SERVO-PROPORTIONAL VALVES

DIRECT OPERATED WITH INTEGRATED ELECTRONICS

D936 AND D937 SERIES

ISO 4401 SIZE 03 AND 05

Rev. D, March 2024

SERVO-PROPORTIONAL SOLENOID OPERATED VALVES
OFFERING HIGH ROBUSTNESS AND RELIABILITY

MOOG | Shaping the way our world moves™

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.

PRODUCT OVERVIEW

Moog D936/D937 Series Valves are direct operated Servo-proportional Valves driven by a proportional solenoid. They are equipped with integrated electronics and closed-loop position control of the spool.

These valves are suitable for electrohydraulic control of position, speed, pressure and force in open and closed loop control systems.

These valve series are characterized by a compact design that allows a space-saving system design.

The robust design allows for a high resistance against harsh environmental conditions like high vibrations and temperature.

The valves offer analog interfaces for command signal and spool position feedback. They are, however, equipped with modern electronics with a digital core that offers high energy efficiency while delivering high static and dynamic control performance.

	D936	**D937**
Valve design	1-stage, with spool and bushing	
Size according ISO 4401	03	05
Mounting pattern	ISO 4401-03-03-0-05 (with or without leakage oil port Y)	ISO 4401-05-05-0-05 (without leakage oil port Y)
Rated flow at Δp_N 35 bar (500 psi)/spool land	4 to 40 l/min (1.06 to 10.6 gpm)	50 or 100 l/min (13.2 or 26.4 gpm)
Maximum operating pressure - port P, A, B	350 bar (5,000 psi)	
Step response time for 0 to 100 % stroke	11 ms	18 ms

FEATURES AND BENEFITS

Features	Benefits
4/4-way design including fail-safe position	Reduces need for additional safety components
Servo valve design with fully hardened spool and bushing	High accuracy and wear resistance
Electronics mechanically uncoupled from housing	High vibration resistance for longer service life and less machine downtime
Next-generation electronics with digital core and energy efficient components	Low thermal stress and long electronics life cycle
Optimized overlaps and clearances between spool and bushing	Low internal leakage and high contamination resistance
Electronics placed on the solenoid	Compact design for minimum installation space

DESCRIPTION OF OPERATION

Valve Design

Moog D936 and D937 Series Servo-proportional Control Valves are closed-loop hydraulic products that are used in industrial applications. These valves are electrical feedback valves, which means that the position control loop for the spool is closed by a position transducer and the integrated valve electronics.

The spool (9) is mounted in a hardened steel bushing (8) that provides high control accuracy and superior wear resistance. The spool is deflected by the proportional solenoid (5) that operates against the return spring (7).

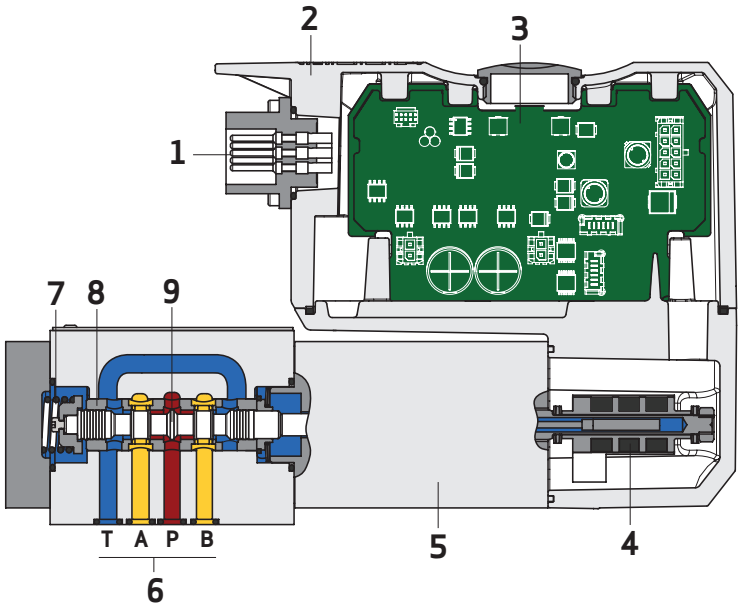
The onboard electronics (3) are mounted on top of the solenoid to create a compact and space-saving valve shape. The electronics are uncoupled from the electronics housing and provide a high resistance against vibrations and shocks.

Operation

An electric command signal (spool position set point) is applied to the valve electronics via the main connector (1). A position transducer (4) measures the actual position of the spool (9). The electronics compare the spool position and the command signal, and control the Pulse Width Modulated (PWM) current to the proportional solenoid. If a control deviation occurs, the PWM current is changed to move the spool to the desired position and the PWM current is kept at a level that holds the spool in this position.

Thus, the position of the spool is proportional to the electric command signal.

D936 Cut-away



1. Valve connector
2. Electronics housing
3. Valve electronics
4. Position transducer (LVDT)
5. Proportional solenoid
6. Ports
7. Spring
8. Bushing
9. Spool

D936

General Technical Data

Valve design	1-stage, with spool and bushing
Mounting pattern	ISO 4401-03-03-0-05 (with or without leakage oil port Y)
Installation position	Any
Weight	2.9 kg (6.4 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, 3 ms
$MTTF_d$ value according to EN ISO 13849-1	150 years

Hydraulic Data

Maximum operating pressure				
Port P, A, B	350 bar (5,000 psi)			
Port T without Y	280 bar (4,000 psi) [1]			
Port T with Y	350 bar (5,000 psi)			
Port Y	Depressurized to tank [1]			
Rated flow at Δp_N 35 bar (500 psi)/spool land for linear flow characteristics (for others see ordering code)	4 l/min (1.06 gpm)	12 l/min (3.2 gpm)	24 l/min (6.3 gpm)	40 l/min (10.6 gpm)
Leakage flow (rate) (≈ zero lap) [2]	0.2 l/min (0.05 gpm)	0.4 l/min (0.11 gpm)	0.7 l/min (0.19 gpm)	1.3 l/min (0.34 gpm)
Maximum allowable pressure drop regarding the transition to the fail-safe position [3]				
Fail-safe options "1" and "F"	350 bar (5,000 psi)			160 bar (2,320 psi)
Fail-safe option "2"	350 bar (5,000 psi)		260 bar (3,770 psi)	120 bar (1,740 psi)
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 100 mm^2/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	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			

1) In order to avoid an emptying of the return line, a back pressure of 2 bar (30 psi) should be maintained on the T and Y ports.

2) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

3) Values apply for 4-way operation, please refer also to the information given in the section "Fail-safe Functions".

D936

Typical Static and Dynamic Data [1)]

Step response time for 0 to 100 % stroke	11 ms
Threshold	< 0.2 %
Hysteresis	< 0.2 %
Null shift at ΔT = 55 K (131 °F)	< 1.5 %
Sample deviation of rated flow	< 3 %

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connector)
Supply voltage [2)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage	2.5 V_{PP}
Maximum current consumption [3)]	1.4 A
Maximum power consumption	33.6 W (1.4 A at 24 V_{DC})
Fuse protection, external, per valve	2 A (slow)
EM compatibility	• Emitted interference as per DIN EN 61000-6-4 • Immunity to interference as per EN 61000-6-2 (evaluation criterion A)

1) Measured at 140 bar (2,000 psi) 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 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.

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

D936

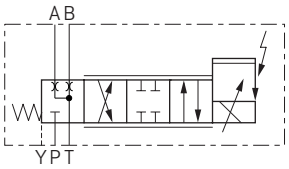
Fail-safe Functions

The D936 valve series offers three different fail-safe options. They can be chosen at position 6 of the ordering code.

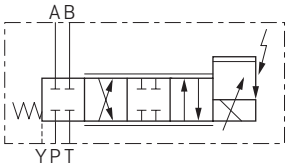
For options "1" and "2" the spool is moved to the 4th position by spring force when the electrical supply of the valve is switched off. Option "1" connects ports A and B with port T and thus relieves the pressure from ports A and B. Option "2" blocks all valve ports, but there will still remain a small amount of internal leakage, so a cylinder or motor may creep when it is under load.

For option "F" the spool is moved to a stroke of about 110% in the direction P→B and A→T when switching off the electrical power.

