

Proportional flow control valve, with on-board electronics (OBE) and inductive position transducer

RE 29221/08.05

1/14

Type 3FREEZ

Nominal size 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 10...70 l/min



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Features

- Directly controlled flow control valves NG6 and NG10 with on-board electronics and inductive position transducer
- With position control, minimal hysteresis < 1 %, see Technical Data
- The 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way)
- Adjustable by means of the controlled solenoid position, the position transducer and the on-board electronics
- For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94, NG10 to ISO 4401-05-04-0-94
- Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
 - Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
 - $U_B = 24 V_{\text{nom}}$ DC
 - Electrical connection 6P+PE
 - Signal actuation
 - Standard 0...+10 V (A1)
 - Valve curve calibrated at the factory

Ordering data

| | | | | | | | | | | | | |
|--|------------|----------|----------|--------------|----------|----------|----------------|-----------|----------|----------|----------|-----------------------------------|
| 3 | FRE | E | Z | B-1X/ | L | 2 | G24-K31 | A1 | M | M | * | Further information in plain text |
| 3-way = 3 | | | | | | | | | | | | |
| Proportional flow control valve, with position control | | | | | | | | | | | | |
| With on-board electronics = E | | | | | | | | | | | | |
| With inductive position transducer = Z | | | | | | | | | | | | |
| NG6 = 6 | | | | | | | | | | | | |
| NG10 = 10 | | | | | | | | | | | | |
| Without external closing fixture for pressure compensator = B | | | | | | | | | | | | |
| Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = 1X | | | | | | | | | | | | |
| Nominal flow rate | | | | | | | | | | | | |
| 10 l/min ($\Delta p = 8$ bar pressure drop) = 10 | | | | | | | | | | | | |
| 35 l/min ($\Delta p = 8$ bar pressure drop) = 35 | | | | | | | | | | | | |
| 70 l/min ($\Delta p = 8$ bar pressure drop) = 70 | | | | | | | | | | | | |
| Flow characteristic (L = linear) = L | | | | | | | | | | | | |
| Setpoint input +10 V, $Q = 0$ l/min (NC) = 2 | | | | | | | | | | | | |
| * Version "F1" (4...20 mA version) available on request | | | | | | | | | | | | |

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

M = Without non-return valve

Interface for trigger electronics*

A1 = Setpoint input 0...+10 V

K31 = **Electrical connection**
without plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

G24 = Voltage supply of trigger electronics
24 V DC

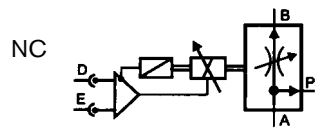
Preferred types

| NG6 | | NG10 | |
|-----------------------------|-----------------|------------------------------|-----------------|
| Type | Material Number | Type | Material Number |
| 3FREEZ6B-1X/10L2G24-K31A1MM | 0 811 403 150 | 3FREEZ10B-1X/70L2G24-K31A1MM | 0 811 403 019 |
| 3FREEZ6B-1X/35L2G24-K31A1MM | 0 811 403 151 | | |

Symbols

For on-board electronics

3-way, normally closed

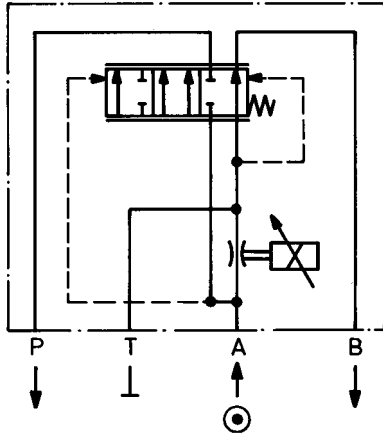


General

Flow control valves are directly actuated throttle valves with integrated pressure compensator.

3-way flow control valve

- A: Supply
- B: Discharge
- P: Residual flow, capacity up to 250 bar, or tank
- T: Closed



Function, sectional diagram


General

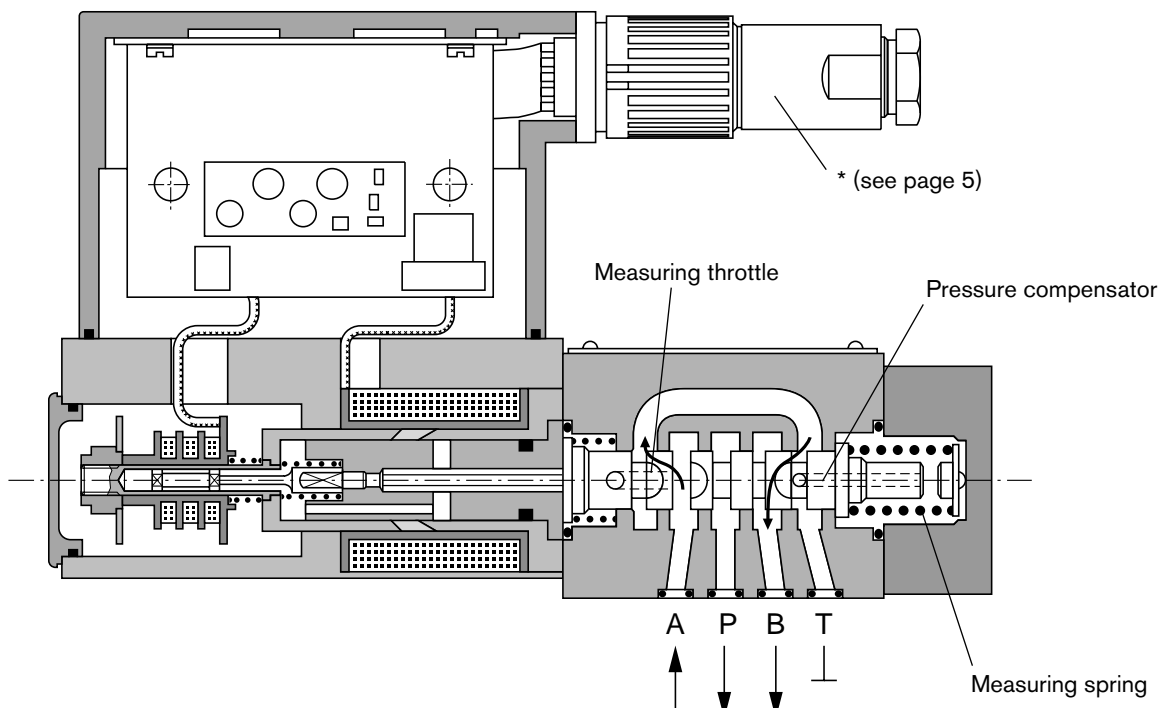
Type 3FREEZ proportional flow control valves with position control and on-board electronics are available in nominal sizes 6 and 10. They are actuated by means of a proportional solenoid with inductive position transducer. Hysteresis is $< 1\%$. The on-board electronics are calibrated at the factory and enable rapid response times. The design of the valve body is such that the residual flow runs through port P.

