

Directional spool valves Type SW 2...

Directly solenoid-operated for oil-hydraulic systems

Operating pressure $p_{\max} = 315 \text{ bar}$; pump delivery flow $Q_{\max} = 25 \text{ l/min}$

Directional spool valve type SW 1... up to 12 l/min, see leaflet D 7450

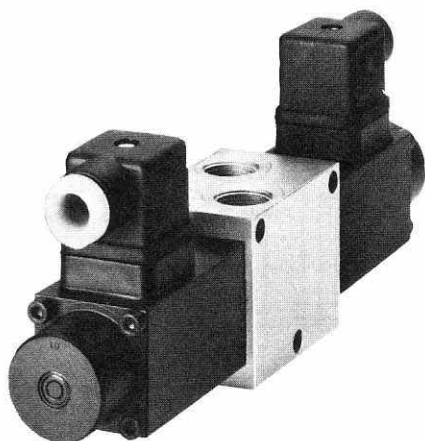
1. General

The type SW 2... directional spool valves are used in oil-hydraulic systems. They serve to control the oil flow and therefore the direction of movement of the consumers (hydraulic cylinders, hydraulic motors). Individual units for pipeline connection or base plate mounting are available, as are directional valve blocks for any desired arrangement in pipeline systems or for fitting onto hydraulic units. The directional valve blocks consist of individual components held together by powerful tension rods.

Full steel design. The housings are therefore insensitive to pressure shocks. The possibility of leaks which sometimes occur in the form of outward hairline cracks on cast housings after extended operating periods is excluded here from the outset. The housing bores are diamond-honed, the valve spool are hardened and ground and both are polished and deburred. This maintains leads to even seal gaps with a minimum leakage rate.

Operation is via pressure sealed single-stroke solenoids (wet-anchor solenoids) which are flanged to each other opposite on the housing and which act immediately on the valve spool. The zero setting is assumed automatically by spring centering.

2. General outlay



Single valves

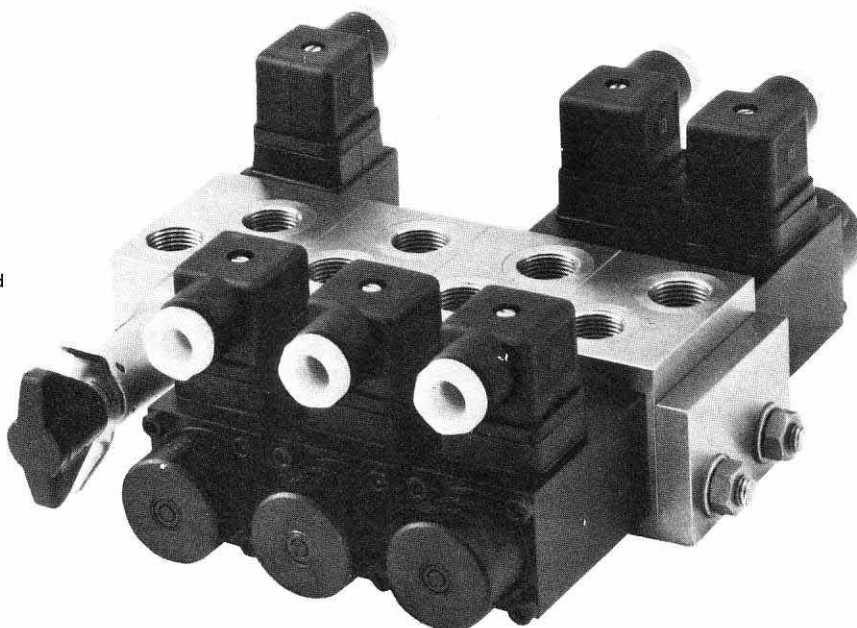
Page 2 ff

- SW2 for direct pipe connection
Standard version (photo)
- SWP2 for plate mounting
For fitting to customer-furnished basic blocks or with single connecting plate without pressure limiting valve supplied by HAWE.
- SWR2 for series mounting
For lateral flanging to directional valve blocks or for fitting on customer-furnished connecting plates

Directional valve blocks

Page 6 ff

- For direct connection to the pipeline system
consisting of series valves flanged laterally onto each other (photo)
- For fitting on to hydraulic units



3. Single valves

3.1. Type code, main data

Example 1:
Single valve for direct pipe connection

Example 2:
Single valve for fitting on customer-furnished base plate, underneath with single sub-plate

Example 3:
Single valve for flanging onto the side of customer-furnished connection block, functional only when terminated by end plate (Sect.3.3 and 4.4), symbol representation, see Section 4.1

SW 2 G **-G 24**
SWP 2 D **-WG 220**
SWP 2 E - 3/8 - G 24
SWR 2 W **-WG 110**

| Basic type Size | Type of connection | Connection size | Main hydr. data |
|-----------------|---------------------|-----------------------------|--|
| SW 2 | Pipeline connection | G 3/8 DIN ISO 228/1 | Press. p _{max} = 315 bar |
| SWR 2 | Series mounting | Hole patterns, see Sect.3.3 | Pump delivery flow Q _{max} = 25 l/min |
| SWP 2 | Plate mounting | | |

Optionally for SWP 2 available single connection plate
P, R, A, B = G 3/8
DIN ISO 228/1 as shown in dimensional sketch, Section 3.3

| Operating solenoid | |
|--------------------|-----------------------|
| G 12 | 12 V DC |
| G 24 | 24 V DC |
| WG 110 | 110 V AC 50 and 60 Hz |
| WG 220 | 220 V AC 50 and 60 Hz |

Preferred voltages, additional voltages see Sect.3.2.2

Flow diagrams

Detailed symbols:

| | G | D | E | O | N | B | W | R |
|---------------------------|---|---|---|---|---|---|---|---|
| Example 1: SWR 2G-... | | | | | | | | |
| Example 2: SWP 2D-... | | | | | | | | |
| Example 3: SWP 2E-3/8-... | | | | | | | | |

