

**RE 66 226/06.00**

Replaces: 06.95



## Hydraulic remotely powered braking systems

### General notes

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#### Features

Heavy vehicles for construction, agricultural and forestry industries together with special purpose vehicles often working in rough conditions must have braking systems which offer a high degree of safety whilst allowing low operating forces.

In these vehicles servo assisted or remotely powered braking systems are required in order to meet the obligatory requirements for braking.

Hydraulic remotely powered braking systems have a number of advantages compared to pneumatic systems:

1. Energy supply from an existing hydraulic system in the vehicle is possible
2. Low maintenance components
3. Small space requirements of all components especially the wheel brake cylinders
4. Quickly ready-for-operation
5. Sensitive metering through low hysteresis
6. Short response times even with low temperatures
7. Fewer components

#### Legal requirements

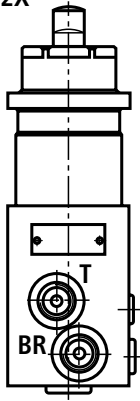
The general content of legal regulations is the demand that a vehicle is road-safe in all operating conditions. The current valid national and international regulations are the basis when projecting a braking system. Furthermore, the braking system must correspond to the current level of technology.

Braking systems must be tested to the valid national and international regulations.

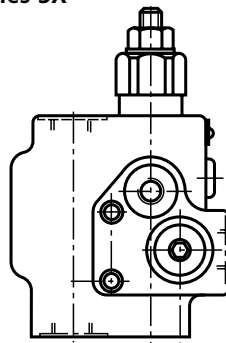
**The responsibility lies with the vehicle manufacturer.**

## Components of decentralised design

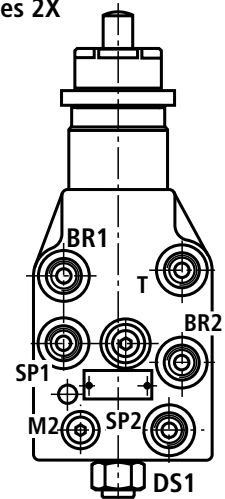
LT 05; Series 2X



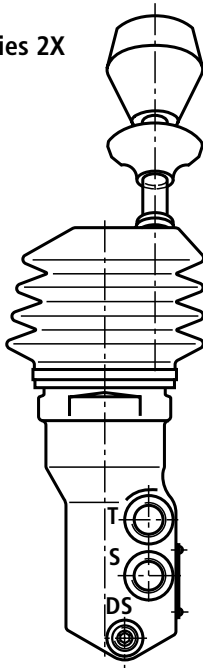
LT 06; Series 3X



LT 07; Series 2X

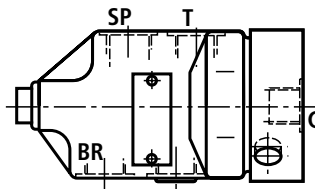


LT 08; Series 2X

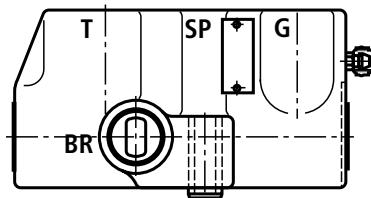


LT 09; Series 1X

Version ..HG..

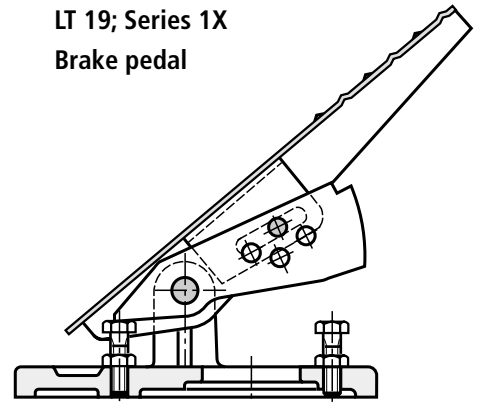


Version ..HA



LT 19; Series 1X

Brake pedal



### Accessories:

- Pressure switch
- Hydraulic accumulator
- Spring accumulator
- Inverted shuttle valve
- Check valve

## Function of 2-circuit remotely powered braking system

The accumulator loading valve (2), which is connected immediately downstream of the pump, supplies the hydraulic accumulator (6), before all other actuators. This happens as soon as the accumulator pressure falls below a limiting value.

After reaching the set loading pressure for the hydraulic accumulator, the accumulator loading valve switches the entire pump flow to the other actuators. The switching pressure difference is approx. 18% of the switch-off pressure.

Both operating brake circuits are protected by valves so that with a failure of one brake circuit the other remains fully functional. The load condition of the hydraulic accumulator must be monitored with warning switches (4) so that with a failure of the energy supply, e.g. motor standstill, the driver is warned with an optical display.

### Function of the operating braking system (OBS)

When operating the operating brake the 2-circuit remotely powered braking system (7) controls the pressure in the brake cylinders (14) in proportion to the operating force of the pedal (10). Via the wheel brakes the vehicle is slowed down. After completion of the braking

process the pressure fluid returns to the tank. When one brake circuit fails the second remains fully functional due to the mechanical contact of both spools in the 2-circuit remote powered brake valve and the safety provided by the two hydraulic accumulators. The operating force remains unchanged.

### Function of the parking brake system (LBS)

In the park position the wheel brake is applied with the force of the highly pre-tensed spring of the spring loaded cylinder (13). When the hand brake valve (9) is moved into the „release“ position, the pressure fluid flows into the spring loaded cylinder and releases the parking brake. The pressure switch (11) indicates whether the hand brake is applied.

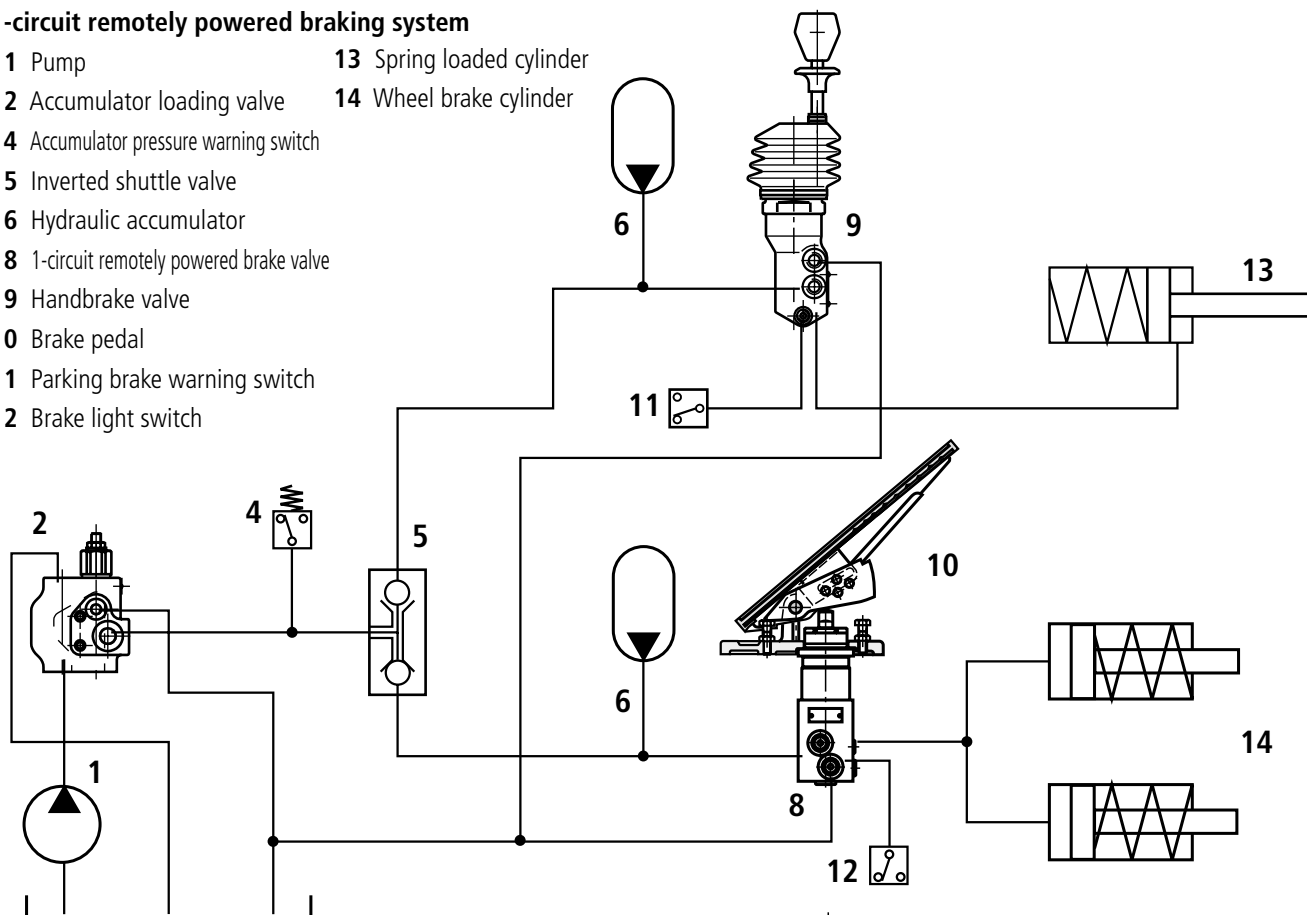
### Auxiliary braking system (ABS)

The design of the auxiliary braking system must correspond to the valid legal regulations.

