 unbiased



With pilot valve D633 biased

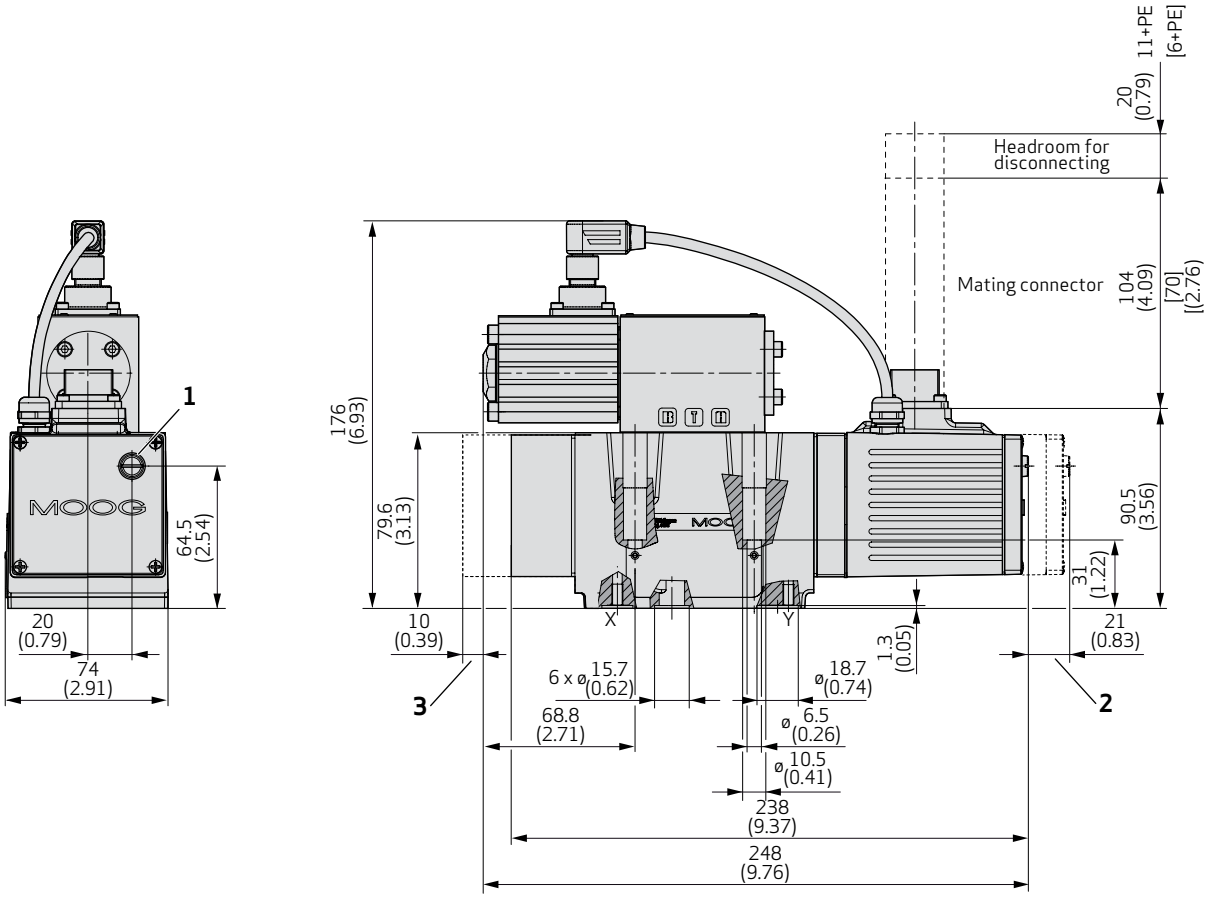


With pilot valve D633 biased



SIZE 05 - D681 WITH OPEN-LOOP CONTROLLED PILOT VALVE

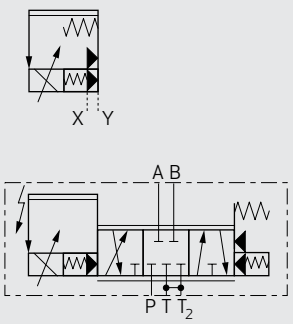
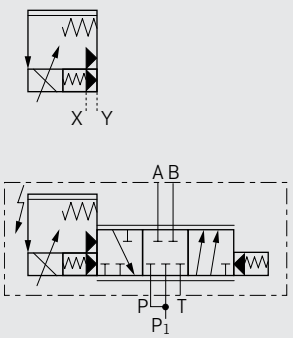
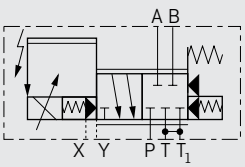
Installation Drawing for Fail-safe Options D, F and M



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

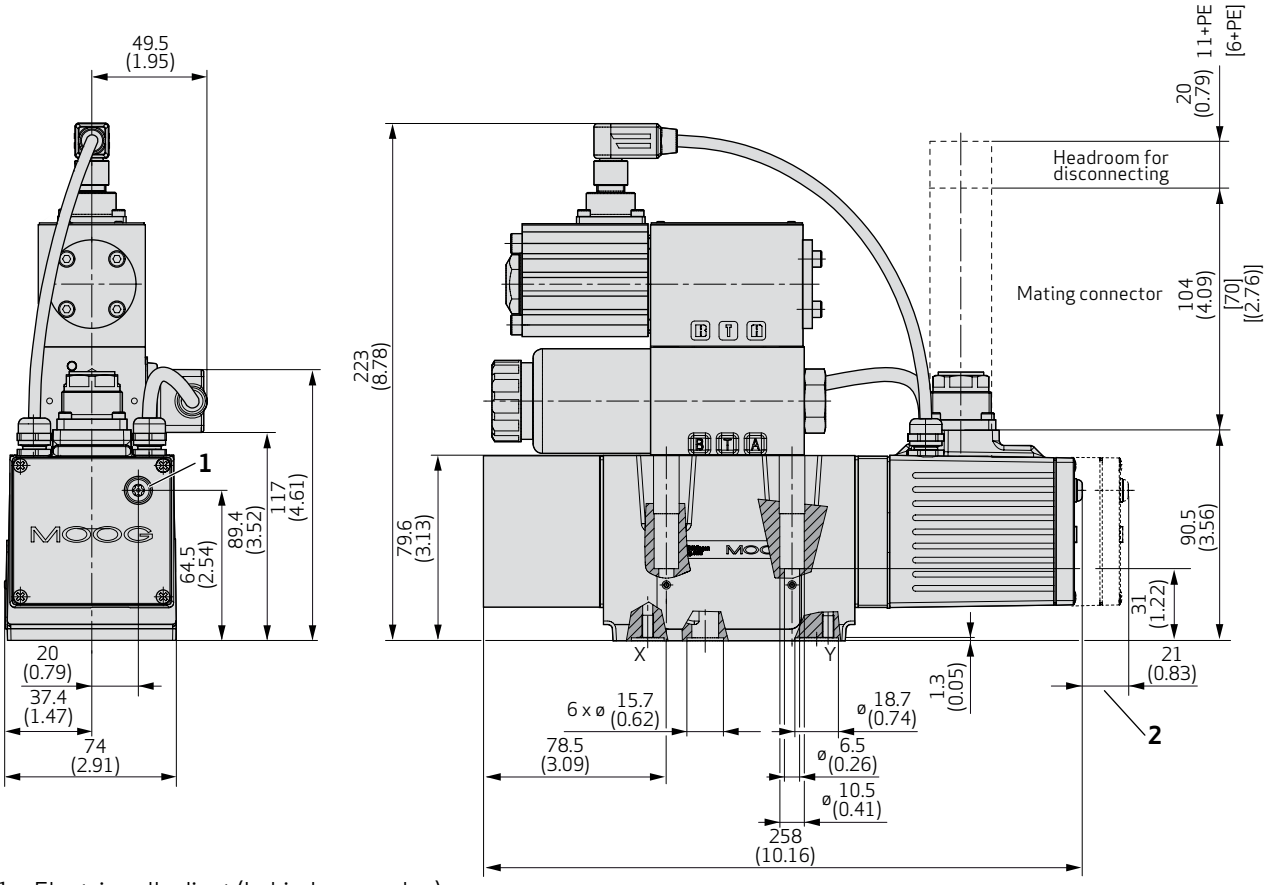
2 With damping plate

3 With end cap for spring centering P → A and B → T

Optional X and Y external	Optional X and Y external "P1" port equal to port "T1" "P1" does not conform to ISO 4401	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 5-way design: Port P_1 required Fail-safe position A → T	Fail-safe option M 2x2-way design: A second tank port T_1 required Flow direction only according to symbol

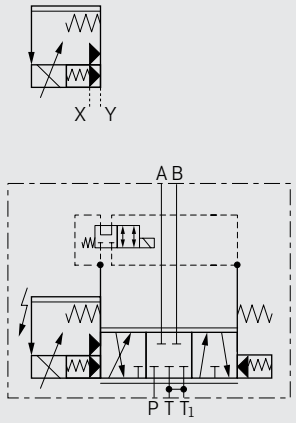
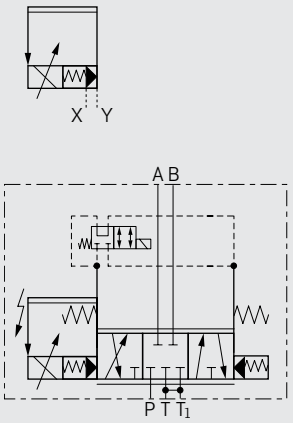
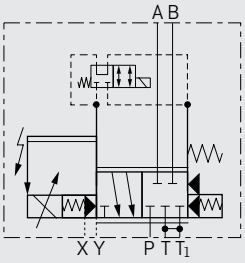
SIZE 05 - D681 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position Flow direction only according to symbol

SIZE 05 - D681 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external	
Mounting pattern	ISO 4401-05-05-0-05 with T_1	
Installation position	Any	
Weight	8.5 kg (18.7 lb)	
Weight including fail-safe valve	10.2 kg (22.5 lb)	
Storage temperature range	-40 to +80 °C (-40 to +176 °F)	
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)	
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz	
Shock resistance	50 g, 6 directions	

Hydraulic Data

Operating pressure pilot valve		
Minimum pressure	10 bar (145 psi) above T or Y	
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)	
Maximum pressure Y port[1)]	70 bar (1,000 psi)	
Maximum operating pressure of main stage		
Port P, A, B	350 bar (5,000 psi)	
Port T at Y internal[3)]	70 bar (1,000 psi)	
Port T at Y external	250 bar (3,625 psi)	
Rated flow at Δp_N 5 bar (75 psi)/spool land	30/60/80/2 x 80 l/min (7.9/15.9/21.1/2 x 21.1 gpm)	
Maximum flow	180 l/min (47.6 gpm)	
Main stage leakage flow (≈ zero lap)	1.8 l/min (0.48 gpm)	
Pilot leakage flow	0.4 l/min (0.1 gpm)	
Pilot flow for 100 % step	8 l/min (2.1 gpm)	6.6 l/min (1.7 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.	
Temperature range	-20 to +80 °C (-4 to +176 °F)	
Viscosity range		
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)	
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)	
Recommended cleanliness class according to ISO 4406[4)]		
For functional safety	18/15/12	
For longer service life	17/14/11	

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 05 - D681 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	9 ms	
Threshold, typical	< 0.1 %	
Threshold, maximum	< 0.2 %	
Hysteresis, typical	< 0.1 %	
Hysteresis, maximum	< 0.2 %	
Null shift at ΔT = 55 K (131 °F)	< 1.5 %	
Sample deviation of rated flow	±10 %	

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[7)]	0.45 A
Maximum current consumption dynamic[7)]	1.35 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

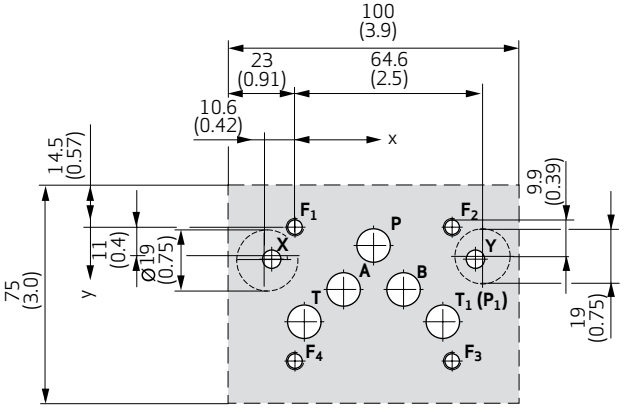
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 05 - D681 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must comform to
ISO 4401-05-05-0-05.
Clamping length minimum 100 mm (3.94 in)

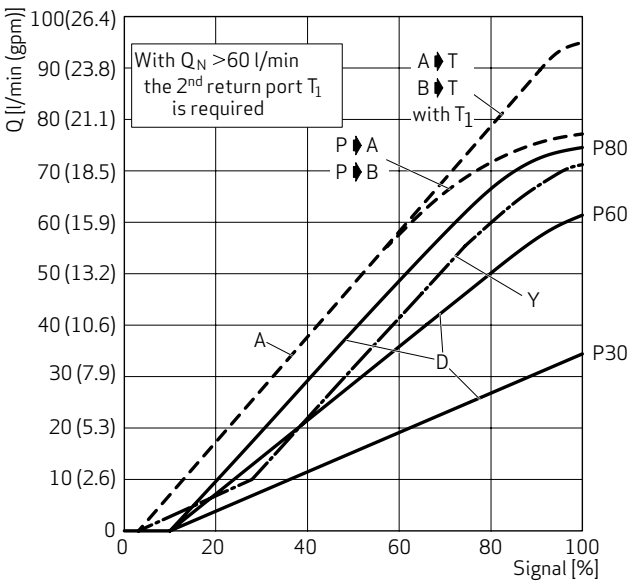
- For valves of 4-way design with Q_N> 60 l/min (15.9 gpm) and for 2/2-way design the second tank port T_1 is required.
- For the 5-way design type B80... T_1 becomes P_1.
- For a maximum flow rate, the ports P, T, T_1, A and B should be provided with a diameter of 11.5 mm (0.45 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness R_a better than 0.8 µm (0.0000314 in).



Designation		P	A	B	T	T_1 (P_1)	X	Y	F_1	F_2	F_3	F_4
Size Ø	**mm**	11.5	11.5	11.5	11.5	11.5	6.3	6.3	M6	M6	M6	M6
	in	0.45	0.45	0.45	0.45	0.45	0.25	0.25	M6	M6	M6	M6
Position X	**mm**	27	16.7	37.3	3.2	50.8	-8	62	0	54	54	0
	in	1.063	0.657	1.469	0.126	2	-0.315	2.441	0	2.126	2.126	0
Position Y	**mm**	6.3	21.4	21.4	32.5	32.5	11	11	0	0	46	46
	in	0.248	0.843	0.843	1.28	1.28	0.433	0.433	0	0	1.811	1.811

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

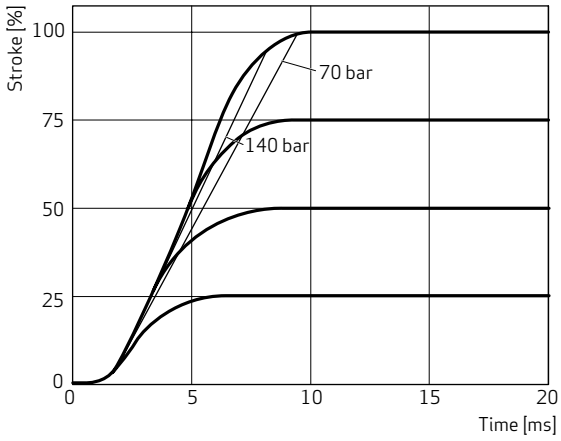


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 05 - D681 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

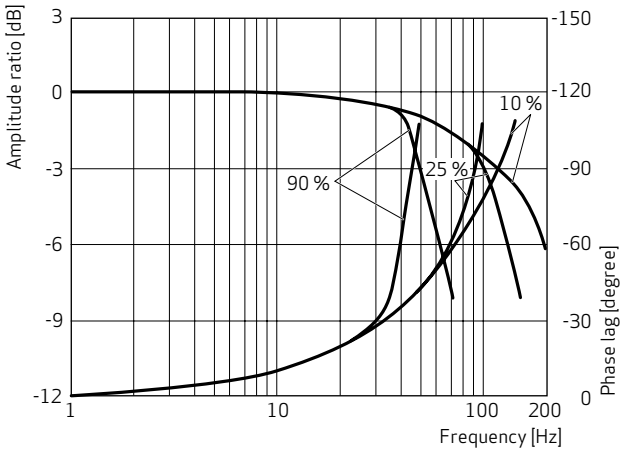
Step Response

With pilot valve D633 unbiased and biased



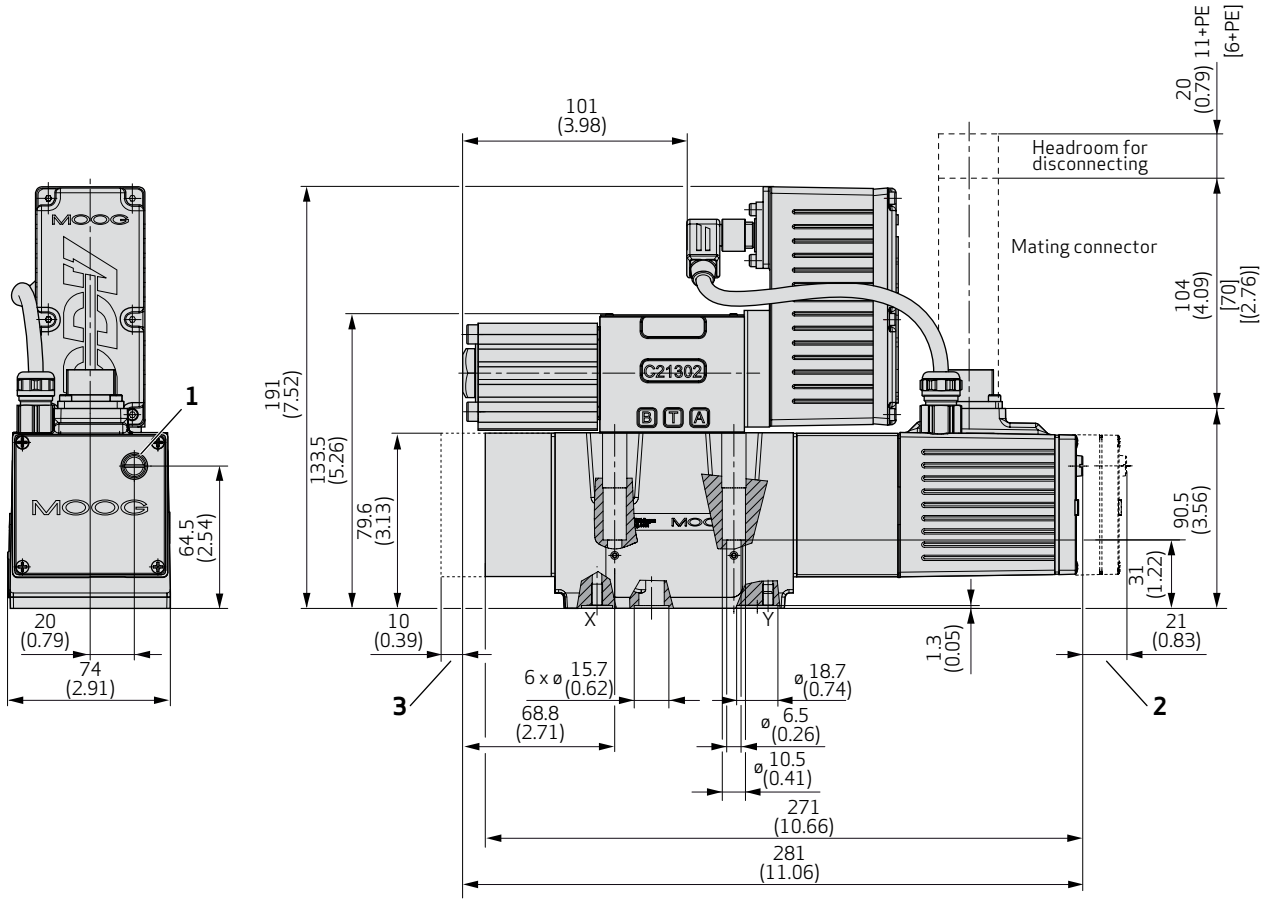
Frequency Response

With pilot valve D633 unbiased and biased



SIZE 05 - D681 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

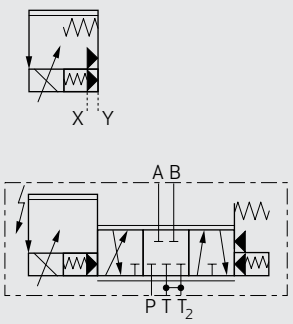
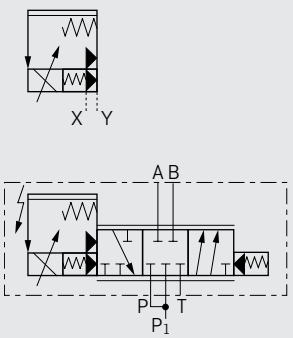
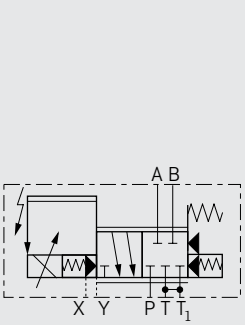
Installation Drawing for Fail-safe Options D, F and M



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

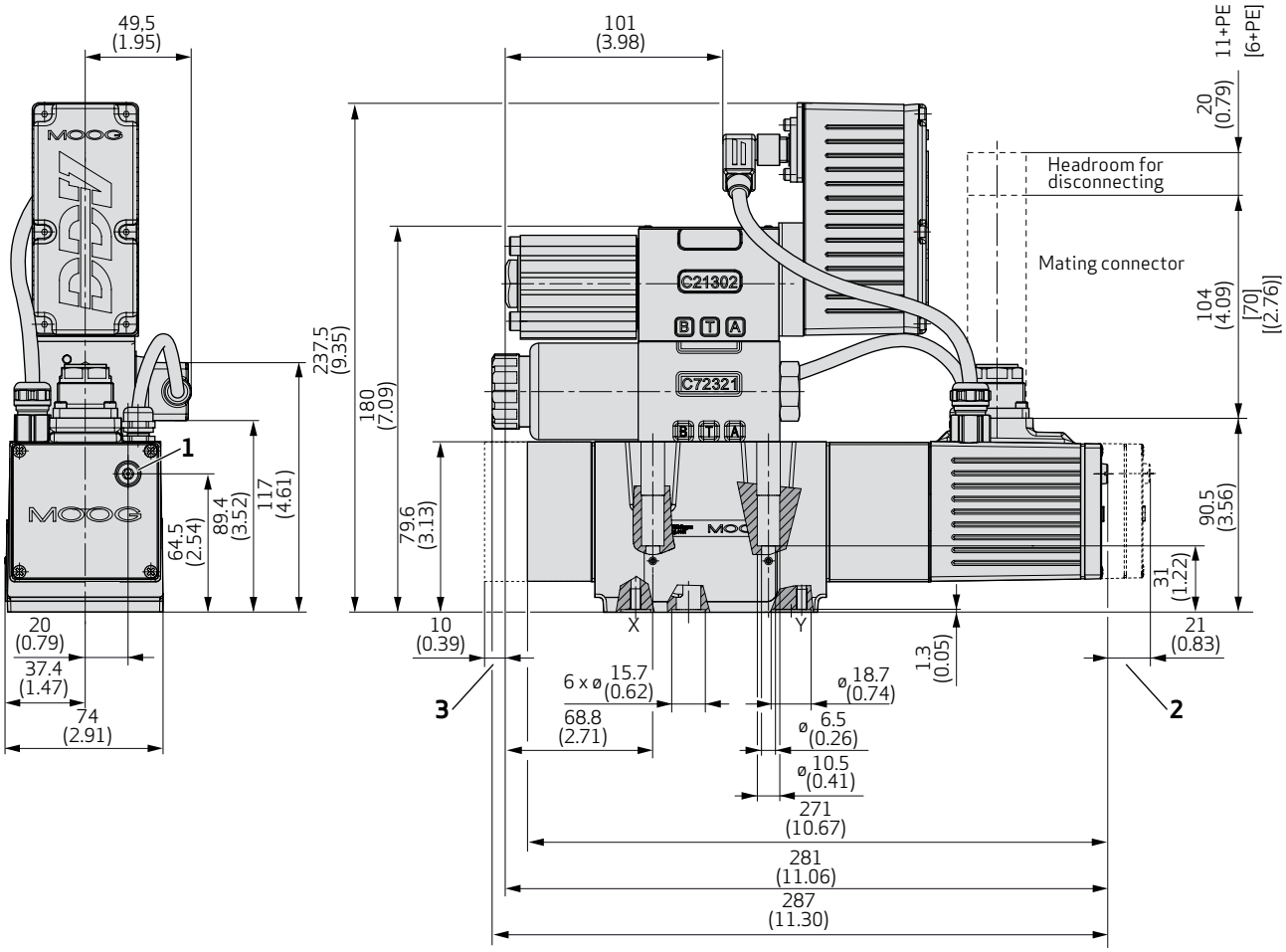
2 With damping plate

3 With end cap for spring centering P → A and B → T

Optional X and Y external	Optional X and Y external "P1" port equal to port "T1" "P1" does not conform to ISO 4401	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 5-way design: Port P_1 required Fail-safe position A → T	Fail-safe option M 2x2-way design: A second tank port T_1 required Flow direction only according to symbol

SIZE 05 - D681 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

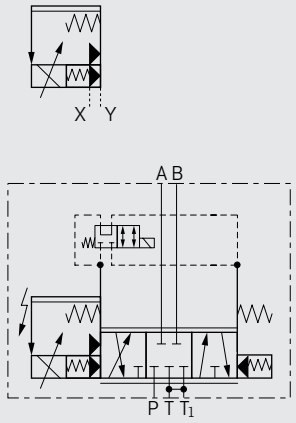
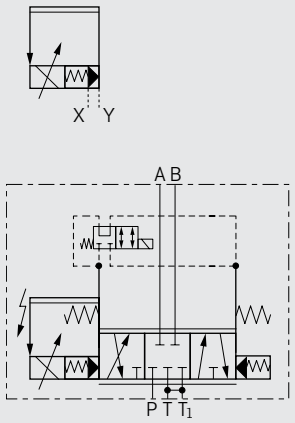
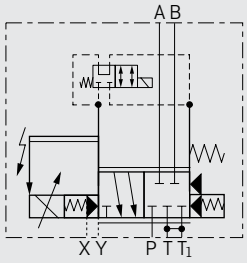
Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

3 With end cap for spring centering P → A and B → T

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position Flow direction only according to symbol

SIZE 07 - D682 WITH OPEN-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external	
Mounting pattern	ISO 4401-07-07-0-05	
Installation position	Any	
Weight	11.2 kg (24.7 lb)	
Weight including fail-safe valve	12.9 kg (28.4 lb)	
Storage temperature range	-40 to +80 °C (-40 to +176 °F)	
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)	
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz	
Shock resistance	50 g, 6 directions	

Hydraulic Data

Operating pressure pilot valve		
Minimum pressure	10 bar (145 psi) above T or Y	
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)	
Maximum pressure Y port[3)]	70 bar (1,000 psi)	
Maximum operating pressure of main stage		
Port P, A, B	350 bar (5,000 psi)	
Port T at Y internal[3)]	70 bar (1,000 psi)	
Port T at Y external	350 bar (5,000 psi)	
Rated flow at Δp_N 5 bar (75 psi)/spool land	150/250 l/min (39.6/66.0 gpm)	
Maximum flow	600 l/min (158.5 gpm)	
Main stage leakage flow (≈ zero lap)	2.5 l/min (0.66 gpm)	
Pilot leakage flow	0.5 l/min (0.1 gpm)	
Pilot flow for 100 % step	35 l/min (9.2 gpm)	26 l/min (6.9 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.	
Temperature range	-20 to +80 °C (-4 to +176 °F)	
Viscosity range		
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)	
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)	
Recommended cleanliness class according to ISO 4406[4)]		
For functional safety	18/15/12	
For longer service life	17/14/11	

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 07 - D682 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	11 ms	13 ms
Threshold, typical	< 0.1 %	
Threshold, maximum	< 0.2 %	
Hysteresis, typical	< 0.1 %	
Hysteresis, maximum	< 0.2 %	
Null shift at ΔT = 55 K (131 °F)	< 1.2 %	< 1 %
Sample deviation of rated flow	±10 %	

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[7)]	0.3 A
Maximum current consumption dynamic[7)]	1.2 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

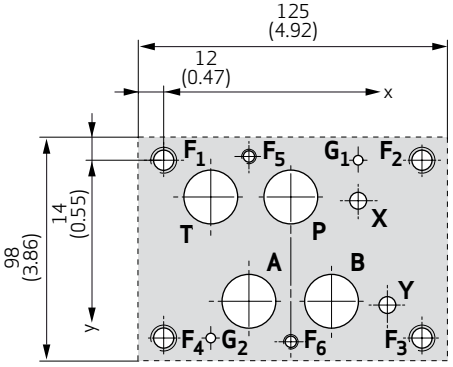
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 07 - D682 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-07-07-0-05.