SW2: Identical to symbols opposite

1) See footnote 1) in Δp-Q characteristics, Section 3.2.1

3.2. Characteristic data

3.2.1. General and hydraulic

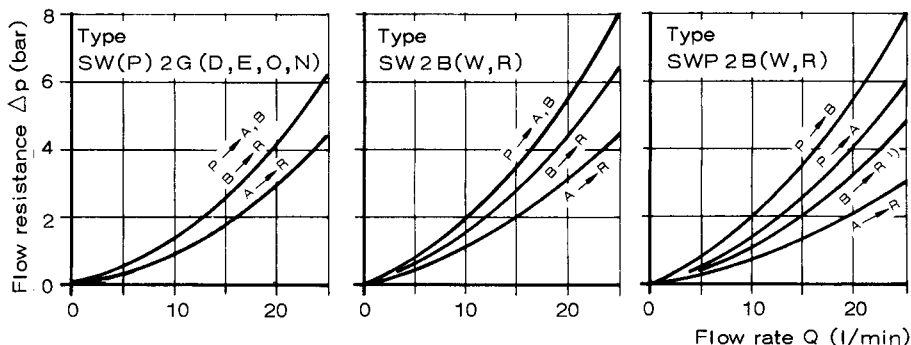
| | |
|------------------------|---|
| Design | Longitudinal spool valves |
| Surface protection | Valve housing electrogalvanized, coil housing of the solenoids electrogalvanized matt and olive-chromated |
| Installation position | Any, mounted as shown in dimensional sketches, Section 3.3 |
| Line connection | Pipe thread DIN ISO 228/1 or plate mounting |
| Connection designation | P = Pressurized oil inlet (pump) G 3/8 A, B = Consumer G 3/8 R = Return G 3/8, on SWP 2 (single valve) two R outlets, optionally one or both can be used, see also 1) for Δp-Q characteristics M = Pressure gauge connection G 1/4 |
| Flow direction | In accordance with arrow direction in the flow diagrams. Reversing not permissible |
| Overlapping | Positive |
| Temperatures | Oil and ambient: approx. - 40 ... + 80°C Pay attention to duty cycle of the solenoid when > 40°C |
| Operating pressure | p _{max} = 315 bar on all connections |
| Flow | Pump delivery flow Q _{max} = 25 l/min; permissible return flow approx. 50 l/min (for double-action differential cyl., connect piston side at A, when > 25 l/min) |
| Pressure medium | Hydraulic oil in accordance with DIN 51 524, Parts 1 and 2: 10 ... 68 mm ² /s at 40°C (ISO VG 10 to VG 68 in accordance with DIN 51 519) Viscosity limits: min. approx. 4; max. approx. 1500 mm ² /s Viscosity range for optimum operation approx. 10 ... 500 mm ² /s |

Mass (weight) appr. kg

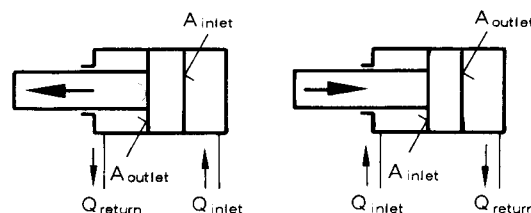
| | | | | |
|-------------------|------|-------|-------|--------------|
| Valve code letter | SW 2 | SWR 2 | SWP 2 | SWP 2...-3/8 |
| G, D, E, O, N | 1,7 | 1,8 | 1,6 | 2,4 |
| B, W, R | 1,2 | 1,3 | 1,1 | 1,9 |

$\Delta p - Q$ characteristics

Oil viscosity during the measurement approx. 60 mm²/s



The characteristics apply in each case to a single flow direction P → R (circulation), P → A(B) or A(B) → R. In the case of 4/3-way or 4/2-way directional spool valves, the total resistance $\Delta p_{tot.}$ measured at inlet P, consists of the inlet-side portion Δp_{inlet} and the outlet-side portion Δp_{outlet} . Bear in mind here that in the case of consumers with uneven area ratios (differential cylinder), the return flow Q_{return} (via which Δp_{outlet} can be read off) can be less than or greater than the inlet Q_{inlet} (for Δp_{inlet}), depending on the direction of movement.



$$\Delta p_{tot.} = \Delta p_{inlet} + \Delta p_{outlet} \frac{A_{outlet}}{A_{inlet}}$$

$$Q_{return} = Q_{inlet} \frac{A_{outlet}}{A_{inlet}}$$

1) SWP 2W: B → R is equivalent to A → R when both R outlets are used (amalgamated in the base plate)

3.2.2. Electrical

Solenoid

constructed and tested in accordance with VDE 0580, switches pressure-sealed in oil
 Appr. value for rated power $P_N \approx 24,4 W \pm$ appr. 6%, depending on the rated volt. U_N and make

| | | | | | | | | | | | | | | |
|--|---|------|------|------|-------------------------------|------|--------------------------------------|------|------------------|-------|-------|-------------------|--|--------|
| Code as per Sect. 3.1 | G 12 | G 24 | G 36 | G 42 | G 48 | G 60 | G 72 | G 80 | G 98 | G 110 | G 180 | G 196 | WG 110 | WG 220 |
| Rated voltage U_N V | 12 | 24 | 36 | 42 | 48 | 60 | 72 | 80 | 98 ²⁾ | 110 | 180 | 196 ²⁾ | 110 | 220 |
| | Direct voltage DC | | | | | | | | | | | | Altern. volt. AC 50 and 60 Hz | |
| Recomm. val. curr. I_{20} A | 2 | 1 | 0,64 | 0,56 | 0,54 | 0,4 | 0,35 | 0,33 | 0,25 | 0,22 | 0,15 | 0,14 | 0,25 | 0,14 |
| Time constant T | Start of stroke appr. 9,3 ms End of stroke appr. 25 ms | | | | | | Inductivity $L = 1000 T \cdot R$ (H) | | | | | | (Recommended value for R in Ω from $R = U_N / I_{20}$) | |
| Circuit diagrams (apply to solenoid a and b) | Direct voltage G... | | | | Alternating voltage WG... | | | | | | | | | |
| Appliance plug | A DIN 43 650 Code G (... V DC) is supplied with gray and black plug Code WG (... V AC) is supplied only with black plugs with bridge rectifier insert (Make: Klar und Beilschmidt, 8300 Landshut) | | | | | | | | | | | | | |
| Relative duty cycle | 100% duty cycle Stamp on the solenoid | | | | | | | | | | | | in operation: at ambient temperature (°C) < 40 60 80 Duty cycle (%) 100 appr. 60 appr. 40 | |
| Switch. times (appr. val.) | On: approx. 60 ... 70 ms Off: approx. 30 ... 60 ms | | | | | | | | | | | | | |
| Switching rate | approx. 3600 switching operations/hour | | | | | | | | | | | | | |
| Protect. class DIN 40 050 | Solenoid IP 65, connection IP 65 (appliance socket in fitted condition) | | | | | | | | | | | | | |
| Insulat. material class | F | | | | | | | | | | | | | |
| Contact temperature | approx. 85°C at 20°C ambient temperature | | | | | | | | | | | | | |
| Mountability | In the event of an electrical fault, the solenoid can simply be pulled axially after undoing four mounting screws and can be replaced by a new one | | | | | | | | | | | | | |