## Hydraulic remotely powered braking system of decentralised design

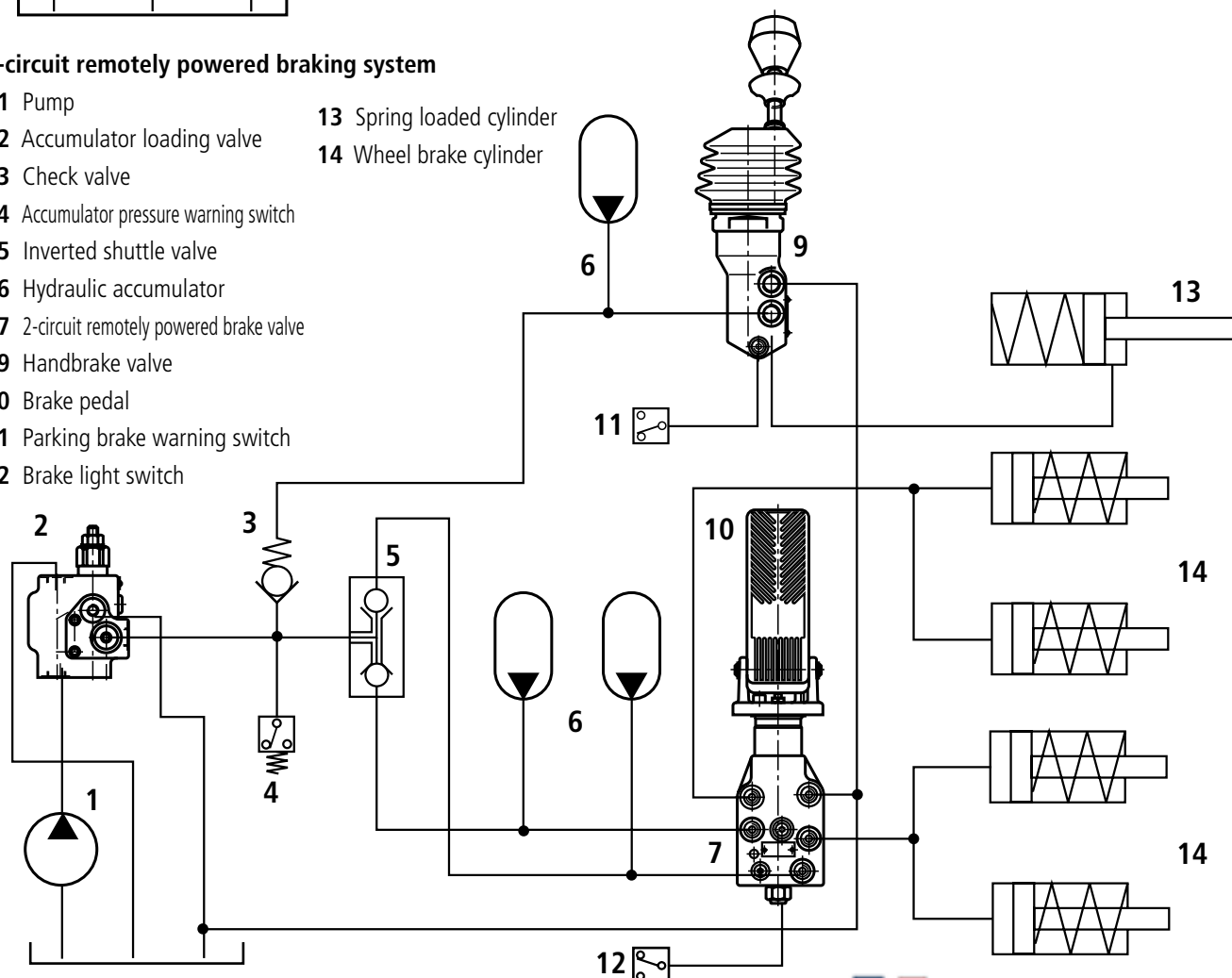
### 1-circuit remotely powered braking system

- 1 Pump
- 2 Accumulator loading valve
- 4 Accumulator pressure warning switch
- 5 Inverted shuttle valve
- 6 Hydraulic accumulator
- 8 1-circuit remotely powered brake valve
- 9 Handbrake valve
- 10 Brake pedal
- 11 Parking brake warning switch
- 12 Brake light switch
- 13 Spring loaded cylinder
- 14 Wheel brake cylinder



### 2-circuit remotely powered braking system

- 1 Pump
- 2 Accumulator loading valve
- 3 Check valve
- 4 Accumulator pressure warning switch
- 5 Inverted shuttle valve
- 6 Hydraulic accumulator
- 7 2-circuit remotely powered brake valve
- 9 Handbrake valve
- 10 Brake pedal
- 11 Parking brake warning switch
- 12 Brake light switch
- 13 Spring loaded cylinder
- 14 Wheel brake cylinder



**Technical data for all components** (for applications outside these parameters, please consult us!)

System pressure	bar	Up to 200
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524;
Pressure fluid temperature range	°C	– 20 to + 80
Viscosity range	mm <sup>2</sup> /s	2.8 to 380
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .

**Notes on installation of components****⚠ Attention!**

The cross-sections of the hydraulic transfer elements (pipes, hoses) must be selected so that, with low operating temperatures, the pressure drop between the hydraulic accumulator and brake cylinder is kept to a minimum.

## 1-circuit remotely powered brake valve Type LT 05 (to RE 66 144)

Series 2X

Nominal braking pressures 60, 80 and 100 bar

### Features

- Pipe line installation
- Small installation dimensions
- Integrated maximum pressure limitation for the brake circuit
- Brake pressure proportional to the operating force
- Low hysteresis
- Weight 2.8 kg

### Function

**The 1-circuit remotely powered brake valve is a direct controlled pressure relief valve of 3-way design with a stepless mechanical operation.**

It has a maximum pressure limitation of the secondary circuit and infinitely adjustable pressure in the secondary circuit (braking circuit) which is in proportion to the travel of the operating element (4).

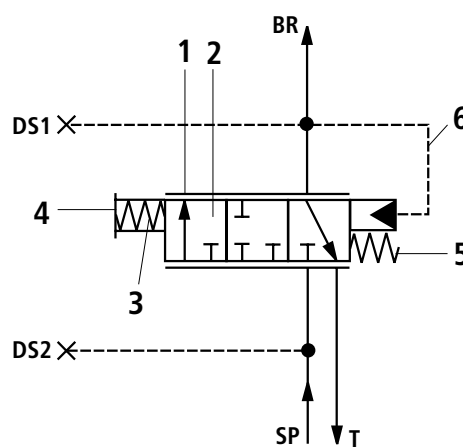
The pressure reducing valve (1-circuit remotely powered braking valve) consists mainly of the housing (1), control spool (2), main compression spring (3), operating element (4) and the return spring (5).

The valve is operated via the operating element (4). This pushes the main control spring (3) against the control spool (2). Firstly the control land closes at port T, afterwards the through flow is released. The pressure which builds up in the brake line now simultaneously pushes the spool against the main compression spring (3) by passing through the pilot oil drilling (6) behind the spool so that the brake pressure (secondary pressure) rises in proportion to the deflection of the operating element (4). While keeping the deflection constant the control spool (2) moves into the control position and holds the set pressure in the channel constant. The opening force of the operating element is, therefore proportional to its deflection. When the main compression spring (3) is unloaded, the compression spring (5) moves the control spool (2) in such a way that it closes and opens to T and thus unloads the secondary circuit (braking circuit).



