Flow divider, type TQ

Product documentation
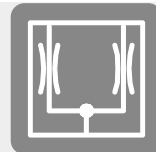
Operating pressure p_{max}:	350 bar
Flow rate $Q_{CN\ max}$:	200 lpm

HAWE HYDRAULIK

Contents

1 Overview of flow divider, type TQ

Flow dividers are a type of flow valve. They divide or add together a total flow rate either evenly or using a fixed ratio. The consumer pressures have no effect. The flow divider, type TQ is, due to its simple design, an economical solution for simple dividing tasks, e.g. if two hydraulic consumers with varying loads supplied from one pump are to be moved simultaneously without interaction.
Intended applications include mobile hydraulics and industrial hydraulics.

Flow divider, type TQ

Features and benefits:

- Excellent dividing accuracy

Intended applications:

- Steering systems
- Synchronous cylinders

2   Available versions, main data

2.1 Valves with same dividing ratio

Circuit symbol:

TQ
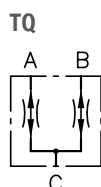
TQ .P
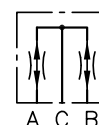
Order coding example:

| TQ 32 - A | 3 |
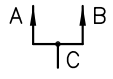
Flow rate   Table 2 Flow rate

Basic type and size   Table 1 Basic type and size

Table 1 Basic type and size

Type	Flow rate Q_{max} (lpm)	Pressure p_{max} (bar)	Connection (ISO 228-1 (BSPP) or JIS B2351-1)	
			A, B	C
Pipe connection				
TQ 21 - A TQ 21 JIS - A	7.5 … 70		G 1/4	G 3/8
TQ 22 - A TQ 22 JIS - A	7.5 … 70		G 3/8	G 3/8
TQ 32 - A TQ 32 JIS - A	7.5 … 70	350	G 3/8	G 1/2
TQ 33 - A TQ 33 JIS - A	7.5 … 70		G 1/2	G 1/2
TQ 43 - A	80 … 120		G 1/2	G 3/4
TQ 54 - A	140 … 200		G 3/4	G 1
Manifold mounting				
TQ 3 P - A	7.5 … 70		∅8	∅10.5
TQ 4 P - A	80 … 120	350	∅13	∅16
TQ 5 P - A	140 … 200		∅15	∅20

Table 2 Flow rate

Coding	available for basic type	Nominal total flow rate Q_{CN} approx. (lpm)	End position compensation approx. (lpm) A → B ↓C	A → B ↓C
0.78		3.5	0.2	0.1
1.1		7.5	1.6	1
1.6	TQ 21 . - A TQ 22 . - A	15	1.6	1
2.3	TQ 32 . - A	30	2.5	1.5
3	TQ 33 . - A TQ 3 P - A	45	4	1.7
3.5		60	5	2
4		70	6.5	3
4	TQ 43 - A	80	6.5	3
5	TQ 4P - A	120	9	5
5.5	TQ 54 - A	140	12	6
6.8	TQ 5 P - A	200	15	7

> **ℹ Note**
> - Nominal total flow rate Q_{CN}: Reference value for the permissible inlet volume flow rate at connection C, $\Delta p\ C \leftrightarrow A$ and $\Delta p\ C \leftrightarrow B$ approx. 30 bar, see Δp-Q characteristics.
> - TQ 21 . - A 4 ($Q_{CN} \approx 70$ lpm): only for applications in which a larger division error (approx. ± 8... 10%) is not a problem.
> - End position compensation: If the leading end stops at the end stop for hydraulic cylinders, the other end follows according to the specified equalising flow (reference value), observe note in Chapter 6.2, "Circuit example" .

