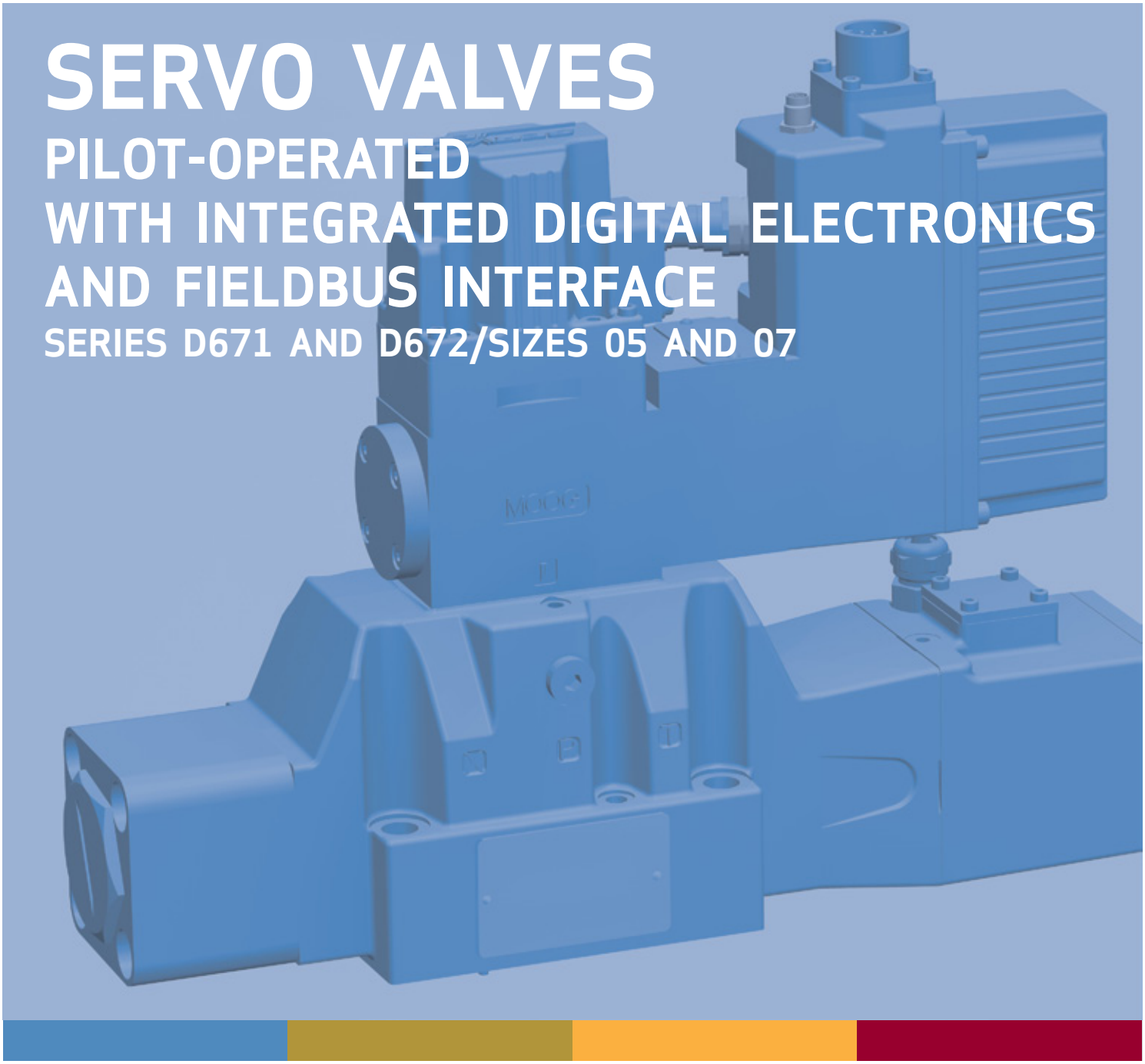
SERVO VALVES

PILOT-OPERATED WITH INTEGRATED DIGITAL ELECTRONICS AND FIELDBUS INTERFACE

SERIES D671 AND D672/SIZES 05 AND 07



Rev C July 2011

OFFERING HIGH PRODUCTIVITY FOR DEMANDING APPLICATIONS REQUIRING HIGHLY DYNAMIC RESPONSE, FLEXIBLE INTEGRATION AND ADVANCED MAINTENANCE

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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PRODUCT OVERVIEW

D671 and D672 Series Servo Valves are used to control position, velocity, pressure or force. This series has very good static and dynamic properties and is ideal for high performance machine applications.

Moog Servo Valves feature a spool sliding in a bushing offering better accuracy, compared to a spool sliding within a cast-iron body. The advantages of this design are:

- The highest precision positioning and control due to expert design and manufacture of the spool lands and slots
- Customer specific flow characteristics due to the availability of a tailored design geometry of slots in the bushing

The D671 Series Servo Valves in size 05 are a 2-stage design with a ServoJet® Pilot Stage. Two pilot stage versions with different flows are offered to meet different dynamic requirements.

- The ServoJet® Standard meets typical requirements and offers lower leakage flow.
- The ServoJet® High Flow provides higher dynamic response.

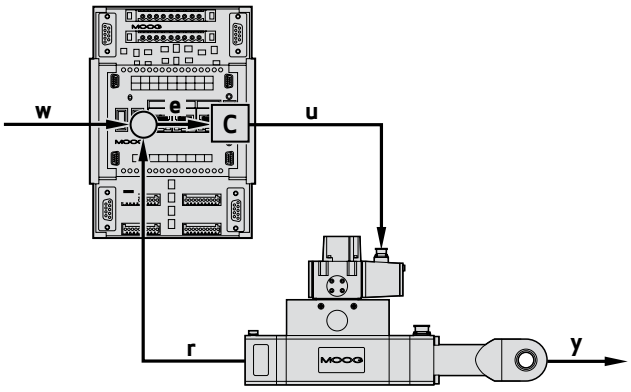
The D672 Series Servo Valves in size 07 are a 3-stage design with the 2-Stage ServoJet® Pilot Valve D670. The 3-stage design offers the highest dynamic response and provides a stable spool control even for the most demanding applications.

This valve series features digital onboard electronics offering the user high flexibility, and an embedded microprocessor enabling very fast processing speeds. The Moog Valve Configuration Software is used to easily tune the valve performance, change parameters and perform diagnostics, all through a service connector.

The valves have an optional fieldbus interface to operate and monitor the valves and set parameters. Common fieldbus technologies like CANopen, Profibus-DP or EtherCAT are supported by Moog's hardware and software. Other options are available upon request.

D671 and D672 Series Servo Valves offer high productivity for demanding applications requiring highly dynamic response, flexible integration and advanced maintenance.

Control loop consisting of controller and valve-actuated cylinder with position transducer



w	Demand value	y	Controlled variable
e	Control deviation	r	Feedback variable
u	Controller output	C	Controller

	D671 with ServoJet® Standard Pilot Stage	D671 with ServoJet® High Flow Pilot Stage	D672 with 2-Stage ServoJet® D670
Valve design	2-stage, with spool and bushing		3-stage, with spool and bushing
Mounting surface	ISO 4401-05-05-0-05 with T1		ISO 4401-07-07-0-05
Size according ISO 4401	05		07
Rated flow at Δp_N 35 bar/spool land (500 psi/spool land)	20/40/80/90/120/160/180 l/min (5.3/10.6/21.1/23.8/31.7/42.3/47.6 gpm)		160/240 l/min (42.3/63.4 gpm)
Maximum flow	250 l/min (66 gpm)		450 l/min (118.9 gpm)
Maximum operating pressure port P, A, B	350 bar (5,000 psi)		
Pilot valve	ServoJet® Standard	ServoJet® High Flow	2-Stage ServoJet® D670
Step response time for 0 to 100 % stroke	9 to 19 ms	7 to 14 ms	7 ms

FEATURES AND BENEFITS

Features	Benefits
Hydraulic Design: This is one of the highest response valves in the Moog family of products.	
Best dynamic and static performance with good valve damping	High productivity
Pilot valve insensitive to contamination even in high pressure applications up to 350 bar (5,000 psi)	High reliability
Vibration-resistant electronics	Robust
Spool and bushing unit is wear-resistant and has no o-rings	Long service life
Standardized mounting surface as per ISO 4401	Standardization
Spool-bushing design allows adaption to customer specific applications	Tailored solution
Digital valve electronics: State-of-the-art design for flexible integration and advanced maintenance.	
Integrated monitoring functions	High reliability
Remote maintenance and setup are possibleQuick tuning	Quick tuning
Diagnostic capability by recording the fault history	Easy maintenance
Fieldbus capability: Flexible integration and control with fieldbus.	
Reduced requirement for cabling due to bus connectors reducing the need for D/A and A/D conversion by customer	Cost savings
Direct data transfer from the PLC without D/A conversion	Simplified control structure
Data transfer without signal noise due to electrically-isolated fieldbus interface	High reliability

D671 WITH SERVOJET® STANDARD PILOT STAGE

General technical data

Valve design	2-stage, with spool and bushing
Pilot valve	ServoJet® Standard
Mounting surface	ISO 4401-05-05-0-05 with T1
Installation position	Any
Weight	13.5 kg (29.8 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 (general)	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance (general)	50 g, 6 directions

Hydraulic data

Operating pressure pilot valve			
Minimum pressure	0.3 x system pressure above T or Y, at least 25 bar (360 psi)		
Operating pressure range X port	25 to 350 bar (360 to 5,000 psi)		
Maximum pressure Y port	210 bar (3,000 psi)		
Maximum operating pressure of main stage			
Port P, A, B	350 bar (5,000 psi)		
Port T at Y internal	210 bar (3,000 psi)		
Port T at Y external	250 bar (3,600 psi)		
Rated flow at Δp_N 35 bar/spool land (500 psi/spool land)	20/90 l/min (5.3/21.1 gpm)	40/80 l/min (10.6/21.1 gpm)	120/160/180 l/min (31.7/42.3/47.6 gpm)
Maximum flow	250 l/min (66 gpm)		
Main stage leakage flow (rate) (≈ zero lap)[1) see next page]	3.0/4.5 l/min (0.8/1.2 gpm)	3.8 l/min (1.0 gpm)	4.5 l/min (1.2 gpm)
Pilot flow static[1) see next page]	1.7 l/min		
Pilot flow for 100 % step[1) see next page]	1.7 l/min (0.4 gpm)		
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids on request.		
Temperature range of hydraulic fluid	-20 to +80 °C (-4 to +176 °F)		
Recommended viscosity range	32 to 68 mm^2/s (cSt)		
Maximum permissible viscosity range	5 to 400 mm^2/s (cSt)		
Recommended cleanliness class as per ISO 4406			
For functional safety	19/16/13		
For longer service life	17/14/11		

Static and dynamic data

Step response time for 0 to 100 % stroke	9 ms	14 ms	19 ms
Threshold	< 0.1 %	< 0.08 %	< 0.05 %
Hysteresis	< 0.4 %	< 0.3 %	< 0.2 %
Null shift at ΔT = 55 K	< 2.0 %	< 1.5 %	< 1.0 %
Sample deviation of rated flow	±10 %		

D671 WITH SERVOJET® STANDARD PILOT STAGE

Electrical data

Duty cycle	100 %
Degree of protection according to EN 60529	IP65 with mounted mating plugs
Supply voltage[2)]	18 to 32 V_{DC}
Permissible ripple of supply voltage[3)]	±3 V
Maximum current consumption static[4)]	0.25 A
Maximum current consumption dynamic[4)]	0.5 A
Fuse protection, external, per valve	1 A (slow)
EM compatibility	Emitted interference as per EN 61000-6-4:2005, interference immunity as per EN 61000-6-2:2005