1-circuit remotely powered brake valve type LT 05 fitted with a standard brake pedal

### Symbol



### Notes on installation

- Rubber parts must **not** be painted.
- Operating element must not be subjected to direct high pressure cleaning.
- Damaged seals must be replaced immediately.
- The cross-sections of the hydraulic transfer elements (pipes, hoses) must be selected so that, with low temperatures, the pressure drop between hydraulic accumulator and brake cylinder remains at a minimum.
- Tank pressure must not exceed the pressure being applied by the brake.
- Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of  $\beta_{10} \geq 75$ .

**Ordering details**

LT 05 MK A -2X / / 02 M \*

Series 20 to 29 = 2X  
 (20 to 29: unchanged installation and connection dimensions)

Nominal braking pressure 60 bar = 060  
 Nominal braking pressure 80 bar = 080  
 Nominal braking pressure 100 bar = 100

Further details in clear text  
 e.g. 12: fitted with a standard brake pedal <sup>1)</sup>

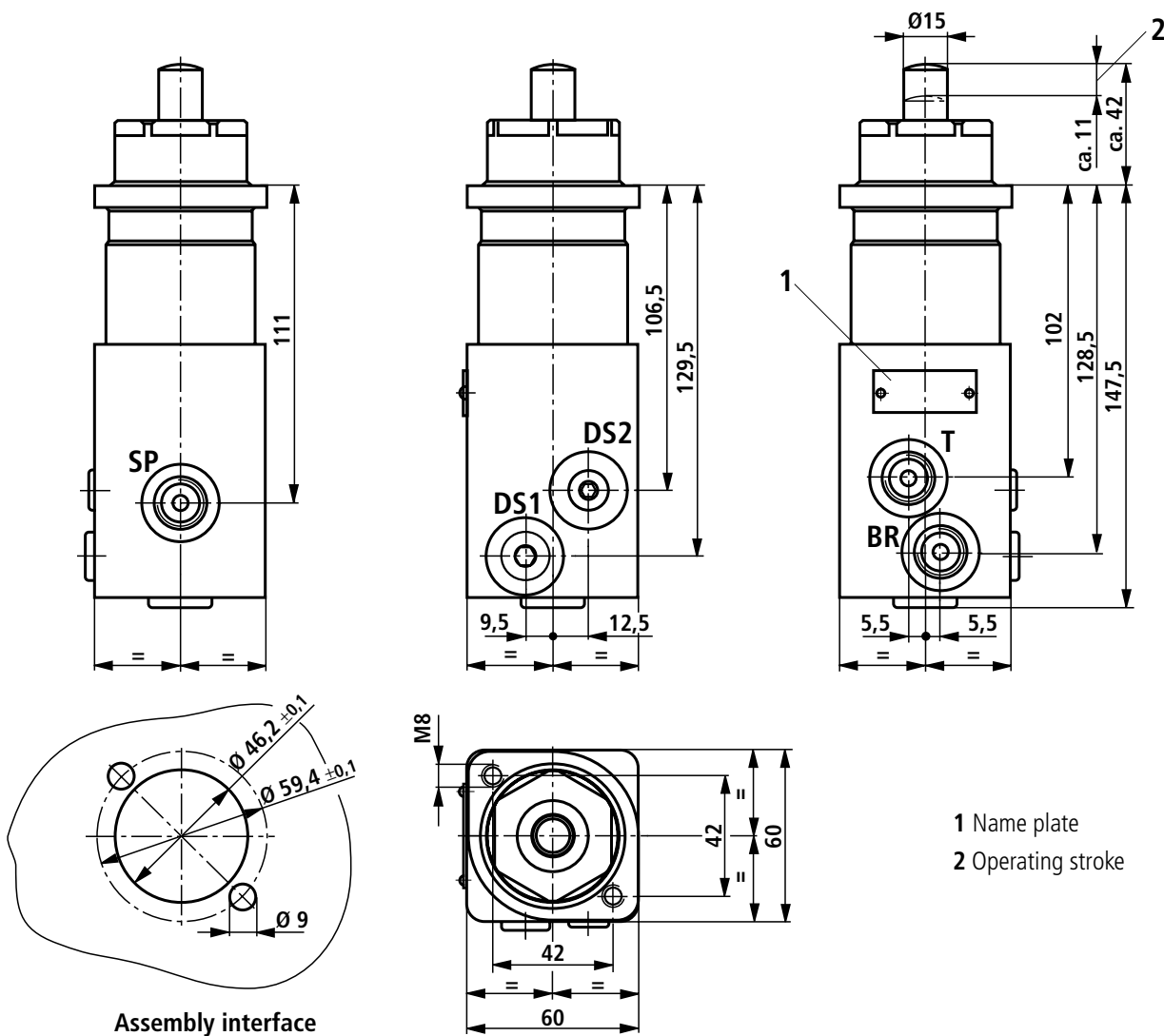
M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524

02 = Connection thread (see table below)  
 Metric thread

<sup>1)</sup> Standard brake pedal, Material No.: 00412419

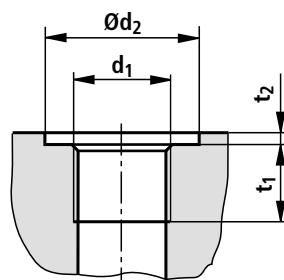
**Unit dimensions**

(Dimensions in mm)



1 Name plate  
 2 Operating stroke

Port	d <sub>1</sub>	Ød <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>
BR	M16x1.5	27	12	3.7
SP	M16x1.5	27	12	2.9
T	M16x1.5	27	12	3.7
DS1	M12x1.5	27	12	2.9
DS2	M10x1	27	10	2.9

