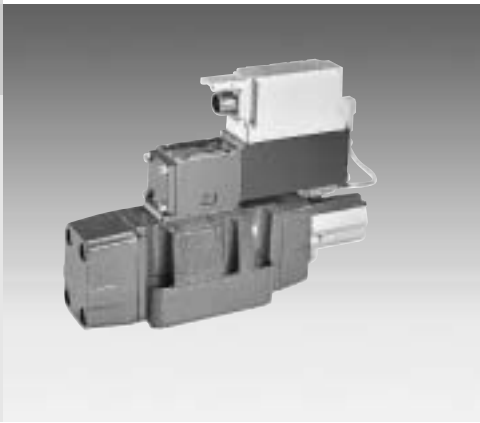
Rexroth
Bosch Group

Servo solenoid valves with on-board electronics (OBE)

RE 29088/01.05 1/18
Replaces: 05.04

Type 4WRLE 10...35, symbols V/V1



Size 10, 16, 25, 35
Unit series 3X
Maximum working pressure P, A, B 350 bar, T, X, Y 250 bar
Nominal flow rate 40...1,000 l/min (Δp 10 bar)

List of contents

Variants on request

- For standard applications
- Special symbols for plastic injection-moulding machines
- Possible valve electronics with 11P+PE line socket and extension of the module.

Features

- Pilot operated servo solenoid valves NG10 to NG35
- Pilot valve NG6, with control piston and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and on-board electronics (OBE), calibrated at the factory
- Main stage in servo quality with position feedback
- Flow characteristic
  - M = Progressive with fine metering notch
  - P = Non-linear curve
  - L = Linear (only available on request)
- Electrical connection 6P+PE
  Signal input difference amplifier with interface
  A1 ±10 V, or interface F1 4...20 mA (R_s 200 Ω)
- Suitable for electrohydraulic controllers in production and testing systems
- For subplate attachment, mounting hole configuration NG10 to ISO 4401-05-05-0-94, NG16 to ISO 4401-07-06-0-94, NG25 to ISO 4401-08-07-0-94 and NG32 to ISO 4401-10-08-0-94
- Subplates as per catalogue section, NG10 RE 45055, NG16 RE 45057, NG25 RE 45059 and NG32 RE 45060 (order separately)
- Line sockets to DIN 43563-AM6, see catalogue section RE 08008 (order separately)

Ordering data and scope of delivery

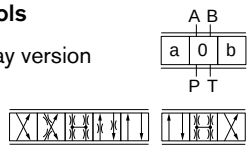
4WRL	E				– 3X	H / G24		K0 /	M	*

With **on-board** trigger electronics **= E**

Size 10 **= 10**
Size 16 **= 16**
Size 25 **= 25**
Size 35 [2] **= 35**

Symbols

4/3-way version



= V, V1

With symbol V1:
P → A: q_v B → T: q_v/2
P → B: q_v/2 A → T: q_v

Nominal flow rate at 10 bar valve pressure difference

Size
10 = 40 [1], 55, 70 [1] or 85 l/min
16 = 90 [1], 120, 150 [1] or 200 l/min
25 = 300 [1], 370 or 430 l/min
35 = 1,000 l/min

[1] Q_N: Flow characteristic "P"

[2] NG35 is a high flow version of the NG32, ports P, A, B and T have Ø 50 mm in the main stage. Contrary to the standard, ports P, A, B and T may be drilled to max. Ø 48 mm in the control block. These valves therefore provide higher flow rates Q_A : Q_B.

Flow characteristic
M = Progressive with linear fine metering
P = Non-liniear curve, linear (kink at 40 %)

3X = Unit series 30 to 39 (installation and connection dimensions unchanged)

H = High flow version (on request)

G24 = **Voltage supply of trigger electronics** +24 V DC

Control oil inlet "x", control oil outlet "y"
No designation = "x" = external, "y" = external
E = "x" = internal, "y" = external
ET = "x" = internal, "y" = internal
T = "x" = external, "y" = internal

K0 = without line socket, with plug to DIN 43563-AM6 Order line socket separately

Electrical connection

Interface for trigger electronics
A1 = Setpoint input ±10 V
F1 = Setpoint input 4...20 mA

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Further information in plain text

Preferred types (available at short notice)

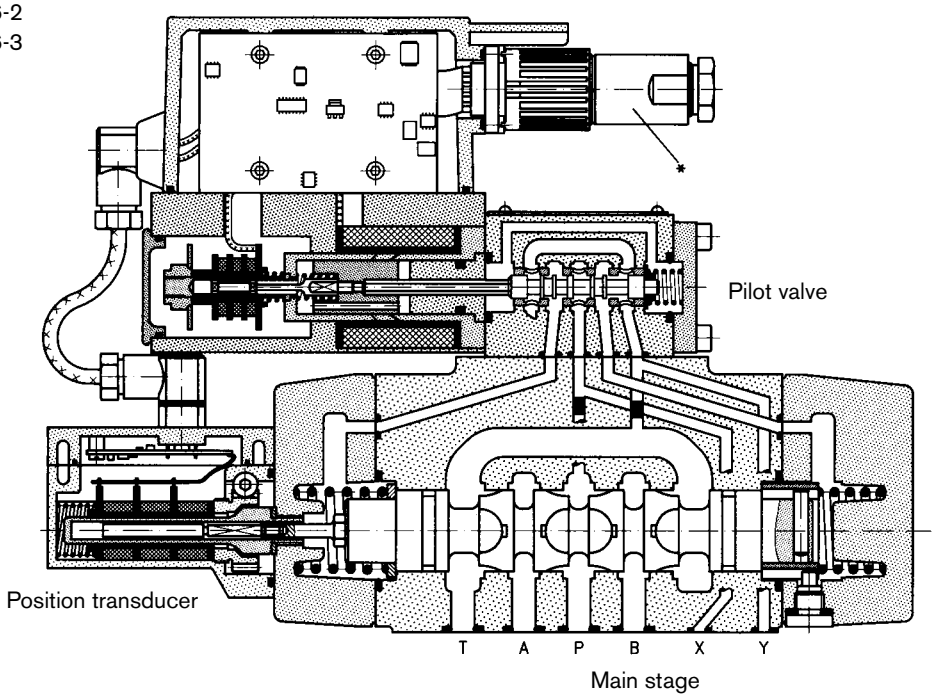
Type 4WRLE	Material No.
NG10	
4WRLE 10 V–55M 3X/G24 KO / A1M	**0 811 404 652**
4WRLE 10 V–55M 3X/G24T KO / A1M	**0 811 404 659**
4WRLE 10 V–55M 3X/G24ET KO / A1M	**0 811 404 661**
4WRLE 10 V–85M 3X/G24 KO / A1M	**0 811 404 653**
4WRLE 10 V–85M 3X/G24T KO / A1M	**0 811 404 660**
4WRLE 10 V–85M 3X/G24ET KO / A1M	**0 811 404 662**
4WRLE 10 V1–55M 3X/G24 KO / A1M	**0 811 404 671**
4WRLE 10 V1–85M 3X/G24 KO / A1M	**0 811 404 672**
4WRLE 10 V1–85M 3X/G24ET KO / A1M	**0 811 404 673**
4WRLE 10 V–40P 3X/G24 KO / A1M	**0 811 404 686**
4WRLE 10 V1–40P 3X/G24 KO / A1M	**0 811 404 688**
4WRLE 10 V–70P 3X/G24 KO / A1M	**0 811 404 687**
4WRLE 10 V1–70P 3X/G24 KO / A1M	**0 811 404 689**

Type 4WRLE	Material No.
NG16	
4WRLE 16 V–120M 3X/G24 KO / A1M	**0 811 404 250**
4WRLE 16 V1–120M 3X/G24 KO / A1M	**0 811 404 279**
4WRLE 16 V1–120M 3X/G24ET KO / A1M	**0 811 404 281**
4WRLE 16 V–200M 3X/G24 KO / A1M	**0 811 404 251**
4WRLE 16 V–200M 3X/G24 KO / F1M	**0 811 404 272**
4WRLE 16 V1–200M 3X/G24 KO / A1M	**0 811 404 280**
4WRLE 16 V1–200M 3X/G24ET KO / A1M	**0 811 404 282**
4WRLE 16 V–90P 3X/G24 KO / A1M	**0 811 404 263**
4WRLE 16 V1–90P 3X/G24 KO / A1M	**0 811 404 265**
4WRLE 16 V–150P 3X/G24 KO / A1M	**0 811 404 264**
4WRLE 16 V1–150P 3X/G24 KO / A1M	**0 811 404 266**
NG25	
4WRLE 25 V–370M 3X/G24 KO / A1M	**0 811 404 430**
4WRLE 25 V1–370M 3X/G24 KO / A1M	**0 811 404 444**
4WRLE 25 V–370M 3X/G24E KO / F1M	**0 811 404 570**
4WRLE 25 V–300P 3X/G24 KO / A1M	**0 811 404 565**
NG35	
4WRLE 35 V–1000M 3X/G24 KO / A1M	**0 811 404 579**

