HAWE compact

Product overview

HAWE HYDRAULIK

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Intelligent solutions to tackle global problems

This compact catalogue provides an overview of HAWE Hydraulik products and components available either separately or packaged together as hydraulics solutions. It is sorted by nomenclature and lists the most important performance data.

Thanks to our approach of consistently designing all components based on a modular system, our components can be easily combined to form space-saving units offering added value. If your requirements are not covered by the product range shown here, we will also be glad to design bespoke hydraulic solutions.

You can obtain additional technical documentation, electrical diagrams or 3D models for individual components and even complete solutions from your HAWE sales representative or sales partner or find them online on the HAWE website and customer portal. We will be glad to assist you with selecting and configuring your system, commissioning and service.

Refer to hawe.com/contact to find your regional contact's details.

Custom-built from the modular kit

Infrastructure

Manufacturing efficiency

Energy

Nutrition and nature

Resources

Health

HAWE Hydraulik SE

HAWE Hydraulik SE capitalises on the power density provided by hydraulics to supply efficient and compact drive and control technology solutions. Thanks to electronic activation, state-of-the-art interfaces and adaptability to the employed drive type, the technology is universally compatible.

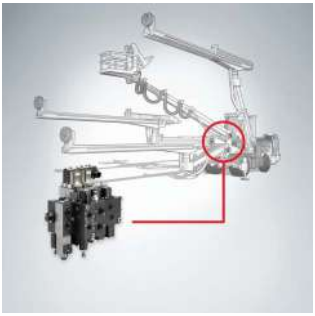
True to our motto of **'Solutions for a world under pressure'**, we aid countless commercial sectors in making business sustainable and operating machines with energy efficiency.

Our ready-for-connection solutions are trusted by manufacturers of medical equipment, wind power plants, machine tools and presses. For mobile work machinery, we are your contact for competent consultation and matching modular product systems for all issues of electrification.

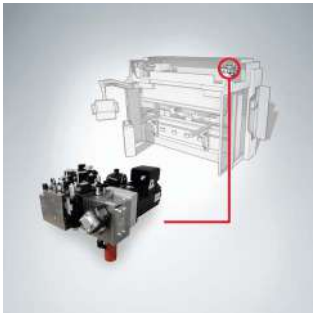
Around 2600 employees in 18 countries and sales partners in more than 40 countries around the globe provide customers with local, professional and personal support.

View of the Alps from the HAWE plant in Kaufbeuren, Germany

Some examples of industry-specific solutions

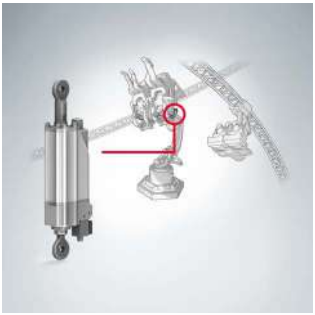


Bore technology with proportional directional spool valve

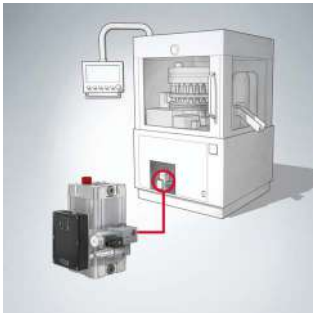


Press brake with electro-hydraulic drive

Operating table with lifting column and floor-lock system



Personal restraint systems with type HLU hydraulic locking unit



Machine tool with type INKA compact hydraulic power pack

Wind turbine with hydraulic power pack for brake control

1 Pumps

1.1 Gear pumps

Gear pump type Z

- Single pump

Features and advantages

- Low noise
- Self-priming
- Low pulsation
- Good price-performance ratio

Type	Size	p_{max}	$V_{g\ max}$	Document
Z	1	260 bar	10.65 cm³/U	D 6820
Z	2	240 bar	26 cm³/U	D 6820
Z	3	210 bar	87.5 cm³/U	D 6820

1.2 Radial piston pumps

Radial piston pump type R, RG

- Single pump
- Motor pump

Features and advantages

- Good function even at low viscosity
- High level of efficiency
- Compact dimensions
- Fine delivery flow gradation
- Multiple pressure connections possible

Type	Size	p_{max}	$V_{g\ max}$	Document
R	7631	700 bar	1.59 cm³/U	D 6010 D 6010 D D 6010 H
R, RG	6010	700 bar	4.58 cm³/U	D 6010 D 6010 D D 6010 H
R, RG	6011	700 bar	10.7 cm³/U	D 6010 D 6010 D D 6010 H
R, RG	6012	700 bar	21.39 cm³/U	D 6010 D 6010 D D 6010 H
R, RG	6014	700 bar	42.79 cm³/U	D 6010 D 6010 D D 6010 H
R, RG	6016	700 bar	64.18 cm³/U	D 6010 D 6010 D D 6010 H