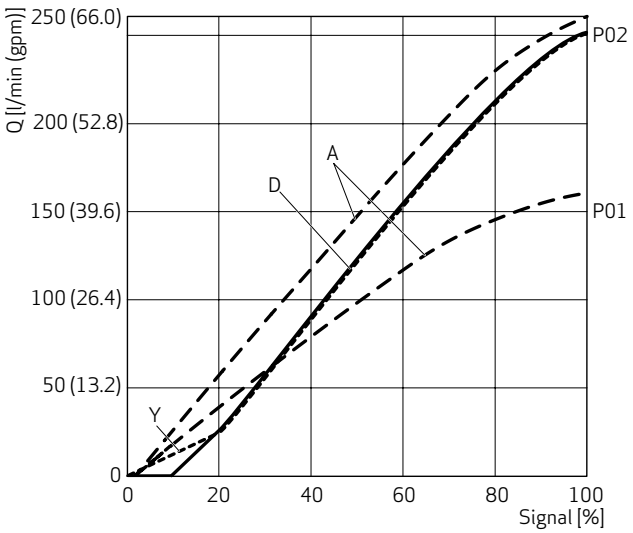
- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 20 mm (0.79 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness R_a better than 0.8 µm (0.0000314 in).



Designation		P	A	B	T	X	Y	F_1	F_2	F_3	F_4	F_5	F_6	G_1	G_2
Size Ø	**mm**	20	20	20	20	6.3	6.3	M10	M10	M10	M10	M6	M6	4	4
	in	0.79	0.79	0.79	0.79	0.25	0.25	M10	M10	M10	M10	M6	M6	0.16	0.16
Position X	**mm**	50	34.1	65.9	18.3	76.6	88.1	0	101.6	101.6	0	34.1	50	76.6	18.3
	in	1.969	1.343	2.594	0.72	3.016	3.469	0	4	4	0	1.343	1.969	3.016	0.72
Position Y	**mm**	14.3	55.6	55.6	14.3	15.9	57.2	0	0	69.9	69.9	-1.6	71.5	0	69.9
	in	0.563	2.189	2.189	0.563	0.626	2.252	0	0	2.752	2.752	-0.063	2.815	0	2.752

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

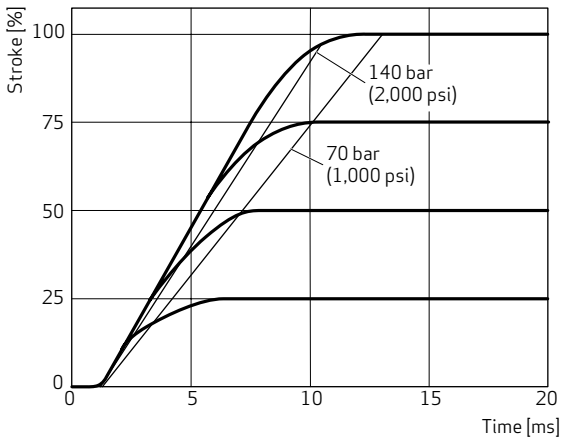


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 07 - D682 WITH OPEN-LOOP CONTROLLED PILOT VALVE

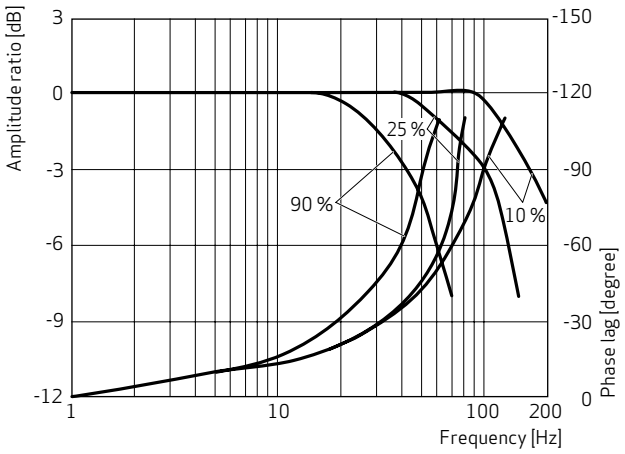
Step Response

With pilot valve D633 unbiased

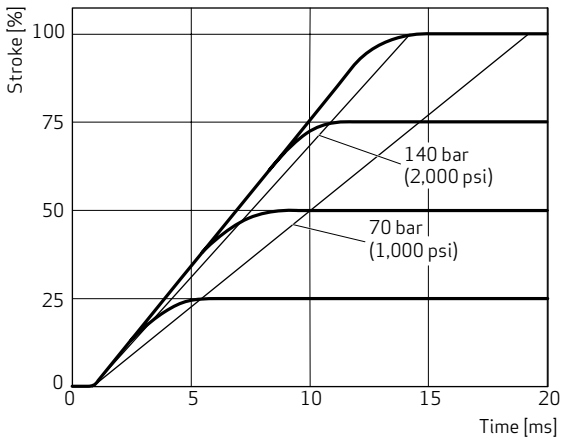


Frequency Response

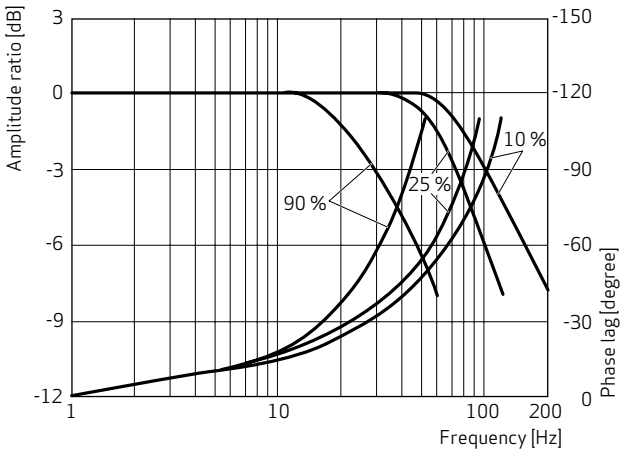
With pilot valve D633 unbiased



With pilot valve D633 biased

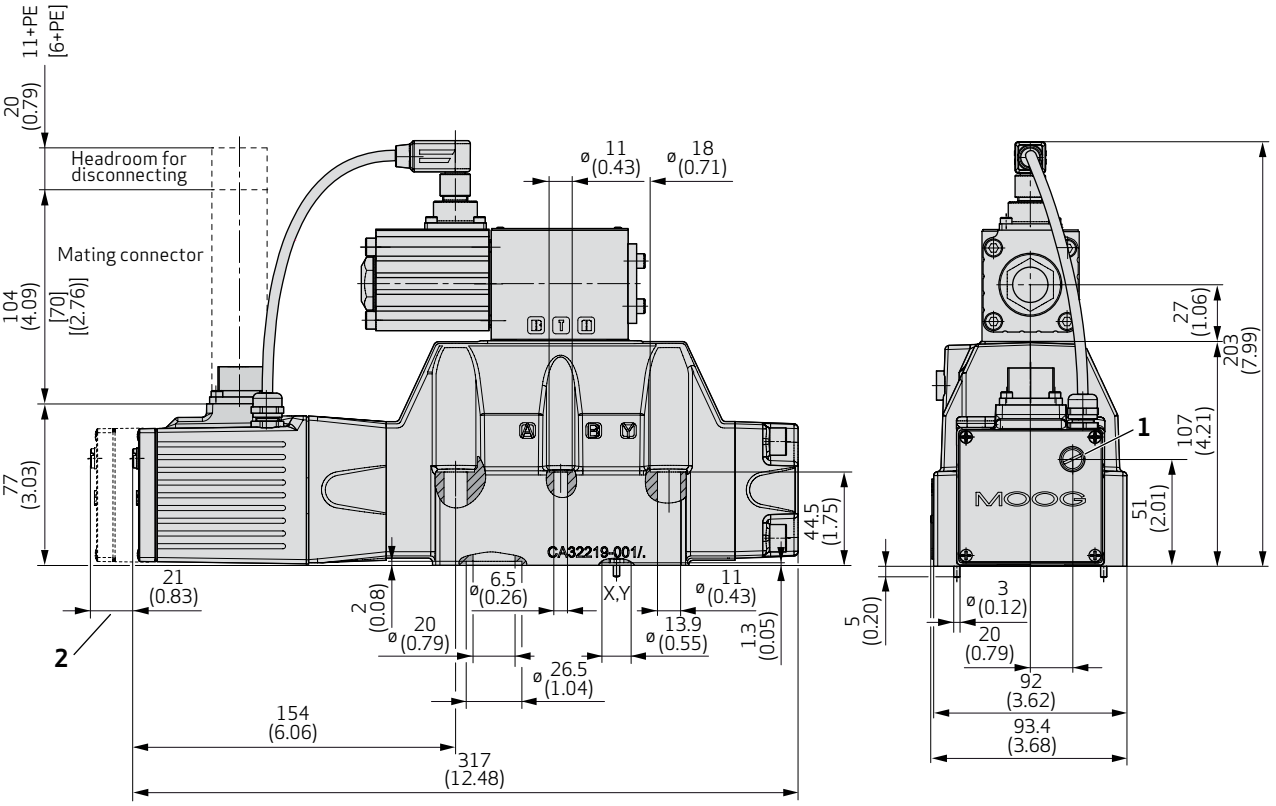


With pilot valve D633 biased



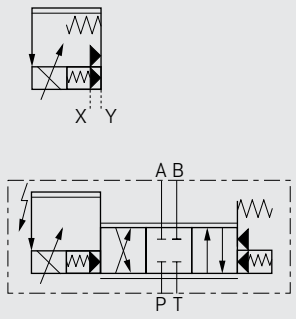
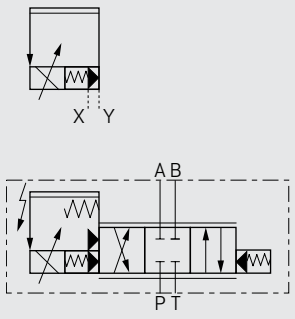
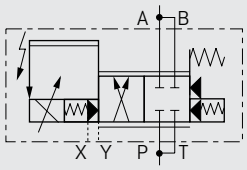
SIZE 07 - D682 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Installation Drawing for Fail-safe Options D, F and M



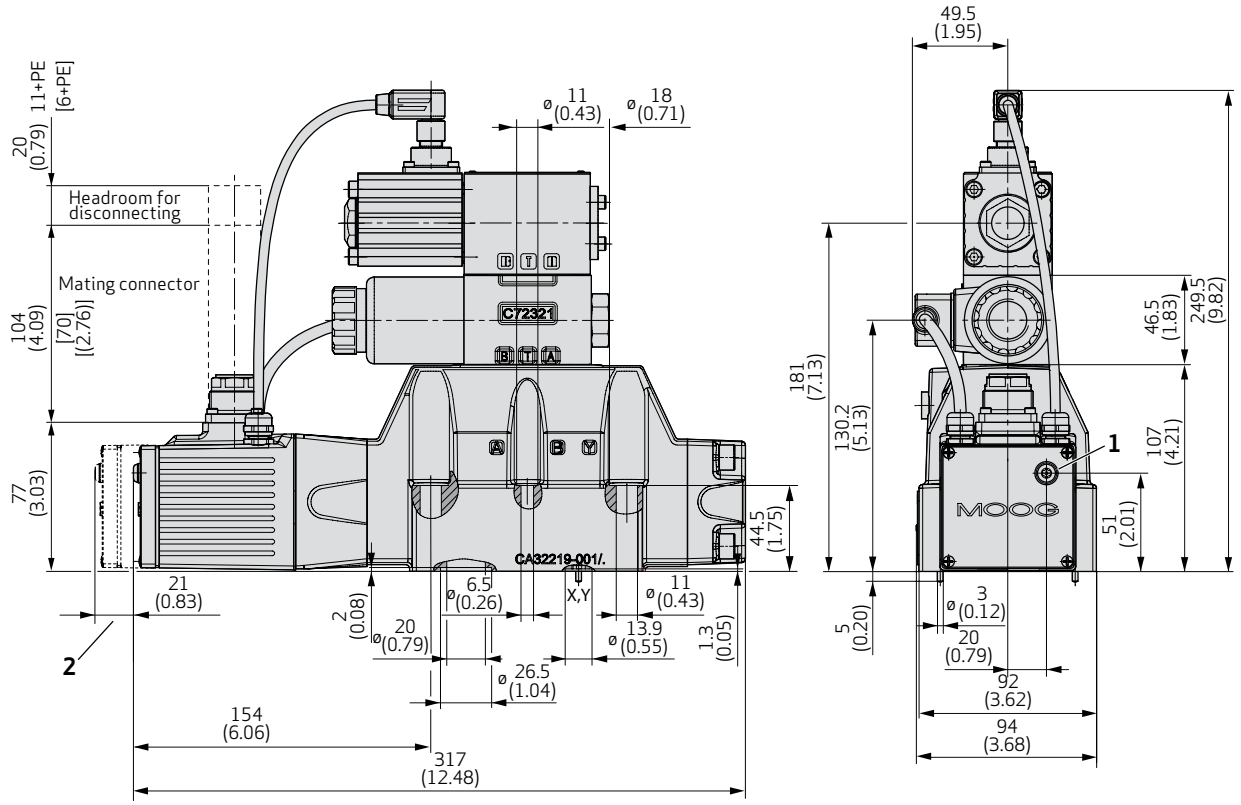
1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

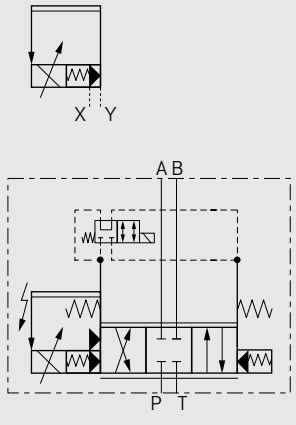
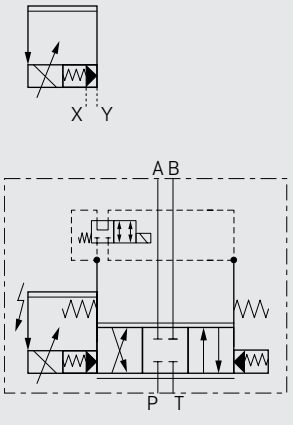
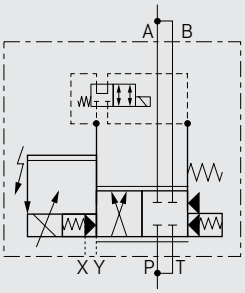
SIZE 07 - D682 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

SIZE 07 - D682 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external	
Mounting pattern	ISO 4401-07-07-0-05	
Installation position	Any	
Weight	11.7 kg (25.8 lb)	
Weight including fail-safe valve	13.4 kg (29.5 lb)	
Storage temperature range	-40 to +80 °C (-40 to +176 °F)	
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)	
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz	
Shock resistance	50 g, 6 directions	

Hydraulic Data

Operating pressure pilot valve		
Minimum pressure	10 bar (145 psi) above T or Y	
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)	
Maximum pressure Y port[1)]	70 bar (1,000 psi)	
Maximum operating pressure of main stage		
Port P, A, B	350 bar (5,000 psi)	
Port T at Y internal[3)]	70 bar (1,000 psi)	
Port T at Y external	250 bar (3,625 psi)	
Rated flow at Δp_N 5 bar (75 psi)/spool land	150/250 l/min (39.6/66.0 gpm)	
Maximum flow	600 l/min (158.5 gpm)	
Main stage leakage flow (≈ zero lap)	2.5 l/min (0.66 gpm)	
Pilot leakage flow	0.5 l/min (0.1 gpm)	
Pilot flow for 100 % step	33 l/min (8.7 gpm)	27 l/min (7.1 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.	
Temperature range	-20 to +80 °C (-4 to +176 °F)	
Viscosity range		
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)	
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)	
Recommended cleanliness class according to ISO 4406[4)]		
For functional safety	18/15/12	
For longer service life	17/14/11	

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 07 - D682 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	10 ms	
Threshold, typical	< 0.1 %	
Threshold, maximum	< 0.2 %	
Hysteresis, typical	< 0.1 %	
Hysteresis, maximum	< 0.2 %	
Null shift at ΔT = 55 K (131 °F)	< 1.2 %	< 1 %
Sample deviation of rated flow	±10 %	

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[5)]	0.45 A
Maximum current consumption dynamic[7)]	1.35 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

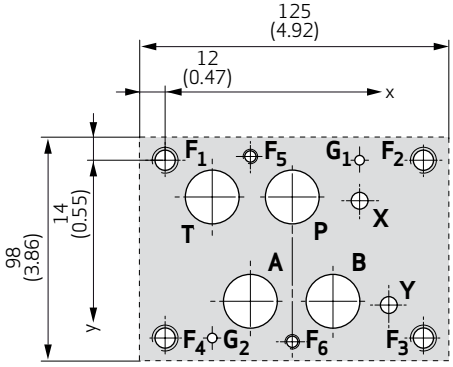
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 07 - D682 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-07-07-0-05.

- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 20 mm (0.79 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness Ra better than 0.8 µm (0.0000314 in).

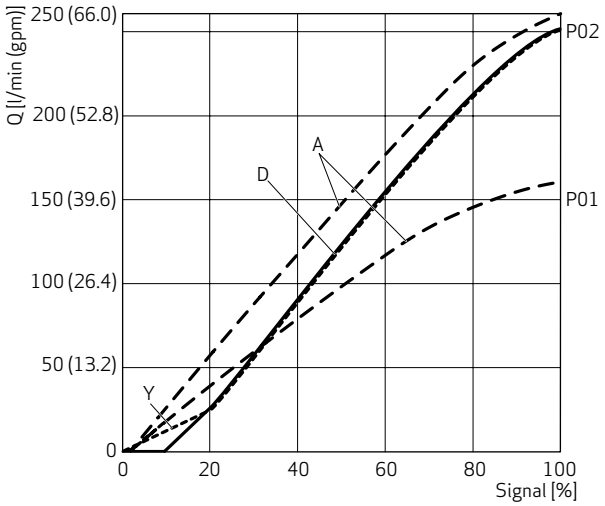


Designation		P	A	B	T	X	Y
Size Ø	mm	20	20	20	20	6.3	6.3
	in	0.79	0.79	0.79	0.79	0.25	0.25
Position X	mm	50	34.1	65.9	18.3	76.6	88.1
	in	1.969	1.343	2.594	0.72	3.016	3.469
Position Y	mm	14.3	55.6	55.6	14.3	15.9	57.2
	in	0.563	2.189	2.189	0.563	0.626	2.252

Designation		F_1	F_2	F_3	F_4	F_5	F_6	G_1	G_2
Size Ø	mm	M10	M10	M10	M10	M6	M6	4	4
	in	M10	M10	M10	M10	M6	M6	0.16	0.16
Position X	mm	0	101.6	101.6	0	34.1	50	76.6	18.3
	in	0	4	4	0	1.343	1.969	3.016	0.72
Position Y	mm	0	0	69.9	69.9	-1.6	71.5	0	69.9
	in	0	0	2.752	2.752	-0.063	2.815	0	2.752

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

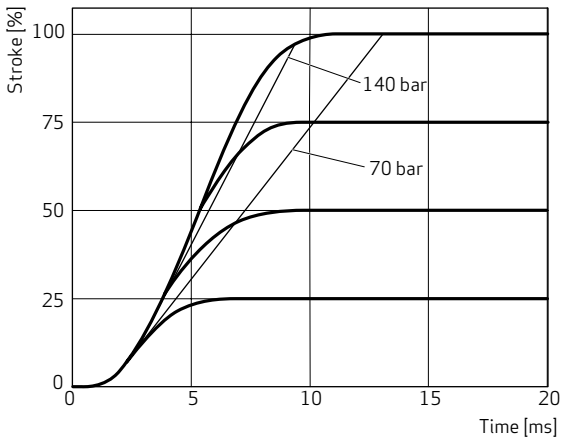


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 07 - D682 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

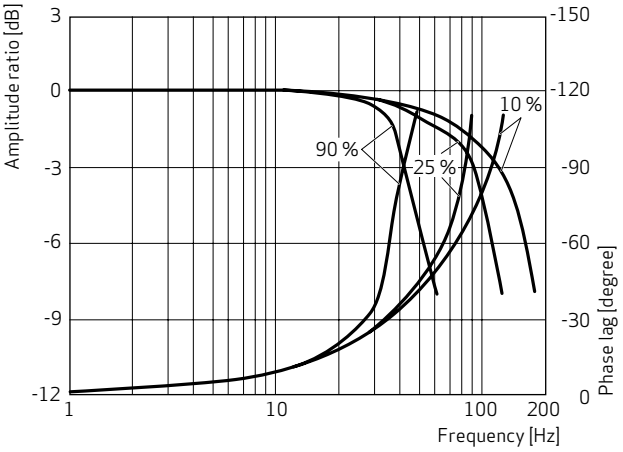
Step Response

With pilot valve D633 unbiased and biased



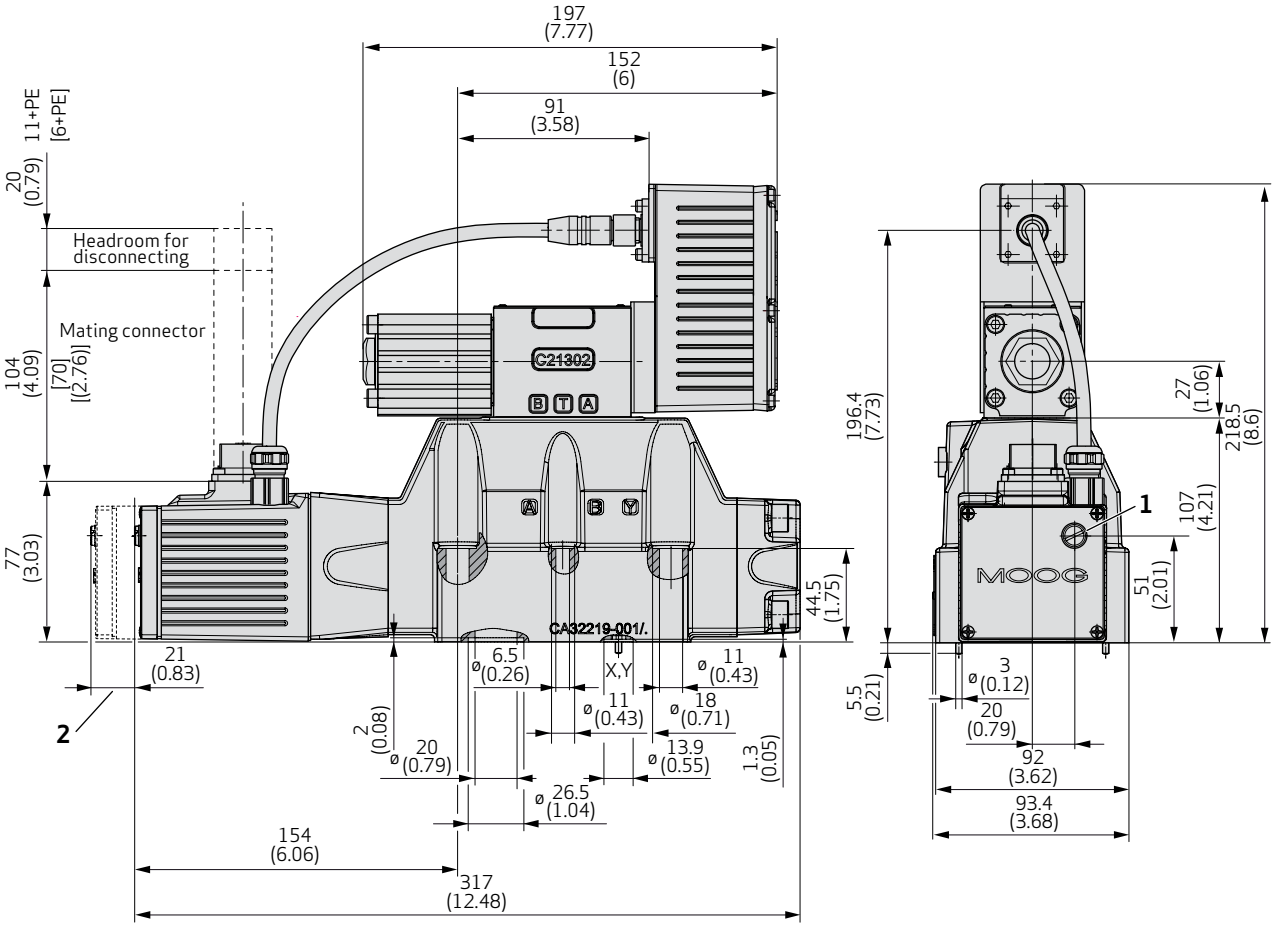
Frequency Response

With pilot valve D633 unbiased and biased



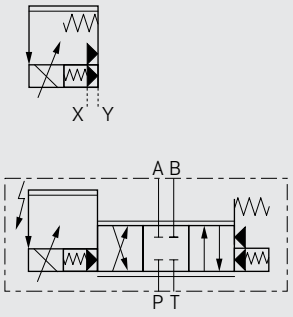
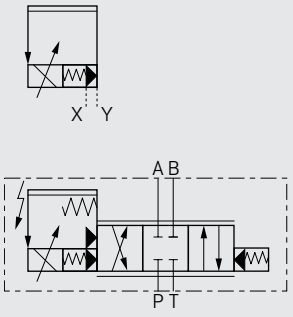
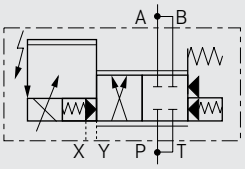
SIZE 07 - D682 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Installation Drawing for Fail-safe Options D, F and M