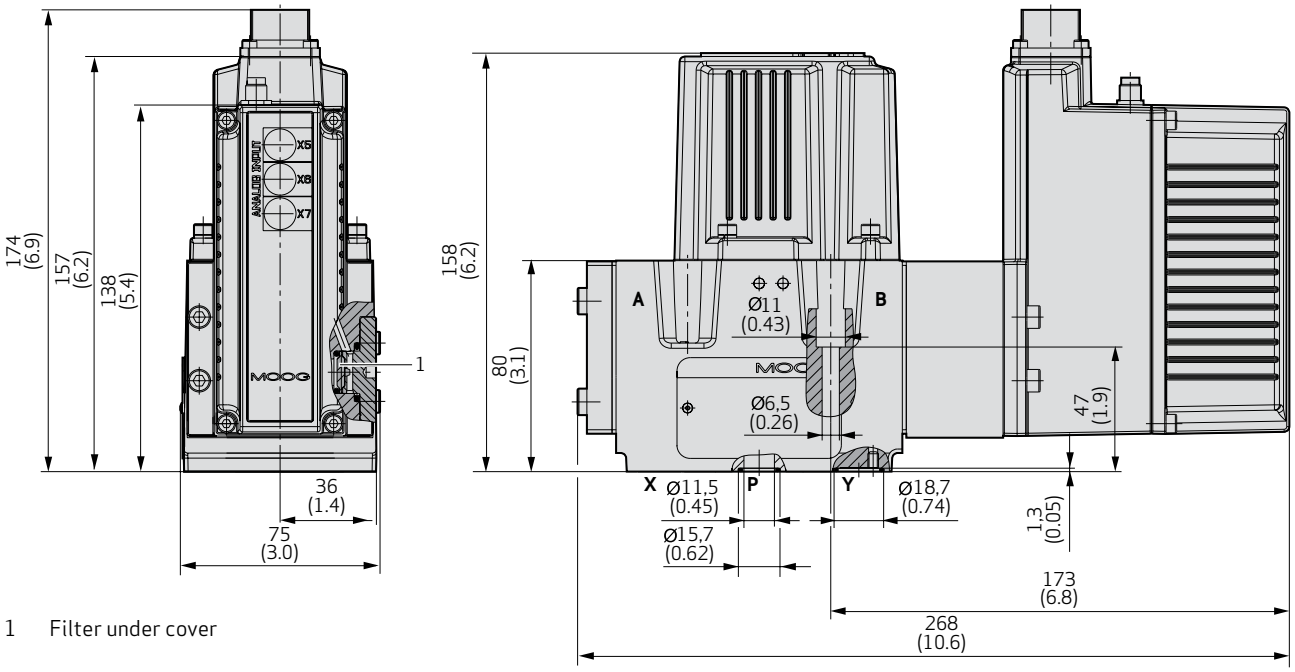
1) Measured at 210 bar (3,000 psi) pilot or system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

2) All connected circuits must be isolated from the mains supply by „electrical separation" in accordance with EN 61558-1 and 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.

3) Frequency from 50 Hz to 10 kHz

4) Measured at ambient temperature 25 °C (77 °F) and supply voltage 24 V

Installation drawing



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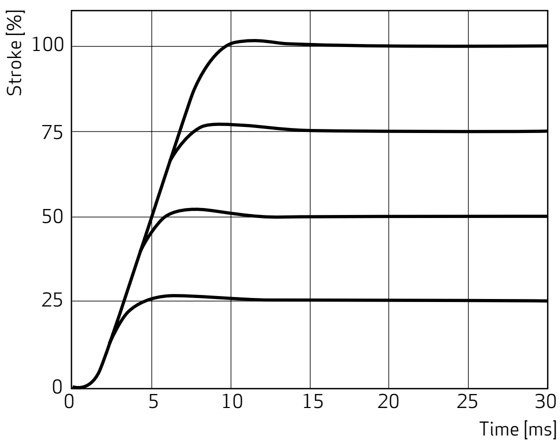
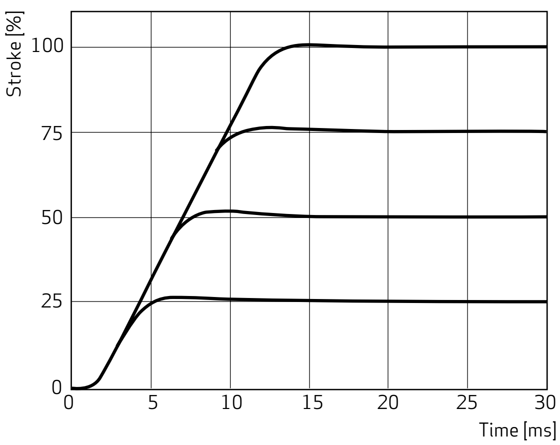
D671 WITH SERVOJET® STANDARD PILOT STAGE

Step response

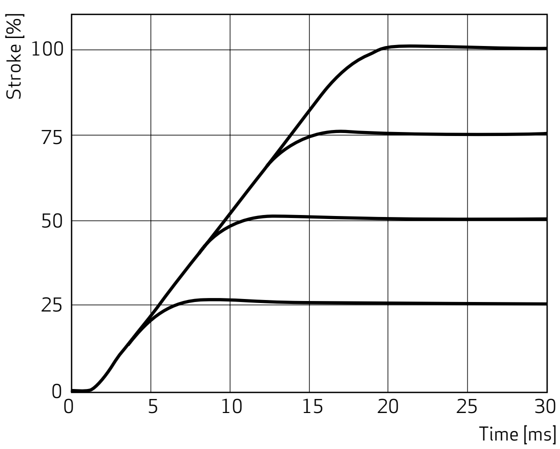
20/90 l/min (5.3/23.8 gpm)



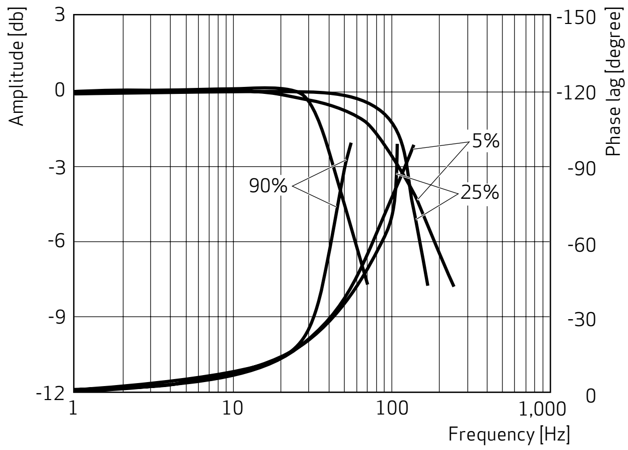
40/80 l/min (10.6/21.1 gpm)

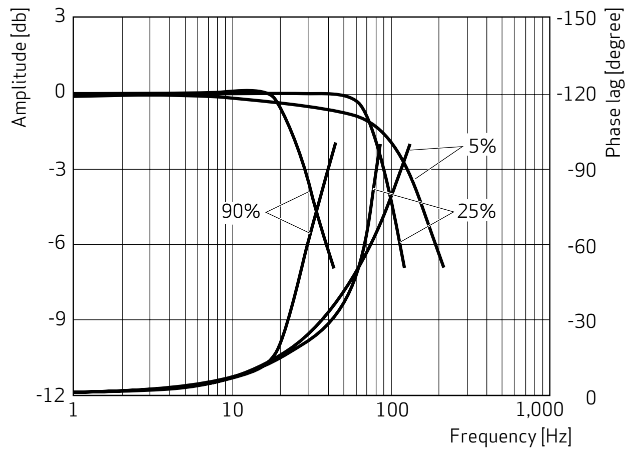


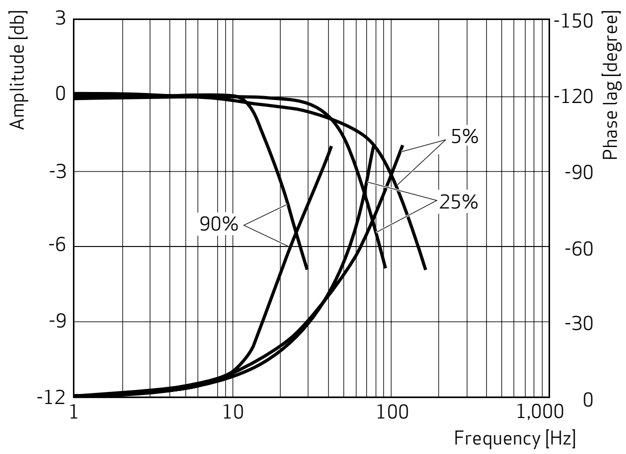
120/160/ 180 l/min (31.7/42.3/ 47.6 gpm)



Frequency response





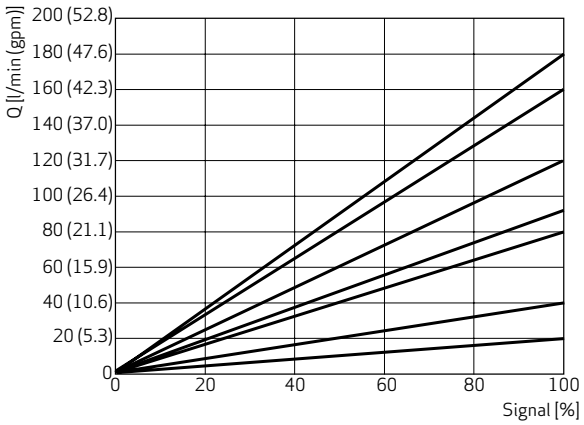


D671 WITH SERVOJET® STANDARD PILOT STAGE

Typical flow characteristics

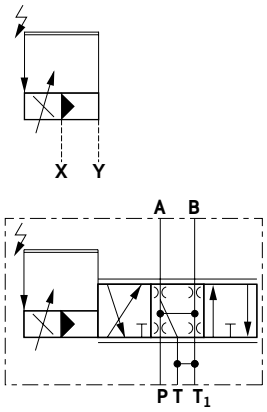
Measured with operational pressure of 210 bar (3,000 psi), oil viscosity 32 mm^2/s and oil temperature of 40 °C (104 °F).

Flow vs. signal curves at Δp_N = 35 bar (500 psi) per spool land



Hydraulic symbol

4-way version, alternatively X and Y external

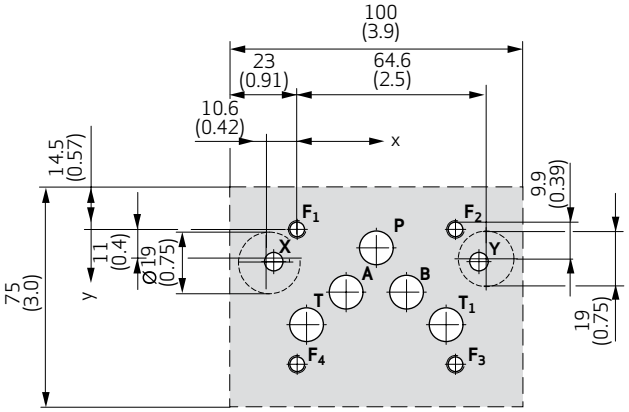


Hole pattern of mounting surface

The mounting surface must conform to ISO 4401-05-05-0-05 with additional T_1. Observe mounting length of minimum 100 mm (3.94 in) and O-ring recesses for X and Y. For 4-way valves with Q > 150 l/min (39.6 gpm) the second tank port T_1 is required.

For maximum flow the ports for P, T, T_1, A and B must be designed with Ø 11.5 mm (0,45 in), not according to the standard.

Evenness of connecting surface has to be 0.01 mm (0.004 in) over 100 mm (3.94 in), average surface finish R_a better than 0.8 µm.