2.2 Valves for unequal division ratios

Order coding example:

TQ 32 - A	3/	2

Ratio of consumer flow rates z = Q_A / Q_B   Table 3 Available versions

Flow rate   Table 2 Flow rate, see Chapter 2.1, "Valves with same dividing ratio"

Basic type and size   Table 1 Basic type and size

Table 3 Available versions

Type	Flow rate/ ratio		Type	Flow rate/ ratio	Type	Flow rate/ ratio
TQ 2.. - A TQ 3.. - A	1.1/2	3/3	TQ 4.. - A	4/1.5	TQ 5.. - A	5.5/2
	1.6/2	3.5/2		4/2		6.8/2
	2.3/1.4	3.5/3		4/3		6.8/3
	2.3/2	3.5/4		5/2		
	2.3/3	4/1.4 *		5/3		
	2.3/4	4/2 *		5/5		
	3/1.5	4/3 *		5/1.5		
	3/2	4/4 *				

> **Note**
> - Q_{CN}: Nominal total flow rate according to the flow rate coding, see Chapter 2.1, "Valves with same dividing ratio", Table 2
> - Connection A: maximum permissible subflow rate is $Q_{A\,max} = 0.5\ Q_{CN}$.
> - Connection B: smaller subflow
> - Connection C: the permissible inlet flow rate $Q_{C\,perm}$ is smaller than Q_{CN}
>   (z = ratio of consumer flow rates, see Table 3)
> - Calculation:
> $$Q_{C\,perm} = Q_{A\,max} + Q_{B\,max} \text{ or } Q_{C\,zal} = 0.5 Q_{CN}\left(1+\tfrac{1}{z}\right)$$
> - Example:
> $$z = 2: Q_B = \tfrac{1}{2}\,Q_A$$
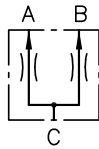> $$z = 3: Q_B = \tfrac{1}{3}\,Q_A$$
> $$z = 4: Q_B = \tfrac{1}{4}\,Q_A$$
> * TQ 21 . - A 4 ($Q_{CN} \approx$ 70 lpm): only for applications in which a larger division error (approx. ± 8... 10%) is not a problem.
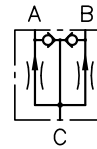
2.3 Valves only for parts C → A, B

Circuit symbol:

TQ ..-B

No return flow

TQ..-R-B

Order coding example:

TQ 32	- B	- 2,3

Flow rate   Table 2 Flow rate

B   with simple mono-control piston
R-B   with bypass check valve

Basic type and size   Table 4 Basic type and size

Table 4 Basic type and size

| Type	Connection (ISO 228-1) (BSPP)			Comment
	A	**B**	**C**	
Pipe connection				
TQ 21-B	G 1/4	G 1/4	G 3/8	Valves with a simple mono-control piston, only for flow direction C → A, B for dividing. Return flow in the opposite direction not possible.
TQ 22-B	G 3/8	G 3/8	G 3/8	
TQ 32-B	G 3/8	G 3/8	G 1/2	
TQ 33-B	G 1/2	G 1/2	G 1/2	
TQ 43-B	G 1/2	G 1/2	G 3/4	
TQ 54-B	G 3/4	G 3/4	G 1	
TQ 32 R-B	G 3/8	G 3/8	G 1/2	Built-in bypass check valves for free, unregulated return flow. Sample application: Grapple buckets or forks, which need to open quickly and unbraked due to their weight and should hit their limit stop to knock loose stuck material.

3   Parameters

3.1 General information

Designation	Flow divider
Design	Piston spool valve
Model	manifold mounting, pipe connection
Material	Steel; electrogalvanised valve housing
Installation position	As desired
Hydraulic fluid	Hydraulic oil: according to part 1 to 3; ISO VG 10 to 68 according to DIN ISO 3448 Viscosity limits: min. approx. 4, max. approx. 1500 mm²/s opt. operation approx. 10... 500 mm²/s. Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C.
Cleanliness level	**ISO 4406** 21/18/15...19/17/13
Temperatures	Ambient: approx. -40 ... +80°C, Fluid: -25 ... +80°C, Note the viscosity range! Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20K higher for the following operation. Biologically degradable pressure fluids: Observe manufacturer's specifications. By consideration of the compatibility with seal material not over +70°C.

Division accuracy	depends on
	
	• Total oil flow Q_C:
	  The total oil flow Q_C should be between 50...100% of Q_{CN}. Below 50% of Q_{CN} the accuracy of the division drops. In this case, you have to select a device with the next smaller flow rate coding.
	• Pressure difference between consumer ports A and B:
	  At the same or slightly different pressures (≤ 20 bar), the division error is approximately ± 1... 2%. For larger pressure differences, the division error increases; at a difference of 100 bar, for the flow rate codings A 0.78 ... 2.3, it is approximately ± 2 ... 2.5% and for larger codings it can rise to ± 3...5%. For A 6.8 it can rise to approximately ± 5...7%.
	