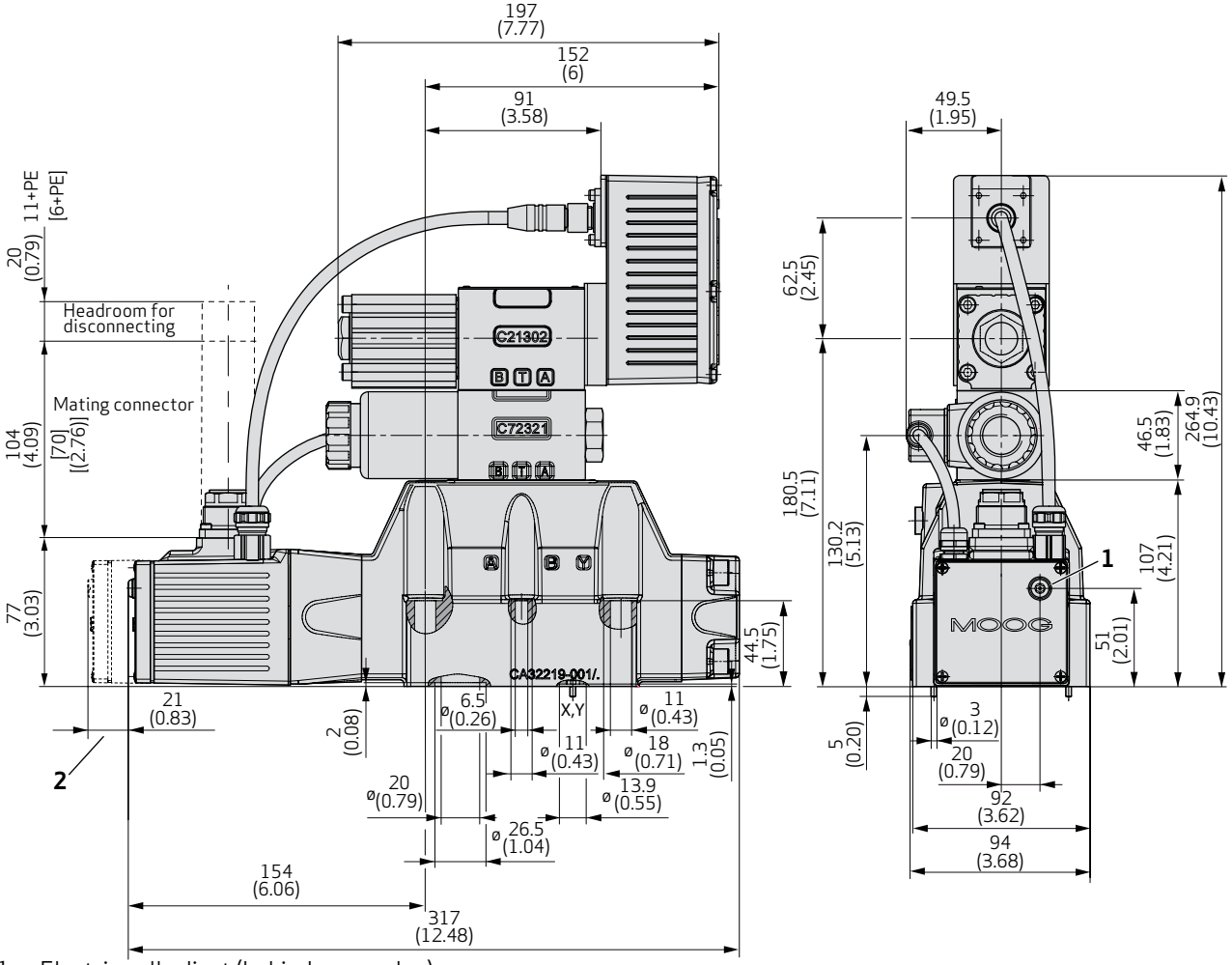
1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

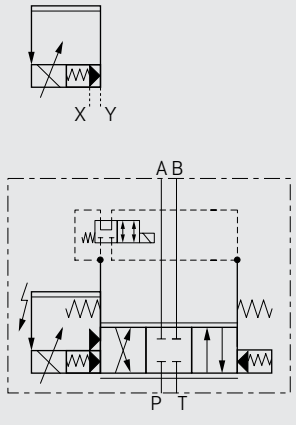
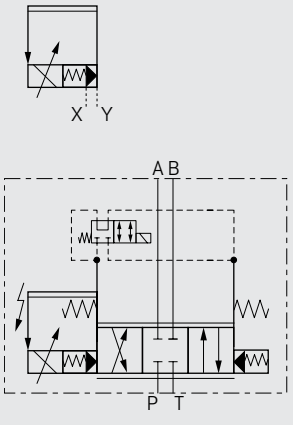
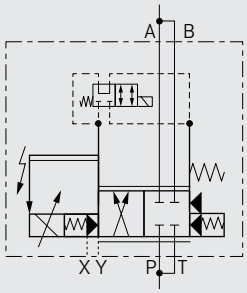
SIZE 07 - D682 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external			
Mounting pattern	ISO 4401-08-08-0-05			
Installation position	Any			
Weight	19.6 kg (43.2 lb)			
Weight including fail-safe valve	21.3 kg (47 lb)			
Storage temperature range	-40 to +80 °C (-40 to +176 °F)			
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)			
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz			
Shock resistance	50 g, 6 directions			

Hydraulic Data

Operating pressure pilot valve				
Minimum pressure	10 bar (145 psi) above T or Y			
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)			
Maximum pressure Y port[3)]	70 bar (1,000 psi)			
Maximum operating pressure of main stage				
Port P, A, B	350 bar (5,000 psi)			
Port T at Y internal[3)]	70 bar (1,000 psi)			
Port T at Y external	350 bar (5,000 psi)			
Rated flow at Δp_N 5 bar (75 psi)/spool land	350 l/min (92.4 gpm)			
Maximum flow	1,100 l/min (290.6 gpm)			
Main stage leakage flow (≈ zero lap)	3 l/min (0.79 gpm)			
Pilot leakage flow	0.5 l/min (0.1 gpm)			
Pilot flow for 100 % step	35 l/min (9.2 gpm)	26 l/min (6.9 gpm)	35 l/min (9.2 gpm)	26 l/min (6.9 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.			
Temperature range	-20 to +80 °C (-4 to +176 °F)			
Viscosity range				
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)			
Recommended cleanliness class according to ISO 4406[4)]				
For functional safety	18/15/12			
For longer service life	17/14/11			

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	13 ms	18 ms	10 ms	13 ms
Threshold, typical	< 0.1 %			
Threshold, maximum	< 0.2 %			
Hysteresis, typical	< 0.1 %			
Hysteresis, maximum	< 0.2 %			
Null shift at ΔT = 55 K (131 °F)	< 1 %			
Sample deviation of rated flow	±10 %			

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[7)]	0.3 A
Maximum current consumption dynamic[7)]	1.2 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

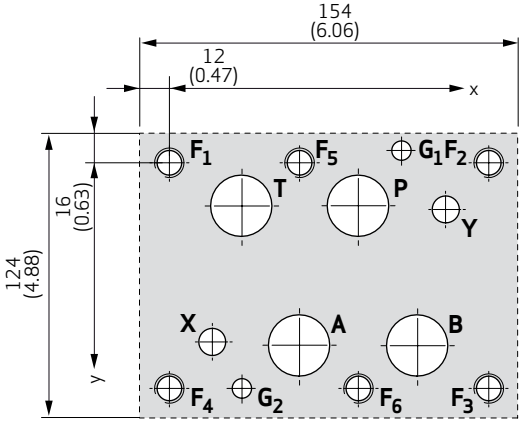
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-08-08-0-05.

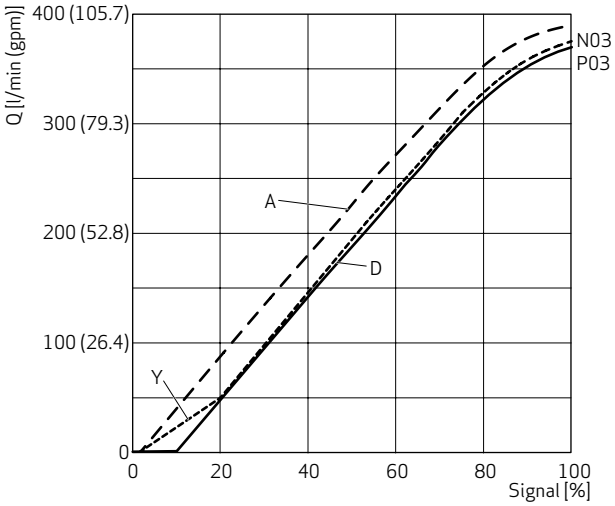
- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 28 mm (1.1 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness R_a better than 0.8 µm (0.0000314 in).



Designation		P	A	B	T	X	Y	F_1	F_2	F_3	F_4	F_5	F_6	G_1	G_2
Size Ø	**mm**	28	28	28	28	11.2	11.2	M12	M12	M12	M12	M12	M12	7.5	7.5
	in	1.1	1.1	1.1	1.1	0.44	0.44	M12	M12	M12	M12	M12	M12	0.3	0.3
Position X	**mm**	77	53.2	100.8	29.4	17.5	112.7	0	130.2	130.2	0	53.2	77	94.5	29.4
	in	3.031	2.094	3.969	1.157	0.689	4.437	0	5.126	5.126	0	2.094	3.031	3.72	1.157
Position Y	**mm**	17.5	74.6	74.6	17.5	73	19	0	0	92.1	92.1	0	92.1	-4.8	92.1
	in	0.689	2.937	2.937	0.689	2.874	0.748	0	0	3.626	3.626	0	3.626	-0.189	3.626

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

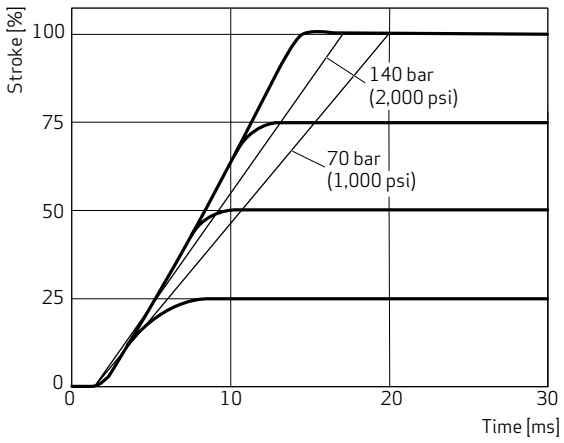


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

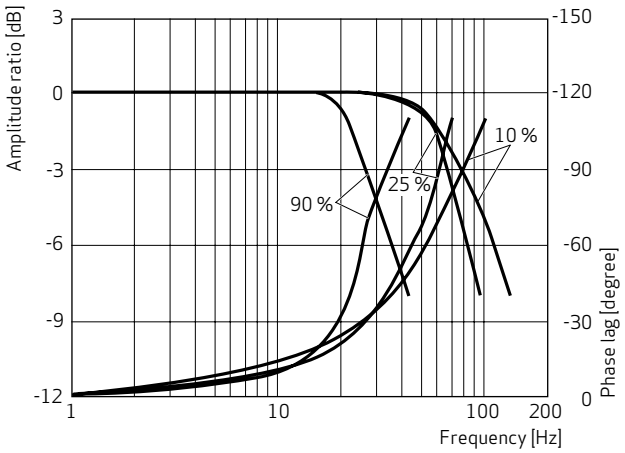
Step Response

With standard spool and pilot valve D633 unbiased

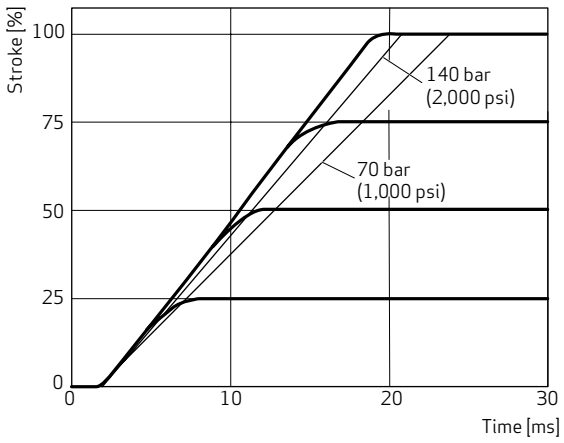


Frequency Response

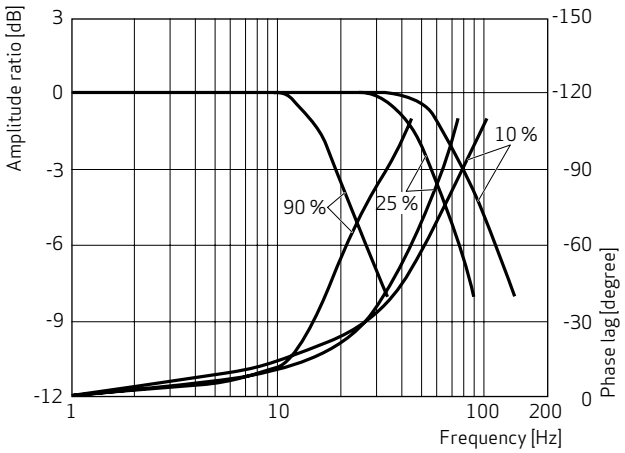
With standard spool and pilot valve D633 unbiased



With standard spool and pilot valve D633 biased



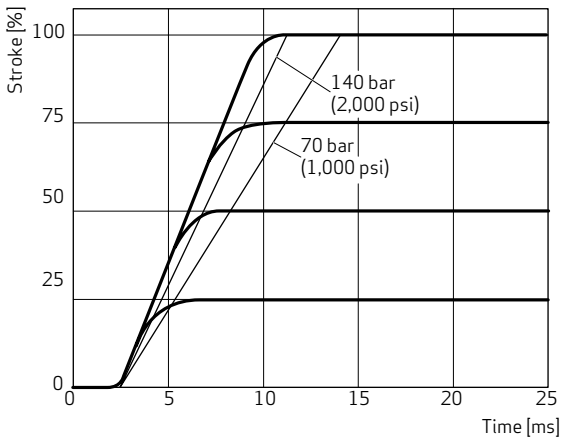
With standard spool and pilot valve D633 biased



SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

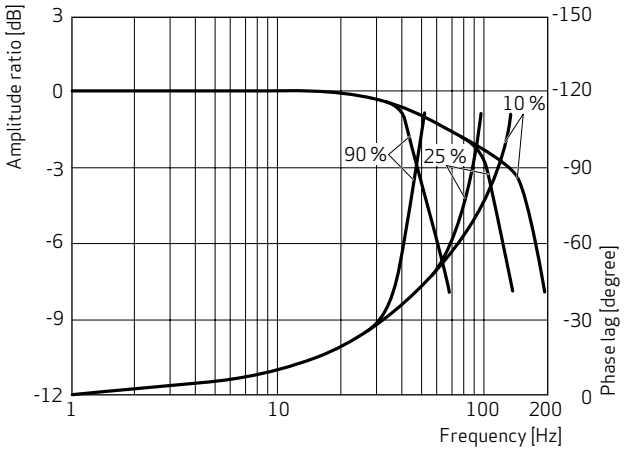
Step Response

With stub shaft spool and pilot valve D633 unbiased

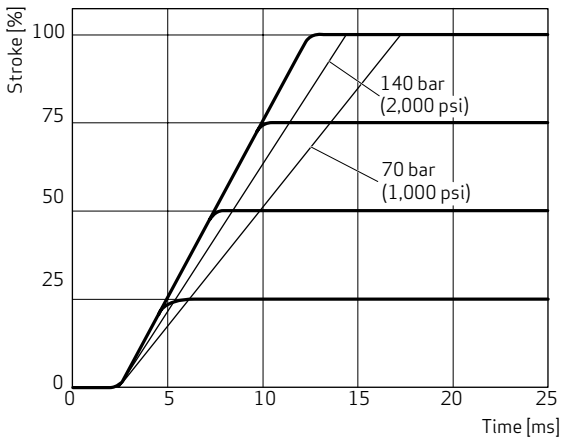


Frequency Response

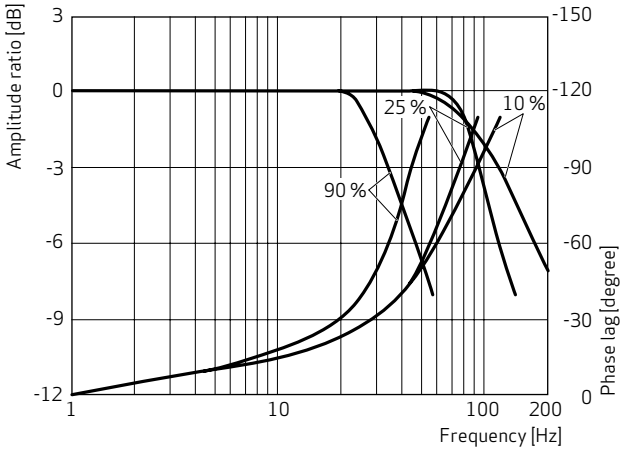
With stub shaft spool and pilot valve D633 unbiased



With stub shaft spool and pilot valve D633 biased

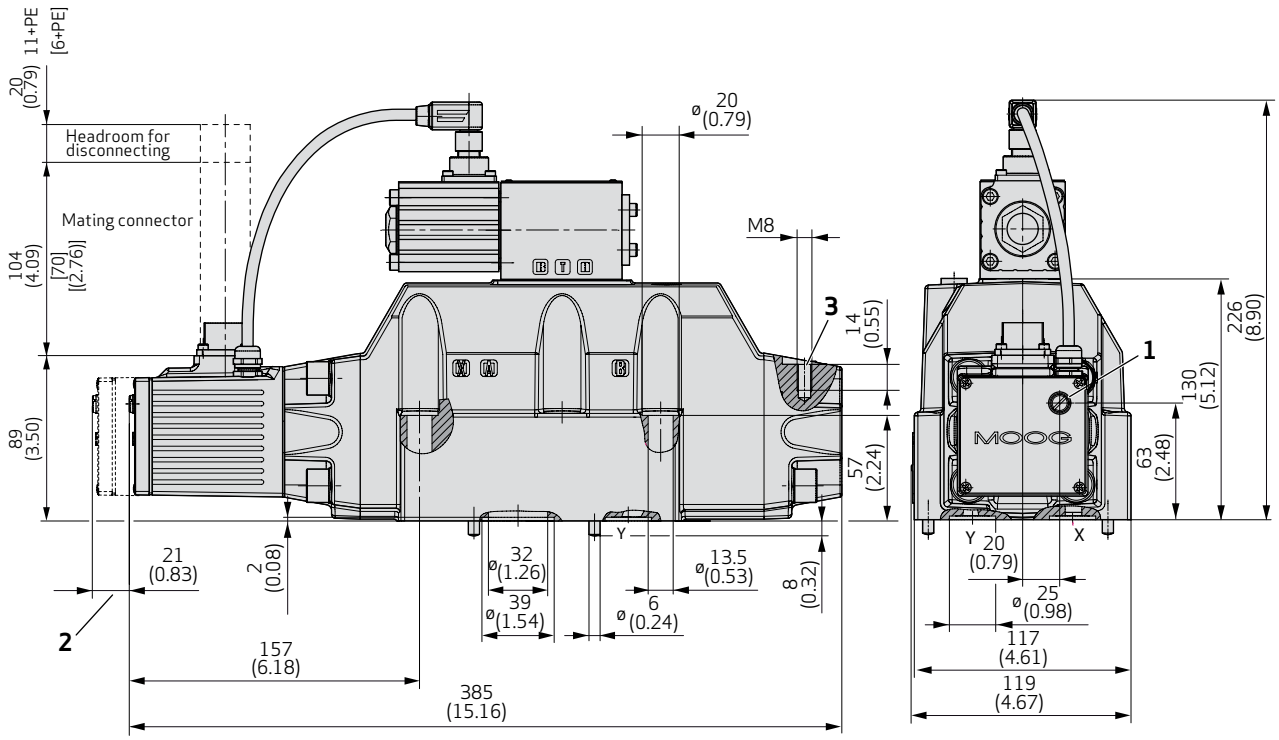


With stub shaft spool and pilot valve D633 biased



SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

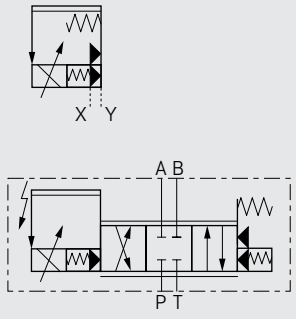
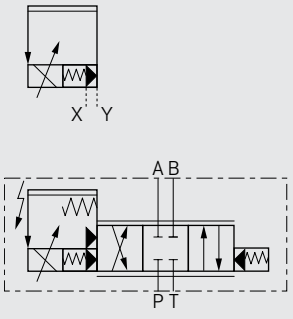
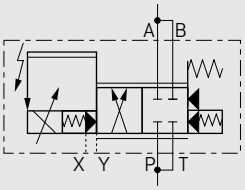
Installation Drawing for Fail-safe Options D, F and M



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

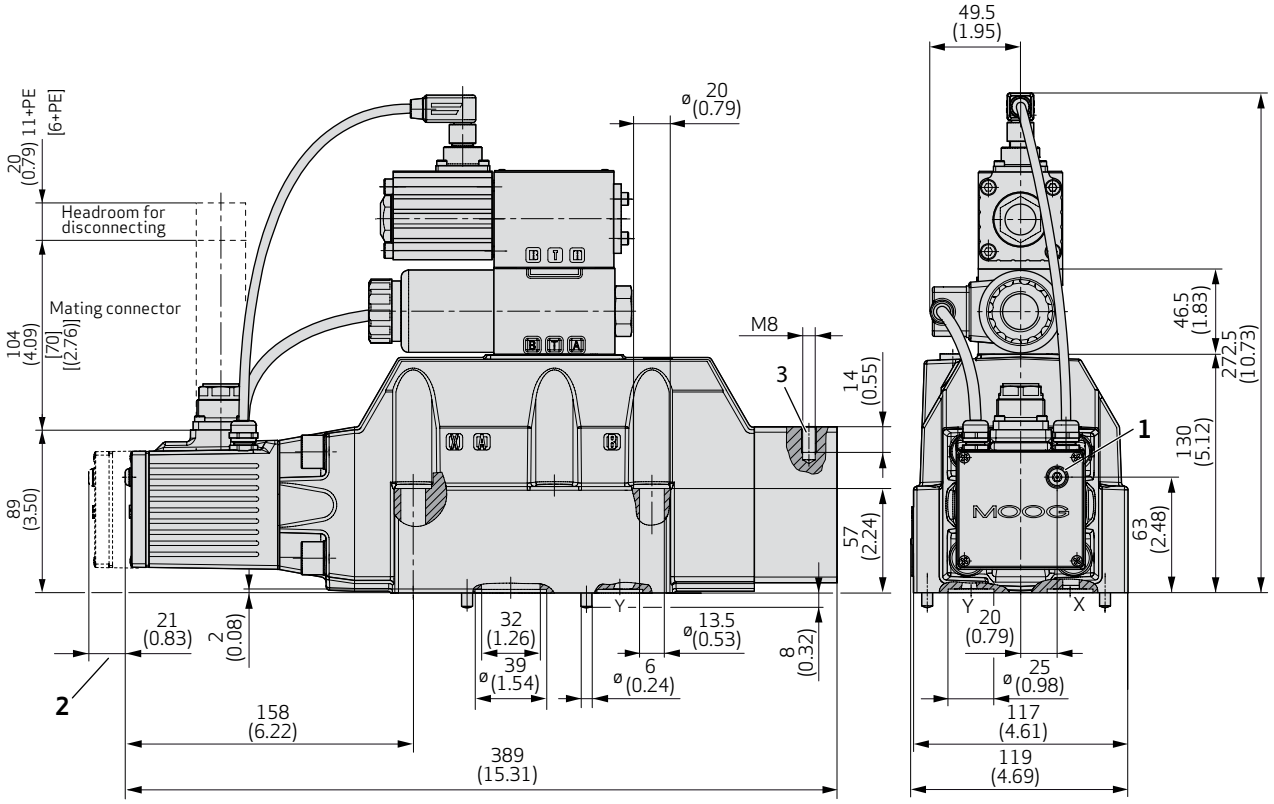
2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction according to symbol