Designation		P	A	B	T	T_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**	6.3	21.4	21.4	32.5	32.5	11.0	11.0	0.0	0.0	46.0	46.0
	in	0.25	0.84	0.84	1.28	1.28	0.43	0.43	0	0	1.81	1.81
Position Y	**mm**	27.0	16.7	37.3	3.2	50.8	-8.0	62.0	0.0	54.0	54.0	0.0
	in	1.06	0.66	1.47	0.13	2	-0.31	2.44	0	2.13	2.13	0

D671 WITH SERVOJET® HIGH FLOW PILOT STAGE

General technical data

Valve design	2-stage, with spool and bushing
Pilot valve	ServoJet® High Flow
Mounting surface	ISO 4401-05-05-0-05 with T1
Installation position	Any
Weight	13.5 kg (29.8 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 (general)	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance (general)	50 g, 6 directions

Hydraulic data

Operating pressure pilot valve			
Minimum pressure	0.3 x system pressure above T or Y, at least 25 bar (360 psi)		
Operating pressure range X port	25 to 350 bar (360 to 5,000 psi)		
Maximum pressure Y port	210 bar (3,000 psi)		
Maximum operating pressure of main stage			
Port P, A, B	350 bar (5,000 psi)		
Port T at Y internal	210 bar (3,000 psi)		
Port T at Y external	250 bar (3,600 psi)		
Rated flow at Δp_N 35 bar/spool land (500 psi/spool land)	20/90 l/min (5.3/21.1 gpm)	40/80 l/min (10.6/21.1 gpm)	120/160/180 l/min (31.7/42.3/47.6 gpm)
Maximum flow	250 l/min (66 gpm)		
Main stage leakage flow (rate) (≈ zero lap) [1) see next page]	3.0/4.5 l/min (0.8/1.2 gpm)	3.8 l/min (1.0 gpm)	4.5 l/min (1.2 gpm)
Pilot flow static [1) see next page]	2.6 l/min		
Pilot flow for 100 % step [1) see next page]	2.6 l/min (0.7 gpm)		
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids on request.		
Temperature range of hydraulic fluid	-20 to +80 °C (-4 to +176 °F)		
Recommended viscosity range	32 to 68 mm^2/s (cSt)		
Maximum permissible viscosity range	5 to 400 mm^2/s (cSt)		
Recommended cleanliness class as per ISO 4406			
For functional safety	19/16/13		
For longer service life	17/14/11		

Static and dynamic data

Step response time for 0 to 100 % stroke	7 ms	11 ms	14 ms
Threshold	< 0.1 %	< 0.08 %	< 0.05 %
Hysteresis	< 0.4 %	< 0.3 %	< 0.2 %
Null shift at ΔT = 55 K	< 2.0 %	< 1.5 %	< 1.0 %
Sample deviation of rated flow	±10 %		

D671 WITH SERVOJET® HIGH FLOW PILOT STAGE

Electrical data

Duty cycle	100 %
Degree of protection according to EN 60529	IP65 with mounted mating plugs
Supply voltage[2)]	18 to 32 V_{DC}
Permissible ripple of supply voltage[3)]	±3 V
Maximum current consumption static[4)]	0.25 A
Maximum current consumption dynamic[4)]	0.5 A
Fuse protection, external, per valve	1 A (slow)
EM compatibility	Emitted interference as per EN 61000-6-4:2005, interference immunity as per EN 61000-6-2:2005

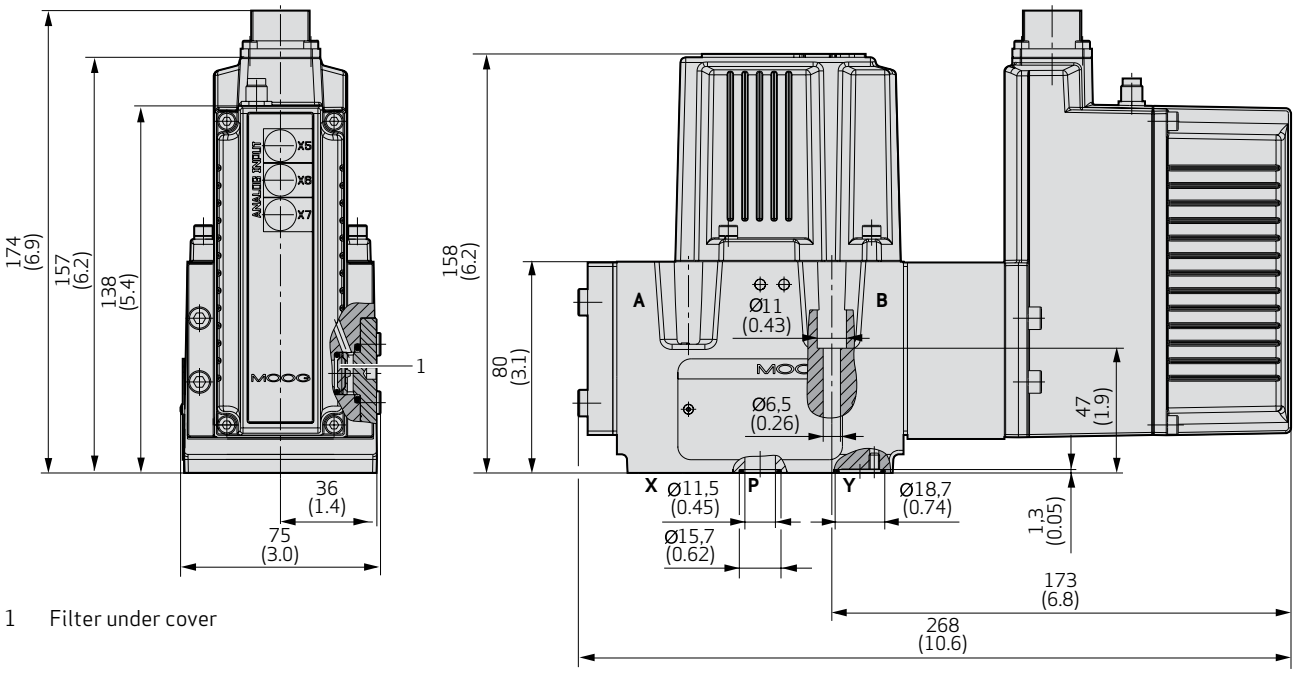
1) Measured at 210 bar (3,000 psi) pilot or system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

2) All connected circuits must be isolated from the mains supply by „electrical separation" in accordance with EN 61558-1 and 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.

3) Frequency from 50 Hz to 10 kHz

4) Measured at ambient temperature 25 °C (77 °F) and supply voltage 24 V

Installation drawing



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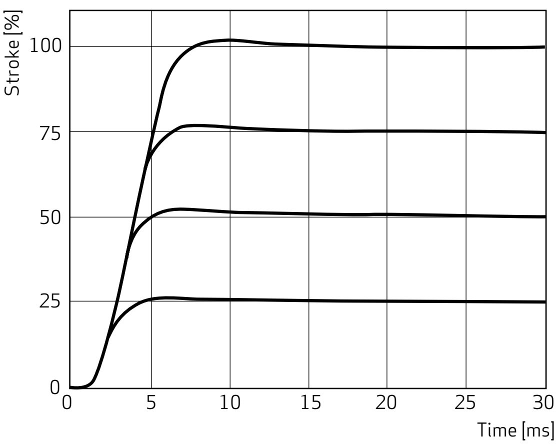
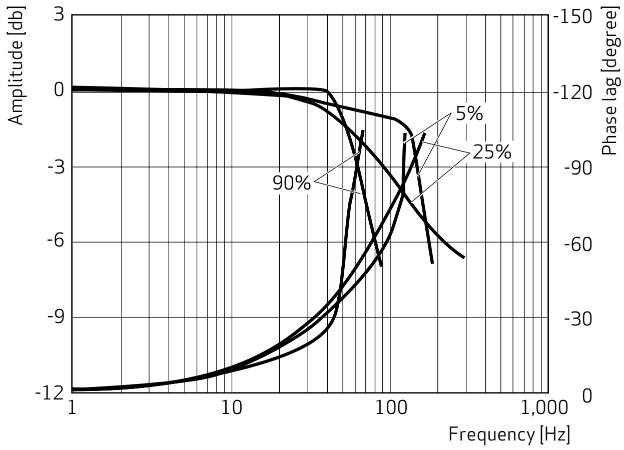
D671 WITH SERVOJET® HIGH FLOW PILOT STAGE

Step response

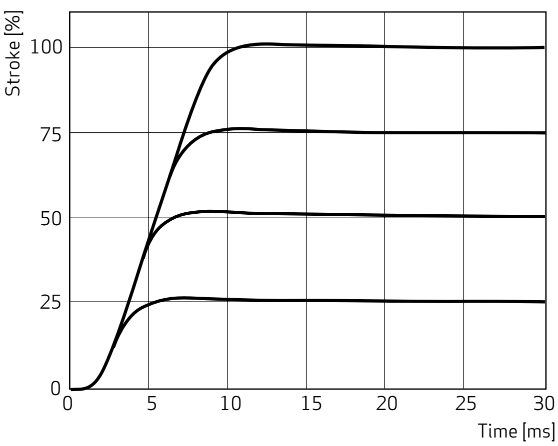
20/90 l/min (5.3/23.8 gpm)

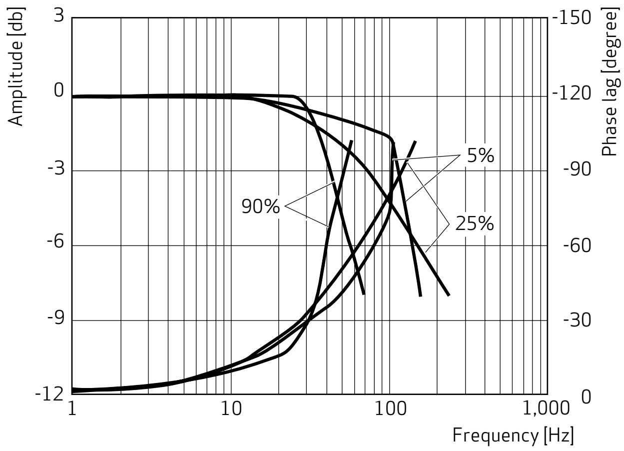


Frequency response

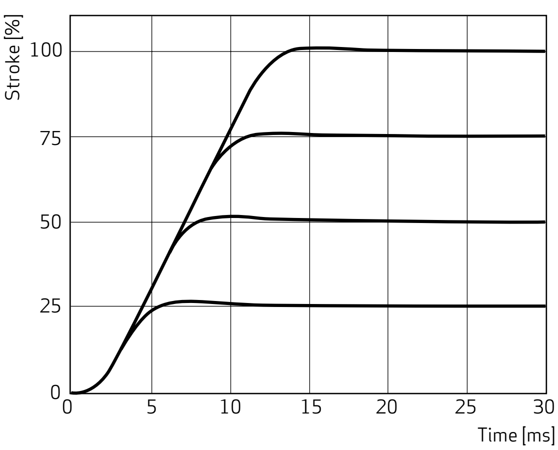


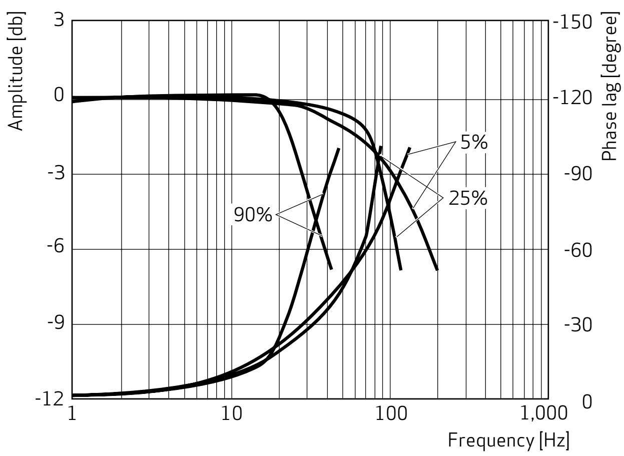
40/80 l/min (10.6/21.1 gpm)





120/160/ 180 l/min (31.7/42.3/ 47.6 gpm)



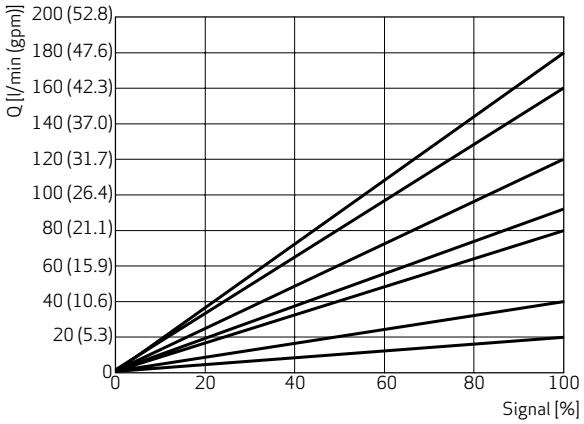


D671 WITH SERVOJET® HIGH FLOW PILOT STAGE

Typical flow characteristics

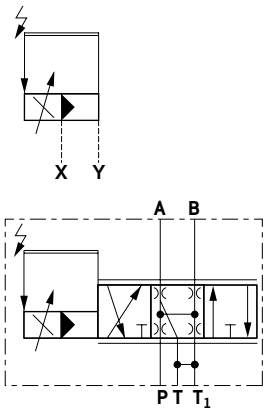
Measured with operational pressure of 210 bar (3,000 psi), oil viscosity 32 mm^2/s and oil temperature of 40 °C (104 °F).