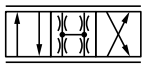
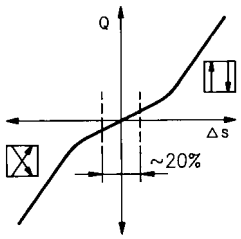
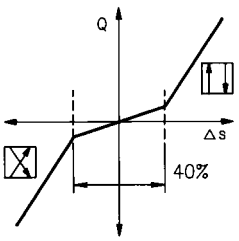
Function, sectional diagram

Servo solenoid valve 4WRLE 10...35

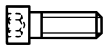
CE EN 61000-6-2
EN 61000-6-3



Symbols

	M: Progressive with fine metering	P: Non-linear, linear (40 %)
		

Accessories, not included in scope of delivery

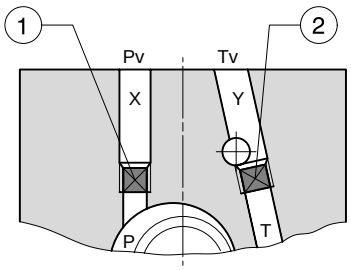
Fastening screws 	NG10	4 x M6 x 40, DIN 912-10.9		**2910151209**
	NG16	2 x M6 x 45, DIN 912-10.9		**2910151211**
		4 x M10 x 50, DIN 912-10.9		**2910151301**
	NG25	6 x M12 x 60, DIN 912-10.9		**2910151354**
	NG35	6 x M20 x 90, DIN 912-10.9		**2910151532**
* 	Line sockets 6P+PE, see also RE 08008		KS	**1834482022**
			KS	**1834482026**
			MS	**1834482023**
			MS	**1834482024**
			KS 90°	**1834484252**

Testing and service equipment

- Test box type VT-PE-TB3, see RE 30065
- Test adapter 6P+PE type VT-PA-2, see RE 30068

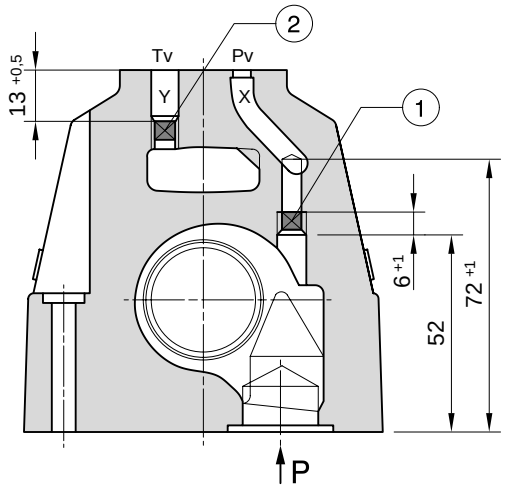
Control oil supply

NG10, 25, 35

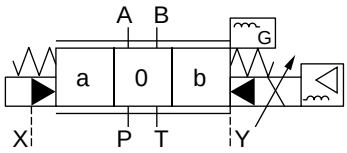


Plug ① ②
NG10...25 **1 813 464 007** SW 3
NG35 **1 813 464 001** SW 4

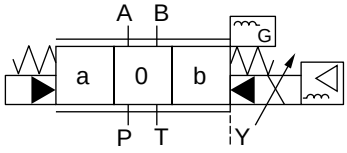
NG16



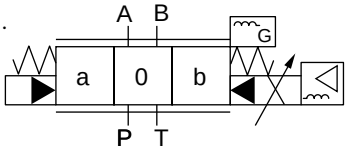
Type … –3X …



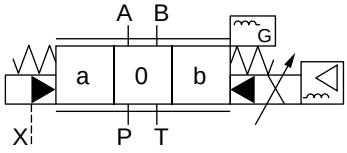
Type … –3X … E …



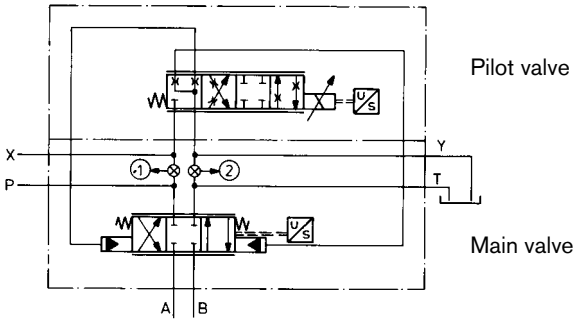
Type … –3X … ET …



Type … –3X … T …



Symbol in detail



No designation = “x” = external, “y” = external
E = “x” = internal, “y” = external
ET = “x” = internal, “y” = internal
T = “x” = external, “y” = internal

Conversion
The pilot valve can be supplied with oil both via ports X and Y (external) and from the main flow ducts P and T.
In the basic version, the valve is equipped with the plugs ① and ②, i.e. X and Y are external.
For valve versions with X and/or Y as internal, see ordering overview or carry out the conversion (see diagram above).
When the control oil supply or discharge is changed, the part number must also be changed.

Important
Hydraulic symbols are largely derived from the symbols of the switching valves. Servo solenoid valves (pilot operated) do not have a closed middle position when switched off! They only perform their function in an active, closed control loop, even when the pilot valve features a relief (fail-safe) 4th symbol.
For details on “switch-off behaviour”, see Technical data.

Technical data

General

Construction		Spool type valve, pilot operated					
Actuation		Servo solenoid valve NG6 – OBE, with position controller for pilot valve and main stage					
Type of mounting		Subplate, mounting hole configuration NG10...35 (ISO 4401-...)					
Installation position		Optional					
Ambient temperature range	°C	–20 … +50					
Weight	kg	**NG10** 8.7		**NG16** 10.6		**NG25** 18.4	**NG35** 81
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)					

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524 … 535, other fluids after prior consultation									
Viscosity range	recommended mm²/s	20 … 100									
	max. permitted mm²/s	10 … 800									
Pressure fluid temperature range	°C	–20 … +70									
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]									
Flow direction		see symbol									
Nominal flow at $\Delta p = 5$ bar per notch [2]	l/min	**NG10**				**NG16**				**NG25**	**NG35**
		40	55	70	85	90	120	150	200	370	1,000
Max. working pressure	bar	Port P, A, B: 350									
Max. pressure	bar	Port T, X, Y: 250									
$q_{max.}$	l/min	170				450				900	3,500
q_N pilot valve	l/min	4				12				24	40
Leakage of pilot valve at 100 bar	cm³/min	<180				<300				<500	<900
Leakage of main stage at 100 bar	cm³/min	<400		<600		<1,000				<1,000	<6,000
Control oil pressure “pilot stage”	bar	min. 10									
	bar	max. 250									

Static/Dynamic

Hysteresis	%	< 0.1, scarely measurable			
Manufacturing tolerance for $q_{max.}$	%	≦ 10			
Response time for signal change (at X = 100 bar)	0 … 100 %	25	26	32	90
	0 … 10 %	14	15	18	40
Response time for signal change (at X = 10 bar)	0 … 100 %	85	80	120	350
	0 … 10 %	50	30	50	150
Switch-off behaviour		After electrical switch-off: pilot valve in “fail-safe” Main stage moves to spring-centred “offset position”: 1 … 6 % P-B/A-T			
Thermal drift		Zero point displacement <1 % at $\Delta T = 40\,°C$			
Zero adjustment		Factory-set ±1 %			
Conformity		CE EN 61000-6-2 EN 61000-6-3			

[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

[2] Flow rate at a different Δp $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

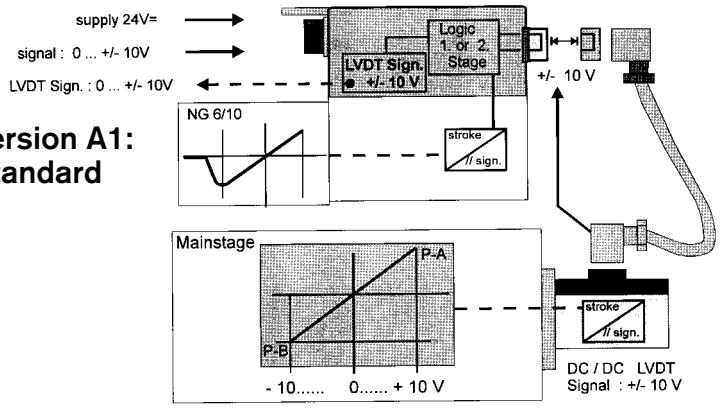
Important
Pilot operated servo solenoid valves only perform their function in an active closed control loop and do not have a safe basic position when switched off. For this reason, many applications require the use of “additional check valves”, which must be taken into account during the On/Off switching sequence.