SIZE 08 - D683 WITH OPEN-LOOP CONTROLLED PILOT VALVE

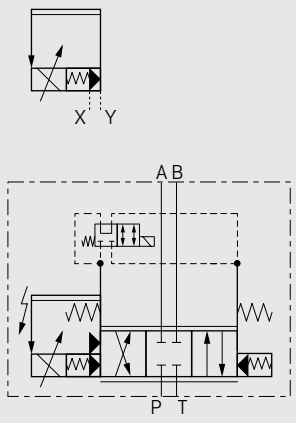
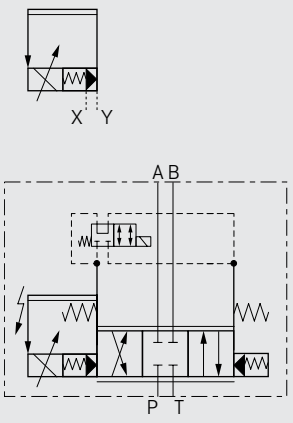
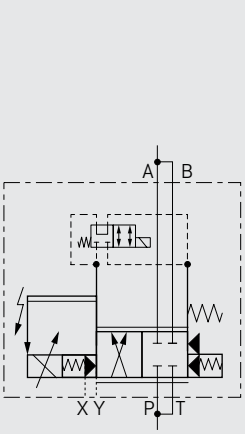
Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

SIZE 08 - D683 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external			
Mounting pattern	ISO 4401-08-08-0-05			
Installation position	Any			
Weight	20.1 kg (44.3 lb)			
Weight including fail-safe valve	21.8 kg (48.1 lb)			
Storage temperature range	-40 to +80 °C (-40 to +176 °F)			
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)			
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz			
Shock resistance	50 g, 6 directions			

Hydraulic Data

Operating pressure pilot valve				
Minimum pressure	10 bar (145 psi) above T or Y			
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)			
Maximum pressure Y port[3)]	70 bar (1,000 psi)			
Maximum operating pressure of main stage				
Port P, A, B	350 bar (5,000 psi)			
Port T at Y internal[3)]	70 bar (1,000 psi)			
Port T at Y external	250 bar (3,625 psi)			
Rated flow at Δp_N 5 bar (75 psi)/spool land	350 l/min (92.4 gpm)			
Maximum flow	1,100 l/min (290.6 gpm)			
Main stage leakage flow (≈ zero lap)	3 l/min (0.79 gpm)			
Pilot leakage flow	0.5 l/min (0.1 gpm)			
Pilot flow for 100 % step	33 l/min (8.7 gpm)	27 l/min (7.1 gpm)	27 l/min (7.1 gpm)	27 l/min (7.1 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.			
Temperature range	-20 to +80 °C (-4 to +176 °F)			
Viscosity range				
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)			
Recommended cleanliness class according to ISO 4406[4)]				
For functional safety	18/15/12			
For longer service life	17/14/11			

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses)

SIZE 08 - D683 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	15 ms		9 ms	
Threshold, typical	< 0.1 %			
Threshold, maximum	< 0.2 %			
Hysteresis, typical	< 0.1 %			
Hysteresis, maximum	< 0.2 %			
Null shift at ΔT = 55 K (131 °F)	< 1 %			
Sample deviation of rated flow	±10 %			

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[5)]	0.45 A
Maximum current consumption dynamic[7)]	1.35 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

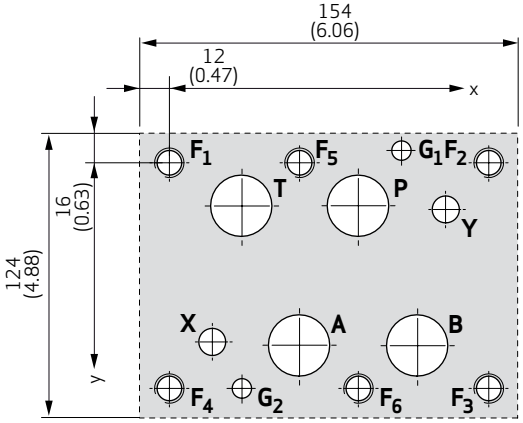
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 08 - D683 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-08-08-0-05.

- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 28 mm (1.1 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness Ra better than 0.8 µm (0.0000314 in).

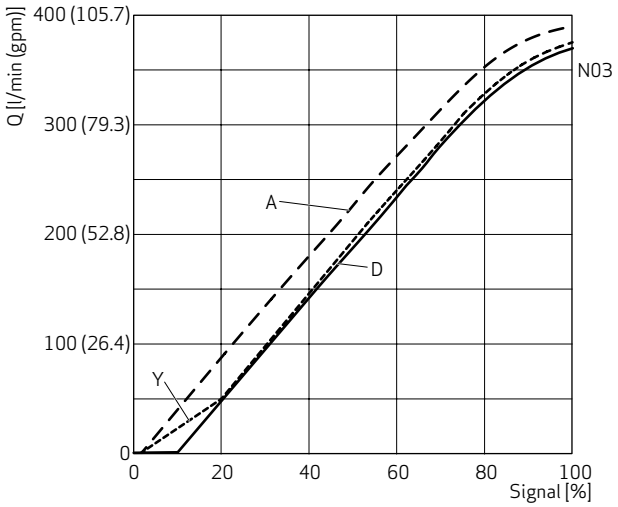


Designation		P	A	B	T	X	Y
Size Ø	mm	28	28	28	28	11.2	11.2
	in	1.1	1.1	1.1	1.1	0.44	0.44
Position X	mm	77	53.2	100.8	29.4	17.5	112.7
	in	3.031	2.094	3.969	1.157	0.689	4.437
Position Y	mm	17.5	74.6	74.6	17.5	73	19
	in	0.689	2.937	2.937	0.689	2.874	0.748

Designation		F_1	F_2	F_3	F_4	F_5	F_6	G_1	G_2
Size Ø	mm	M12	M12	M12	M12	M12	M12	7.5	7.5
	in	M12	M12	M12	M12	M12	M12	0.3	0.3
Position X	mm	0	130.2	130.2	0	53.2	77	94.5	29.4
	in	0	5.126	5.126	0	2.094	3.031	3.72	1.157
Position Y	mm	0	0	92.1	92.1	0	92.1	-4.8	92.1
	in	0	0	3.626	3.626	0	3.626	-0.189	3.626

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

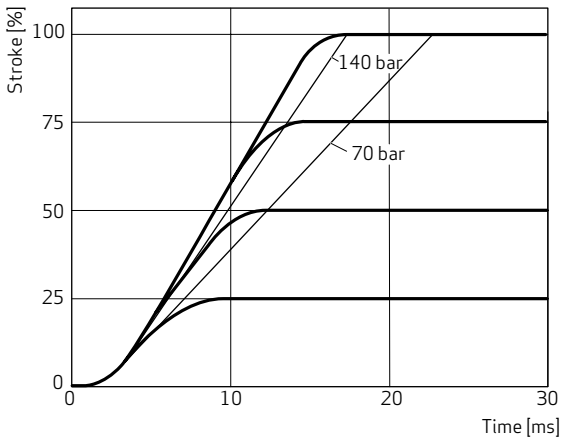


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 08 - D683 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

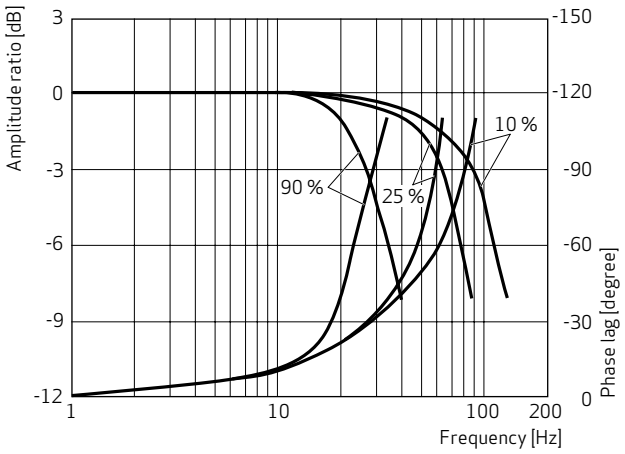
Step Response

With standard spool and pilot valve D633 unbiased and biased

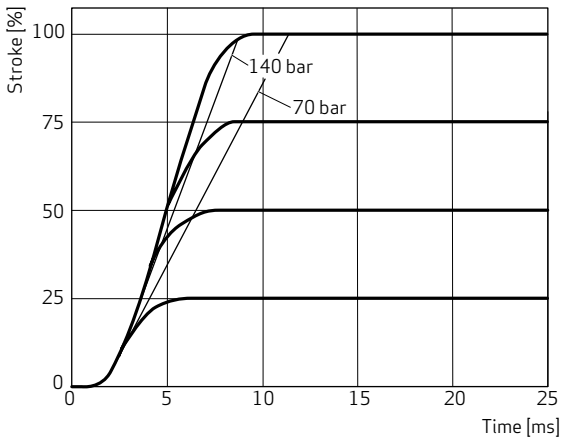


Frequency Response

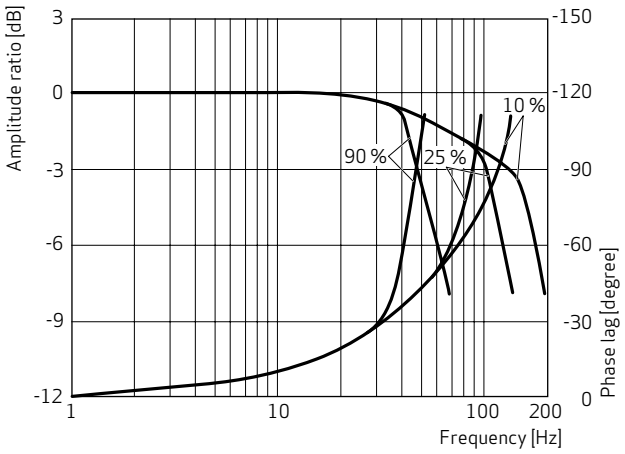
With standard spool and pilot valve D633 unbiased and biased



With stub shaft spool and pilot valve D633 unbiased and biased

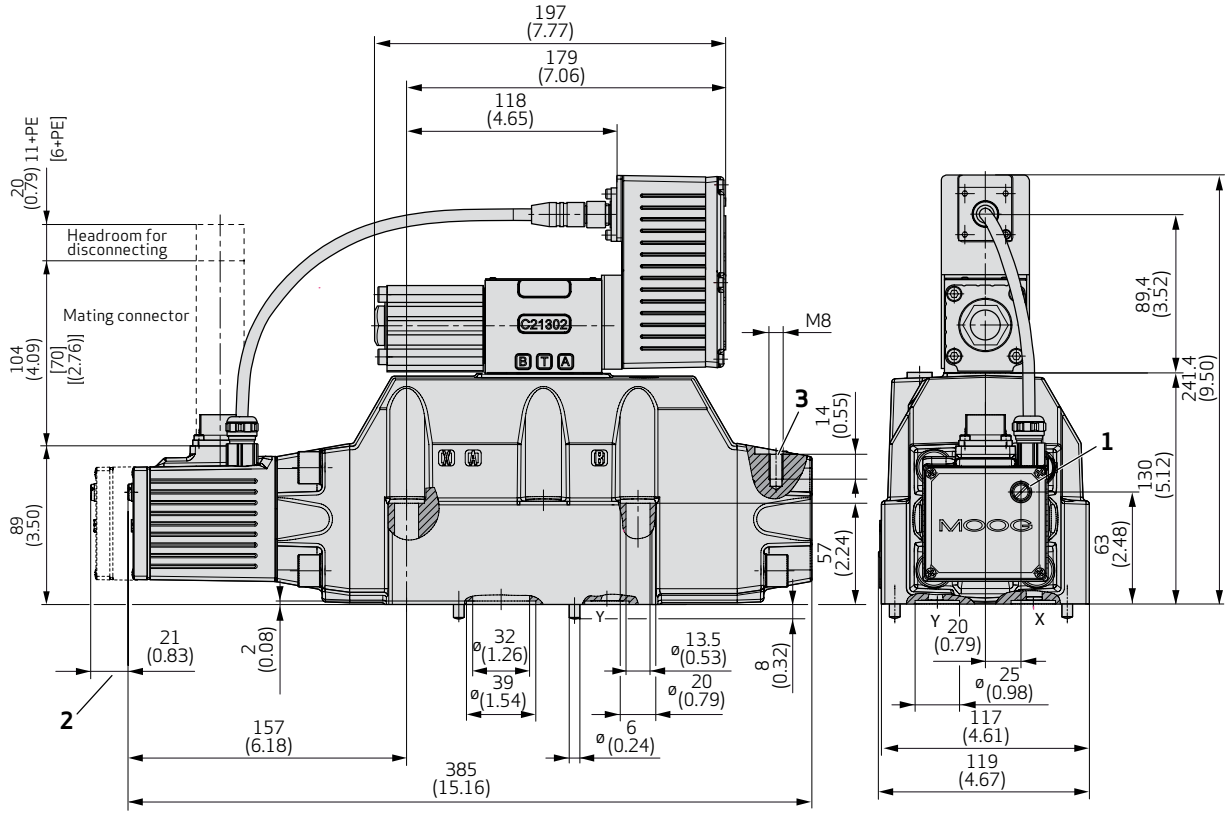


With stub shaft spool and pilot valve D633 unbiased and biased



SIZE 08 - D683 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

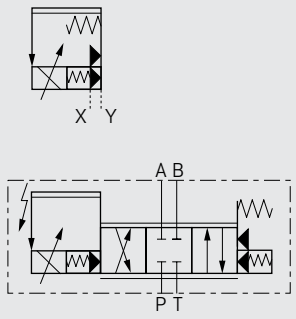
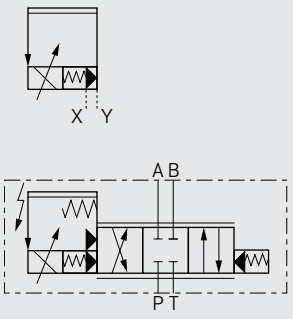
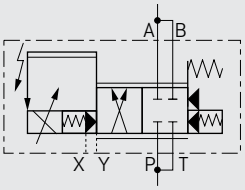
Installation Drawing for Fail-safe Options D, F and M



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

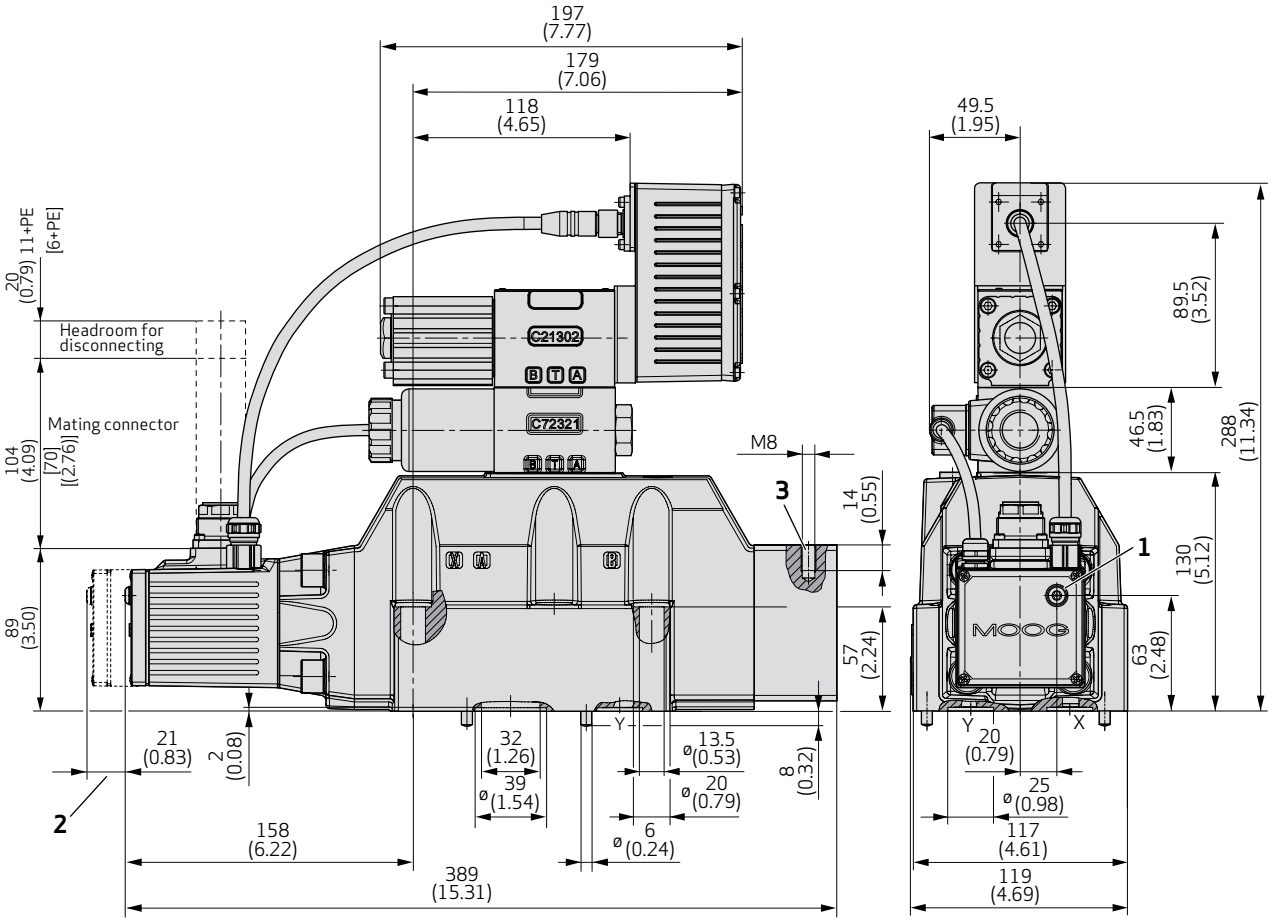
2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction according to symbol

SIZE 08 - D683 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

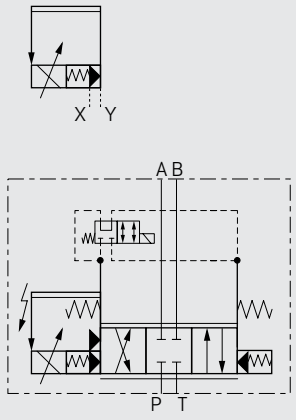
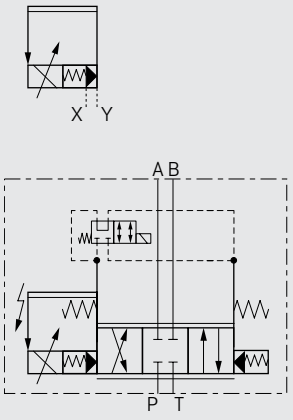
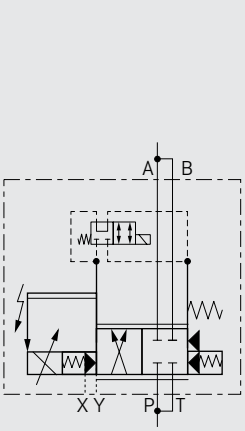
Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external			
Mounting pattern	ISO 4401-08-08-0-05			
Installation position	Any			
Weight	19.6 kg (43.2 lb)			
Weight including fail-safe valve	21.3 kg (47 lb)			
Storage temperature range	-40 to +80 °C (-40 to +176 °F)			
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)			
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz			
Shock resistance	50 g, 6 directions			

Hydraulic Data

Operating pressure pilot valve				
Minimum pressure	10 bar (145 psi) above T or Y			
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)			
Maximum pressure Y port[3)]	70 bar (1,000 psi)			
Maximum operating pressure of main stage				
Port P, A, B	350 bar (5,000 psi)			
Port T at Y internal[3)]	70 bar (1,000 psi)			
Port T at Y external	350 bar (5,000 psi)			
Rated flow at Δp_N 5 bar (75 psi)/spool land	550 l/min (145.3 gpm)			
Maximum flow	1,500 l/min (396.3 gpm)			
Main stage leakage flow (≈ zero lap)	3 l/min (0.79 gpm)			
Pilot leakage flow	0.5 l/min (0.1 gpm)			
Pilot flow for 100 % step	35 l/min (9.2 gpm)	26 l/min (6.9 gpm)	35 l/min (9.2 gpm)	26 l/min (6.9 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.			
Temperature range	-20 to +80 °C (-4 to +176 °F)			
Viscosity range				
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)			
Recommended cleanliness class according to ISO 4406[4)]				
For functional safety	18/15/12			
For longer service life	17/14/11			

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	18 ms	26 ms	12 ms	16 ms
Threshold, typical	< 0.1 %			
Threshold, maximum	< 0.2 %			
Hysteresis, typical	< 0.1 %			
Hysteresis, maximum	< 0.2 %			
Null shift at ΔT = 55 K (131 °F)	< 1 %			
Sample deviation of rated flow	±10 %			

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[7)]	0.3 A
Maximum current consumption dynamic[7)]	1.2 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

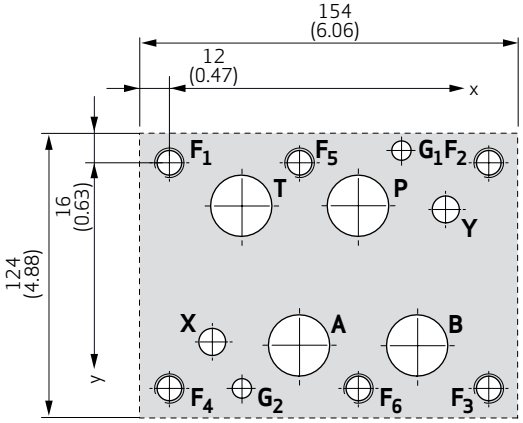
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-08-08-0-05.

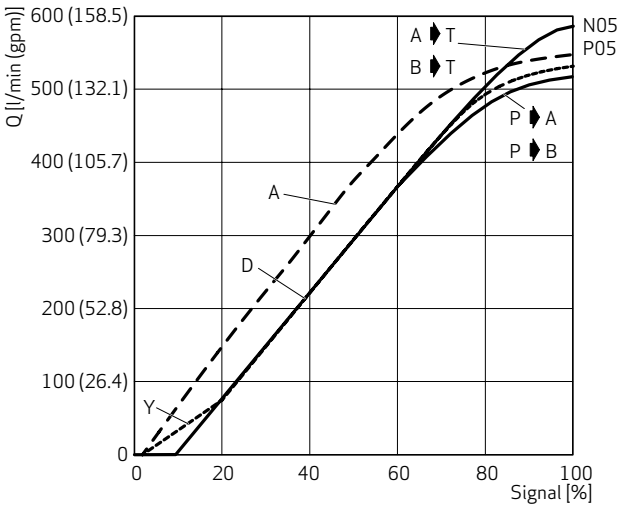
- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 32 mm (1.26 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness R_a better than 0.8 µm (0.0000314 in).