Basic principle

To adjust the oil flow rate from B, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil as a function of the signal from the position transducer. The position control ensures very low hysteresis. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of an 8-bar measuring spring. The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula: "Load pressure plus force of measuring spring". In this way, the pressure drop over the metering edge is maintained at a constant level.


NG6

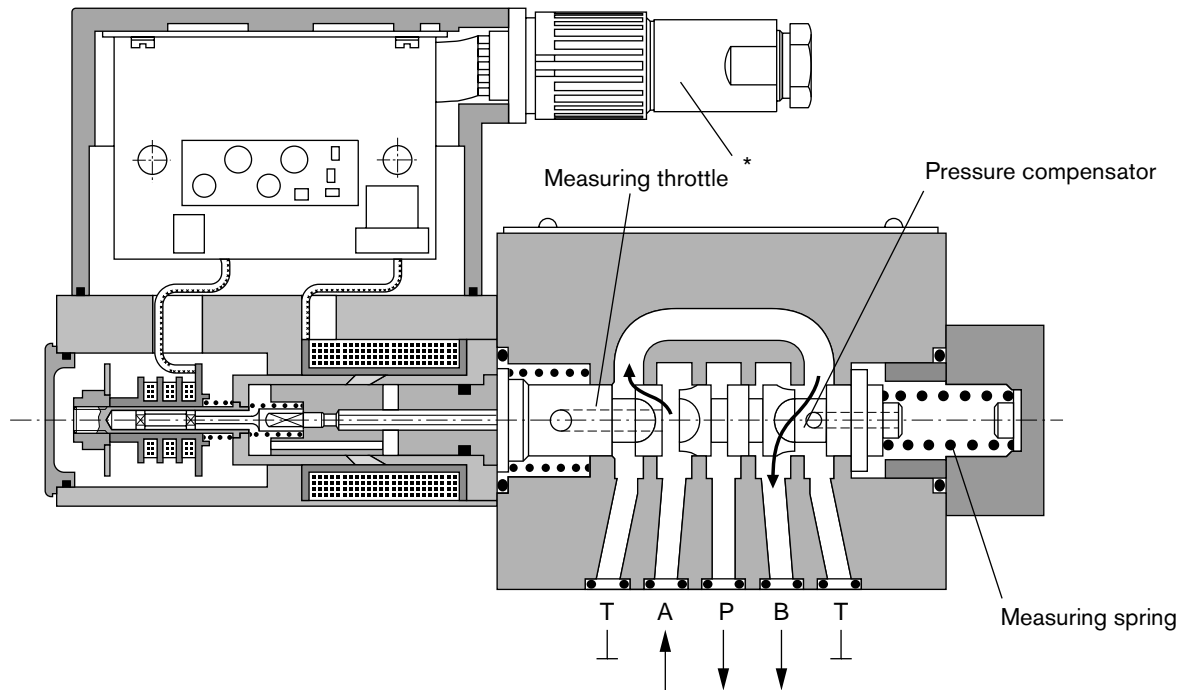
 EN 61000-6-2: 2002-08
 EN 61000-6-3: 2002-08






Function, sectional diagram

NG10

 EN 61000-6-2: 2002-08
 EN 61000-6-3: 2002-08



Accessories

| Type | | Material Number | |
|--|--|-----------------|---------------|
| (4x)  ISO 4762-M5x30-10.9 | Cheese-head bolts NG6 | 2 910 151 166 | |
| (4x)  ISO 4762-M6x35-10.9 | Cheese-head bolts NG10 | 2 910 151 207 | |
| *  | Plug-in connectors 6P+PE, see also RE 08008 | KS | 1 834 482 022 |
| | | KS | 1 834 482 026 |
| | | MS | 1 834 482 023 |
| | | MS | 1 834 482 024 |
| | | KS 90° | 1 834 484 252 |

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065

Measuring adapter 6P+PE type VT-PA-2, see RE 30068


Technical data

| General | | |
|--------------------------------------|---|-----|
| Construction | Spool-type valve with integrated pressure compensator | |
| Actuation | Proportional solenoid with position control and on-board electronics OBE | |
| Connection type | Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94), NG10 (ISO 4401-05-04-0-94) | |
| Mounting position | Optional | |
| Ambient temperature range | °C -20...+50 | |
| Weight | NG6 kg | 3.1 |
| | NG10 kg | 6.9 |
| Vibration resistance, test condition | Max. 25 g, shaken in 3 dimensions (24 h) | |