Flow vs. signal curves at Δp_N = 35 bar (500 psi) per spool land



Hydraulic symbol

4-way version, alternatively X and Y external

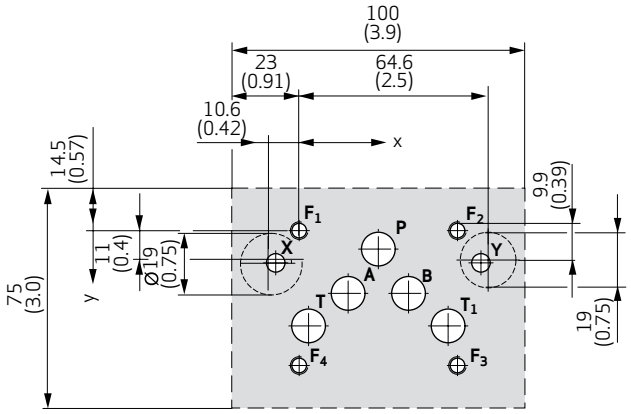


Hole pattern of mounting surface

The mounting surface must conform to ISO 4401-05-05-0-05 with additional T_1. Observe mounting length of minimum 100 mm (3.94 in) and O-ring recesses for X and Y. For 4-way valves with Q > 150 l/min (39.6 gpm) the second tank port T_1 is required.

For maximum flow the ports for P, T, T_1, A and B must be designed with Ø 11.5 mm (0,45 in), not according to the standard.

Evenness of connecting surface has to be 0.01 mm (0.004 in) over 100 mm (3.94 in), average surface finish R_a better than 0.8 µm.



Designation		P	A	B	T	T_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**	6.3	21.4	21.4	32.5	32.5	11.0	11.0	0.0	0.0	46.0	46.0
	in	0.25	0.84	0.84	1.28	1.28	0.43	0.43	0	0	1.81	1.81
Position Y	**mm**	27.0	16.7	37.3	3.2	50.8	-8.0	62.0	0.0	54.0	54.0	0.0
	in	1.06	0.66	1.47	0.13	2	-0.31	2.44	0	2.13	2.13	0

D672 WITH 2-STAGE SERVOJET® D670

General technical data

Valve design	3-stage, with spool and bushing
Pilot valve	2-Stage ServoJet® D670
Mounting surface	ISO 4401-07-07-0-05
Installation position	Any
Weight	13.5 kg (29.8 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 (general)	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance (general)	50 g, 6 directions

Hydraulic data

Operating pressure pilot valve		
Minimum pressure	0.3 x system pressure above T or Y, at least 25 bar (360 psi)	
Operating pressure range X port	25 to 350 bar (360 to 5,000 psi)	
Maximum pressure Y port	210 bar (3,000 psi)	
Maximum operating pressure of main stage		
Port P, A, B	350 bar (5,000 psi)	
Port T at Y internal	210 bar (3,000 psi)	
Port T at Y external	350 bar (5,000 psi)	
Rated flow at Δp_N 35 bar/spool land (500 psi/spool land)	160 l/min (42.3 gpm)	240 l/min (63.4 gpm)
Maximum flow	450 l/min (118.9 gpm)	
Main stage leakage flow (rate) (≈ zero lap)[1) see next page]	3.5 l/min (0.9 gpm)	
Pilot flow static[1) see next page]	3.5 l/min	
Pilot flow for 100 % step[1) see next page]	17 l/min (4.5 gpm)	
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids on request.	
Temperature range of hydraulic fluid	-20 to +80 °C (-4 to +176 °F)	
Recommended viscosity range	32 to 68 mm^2/s (cSt)	
Maximum permissible viscosity range	5 to 400 mm^2/s (cSt)	
Recommended cleanliness class as per ISO 4406		
For functional safety	19/16/13	
For longer service life	17/14/11	

Typical static and dynamic data

Step response time for 0 to 100 % stroke	7 ms
Threshold	< 0.1 %
Hysteresis	< 0.2 %
Null shift at ΔT = 55 K	< 1.5 %
Sample deviation of rated flow	±10 %

D672 WITH 2-STAGE SERVOJET® D670

Electrical data

Duty cycle	100 %
Degree of protection according to EN 60529	IP65 with mounted mating plugs
Supply voltage[2)]	18 to 32 V_{DC}
Permissible ripple of supply voltage[3)]	±3 V
Maximum current consumption static[4)]	0.25 A
Maximum current consumption dynamic[4)]	2.1 A
Fuse protection, external, per valve	2.5 A (slow)
EM compatibility	Emitted interference as per EN 61000-6-4:2005, interference immunity as per EN 61000-6-2:2005

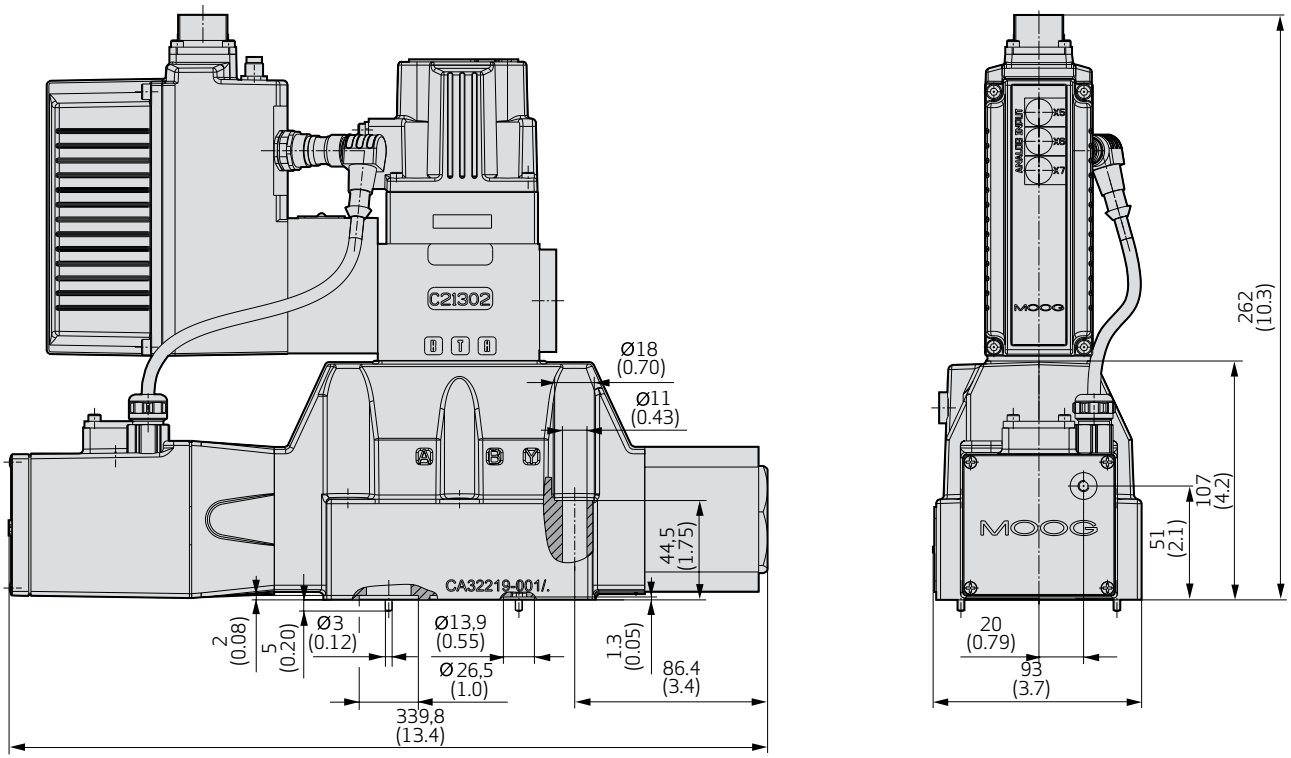
1) Measured at 210 bar (3,000 psi) pilot or system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

2) All connected circuits must be isolated from the mains supply by „electrical separation" in accordance with EN 61558-1 and 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.

3) Frequency from 50 Hz to 10 kHz

4) Measured at ambient temperature 25 °C (77 °F) and supply voltage 24 V

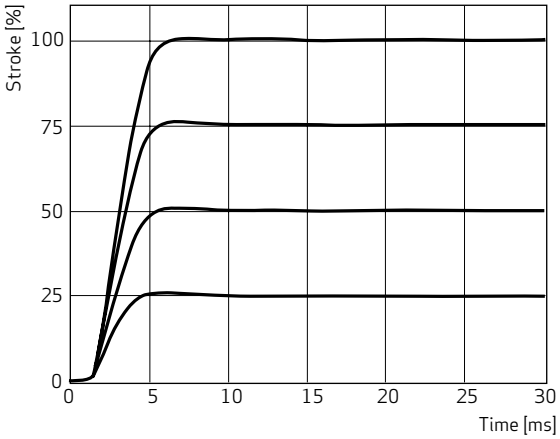
Installation drawing



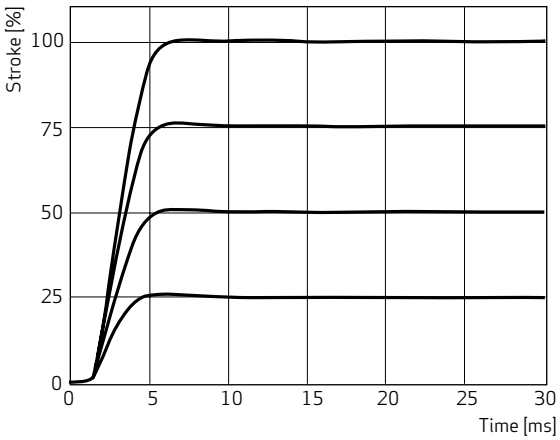
D672 WITH 2-STAGE SERVOJET® D670

Step response

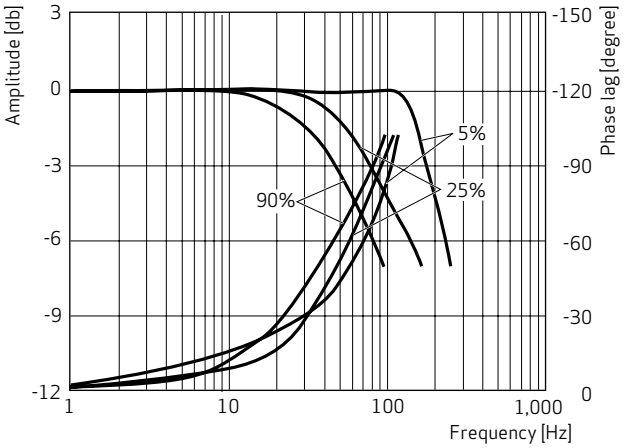
160 l/min (42.3 gpm)

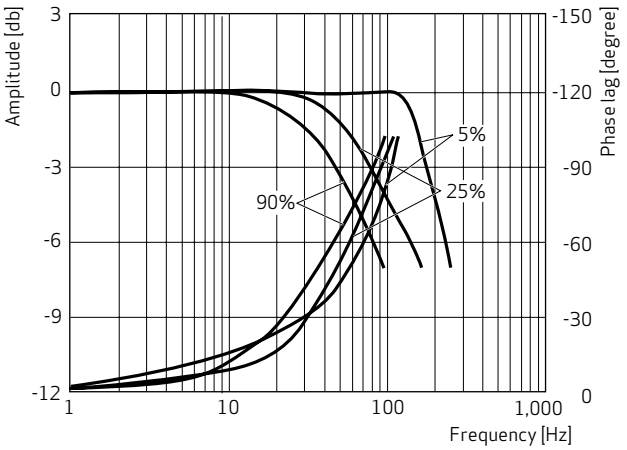


240 l/min (63.4 gpm)