Radial piston pump type RZ

- Dual-stage pump (high pressure and low pressure)

Features and advantages

- Good function even at low viscosity
- High level of efficiency
- Compact dimensions
- Fine delivery flow gradation
- Multiple pressure connections possible

Type	Size	p_{max}	$V_{g\ max}$	Document
RZ	7631	700 bar	1.59 cm³/U	D 6910 D 6910 H
RZ	6910	700 bar	4.58 cm³/U	D 6910 D 6910 H
RZ	6911	700 bar	10.7 cm³/U	D 6910 D 6910 H
RZ	6912	700 bar	21.39 cm³/U	D 6910 D 6910 H
RZ	6914	700 bar	42.79 cm³/U	D 6910 D 6910 H
RZ	6916	700 bar	64.18 cm³/U	D 6910 D 6910 H

1.3 Axial piston pumps

Variable displacement axial piston pump V30D

- Heavy-duty industrial pump

Features and advantages

- Low-noise emissions
- Long lifetime even under demanding application conditions
- Broad selection of controllers
- Full torque available at the second pump in tandem pump applications

Nominal size	Nominal pressure p_{max}	Peak pressure p_{max}	$V_{g\ max}$	Document
045	350 bar	420 bar	45 cm³/U	D 7960
075	350 bar	420 bar	75 cm³/U	D 7960
095	350 bar	420 bar	96 cm³/U	D 7960
115	250 bar	300 bar	115 cm³/U	D 7960
140	350 bar	420 bar	142 cm³/U	D 7960
160	250 bar	300 bar	164 cm³/U	D 7960
250	350 bar	420 bar	250 cm³/U	D 7960

Variable displacement axial piston pump type V30E, V80M

- Heavy-duty mobile pump

Features and advantages

- Low-noise
- Broad selection of controllers
- High speed
- High nominal pressure
- Full torque available at the second pump in tandem pump applications

Nominal size	Nominal pressure p_{max}	Peak pressure p_{max}	$V_{g\ max}$	Document
095	350 bar	420 bar	98 cm³/U	D 7960 E
160	350 bar	420 bar	160 cm³/U	D 7960 E
200	400 bar	450 bar	202 cm³/U	D 7962 M
270	350 bar	420 bar	270 cm³/U	D 7960 E

Variable displacement axial piston pump type V60N

- Medium-duty mobile pump

Features and advantages

- Optimized power-to-weight ratio
- Broad selection of controllers
- Slim design matching PTO (power take-off)
- Thru-shaft compatibility
- High self-suction speed

Nominal size	Nominal pressure p_{max}	Peak pressure p_{max}	$V_{g\ max}$	Document
060	350 bar	400 bar	60 cm³/U	D 7960 N
090	350 bar	400 bar	90 cm³/U	D 7960 N
110	350 bar	400 bar	110 cm³/U	D 7960 N
130	400 bar	450 bar	130 cm³/U	D 7960 N

Variable displacement axial piston pump type C40V

- Heavy-duty mobile pump

Features and advantages

- Optimised power-to-weight ratio
- Broad selection of controllers
- High self-suction speed
- Thru-shaft compatibility
- Compact design

Nominal size	Nominal pressure p_{max}	Peak pressure p_{max}	$V_{g\ max}$	Document
028	280 bar	320 bar	29 cm³/U	D 7964
045	280 bar	320 bar	46 cm³/U	D 7964
085	280 bar	320 bar	86 cm³/U	D 7964

Fixed displacement axial piston pump type K60N, K61N

- Medium-duty mobile pump

Features and advantages

- Optimized power-to-weight ratio
- High speed
- Different shaft and flange versions
- Smooth running across entire speed range
- Low heat generation

Nominal size	Nominal pressure p_{max}	$V_{g\ max}$	Document
012	400 bar	12.6 cm³/U	D 7960 K D 7961 K
017	400 bar	17 cm³/U	D 7960 K D 7961 K
025	400 bar	25.4 cm³/U	D 7960 K D 7961 K
034	400 bar	34.2 cm³/U	D 7960 K D 7961 K
040	400 bar	41.2 cm³/U	D 7960 K D 7961 K
047	400 bar	47.1 cm³/U	D 7960 K D 7961 K
056	400 bar	56 cm³/U	D 7960 K D 7961 K
064	400 bar	63.6 cm³/U	D 7960 K D 7961 K
084	400 bar	83.6 cm³/U	D 7960 K D 7961 K
108	400 bar	108 cm³/U	D 7960 K D 7961 K