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

| | | | |
|---|---|---|-------------|
| Pressure fluid | Hydraulic oil to DIN 51524...535, other fluids after prior consultation | | |
| Viscosity range, | recommended mm ² /s | 20...100 | |
| | max. permitted mm ² /s | 10...800 | |
| Pressure fluid temperature range | °C | -20...+70 | |
| Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c) | Class 18/16/13 ¹⁾ | | |
| Direction of flow, see symbol | NG6 | | NG10 |
| Nominal flow rate Q_B with closed-loop control | l/min | 10 | 35 |
| Pressure drop Δp | bar | 8 | 8 |
| Supply flow rate $Q_{A\max}$ | l/min | 50 | 50 |
| Minimum pressure drop $p_A > p_B$ | bar | 14 | 14 |
| Max. working pressure | bar | Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar | |

Static/Dynamic

| | | | |
|--|--|-------|-------|
| Hysteresis | % | ≤ 1 | ≤ 1 |
| Range of inversion | % | ≤ 0.5 | ≤ 0.5 |
| Manufacturing tolerance | % | ≤ 5 | ≤ 5 |
| Resp. time 100%/signal change 10% | ms | 25/25 | 35/25 |
| Correction time on max. load change (pressure compensator) | ms | ≤ 30 | ≤ 45 |
| Conformity |  EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08 | | |

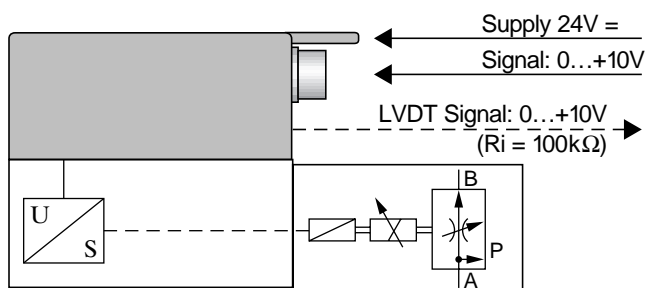
¹⁾ The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

Technical data

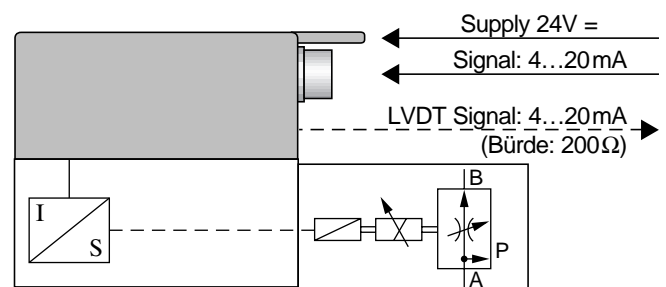
| Electrical, trigger electronics integrated in valve | | |
|---|-----|--|
| Cyclic duration factor | % | 100 |
| Degree of protection | | IP 65 to DIN 40050 and IEC 14434/5 |
| Connection | | Plug-in connector 6P+PE, DIN 43563 |
| Supply voltage | | 24 V DC _{nom} |
| Terminal A: | | Min. 21 V DC/max. 40 V DC |
| Terminal B: 0 V | | Ripple max. 2 V DC |
| Power consumption | | Solenoid \square 45 mm = 40 VA max. |
| External fuse | | 2.5 A _F |
| Input, "standard" version | A1 | Differential amplifier, $R_i = 100 \text{ k}\Omega$ |
| Terminal D: U_E | | 0...+10 V |
| Terminal E: | | 0 V |
| Input, "mA signal" version | F1* | Burden, $R_{sh} = 200 \Omega$ |
| Terminal D: I_{D-E} | | 4...20 mA |
| Terminal E: I_{D-E} | | Current loop I_{D-E} feedback |
| Max. voltage to differential inputs over 0 V | | $\left. \begin{array}{l} D \rightarrow B \\ E \rightarrow B \end{array} \right\} \text{max. } 18 \text{ V DC}$ |
| Test signal, "standard" version | A1 | LVDT |
| Terminal F: U_{Test} | | 0...+10 V |
| Terminal C: | | Reference 0 V |
| Test signal, "mA signal" version | F1* | LVDT signal 4...20 mA at external load 200...500 Ω max. |
| Terminal F: I_{F-C} | | 4...20 mA output |
| Terminal C: I_{F-C} | | Current loop I_{F-C} feedback |
| Safety earth conductor and shield | | See pin assignment (installation in conformity with CE) |
| Recommended cable | | See pin assignment up to 20 m 7 x 0.75 mm ² up to 40 m 7 x 1 mm ² |
| Calibration | | Calibrated at the factory, see valve curve |

* Version "F1" (4...20 mA version) available on request

Version A1: Standard

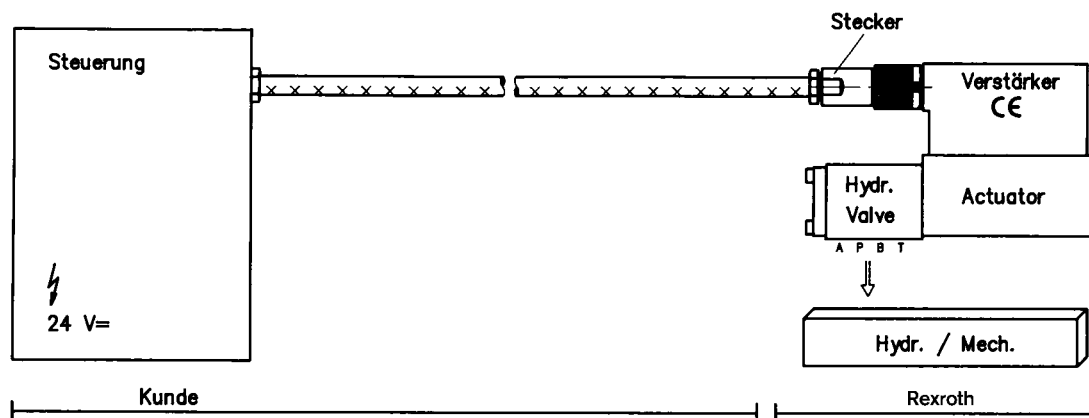


* Version F1: mA Signal



Connection

For electrical data, see page 7 and
Operating Instructions 1 819 929 083



Technical notes for the cable

- Design:**
- Multi-wire cable
 - Extra-finely stranded wire to VDE 0295, Class 6
 - Safety earth conductor, green/yellow
 - Cu braided shield
- Type:**
- e.g. Ölflex-FD 855 CP (from Lappkabel company)
- No. of wires:**
- Determined by type of valve, plug type and signal assignment
- Cable Ø:**
- 0.75 mm² up to 20 m long
 - 1.0 mm² up to 40 m long
- Outside Ø:**
- 9.4...11.8 mm – Pg 11
 - 12.7...13.5 mm – Pg 16

Important

Power 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:

$I_{D-E} \geq 3 \text{ mA}$ – valve is active

$I_{D-E} \leq 2 \text{ mA}$ – valve is deactivated.