Technical data

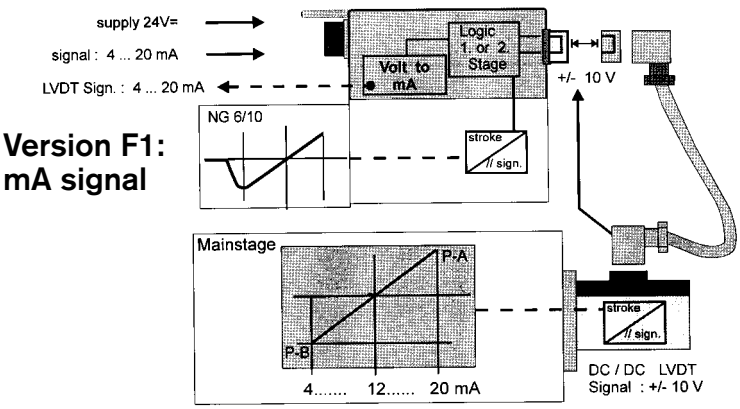
Electric pilot valve NG6, trigger electronics integrated in the valve

Cylic duration factor %	100
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5
Connection	Line socket 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V	24 V DC_{nom} min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption	Solenoid ☑ 45 mm = 40 VA max.
External fuse	2.5 A_F
Input, “Standard” version Terminal D: U_E Terminal E:	Difference amplifier, $R_i = 100\ \Omega$ 0...±10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	Burden, $R_{sh} = 200\ \Omega$ 4...(12)...20 mA Curent loop I_{D-E} feedback
Max. differential input voltage at 0 V	D → B E → B } max. 18 V DC
Test signal, “Standard” version Terminal F: U_{Test} Terminal C:	LVDT 0...±10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Protective conductor and screen	See pin assignment (installation conforms to CE)
Recommended cable	See pin assignment up to 20 m 7x0.75 mm² up to 40 m 7x1 mm²
Calibration	Calibrated at the factory, see valve performance curve

Version A1: Standard

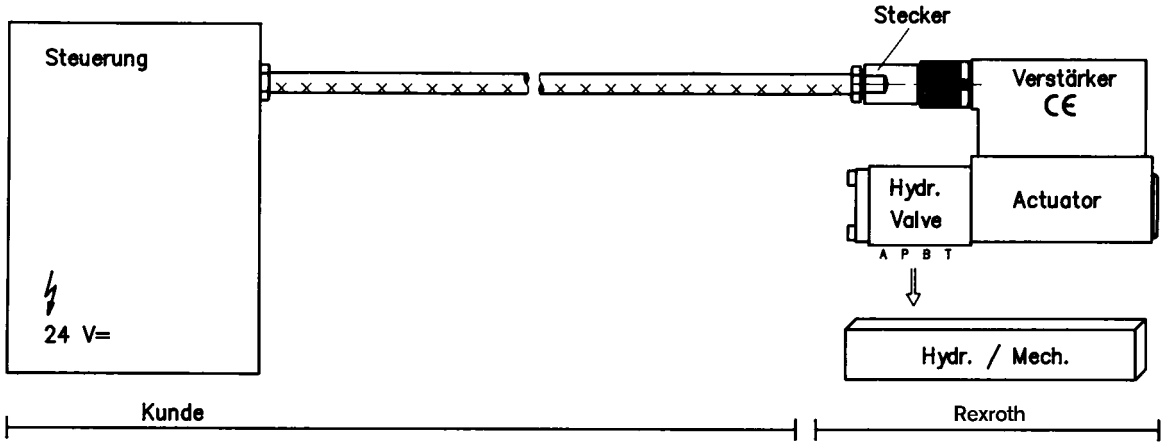


Version F1: mA signal



Connection

For electrical data, see page 6 and
Operating Instructions **1 819 929 083**



Technical notes on the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Protective conductor, green/yellow
- Cu braided screen

Types:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug types and signal assignment

Cable Ø:
- 0.75 mm² to 20 m length
- 1.0 mm² to 40 m length

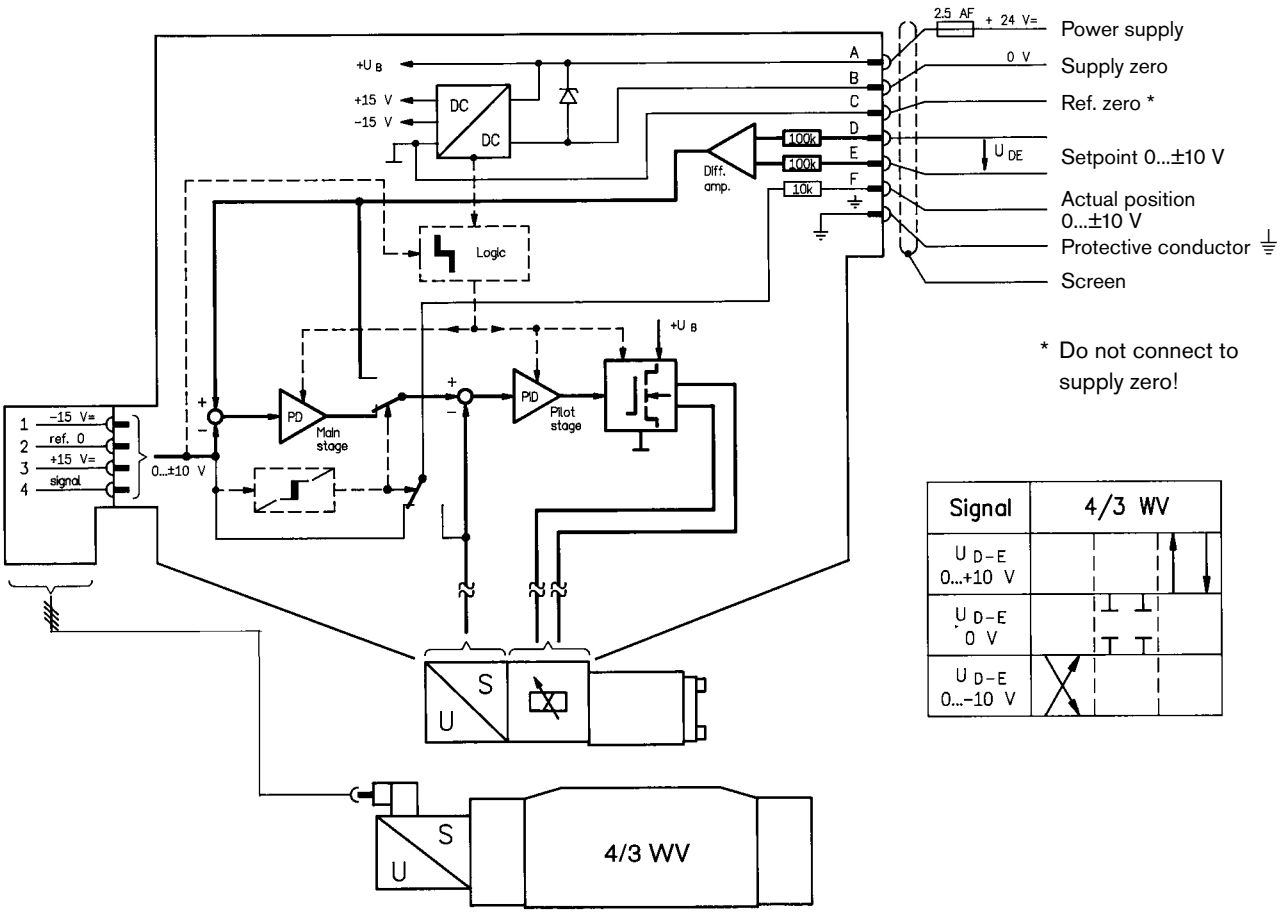
Outside Ø:
- 9.4 ... 11.8 mm – Pg11
- 12.7 ... 13.5 mm – Pg16

Important

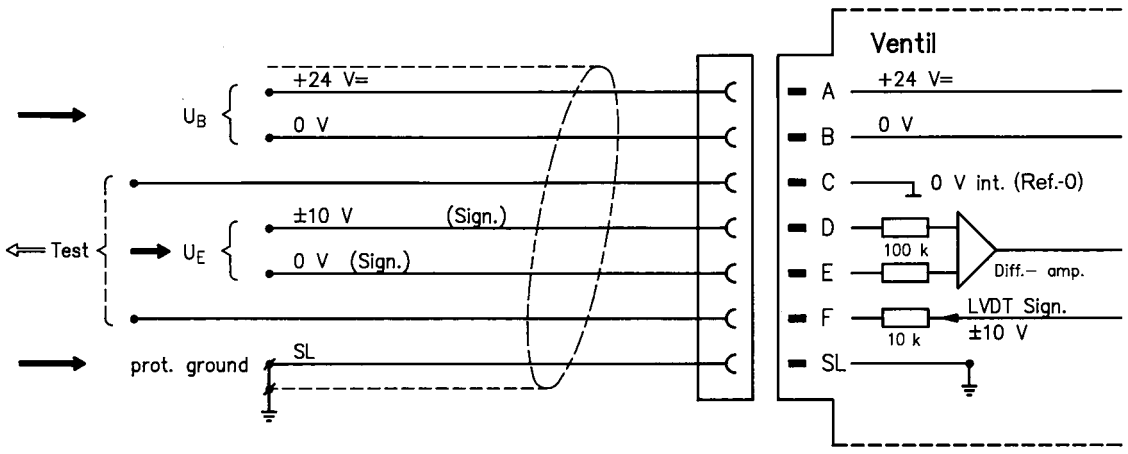
Voltage supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions! (See European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982!)