1.4 Air pumps

Air-driven hydraulic pump type LP

- Single pump

Features and advantages

- High operating pressures
- Suitable for use in potentially explosive areas
- Energy supplied by means of compressed air
- Start-stop can be implemented via pump

Type	Size	p_{max}	$V_{g\ max}$	Document
LP	80	700 bar	6 cm³/Hub	D 7280
LP	125	1500 bar	28.3 cm³/Hub	D 7280
LP	160	1500 bar	28.3 cm³/Hub	D 7280

1.5 Hand pumps

Hand pump type H, HE, HD

- Single-acting hand pump
- Double-acting hand pump

Features and advantages

- Sturdy design
- Corrosion resistance
- Practically zero-leakage pressure connections
- Suitable for explosion-proof systems and equipment without electric energy sources

Type	Size	p_{max}	$V_{g\ max}$	Document
HE	3	800 bar	3 cm³/Hub	D 7147/1
HE	4	600 bar	4 cm³/Hub	D 7147/1
HD	13	350 bar	13 cm³/Hub	D 7147/1
HD	30	150 bar	30 cm³/Hub	D 7147/1
and others				D 7147/1

Hand pump type CH

- Single-acting hand pump

Features and advantages

- Sturdy design
- Corrosion-resistant
- Zero-leakage pressure connection

Type	Size	p_{max}	$V_{g\ max}$	Document
CH	08	300 bar	8.3 cm^3/Hub	D 7147 CH

2 Hydraulic power packs

2.1 Compact hydraulic power packs

Compact hydraulic power pack type A

Mini hydraulic power pack for short period and intermittent operation (S2, S3)

Hydraulic power pack with built-in electric motor (DC, AC or 3-phase version) and single-circuit pump

Features and advantages
- DC and AC power supply
- Suitable for short period operation
- Vertical and horizontal installation possible
- Quiet operation

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
065	0.43 l	0.38 l	160 bar	1 cm³/U	D 6025
100	1.2 l	0.8 l	210 bar	2.5 cm³/U	D 6025

Mini hydraulic power pack type HR

Mini hydraulic power pack for intermittent operation (S3)

Hydraulic power pack with built-in electric motor (DC, 1-phase or 3-phase version) and reversible single-circuit pump

Features and advantages
- Suitable for intermittent operation
- DC, three-phase or AC power supply
- Various installation positions possible

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
050	0.3 l	0.23 l	200 bar	0.15 cm³/U	D 6014
080	0.3 l	0.23 l	210 bar	0.19 cm³/U	D 6342
120	0.7 l	0.5 l	210 bar	0.19 cm³/U	D 6343

Compact hydraulic power pack type NPC

Oil immersed compact hydraulic power pack for intermittent operation (S3)

Hydraulic power pack with built-in electric motor (DC version) and single-circuit pump

Features and advantages
- 12 V to 24 V DC
- Long service life and high reliability
- Vertical and horizontal installation possible
- Resource-saving due to small oil filling volume

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
11	1 l	0.65 l	750 bar	0.76 cm³/U	D 7940
12	1 l	0.65 l	750 bar	0.76 cm³/U	D 7940

Compact hydraulic power pack type HC, HCW

Oil immersed compact hydraulic power pack for short period and intermittent operation (S2, S3)

Hydraulic power pack with built-in electric motor (1-phase or 3-phase version) and single-circuit pump

Features and advantages

- Long service life and high pressures thanks to use of radial piston pumps
- Environmentally friendly thanks to low oil filling volume; low cost of disposal and low hydraulic fluid costs
- Tailored range of valves and accessories from modular system
- Vertical and horizontal installation possible

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
2	2.5 l	1.5 l	700 bar	1.59 cm³/U	D 7900

Compact hydraulic power pack type H

Mini hydraulic power pack for intermittent operation (S3)

Hydraulic power pack with built-in electric motor (3-phase version)

Features and advantages

- Valve technology integrated in pump carrier
- Compact design
- Suitable for short period operation
- Vertical and horizontal installation possible

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
3	3.9 l	3.3 l	190 bar	1.52 cm³/U	D 6344
4	10.5 l	9.5 l	230 bar	7.9 cm³/U	D 6345

Compact hydraulic power pack type KA, KAW

Oil immersed compact hydraulic power pack for short period and intermittent operation (S2, S3)