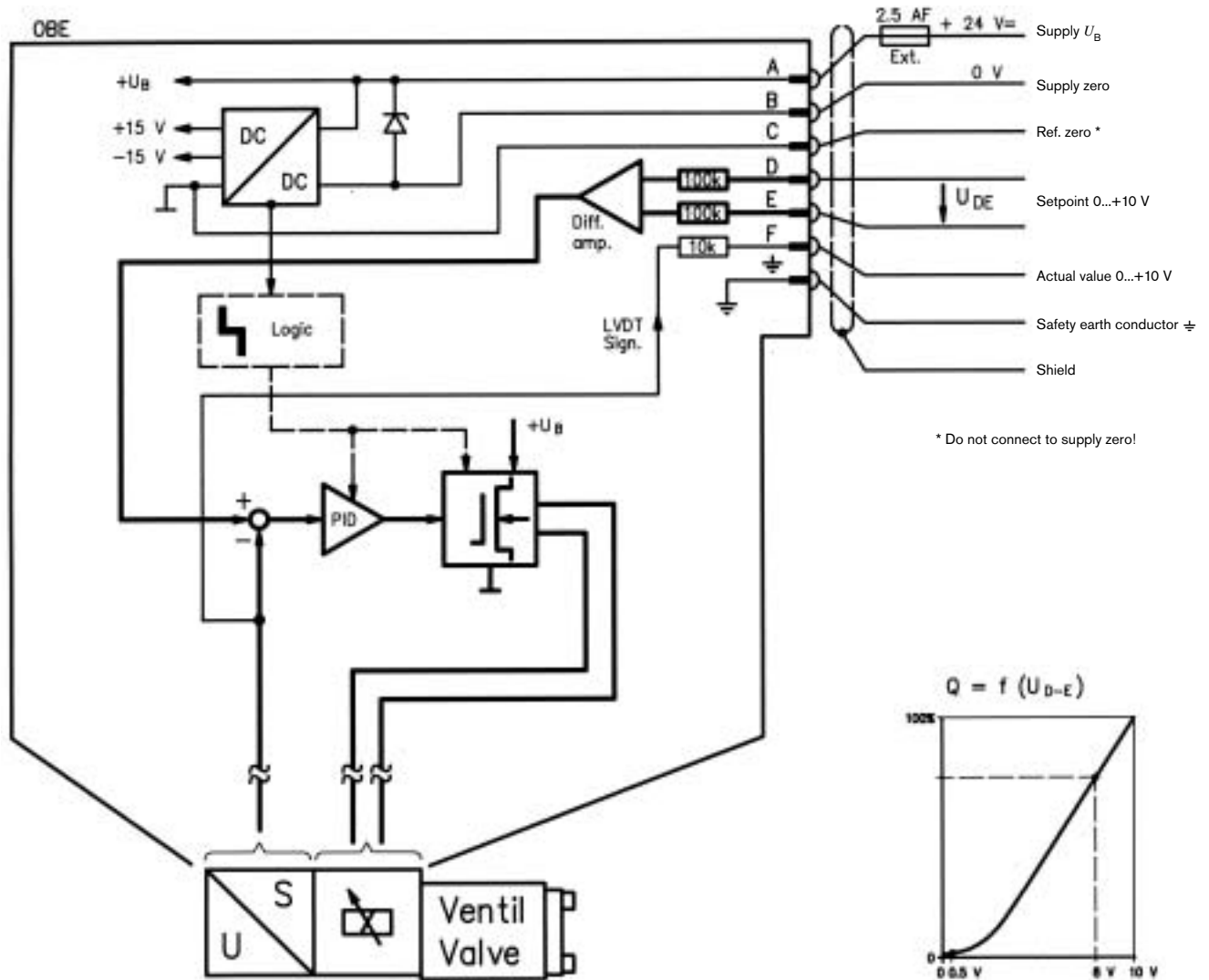
Electrical signals (e.g. actual values) emitted via the trigger electronics must not be used to shut down safety-relevant machine functions!

(Also see European Standard, “Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics”, EN 982).