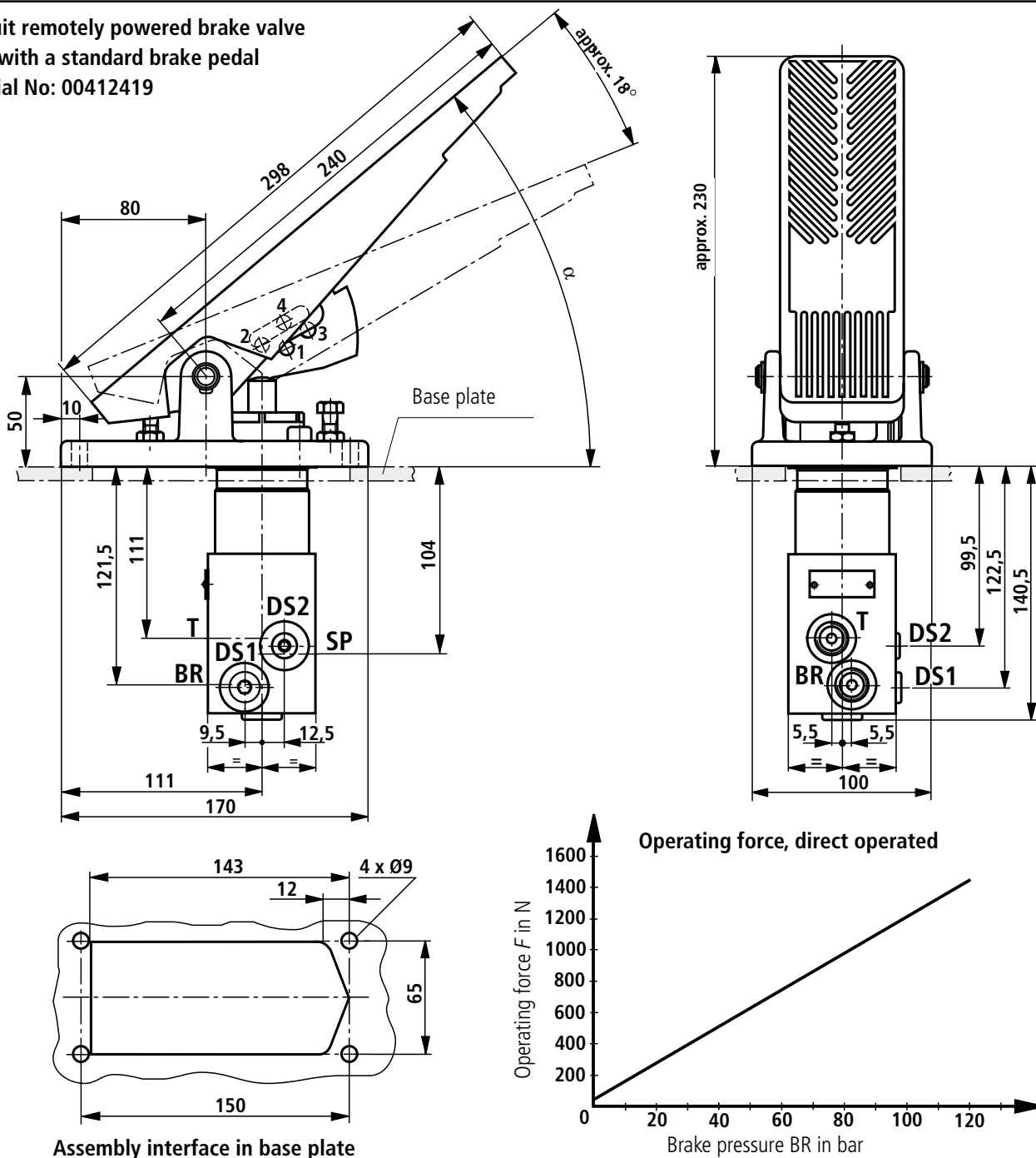


- SP** = Accumulator for operating brake (operating circuit)
- T** = Tank
- BR** = Operating brake (braking circuit)
- DS1** = Brake light pressure switch
- DS2** = Accumulator pressure pressure switch

**Unit dimensions**

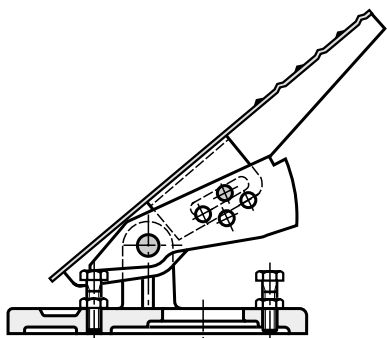
(Dimensions in mm)

1-circuit remotely powered brake valve  
fitted with a standard brake pedal  
Material No: 00412419

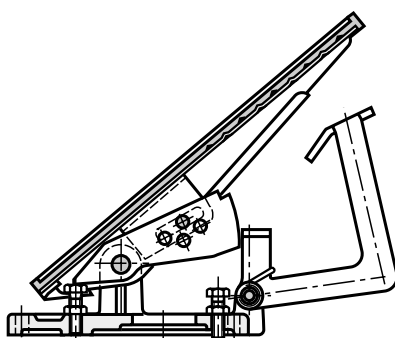


**Brake pedal variations LT 19 and LT 20 (further variations on request)**

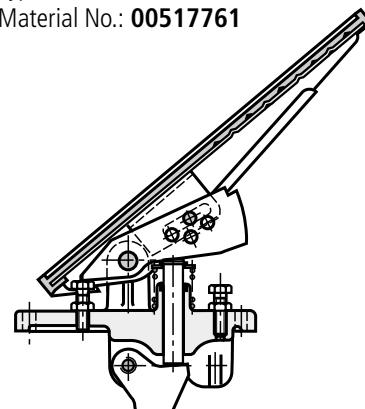
Type: **LT 19 MKA-1X/000/00-S09**  
Material No.: **00571680**



Type: **LT 19 MKA-1X/000H/00-S01**  
Material No.: **00328534**



Type: **LT 20 MKA-1X/000H/00-S05**  
Material No.: **00517761**



## 2-circuit remotely powered brake valve Type LT 07

(to RE 66 146)

Series 2X

Nominal braking pressures 60, 80 and 100 bar

### Features

- Pipe line installation
- Small installation dimensions
- Integrated maximum pressure limitation of the braking circuit
- Brake pressure proportional to the operating force
- Synchronisation through low hysteresis
- All consumer ports on one side
- External brake pressure return (on request)
- Weight 5.5 kg

### Function

**2-circuit remotely powered brake valve is a direct controlled pressure relief valve of 3-way design with stepless mechanical operation.**

It has a maximum pressure relief of secondary circuits and infinitely adjustable pressure in the secondary circuits (braking circuits) which is in proportion to the travel of the operating element (4).

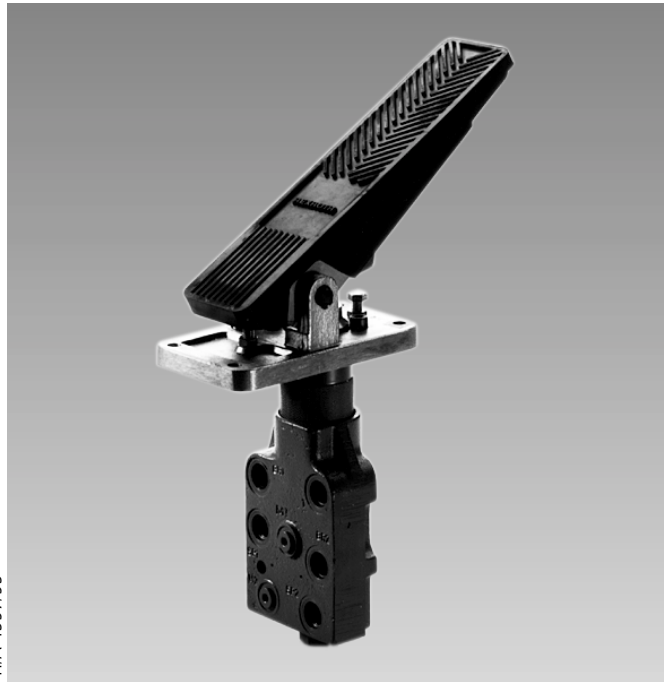
With the failure of one brake circuit the second brake circuit remains fully functional due to the mechanical contact of both spools (2). The operating force at the pedal remains unchanged.

The 2-circuit remotely powered brake valve consists mainly of the housing (1) and control spool (2), main compression spring (3), operating element (4) and the return springs (5) and (6).

The valve is operated via the operating element (4). This pushes the main control spring (3) against both control spools (2). Firstly the control land closes at channel T, afterwards the flow from SP and BR is released in both braking circuits.

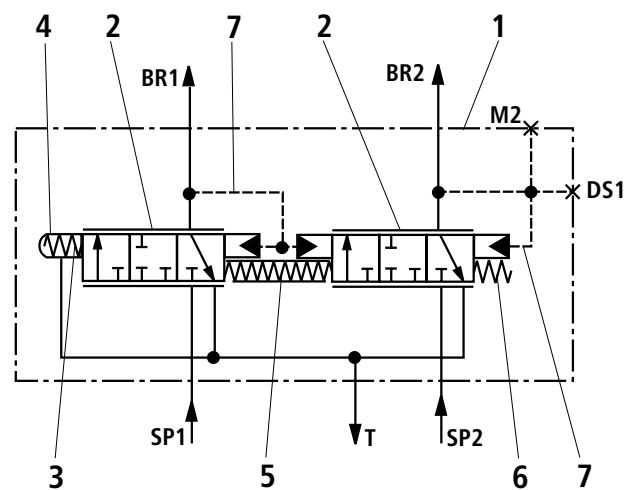
The pressure building up in the brake lines pushes simultaneously via the pilot oil drillings (7) behind the control spool against the main compression spring (3), so that the brake pressure (secondary pressure) rises in proportion to the deflection of the operating element (4). With the deflection of the operating element kept constant the control spool (2) moves into the control position and holds the defined pressure in channels BR1 and BR2 constant. The operating force of the operating element is, therefore proportional to its deflection.

When the main compression spring (3) is unloaded, the pressure springs and the control spools move in such a way that they close SP and BR and open BR towards T and thus closes the secondary circuits (braking circuits).



2-circuit remotely powered brake valve type LT 07 fitted with a standard foot pedal

### Symbol



### Notes on installation

- Rubber parts must **not** be painted
- Operating element must not be subjected to direct high pressure cleaning.
- Damaged seals must be replaced immediately.
- The cross-sections of the hydraulic transfer elements (pipes, hoses) must be selected so that with low temperatures the pressure drop between hydraulic accumulator and brake cylinder remains at a minimum.
- Tank pressure must not exceed the pressure being applied by the brake.
- Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of  $\beta_{10} \geq 75$ .