Hydraulic power pack with built-in electric motor (1-phase or 3-phase version) and single-circuit pump or dual-circuit pump (high pressure and low pressure)

Features and advantages

- Optimum efficiency through oil-immersion motor cooling, direct power transmission and sophisticated heat dissipation
- Resource-saving due to small oil filling volume
- Vertical and horizontal installation possible

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
2	11.1 l	9.05 l	700 bar	7.89 cm³/U	D 8010
4	39.5 l	28.75 l	700 bar	31 cm³/U	D 8010-4

Compact hydraulic power pack type CPU

Oil immersed compact hydraulic power pack for short period and intermittent operation (S2, S3)

Hydraulic power pack with built-in electric motor (3-phase version) and single-circuit pump

Features and advantages

- Excellent price-performance ratio
- Resource-saving due to small oil filling volume
- Vertical and horizontal installation possible

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
3	16.1 l	12.6 l	350 bar	7.9 cm³/U	D 8010 CPU

Compact hydraulic power pack type HK, HKF

Oil immersed compact hydraulic power pack for continuous operation, intermittent operation and continuous run with intermittent load (S1, S3, S6)

Hydraulic power pack with built-in electric motor (1-phase or 3-phase version) and single-circuit pump or dual-circuit pump (high pressure and low pressure)

Features and advantages

- Environmentally friendly thanks to low oil filling volume; low cost of disposal and low hydraulic fluid costs
- Long service life and high reliability

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
3	6.1 l	2.9 l	700 bar	4.58 cm³/U	D 7600-3
4	15.4 l	11.1 l	700 bar	9.17 cm³/U	D 7600-4 D 7600-4 FU

Compact hydraulic power pack type HKL

Oil immersed compact hydraulic power pack for continuous operation, intermittent operation and continuous run with intermittent load (S1, S3, S6)

Hydraulic power pack with built-in electric motor (1-phase or 3-phase version) and single-circuit pump or dual-circuit pump (high pressure and low pressure)

Features and advantages

- Environmentally friendly thanks to low oil filling volume; low cost of disposal and low hydraulic fluid costs
- Long service life and high reliability

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
3	13 l	9.1 l	700 bar	9.17 cm³/U	D 7600-3L

Compact hydraulic power pack type MPN, MPNW

Oil immersed compact hydraulic power pack for short period and intermittent operation and continuous run with intermittent load (S2, S3, S6)

Hydraulic power pack with built-in electric motor (1-phase or 3-phase version) and single-circuit pump or dual-circuit pump (high pressure and low pressure)

Features and advantages

- Long service life and high reliability
- Low noise when using an internal gear pump
- Optimum efficiency thanks to submersible motor cooling

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
4	100 l	75 l	700 bar	61 cm^3/U	D 7207

Compact hydraulic power pack type INKA 1

Oil immersed compact hydraulic power pack for short period and intermittent operation (S2, S3)

Hydraulic power pack with built-in electric motor (1-phase or 3-phase version) and single-circuit pump

Features and advantages

- Prepared for condition monitoring with integrated sensors and communication box
- Optimum efficiency through under-oil motor cooling, direct power transmission, and sophisticated heat dissipation
- Resource-saving due to small oil filling volume

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
1	2.75 l	1.65 l	700 bar	1.5 cm^3/U	D 8132-1

Compact hydraulic power pack type HICON

Oil immersed compact hydraulic power pack for continuous and intermittent operation (S1, S3)

Hydraulic power pack with built-in brushless electric motor (DC version) and single-circuit pump

Features and advantages

- 12 V to 24 V DC
- Vertical and horizontal installation possible
- Protection class IP 67
- CAN bus functionality compatible with J1939 protocol

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
1	0.75 l	0.6 l	170 bar	0.5 cm^3/U	D 8543

2.2 Servo hydraulic power packs

Servo hydraulic power pack type HS

Servo hydraulic power pack for short period and intermittent operation (S2, S3)

Servo hydraulic power pack with reversible servomotor (3-phase version) and single-circuit pump

Features and advantages

- Very energy-efficient, quiet and compact
- Resource-saving due to small oil filling volume
- Horizontal installation

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
120	1.05 l	0.3 l	150 bar	3.2 cm³/U	D 6347

2.3 Standard hydraulic power packs

Hydraulic power pack type FXU

Standard hydraulic power pack for continuous operation (S1)

Hydraulic power pack with single-circuit pump or dual-circuit pump (radial piston pump and/or gear pump in tank), high pressure and low pressure