	$\Delta Q_{A,\,B}$
	
	Q_C/Q_{CN} total oil flow (%); $\Delta Q_{A,\,B}$ subflow (±%)
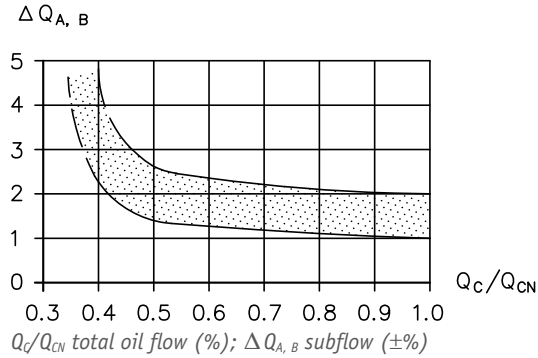	
	Division error:
	
	$$Q_{A,B} = f\left(\frac{Q_C}{Q_{CN}}\right) \text{ in \% von } Q_{A,B} = \frac{1}{2}\,Q_C$$
	
	at the same load pressures or low pressure differences between connections A and B.

Pressure and flow rate

Operating pressure	p_{max} = 350 bar
Flow rate	See Chapter 2.1, "Valves with same dividing ratio", Table 2

Oil viscosity approx. 60 mm²/s

$\triangle$ p-Q characteristics

TQ..-A.. TQ..-B..

$\triangle$ p

$Q_{A, B}$ subflow (lpm); $\triangle$ p flow resistance (bar)

$\triangle$ p

$Q_{A, B}$ subflow (lpm); $\triangle$ p flow resistance (bar)

$\triangle$ p

$Q_{A, B}$ subflow (lpm); $\triangle$ p flow resistance (bar)
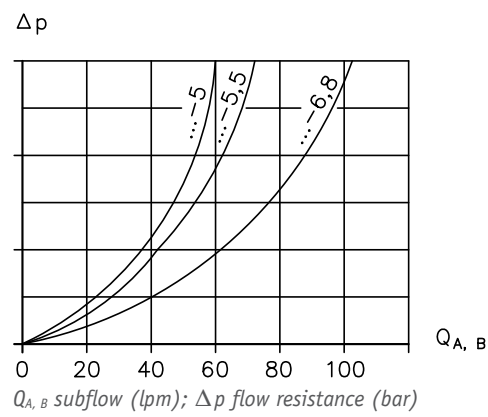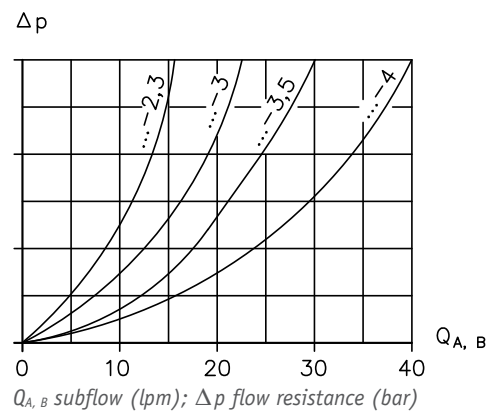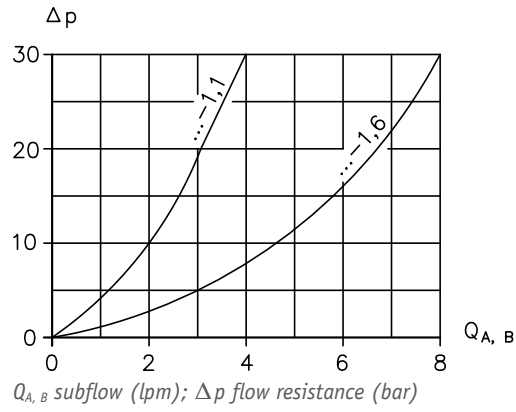
Characteristics