Frequency response



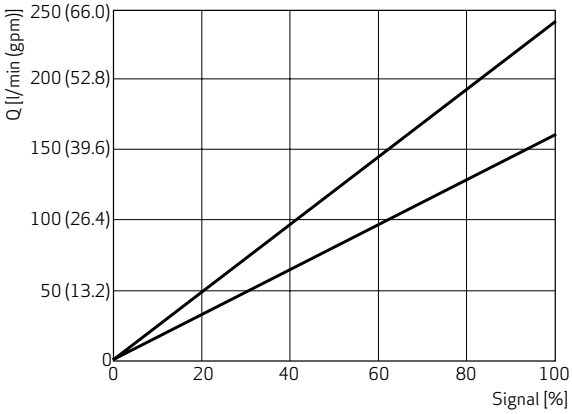


D672 WITH 2-STAGE SERVOJET® D670

Typical flow characteristics

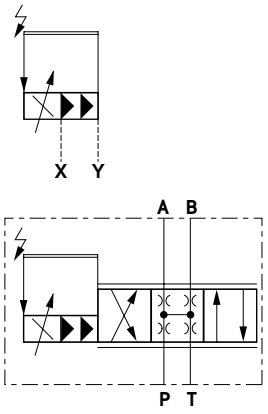
Measured with operational pressure of 210 bar (3,000 psi), oil viscosity 32 mm²/s and oil temperature of 40 °C (104 °F).

Flow signal curves at ΔpN = 35 bar per spool land



Hydraulic symbol

4-way version, alternatively X and Y external

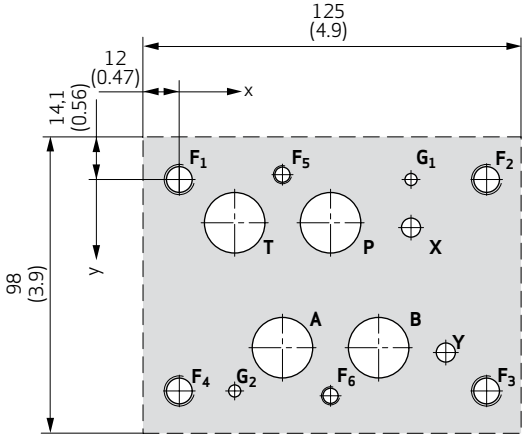


Hole pattern of mounting surface

The mounting surface must correspond to ISO 4401-07-07-0-05.

For maximum flow the ports for P, T, A and B must be designed with Ø 20 mm (0.79 in), not according to the standard.

Evenness of connecting surface 0.01 mm (0.004 in) over 100 mm (3.94 in), average surface finish R_a better than 0.8 µm.

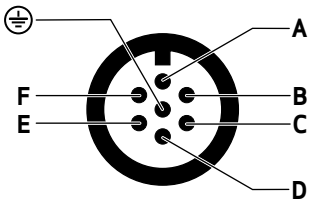


Designation		P	A	T	B	X	Y	G_1	G_2	F_1	F_2	F_3	F_4	F_5	F_6
Size Ø	**mm**	20.0	20.0	20.0	20.0	6.3	6.3	4.0	4.0	M10	M10	M10	M10	M6	M6
	in	0.79	0.79	0.79	0.79	0.25	0.25	0.16	0.16	M10	M10	M10	M10	M6	M6
Position X	**mm**	14.3	55.6	14.3	55.6	15.9	57.2	0.0	69.9	0.0	0.0	69.9	69.9	-1.6	71.5
	in	0.56	2.19	0.56	2.19	0.63	2.25	0	2.75	0	0	2.75	2.75	-0.06	2.81
Position Y	**mm**	50.0	34.1	18.3	65.9	76.6	88.1	76.6	18.3	0.0	101.6	101.6	0.0	34.1	50.0
	in	1.97	1.34	0.72	2.59	3.02	3.47	3.02	0.72	0	4	4	0	1.34	1.97

ELECTRONICS

Pin assignment for valves with 6-pole + PE connector, male (X1)

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



Pin	Pin assignment	Signal type	
		Voltage floating ±10 V	**Current floating ±10 mA, 4 to 20 mA[1)]**
A	**Supply voltage**	24 V DC (18 to 32 V DC) referred to GND (polarized against GND)	24 V DC (18 to 32 V DC) referred to GND (reverse polarity protected against GND)
B	**GND**	Power ground / signal ground	
C	**Enable input**	> 8.5 to 32 V DC referred to GND: valve ready for operation (enabled) 6.5 V DC referred to GND: valve disabled The input resistance is 10 kΩ	
D **E**	**Command input differential amplifier inputs**	The potential difference (referred to GND) must be between -15 V and +32 V $U_{in} = U_{DE}$ R_{in} = 20 kΩ	The potential difference (referred to GND) must be between -15 V and +32 V $I_{in} = I_D = -I_E$ R_{in} = 200 Ω I_{max} = ±25 mA
F	**Actual value output**	I_{out}: 4 to 20 mA referred to GND. R_L = 0 to 500 Ω (I_{out} is proportional to the spool position, 12 mA corresponds to the valve mid position)	
⏚	**Protective earth (PE)**	Connected with valve body	

1) Command signals I_{in} < 3 mA (due to cable break, for example) indicates a failure of 4 to 20 mA signals. The valve reaction to this failure may be customized and activated by the customer.

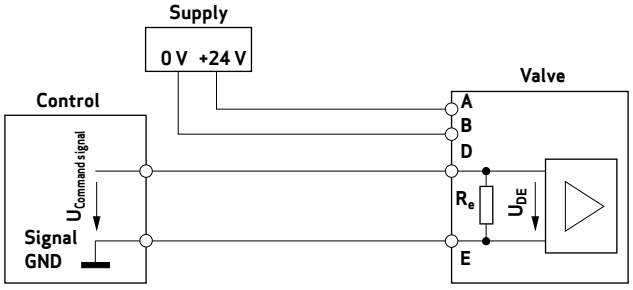
ELECTRONICS

Order codes, signal and pin assignment for valves with 6-pole + PE connector

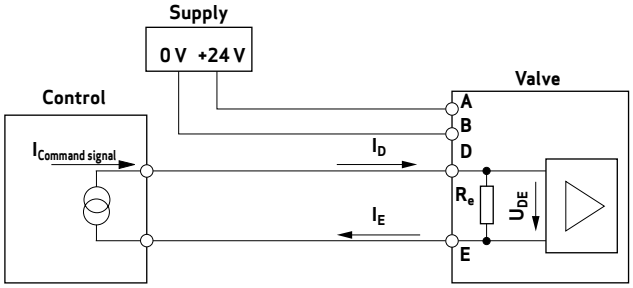
Order code	Command signal Q ±100 % spool stroke	Actual value ±100 % spool stroke	Command signal Q polarity 6 + PE	Actual value Q polarity 6 + PE	Hydraulic
D	±10 V	2 to 10 V	$U_D - U_E = 10$ V	$U_F - U_B = 10$ V	P→A and B→T
E	4 to 20 mA	4 to 20 mA	$I_D = -I_E = 20$ mA	$I_F = -I_B = 20$ mA	P→A and B→T
M	±10 V	4 to 20 mA	$U_D - U_E = 10$ V	$I_F = -I_B = 20$ mA	P→A and B→T
X	±10 mA	4 to 20 mA	$I_D = -I_E = 10$ mA	$I_F = -I_B = 20$ mA	P→A and B→T

Command signal

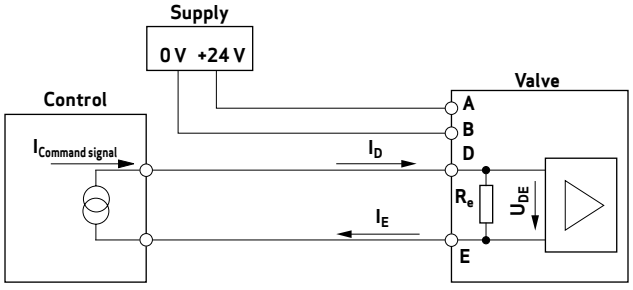
Command signal ±10 V, floating, order code D and M



Command signal ±10 mA, floating, order code X

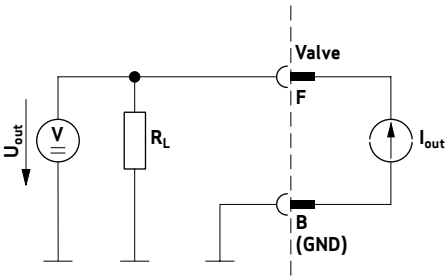


Command signal 4 to 20 mA, floating (12 mA = valve mid position), order code E



Actual value

Actual value I_{out} (spool position)



Command signal U_{out} = 2 to 10 V
Actual value I_{out} = 4 to 20 mA
Resistor R_L = 500 Ω (0.25 W)
With order code „D" load resistor R_L is in the valve electronics.
Further information in Moog Technical Notes TN353 and TN494.

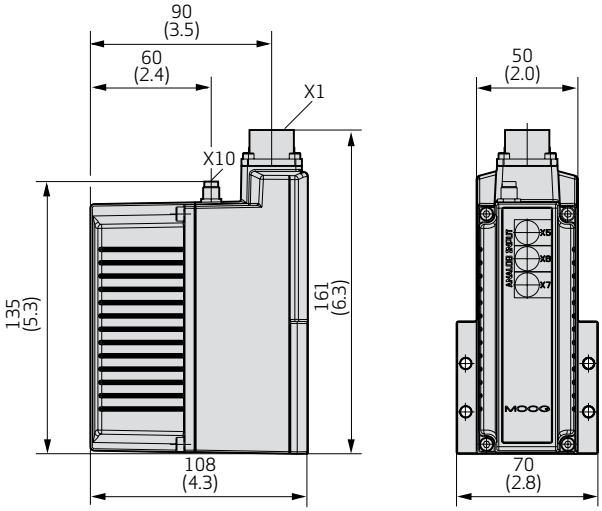
ELECTRONICS

Installation drawings electronic housing

Analog interface for 2-stage valves

Order code O without fieldbus connector

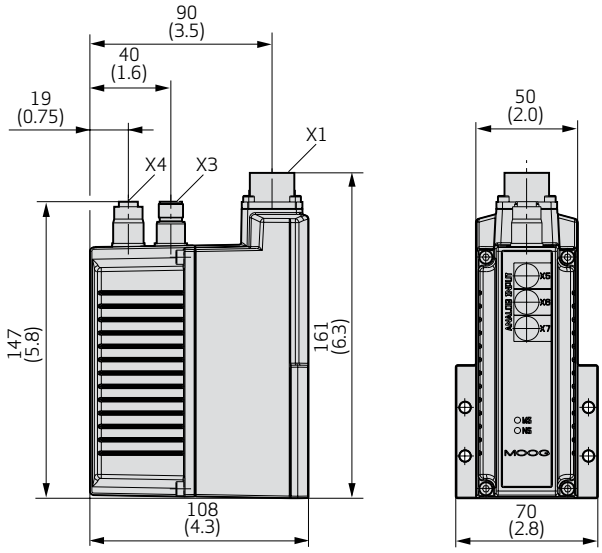
X1 Valve connector
X10 Service connector