On-board trigger electronics

Block diagram/pin assignment
Version A1: U_{D-E} ±10 V

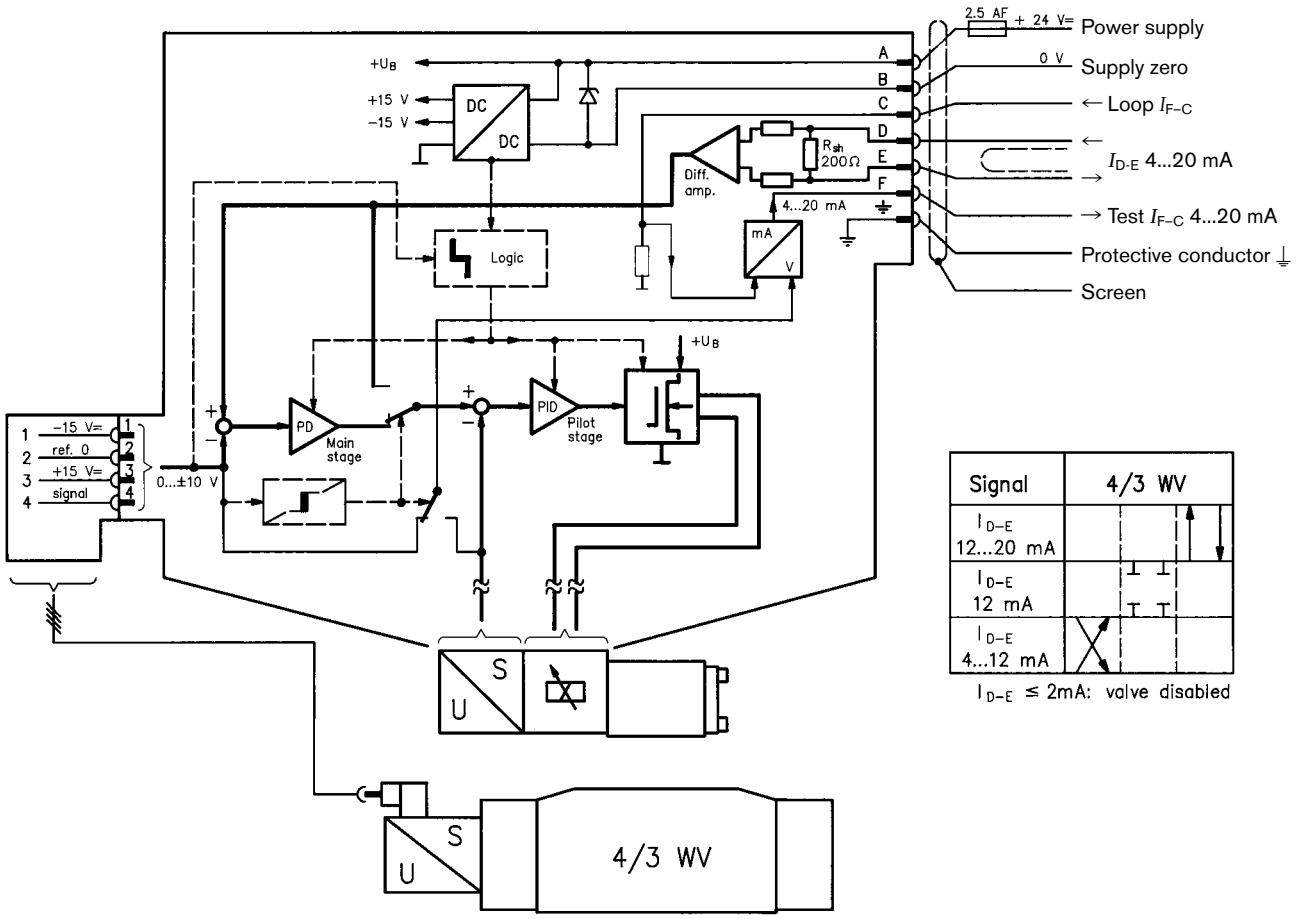


Pin assignment 6P+PE
Version A1: U_{D-E} ±10 V
(R_i = 100 kΩ)

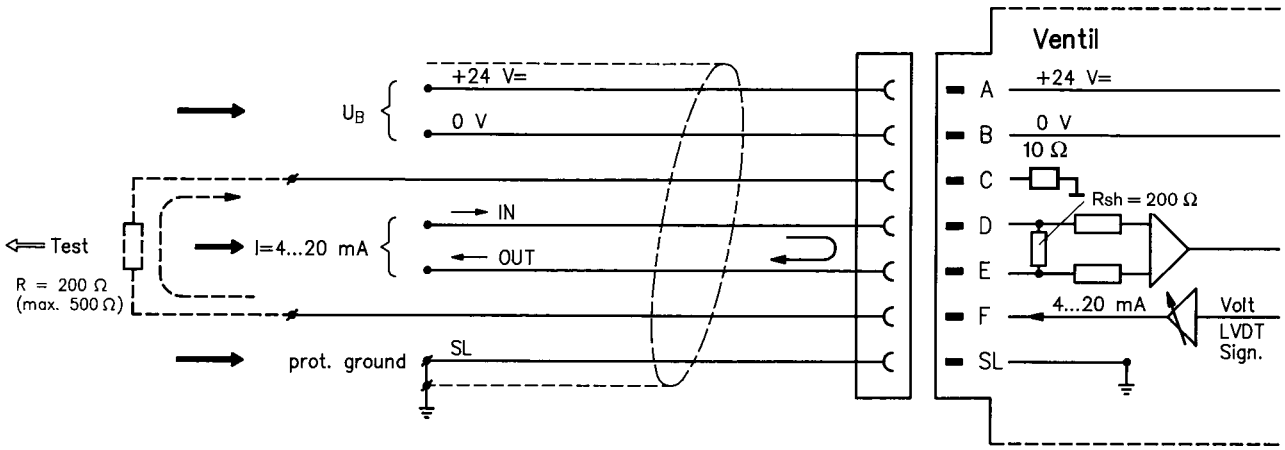


On-board trigger electronics

Block diagram/pin assignment
Version F1: I_{D-E} 4...12...20 mA

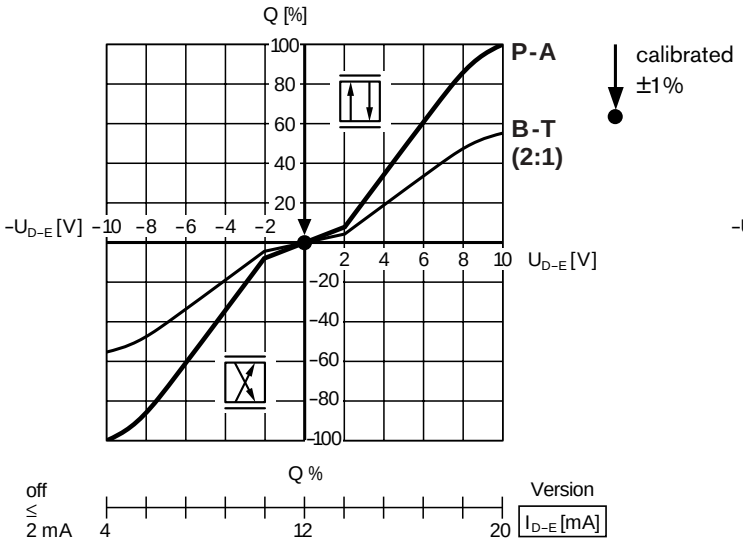


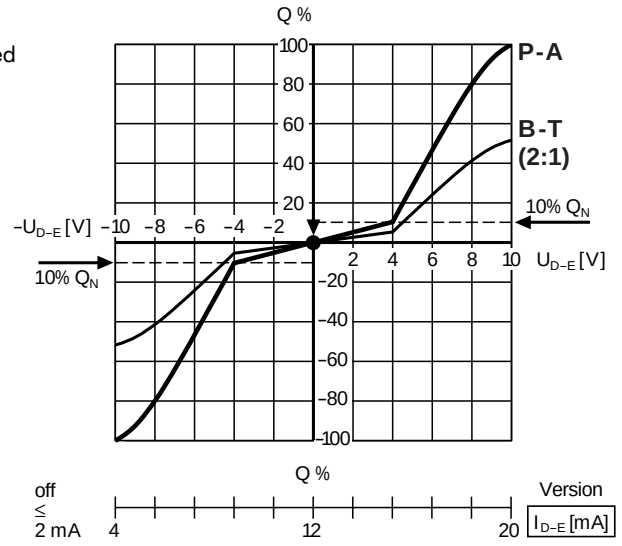
Pin assignment 6P+PE
Version F1: I_{D-E} 4...12...20 mA
($R_{sh} = 200\,\Omega$)