On-board trigger electronics

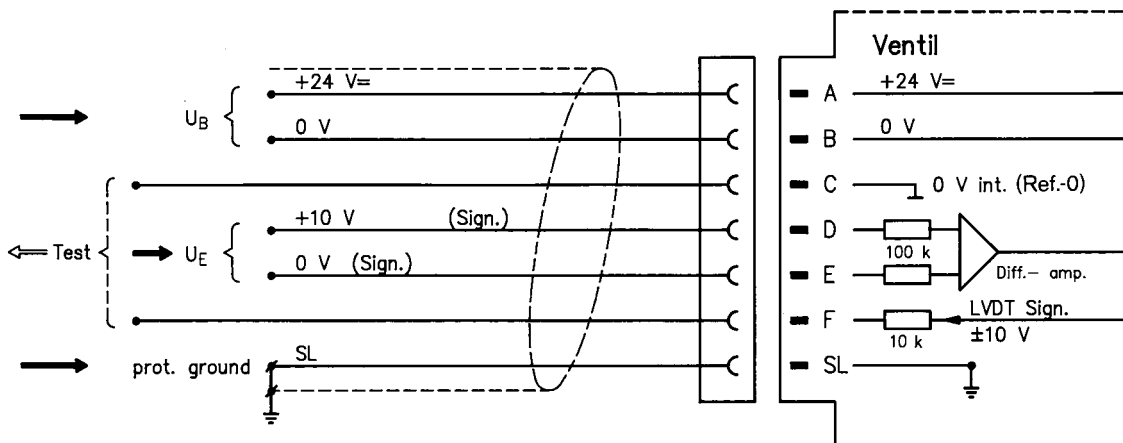
Circuit diagram/pin assignment

Version A1: U_{D-E} 0...+10 V



Pin assignment

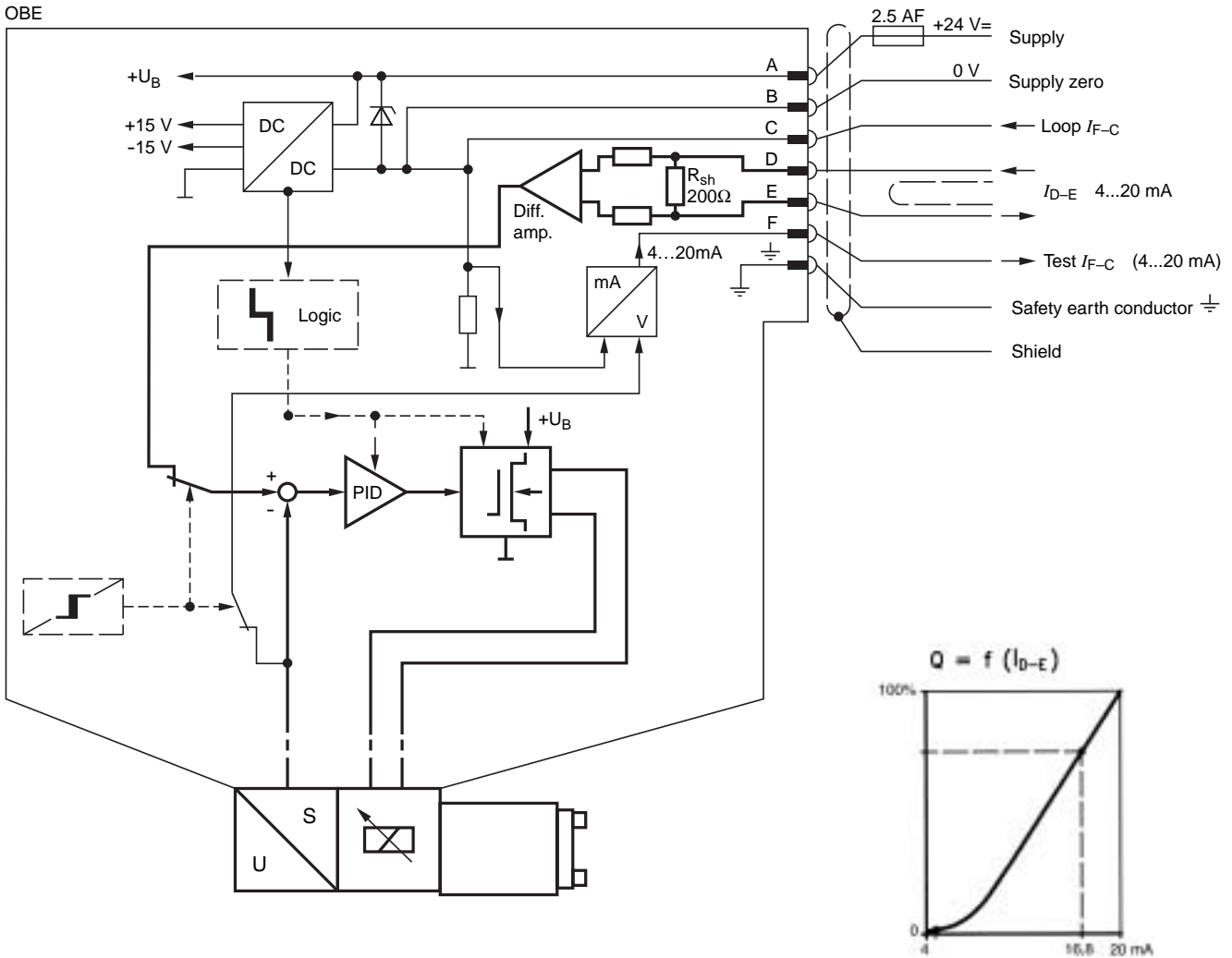
Version A1: U_{D-E} 0...+10 V
 ($R_i = 100 \text{ k}\Omega$)



On-board trigger electronics

Circuit diagram/pin assignment

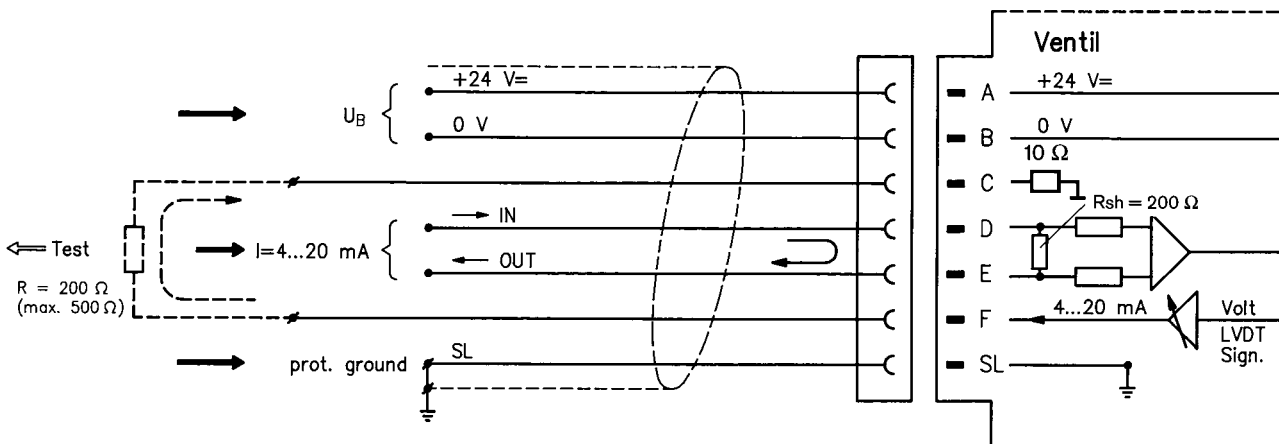
Version F1: I_{D-E} 4...20 mA



Pin assignment 6P+PE

Version F1: I_{D-E} 4...20 mA

($R_{sh} = 200 \text{ k}\Omega$)