CANopen interface for 2-stage valves

Order code C CANopen

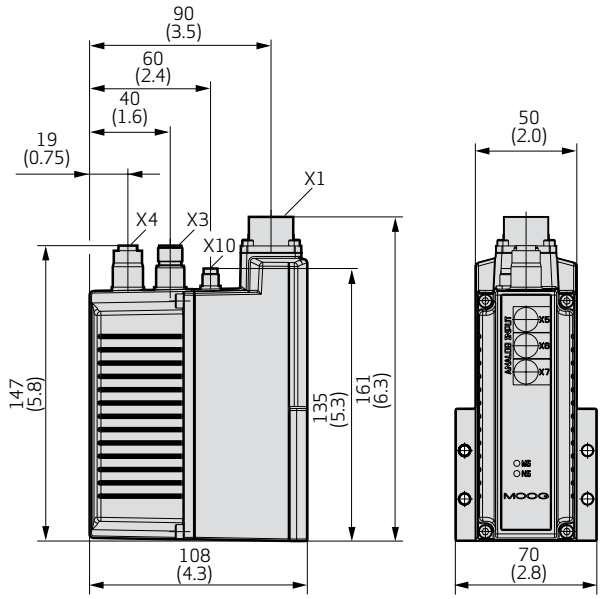
X1 Valve connector
X3 Fieldbus connector
X4 Fieldbus connector



Profibus DP or EtherCAT interface for 2-stage valves

Order code D Profibus-DPE EtherCAT

X1 Valve connector
X3 Fieldbus connector
X4 Fieldbus connector
X10 Service connector



ELECTRONICS

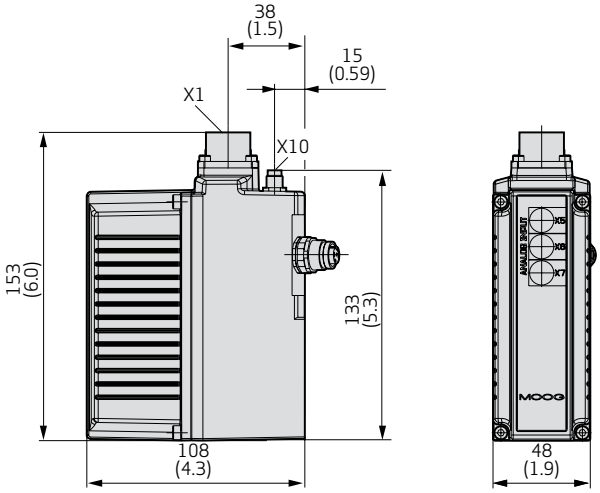
Installation drawings electronic housing

Analog interface for 3-stage valves

Order code O without fieldbus connector

X1 Valve connector

X10 Service connector



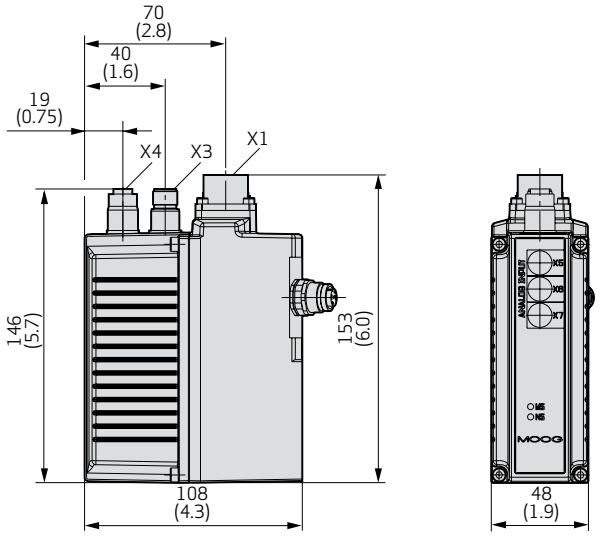
CANopen interface for 3-stage valves

Order code C CANopen

X1 Valve connector

X3 Fieldbus connector

X4 Fieldbus connector



Profibus DP or EtherCAT interface for 3-stage valves

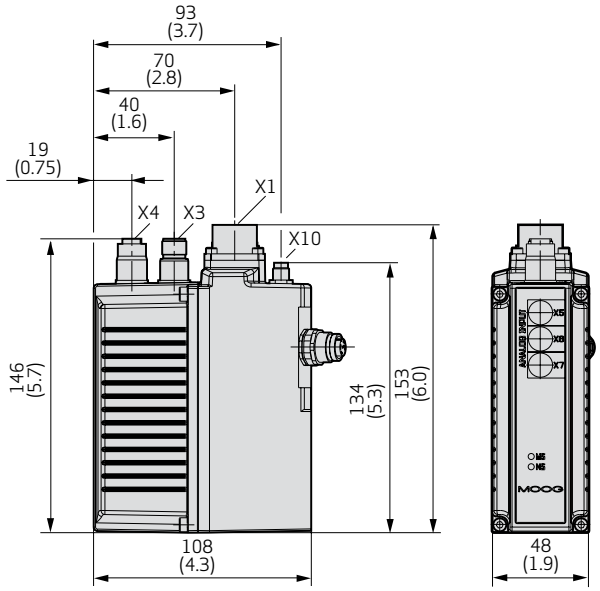
Order code D Profibus-DPE EtherCAT

X1 Valve connector

X3 Fieldbus connector

X4 Fieldbus connector

X10 Service connector



ELECTRONICS

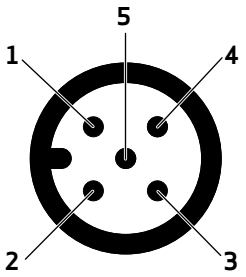
Fieldbus connectors

CAN connectors (X3, X4)

- Coding A
- Thread M12x1
- 5-pole

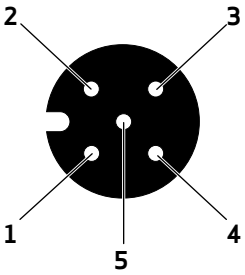
Pin	Signal X3, X4	Description
1	CAN_SHLD	Shield
2	CAN_V+	Not connected in the valve
3	CAN_GND	Mass
4	CAN_H	Transceiver H
5	CAN_L	Transceiver L

External thread, pin contact



View on CAN connector X3

Internal thread, socket contact



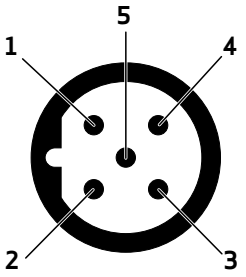
View on CAN connector X4

Profibus-DP connectors (X3, X4)

- Coding B
- Thread M12x1
- 5-pole

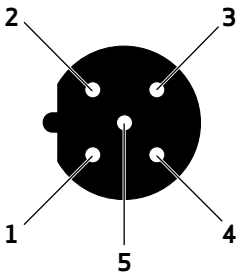
Pin	Signal X3, X4	Description
1	Profi V+	Power supply 5 V of terminal resistors
2	Profi A	Receive/transmit data –
3	Profi GND	Mass
4	Profi B	Receive/transmit data +
5	Shield	Shield

External thread, pin contact



View on Profibus-DP connector X3

Internal thread, socket contact



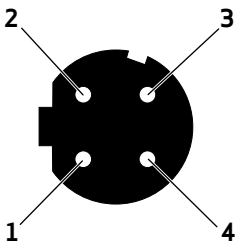
View on Profibus-DP connector X4

EtherCAT IN & OUT connectors (X3, X4)

- Coding D
- Thread M12x1
- 4-pole

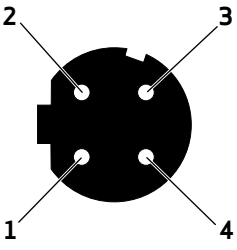
Pin	Signal X4 IN	Signal X3 OUT
1	TX + IN	TX + OUT
2	RX + IN	RX + OUT
3	TX – IN	TX – OUT
4	RX – IN	RX – OUT

Internal thread, socket contact



View on EtherCAT connector X3

Internal thread, socket contact



View on EtherCAT connector X4

SAFETY OPTIONS

If the electric power supply or the pilot pressure fails, different spool positions can be selected for the servovalves.

The following table is an aid to selecting the desired performance. It describes the spool position of the main stage as a function of the pilot pressure and the power supply of the valve electronics.

Valves with ServoJet® Pilot Stage

Order code - Fail safe option	Pilot pressure (or system pressure in case of internal pilot connection)	Electrical supply	Spool position in case of power fail/ loss of pilot pressure
A	On	Off	End position P→B and A→T
	Off	On	Undefined
	Off	Off	Undefined
B	On	Off	End position P→A and B→T
	Off	On	Undefined
	Off	Off	Undefined
O	On	Off	Undefined
	Off	On	Undefined
	Off	Off	Undefined

Pilot pressure „On“ means that the pilot pressure corresponds to the minimum pressure (see hydraulic data). At lower pressures the spool position of the main stage is undefined.

Pilot pressure „Off“ means depressurized, < 1 bar (15 psi). At higher pressures the spool position of the main stage is undefined.

DESCRIPTION OF OPERATION

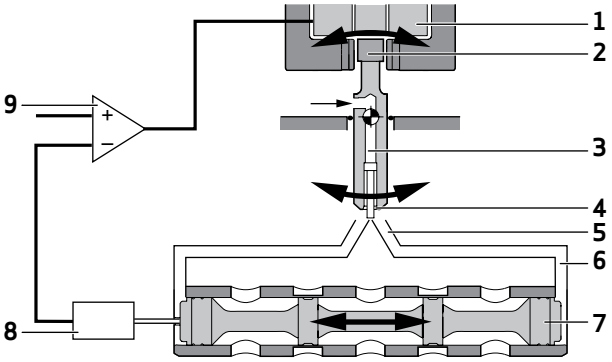
2-Stage Servovalve with ServoJet® Pilot Stage

The ServoJet® Pilot Stage is based on the jet pipe design and consists mainly of torque motor, jet pipe and receiver.

An electric current through the coil (1) displaces the armature (2) from its neutral position. This displacement moves the nozzle (4) of the jet pipe (3) and directs a focused fluid jet towards one side of the receiver (5). This creates a pressure difference in the control ports (6) at the ends of the spool. The spool moves into the corresponding direction. The pilot stage is drained via the valve's tank port or external Y-line.

The position of the spool (7) is measured by a position transducer (8). The valve electronics closes the position control loop (9) and moves the spool precisely to its position specified electrically by an external source.

Principle of operation of the ServoJet® Pilot Stage



1 Coil
2 Armature
3 Jet pipe
4 Nozzle
5 Receiver
6 Control ports
7 Spool
8 Position transducer (LVDT)
9 Position control loop

Benefits

The ServoJet® Pilot Stage has a very simple structural design with comparatively large gaps. This ensures that the assembly is less sensitive to fluid contamination. It is extremely reliable and guarantees safe operation, even in demanding environments. There is a small, constant and calculable flow of pilot oil.

Due to its low moving mass and high rigidity, the ServoJet® Pilot Stage has a very high natural frequency. In addition, it has been designed with a good dampening property which is ideal for use as the pilot stage in a valve's closed-loop position control to achieve maximum performance.

With two pilot stage options (Standard and High Flow) a user can choose the dynamic response needed for their application.

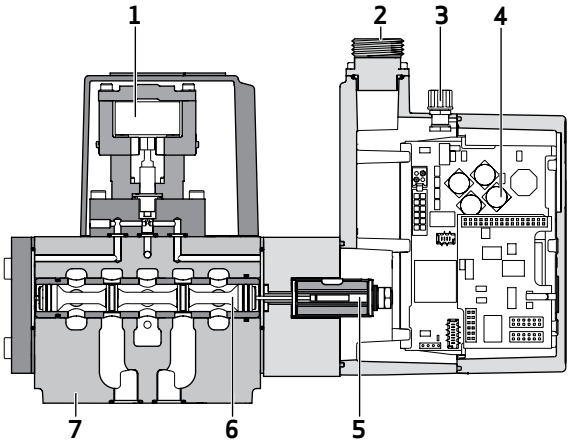
The benefits:

- High reliability
- Ruggedness
- Long service life
- Insensitivity to contamination
- High-dynamic response

This results in the following benefit for your application:

- Higher productivity with consistent high quality of the produced parts

Cutaway view, 2-stage servovalve



1 ServoJet® pilot valve
2 Valve connector
3 Service connector
4 Digital electronics
5 Position transducer (LVDT)
6 Spool
7 Connecting surface

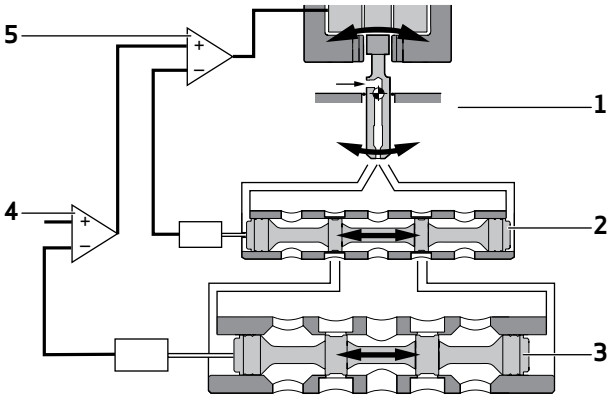
DESCRIPTION OF OPERATION

3-Stage Servovalve with 2-Stage ServoJet® Pilot Valve D670

A 3-stage servovalve consists of the pilot stage (1), the spool of the pilot valve (2) and the spool of the main stage (3). The ServoJet® Pilot Stage is based on the jet pipe design.