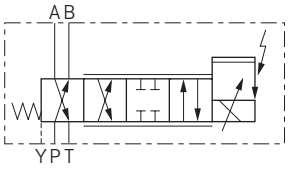
Fail-safe option "1"



Fail-safe option "2"



Fail-safe option "F"



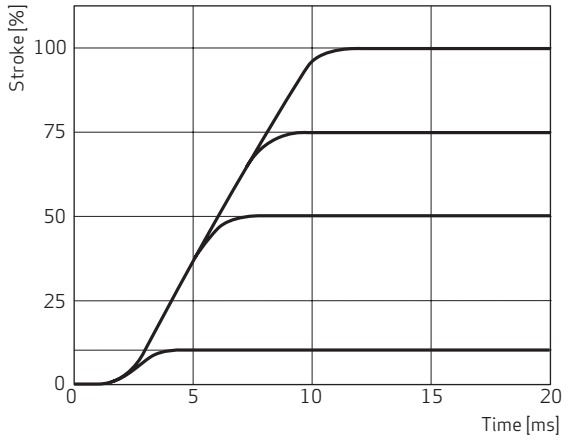
Please note:

1. For both options "1" and "2" the spool is moved through the fully open Position P→B and A→T when travelling to the 4th position. That means there will be full flow for a short period of time.
2. The switching force of the spring is limited, so there are limits concerning the maximum allowable pressure drop to reach the fail-safe position. These limits depend on the rated flow and the fail-safe option. Limits for reaching the fail-safe position are given on page 6.
3. The maximum pressure drop for leaving the fail-safe position is also limited. In some cases, those limits can be lower than the pressure drop limits to reach the fail-safe position. Depending on the system configuration, it may be necessary to reduce or shut down the hydraulic supply pressure to leave the fail-safe position.
4. For certain errors (e.g. power supply voltage too low), the valve electronics will switch off the solenoid power and the valve will move to the fail-safe position. The solenoid power will be switched on again as soon as the error is no longer present.

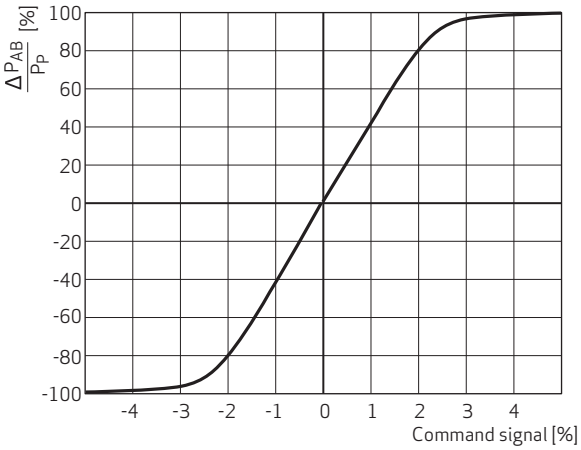
D936

Typical Characteristic Curves

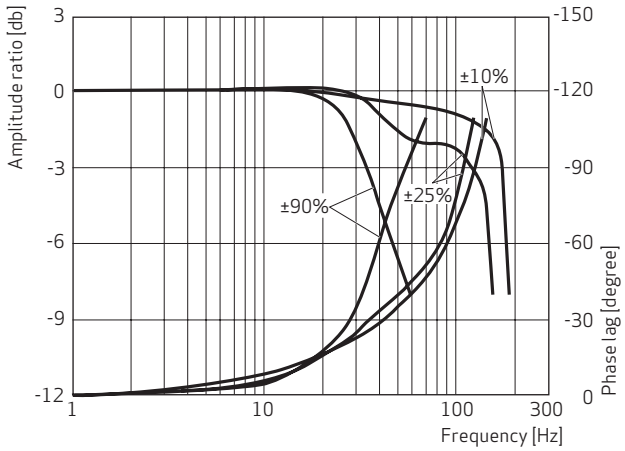
Step Response [1)]



Pressure Signal Characteristic



Frequency Response [1)]



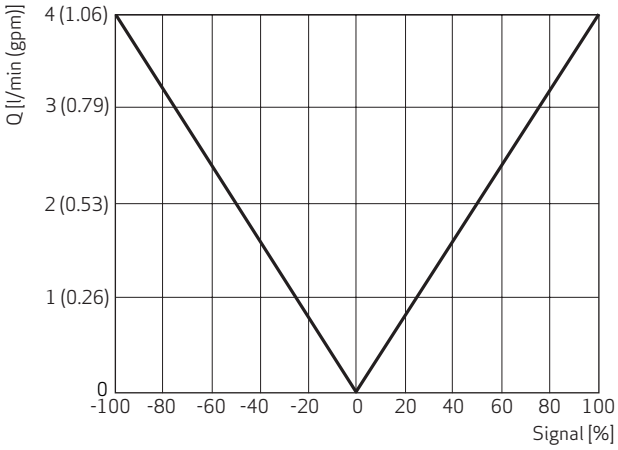
1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D936

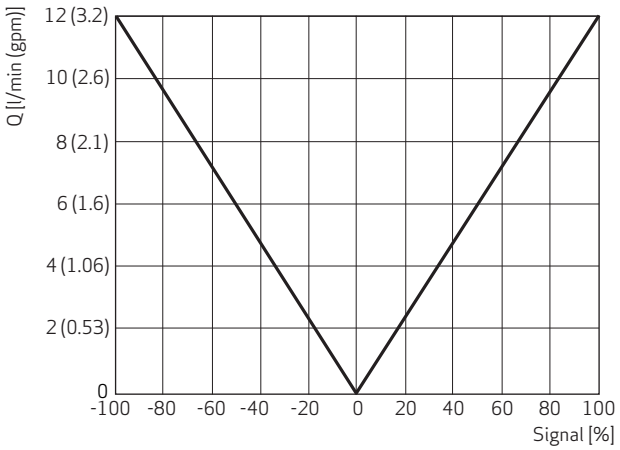
Rated flow at Δp_N 35 bar (500 psi)/spool land

Linear Flow Characteristics (Bushing/Spool Option "O")

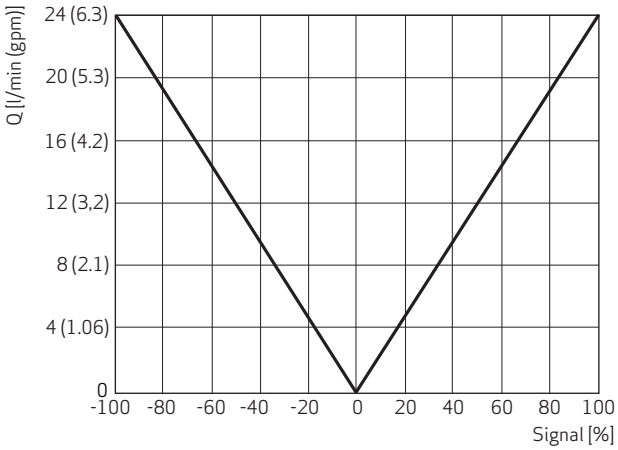
Rated flow 4 l/min



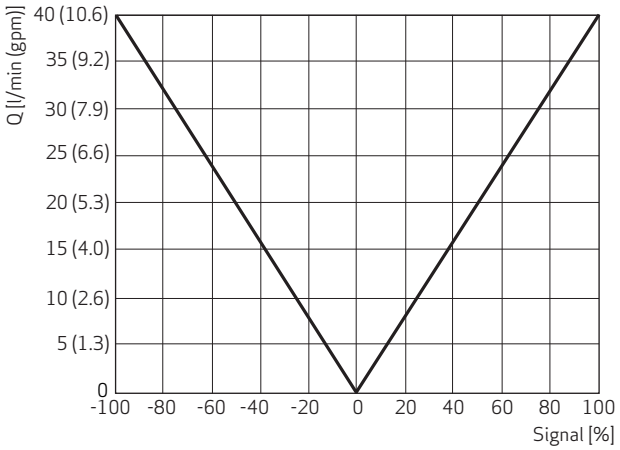
Rated flow 12 l/min



Rated flow 24 l/min



Rated flow 40 l/min



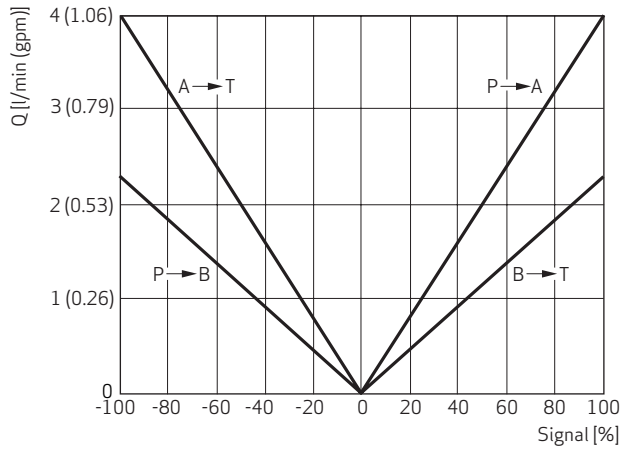
1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D936