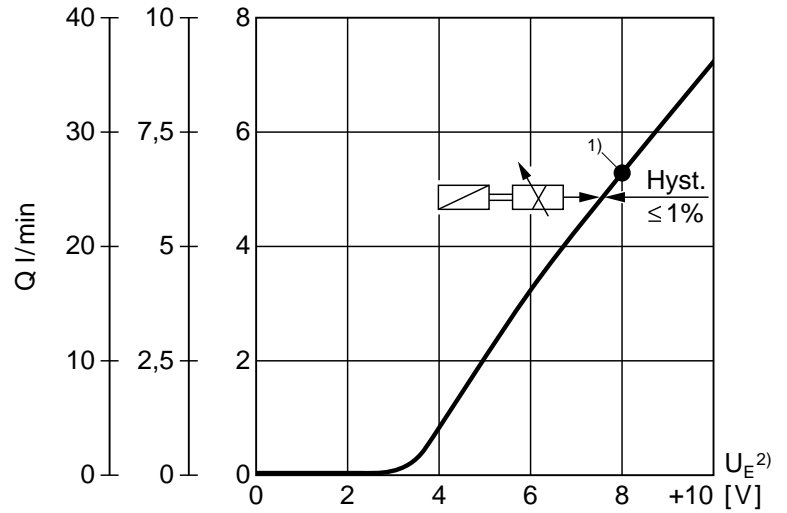
Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$)

$Q_{nom} = 10/35 \text{ l/min}$

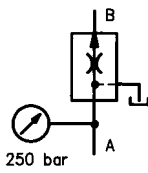
Basic position closed "NC"

Valve amplifier

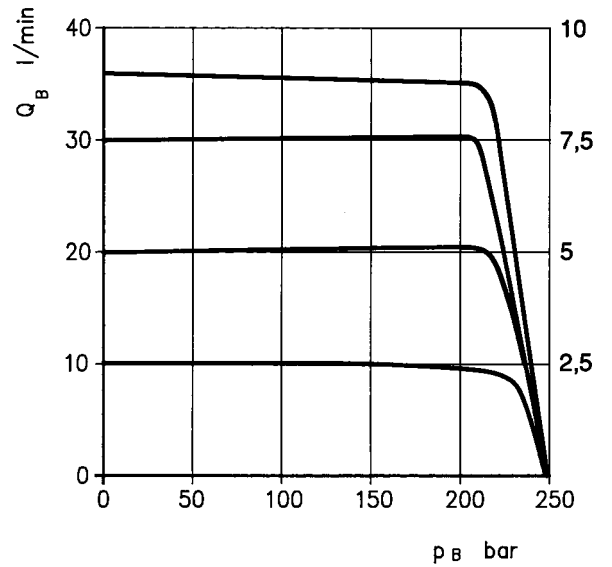
- 1) Factory setting – OBE
±5% manufacturing tolerance
- 2) Version: $U_E = 0 \dots +10 \text{ V}$



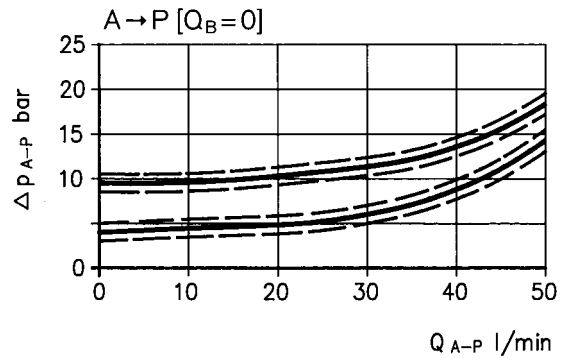
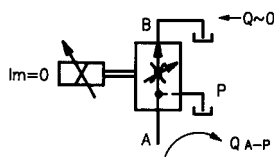
3-way version



$Q_{nom} = 10/35 \text{ l/min}$



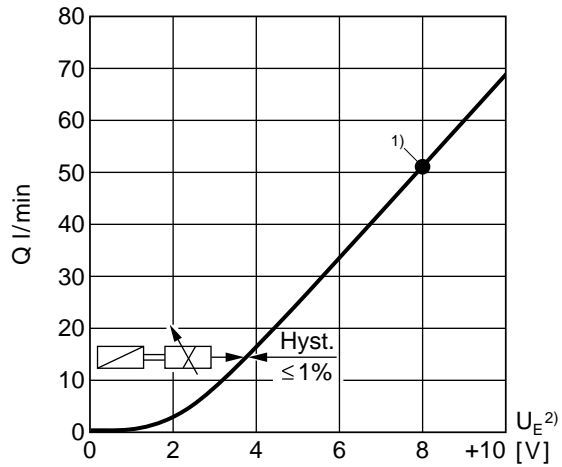
Residual flow "A-P"
(pressure drop)



Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$)

$Q_{nom.} = 70 \text{ l/min}$

Basic position closed "NC"