²⁾ For connection to alternating voltage 50/60 Hz via separately arranged, customer-furnished bridge rectifier (silicon rectifier): G 98 for mains 110 V AC; G 196 for mains 220 V AC

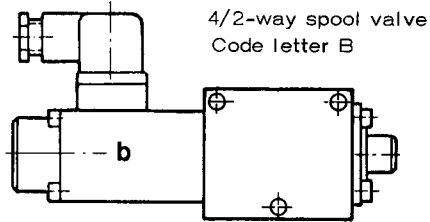
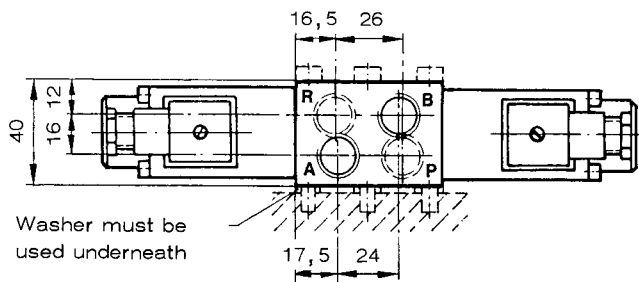
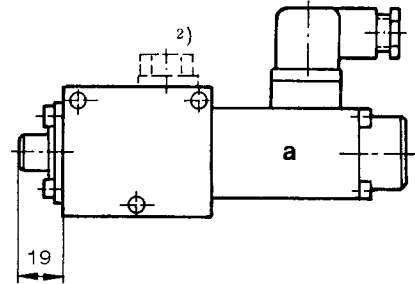
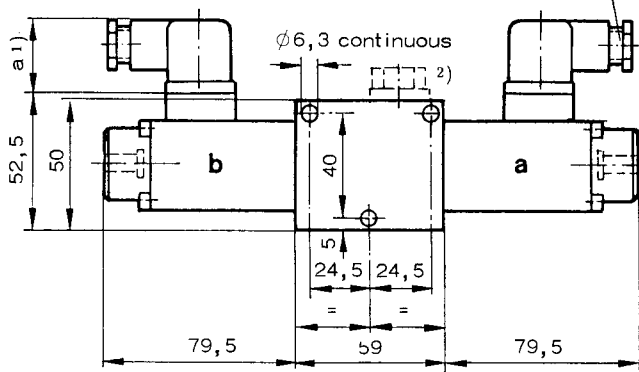
3.3. Dimensions All dimensions are in mm, subject to change without notice!

Type SW 2

4/3-way and 3/3-way spool valves
Code letters G, D, E, O and N

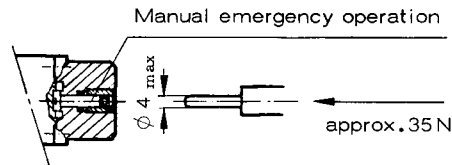
Cable
connector Pg 9

4/2-way spool valve
Code letter W and R



Washer must be used underneath

Connection A, B, P, R = G 3/8



1) a = 29 (solenoid G 12, G 24) and 34 (solenoid WG 110, WG 220)

These measurements can be up to max. 40 mm in accordance with DIN 43 650, depending on the make (here Messrs. Klar und Beilschmidt, Landshut)

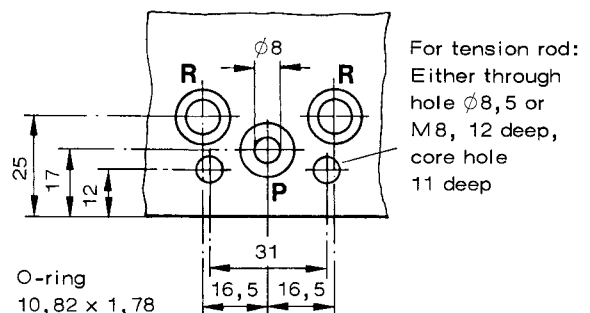
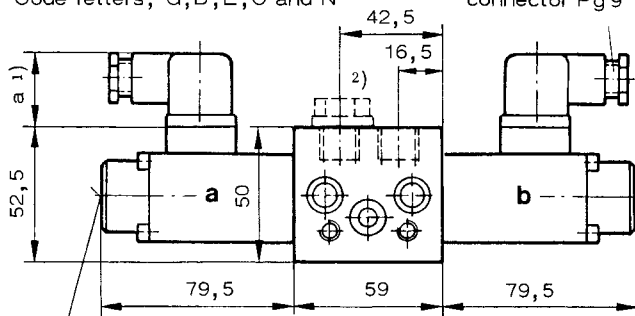
2) Connection B is closed on valves N and R (screw plug G 3/8 x 12, modified to sealing edge, HAWE No. 1371 007)

Type SWR 2

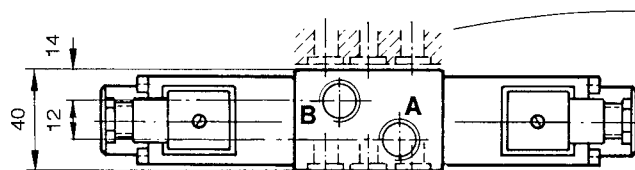
4/3-way and 3/3-way spool valves
Code letters, G, D, E, O and N

Cable
connector Pg 9

Hole pattern for customer-furnished connection



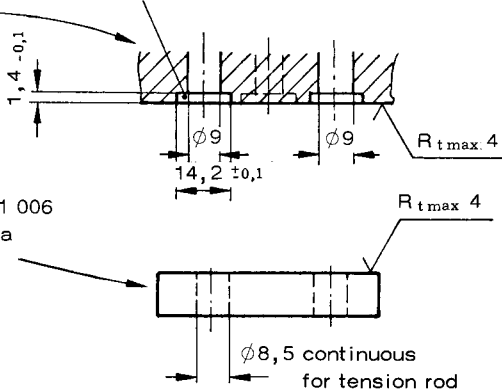
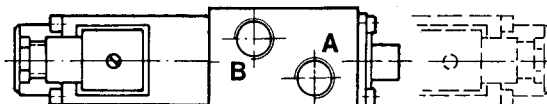
Manual emergency operation, see SW 2!