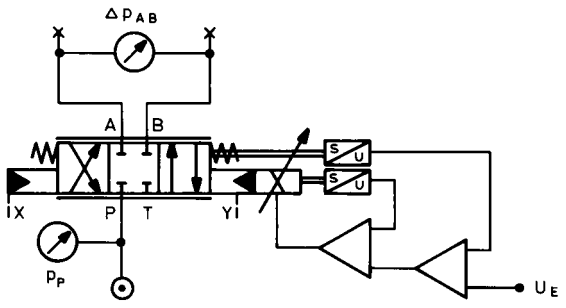
Performance curves (measured with HLP46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

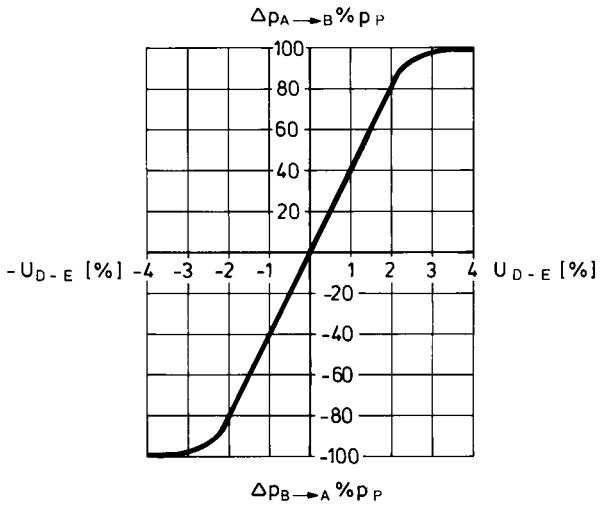
Flow rate – Signal function $Q = f(U_{D-E})$
$Q = f(I_{D-E})$





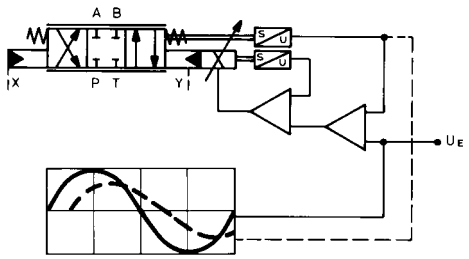
Pressure gain



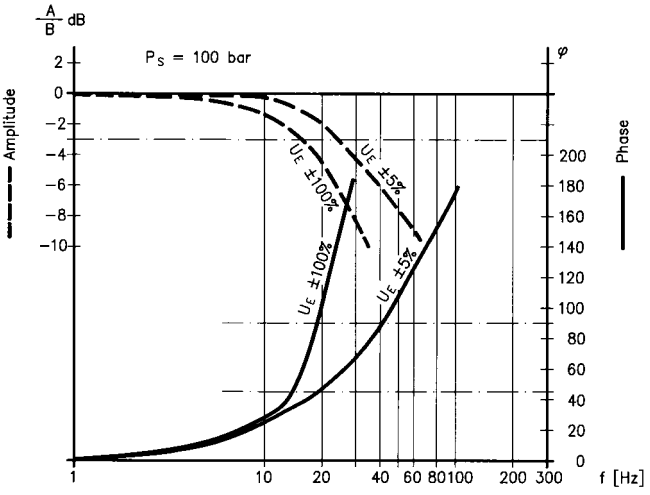


Performance curves (measured with HLP46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