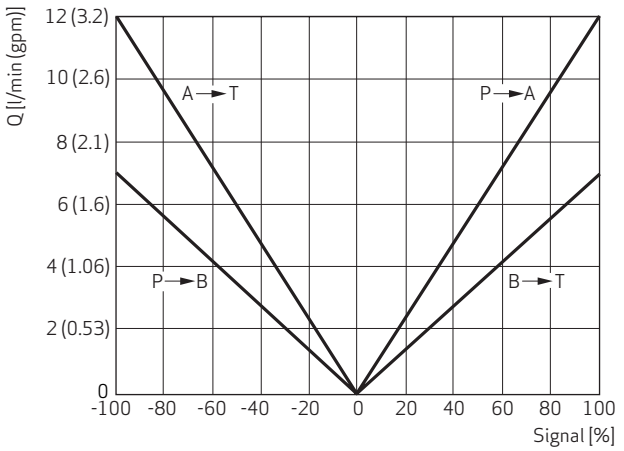
Rated flow at Δp_N 35 bar (500 psi)/spool land

Linear Flow Characteristics for Differential Cylinders (Bushing/Spool Option "J")

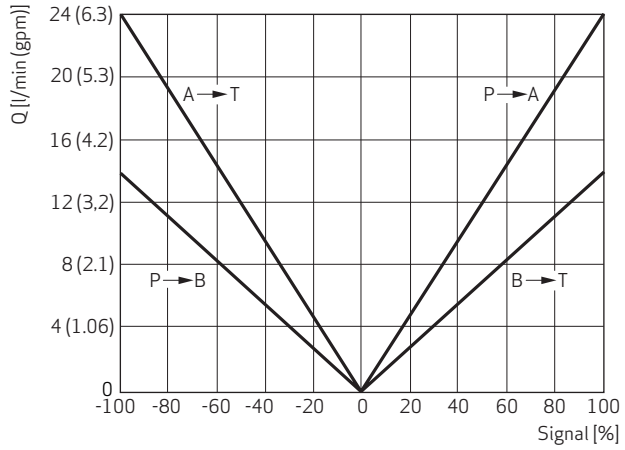
Rated flow 4 l/min



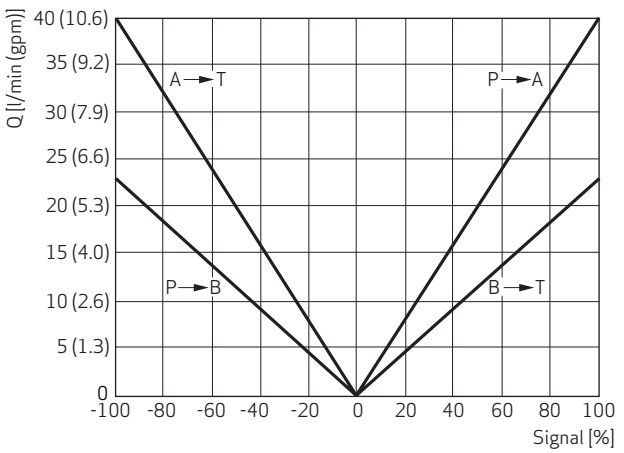
Rated flow 12 l/min



Rated flow 24 l/min



Rated flow 40 l/min



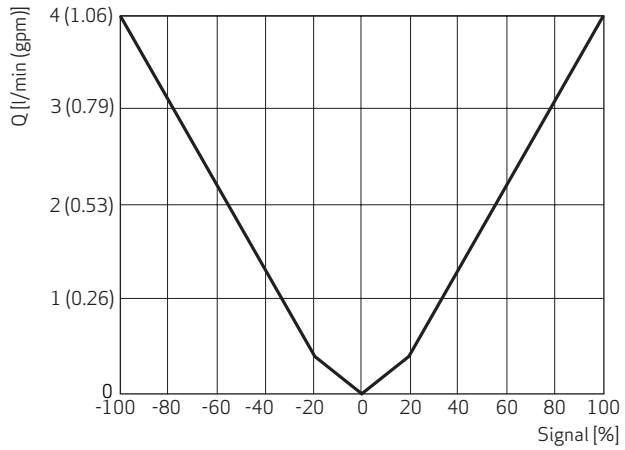
1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D936

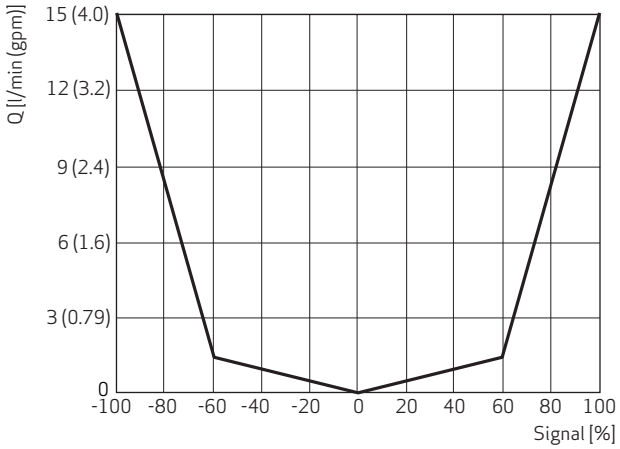
Rated flow at Δp_N 35 bar (500 psi)/spool land

Dual Gain Flow Characteristics (Bushing/Spool Option "Y")

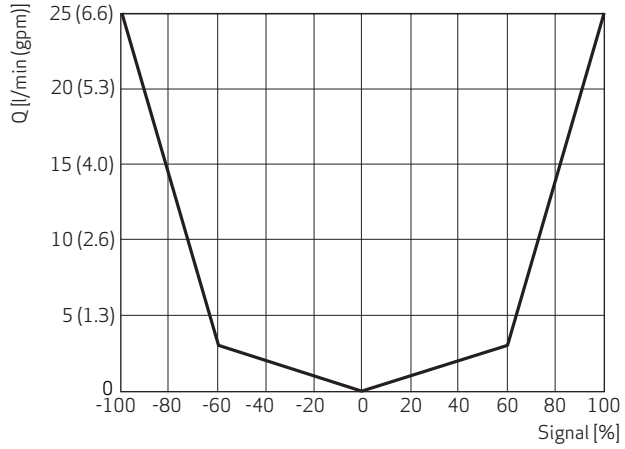
Rated flow 4 l/min



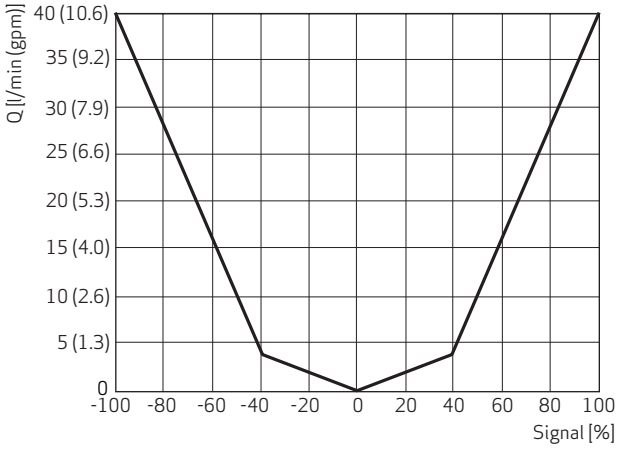
Rated flow 15 l/min



Rated flow 25 l/min



Rated flow 40 l/min



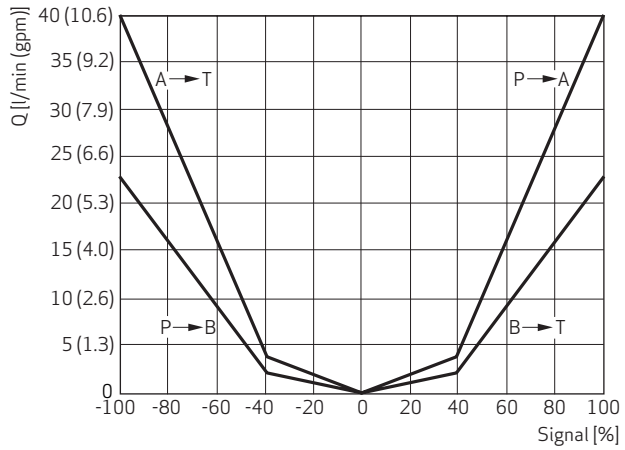
1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D936