Connection A, B = G 3/8

4/2-way spool valve
Code letters W and R

Code letter B

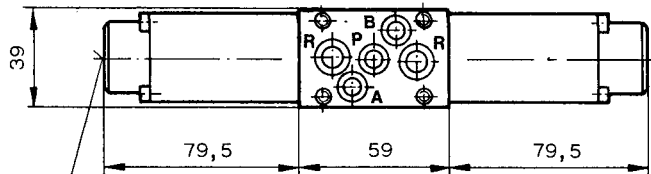


HAWE part 7451 006 can be used as a cover plate

Type SWP 2

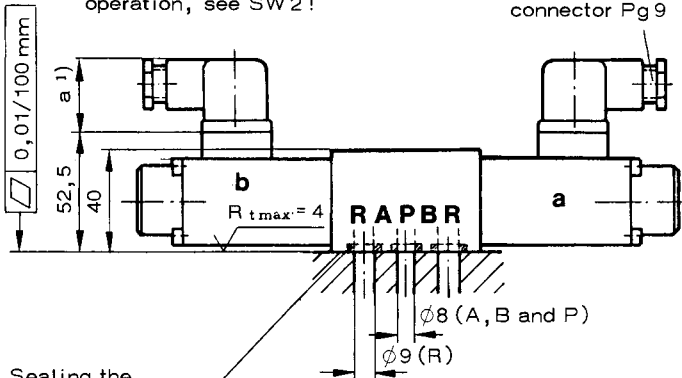
4/3-way and 3/3-way spool valves

Code letters G, D, E, O and N



Manual emergency operation, see SW 2!

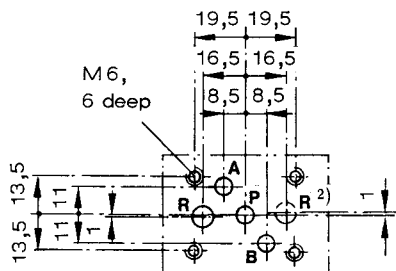
Cable connector Pg 9



Sealing the connections:

A, B and P by O-ring 9,25 x 1,78 90 Shore
R by O-ring 10,82 x 1,78 90 Shore

Hole pattern of base plate (top view):

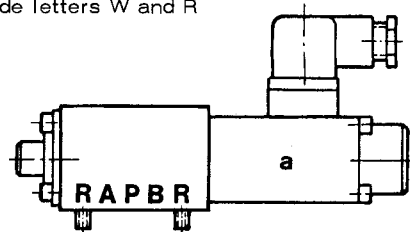


1) a = 29(G 12 to G 196); 34 (WG 110 and WG 220)

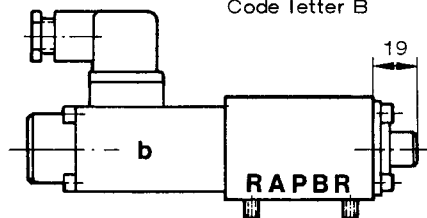
These measurements can be up to max.40 mm in accordance with DIN 43 650, depending on the make (here Messrs. Klar und Beilschmidt, Landshut)

2) For two returns $\Delta p_{B \rightarrow R} = \Delta p_{A \rightarrow R}$, also see $\Delta p-Q$ characteristics, Footnote 1) and detailed symbol, Section 3.1

4/2-way spool valve
Code letters W and R

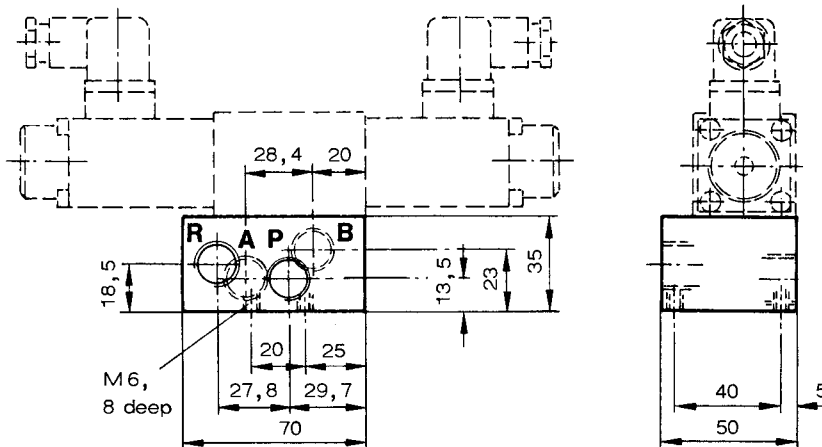


4/2-way spool valve
Code letter B



Connecting plate, Code -3/8

Coding example, see Section 3.1



Connections

A, B, P, R = G3/8 DIN ISO 228/1

4. Directional valve blocks Only connected in parallel

4.1. Type code, main data

Example 1:

Directional valve block, circulation connection block with adjustable pressure limiting valve up to 210 bar, valve flow diagrams G and D, 24V DC solenoids

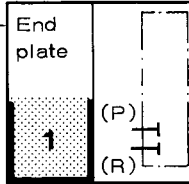
Example 2:

Directional valve block for fitting to hydraulic units type MP (D 7200), HK (D 7600/D 7600-34/D 7600-24)

SWR 2 S7 - GDW - 1 - G 24 - 210

SWR 2 F - G Z3 D - 1 - WG 220

Desired pressure setting (bar)
Possible pressure ranges:
(0) ... 80 bar Press. specificat. determ. the spring
(0) ... 160 bar
(0) ... 315 bar
Not for connection block A 5, F and D