**Ordering details**

LT	07	MK	A -2X /	/ 02	M	*
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Series 20 to 29 = 2X  
 (20 to 29: unchanged installation and connection dimensions)

Nominal braking pressure 60 bar = 060  
 Nominal braking pressure 80 bar = 080  
 Nominal braking pressure 100 bar = 100

02 =

M =

Connection thread (see table below)

NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524

Metric thread

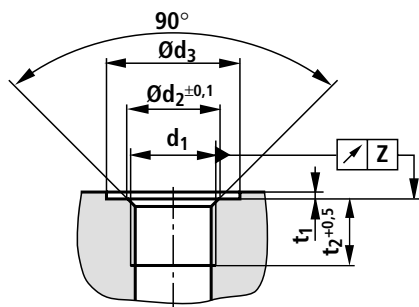
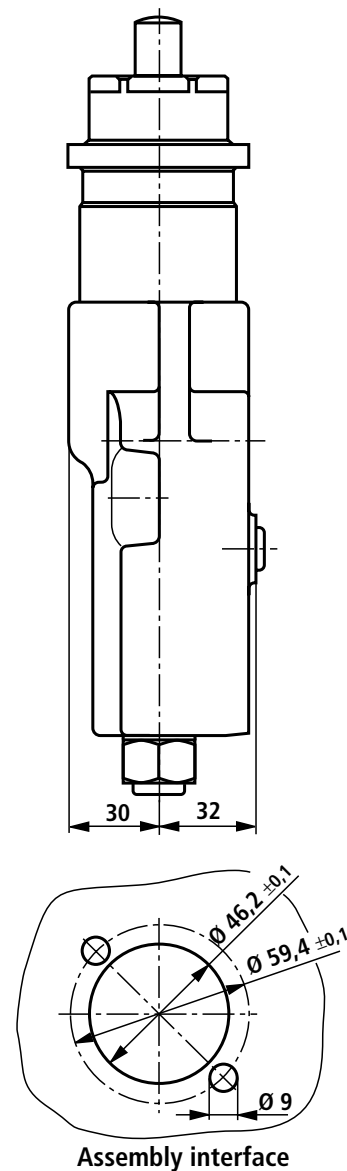
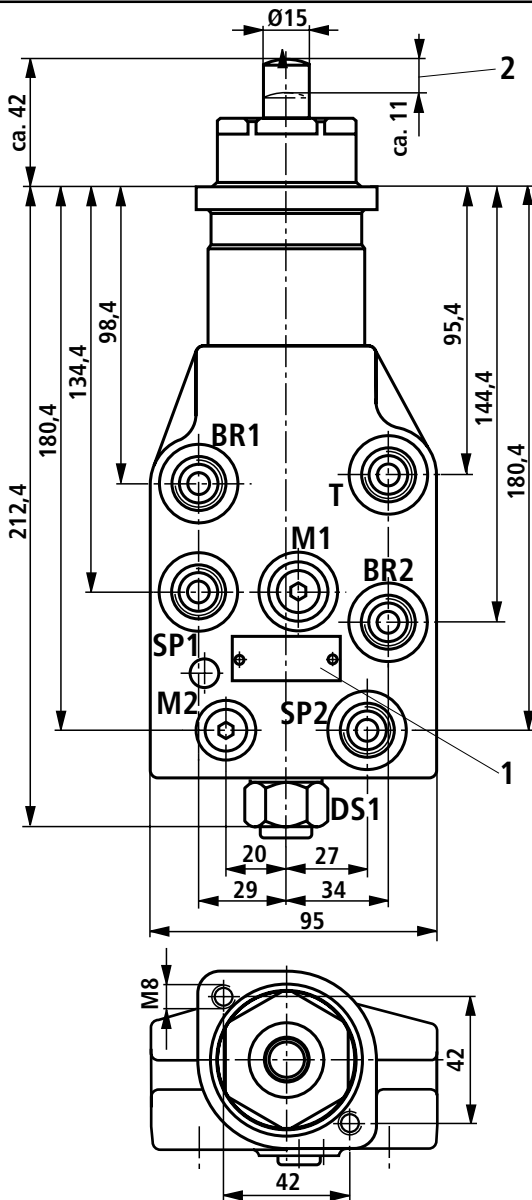
Further details in clear text e.g. 12: fitted with a standard brake pedal <sup>1)</sup>

<sup>1)</sup> Standard brake pedal, Material No: 00412419

**Unit dimensions**

(Dimensions in mm)

- 1 Name plate
- 2 Operating stroke
- SP1 = Accumulator operating brake (operating circuit 1)
- SP2 = Accumulator operating brake (operating circuit 2)
- M1 = Brake pressure connection feedback (brake circuit 1)
- M2 = Brake pressure connection feedback (brake circuit 2)
- DS1 = Pressure switch connection (brake light)
- T = Tank
- BR1 = Operating brake (brake circuit 1)
- BR2 = Operating brake (brake circuit 2)

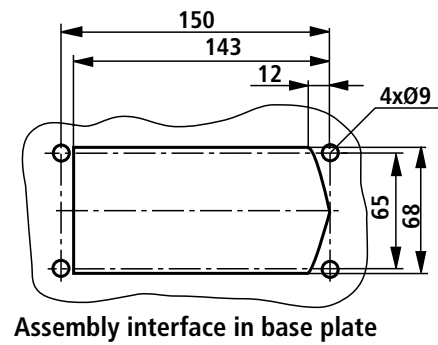
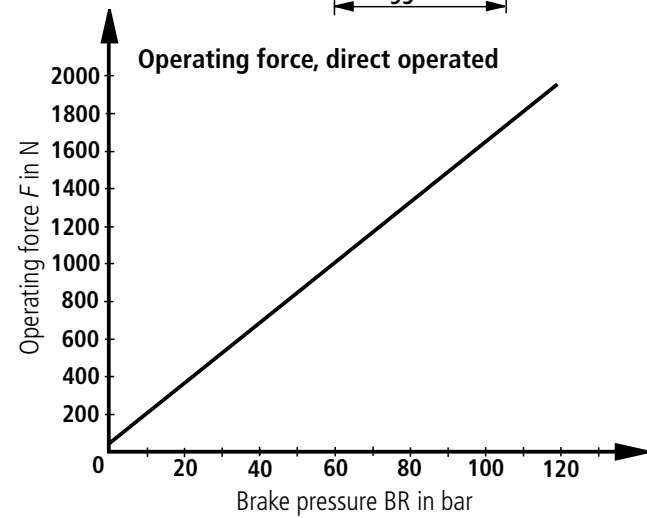
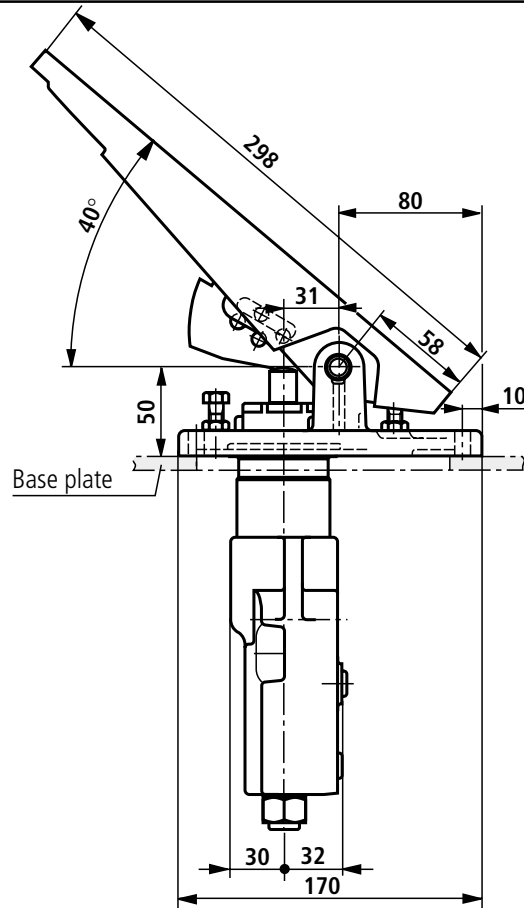
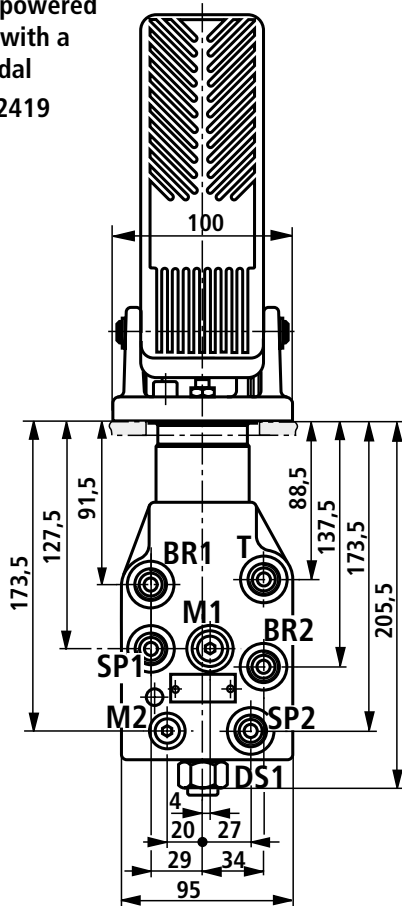