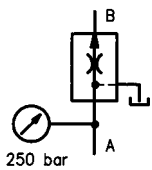


Valve amplifier

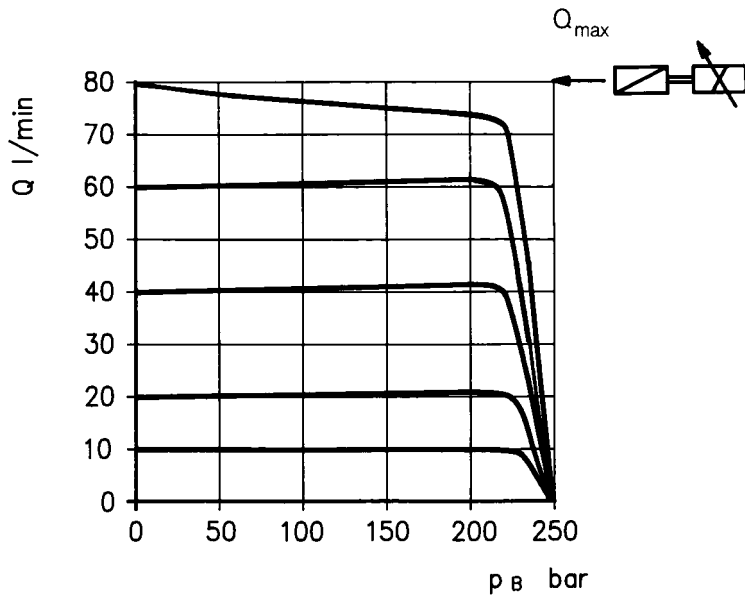
¹⁾ Factory setting – OBE
±5% manufacturing tolerance

²⁾ Version: $U_E = 0...+10 \text{ V}$

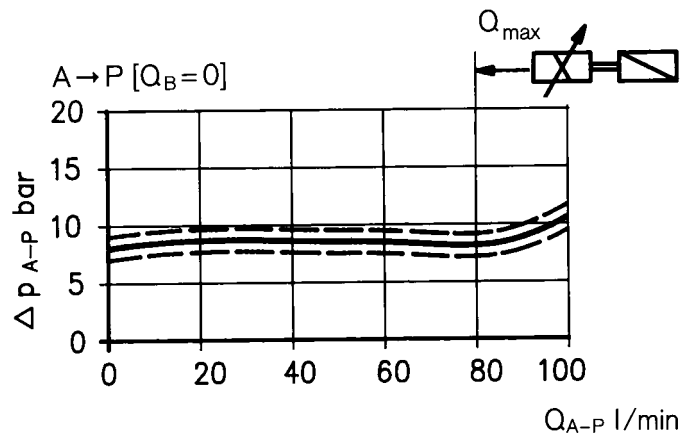
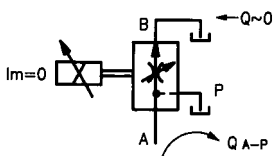
3-way version



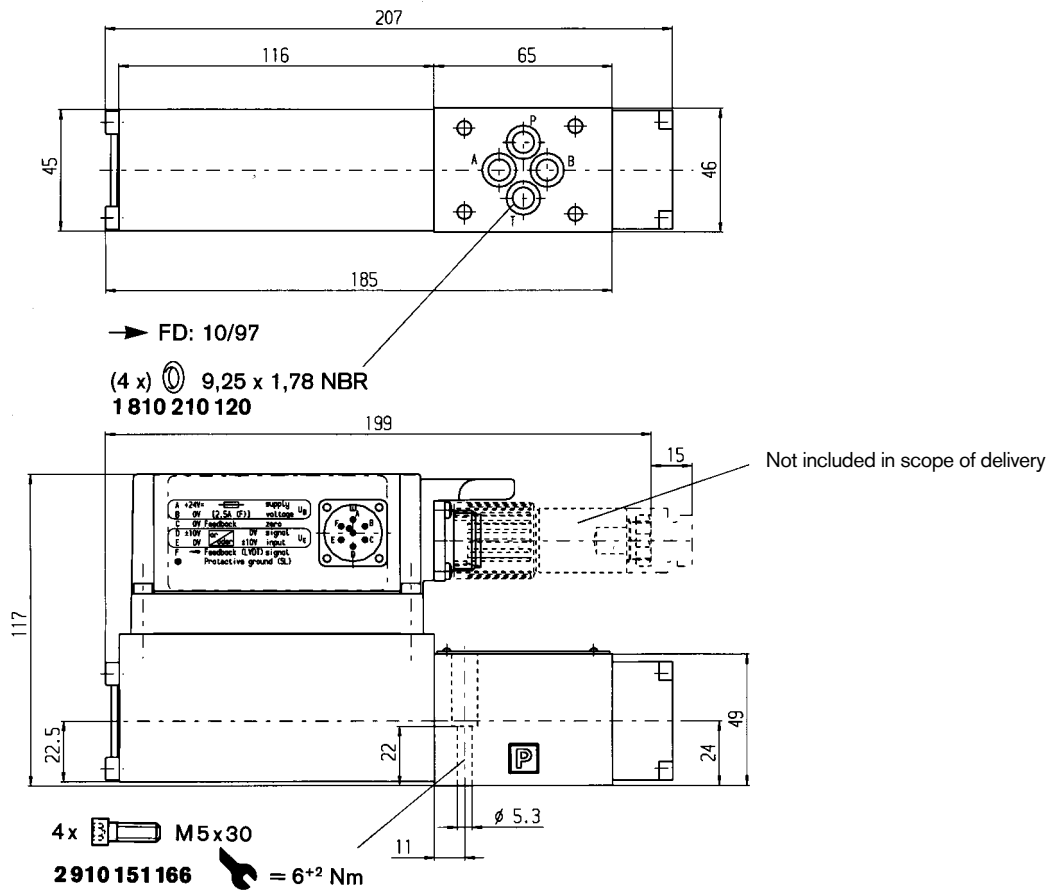
$Q_{nom} = 70 \text{ l/min}$



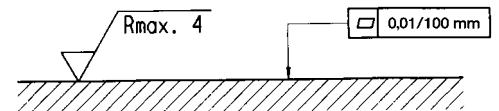
Residual flow "A-P" (pressure drop)