Designation		P	A	B	T	X	Y	F_1	F_2	F_3	F_4	F_5	F_6	G_1	G_2
Size Ø	**mm**	32	32	32	32	11.2	11.2	M12	M12	M12	M12	M12	M12	7.5	7.5
	in	1.26	1.26	1.26	1.26	0.44	0.44	M12	M12	M12	M12	M12	M12	0.3	0.3
Position X	**mm**	77	53.2	100.8	29.4	17.5	112.7	0	130.2	130.2	0	53.2	77	94.5	29.4
	in	3.031	2.094	3.969	1.157	0.689	4.437	0	5.126	5.126	0	2.094	3.031	3.72	1.157
Position Y	**mm**	17.5	74.6	74.6	17.5	73	19	0	0	92.1	92.1	0	92.1	-4.8	92.1
	in	0.689	2.937	2.937	0.689	2.874	0.748	0	0	3.626	3.626	0	3.626	-0.189	3.626

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

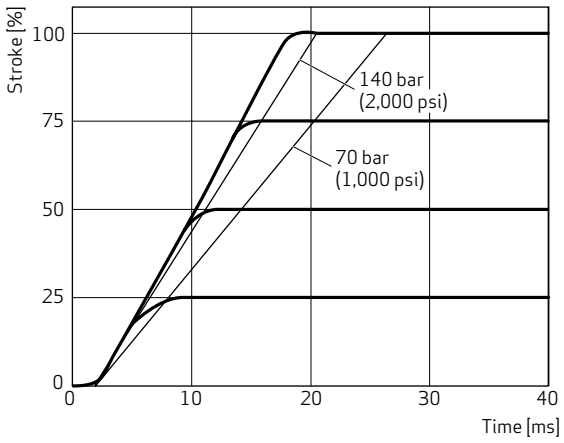


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

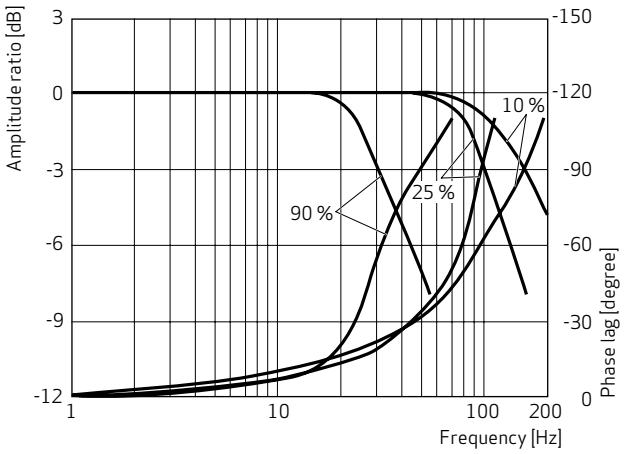
Step Response

With standard spool and pilot valve D633 unbiased

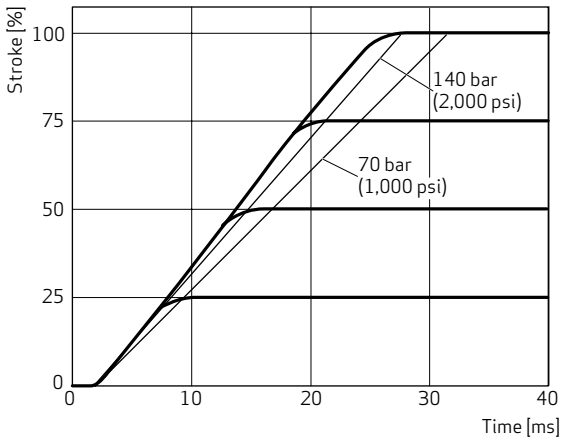


Frequency Response

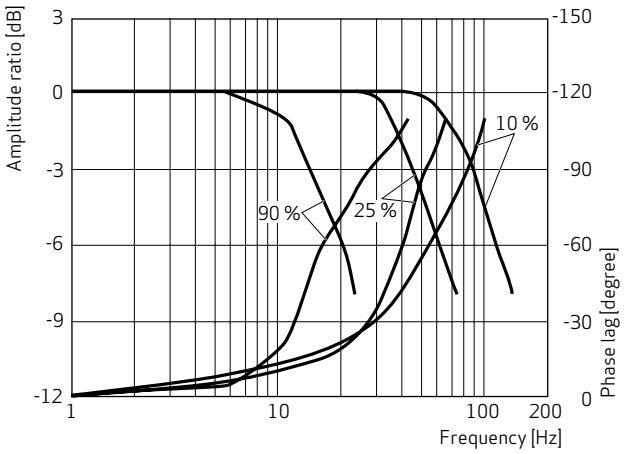
With standard spool and pilot valve D633 unbiased



With standard spool and pilot valve D633 biased



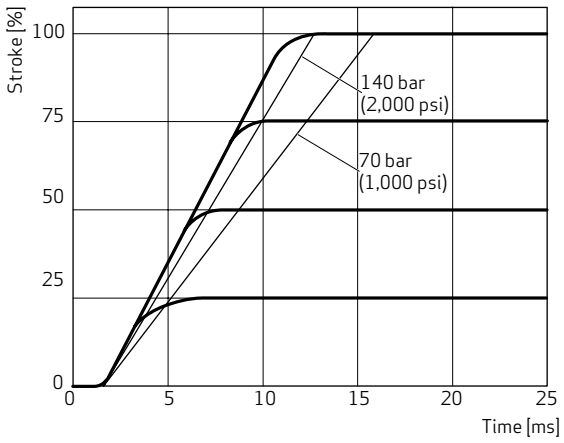
With standard spool and pilot valve D633 biased



SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

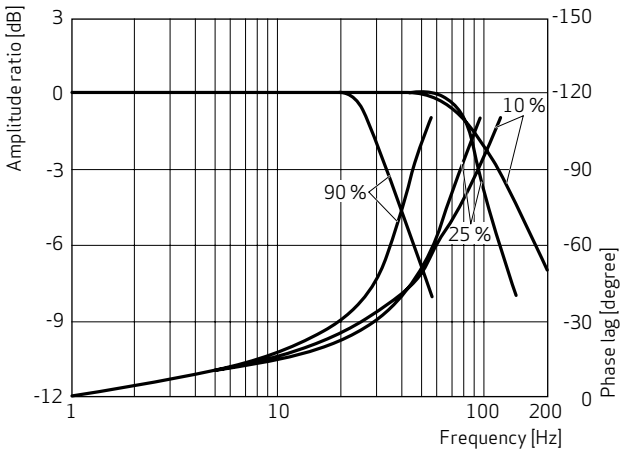
Step Response

With stub shaft spool and pilot valve D633 unbiased

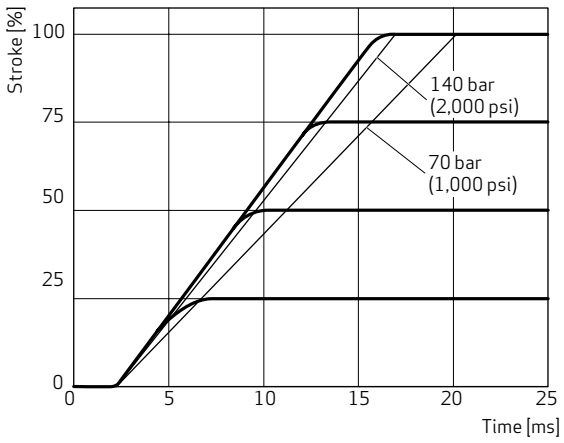


Frequency Response

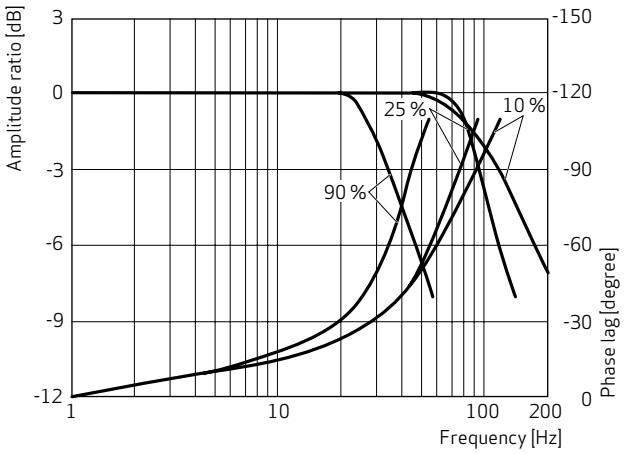
With stub shaft spool and pilot valve D633 unbiased



With stub shaft spool and pilot valve D633 biased

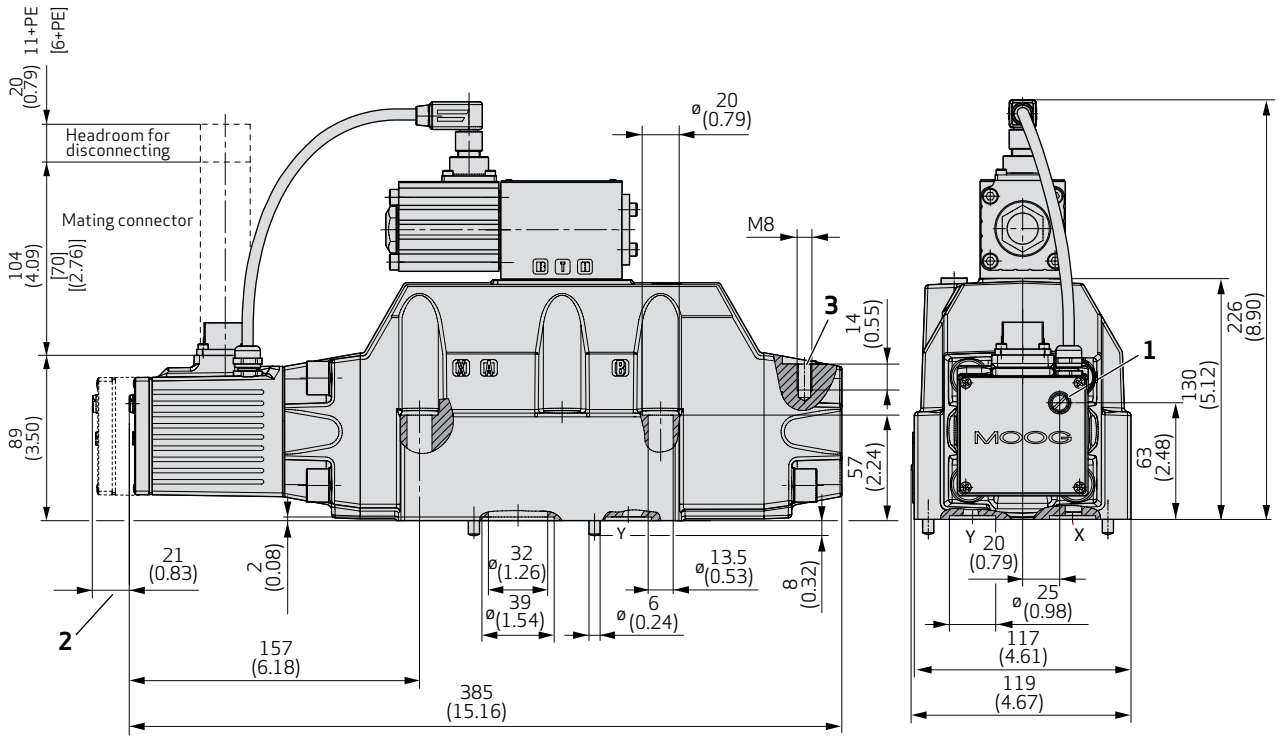


With stub shaft spool and pilot valve D633 biased



SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

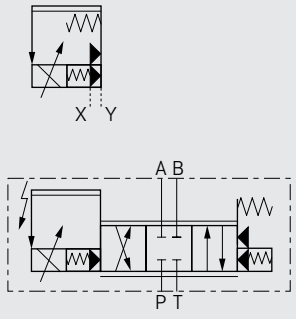
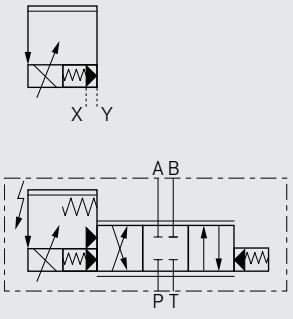
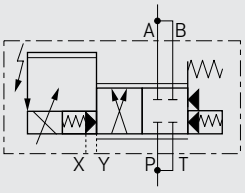
Installation Drawing for Fail-safe Options D, F and M



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

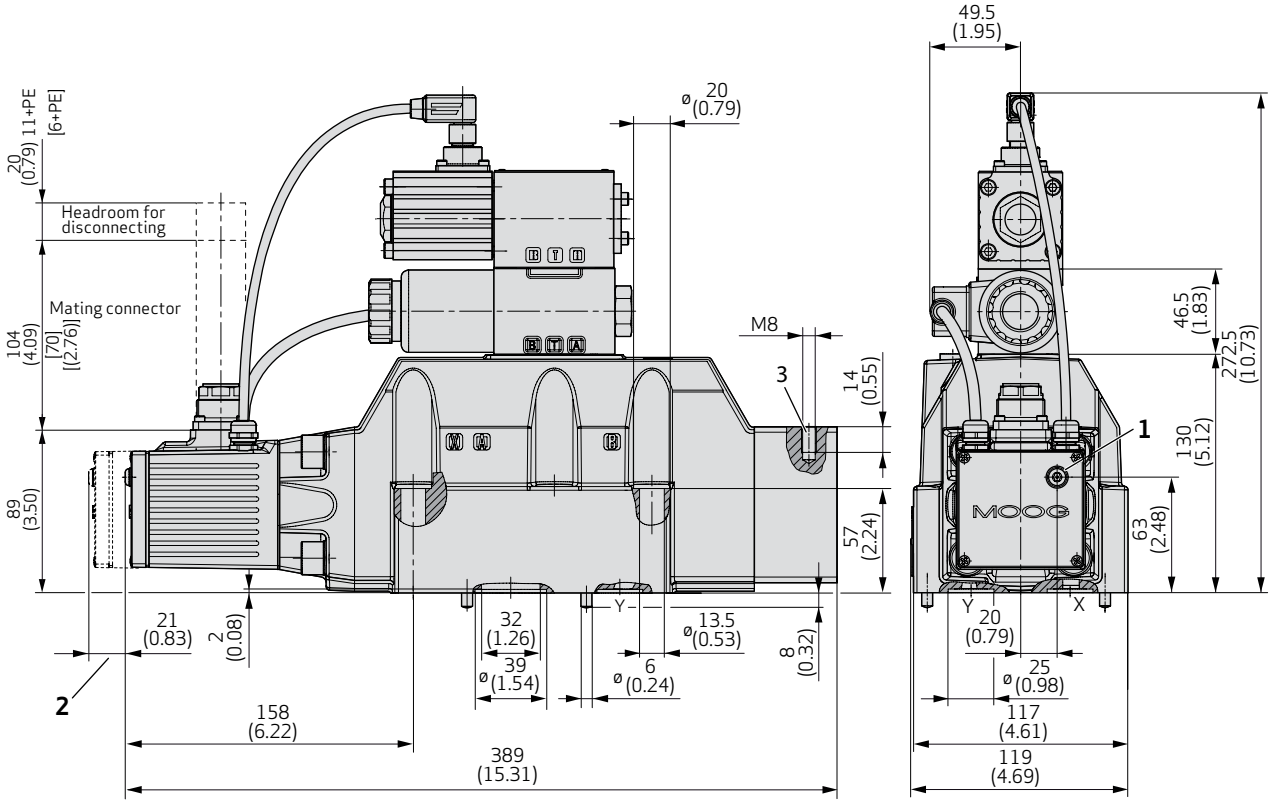
2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction according to symbol

SIZE 08 - D684 WITH OPEN-LOOP CONTROLLED PILOT VALVE

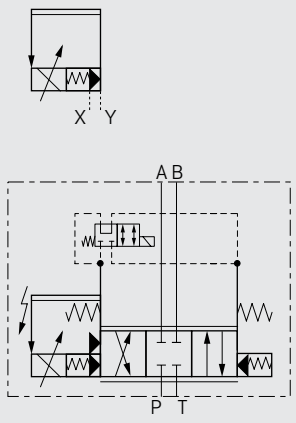
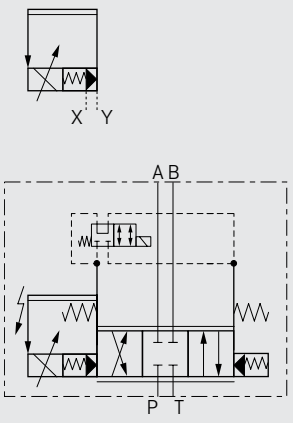
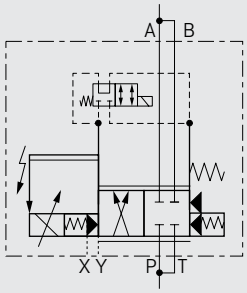
Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

SIZE 08 - D684 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external			
Mounting pattern	ISO 4401-08-08-0-05			
Installation position	Any			
Weight	20.1 kg (44.3 lb)			
Weight including fail-safe valve	21.8 kg (48.1 lb)			
Storage temperature range	-40 to +80 °C (-40 to +176 °F)			
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)			
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz			
Shock resistance	50 g, 6 directions			

Hydraulic Data

Operating pressure pilot valve				
Minimum pressure	10 bar (145 psi) above T or Y			
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)			
Maximum pressure Y port[1)]	70 bar (1,000 psi)			
Maximum operating pressure of main stage				
Port P, A, B	350 bar (5,000 psi)			
Port T at Y internal[3)]	70 bar (1,000 psi)			
Port T at Y external	250 bar (3625 psi)			
Rated flow at Δp_N 5 bar (75 psi)/spool land	550 l/min (145.3 gpm)			
Maximum flow	1,500 l/min (396.3 gpm)			
Main stage leakage flow (≈ zero lap)	3 l/min (0.79 gpm)			
Pilot leakage flow	0.5 l/min (0.1 gpm)			
Pilot flow for 100 % step	33 l/min (8.7 gpm)	27 l/min (7.1 gpm)	27 l/min (7.1 gpm)	27 l/min (7.1 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.			
Temperature range	-20 to +80 °C (-4 to +176 °F)			
Viscosity range				
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)			
Recommended cleanliness class according to ISO 4406[4)]				
For functional safety	18/15/12			
For longer service life	17/14/11			

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses)

SIZE 08 - D684 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool		2-stage, with stub shaft spool	
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	20 ms		11 ms	
Threshold, typical	< 0.1 %			
Threshold, maximum	< 0.2 %			
Hysteresis, typical	< 0.1 %			
Hysteresis, maximum	< 0.2 %			
Null shift at ΔT = 55 K (131 °F)	< 1 %			
Sample deviation of rated flow	±10 %			

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[5)]	0.45 A
Maximum current consumption dynamic[7)]	1.35 A
Fuse protection, external, per valve	1.6 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

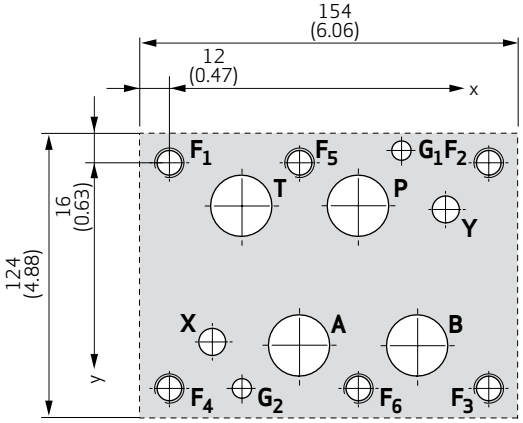
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 08 - D684 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-08-08-0-05.

- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 32 mm (1.26 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness Ra better than 0.8 µm (0.0000314 in).

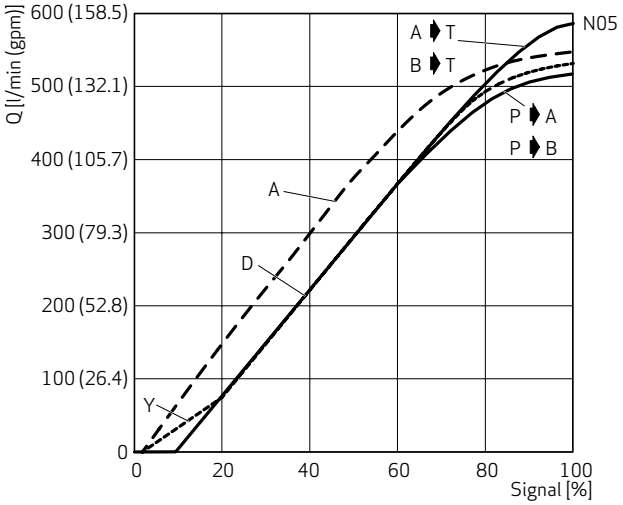


Designation		P	A	B	T	X	Y
Size Ø	mm	32	32	32	32	11.2	11.2
	in	1.26	1.26	1.26	1.26	0.44	0.44
Position X	mm	77	53.2	100.8	29.4	17.5	112.7
	in	3.031	2.094	3.969	1.157	0.689	4.437
Position Y	mm	17.5	74.6	74.6	17.5	73	19
	in	0.689	2.937	2.937	0.689	2.874	0.748

Designation		F_1	F_2	F_3	F_4	F_5	F_6	G_1	G_2
Size Ø	mm	M12	M12	M12	M12	M12	M12	7.5	7.5
	in	M12	M12	M12	M12	M12	M12	0.3	0.3
Position X	mm	0	130.2	130.2	0	53.2	77	94.5	29.4
	in	0	5.126	5.126	0	2.094	3.031	3.72	1.157
Position Y	mm	0	0	92.1	92.1	0	92.1	-4.8	92.1
	in	0	0	3.626	3.626	0	3.626	-0.189	3.626

Typical Characteristic Curves

Flow signal curves at Δp_N = 5 bar (75 psi) per land

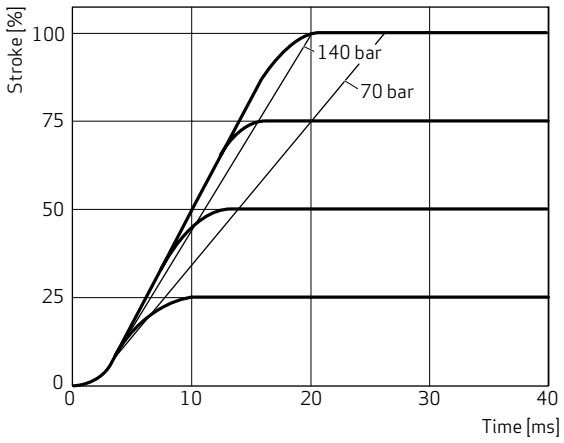


Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic

SIZE 08 - D684 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

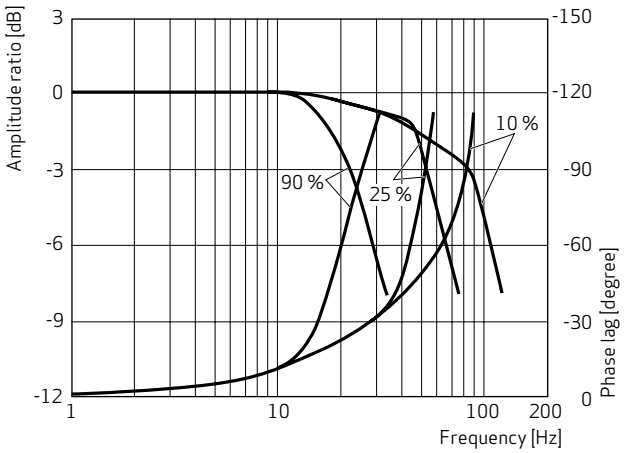
Step Response

With standard spool and pilot valve D633 unbiased and biased

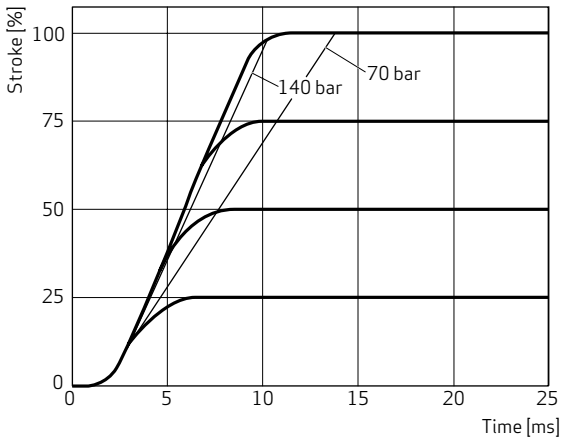


Frequency Response

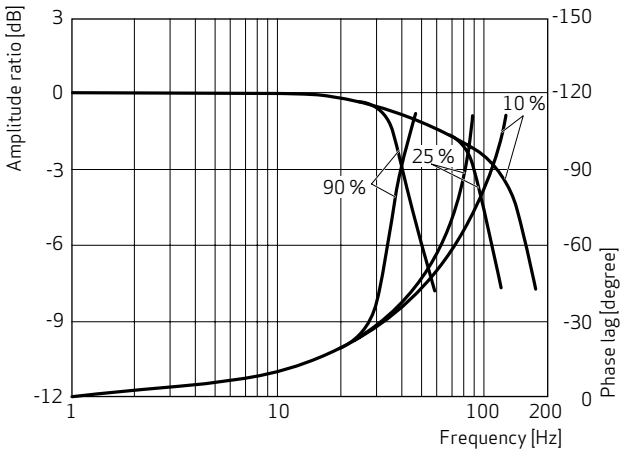
With standard spool and pilot valve D633 unbiased and biased



With stub shaft spool and pilot valve D633 unbiased and biased

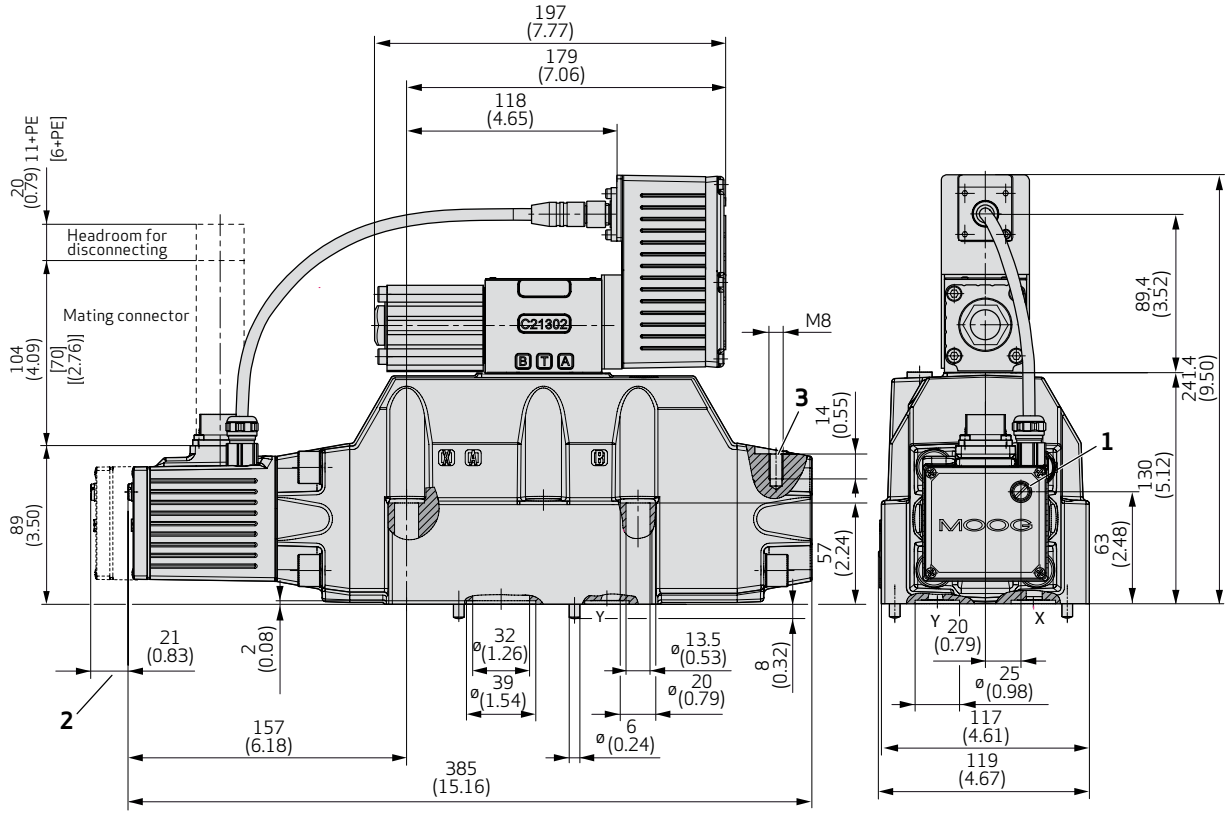


With stub shaft spool and pilot valve D633 unbiased and biased



SIZE 08 - D684 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

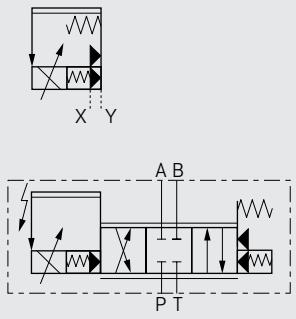
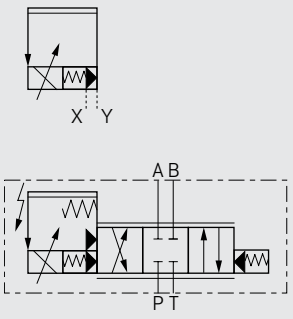
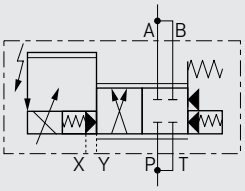
Installation Drawing for Fail-safe Options D, F and M