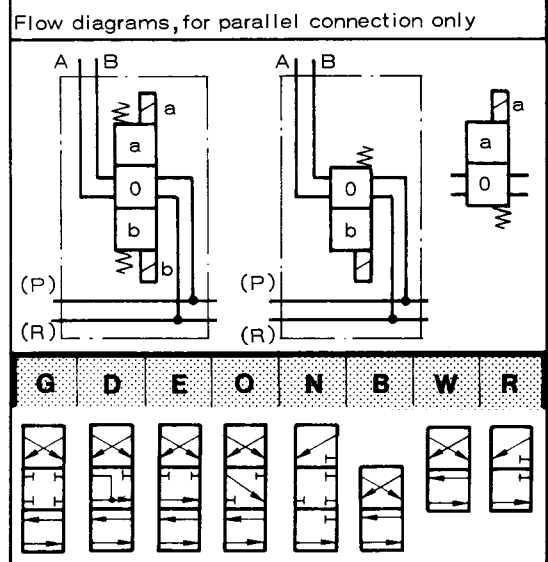
Operating solenoid **G 12 to WG 220** as per Sect. 3.1 and 3.2.2

Additional unit pressure control valve, see Section 4.2

SWR 2 Basic type designat. and size as per Sect. 3.1

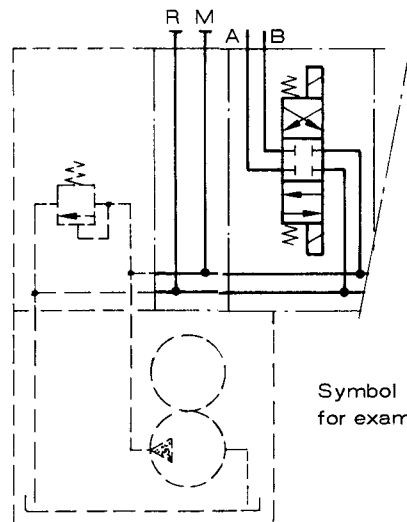
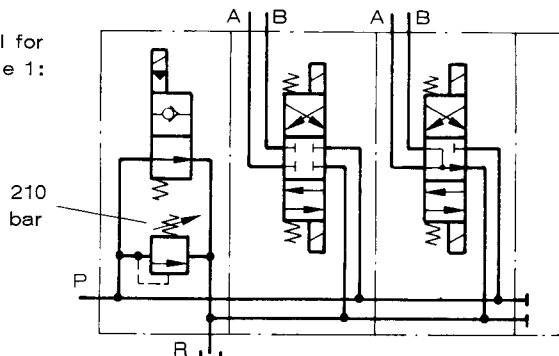
DBV = Pressure limiting valve

| P (pump) and R (return) = G 1/4 DIN ISO 228/1 M (pressure gauge connection) = G 3/8 DIN ISO 228/1 | | | |
|--|---|--|---------|
| Code | Pressure limiting valve 1) | Circulat. valve D 7490 | Symbols |
| 5 | without DBV | Without | |
| A 6 | Set | | |
| 7 | Ad-justable | | |
| S 6 | Set | EM 20 S Circulation de-energized | |
| 7 | Ad-justable | | |
| S 6H | Set | EM 20 SH Manual emerg. operation | |
| 7H | Ad-justable | | |
| V 6 | Set | EM 20 V Circulat. with currents | |
| 7 | Ad-justable | | |
| F | Fitted to hydraulic units MP acc. to D 7200 HK acc. to D 7600.. | Screwed onto the connect. block A (AS, AV) 1 and 2 (3, 4) in accordance with D 7600... | |
| D in prepa- ration | Fitted to R hydraul. units acc. to D 6010, tank sizes B 50 and B 75 | Screwed onto the connection block A... and B in accordance with D 6010 | |
| SE...F | 3-way proportional flow controller, see Sect. 5.1 | | |



1) The spring dome of the pressure limiting valve is made of diecast zinc (standard). If pressure surges in excess of 20 ... 25 bar are expected in the return line, a steel spring dome can be optionally fitted. This must be stated in plain text when ordering.

Symbol for example 1:

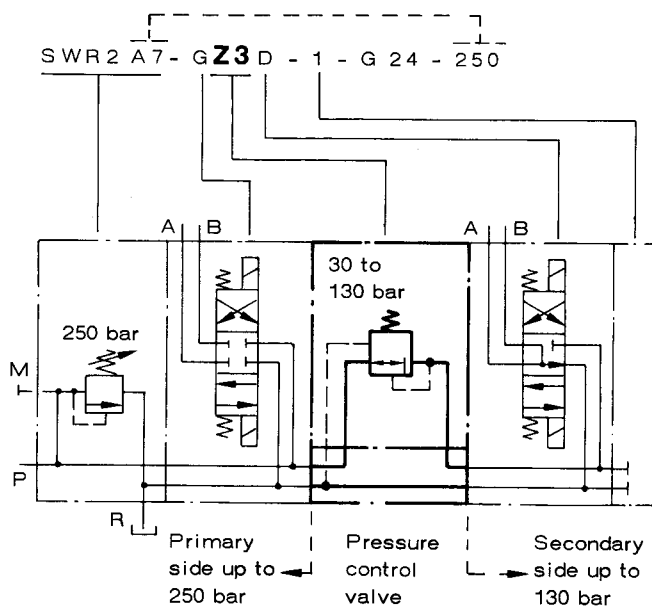


Symbol cutout for example 2:

4.2. Pressure control valve (pressure reducing valve) as additional unit

The valve can be positioned at any desired position between the spool valves. The spool valves behind it receive only pressurized oil with the set pressure (secondary pressure), independently of the higher system pressure upstream of the valve (primary pressure) and the spool valves located there. The code Z1...Z8 is positioned at the desired place within the code letter row of the spool valves. See coding example opposite.