Oil viscosity approx. 60 mm²/s

$\triangle$ p-Q characteristics for return flow

TQ 32 R-B

$Q_{A(B) \to C}$ subflow (lpm); $\triangle p$ flow resistance (bar)
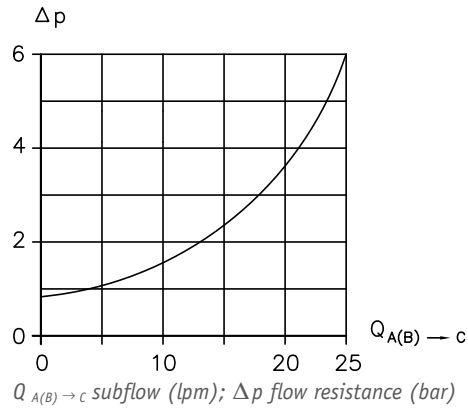
Weight

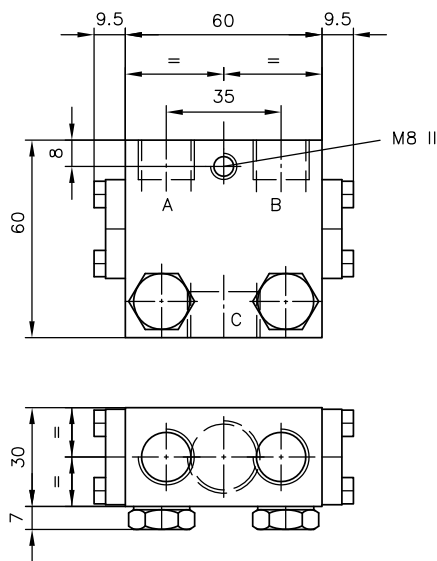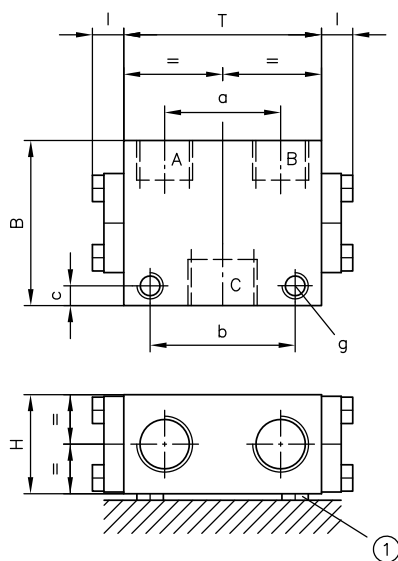| Type	
TQ 21., TQ 22.	= 0.6 kg
TQ 32., TQ 33.	= 0.6 kg
TQ 43	= 1.5 kg
TQ 54	= 3.0 kg
TQ 3P-A	= 0.7 kg
TQ 4P-A	= 1.6 kg
TQ 5P-A	= 3.1 kg

4 Dimensions

All dimensions in mm, subject to change.

4.1 Version for pipe connection

TQ 21 . - A ... TQ 54 . - A
TQ 21 . - B ... TQ 54 . - B

TQ 32 R - B ..

1 See Note

> **Note**
> Do not deform housing on mounting level; place washers in between as spacers to prevent unevenness

Type	H	B	T	a	b	c	l	g
TQ 21				34.8				
TQ 21 JIS				31				
TQ 22	30	50	59.6	34.8	44	6	9.5	
TQ 22 JIS				31				M8, continuous
TQ 32				34.8				
TQ 32 JIS				35				
TQ 33	30	60	66	36	44	4	9.5	
TQ 33 JIS				35				
TQ 43	40	60	80	50	60	6	15	M8, 10 deep front/rear, continuous core drilling
TQ 54	50	80	104	60	80	10	15	

4.2 Version for manifold mounting

TQ 3P-A
TQ 4P-A
TQ 5P-A
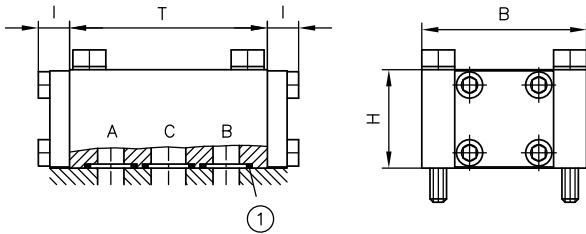
1   O-ring NBR 90 Shore