Rated flow at Δp_N 35 bar (500 psi)/spool land

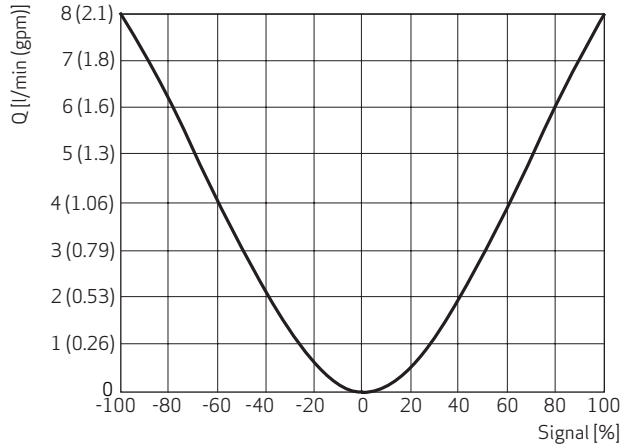
Dual Gain Flow Characteristics for Differential Cylinders (Bushing/Spool Option "E")

Rated flow 40 l/min

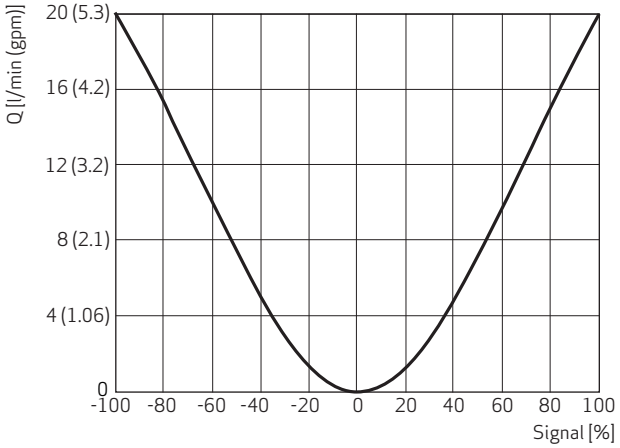


Progressive Flow Characteristics (Bushing/Spool Option "L")

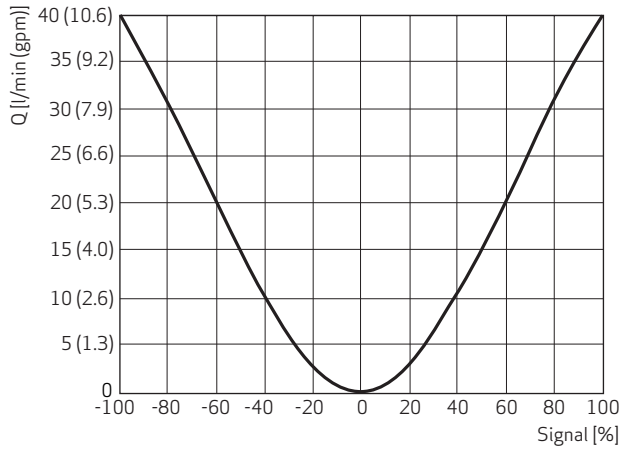
Rated flow 8 l/min



Rated flow 20 l/min



Rated flow 40 l/min



1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

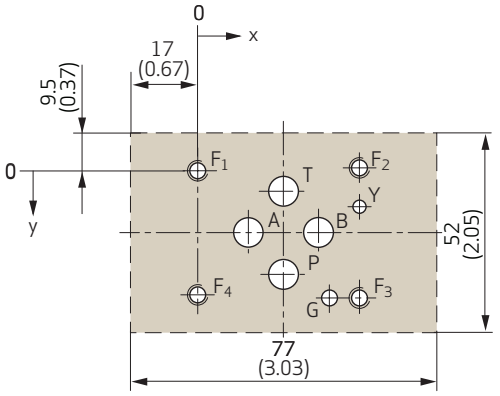
D936

Port Pattern of Mounting Surface

The mounting surface must conform to ISO 4401-03-03-0-05. Please observe a mounting length of a minimum 77 mm (3.0 in) and O-ring recesses for Y.

For maximum flow the ports for P, T, A and B must be designed with Ø 7.5 mm (0.3 in), not according to the standard.

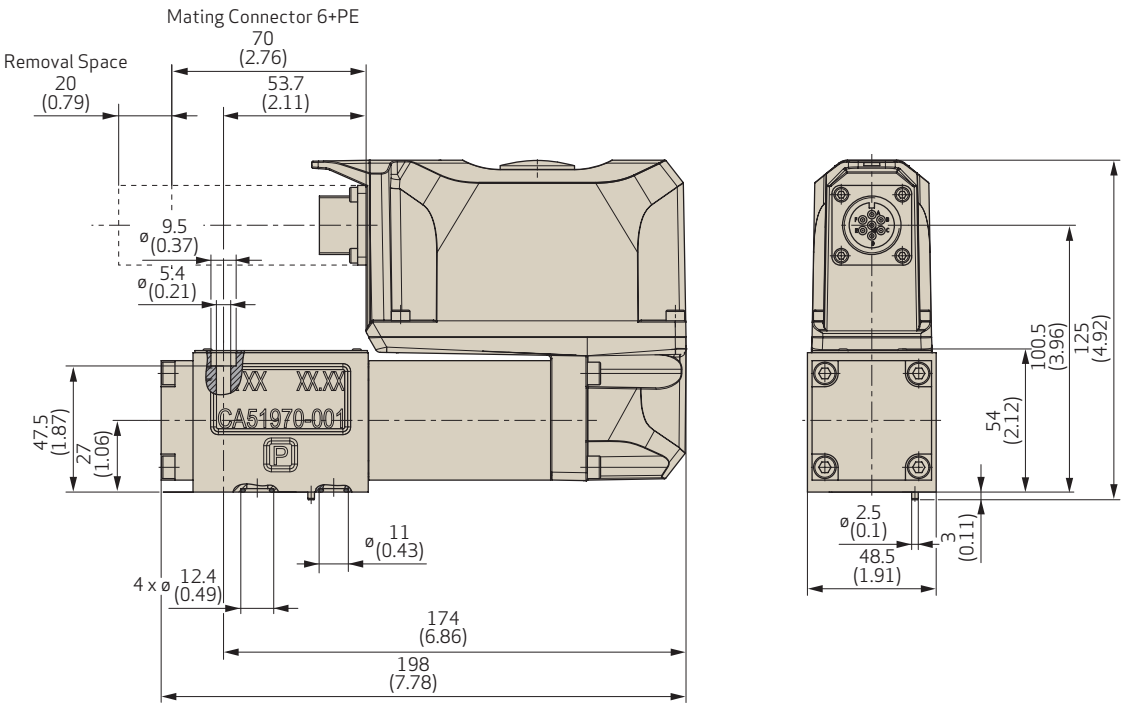
The evenness of the connecting surface has to be 0.01 mm (0.0004 in) over 100 mm (3.94 in), and average surface finish R_a better than 0.8 µm (0.0000315 in).