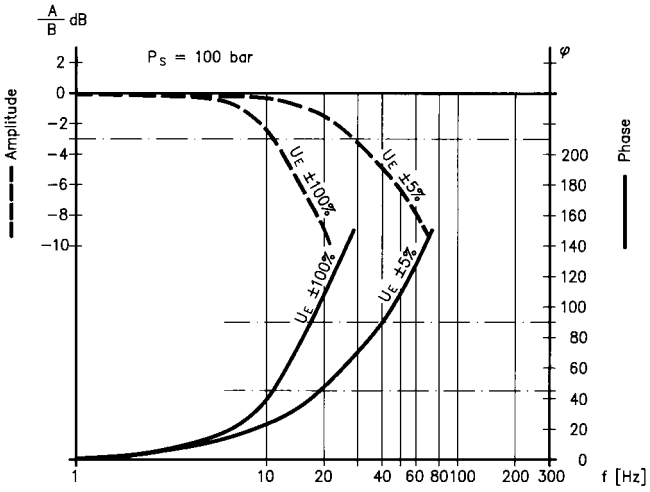
Bode diagrams



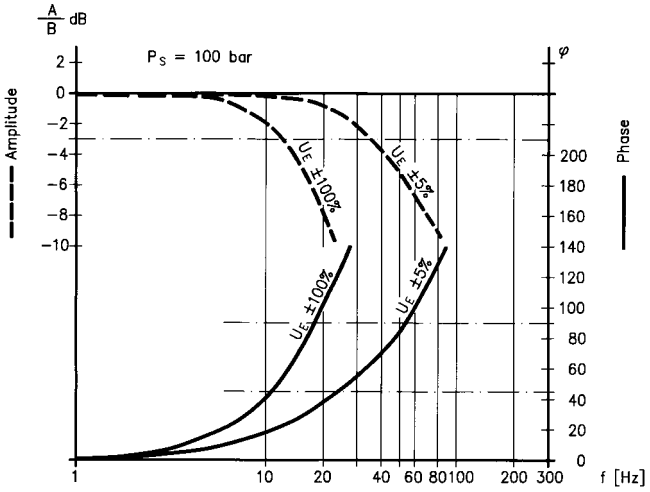
NG10



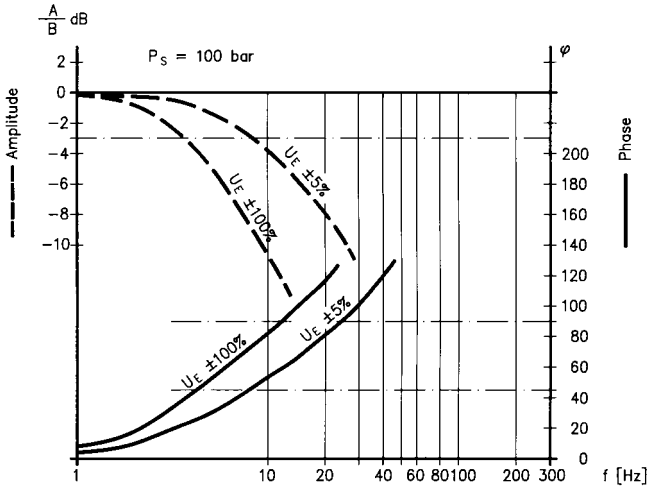
NG16



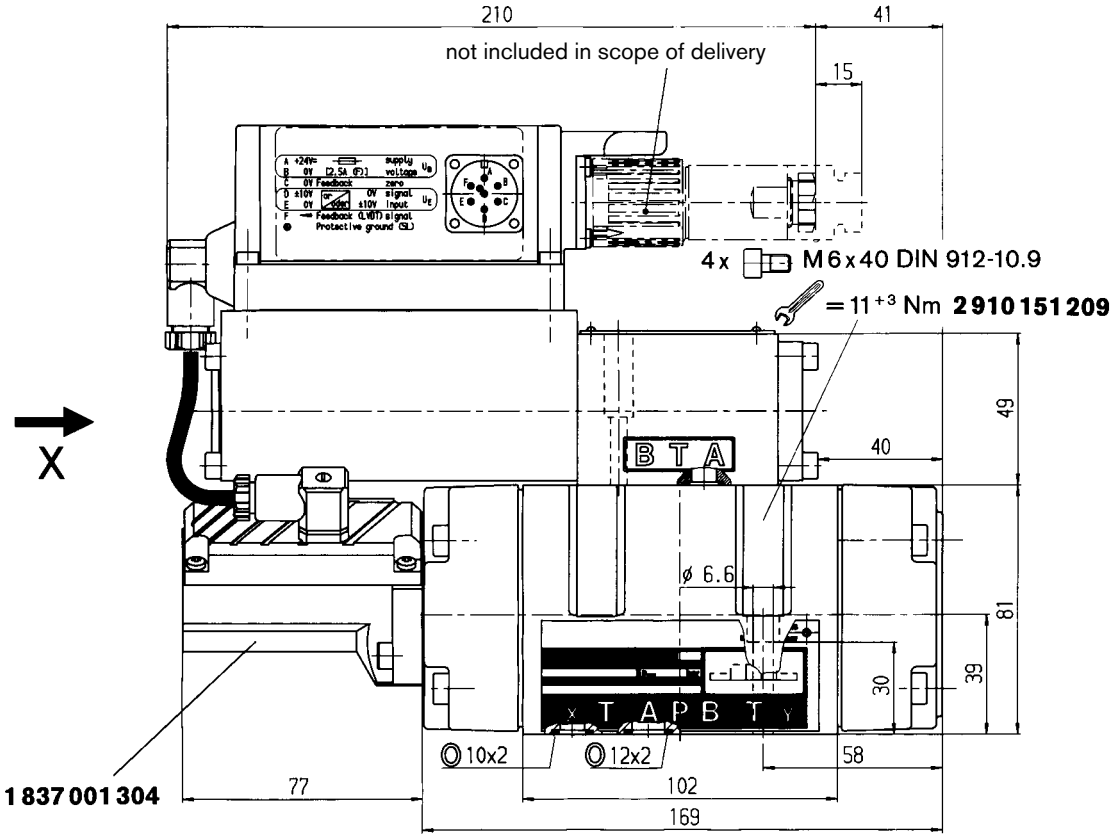
NG25



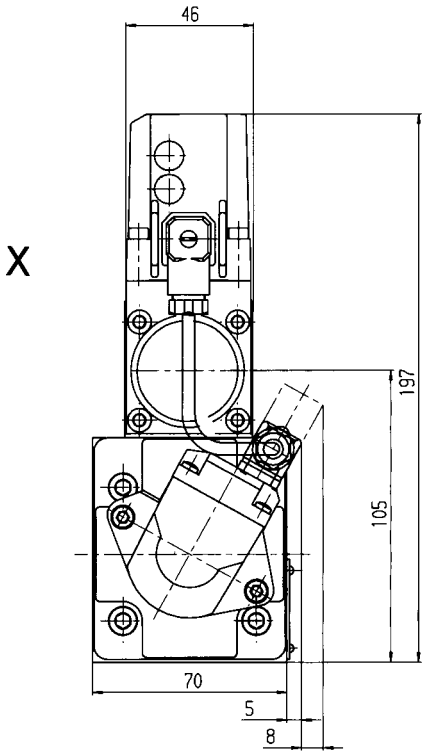
NG35



Unit dimensions NG10 (nominal dimensions in mm)

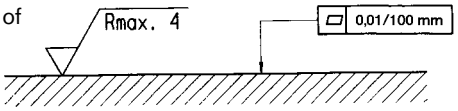


Set **1817010280**

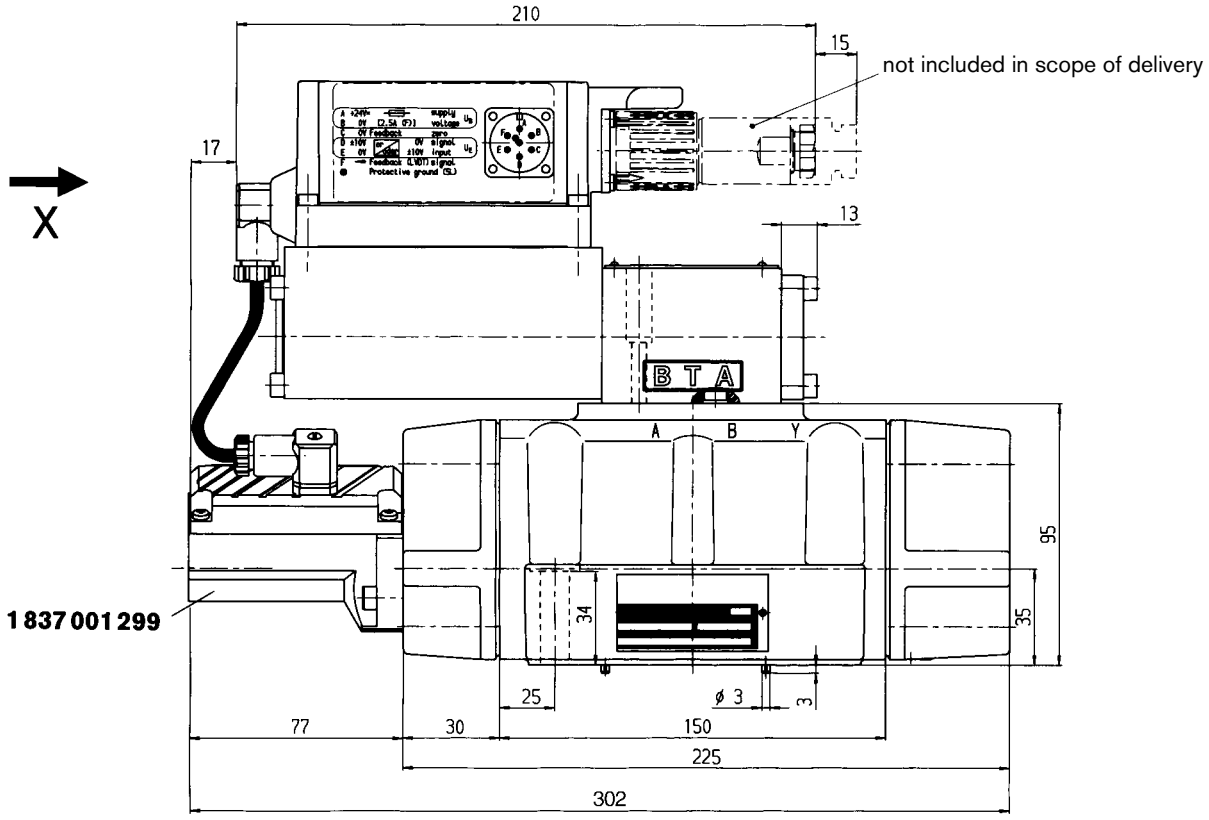


Mounting hole configuration: NG10
(ISO 4401-05-05-0-94),
see page 16
For subplates, see catalogue section RE 45055

Required surface quality of mating component



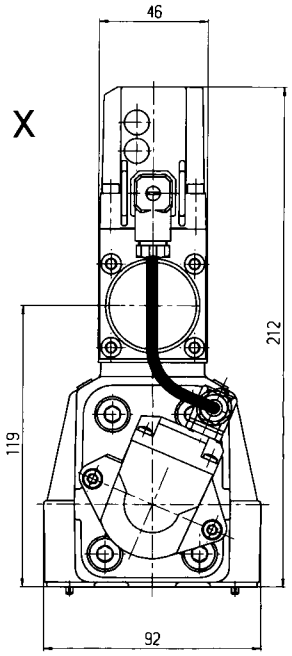
Unit dimensions NG16 (nominal dimensions in mm)



○ X, Y Ø 9x2
○ P, A, B, T Ø 23x2,5
○ Set **1817010275**

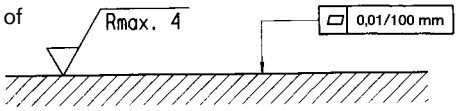
2 x M 6 x 45, DIN 912-10.9 11^{+3} Nm
4 x M 10 x 50, DIN 912-10.9 50^{+10} Nm