Base plate hole pattern
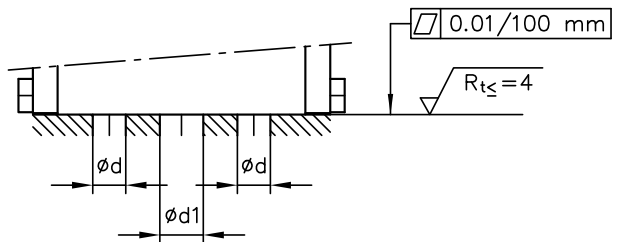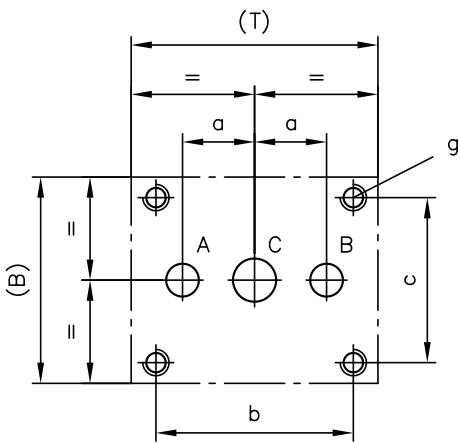
Type	H	B	T	a	b	c	∅d	∅d1	l	g	O-ring
TQ 3P-A	30	50	60	17.5	48	40	8	10.5	9.5	M6, 10 deep	12.42x1.78
TQ 4P-A	40	60	80	26	64	47	13	16	15	M8, 10 deep	18.72x2.62
TQ 5P-A	50	80	104	31	80	63	15	20	15	M10, 10 deep	31.42x2.62

5 Assembly, operation and maintenance recommendations

5.1 Intended use

This valve is intended exclusively for hydraulic applications (fluid technology).

The user must observe the safety measures and warnings in this documentation.

Essential requirements for the product to function correctly and safely:

– All information in this documentation must be observed. This applies in particular to all safety measures and warnings.
– The product must only be assembled and put into operation by qualified personnel.
– The product must only be operated within the specified technical parameters. The technical parameters are described in detail in this documentation.
– The operating and maintenance manual of the components, assemblies and the specific complete system must also always be observed.

If the product can no longer be operated safely:

1. Remove the product from operation and mark it accordingly.
✓ It is then not permitted to continue using or operating the product.

5.2 Assembly information

The product must only be installed in the complete system with standard and compliant connection components (fittings, hoses, pipes, fixtures, etc.).

The hydraulic power pack must be shut down correctly prior to dismounting; this applies in particular to power packs with hydraulic accumulators.

> ⚠ **Danger**
> **Risk to life caused by sudden movement of the hydraulic drives when dismantled incorrectly!**
> Risk of serious injury or death.
>
> ▪ Depressurise the hydraulic system.
> ▪ Perform safety measures in preparation for maintenance.

5.3 Operating instructions

Note product configuration and pressure / flow rate

The statements and technical parameters in this documentation must be strictly observed.
The instructions for the complete technical system must also always be followed.

> **ℹ Note**
> - Read the documentation carefully before usage.
> - The documentation must be accessible to the operating and maintenance staff at all times.
> - Keep documentation up to date after every addition or update.

> **⚠ Caution**
> **Risk of injury due to unexpected movement processes in the machine due to incorrect flow setting!**
> Risk of minor injury
>
> - Be prepared for unexpected, fast movements. On changing the flow settings, consumers will move more slowly or more quickly.
> - Always monitor the pressure gauge when setting or changing the flow.

Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of the hydraulic component. Contamination can cause irreparable damage.

Examples of fine contamination include:

– Metal chips
– Rubber particles from hoses and seals
– Dirt due to assembly and maintenance
– Mechanical debris
– Chemical ageing of the hydraulic fluid

> **ℹ Note**
> Fresh hydraulic fluid from the drum does not always have the highest degree of purity. Under some circumstances the fresh hydraulic fluid must be filtered before use.

Adhere to the cleanliness level of the hydraulic fluid in order to maintain faultless operation.
(also see cleanliness level in Chapter 3, "Parameters").