Designation		P	A	B	T	Y	F_1	F_2	F_3	F_4	G
Size Ø	**mm**	7.5				3.3	M5 [1]				4
	in	0.30				0.13					0.16
Position X	**mm**	21.5	12.7	30.2	21.5	40.5	0	40.5		0	33
	in	0.85	0.50	1.19	0.85	1.59		1.59			1.30
Position Y	**mm**	25.9	15.5		5.1	9	0	-0.75	31.75	31	31.75
	in	1.02	0.61		0.20	0.35		-0.03	1.25	1.22	1.25

1) For screw dimensions and tightening torques please refer to section "Accessories and Spare Parts")

Installation Drawing



D937

General Technical Data

Valve design	1-stage, with spool and bushing
Mounting pattern	ISO 4401-05-05-0-05 (without leakage oil port Y)
Installation position	Any
Weight	6.8 kg (15 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	20 g, 3 axis, 10 Hz to 2 kHz
Shock resistance	50 g, 6 directions, 3 ms
$MTTF_d$ value according to EN ISO 13849-1	150 years

Hydraulic Data

Maximum operating pressure		
Port P, A, B	350 bar (5,000 psi)	
Port T	250 bar (3,600 psi) [1]	
Rated flow at Δp_N 35 bar (500 psi)/spool land for linear flow characteristics (for others see ordering code)	50 l/min (13.2 gpm)	100 l/min (26.4 gpm)
Leakage flow (rate) (≈ zero lap) [2]	1.7 l/min (0.45 gpm)	2.1 l/min (0.55 gpm)
Maximum allowable pressure drop regarding the transition to the fail-safe position [3]		
Fail-safe options "1" and "F"	350 bar (5,000 psi)	140 bar (2,030 psi)
Fail-safe option "2"	250 bar (3,600 psi)	100 bar (1,450 psi)
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 100 mm^2/s (cSt)	
Maximum permissible viscosity range at 38 °C (100 °F)	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	

1) In order to avoid an emptying of the return line, a back pressure of 2 bar (30 psi) should be maintained on the T ports.

2) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

3) Values apply for 4-way operation, please refer also to the information given in the section "Fail-safe Functions".

D937

Typical Static and Dynamic Data [1)]

Step response time for 0 to 100 % stroke	18 ms
Threshold	< 0.2 %
Hysteresis	< 0.2 %
Null shift at ΔT = 55 K (131 °F)	< 1.5 %
Sample deviation of rated flow	< 3 %

Electrical Data

Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 (with mounted mating connector)
Supply voltage [2)]	24 V_{DC} (18 to 32 V_{DC})
Permissible ripple of supply voltage	2.5 V_{PP}
Maximum current consumption [3)]	2.7 A
Maximum power consumption	65 W (2.7 A at 24 V_{DC})
Fuse protection, external, per valve	3.15 A (slow)
EM compatibility	• Emitted interference as per DIN EN 61000-6-4 • Immunity to interference as per EN 61000-6-2 (evaluation criterion A)

1) Measured at 140 bar (2,000 psi) 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 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.

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

D937

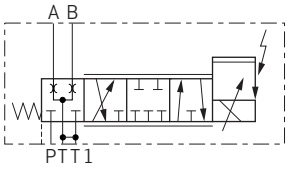
Fail-safe Functions

The D937 valve series offers three different fail-safe options. They can be chosen at position 6 of the ordering code.

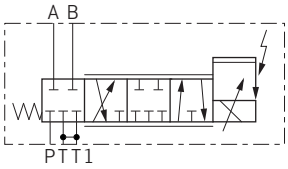
For options "1" and "2" the spool is moved to the 4th position by spring force when the electrical supply of the valve is switched off. Option "1" connects ports A and B with port T and thus relieves the pressure from ports A and B. Option "2" blocks all valve ports, but there will still remain a small amount of internal leakage, so a cylinder or motor may creep when it is under load.

For option "F" the spool is moved to a stroke of about 110% in the direction P→B and A→T when switching off the electrical power.

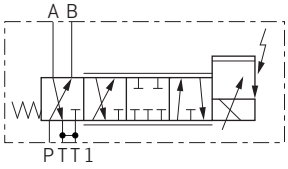
Fail-safe option "1"



Fail-safe option "2"



Fail-safe option "F"



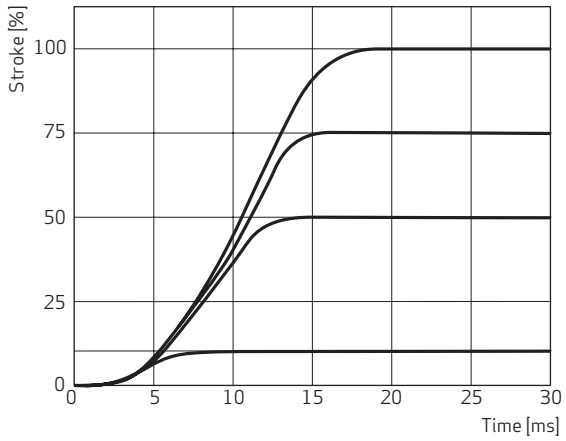
Please note:

1. For both options "1" and "2" the spool is moved through the fully open Position P→B and A→T when travelling to the 4th position. That means there will be full flow for a short period of time.
2. The switching force of the spring is limited, so there are limits concerning the maximum allowable pressure drop to reach the fail-safe position. These limits depend on the rated flow and the fail-safe option. Limits for reaching the fail-safe position are given on page 15.
3. The maximum pressure drop for leaving the fail-safe position is also limited. In some cases, those limits can be lower than the pressure drop limits to reach the fail-safe position. Depending on the system configuration, it may be necessary to reduce or shut down the hydraulic supply pressure to leave the fail-safe position.
4. For certain errors (e.g. power supply voltage too low), the valve electronics will switch off the solenoid power and the valve will move to the fail-safe position. The solenoid power will be switched on again as soon as the error is no longer present.

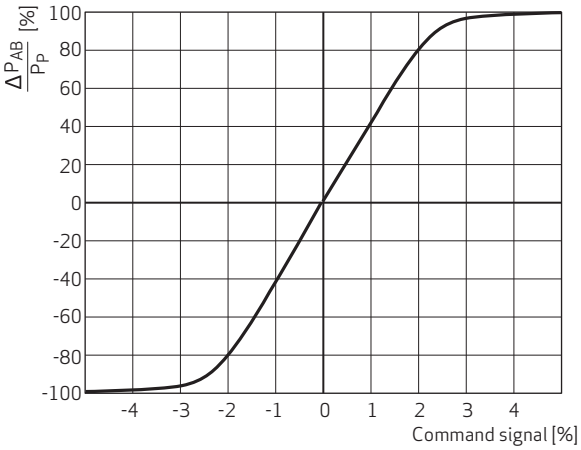
D937

Typical Characteristic Curves

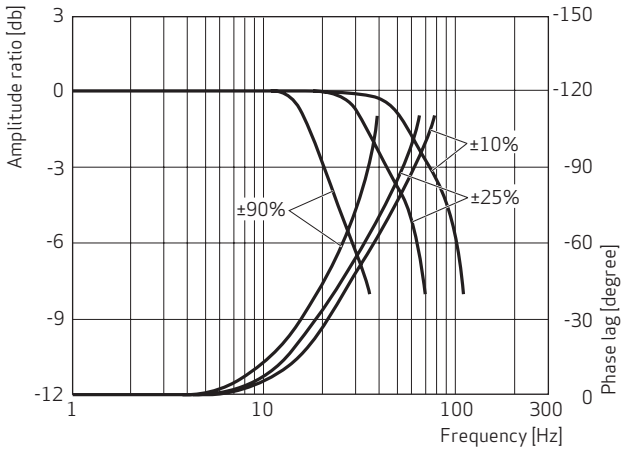
Step Response [1)]



Pressure Signal Characteristic



Frequency Response [1)]



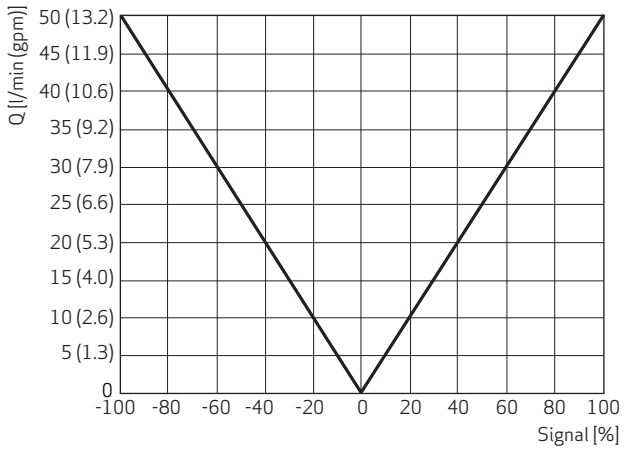
1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D937