The ServoJet® Pilot Stage moves the position-controlled spool of the pilot valve (2), which in turn moves the position-controlled spool of the main stage (3). The two closed-position control loops (4, 5) in the valve electronics moves the spool of the main stage precisely to its position specified electrically from an external source.

Principle of operation of the 3-stage valve with 2-Stage ServoJet® Pilot Valve D670



1 Pilot stage
2 Spool, pilot valve
3 Spool, main stage
4 Position control loop, main stage
5 Position control loop, pilot valve

Benefits

The 2-stage ServoJet® Pilot Valve D670 features a dynamically enhanced ServoJet® Pilot Stage. Its natural frequency has been doubled compared to the standard version. Combined with the high flow rate of a 2-stage pilot valve a superior dynamic performance is obtained. Sophisticated digital control algorithms enable high stability.

Employing the proven jet pipe principle, the same robustness and reliability are obtained as for the single stage ServoJet® Pilot Valve.

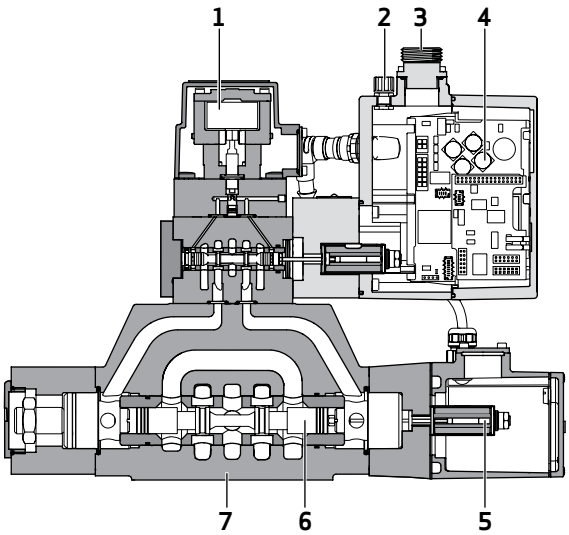
The benefits:

- High availability
- High reliability
- Ruggedness and long service life
- Insensitivity to contamination
-

This results in the following benefits for your application:

- Higher productivity with consistent high quality of the produced parts
- Highest dynamic response

Cutaway view, 3-stage servovalve



1 ServoJet® Pilot Valve
2 Service connector
3 Valve connector
4 Digital electronics
5 Position transducer (LVDT)
6 Spool
7 Connecting surface

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.

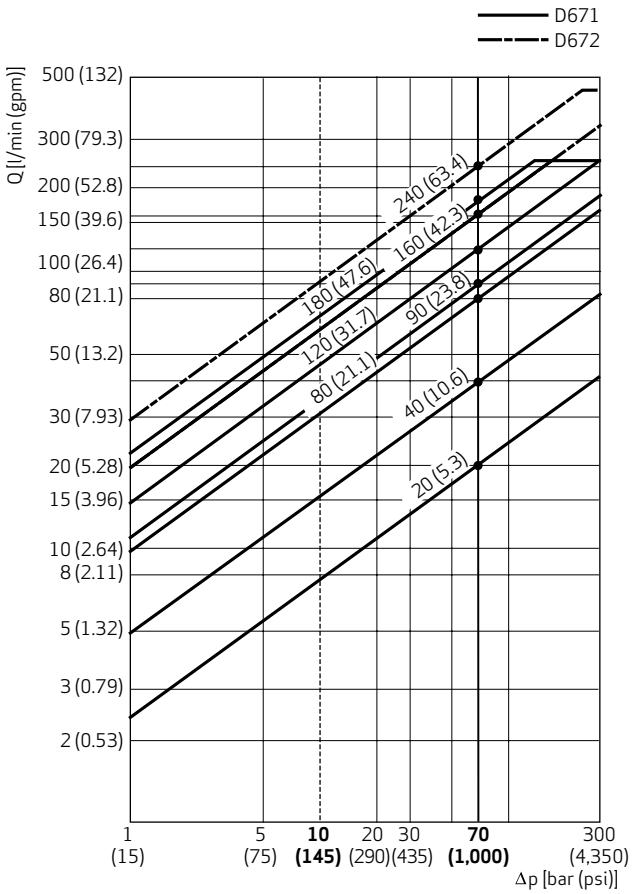
When the valve is deflected at 100 %, it delivers the rated flow with the rated pressure drop.

On servo valves, the rated flow corresponds to a pressure drop of 35 bar (500 psi) per land, equating to 70 bar (1,000 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 below or taken from the diagram.

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

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

Flow 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).

In the case of a mounting surface in accordance with ISO 4401 size 05 the second tank port must additionally be connected starting from a flow Q exceeding 150 l/min (39.6 gpm).

The ports inside the manifold should exceed the valve ports by one or two sizes to achieve the maximum flow.

DIGITAL ELECTRONICS

Digital valve electronics

The valve electronics is based on microprocessor hardware with corresponding A/D-D/A converters for analog input and output signals. All functions of the valve are integrated in the firmware. The digital electronics offer the following advantages over conventional analog electronics:

- Greater flexibility: Ability to change the valve parameters easily using configuration software and the possibility of linearizing flow curves
- Higher reliability due to integrated monitoring functions
- Easier maintenance due to diagnostic capability and recording the fault history
- Remote maintenance and setup

Using the optional fieldbus interface cuts down the amount of wiring needed and eliminates the need for control interfaces in the PLC.

In the basic version the valve has a standard connector, and service connector and does not include the fieldbus interface. In this case the valve is actuated via an analog command signal.

The service connector offers the possibility to connect the valve to a PC or Notebook via an USB-to-CAN adaptor (see accessories). Its CANopen interface offers access to the valve parameters, which can be changed and monitored, as well as diagnosing valve performance and possible faults.

The flexibility of the integrated firmware enables the user to optimize the valve characteristic on-site as required by the application:

- Adapting the valve flow curve to the needs of the controlled system
- Adjusting the maximum valve opening separately for each direction of motion
- Defining fault reactions

The results obtained by the parameter changes can be viewed and analyzed directly using the built-in data logger. The parameters optimized during commissioning can be saved and copied. When the valve is replaced or used for series applications no tuning is required. The valves are supplied with a predefined parameter set if required.

Optional fieldbus interface

When the valves are operated with a fieldbus, they are parameterized, activated and monitored via the fieldbus. CANopen®, Profibus-DP® or EtherCAT® interfaces are available, others upon request. The fieldbus interface is equipped with two bus connectors (IN & OUT) for cost-effective wiring. Valves can be integrated directly into the bus without any external T-joints. The electrically isolated fieldbus interface ensures reliable data transfer. Further analog inputs and outputs and inputs for SSI or encodesr are available upon request.

FIELDBUS INTERFACE

Modern automation technology is characterized by an increasing decentralization of processing functions via serial data communication systems. The use of serial bus systems in place of analog signal transfer guarantees greater system flexibility with regard to alterations and expansions.

There is also considerable potential for saving project planning and installation costs in many areas of industrial automation. Further possibilities of parameterization, better diagnostics and a reduction of the number of variants are advantages which have only been made possible by the use of field buses.

VDMA profile

In a working group within the VDMA (German Machinery and Plant Manufacturers' Association), a profile was created in collaboration with numerous well-known hydraulic system manufacturers. This profile describes the communication between hydraulic components via a fieldbus and defines uniform functions and parameters. In this way, a standardized exchange format covering all manufacturers was created.

Moog Valves are optionally equipped with one of the following fieldbus interfaces:

CANopen®

According to EN 50325-4 CAN bus was originally developed for use in automobiles, but has also been used for years a variety of industrial applications. The CAN bus is primarily designed for transmission reliability and speed.

The CAN bus has the following general features:

- Multi-master system: Each node can transmit and receive
- Topology: Line structure with short stub cables
- Network expansion and transmission rates:
  - Up to 25 m (80.4 ft) at 1 Mbit/s
  - Up to 5,000 m (16,090 ft) at 25 kbit/s
- Addressing type: Message-orientated via identifiers. Priority assignment of messages possible via identifiers
- Safety: Hamming distance=6, i.e. up to 6 individual errors per message are detected.
- Bus physics: ISO 11898
- Maximum number of nodes: 110 (64 without repeaters)

Profibus-DP®

According to EN 61158 Profibus-DP® was developed for the process and manufacturing industries. IT is thereby supported by numerous control system manufacturers.

Profibus-DP® has the following features:

- Multi-master system: The masters share access time and initiate communication. The slaves react only upon request
- Topology: Line structure with short stub cables
- Network expansion and transmission rates:
  - Up to 100 m (321.8 ft) at 12 Mbit/s
  - Up to 1,200 m (3,861.6 ft) at 9,6 kbit/s per segment
- Use of repeaters possible
- Addressing type: Address-orientated. Priority/cycle time assignment of messages via master configuration
- Bus physics: RS-485 in accordance with EIA-485
- Maximum number of nodes: 126 (32 without repeaters)

EtherCAT®

According to IEC/PAS 62407 EtherCAT® was developed based on the Ethernet as an industry bus based on Ethernet to meet the increasing demands regarding cycle times. The EtherCAT® bus is designed for high data transmission rates and fast cycle times.

The EtherCAT® bus has the following features:

- Single-master system: The master initiates communication. The slaves react only upon request
- Topology: Line, star, tree and ring structure based on the daisy chain principle
- Network expansion and transmission rates: 100 m (321.8 ft) between two nodes at 100 Mbit/s
- Addressing type: Address-orientated, one telegram for all nodes
- Bus physics: Fast Ethernet 100 Base Tx
- Maximum number of nodes: 65,535

CONFIGURATION SOFTWARE

The Windows®-based "Moog Valve Configuration Software" enables fast and convenient commissioning, diagnostics and configuration of the valve. It is possible to transfer data from the PC to the valve or to process the valve's current settings on the PC. The valve can be controlled by means of graphical control elements. Status information, command signals, actual values and characteristic curves are represented in graphical form. System parameters can be recorded and visualized via an integrated data logger.

The software is available free of charge from Moog upon request. Please visit www.moog.com/industrial/downloads to download the software.