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

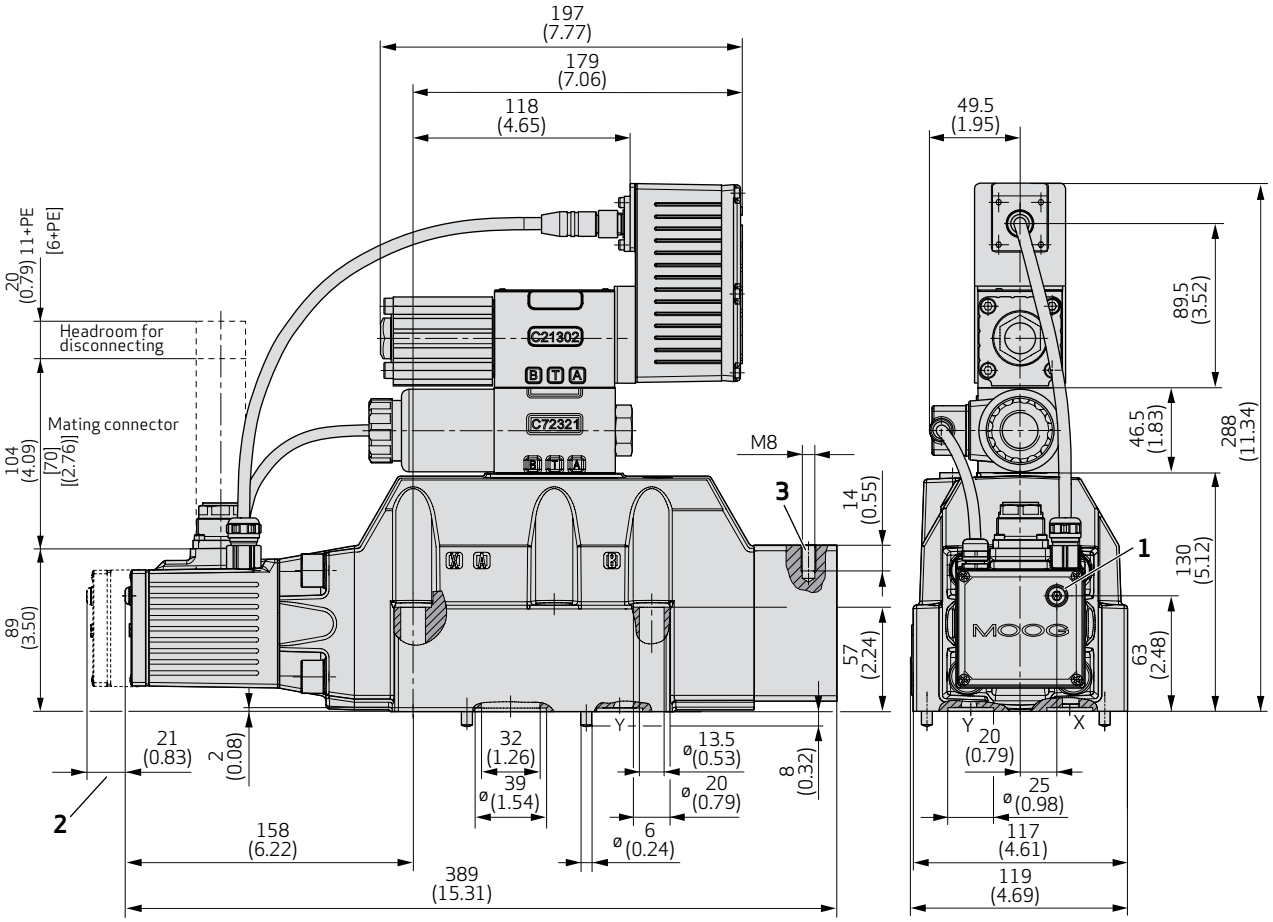
2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction according to symbol

SIZE 08 - D684 WITH CLOSED-LOOP CONTROLLED PILOT VALVE

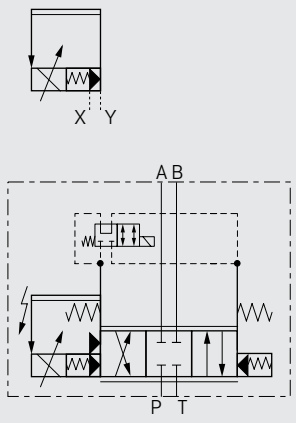
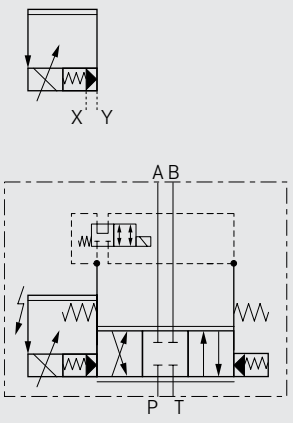
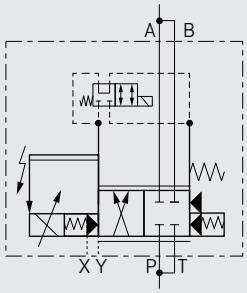
Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

3 Transportation thread

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

SIZE 10 - D685

General Technical Data

Technical data and characteristic curves measured with system pressure p_p of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature +40 °C (+104 °F).

Valve design	2-stage, with standard spool			
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Pilot connection X and Y	Internal or external			
Mounting pattern	ISO 4401-10-09-0-05			
Installation position	Any			
Weight	71.5 kg (157.7 lb)			
Weight including fail-safe valve	74 kg (163.2 lb)			
Storage temperature range	-40 to +80 °C (-40 to +176 °F)			
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)			
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz			
Shock resistance	50 g, 6 directions			

Hydraulic Data

Operating pressure pilot valve				
Minimum pressure	10 bar (145 psi) above T or Y			
Operating pressure range X port	10 to 350 bar (145 to 5,000 psi)			
Maximum pressure Y port[3)]	50 bar (725 psi)			
Maximum operating pressure of main stage				
Port P, A, B	350 bar (5,000 psi)			
Port T at Y internal[3)]	50 bar (725 psi)			
Port T at Y external	350 bar (5,000 psi)			
Rated flow at Δp_N 5 bar (75 psi)/spool land	1,000 l/min (264.2 gpm)		1,500 l/min (396.3 gpm)	
Maximum flow	3,600 l/min (951 gpm)			
Main stage leakage flow (≈ zero lap)	8.0 l/min (2.1 gpm)			
Pilot leakage flow	1.4 l/min (0.4 gpm)			
Pilot flow for 100 % step	70 l/min (18.5 gpm)	52 l/min (13.7 gpm)	70 l/min (18.5 gpm)	52 l/min (13.7 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.			
Temperature range	-20 to +80 °C (-4 to +176 °F)			
Viscosity range				
Recommended viscosity range at 38 °C (100 °F)	15 to 45 mm²/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm²/s (cSt)			
Recommended cleanliness class according to ISO 4406[4)]				
For functional safety	18/15/12			
For longer service life	17/14/11			

1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
3) Pressure peaks up to 210 bar (3,000 psi) permissible
4) The cleanliness of the hydraulic fluid strongly affects functional safety (e.g. safe positioning of the spool, high resolution) and wear of lands (e.g. pressure gain, leak losses).

SIZE 10 - D685

Typical Static and Dynamic Data

Valve design	2-stage, with standard spool			
Pilot valve	D633 unbiased[1)]	D633 biased[2)]	D633 unbiased[1)]	D633 biased[2)]
Step response time for 0 to 100 % stroke	35 ms		40 ms	
Threshold, typical	< 0.1 %			
Threshold, maximum	< 0.2 %			
Hysteresis, typical	< 0.2 %			
Hysteresis, maximum	< 0.3 %		< 0.2 %	
Null shift at ΔT = 55 K (131 °F)	< 2 %			
Sample deviation of rated flow	±10 %			

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connectors)
Supply voltage[5)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage[6)]	±3 V_{RMS}
Maximum current consumption static[7)]	0.35 A
Maximum current consumption dynamic[7)]	1.8 A
Fuse protection, external, per valve	2 A (slow)
EM compatibility	• Transient emissions according to EN 61000-6-4 • Emission protection according to EN 61000-6-2

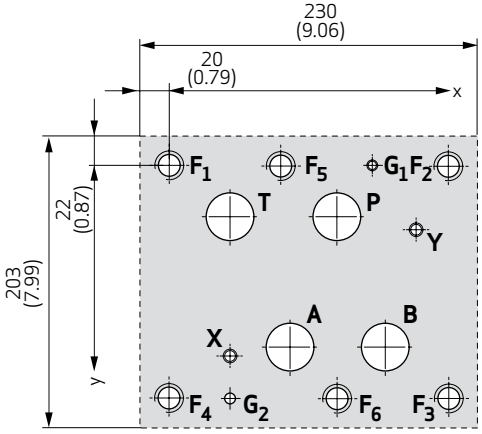
1) Unbiased Pilot Valve for Fail-safe options W
2) Biased Pilot Valve for Fail-safe options D, F, M (2x2-way) and U
5) All connected circuits must be isolated from the mains supply by “electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.
6) Frequency from 50 Hz to 10 kHz
7) Measured at +25 °C (+77 °F) ambient temperature and 24 V supply voltage

SIZE 10 - D685

Hole Pattern of Mounting Surface

The mounting manifold must conform to ISO 4401-10-09-0-05.

- For a maximum flow rate, the ports P, T, A and B should be provided with a diameter of 50 mm (1.97 in) (not according to standard).
- Flatness of mounting surface < 0.01 mm (0.0004 in) over a distance of 100 mm (3.94 in).
- Mean roughness R_a better than 0.8 µm (0.0000314 in).



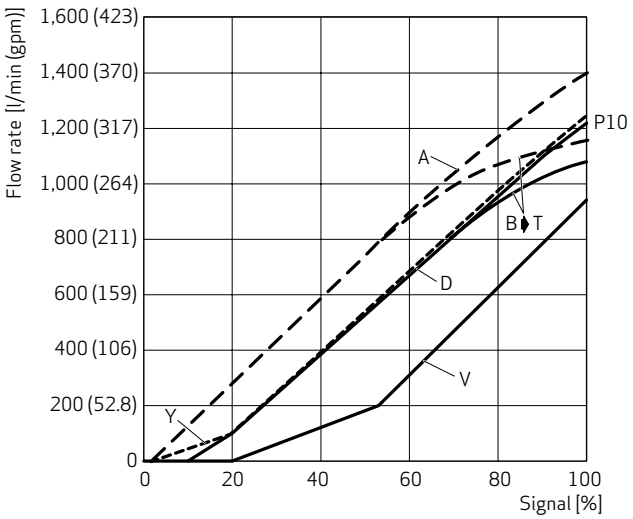
Designation		P	A	B	T	X	Y	F_1	F_2	F_3	F_4	F_5	F_6	G_1 [1)]	G_2
Size Ø	**mm**	50	50	50	50	11.2	11.2	M20	M20	M20	M20	M20	M20	7.5	7.5
	in	1.97	1.97	1.97	1.97	0.44	0.44	M20	M20	M20	M20	M20	M20	0.3	0.3
Position X	**mm**	114.3	82.5	147.6	41.3	41.3	168.3	0	190.5	190.5	0	76.2	114.3	147.6	41.3
	in	4.5	3.248	5.811	1.626	1.626	6.626	0	7.5	7.5	0	3	4.5	5.811	1.626
Position Y	**mm**	35	123.8	123.8	35	130.2	44.5	0	0	158.8	158.8	0	158.8	0	158.8
	in	1.378	4.874	4.874	1.378	5.126	1.752	0	0	6.252	6.252	0	6.252	0	6.252

1) Dimension not according to ISO 4401 but DIN 24340-2. The position of the mounted safety pin is according to EN standard. Hole G_1 according to ISO 4401 is at 138.6 mm (5.46 in) and it is additionally drilled in the valve body in line with ISO 4401.

SIZE 10 - D685

Typical Characteristic Curves

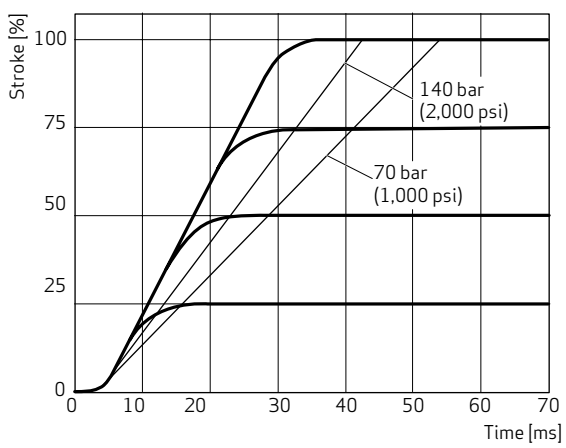
Flow signal curves at Δp_N = 5 bar(75 psi) per land, rated flow 1,000 l/min (263.1 gpm)



Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear flow characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic
Spool version V: -20 % overlap, dual gain flow characteristic

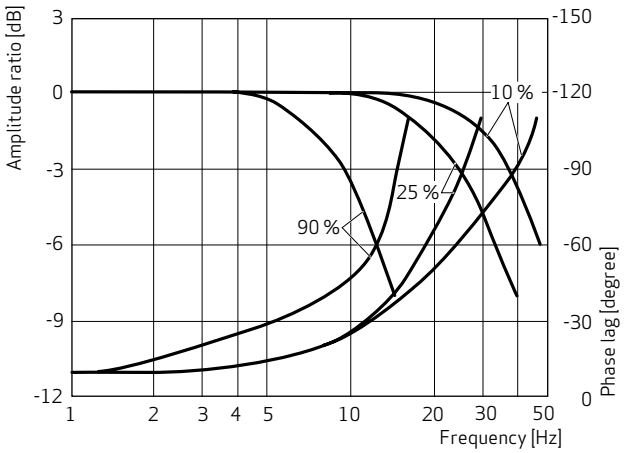
Step Response

With pilot valve D633, rated flow 1,000 l/min (263.1 gpm)



Frequency Response

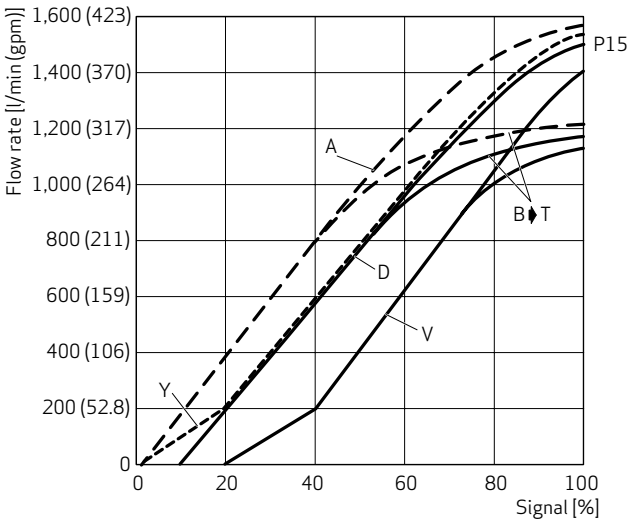
With pilot valve D633, rated flow 1,000 l/min (263.1 gpm)



SIZE 10 - D685

Typical Characteristic Curves

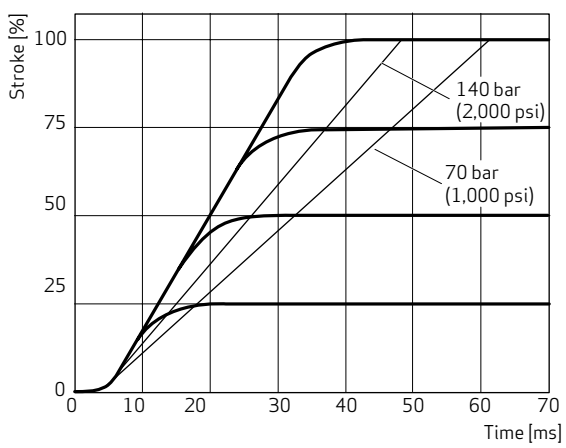
Flow signal curves at Δp_N = 5 bar(75 psi) per land, rated flow 1,500 l/min (394.7 gpm)



Spool version A: <±3 % overlap, linear flow characteristic
Spool version D: ±10 % overlap, linear flow characteristic
Spool version Y: <±3 % overlap, dual gain flow characteristic
Spool version V: -20 % overlap, dual gain flow characteristic

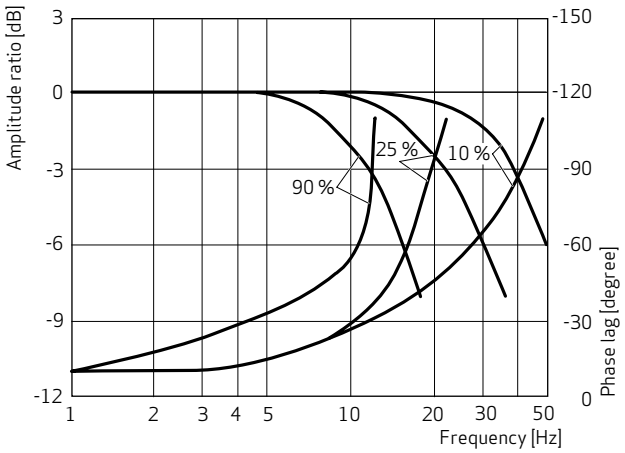
Step Response

With pilot valve D633, rated flow 1,500 l/min (394.7 gpm)



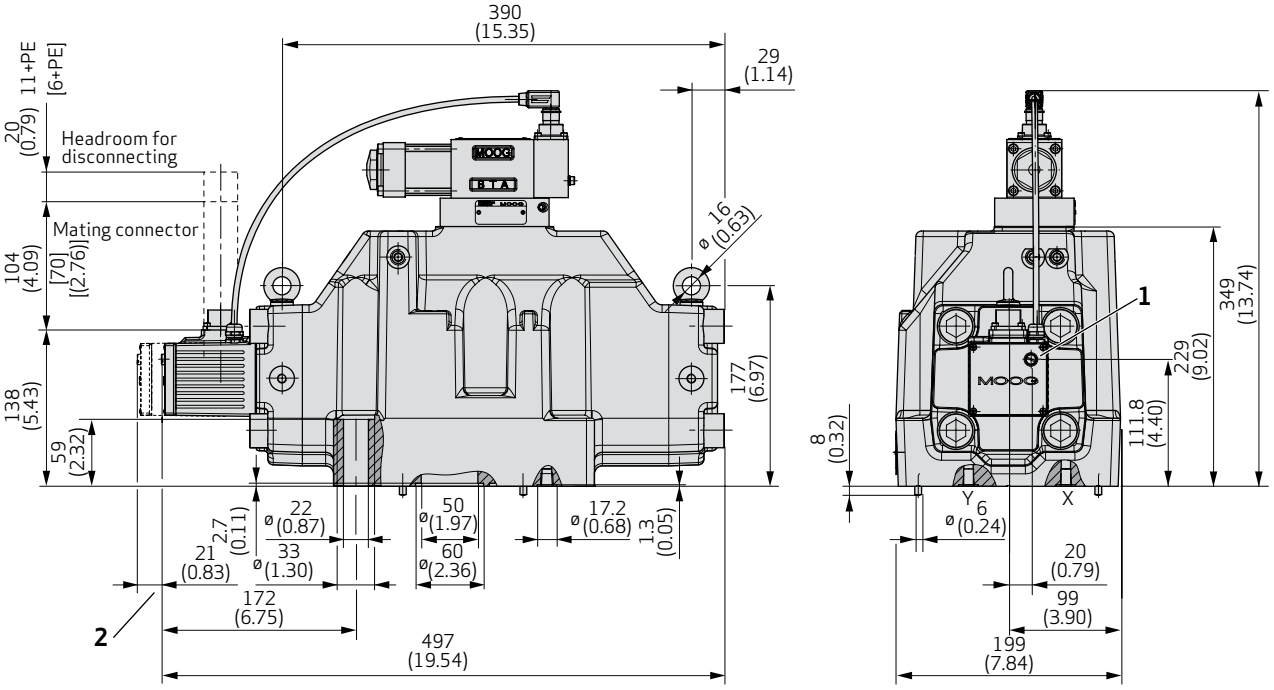
Frequency Response

With pilot valve D633, rated flow1,500 l/min (394.7 gpm)



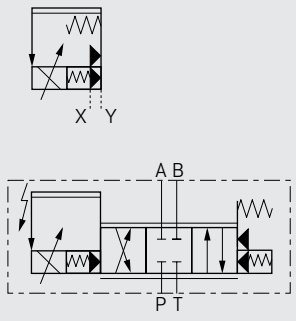
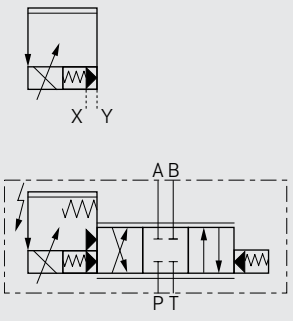
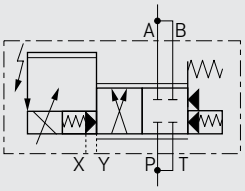
SIZE 10 - D685

Installation Drawing for Fail-safe Options D, F and M



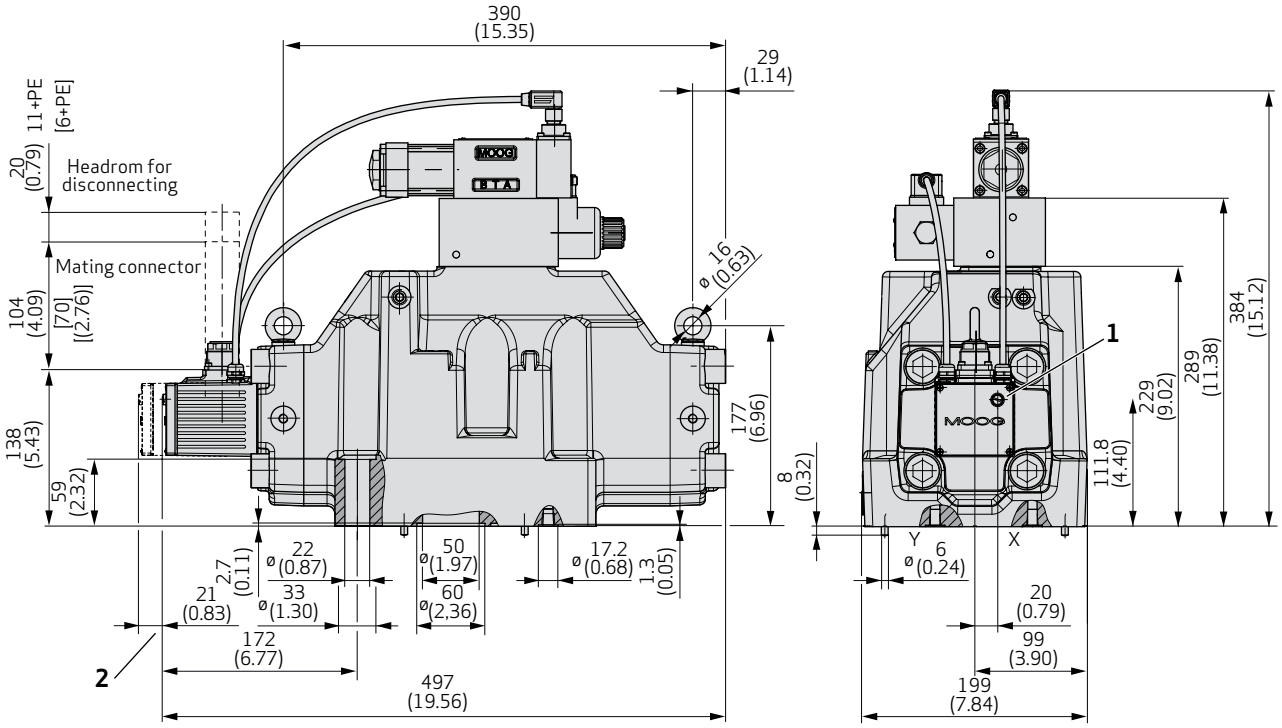
1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

2 With damping plate

Optional X and Y external	Optional X and Y external	Only X and Y external
		
Fail-safe option D 4-way design Fail-safe position P → A and B → T	Fail-safe option F 4-way design Fail-safe position P → B and A → T	Fail-safe option M 2x2-way design Defined center position by mechanical spool stop Flow direction according to symbol

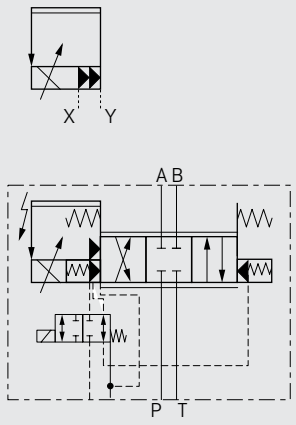
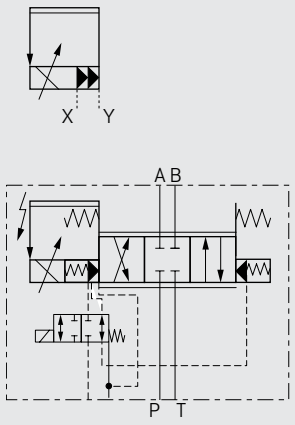
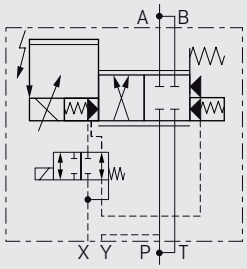
SIZE 10 - D685

Installation Drawing for Fail-safe Options U and W



1 Electric null adjust (behind screw plug)
Attention! Electric null adjust is not possible if the position of the main spool is monitored!