Additionally applicable document: D 5488/1 Oil recommendations

5.4 Maintenance information

Conduct a visual inspection at regular intervals, but at least once per year, to check if the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the device surface of dust deposits and dirt at regular intervals, but at least once per year.

6.1 Structure and operating principle

In addition to the housing, the flow divider consists of two coupled control pistons **1**. The control pistons are held in the middle position (rest position) using centring springs **4**.

A fixed orifice **2** and a variable throttle point **3** are integrated into the control pistons.

A flow from C to A and B creates a pressure drop which brings the control pistons into the control position (flow control function).

By coupling the two control pistons, the flow rates at A and B are kept constant in accordance with the ratio, even if there are different load pressures at A and B.
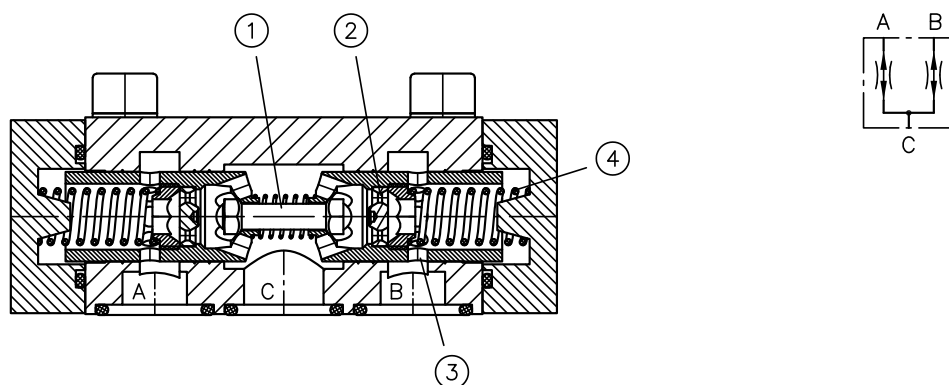
1   Control piston, coupled, hardened and polished
2   Orifice
3   Variable cross-section (variable throttle point)
4   Centring springs and control springs

6.2 Circuit example

Double-acting consumer

1   From the pump
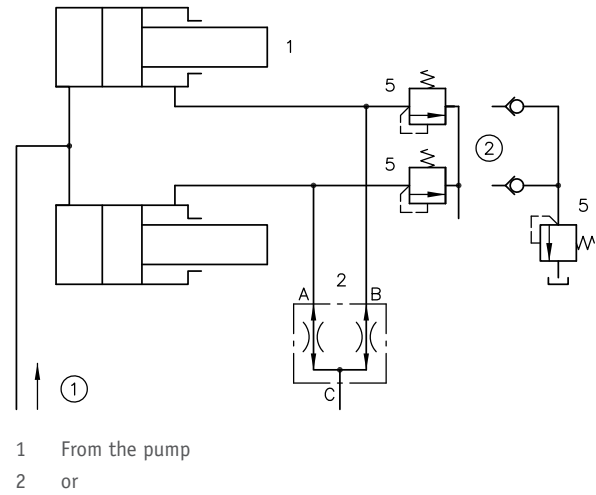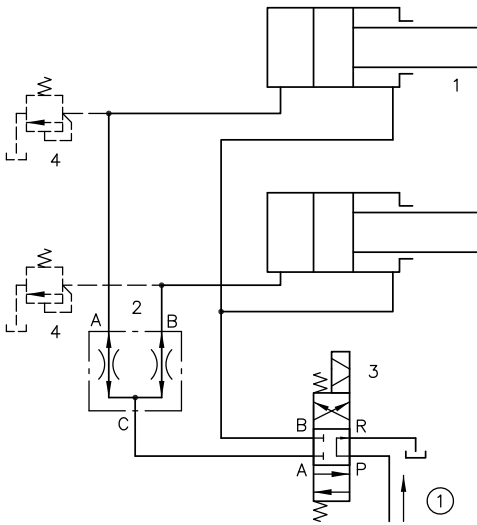
1   From the pump
2   or