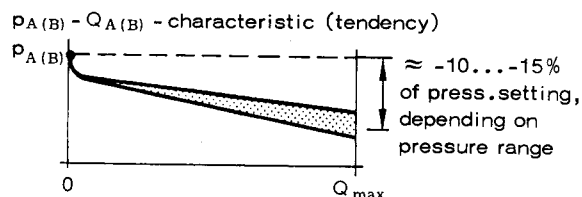
Coding example and symbol



Pressure specification referred to the coding example

1) Gauge pressure settings when $Q_{A,B} = 0$ l/min (Consumer on the secondary side in end position)

| Adjustable pressure range ¹⁾ from ... to (bar) | Code | |
|--|------|------------|
| | Set | Adjustable |
| 160...250 | Z1 | Z5 |
| 60...160 | Z2 | Z6 |
| 30...130 | Z3 | Z7 |
| 10...30 | Z4 | Z8 |



Z valves are set at the works to the respective maximum pressure if there is no pressure specification in the order. If a certain pressure setting is desired, this must be given in plain text after the order code.

Example: SWR 2 A 6 - G Z3 DD - 1 - G 24 - 210, Z3 set to 100 bar

If there are several Z valves, it must also be stated in plain text which valves should be set to which pressure, counting from the start of the block (pressurized oil inlet P).

Example: SWR 2 S 6 - GG Z3 DD Z3 D - 1 - WG 220 - 240, first Z3 set to 120 bar
second Z3 set to 80 bar

In the case of a single unit for the customer's stocks, replacements etc., the order code is as follows:
ADM22PA for Z1; ADM22PC for Z2; ADM22PD for Z3; ADM22PF for Z4
ADM22PAR for Z5; ADM22PCR for Z6; ADM22PDR for Z7; ADM22PFR for Z8
Subplate for pressure control valve HAWE No. 7451 004

4.3. Characteristic data

Only if not shown in Sections 3.2.1 and 3.2.2 or if they deviate from those characteristic data

4.3.1. General and hydraulic

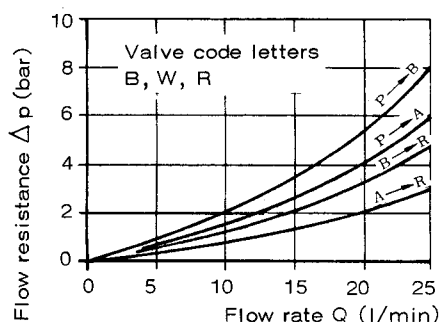
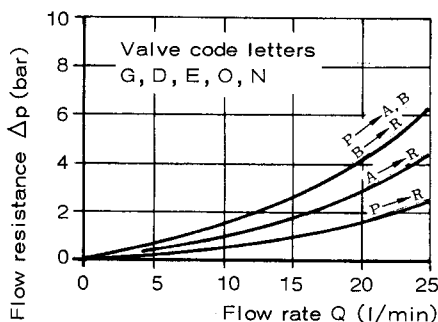
Type designation In accordance with type code, Section 4.1
Mounting Through holes $\varnothing 8,5$ or threaded holes M8 x 12 deep, depending on design. See dimensional sketches.

| Mass (weight) | Connection block with end plate | | | | | Direct spool val. Code letter G, D, E, O and N | Pressure control valve Z1 to Z8 |
|---------------|---------------------------------|------------|--------------------------------|-----|----------------|---|------------------------------------|
| | A 5 | A 6 A 7 | S 6 (H) S 7 (H) V 6, V 7 | F | D | | |
| appr. kg | 0,8 | 1,5 | 1,8 | 0,8 | in preparation | 1,8 | 1,3 |

$\Delta p - Q$ characteristics

The characteristics apply to every valve, irrespective of the number of figures. The measurable deviations are insignificant.