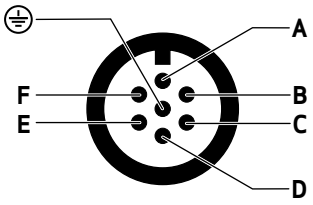
2 With damping plate

Optional X and Y external	Optional X and Y external	X and Y external necessary
		
Fail-safe option U 4-way design Fail-safe position P → B, A → T and defined center position	Fail-safe option W 4-way design Defined center position	Fail-safe option W 2x2-way design Defined center position by mechanical spool stop Flow direction only according to symbol

ELECTRONICS

Pin Assignment for Valves with 6-pole + PE Connector, Pin Contacts

According to EN 175201-804, mating connector (type R or S, metal) with preleading protective earth pin (⏚)



Pin	Pin assignment	Signal type[1]	
		Voltage floating	**Current floating**
A	**Supply voltage**	U_{A-B} = 24 V_{DC} (18 to 32 V_{DC}) referenced to GND (reverse polarity protected against GND)	
B	**GND**	Power ground/signal ground	
C	**Enable input**	U_{C-B} > 8.5 to 32 V_{DC} referenced to GND: Valve ready for operation (enabled) U_{C-B}< 6.5 V_{DC} referenced to GND: Valve disabled The input resistance is 10 kΩ	
D	**Command signal - spool position**	U_{in} = U_{D-E} R_{in} = 10 kΩ	I_{in} = I_D = -I_E R_{in} = 200 Ω I_{max} = ±25 mA
E	**Reference point Input rated command**	Reference for pin D[2]	
F	**Actual value - spool position**	U_{F-B} = 2 to 10 V; U_{F-B} is proportional to the spool position; 6 V corresponds to the spool center position; R_L = 500 Ω	4 to 20 mA referenced to GND; I_{out} is proportional to the spool position; 12 mA corresponds to the spool center position; the output is short-circuit-proof; R_L = 100 to 500 Ω
⏚	**Protective earth (PE)**	Connected with valve body	

1) Signal ranges see next page.

2) The potential difference between pins D or E referenced to pin B must be between -15 and +32 V.

ELECTRONICS

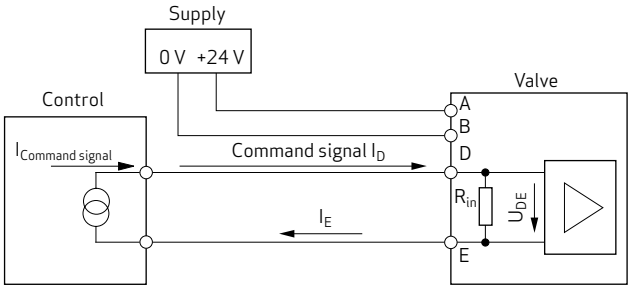
Ordering Codes and Signals for Valves with 6-pole + PE Connector

Ordering code position 10	Command signal ±100% spool position		Actual value ±100 % spool position	
D	U_D - U_E	-10 to +10 V	U_F - U_B	2 to 10 V
M	U_D - U_E	-10 to +10 V	I_F	4 to 20 mA
X	I_D	-10 to +10 mA	I_F	4 to 20 mA
E	I_D	4 to 20 mA	I_F	4 to 20 mA

Note: See inside back cover for complete ordering information.

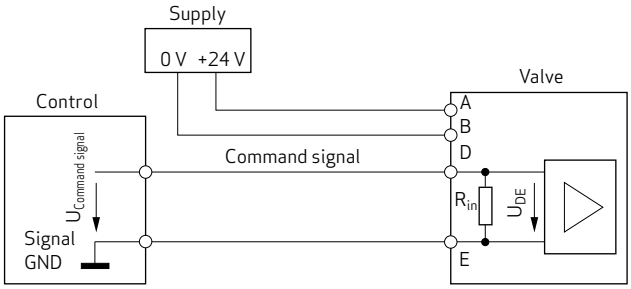
Command Signal Current Floating, Ordering Code X or E

The spool position is proportional to $I_D = - I_E$.
For a command signal I_D = 20 mA (code E) or +10 mA (code X) the spool moves to 100 % P → A and B → T.
For a command signal I_D = 12 mA (code E) or 0 mA (code X) the spool is in the defined center position.



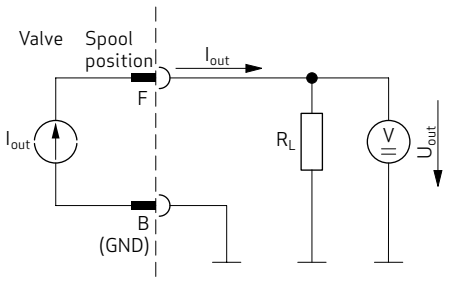
Command Signal Voltage Floating, Ordering Code D or M

The spool position is proportional to $U_D - U_E$.
For a command signal $U_D - U_E$ = +10 V the spool moves to 100 % P → A and B → T.
For a command signal $U_D - U_E$ = 0 V the spool is in the defined center position.



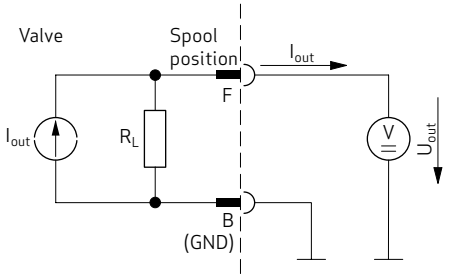
Actual Value 4 to 20 mA, Ordering Code M, X or E

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to I_{out}. The spool position corresponds to 4 to 20 mA. At 12 mA the spool is in center position.
20 mA corresponds to 100 % valve opening P → A and B → T. A cable fault is detected by I_{out} = 0 mA.
Actual value U_{out} = 2 to 10 V with resistor R_L = 500 Ω (0.25 W) provided by customer.



Actual Value 2 to 10 V, Ordering Code D

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to U_{out}. The spool position corresponds to 2 to 10 V. At 6 V the spool is in center position.
10 V corresponds to 100 % valve opening P → A and B → T.
A cable fault is detected by U_{out} = 0 V.
R_L = 500 Ω (0.25 W).

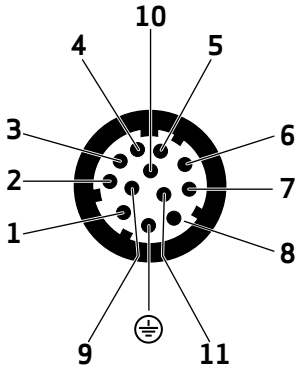


Note: For more information see Technical Notes TN 353 "Protective Grounding and Electrical Shielding of Valves", TN 426 "Wiring Instructions" and TN 494 "Maximum Permissible Length of Electric Cables for Valves with Integrated Electronics".
Visit www.moog.com to download document.

ELECTRONICS

Pin Assignment for Valves with 11-pole + PE Connector, Pin Contacts

According to EN 175201-804, mating connector (type E, metal) with preleading protective earth pin (⏚)



Pin	Pin assignment	Signal type[1]	
		Voltage floating	**Current floating**
1	**Supply voltage**	U_{1-2} = 24 V_{DC} (18 to 32 V_{DC}) referenced to GND (reverse polarity protected against GND)	
2	**GND**	Power ground/signal ground (enable and output)	
3	**Enable input**	U_{3-2} > 8.5 to 32 V_{DC} referenced to GND: Valve ready for operation (enabled) U_{3-2} < 6.5 V_{DC} referenced to GND: Valve disabled The input resistance is 10 kΩ	
4	**Command signal - spool position**	U_{in} = U_{4-5} R_{in} = 10 kΩ	I_{in} = I_4 = -I_5 R_{in} = 200 Ω I_{max} = ±25 mA
5	**Reference point Input rated command**	Reference for pin 4[2]	
6	**Actual value - spool position**	U_{6-2} = 2 to 10 V. At 6 V spool is in centered position. R_L = 500 Ω	4 to 20 mA referenced to GND (I_{out} is proportional to the spool position, 12 mA corresponds to the valve middle position, the output is short-circuit-proof); R_L = 100 to 500 Ω
7		U_{7-2}: 13 to 3 V referenced to GND (U_{7-2} is proportional to the spool position, 8 V corresponds to the valve middle position, the output is short-circuit-proof); R_L = 5 kΩ	
8	**Digital output - valve status**	U_{8-2} > 8.5 V: Valve ready for operation (enabled and supply OK). U_{8-2} < 6.5 V: Valve disabled. Load type: Ohmic, inductive, lamp load. I_{max} = 20 mA (short-circuit-proof).	U_{8-2} > 8.5 V: Valve ready for operation (enabled and supply OK). U_{8-2} < 6.5 V: Valve disabled. Load type: Ohmic, inductive, lamp load. Output current maximum 1.5 A (short-circuit-proof).
9	**Optional - fail-safe valve supply**	U_{9-10} = 24 V_{DC} (22.8 to 26.4 V_{DC}) referenced to failsafe valve GND (reverse polarity protected against GND); I_{max} = 1.35 A, 36 W	
10	**Optional - fail-safe valve GND**	Power ground - fail-safe valve	
11	**Digital output - error monitoring**	U_{11-2} > 8.5 V: No error. U_{11-2} < 6.5 V: Indicates error[3]. Load type: Ohmic, inductive, lamp load. I_{max} = 20 mA (short-circuit-proof)[4].	
⏚	**Protective earth (PE)**	Connected with valve body	

1) Signal ranges see next page.
2) The potential difference between pins 4 or 5 referenced to pin 2 must be between -15 and +32 V.
3) Output can be programmed at the factory, enable function order code: K and L - safe position of spool, M and R - command signal/ actual valve deviation, others upon request.
4) The currents drawn at the outputs pin 11 (referenced to GND) must be added to the valve supply current. The valve fuse must be configured for the total current.

ELECTRONICS

Ordering Codes and Signals for Valves with 11-pole + PE Connector

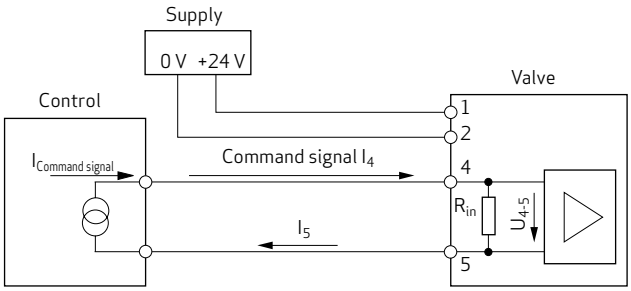
Ordering code position 10	Command signal ±100% spool position		Actual value ±100 % spool position	
A	U_{4-5}	-10 to +10 V	U_{6-7}	-10 to +10 V
D	U_{4-5}	-10 to +10 V	U_{6-2}	2 to 10 V
M	U_{4-5}	-10 to +10 V	I_6	4 to 20 mA
T[1)]	U_{4-5}	-10 to +10 V	U_{6-7}	-10 to +10 V
X	I_4	-10 to +10 mA	I_6	4 to 20 mA
E	I_4	4 to 20 mA	I_6	4 to 20 mA

Note: See inside back cover for complete ordering information.

1) With dead band compensation

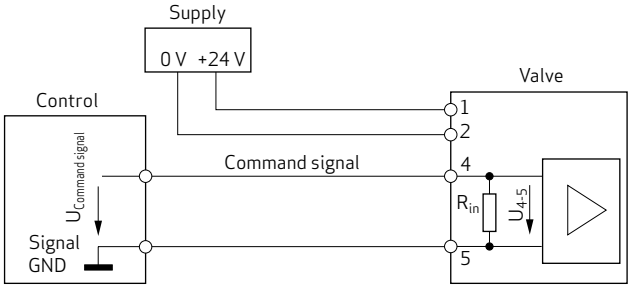
Command Signal Current Floating, Ordering Code X or E

The spool position is proportional to $I_4 - I_5$.
For a command signal I_4 = 20 mA (code E) or +10 mA (code X) the spool moves 100 % P → A and B → T.
For a command signal I_4 = 12 mA (code E) or 0 mA (code X) the spool is in the defined center position.



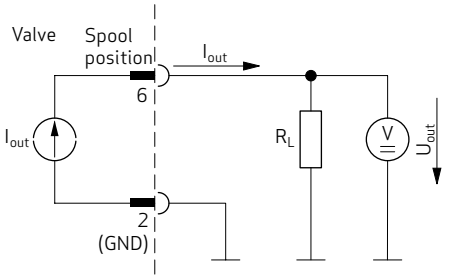
Command Signal Voltage Floating, Ordering Code A, D, M or T

The spool position is proportional to $U_4 - U_5$.
For a command signal $U_4 - U_5$ = +10 V the spool moves 100 % P → A and B → T.
For a command signal $U_4 - U_5$ = 0 V the spool is in the defined center position.



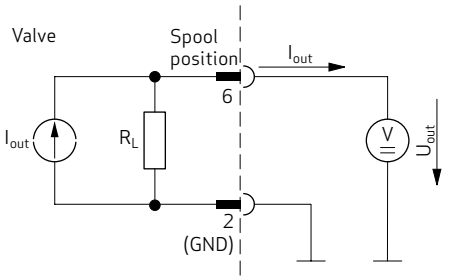
Actual Value 4 to 20 mA, Ordering Code M, X or E

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to I_{out}. The spool position corresponds to 4 to 20 mA. At 12 mA the spool is in center position.
20 mA corresponds to 100 % valve opening P → A and B → T. A cable fault is detected by I_{out} = 0 mA.
Actual value U_{out} = 2 to 10 V with resistor R_L = 500 Ω (0.25 W) provided by customer.



Actual Value 2 to 10 V, Ordering Code D or -10 to +10 V, Ordering Code A or T

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to Uout. The spool position corresponds to 2 to 10 or -10 to +10 V . At 6 V (0 V for A or T) the spool is in center position.
10 V corresponds to 100 % valve opening P → A and B → T.
A cable fault is detected by Uout = 0 V for order code D.
R_L = 500 Ω (0.25 W).



Note: For more information see Technical Notes TN 353 "Protective Grounding and Electrical Shielding of Valves", TN 426 "Wiring Instructions" and TN 494 "Maximum Permissible Length of Electric Cables for Valves with Integrated Electronics".
Visit www.moog.com to download document.

PILOT PRESSURE AND FLOW CALCULATION

Pilot Pressure

To achieve reliable functioning of the valves we recommend the following pilot pressure p:

- p_x > 10 bar (150 psi) over T or Y
- For valves with stub shaft spools p_x > = p_P
- For valves with standard spools p_x > = 0.3 x p_P

p_P = Pressure at port P of the valve (supply pressure)

Note: The pilot pressure range (see technical data) must be observed.

Flow Calculation

When the valve is open, the prevailing flow is dependent not only on the spool position, (i.e. the opening cross section of the valve), but also on the pressure drop at the individual lands. When the spool is deflected at 100 %, it delivers the rated flow with the rated pressure drop.

$$Q = Q_N \cdot \sqrt{\frac{\Delta p}{\Delta p_N}}$$

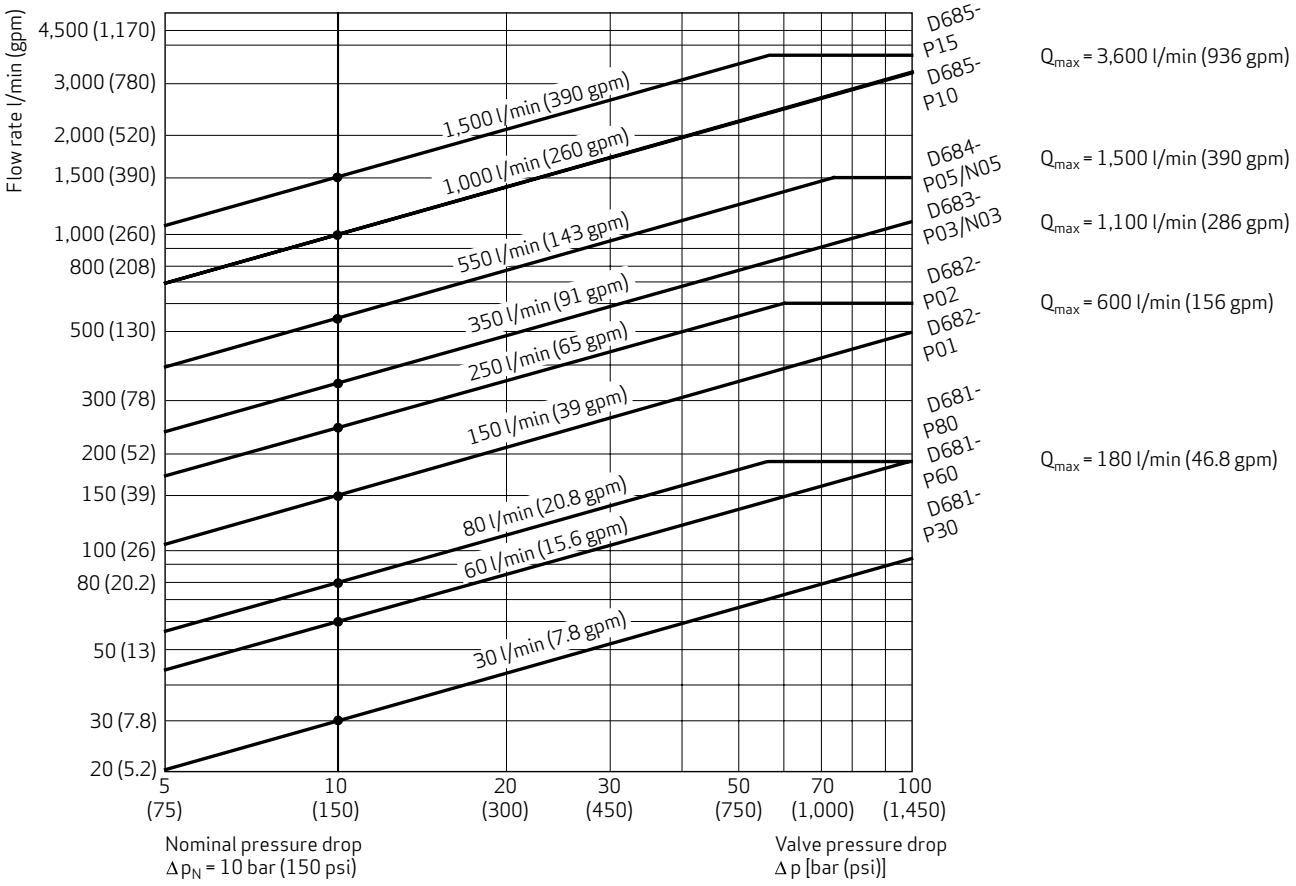
Q [l/min (gpm)]	actual flow
Q_N [l/min (gpm)]	rated flow
Δp [bar (psi)]	actual pressure drop per spool land
Δp_N [bar (psi)]	rated pressure drop per spool land

The rated flow of a proportional valve corresponds to a pressure drop of 5 bar (75 psi) per land, equating to 10 bar (145 psi) for two lands. When a valve is opened at 100 %, the flow can be calculated as a function of the actual pressure drop with the aid of the formula or taken from the diagram.

The actual flow in the valve ports must not exceed a mean flow velocity of approximately 30 m/s (96.5 ft/s) due to the risk of cavitation.

When operating the valves close to these application limits, it is necessary to drill the ports to the maximum possible diameters (see specifications for the respective valve).

Flow chart



ELECTRONICS LOGIC FUNCTIONS

The onboard electronics of D680 Series Proportional Control Valves is equipped with several logic functions. Short descriptions of these functions are given in the following. For more detailed information, please refer to the Moog technical note TN 435: "Description of Logic Functions".

Enable Input

The enable input is used to activate or deactivate the valve while the electric supply is powered. If the enable input is switched to HIGH, the valve is in normal operation mode. If the enable input is switched to LOW, there are two possible modes:

1. The main spool moves to the defined safe end position P→A or P→B. To achieve this, the control current to the pilot valve is switched off and the pilot valve's spool moves to its spring centered position, which is about 10 to 20 % open towards P→A or P→B, respectively. Then the main spool is moved to its fully opened position by hydraulic power ("open loop"). This option is not possible with fail-safe option W.
2. The valve stays in closed-loop control mode and gets an internal command signal that moves it to its center position. The external command signal is ignored.

Digital Outputs for Monitoring

The D680 Series Proportional Control Valves can be equipped with monitoring functions. Valves with an 11-pole + PE connector have 2 digital outputs for monitoring functions:

1. Valve Status Output

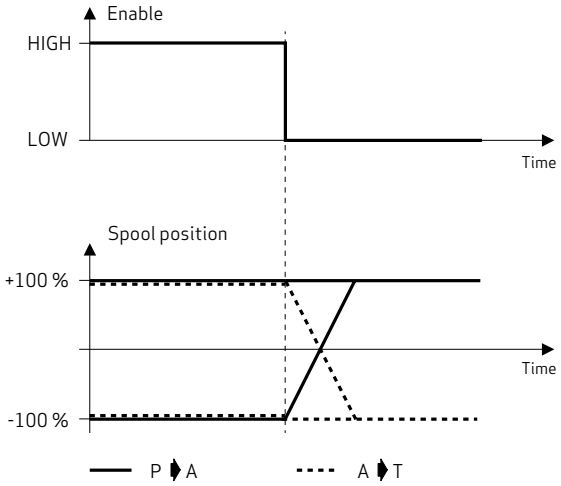
   This output indicates whether the valve is operational. If the supply voltage is sufficient and the enable signal is HIGH, the valve status signal is also HIGH. If either the supply voltage is below 18 V or the enable signal is LOW, the valve status signal is LOW.

2. Error Monitoring Output

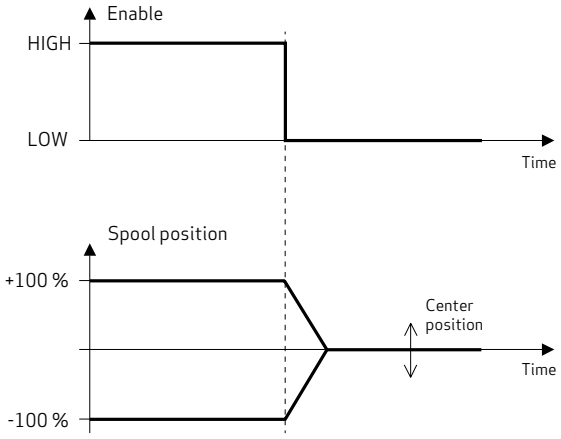
   Two options are available for the error monitoring output:

   a) Spool control deviation monitoring: If the control deviation of the spool controller is larger than a certain threshold (default is 30 %) for a certain time, the output is switched to LOW, which indicates an error. As long as the control deviation is within the threshold, the output is HIGH, indicating normal operation. This is used to detect if the main spool is stuck, e.g. due to contamination.

   b) Spool position monitoring: This function monitors whether the spool is within a certain position range. As long as the spool is within this position range, the output signal is HIGH. If the spool is outside this range, the output is switched to LOW. This can be used, e.g. for safety functions to monitor whether the spool is within its overlap range or not.

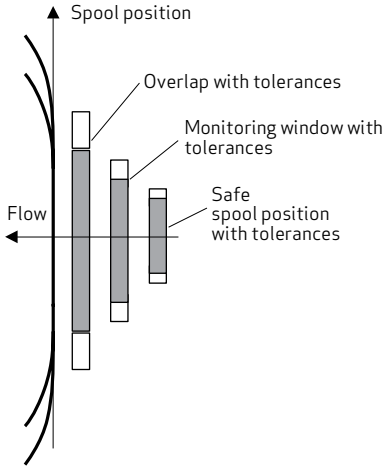


Move spool to end position



Move spool to center position

Safe spool positions



APPLICATIONS WITH SAFETY REQUIREMENTS

Installation in safety-related parts of control systems in accordance with DIN EN ISO 13849-1:2016-06

Moog D680 Series Proportional Control Valves are suitable for installation in safety-related parts of control systems in accordance with DIN EN ISO 13849-1:2016-06, subject to the following requirements:

- The valves must be fitted with springs for setting the main spool to a defined position.
- The safety-relevant function of the valves is to set the main spool to a defined position by spring power to prevent unsafe motion after the power that controls the main spool has been shut off.
- If a motion of the actuator in the safe position has to be prevented, a sufficient overlap must be selected. Note that in the case of spool valves internal leakage may occur even with large overlaps, and this may result in a drifting motion of the actuator.
- Depending on the required safety functions it may be necessary to fit pilot-controlled valves with integrated 4/2-way solenoid valves.
- The user has to comply with the basic and well-tried safety principles for implementation and operation of valves in accordance with DIN EN ISO 13849-2:2013-02, Tables C.1 and C.2.
- The user implements the valves in accordance with the environmental and application conditions described in the catalog, the operating instructions and the mounting and installation notes.

The valves have been designed to conform to the basic and well-tried safety principles in accordance with DIN EN ISO 13849-2:2013-02, Tables C.1 and C.2.

If the above requirements are met, an MTTFd of 150 years or a time according to table C.1 of DIN EN ISO 13849-1:2016-06 can be set for the safety-relevant function of the valves.
Please note: Moog cannot give values for the Performance Level or the Diagnostic Coverage of the valves, because these values also depend on the system surrounding the valves and cannot be determined for the valves alone.