Unit dimensions NG6 (nominal dimensions in mm)



Required surface quality of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)

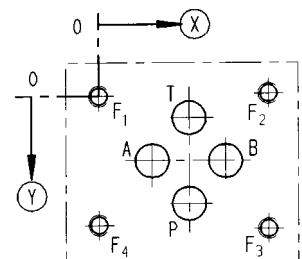
For subplates see catalog sheet RE 45053

1) Deviates from standard

2) Thread depth:

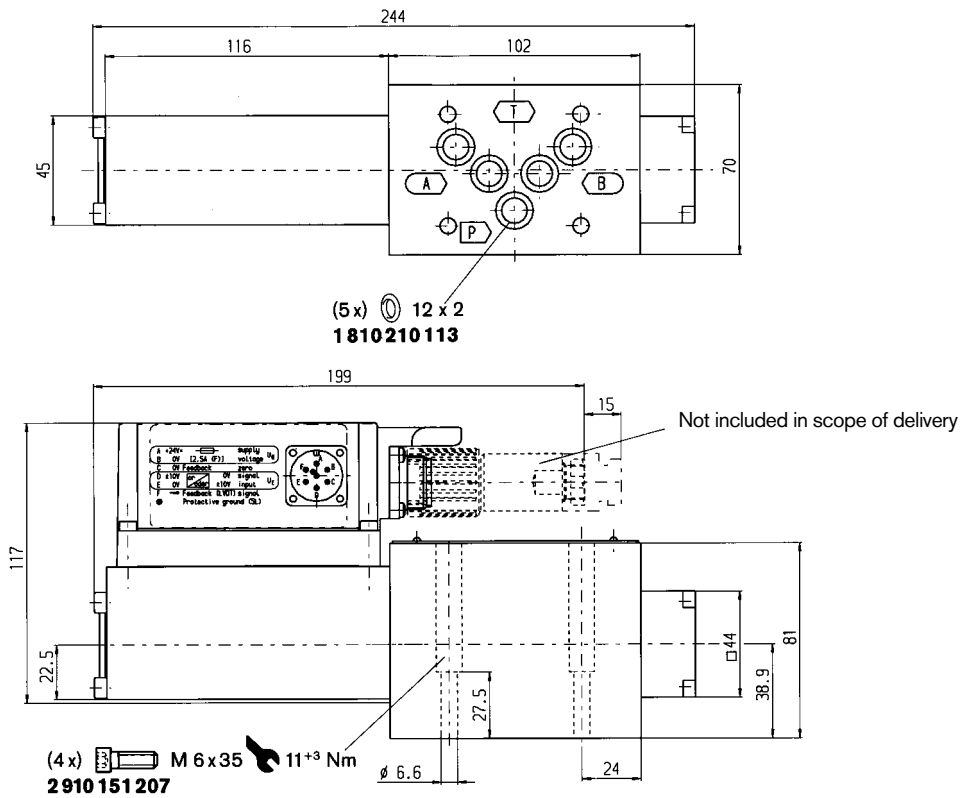
Ferrous metal 1.5 x ϕ

Non-ferrous 2 x ϕ

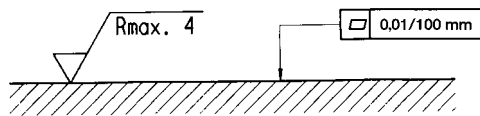


| | P | A | T | B | F ₁ | F ₂ | F ₃ | F ₄ |
|------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|
| X | 21.5 | 12.5 | 21.5 | 30.2 | 0 | 40.5 | 40.5 | 0 |
| Y | 25.9 | 15.5 | 5.1 | 15.5 | 0 | -0.75 | 31.75 | 31 |
| O | 8 ¹⁾ | 8 ¹⁾ | 8 ¹⁾ | 8 ¹⁾ | M5 ²⁾ | M5 ²⁾ | M5 ²⁾ | M5 ²⁾ |

Unit dimensions NG10 (nominal dimensions in mm)



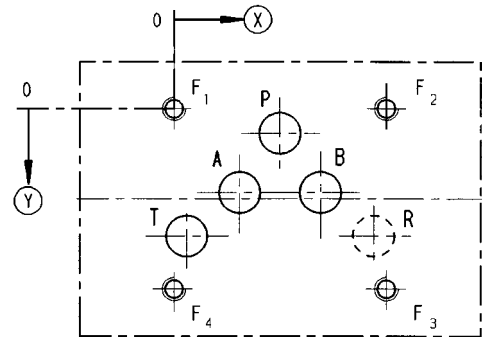
Required surface quality of mating component



Mounting hole configuration: NG10 (ISO 4401-05-04-0-94)

For subplates see catalog sheet RE 45055

- 1) Deviates from standard
- 2) Thread depth:
 Ferrous metal $1.5 \times \text{Ø}^*$
 Non-ferrous $2 \times \text{Ø}$
- * NG10 min. 10.5 mm



| | P | A | T | B | F ₁ | F ₂ | F ₃ | F ₄ | R |
|---|--------------------|--------------------|--------------------|--------------------|------------------|------------------|------------------|------------------|--------------------|
| ⊗ | 27 | 16.7 | 3.2 | 37.3 | 0 | 54 | 54 | 0 | 50.8 |
| ⊙ | 6.3 | 21.4 | 32.5 | 21.4 | 0 | 0 | 46 | 46 | 32.5 |
| ⊘ | 10.5 ¹⁾ | 10.5 ¹⁾ | 10.5 ¹⁾ | 10.5 ¹⁾ | M6 ²⁾ | M6 ²⁾ | M6 ²⁾ | M6 ²⁾ | 10.5 ¹⁾ |

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Notes

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Notes