Port	d <sub>1</sub>	Ød <sub>2</sub> <sup>±0.1</sup>	Ød <sub>3</sub>	t <sub>1</sub>	t <sub>2</sub>	z
BR1; BR2	M16x1.5	16.4	26	1.5	12	0.05
SP1; SP2	M16x1.5	16.4	26	1.5	12	0.05
T	M16x1.5	16.4	26	1.5	12	0.05
DS1	M12x1.5	12.4	20	0.9	11	0.1
M1	M10x1	10.4	20	1	8	0.05
M2	M10x1	10.4	20	1	8	0.05

**Unit dimensions**

(Maßangaben in mm)

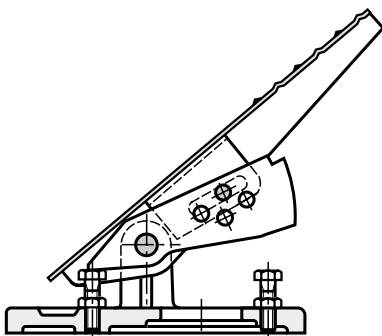
2-circuit remotely powered  
brake valve fitted with a  
standard brake pedal  
Material No. 00412419



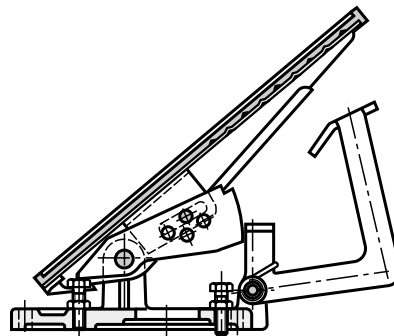
**Note on assembly:**  
When assembling below the base plate it must be taken care that the movement of the pedal cannot be affected by dirt.

**Brake pedal variations LT 19 and LT 20 (further variations on request)**

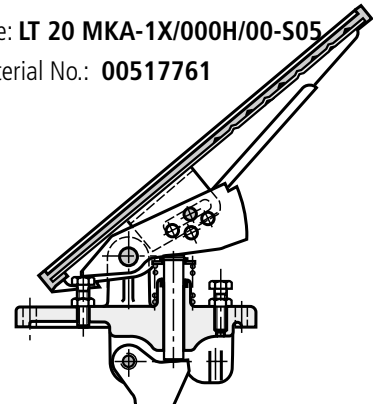
Type: **LT 19 MKA-1X/000/00-S09**  
Material No.: **00571680**



Type: **LT 19 MKA-1X/000H/00-S01**  
Material No.: **00328543**



Type: **LT 20 MKA-1X/000H/00-S05**  
Material No.: **00517761**



## Accumulator loading valve

### Type LT 06

(to RE 66 191)

Series 3X

Maximum operating pressure 200 bar

Flow 70 L/min

### Features

- Pipe line installation
- Simple installation
- Accumulator pressure orientated pump loading during loading process

### Function

The accumulator loading valve or pressure switch-off valve has the purpose of keeping a pressure level within certain limiting values (switch-off pressure, switch-on pressure) in an accumulator circuit. The switching pressure difference is approx. 18 % of the switch-off pressure.

**Note:** If actuators (N) downstream from the pump produce a higher pressure than the switch-off pressure of the accumulator loading valve, then the accumulator circuit is raised to this pressure level.

The valve consists mainly of a pilot control with pressure setting element (1), pressure compensator (2) and check valve (3).

### Switching over of pump flow from accumulator loading into neutral circulation

The pump delivers into the accumulator circuit via the check valve (3) during the loading procedure. For this the pressure is passed to the load signal side of the pressure compensator (2) via the control line and pilot control. This throttles the pump flow until the pressure, which builds up in the accumulator circuit, overcomes the spring force of the pressure setting element (1). The pilot control element switches the load signal line of the pressure compensator (2) from S1 to T. The pressure compensator (2) then switches the pump flow from P to N and the check valve (3) closes. The loading process is complete and the pump flow flows with low  $\Delta p$  through the loading valve.

### Technical data (for applications outside these parameters, please consult us!)

System pressure	bar	Up to 200	
Operating pressure in accumulator circuit	bar	Up to 200	
Flow	From P to Sp	L/min	Approx. 17 (standard)
	From P to N	L/min	Max. 70
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524	
Pressure fluid temperature range	°C	–20 to +80	
Viscosity range	mm <sup>2</sup> /s	2.8 to 380	
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $B_{10} \geq 75$ .	
Weight	kg	2.0	

### Notes on installation

- Port T must be led separately to the tank.

F 89 005

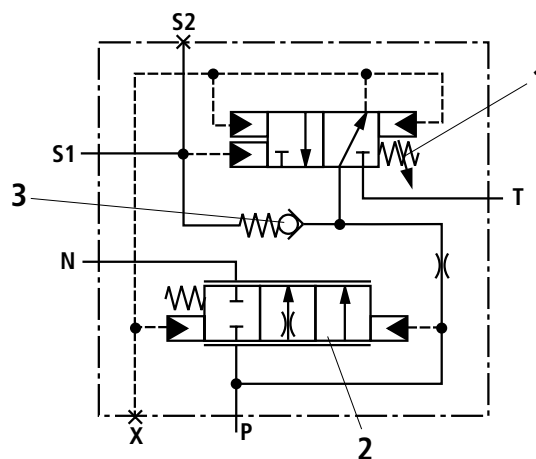


Accumulator loading valve, type LT 06

### Switching over the pump flow from neutral circulation into accumulator loading

If the pressure in the accumulator circuit decreases to the lower switching point (switch-on pressure), P is connected to the load signal chamber of the pressure compensator (2) and the pump delivers again into the accumulator circuit.

### Symbol



**Ordering details**

**LT 06 - A 06-3X / / 02 M \***

Series 30 to 39  
(30 to 39: unchanged installation and connection dimensions)

= 3X

**Pressure stage of accumulator circuit**

Pressure stage 100 bar = 100

**Pressure stage 150 bar (standard) = 150**

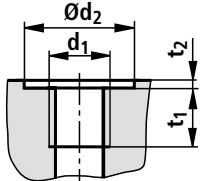
Pressure stage 200 bar = 200

Further details in clear text  
M = NBR seals suitable for mineral oil (HL, HLP) to DIN 51 524