M 6x45 **2910151211**
M 10x50 **2910151301**

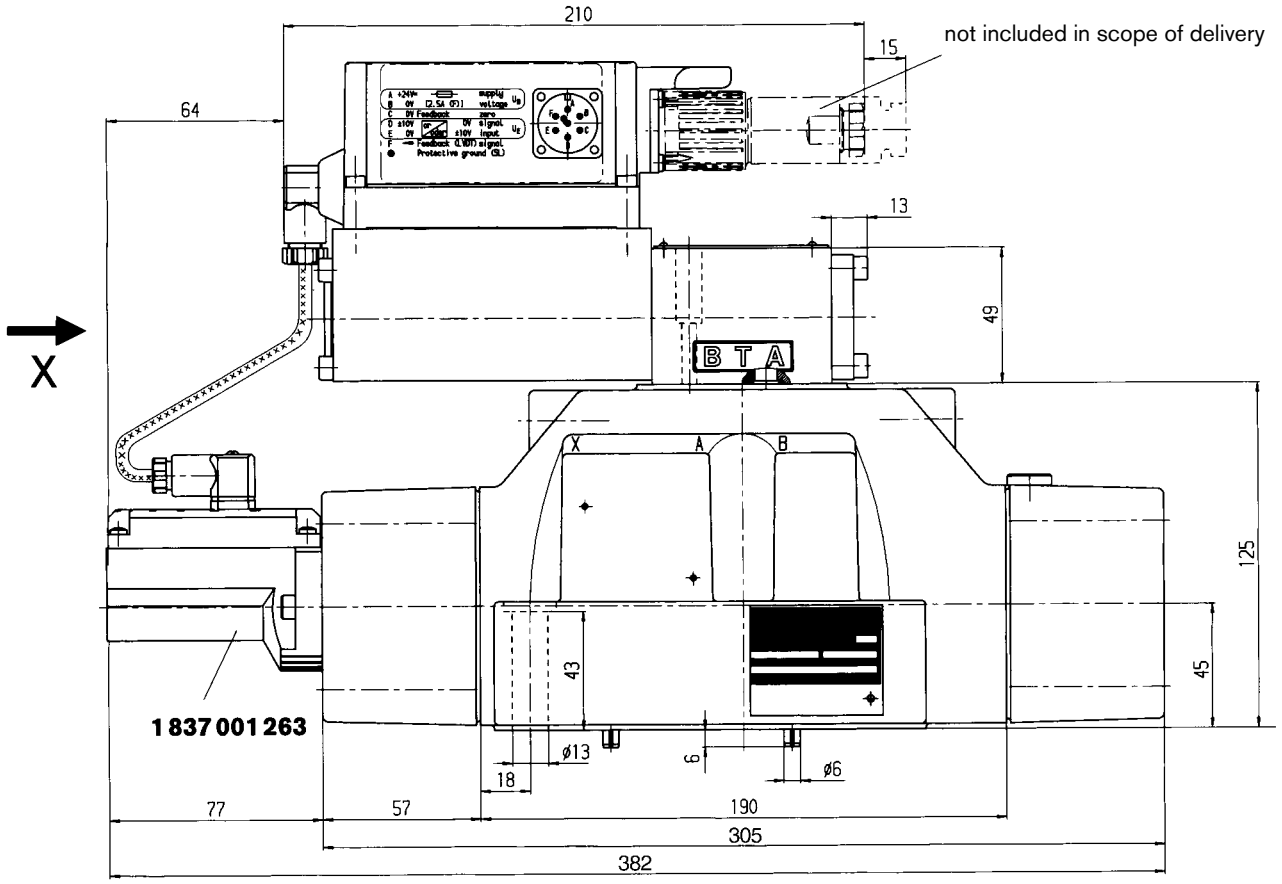


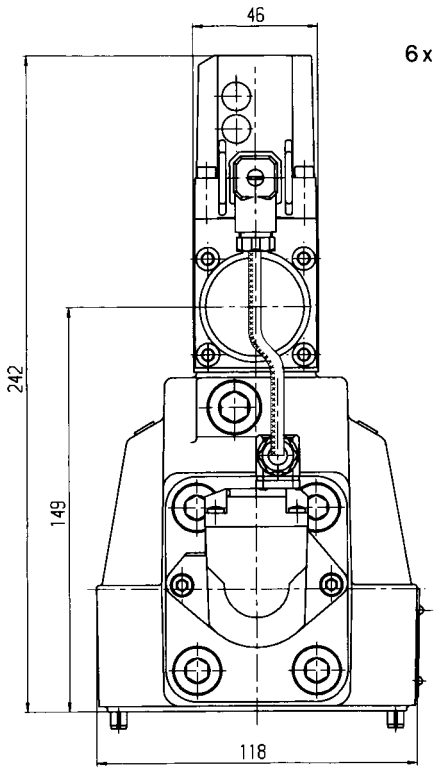
Mounting hole configuration: NG16
(ISO 4401-07-06-0-94),
see page 16
For subplates, see catalogue section RE 45057

Required surface quality of mating component



Unit dimensions NG25 (nominal dimensions in mm)





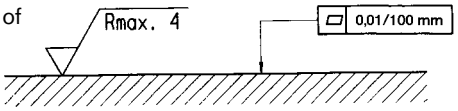
X

- X, Y Ø 15 x 2,5
- P, A, B, T Ø 28 x 3
- Set **1 817 010 273**

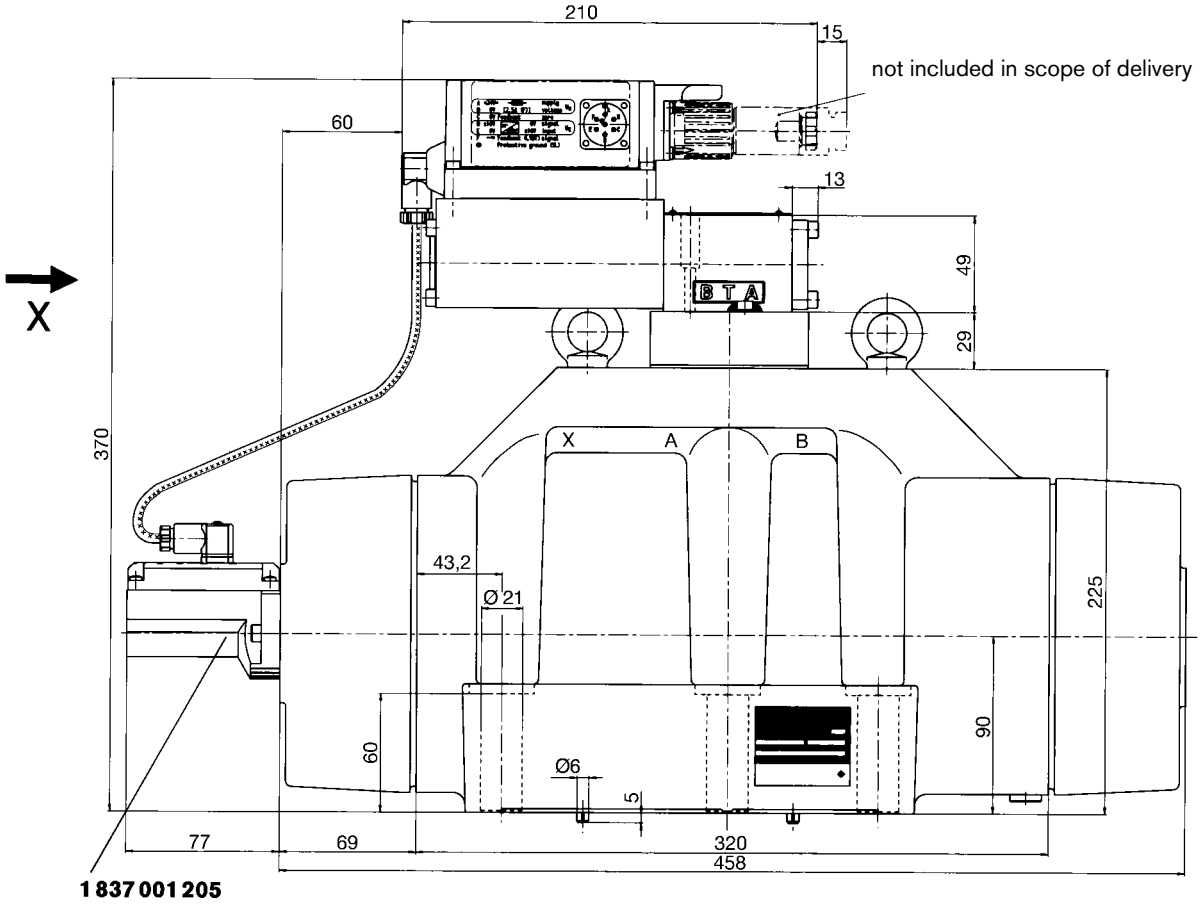
6 x M 12 x 60 DIN 912-10.9
= 90 +30 Nm
2 910 151 354

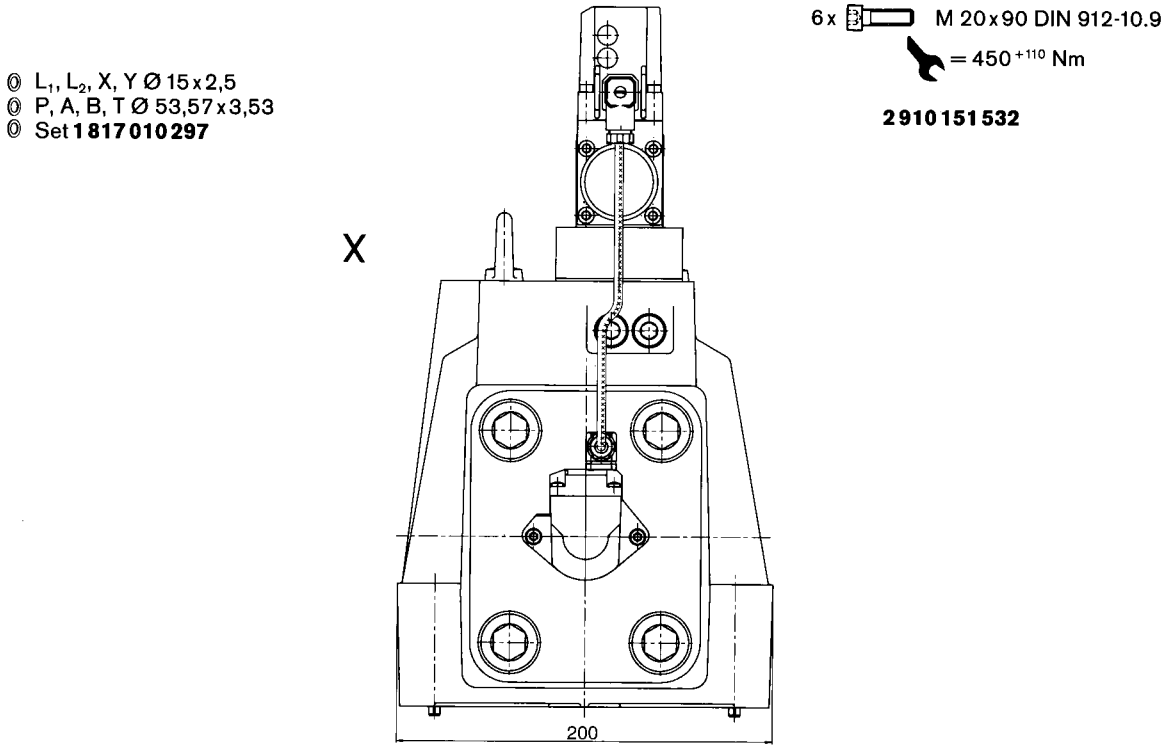
Mounting hole configuration: NG25
(ISO 4401-08-07-0-94),
see page 17
For subplates, see catalogue section RE 45059