System requirements

The configuration software can be installed on a PC with the following minimum requirements:

- IBM PC-compatible with 133 MHz
- Windows® 95/98/ME, Windows® NT/2000/XP
- 64 MB RAM
- 40 MB free hard disk space
- Monitor resolution 640 x 480 pixels
- Keyboard, mouse

Recommended requirements

- IBM PC-compatible with 500 MHz
- Windows® NT/2000/XP/Vista

Equipment

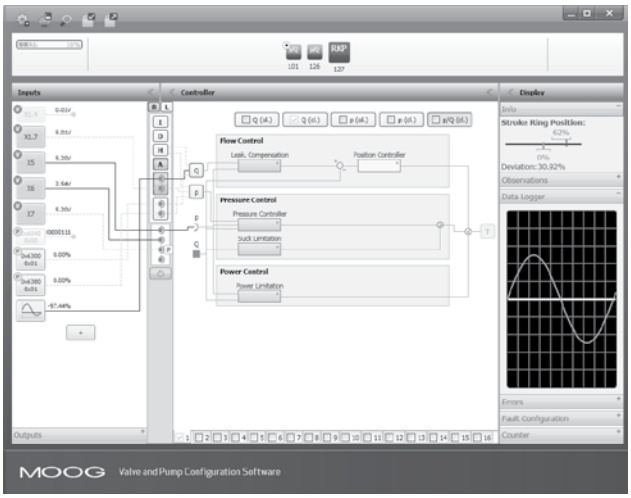
The following equipment is also required to be able to use the software (see also list of accessories):

- USB port
- USB CAN adapter
- Configuration/commissioning cable
- Adapter for service connector (not required for CANopen fieldbus)
- Valve electrically connected and power supply switched on

Note

Configuration or commissioning with the "Moog Valve Configuration Software" can be performed via:

- Fieldbus connectors on valves with a CANopen fieldbus
- Integrated service connector on valves with Profibus DP or EtherCAT fieldbus or on valves with analog activation

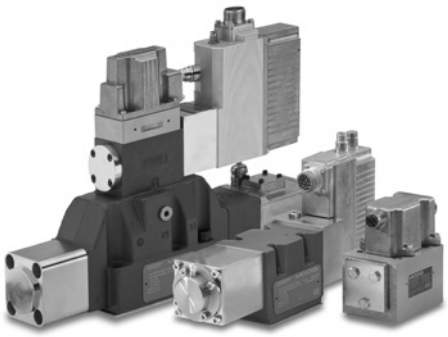


ABOUT MOOG

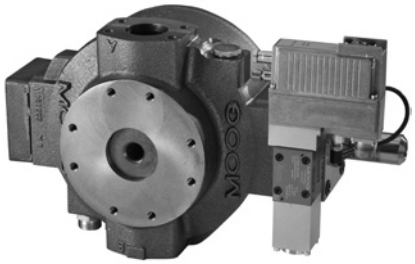
Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of 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. Moog's Industrial Group, with fiscal year 2010 sales of USD 540 million and over 40 locations worldwide, is part of Moog Inc. (NYSE:MOGA and MOG.B) which has sales of USD 2.1 billion.

Moog maintains facilities in 25 countries around the globe. 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



Radial Piston Pumps

Servo Motors

Servodrives

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 Valves and Proportional Valves
- Servo Motors and Servo Drives
- Servo Controllers and Software
- Radial Piston Pumps
- Actuators
- Integrated Hydraulic Manifold Systems and Cartridge Valves
- Slip Rings
- Motion Bases

ABOUT MOOG

Solutions

Hydraulic solutions

Since Bill Moog invented the first commercially viable servovalve 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.

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.

Moog Global Support

Moog Global Support™ is our promise to offer world-class Repair and Maintenance Services delivered expertly by our trained technicians. With the reliability only available from a leading manufacturer with facilities around the world, Moog offers you service and expertise you can count on to keep your equipment operating as it should.

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:

- Repair services using OEM parts are performed by trained technicians to the latest specifications
- Stock management of spare parts and products to prevent unplanned downtime
- Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/multi-year contracts
- On-site services bring the expertise to you, providing quicker commissioning, set-up and diagnostics
- Access to reliable services that are guaranteed to offer consistent quality anywhere in the world

For more information on Moog Global Support™, visit www.moog.com/industrial/service.

MOOG GLOBAL SUPPORT™

ACCESSORIES AND SPARE PARTS

Series-dependent accessories and spare parts

Accessories D671

Part designation	Description	Part number
Attachment screws	4 pieces M6x60, ISO 4762-10.9 tightening torque 11 Nm (97 lbf in)	A03665-200-090
Connecting plates	-	On request
Flushing plate	P, T, T_1, X, Y	B67728-002
	P, T, T_1 and X, Y	B67728-003

Spare parts D671

Part designation	Description	Material	Part number
O-ring for filter	1 piece for filter inner Ø 12.0 (0.47) x Ø 2.0 mm (0.08 in)	FKM 85 Shore	A25163-012-020
	1 piece inner Ø 12 x Ø 2.0 mm	NBR 85 Shore	-66117-012-020
O-ring for filter cover		FKM 85 Shore	-42082-080
	1 piece for filter cover inner Ø 17.1 (0.67) x Ø 2.6mm (0.10in)	NBR 85 Shore	B97009-080
Replaceable filter	200 µm nominal		A67999-200
Service sealing set	Contains the following O-rings: • 5 pieces for P, T, T_1, A, B inner Ø 12.4 (0.49) x Ø 1.8 mm (0.07 in) • 2 pieces for X, Y inner Ø 15.6 (0.61) x Ø 1.8 mm (0.07 in) • 1 piece for filter inner Ø 12.0 (0.47) x Ø 2.0 mm (0.08 in) • 1 piece for filter cover inner Ø 17.1 (0.67) x Ø 2.6 mm (0.10 in)	FKM 85 Shore	B97215-V661F10
		NBR 85 Shore	B97215-N661F10

Accessories D672

Part designation	Description	Part number
Attachment 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
Flushing plate	P, T, X, Y	-76741

Spare parts D672

Part designation	Description	Material	Part number
Service sealing set	Contains the following O-rings: • 4 pieces for P, T, A, B inner Ø 21.89 (0.86) x Ø 2.6 mm (0.10 in) • 2 pieces for X, Y inner Ø 10.82 (0.43) x Ø 1.8 mm (0.07 in)	FKM 85 Shore	B97215-V6X2-16
		NBR 85 Shore	B97215-N6X2-16
Service sealing set, pilot valve	Note: Filter change on D670 pilot valve only possible through Moog Global Support™	FKM 85 Shore	B97215-V630F63
		NBR 85 Shore	B97215-N630F63

ACCESSORIES AND SPARE PARTS

Series-independent accessories

Accessories D671 and D672 Servo Valves

Part designation	Description	Remark	Part number
Accessories for CAN bus	M12x1 connector with terminal resistor		CA63585-001
	M12x1 socket with terminal resistor		CA63584-001
Dust protection cap for fieldbus connectors X3, X4	For external thread M12x1	Required for operation without mating connector (IP protection)	C55823-001
	For internal thread M12x1		CA24141-001
Mains power connection	Power pack 24 V, 10 A		D137-003-001
	Power supply cable, length 2 m (78.7 in)		B95924-002
Mating connector	Cable with straight mating connector 6-pole + PE	Length on request	C21033-xxx-001
	Mating connector, elbow 6-pole + PE	In accordance with EN 175201-804, type S, metal, cable diameter minimum 8 mm (0.31 in) and maximum 12 mm (0.47 in)	B97069-061
	Mating connector, straight 6-pole + PE	In accordance with EN 175201-804, type R, metal, cable diameter minimum 8 mm (0.31 in) and maximum 12 mm (0.47 in)	B97007-061
Service and commissioning set	Adapter, service connectors X10, M8 in accordance with M12x1		CA40934-001
	Configuration/commissioning cable 2 m (78.7 in)		TD3999-137
	Configuration/commissioning software		B99104
	USB CAN adapter		C43094-001

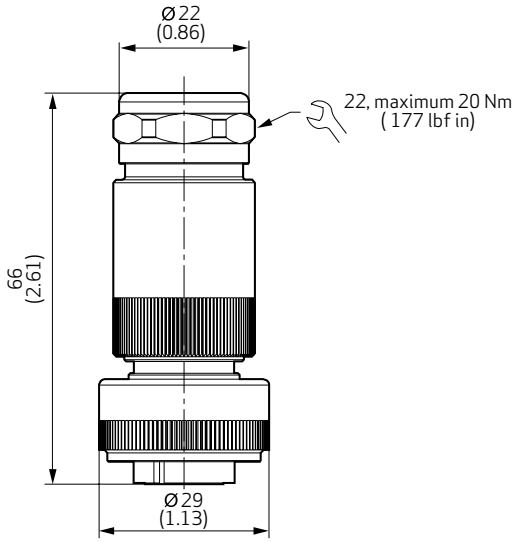
Documents (not included in scope of delivery)

Part designation	Description	Remark	Part number
Manual D671 and D672 Series Servovalves	Operating Instructions	Note: Visit www.moog.com/industrial/literature to download document	On request
Technical Note TN 353	Protective Grounding and Electrical Shielding of Hydraulic Valves with Integrated Electronics	Note: Visit www.moog.com/industrial/literature to download document.	CA58437-001
Technical Note TN 494	Maximum Permissible Length of Electric Cables for Valves with Integrated Eletronics	Note: Visit www.moog.com/industrial/literature to download document.	CA48851-001

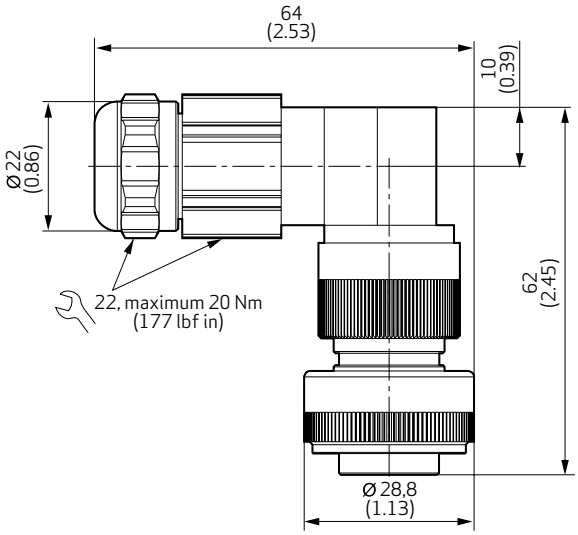
ACCESSORIES AND SPARE PARTS

Installation drawings for accessories

Mating connector, straight 6-pole + PE



Mating connector, elbow 6-pole + PE



ORDER CODE

Model number (assigned at the factory) Type designation

D 671 - D 672	-	☐	-	☐☐☐☐	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Model designation

Variant

1	Valve version
G	Servo valve

2	Rated flow in l/min (gpm)		
	For Δp_N = 35 bar (500 psi) per spool land		Series
08	20	(5.3)	D671
15	40	(10.6)	D671
30	80	(21.1)	D671
35	90	(23.8)	D671
45	120	(31.7)	D671
60	160	(42.3)	D671
75	180	(47.6)	D671
16	160	(42.3)	D672
25	240	(63.4)	D672

3	Maximum operating pressure in bar (psi)	
	For internal pilot connection X, the maximum operating pressure is the maximum pilot pressure. The valve electronics is adapted to the control pressure.	
B	70	(1,000)
F	210	(3,000)
H	280	(4,000)
K	350	(5,000)

4	Bushing/spool design
O	4-way: zero lap, linear flow characteristic
X	Special spool on request

5	Pilot stage design	Series
W	ServoJet® Standard	D671
C	ServoJet® High Flow	D671
K	D670 ServoJet® 2-stage	D672

6	Spool position in case of power fail/loss of pilot pressure
O	Undefined
A	P≥ B, A≥ T connected
B	P≥ A, B≥ T connected

7	Pilot connection	
	Inlet X	Outlet X
4	Internal	Internal
5	External	Internal
6	External	External
7	Internal	External

8	Seal material
N	NBR
V	FKM

9	Valve connector X1
S	6-pole + PE EN 175201-04

10	Signals for 100 % spool stroke	
	Input	Measuring output
D	± 10 V	2 to 10 V
E	4 to20 mA	4 to 20 mA
M	± 10 V	4 to 20 mA
X	± 10 mA	4 to 20 mA
9	Fieldbus	Fieldbus
Y	Others on request	

11	Supply voltage
2	24 V DC, for more information, see section “Electronics“

13	Enable function
A	Without enable signal, the spool moves to a factory defined zero position
B	Without enable signal, the spool moves to a defined final position A→T or B→T

14	Fieldbus connector X3, X4
C	CANopen
D	Profibus DP
E	EtherCAT
O	Without fieldbus connector

16	Factory defined

TAKE A CLOSER LOOK.

Moog designs a range of motion control products that complement the performance of those featured in this catalog. Visit our website for more information and contact the Moog facility nearest you.

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