OPTIONAL VALVE FEATURES UPON REQUEST

Moog offers a variety of optional features for the D680 Series Proportional Control Valves including:

- Ruggedized valve for operation in demanding environments
- High flow version
- Hydraulically actuated fail-safe option
- Valves for special fluids

Decoupled electronics for high vibration environments

In highly dynamic applications such as presses, valves are exposed to very high accelerations, vibration and shocks exceeding the limits given in this catalog. If this happens continuously, the valve electronics might be damaged over time. To avoid this kind of damage, the valves can be equipped with a damping plate between the valve housing and the electronics. This damping plate partially decouples the electronics from the valve housing, and thus significantly lowers the stress on the electronics caused by vibration. This option is suitable for vibrations with frequencies above 300 Hz.

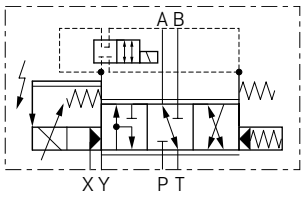
The mounting of a damping plate results in an extension of the mounting length of the valve of 20 mm (0.79 in). The extended valve dimension needs to be considered during machine design.

Hardened valve housing to reduce wear

For applications where the valve operates at very high pressure drops and can be subject to excessive wear of control lands, Moog offers a version with hardened valve housings. In these valves, the spool contact surfaces including the control lands are plasma nitrided to increase the surface hardness. This leads to reduced wear and increased valve operation times.

High-flow version for 3/3-way applications (D684)

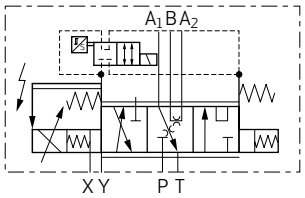
For use in 3/3-way applications with D684 (size 08) valves, a valve version with higher rated flow is available. This version uses a standard ISO 4401 port pattern with a special port assignment. The flow directions are from P → A + T with a higher rated flow (800 l/min @ 5 bar pressure drop) and from B → P with standard rated flow. Thus, by combining two ports for the flow leaving the valve, the rated flow in one direction is increased. This valve version is available with stub shaft spools only.



5-Port Version for Use in Regenerative Circuits

For use in regenerative circuits, the valves sizes D681 to D684 (size 05 to size 08) are available as 5-port versions where the flow from the rod side of the differential cylinder can be directly fed into the bore side. The sizes D682 to D684 use a special port pattern that derives from ISO 4401 and includes a 5th port A2.

Port A2 has to be connected to port A in the manifold. If the differential cylinder is extended, the oil from the rod side (connected to port B) is fed into port A2 and thus port A, which is connected to the bore side of the cylinder. This leads to a permanent regenerative circuit when extending the cylinder.



Hydraulically Actuated Fail-Safe Valve

Moog offers the option of a hydraulically actuated fail-safe valve for applications where a solenoid actuated fail-safe valve is not suitable. An additional feature of this variant is that the main stage spool is moved to the end position not only by mechanical springs, but also by hydraulic force of the pilot oil. This leads to more reliability in reaching the end position, as the hydraulic force can easily overcome friction caused by contamination or particles.

Valves for Operation with Phosphate Ester Based Fluids

Standard hydraulic seal materials, like NBR and FKM, are often not compatible with fire resistant fluids based on phosphate esters. For use of the valves with these fluids, Moog offers valves with special seal versions that are resistant to mineral oil as well as phosphate esters. Please note: These valves are tested at Moog with mineral oil. Remnants of mineral oil will remain in the valve after testing.

Please contact Moog for more details on special versions available for your application.

ABOUT MOOG

Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including energy production and generation machinery, industrial production machinery and simulation and test equipment. We help performance-driven companies design and develop their next-generation machines.

This vast scope ensures that our engineers remain close to the needs of machine builders and provide flexible design solutions and technical expertise tailored to our customers' toughest challenges.

Moog experts work in close collaboration with machine builders and application engineers to design motion control systems for greater productivity, higher reliability, superior connectivity, less costly maintenance and more effective operations. Our regional presence, industry knowledge and design flexibility ensures Moog motion control solutions are tailored to their environment — from meeting operating regulations and performance standards, to taking machine performance to a higher level.

Servo Valves

Servo Cartridge Valves

Products

At the heart of every Moog solution is an array of products engineered for precision, high performance and reliability. For more than six decades, Moog products have been specified for critical machine applications.

Some are developed specifically for unique operating environments. Others are standard equipment on machines across many industries. All are continuously improved to take advantage of the latest technology breakthroughs and advancements.

Moog products include:

- Servo and Proportional Valves
- Industrial Cartridge Valves
- Integrated Hydraulic Manifold Systems
- Radial Piston Pumps
- Servo Motors and Servo Drives
- Machine and Motion Controllers
- Electro-Mechanical Actuators
- Ball, Planetary Roller and Inverted Roller Screws

Radial Piston Pumps

Servo Drives

SOLUTIONS

Solutions

Hydraulic Solutions

Since Bill Moog invented the first commercially viable servo valve in 1951, Moog has set the standard for world-class hydraulic technology. Today, Moog products are used in a variety of applications - providing high power, enhanced productivity and ever better performance for some of the worlds most demanding applications.

Flight Simulation

Electric Solutions

Clean operation, low noise generation, less maintenance and reduced power consumption make Moog electric solutions ideal for applications worldwide. Moog is the ideal partner for applications where transitioning technologies requires special expertise.

Hybrid Solutions

By incorporating the advantages of existing hydraulic and electric technologies - including modular flexibility, increased efficiency and cleanliness - into innovative hybrid solutions, Moog offers new performance potential in specialized applications.

Simulation Table

MOOG GLOBAL SUPPORT

Moog Global Support is our promise to help you:

- Maximize uptime
- Get more from your machine investment

It reflects our commitment to keeping your motion control components and systems running at peak performance. We help you transform maintenance by moving from reactive to planned. Around the globe in 24 countries, local teams of trained Moog technicians are on standby with the services you need from express repairs to exchange programs, and on-site technical support.

This promise offers many benefits to our customers including:

- Reduce your downtime by keeping critical machines running in peak performance
- Protect your investment by ensuring reliability, versatility and long-life of products
- Better plan your maintenance activities and make systematic upgrades
- Leverage our flexible programs to meet the unique service requirements of your facility

Look to Moog for global support including:

- Factory Repair Services – Restore your products to "like new" performance with high quality repairs using authentic OEM components
- Replacement Parts/Spares – Obtain authentic OEM products whenever and wherever they are needed around the globe
- Professional Field Services – Access on-site technical support from knowledgeable professionals for installation, commissioning and troubleshooting
- Flexible Service Agreements – Lower your total cost of ownership and reduce your risk of downtime with a tailored package of services to meet your needs
- Offer consistent quality anywhere in the world

For more information on Moog Global Support visit **www.moogglobalsupport.com.**

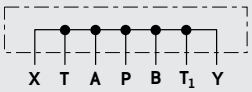
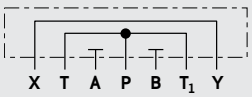
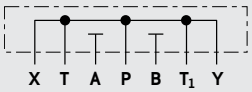
ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts D681 Proportional Control Valve

Part name	Description	Material	Part number
Service sealing set for main stage	Contains the following O-rings: • 5 pieces for ports P, T, T_1, A, B, inner Ø 12.4 mm (0.49 in) x Ø 1.8 mm (0.07 in) • 2 pieces for ports X, Y, inner Ø 15.6 mm (0.61 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V681-10
		NBR 90 Shore	B97215-N681-10
Service sealing set for pilot valve or 4/2-way solenoid valve	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in) • 1 piece for port Y, inner Ø 7.65 mm (0.3 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V630F63
		HNBR 90 Shore	B97215-H630F61

Accessories D681 Proportional Control Valve

Part name	Description	Remark	Part number
Flushing plate	P-A-B-T-T_1-X-Y Mounting screws and O-rings included		B67728-001
	P-T-T_1 and X-Y Mounting screws and O-rings included		B67728-003
	P-T-T_1-X-Y Mounting screws and O-rings included		B67728-002
Manifold	ISO 4401 size 05, ports P, A, B, T with G 3/4 A, ports X, Y with G 1/4 A		C41407-001
Mounting screws	4 pieces M6x40, ISO 4762-10.9, tightening torque 11 Nm (97 lbf in)		A03665-060-040
Shipping plate	ISO 4401 size 05		A40508

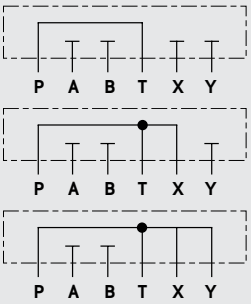
ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts D682 Proportional Control Valve

Part name	Description	Material	Part number
Service sealing set for main stage	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 21.89 mm (0.86 in) x Ø 2.6 mm (0.1 in) • 2 pieces for ports X, Y, inner Ø 10.82 mm (0.43 in) x Ø 1.8 mm (0.07 in)	FKM 85 Shore	B97215-V6X2-16
		NBR 85 and 90 Shore	B97215-N6X2-16
	Contains the following Kantseals: • 4 pieces for ports P, T, A, B, inner Ø 21.89 mm (0.86 in) x ☐ 2.6 mm (0.1 in) • 2 pieces for ports X, Y, inner Ø 10.82 mm (0.43 in) x ☐ 1.8 mm (0.07 in)	Kantseal HNBR 85 Shore	B97215-S6X2-16
Service sealing set for pilot valve or 4/2-way solenoid valve	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in) • 1 piece for port Y, inner Ø 7.65 mm (0.3 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V630F63
		HNBR 90 Shore	B97215-H630F61

Accessories D682 Proportional Control Valve

Part name	Description	Remark	Part number
Flushing plate	P-T or P-T-X or P-T-X-Y adjustable Mounting screws and O-rings included		-76741-001
Manifold	ISO 4401 size 07, ports P, A, B, T with G 1 A, ports X, Y with G 1/4 A		B46891-001
Mounting screws	2 pieces M6x55, ISO 4762-10.9, tightening torque 11 Nm (97 lbf in)		A03665-060-055
	4 pieces M10x60, ISO 4762-10.9, tightening torque 54 Nm (40 lbf ft)		A03665-100-060
Shipping plate	ISO 4401 size 07		A88833

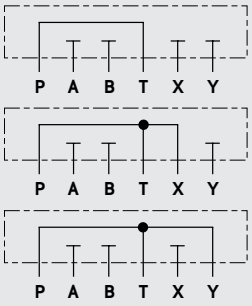
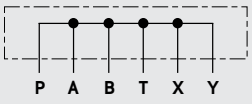
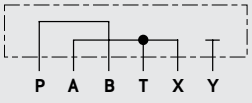
ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts D683 Proportional Control Valve

Part name	Description	Material	Part number
Service sealing set for main stage	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 34.6 mm (1.36 in) x Ø 2.6 mm (0.1 in) • 2 pieces for ports X, Y, inner Ø 20.29 mm (0.8 in) x Ø 2.6 mm (0.1 in)	FKM 90 Shore	B97215-V6X4-25
		NBR 90 Shore	B97215-N6X4-25
	Contains the following Kantseals: • 4 pieces for ports P, T, A, B, inner 34.6 mm (1.36 in) x ☐ 2.6 mm (0.1 in) • 2 pieces for ports X, Y, inner Ø 20.29 mm (0.8 in) x ☐ 2.6 mm (0.1 in)	Kantseal HNBR 85 Shore	B97215-S6X4-25
Service sealing set for pilot valve or 4/2-way solenoid valve	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in) • 1 piece for port Y, inner Ø 7.65 mm (0.3 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V630F63
		HNBR 90 Shore	B97215-H630F61

Accessories D683 Proportional Control Valve

Part name	Description	Remark	Part number
Flushing plate	P-T or P-T-X or P-T-X-Y adjustable Mounting screws and O-rings included		-76047-001
	P-A-B-T-X-Y Mounting screws and O-rings included		-76047-002
	P-B and A-T-X Mounting screws and O-rings included		-76047-003
Manifold	ISO 4401 size 08, ports P, A, B, T with G 1 1/2 A, ports X, Y with G 1/2 A		A25855-009
Mounting screws	6 pieces M12x75, ISO 4762-10.9, tightening torque 94 Nm (69 lbf ft)		A03665-120-075
Shipping plate	ISO 4401 size 08		A88832

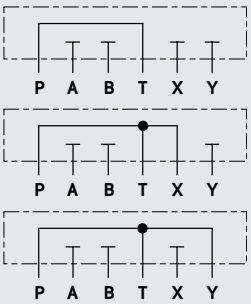
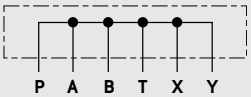
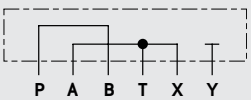
ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts D684 Proportional Control Valve

Part name	Description	Material	Part number
Service sealing set for main stage	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 34.6 mm (1.36 in) x Ø 2.6 mm (0.1 in) • 2 pieces for ports X, Y, inner Ø 20.29 mm (0.8 in) x Ø 2.6 mm (0.1 in)	FKM 90 Shore	B97215-V6X4-25
		NBR 90 Shore	B97215-N6X4-25
	Contains the following Kantseals: • 4 pieces for ports P, T, A, B, inner Ø 34.6 mm (1.36 in) x ☐ 2.6 mm (0.1 in) • 2 pieces for ports X, Y, inner Ø 20.29 mm (0.8 in) x ☐ 2.6 mm (0.1 in)	Kantseal HNBR 85 Shore	B97215-S6X4-25
Service sealing set for pilot valve or 4/2-way solenoid valve	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in) • 1 piece for port Y, inner Ø 7.65 mm (0.3 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V630F63
		HNBR 90 Shore	B97215-H630F61

Accessories D684 Proportional Control Valve

Part name	Description	Remark	Part number
Flushing plate	P-T or P-T-X or P-T-X-Y adjustable Mounting screws and O-rings included		-76047-001
	P-A-B-T-X-Y Mounting screws and O-rings included		-76047-002
	P-B and A-T-X Mounting screws and O-rings included		-76047-003
Manifold	ISO 4401 size 08, ports P, A, B, T with G 1 1/2 A, ports X, Y with G 1/2 A		A25855-009
Mounting screws	6 pieces M12x75, ISO 4762-10.9, tightening torque 94 Nm (69 lbf ft)		A03665-120-075
Shipping plate	ISO 4401 size 08		A88832

ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts D685 Proportional Control Valve

Part name	Description	Material	Part number
Service sealing set for main stage	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 53.6 mm (2.11 in) x Ø 3.5 mm (0.14 in) • 2 pieces for ports X, Y, inner Ø 14 mm (0.55 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V6X5-32
		HNBR 85 Shore	B97215-N6X5-32
	Contains the following Kantseals: • 4 pieces for ports P, T, A, B, inner Ø 53.6 mm (2.11 in) x ☐ 3.5 mm (0.14 in) • 2 pieces for ports X, Y, inner Ø 14 mm (0.55 in) x ☐ 1.8 mm (0.07 in)	Kantseal HNBR 85 Shore	B97215-S6X5-32
Service sealing set for pilot valve or 4/2-way solenoid valve	Contains the following O-rings: • 4 pieces for ports P, T, A, B, inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in) • 1 piece for port Y, inner Ø 7.65 mm (0.3 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V630F63
		HNBR 90 Shore	B97215-H630F61

Accessories D685 Proportional Control Valve

Part name	Description	Part number
Manifold	ISO 4401 size 10, ports P, A, B, T with G 1 1/2 A, ports X, Y with G 3/8 A	A25856-001
Mounting screws	6 pieces M20x90, ISO 4762-10.9, tightening torque 460 Nm (339 lbf ft)	A03665-200-090
Shipping plate	ISO 4401 size 10	A03398

ACCESSORIES AND SPARE PARTS

Series-independent Accessories

Accessories D680 - Proportional Control Valves

Part name	Description	Remark	Part number
Mains power connection	Power supply cable, length 2 m (6.4 ft)		B95924-002
	SELV power pack 24 V_{DC}, 10 A		D137-003-001
Mating connector	Cable with straight mating connector 11-pole + PE	5, 10, 20 or 25 m, e.g. for 5 m specify 005, other length upon request	C21031-xxx-001
	Cable with straight mating connector 6-pole + PE		C21033-xxx-001
	Mating connector, elbow 6-pole + PE	In accordance with EN 175201-804, type S, metal, IP65, crimp contact Ø 0.75 to 1.5 mm^2 (0.0012 to 0.0023 in^2), conus Ø 12.2 mm (0.48 in), cable Ø 8 to 12 mm (0.31 to 0.47 in), sealing element Ø 9 to 13 mm (0.35 to 0.51 in)	B97069-061
	Mating connector, straight 11-pole + PE	In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.14 to 0.5 mm^2 (0.00022 to 0.00078 in^2), cable Ø 12 to 15 mm (0.47 to 0.59 in)	B97067-111
	Mating connector, straight 6-pole + PE	In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.75 to 1.5 mm^2 (0.0012 to 0.0023 in^2), conus Ø 12.2 mm (0.48 in), cable Ø 8 to 12 mm (0.31 to 0.47 in), sealing element Ø 9 to 13 mm (0.35 to 0.51 in)	B97007-061

Documents D680 - Proportional Control Valves

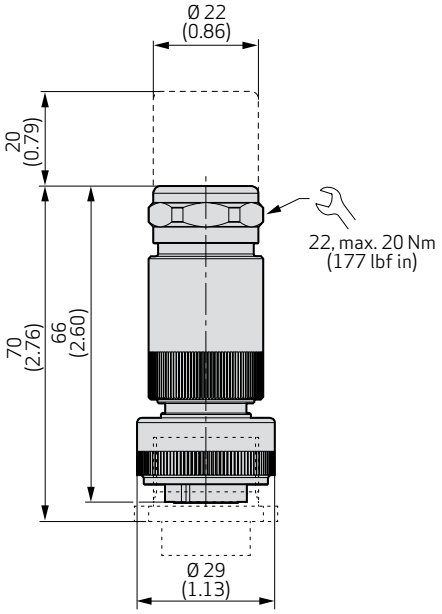
Part name	Description	Remark	Part number
Technical Note	Protective Grounding and Electrical Shielding of Hydraulic Valves with Integrated Electronics	Visit www.moog.com to download a document using the part number in a search	TN 353
	Wiring Instruction		TN 426
	Description of Logic Functions		TN 435
	Maximum Permissible Length of Electric Cables for Valves with Integrated Eletronics		TN 494
	Use of Moog Valves in Safety-Related Parts of Control Systems in Accordance with DIN EN ISO 13849-1:2016-06		TN 591
Mounting and Installation Notes	D680 Series – Proportional Control Valves	Visit www.moog.com to download a document using the part number in a search	B97072-680

ACCESSORIES AND SPARE PARTS

Mating Connector, Straight 6-pole + PE

In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.75 to 1.5 mm² (0.0012 to 0.0023 in²), conus Ø 12.2 mm (0.48 in), cable Ø 8 to 12 mm (0.31 to 0.47 in), sealing element Ø 9 to 13 mm (0.35 to 0.51 in)

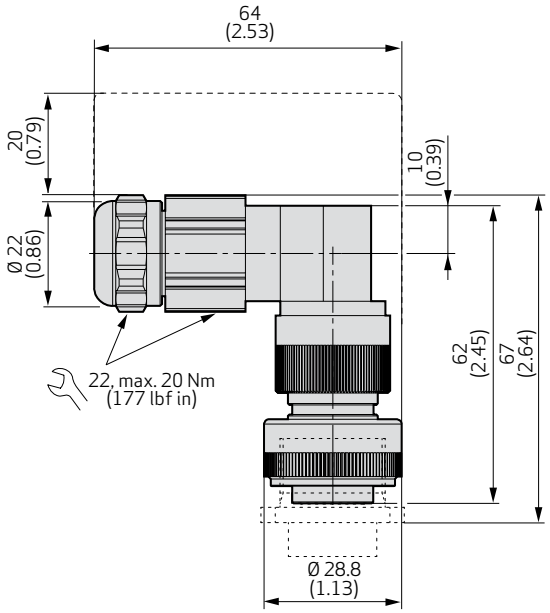
Part number B97007-061



Mating Connector, Elbow 6-pole + PE

In accordance with EN 175201-804, type S, metal, IP65, crimp contact Ø 0.75 to 1.5 mm² (0.0012 to 0.0023 in²), conus Ø 12.2 mm (0.48 in), cable Ø 8 to 12 mm (0.31 to 0.47 in), sealing element Ø 9 to 13 mm (0.35 to 0.51 in)

Part number B97069-061

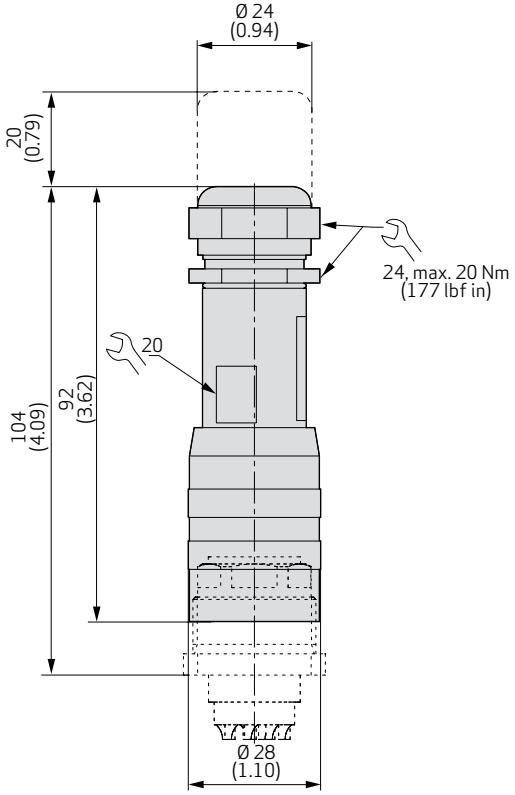


ACCESSORIES AND SPARE PARTS

Mating Connector, Straight 11-pole + PE

In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.14 to 0.5 mm² (0.00022 to 0.00078 in²), cable Ø 12 to 15 mm (0.47 to 0.59 in)

Part number B97067-111



ORDERING CODE

Model number (assigned at the factory)

Type designation

1 2 3 4 5 6 ...

D681 to D685 [ ] [ ] [ ] [ ] [ ] [ ]

Specification status	
–	Series specification
Z	Special specification

Model designation

Factory identification

1	**Valve type**	**Series**
B	Proportional spool, 5-way	D681 (+ P1)
P	Proportional spool	D681 to D685
N	Stub shaft spool	D683 and D684

2	**Rated flow per spool land [l/min (gpm)]**	**Series**
	For Δp_N = 5 bar (75 psi)	
30	30 (7.9)	D681
60	50 (13)	D681
80	80 (21)	D681
01	150 (40)	D682
02	250 (66)	D682
03	350 (93)	D683
05	550 (145)	D684
10	1,000 (264)	D685
15	1,500 (396)	D685

3	**Pressure range [bar (psi)]**
	Maximum operating pressure[1)]
B	70 bar (1,000 psi)
H	280 bar (4,000 psi)
K	350 bar (5,000 psi)

4	**Spool design**
A	4-way: 1.5 to 3 % positive overlap, linear flow characteristic
D	4-way: 10 % positive overlap, linear flow characteristic
R	4-way: 10 % positive overlap, dual gain flow characteristic
Y	4-way: 1.5 to 3 % positive overlap, dual gain flow characteristic
Z	2x2-way A → T, B → T1: D681 P → B, T → A: D682 to D685
X	Special spool upon request

5	**Direct drive pilot valve**	**Series**
Z	D633-7... (80 N linear motor, open-loop controlled)	D681 to D684
V	D633-8... (80 N linear motor, closed-loop controlled)	D681 to D684
T	D633-1... (200 N linear motor)	D685
X	Special valve version upon request	

6	**Fail-safe function**
	Mechanical fail-safe version
F	P → B, A → T
D	P → A, B → T
M	2x2-way valve
	Electrically controlled fail-safe version
W	Center position, not possible for valves with this combination: stub shaft spool (pos. 1 "N") and pilot valve D633-8 (pos. 5 "V")

1) System pressure for main stage can vary from the maximum pilot pressure

ORDERING CODE

7	8	9	10	11	12	13
…				2	–	

13 Enable function

A	B	G	H	J	
X	–	X	–	X	If the enable signal is low: The spool moves to a closed loop controlled neutral position (the HOLD position).
–	X	–	X	–	If the enable signal is low: The linear force motor is de-energized. The spool moves to its spring centered position (as defined at position 6 of the order code).
–	–	X	X	–	Monitoring of the safe position of the spool at pin 11 [2]. The range of the safe position can be freely defined (the default range is around the spring centered position). HIGH: Within the safe position range LOW: Outside of the safe position range
–	–	–	–	X	Monitoring of the spool control error at pin 11 [2]. The threshold for the spool control error can be freely defined (the default value is >30 % of maximum spool stroke after 500 ms). HIGH: Control error is below the threshold LOW: Control error is above the threshold

12 Valve function

–	

11 Supply voltage

2	24 V_{DC}, for more information, see section “Electronics“

10 Command signals

	Command signal	Actual value	Valve connector
A	± 10 V	± 10 V	E
D	± 10 V	2 to 10 V	E/S
E	4 to 20 mA	4 to 20 mA	E/S
M	± 10 V	4 to 20 mA	E/S
T	± 10 V	±10 V with dead band compensation	E
X	± 10 mA	4 to 20 mA	E/S
Y	Others upon request		

9 Valve connector

S	6-pole + PE EN 175201-804
E	11-pole + PE EN 175201-804

8	Seal material	Series
N	NBR	D681 to D685
V	FKM	D681 to D685
S	Kantseal HNBR	D682 to D685
Y	Others upon request	

7 Pilot connection

	Supply X	Return Y
4	Internal	Internal
5	External	Internal
6	External	External
7	Internal	External

2) Only in combination with valve connector option „E“

MORE PRODUCTS. MORE SUPPORT.

Moog designs a range of motion control products to complement those featured in this document. Moog also provides service and support for all of our products. For more information, contact the Moog facility closest to you.

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D680 Series Proportional Control Valves

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