Required surface quality of mating component



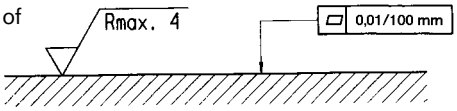
Unit dimensions NG35 (nominal dimensions in mm)





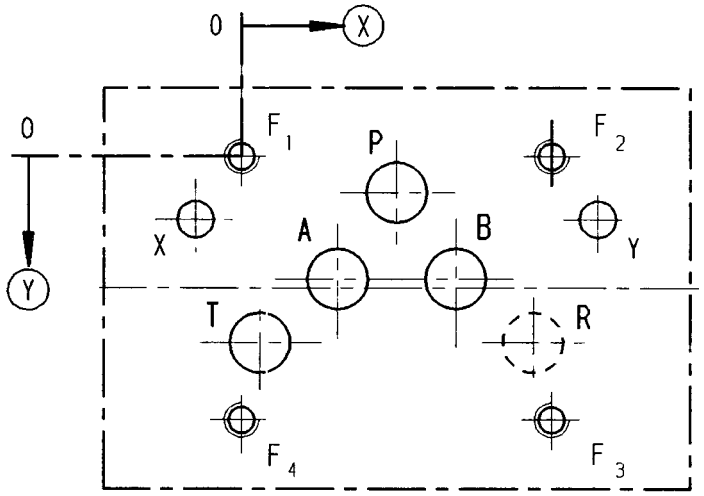
Mounting hole configuration: NG32
(ISO 4401-10-08-0-94),
see page 17
For subplates, see catalogue section RE 45060

Required surface quality of mating component



Mounting hole configurations (nominal dimensions in mm)

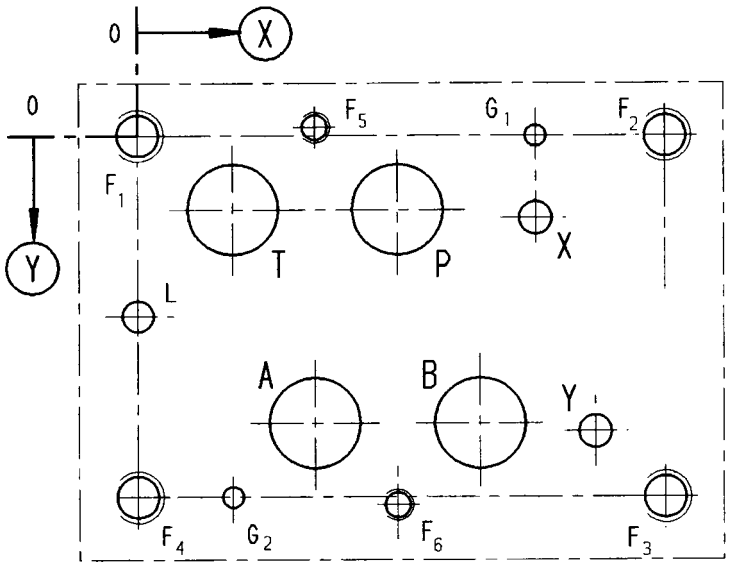
NG10 – ISO 4401-05-05-0-94



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* (NG10 min. 10.5 mm)

	P	A	T	B	F_1	F_2	F_3	F_4	X	Y	R
⊗	27	16.7	3.2	37.3	0	54	54	0	–8	62	50.8
Ⓨ	6.3	21.4	32.5	21.4	0	0	46	46	11	11	32.5
∅	10.5 1)	10.5 1)	10.5 1)	10.5 1)	M6 2)	M6 2)	M6 2)	M6 2)	6.3	6.3	10.5 1)

NG16 – ISO 4401-07-06-0-94

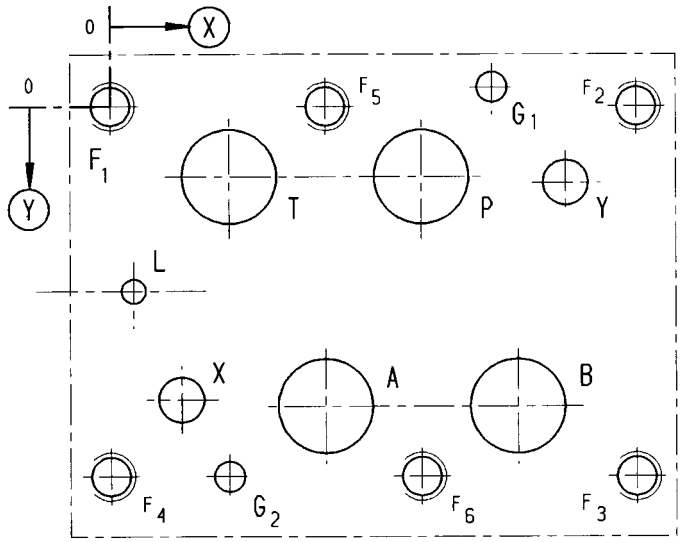


1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	L	X	Y	G_1	G_2	F_1	F_2	F_3	F_4	F_5	F_6
⊗	50	34.1	18.3	65.9	0	76.6	88.1	76.6	18.3	0	101.6	101.6	0	34.1	50
Ⓨ	14.3	55.6	14.3	55.6	34.9	15.9	57.2	0	69.9	0	0	69.9	69.9	–1.6	71.5
∅	20 1)	20 1)	20 1)	20 1)	6.3	6.3	6.3	4	4	M10 2)	M10 2)	M10 2)	M10 2)	M6 2)	M6 2)

Mounting hole configurations (nominal dimensions in mm)

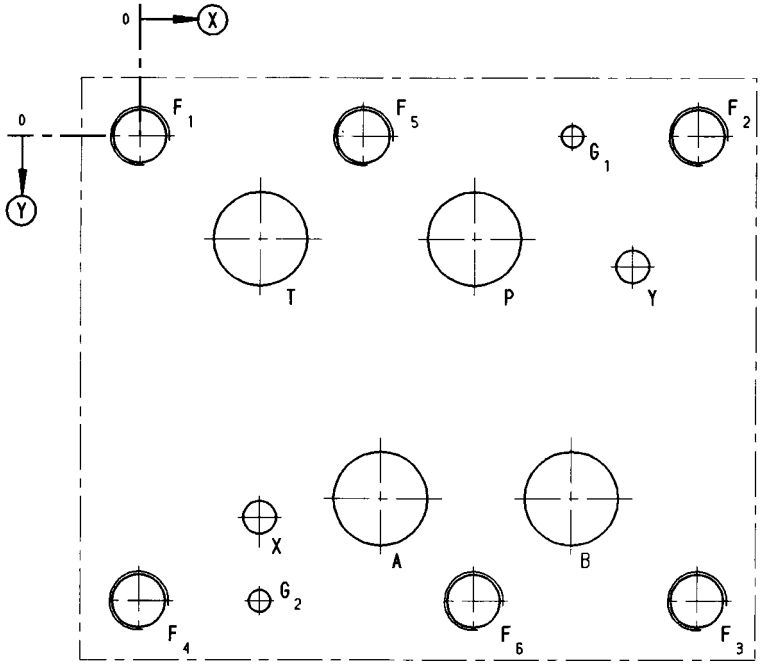
NG25 – ISO 4401-08-07-0-94



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	L	X	Y	G_1	G_2	F_1	F_2	F_3	F_4	F_5	F_6
⊗	77	53.2	29.4	100.8	5.6	17.5	112.7	94.5	29.4	0	130.2	130.2	0	53.2	77
Ⓨ	17.5	74.6	17.5	74.6	46	73	19	–4.8	92.1	0	0	92.1	92.1	0	92.1
∅	25 1)	25 1)	25 1)	25 1)	11.2	11.2	11.2	7.5	7.5	M12 2)	M12 2)	M12 2)	M12 2)	M12 2)	M12 2)

NG32 – ISO 4401-10-08-0-94



1) Deviates from standard (NG35)
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	X	Y	G_1	G_2	F_1	F_2	F_3	F_4	F_5	F_6
⊗	114.3	82.5	41.3	147.6	41.3	168.3	147.6	41.3	0	190.5	190.5	0	76.2	114.3
Ⓨ	35	123.8	35	123.8	130.2	44.5	0	158.8	0	0	158.8	158.8	0	158.8
∅	48 1)	48 1)	48 1)	48 1)	11.2	11.2	7.5	7.5	M20 2)	M20 2)	M20 2)	M20 2)	M20 2)	M20 2)

Notes

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