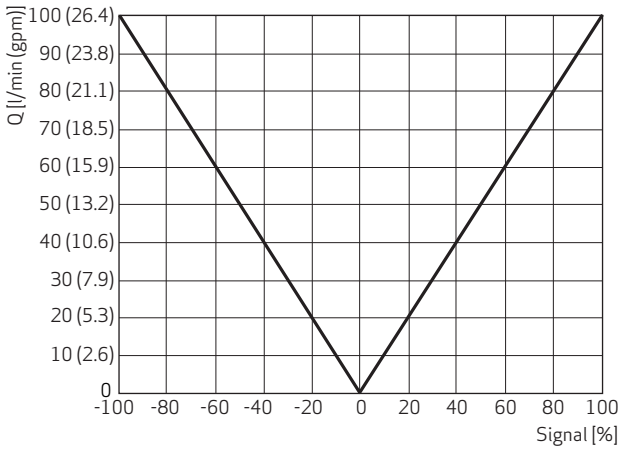
Rated flow at Δp_N 35 bar (500 psi)/spool land

Linear Flow Characteristics (Bushing/Spool Option "O")

Rated flow 50 l/min

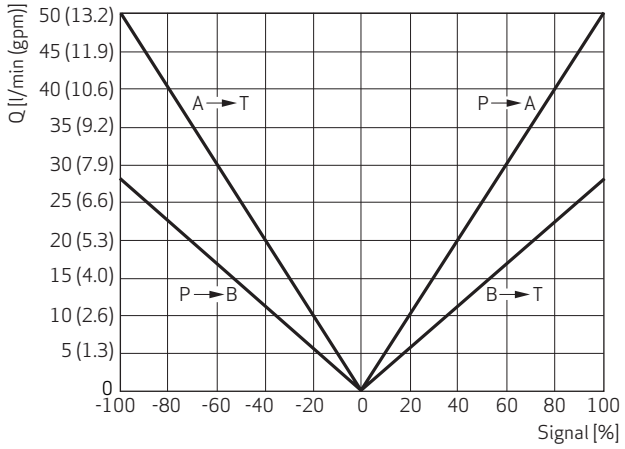


Rated flow 100 l/min

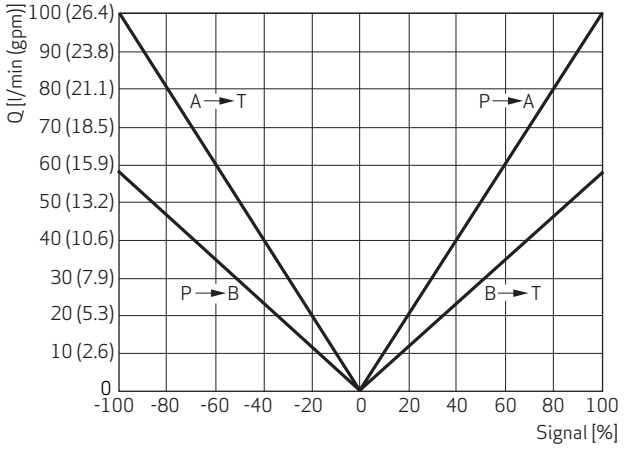


Linear Flow Characteristics for Differential Cylinders (Bushing/Spool Option "J")

Rated flow 50 l/min



Rated flow 100 l/min



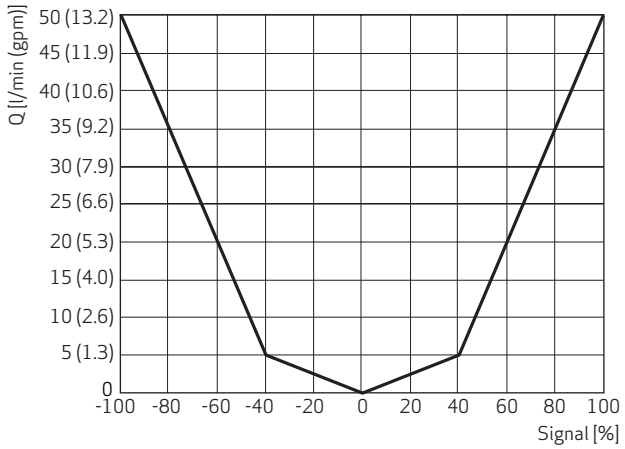
1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D937

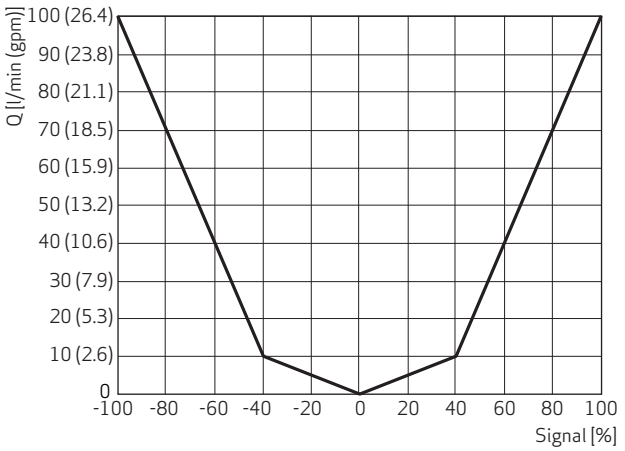
Rated flow at Δp_N 35 bar (500 psi)/spool land

Dual Gain Flow Characteristics (Bushing/Spool Option "Y")

Rated flow 50 l/min

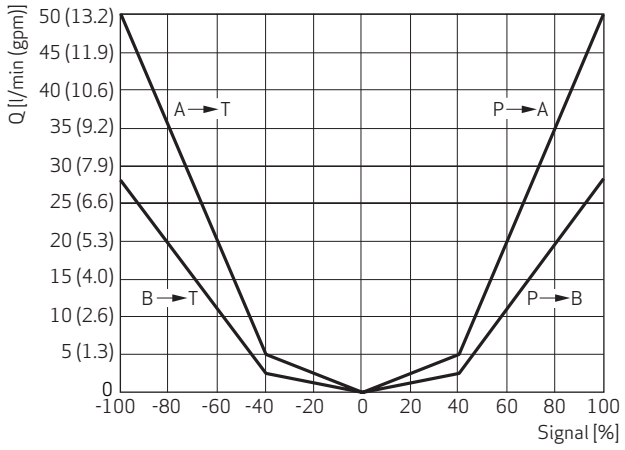


Rated flow 100 l/min

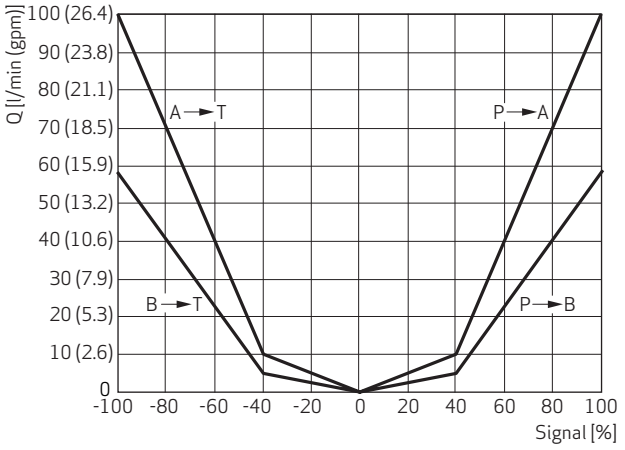


Dual Gain Flow Characteristics for Differential Cylinders (Bushing/Spool Option "E")

Rated flow 50 l/min

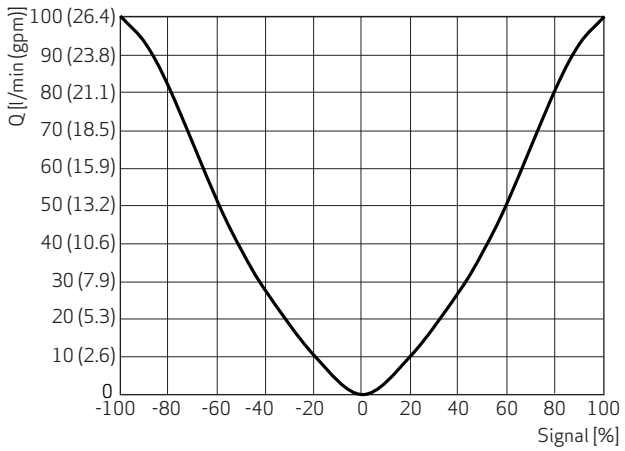


Rated flow 100 l/min



Progressive Flow Characteristics (Bushing/Spool Option "L")

Rated flow 100 l/min



1) Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

D937

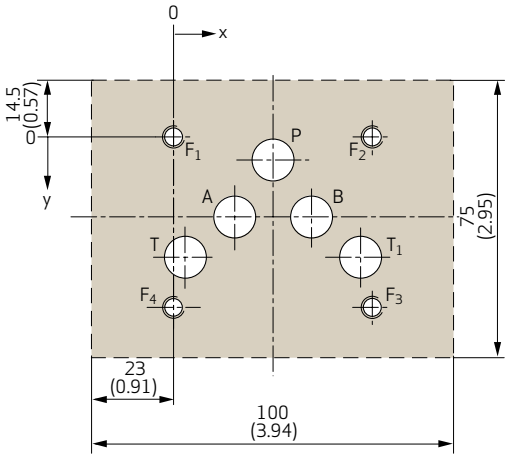
Port Pattern of Mounting Surface

The mounting surface must conform to ISO 4401-05-05-0-05. Please observe a mounting length of a minimum 100 mm (3.94 in).