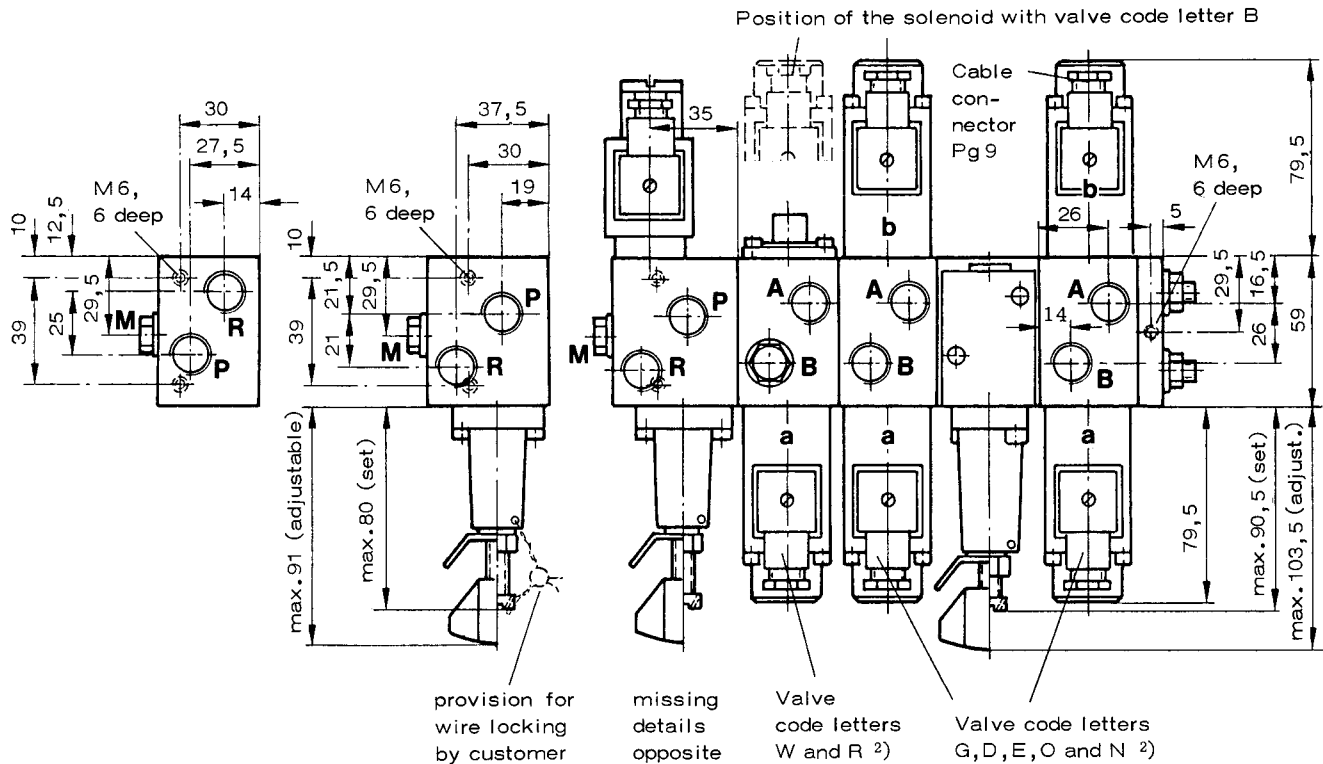
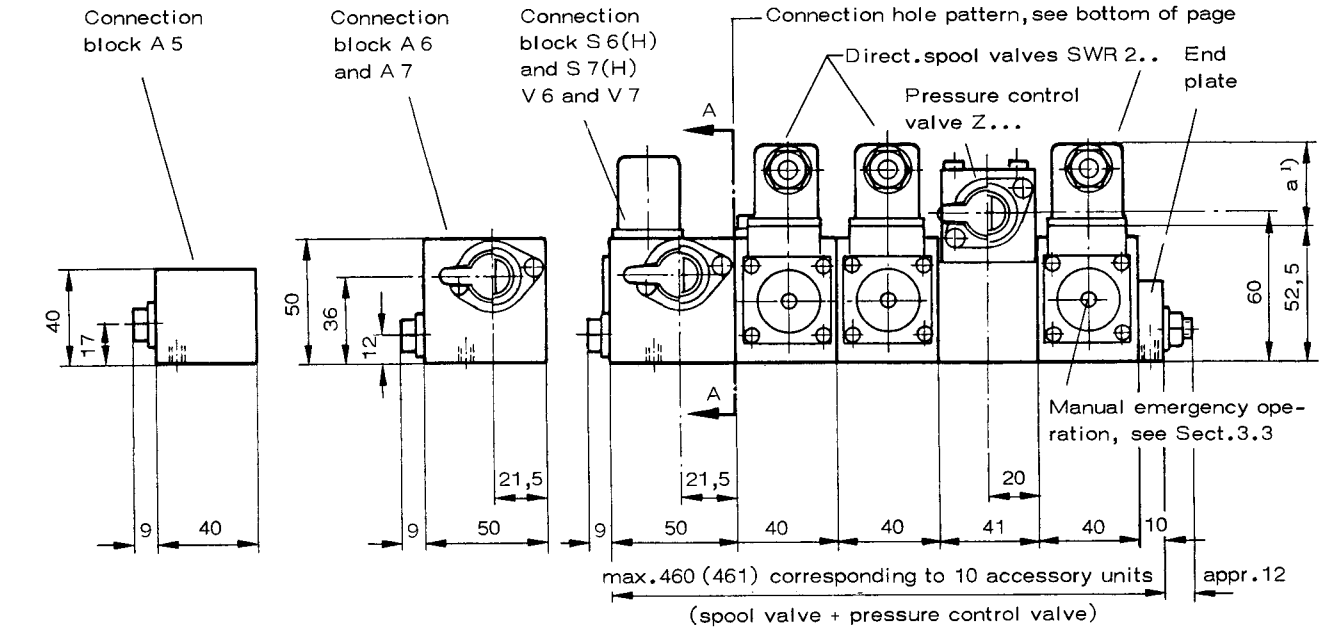
Oil viscosity during the measurement appr. 60 mm²/s



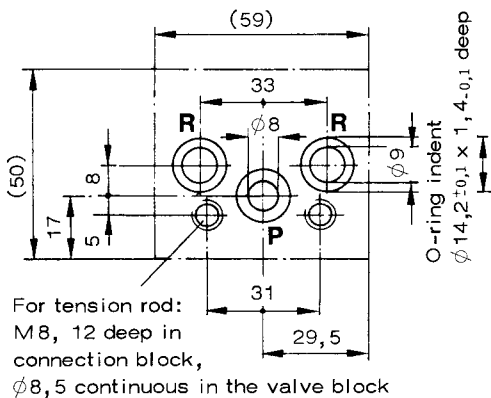
4.4. Dimensions of units All dimensions are in mm, subject to change without notice !

Connection block code letter D in preparation. Not yet defined dimensionally. Please enquire if needed.

Type SWR2A..., S... and V...



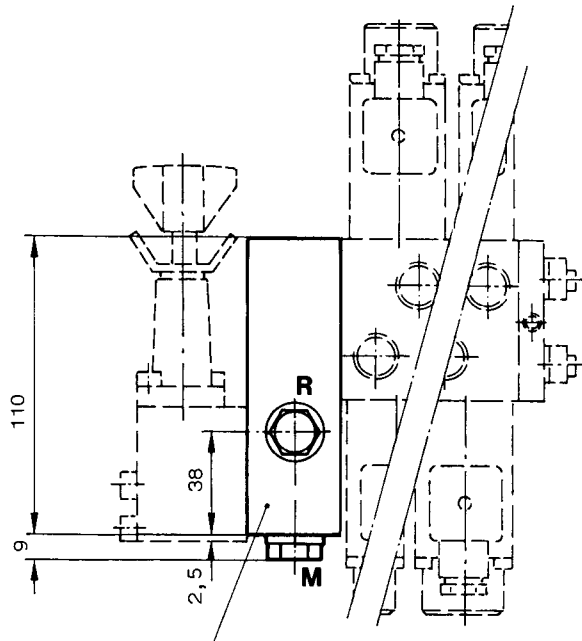
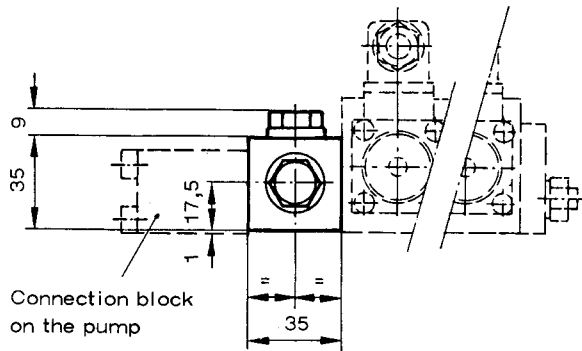
Hole pattern in direction A - A for customer-furnished connection block