1   From the pump

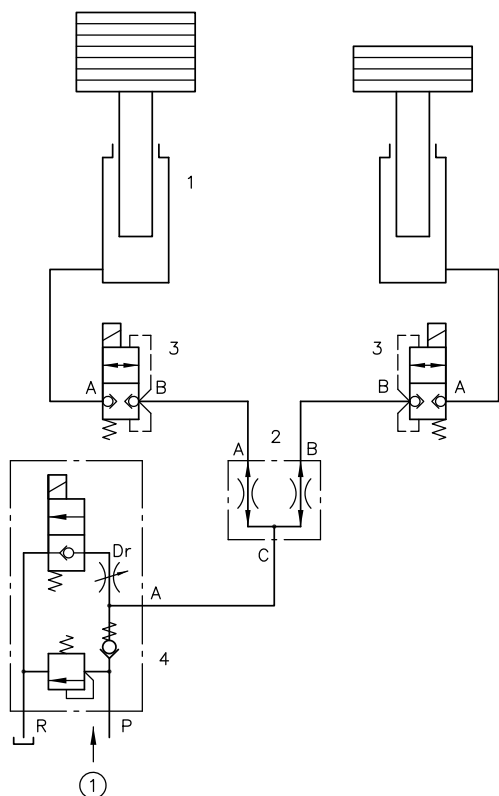|	
1	**Double-acting hydraulic cylinder** for example, after D 2055/1
2	**Flow divider, type TQ**
3	**Directional spool valve** Figure on left: When extending the cylinders (dividing), there is a flow resistance at the flow divider for $Q_A = Q_B = 0.5\ Q_C$ $(= 0.5\ Q_{pump})$ according to the Δp-Q characteristics. When retracting (merging), the subflows $Q_A = Q_B$ are larger according to the surface ratio of the cylinders; the associated flow resistance is also greater according to the surface ratio for the pump. In borderline cases with Q_{pump} in the range $Q_{C\ max}$, connection of the flow divider to the rod side of the cylinders can therefore be more preferable (see **5**)
4	**Pressure-limiting valves** With the flow divider on the piston side: Pressure-limiting valves are to be used if the end position compensation (during extension) of the trailing cylinder is to be performed without a speed limitation. The triggering pressure-limiting valve of the cylinder that arrives first at the end stop continues to simulate the hydraulic fluid demand for the flow divider even though the piston has stopped. (Pressure setting slightly lower than pressure-limiting valve on the pump side)
5	**Pressure-limiting valves** With the flow divider on the rod side: Pressure-limiting valves are to be planned in order to avoid (during end position compensation during extension) transmissions of pressure due to the surface difference of the cylinders. (Pressure setting slightly lower than pressure-limiting valve on the pump side)

Single-acting, weight-loaded consumers (lifting equipment)

1   From the pump

1	**Single-acting hydraulic cylinder** weight-loaded
2	**Flow divider, type TQ**
3	**Zero-leakage directional seated valves** for example, D 7765 or D 7300 or equivalent versions for blocking the cylinder lines for "stop" in any raised, intermediate position. Directional seated valves prevent uncontrolled volume exchange via the flow divider from the cylinder that is more greatly loaded to the less loaded cylinder, thus preventing retraction of the one and extension of the other. If you always drive against the end stop without an intermediate stop, the directional seat valves are not required.
4	**Lifting/lowering valve, type HSV 21** See D 7032 Adjust the lowering speed using the throttle "Dr".

> **ⓘ Note**
>
> **Avoid high lowering speeds!**
>
> When lowering the loads (merging of the subflows), at the connection C, due to the directional valve open to the tank, low reflux resistance prevails.
>
> Although the control orifice on the higher-load consumer side (in the picture at A) compensates for the pressure difference compared to the lower-load consumer, the subflows $Q_A = Q_B$ would then result according to the Δp-Q characteristics in "Parameters" for Δp = load pressure of the lower-load cylinder. In order to avoid excess lowering speeds, the total return flow must be limited to values $\leq Q_{CN}$ by a suitable flow valve.
>
> In the example: Limitation by the throttle "Dr" present in the lifting/lowering valve or by a drop-rate braking valve (D 6920) or another equivalent device.

Further information

Additional versions

- Flow control valve (lowering brake valve) type SB and SQ: D 6920
- Flow control valve type SJ: D 7395
- Flow control valve type CSJ: D 7736
- Flow control valve type SD, SF and SK: D 6233
- Proportional flow control valve type SE and SEH: D 7557/1