For Q > 60 l/min (15.9 gpm) the second tank port T1 is required.

For maximum flow the ports for P, T, T1, A and B must be designed with Ø 11.5 mm (0.45 in), not according to the standard.

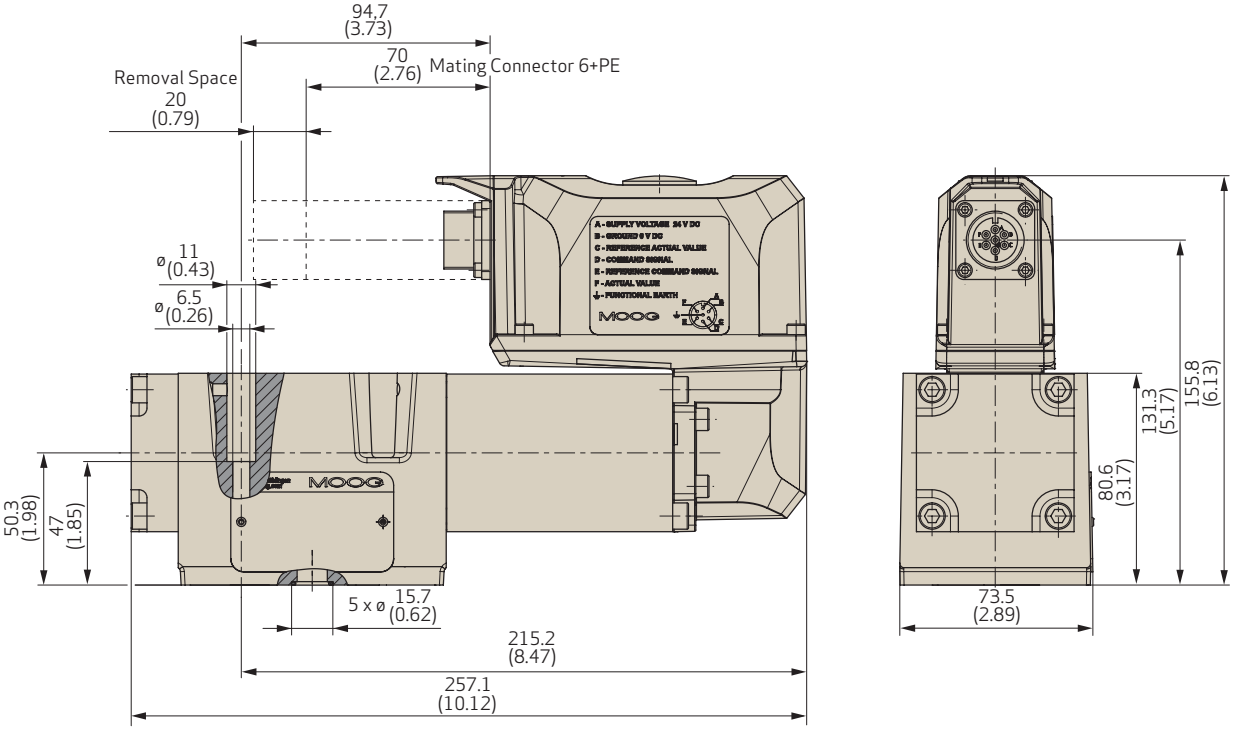
The evenness of the connecting surface has to be 0.01 mm (0.0004 in) over 100 mm (3.94 in), and average surface finish R_a better than 0.8 µm (0.0000315 in).



Designation		P	A	B	T	T_1	F_1	F_2	F_3	F_4
Size Ø	**mm**	11.2					M6			
	in	0.44								
Position X	**mm**	27	16.7	37.3	3.2	50.8	0	54		0
	in	1.06	0.66	1.47	0.13	2		2.13		
Position Y	**mm**	6.3	21.4		23.5		0		46	46
	in	0.25	0.84		1.28				1.81	1.81

1) For screw dimensions and tightening torques please refer to section "Accessories and Spare Parts")

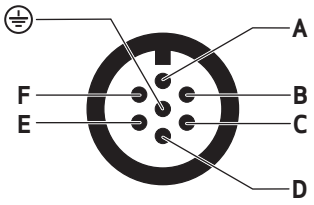
Installation Drawing



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 leading protective earth pin (⏚)



Pin	Pin Assignment	Signal Type [1]	
		Voltage Floating	**Current Floating [2]**
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	Reference point actual value	Reference for Pin F	
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-C} = -10 to 10 V; U_{F-C} is proportional to the spool position; 0 V corresponds to the spool center position	I_{out} = 4 to 20 mA referenced to PIN C; I_{out} is proportional to the spool position; 12 mA corresponds to the spool center position; the output is short-circuit-proof; R_L = 0 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	
H	U_D - U_E	-10 to +10 V	U_F - U_C	-10 to +10 V
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

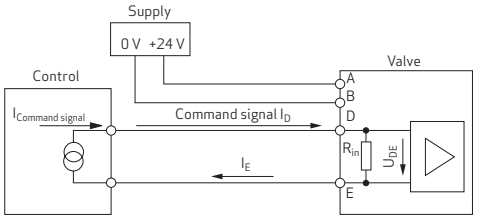
Note: See chapter "Ordering Code" for complete ordering information

Command Signal Current Floating, Ordering Code X or E

The spool position is proportional to I_D = - I_E.

For a command signal ID = 20 mA (code E) or +10 mA (code X) the spool moves to 100 % P→A and B→T.

For a command signal ID = 12 mA (code E) or 0 mA (code X) the spool is in the defined center position.

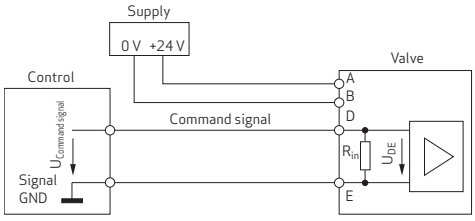


Command Signal Voltage Floating, Ordering Code H

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.

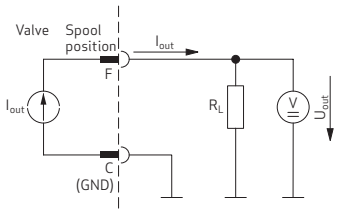


Actual Value 4 to 20 mA, Ordering Code X or E

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.

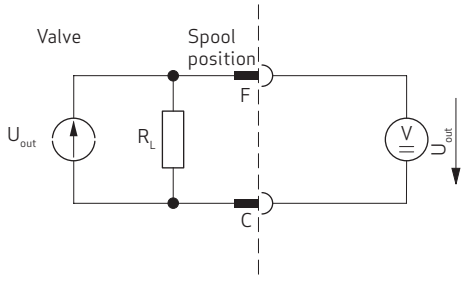
Actual value U_{out} = 2 to 10 V with resistor R_L = 500 Ω (0.25 W) provided by the customer.



Actual Value -10 to +10 V, Ordering Code H

The spool position is proportional to U_{out}. The spool position corresponds to -10 to +10 V. At 0 V the spool is in center position.

+10 V corresponds to 100 % valve opening P→A and B→T.



For ordering code H, do not connect pin C to Power GND (pin B).