Connections A, B, P, R = G 3/8
M = G 1/4

- 1) a = 29 for solenoid G 12 and G 24
34 for solenoid WG 110 and WG 220
Measurements can be up to max. 40 mm in accordance with DIN 43 650, depending on the make (Messrs. Klar und Beilschmidt, Landshut)
- 2) Connection B is closed in the case of valve code letter N and R (screw plug G 3/8 x 12, modified to sealing edge, HAWE No. 1371 007)

Type SWR 2 F



Adapter plate with
Return connection R = G3/8
Pressure gauge connection M = G3/8

See SWR 2A... for missing details

5. Appendix

5.1. Connection block with flow control type SWR 2 SE...F

The functional parts of the 3-way proportional flow control valve, type SEH3-2/..F as described in D 7557 are integrated in this connection block. This gives the possibility of moving the connected consumers at their working speed steplessly and independently of the load pressure by controlling the inflow current. This is in addition to their direction of movement. This valve combination can replace a costly proportional directional valve block and represents a very economical alternative.

Coding example: SWR2 **SE 30 F A6** -DD -1 -**G 24** -180

refer to Sect.4.1

| Rated flow Control orifice, closed when de- energized ¹⁾ (Standard version) | Control range Useful oil flow Q _A approx. l/min from ... to | Symbol |
|--|--|--------|
| 30 F | 0,2...30 | |
| 22 F | 0,2...22 | |
| 15 F or A 6 ²⁾ | 0,2...15 | |
| 10 F or A 7 ²⁾ | 0,1...10 | |
| 6 F | 0,1...6 | |
| 3 F | 0,1...3 | |

| Proportional solenoid U _N ³⁾ | G 12 | G 24 |
|--|-------------|-------------|
| | | 12V DC |

¹⁾ Open de-energized (code letter F omitted) on request, but observe restriction as defined in D 7557, Sect.2.1, Footnote ¹⁾

²⁾ ... A 6 = Pressure limiting valve, set
... A 7 = Press.limit.valve, adjustable

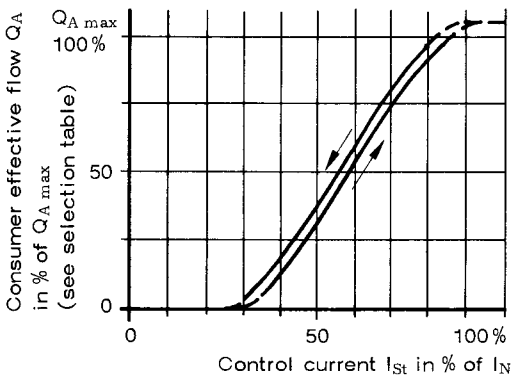
³⁾ SE... only available with proportional solenoid G 12 or G 24

If this voltage does not correspond to the usual valve solenoids, their voltage must be added with a diagonal stroke:

SWR 2 SE 10 F A 6/DD-1-G 24 / WG 220

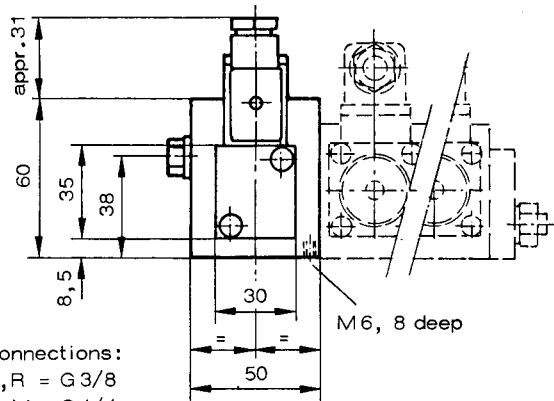
Proport. solenoid _____
Valve solenoid _____

Q-I characteristics for consumer effective oil flow (recommended values)



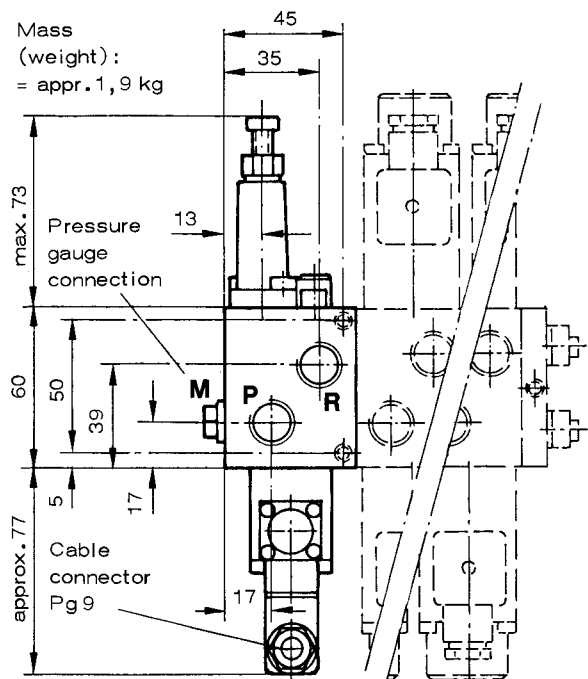
Oil viscosity during the measurement approx. 50 mm²/s

Dimensions of units
All dimensions are in mm,
subject to change without notice!



Connections:
P, R = G 3/8
M = G 1/4

Mass
(weight):
= appr. 1,9 kg



Proportional solenoid

| Solenoid | in acc. with VDE 0580 | |
|--|--|--------|
| Rated voltage U _N | 12V DC | 24V DC |
| Coil resistance R ₂₀ | 6,0 Ω | 24,0 Ω |
| Cold current I ₂₀ | 2,0 A | 1,0 A |
| Rated current I _N ≈ 70% of I ₂₀ | 1,26 A | 0,63 A |
| Cold output P ₂₀ = R ₂₀ × I ₂₀ ² | 24,0 W | |
| Rated power P _N = R ₂₀ × I _N ² | 9,5 W | |
| Dither frequency | 50...150 Hz | |
| Relative duty cycle | 100% duty cycle (ref. temp. θ ₁₁ = 50°C) | |
| Electrical connection | DIN 43 650 B (industrial standard) | |
| Type of protection DIN 40 050 | Solenoid IP 54; connection IP 65 with correctly fitted plug | |