02 = **Connection thread**  
Metric thread

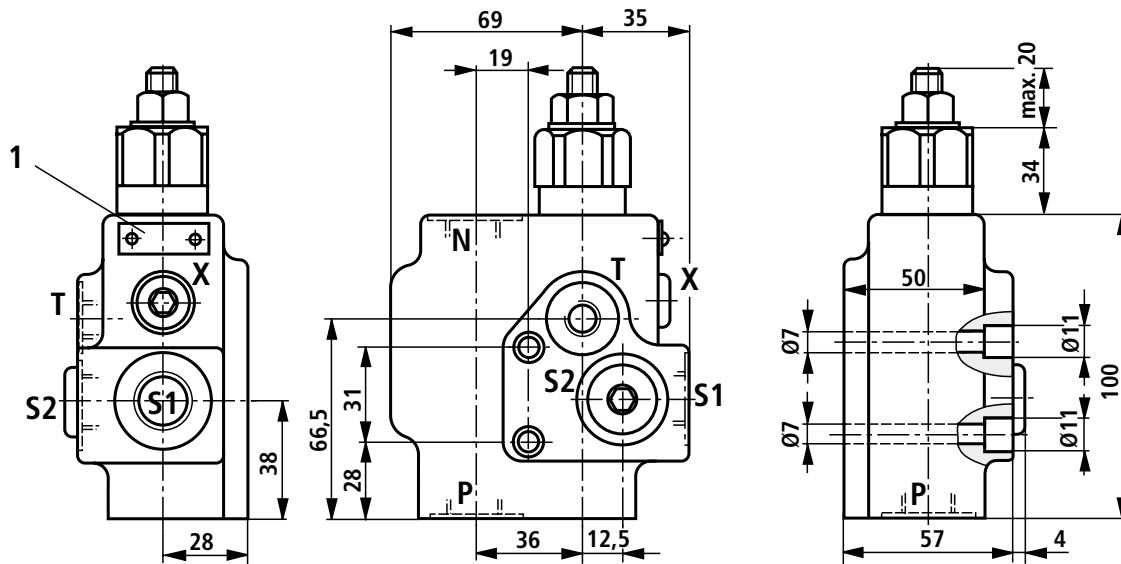
B18 = **Accumulator loading flow**  
Approx. 6 L/min  
B40 = **(standard) approx. 17 L/min**

Port	02			
	d <sub>1</sub>	Ød <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>
P, N	M18x1.5	32	12	1
S1, S2	M18x1.5	32	12	1
T, X	M12x1.5	19	12	1



**Unit dimensions**

(Dimensions in mm)



1 Name plate

## Hand brake valve

### Type LT 08

(to RE 66 148)

Series 2X

### Features

- Pipe line installation
- Integrated maximum pressure relief
- Good fine control
- Mechanically operated

### Function

The hand brake valve is designed as a direct operated 3-way pressure reducing valve and is designed for use in spring loaded braking systems; other applications, however, are also possible.

In position **I** (see Unit dimensions) of the hand lever the through flow from S to B is open. The spring load braking system is, therefore, opened with the pressure applied in B. In this position the maximum defined pressure in B is limited according to type of the valve 25, 40, 60, 100 or 125 bar independent on the pressure at input S.

By moving the hand lever into the detent position **II**, the pressure from B to T is decreased directly proportional to the travel of the lever and the operating speed. The pressure at port B can be finely controlled with the hand lever. The spring load braking system is activated.

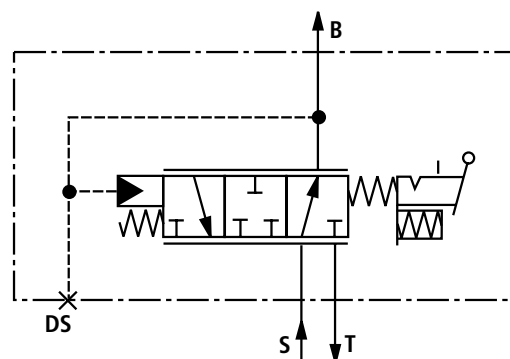
The operating lever is released by lightly lifting the release ring (1).



F 89 007

Hand brake valve type LT 08 MMA-2X/...

### Symbol



### Technical data (for applications outside these parameters, please consult us!)

Supply pressure, max.	bar	200
Tank pressure, max.	bar	0.5
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524
Pressure fluid temperature range	°C	– 20 to + 80
Viscosity range	mm <sup>2</sup> /s	2.8 to 380
Degree of pressure fluid contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .
Weight	kg	3.2

**Ordering details**

LT	08	MM	A	-2X	/	/	02	M	*
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Series 20 to 29 = 2X  
 (20 to 29: unchanged installation and connection dimensions)

**Brake ventilation pressure**

Pressure stage 25 bar	= 025
Pressure stage 40 bar	= 040
Pressure stage 60 bar	= 060
Pressure stage 80 bar	= 080
Pressure stage 100 bar	= 100
Pressure stage 125 bar	= 125

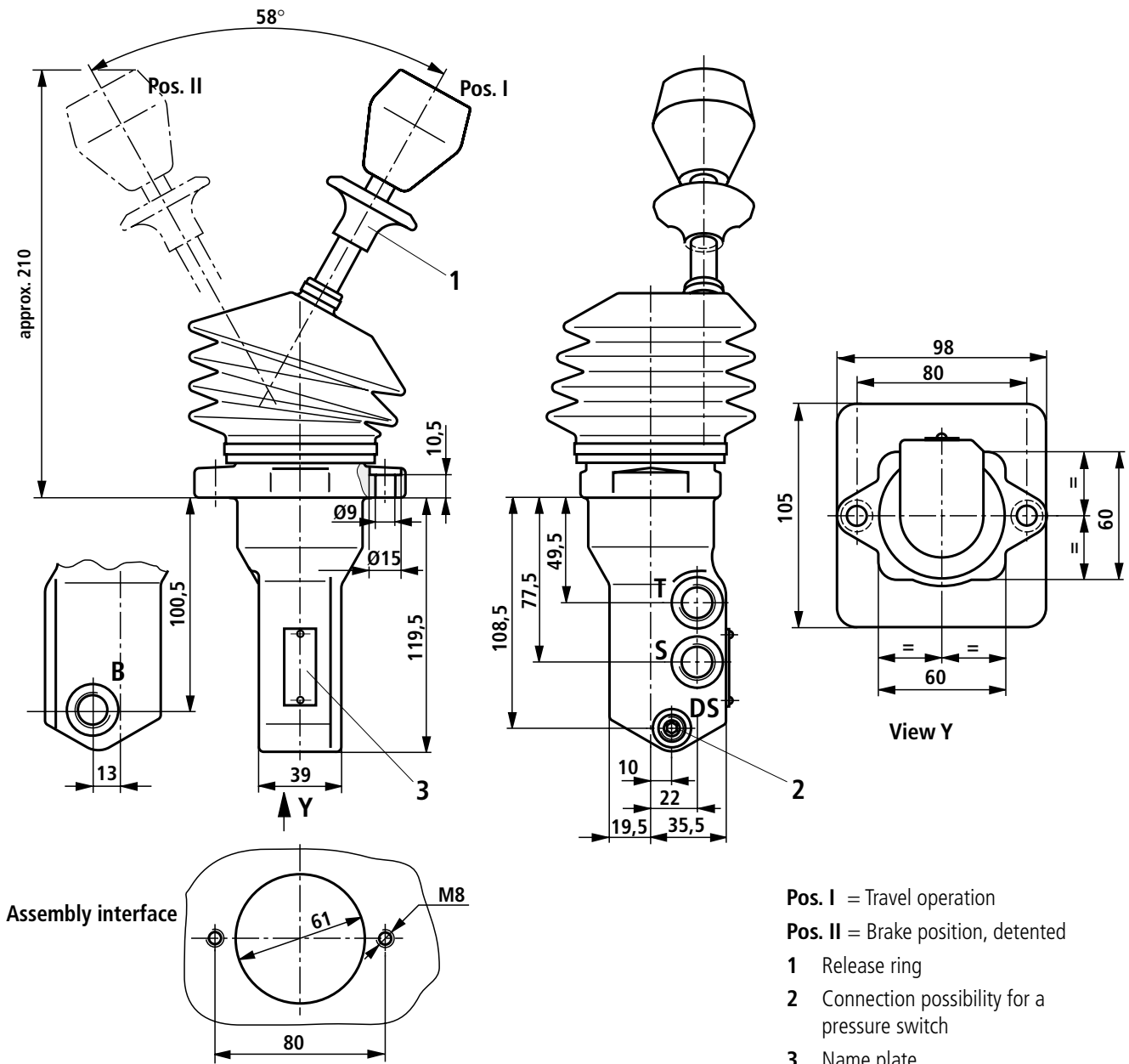
Further details in clear text  
 M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524

02 = **Connection thread**  
 Metric thread

	Port	d <sub>1</sub>	Ød <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>	
02	S, T, B	M16x1.5	24.3	12	1	
	DS	M12x1.5	18	12	1	

**Unit dimensions**

(Dimensions in mm)



## Relay valve

### Type LT 09

(to RE 66 152)

Series 1X

#### Features

- Relay valves are used in vehicles with very long brake lines or very large brake cylinder volumes.
- The connection is directly at the axis which is to be decelerated.