FLOW CALCULATION

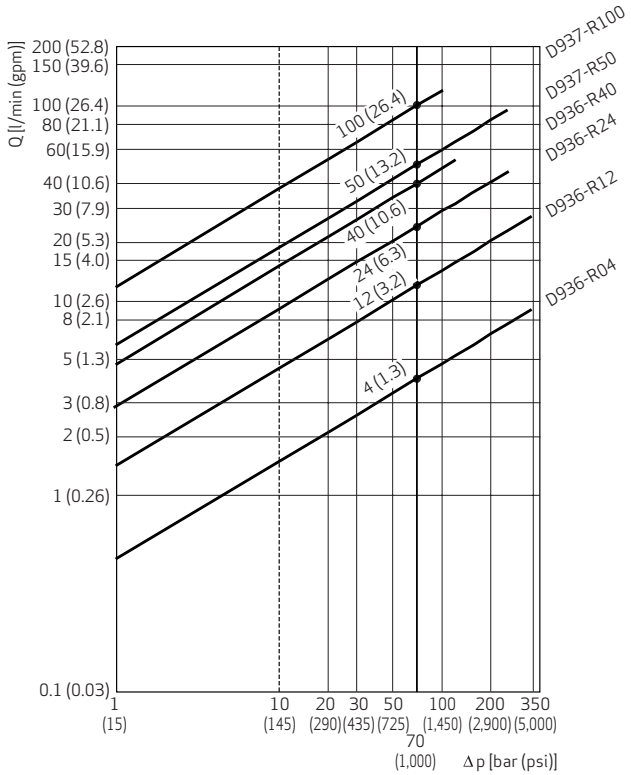
When the valve is open the resulting flow is dependent not only on the spool position, (i.e. the opening cross section of the valve), but also on the pressure drop at the individual lands. When the valve is deflected at 100 %, it delivers the rated flow with the rated pressure drop. The rated flow of a servo valve 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 it can be 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 for two lands
Δp_N [bar (psi)]	rated pressure drop for two lands

When operating the valves close to these application limits, it is necessary to drill the ports to the maximum possible diameters (see “Port Pattern of Mounting Surface” on page 14 for the D936 valves and page 23 for the D937 valves).

Flow Chart



ACCESSORIES AND SPARE PARTS

Spare Parts

Part Name	Series	Description	Material	Part Number
Service sealing set	D936	O-rings for ports P, T, A, B, Y, consisting of: 4 pieces inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in) 1 piece 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
	D937	O-rings for ports P, T, T_1, A, B, Y, consisting of: 5 pieces inner Ø 12.4 mm (0.49 in) x Ø 1.8 mm (0.07 in) 2 pieces inner Ø 15.6 mm (0.61 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	B97215-V681-10
			HNBR 90 Shore	B97215-H681-10

Accessories

Part Name	Series	Description	Remark	Part Number
Mating connector	D936, D937	Cable with straight mating connector 6-pole + PE	5, 10, 20 or 25 m, e.g. for 5 m specify 005, other length upon request	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 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
Mounting screws	D936	4 pieces M5x55, ISO 4762-10.9, tightening torque 6.8 Nm (60 lbf in)	-	A03665-050-055
	D937	4 pieces M6x60, ISO 4762-10.9, tightening torque 11 Nm (97 lbf in)	-	A03665-060-060
Shipping plate	D936	1 piece	-	B46035-001
	D937		-	A40503

Documents

Title	Description	Remark	Part Number
Mounting and Installation Instruction D936/D937 Series Valves	Installation Instructions	Visit www.moog.com to download a document using the part number in a search	B97072-936
Technical Note TN 353	Protective Grounding and Electrical Shielding of Hydraulic Valves with Integrated Electronics		CA58437
Technical Note TN 494	Maximum Permissible Length of Electric Cables for Valves with Integrated Electronics		CA48851

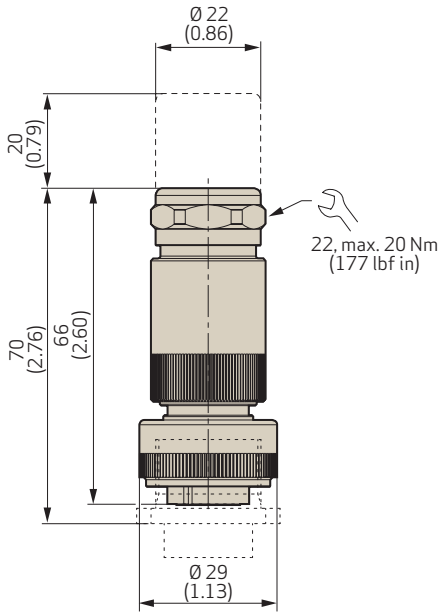
ACCESSORIES AND SPARE PARTS

Installation Drawings

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)

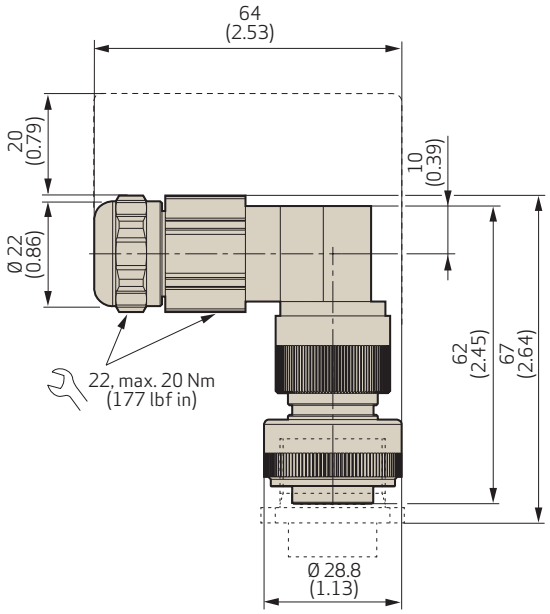
Part number B97007-061



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



ORDERING CODE

Model Number (assigned at the factory) **Type Designation**

		1	2	3	4	5	6	7	8	9	10	11		13
D93_	....	**R**		**K**		**9**				**S**		**2**	-	**0**

Size	
6	Size 03
7	Size 05

Model Designation	

1	**Valve Type**
R	Servo-proportional valve with integrated digital electronics

2	**Rated Flow per Spool Land [l/min (gpm)]** [1]			
	D936	**D937**	**For p = 35 bar (500 psi)**	**For p = 5 bar (75 psi)**
04	●	–	4 (1.06)	1.5 (0.4)
08	●	–	8 (2.1)	3 (0.8)
12	●	–	12 (3.2)	4.5 (1.2)
15	●	–	15 (4)	5.7 (1.5)
20	●	–	20 (5.3)	7.6 (2)
24	●	–	24 (6.3)	9.1 (2.4)
25	●	–	25 (6.6)	9.5 (2.5)
40	●	–	**40 (10.6)**	**15.1 (4)**
50	–	●	50 (13.2)	18.9 (5)
99	–	●	**100 (26.4)**	**37.8 (10)**

3	**Maximum Operating Pressure**
K	350 bar (5,000 psi)

4	**Bushing/Spool Design** [1]
0	**4-way: zero lap, linear flow characteristic**
J	4-way: zero lap, linear flow characteristic, A:B = 2:1
Y	4-way: zero lap, dual gain flow characteristic
E	4-way: zero lap, dual gain flow characteristic, A:B = 2:1
L	4-way: zero lap, progressive flow characteristic

5	**Proportional Solenoid**
9	Proportional solenoid on B side

6	**Spool Position Without Electrical Supply**
1	**Port P blocked, ports A and B connected to T**
2	**Ports P, A, B and T blocked**
F	P→B, A→T connected

7	**Y Port**		
0	**No Y port**	**D936**	**p_{Tmax} = 280 bar (4,000 psi)**
		D937	**p_{Tmax} = 250 bar (3,600 psi)**
3	With Y port	D936	p_{Tmax} = 350 bar (5,000 psi)
		D937	Not available

8	**Seal Material**
H	**HNBR**
V	FKM

9	**Valve Connector X1**
S	6-pole + PE EN 175201-804

10	**Command Signals**	
	Command signal	**Actual value**
H	**±10 V**	**±10 V**
E	4 to 20 mA	4 to 20 mA
X	±10 mA	4 to 20 mA

11	**Supply Voltage**
2	24 V_{DC}, for more information, see section “Electronics“

13	**Enable Function**
0	No enable signal

Note: Preferred options marked in **bold**.

[1] Combinations of Rated Flows and Flow Characteristics

Rated Flow (Pos. 2)	**Series**	**Flow Characteristics (Pos. 4)**				
		0	J	Y	E	L
04	D936	●	●	●	–	–
08	D936	–	–	–	–	●
12	D936	●	●	–	–	–
15	D936	–	–	●	–	–
20	D936	–	–	–	–	●
24	D936	●	●			
25	D936	–	–	●	–	–
40	D936	●	●	●	●	●
50	D937	●	●	●	●	–
99	D937	●	●	●	●	●

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