#### Function

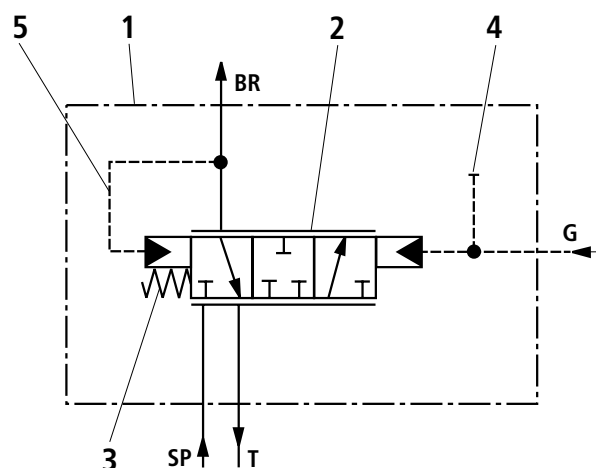
The hydraulic relay valve is a direct operated proportional pressure reducing valve of 3-way design with hydraulic pilot.

The relay valve consists mainly of the housing (1), control spool (2), return spring (3) and bleed screw (4).

The valve is controlled via a hydraulic control pressure in port G. This control pressure directly effects the control spool (2). Firstly the control land closes at port T, afterwards the through flow from SP to BR is released.

The pressure which builds up in the brake line BR simultaneously pushes via the pilot oil drilling (5) behind the control spool (2) against the control pressure so that the brake pressure rises in proportion to the control pressure. With the control pressure being held constant the control spool (2) moves into the control position and holds the value set in channel BR constant. When the control pressure decreases the return spring closes via the control spool (2) from SP to BR and opens BR to T, so that the braking circuit is unloaded.

#### Symbol



#### Technical data (for applications outside these parameters, please consult us!)

Supply pressure, max.	bar	200
Control pressure, max.	bar	100
Operating brake pressure, max.	bar	100
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524
Pressure fluid temperature range	°C	–20 to +80
Viscosity range	mm <sup>2</sup> /s	2.8 to 380
Degree of pressure fluid contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $B_{10} \geq 75$ .
Weight	kg	1.3

#### Notes on installation

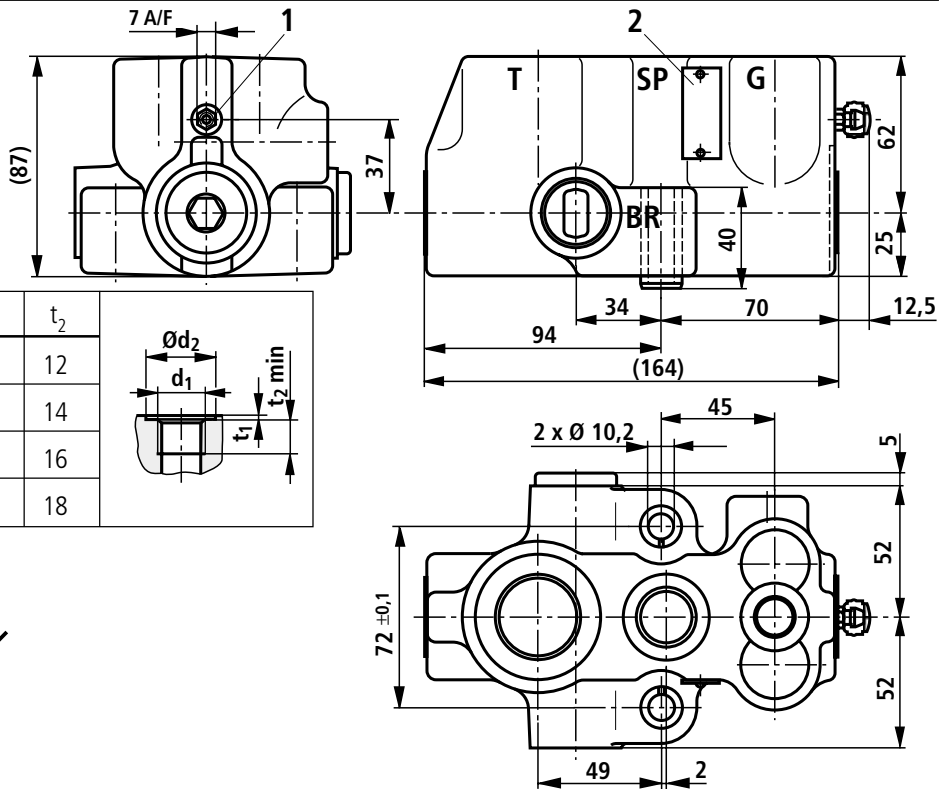
- The cross-sections of the transfer elements (pipes, hoses) must be selected so that with low operating temperatures the pressure loss between hydraulic accumulator and braking cylinder is kept to a minimum.
- Preferably the accumulators should be installed near the relay valve.

**Unit dimensions**

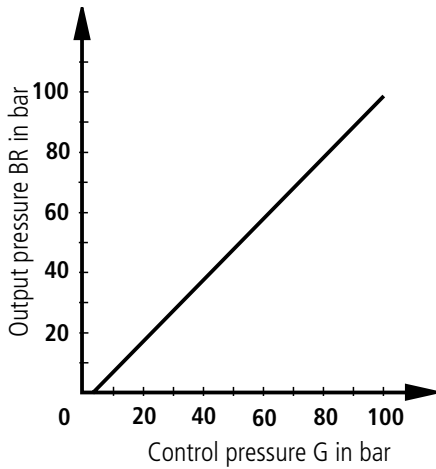
(Dimensions in mm)

Type: **LT 09 HA11-1X/150/02V**

Material No.: **00563937**



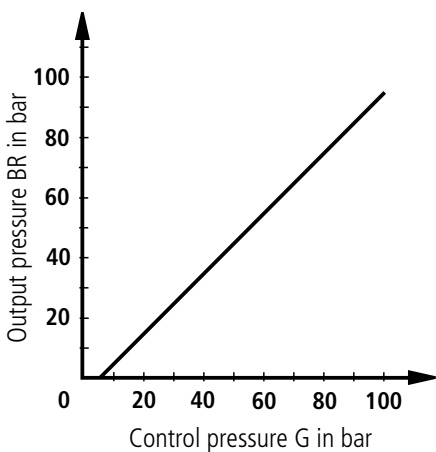
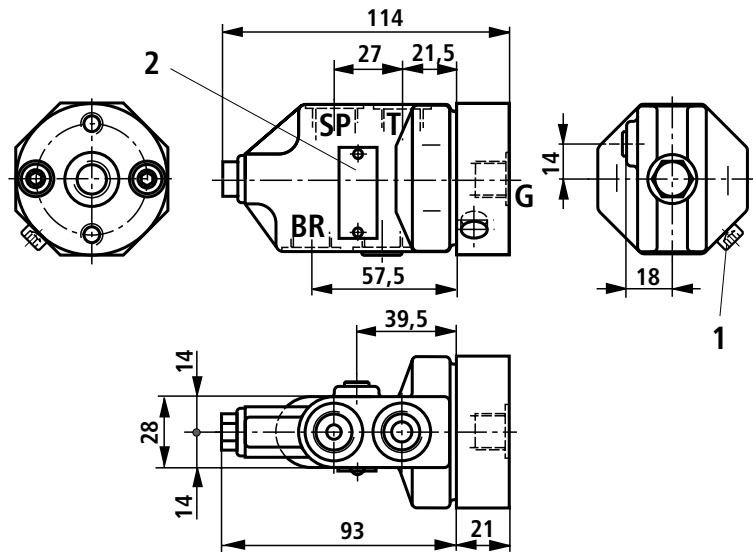
Port	d <sub>1</sub>	Ød <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>
G	M16x1.5	27	5	12
SP	M22x1.5	34	5	14
BR	M27x2	-	-	16
T	M33x2	50	4	18



- 1 Bleed screw
- 2 Name plate

Type: **LT 09 HG-1X/125/02M**

Material No.: **00375749**



Port	d <sub>1</sub>	Ød <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>
G	M14x1.5	21	1.5	12
SP	M16x1.5	23	1.5	12
BR	M16x1.5	23	1.5	12
T	M16x1.5	23	1.5	12

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