Features and advantages

- Quick to configure due to tailored modular system
- Customer-specific documentation with EPlan-Fluid and step model
- It is possible to mount HAWE valve banks with seated and spool valves directly
- Attaching proportional directional spool valves from series PSL 3 possible
- Low noise when using a gear pump

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
-	630 l	560 l	700 bar	63 cm³/U	D 6020

2.4 Hydraulic power packs

Hydraulic power pack type LP

Air-driven hydraulic power pack

- Hydraulic power pack with various cover plate versions
- Hydraulic power pack with various tank sizes

Features and advantages

- High operating pressures
- Suitable for use in potentially explosive areas
- Energy supplied by means of compressed air
- Start-stop can be implemented via pump

Size	$V_{fill\ max}$	$V_{usable\ max}$	p_{max}	$V_{g\ max}$	Document
80	5 l	7 l	700 bar	6 cm³/U	D 7280 H
125	34 l	29 l	700 bar	28.3 cm³/U	D 7280 H
160	33 l	28 l	700 bar	28.3 cm³/U	D 7280 H

3 Manifolds, valve banks

3.1 Valve combinations

Check valve type GRV

- Intermediate plate with releasable twin check valve

Features and advantages
- Single-acting or double-acting
- Check valve in line A, in line B or in line A and B
- Tailor-made for mounting on compact hydraulic power pack type H3 or H4

Type	Size	p_{max}	Q_{max}	Document
GRV	4	320 bar	20 l/min	D 6434
GRV	6	350 bar	40 l/min	D 6432 D 6435
GRV	10	350 bar	60 l/min	D 6433 D 6436

Lifting/lowering valves type HSV, HZV

- Valve combination

Actuation
– Electromagnetic

Features and advantages
- Optimum control of lifting and lowering function
- Compact design
- Zero leakage to prevent undesirable lowering of the load
- Integral overpressure protection
- High pressures up to 400 bar
- Optionally also possible with lowering function independent of load

Type	Size	p_{max}	Q_{max}	Document
HSV	21	315 bar	20 l/min	D 7032
HSV	22	315 bar	30 l/min	D 7032
HSV	23	315 bar	40 l/min	D 7032
HSV	61	400 bar	60 l/min	D 7032
HSV	71	400 bar	160 l/min	D 7032

Switch unit type CR

- Single valve for pipe connection

Actuation
– Electromagnetic
– Manual

Features and advantages
- Special valve for controlling upstroke presses
- Smooth, gentle switching
- No pressure drop during press operation due to zero leakage
- Fully automatic switching of the low-pressure pump to circulation

Type	Size	p_{max} HP	p_{max} LP	Q_{max} HP	Q_{max} LP	Document
CR	4	400 bar	60 bar	8 l/min	80 l/min	D 7150
CR	5	400 bar	60 bar	20 l/min	160 l/min	D 7150

3.2 Valve banks

Valve bank (directional seated valve), type TLC

- For pipe connection
- For combining with A100 compact hydraulic power packs

Actuation

– Electromagnetic
– With releasable check valves
– With return throttle

Features and advantages

- Requires little space thanks to compact design
- IP 65 connector (AMP superseal)

Type	Size	p_{max}	Q_{max}	Document
TLC	3	250 bar	3 l/min	D 6020 TLC 3

Valve bank (directional spool valve or directional seated valve) type BA, BVH

- For pipe connection (NG-6)
- For combining with compact hydraulic power packs

Actuation

– Electromagnetic
– Pressure-actuated
– Manual
– Mechanical

Features and advantages

- Flexible connection options
- Additional functions can be integrated as intermediate plates
- Hydraulic accumulator can be mounted directly

Type	Size	p_{max}	Q_{max}	Document
BA	2	400 bar	30 l/min	D 7788
BVH	11	400 bar	20 l/min	D 7788 BV
NPZ	16	500 bar	50 l/min	D 7788 Z

Valve bank (directional spool valve) type CWS

- For pipe connection

Actuation

– Electromagnetic
– Manual

Features and advantages

- One valve for different control functions
- Modular system with numerous variants and combination possibilities
- Compact and robust design
- Robust and long-lasting design

Type	Size	p_{max}	Q_{max}	Document
CWS	2	315 bar	80 l/min	D 7951 CWS

Valve bank (directional spool valve or directional seated valve) type BNG

- For pipe connection (NG-6)
- For combining with compact hydraulic power packs

Actuation

- Electromagnetic
- Pressure-actuated
- Manual
- Mechanical

Features and advantages

- Flexible connection options
- Additional functions can be integrated as intermediate plates
- Hydraulic accumulator can be mounted directly

Type	Size	p_{max}	Q_{max}	Document
BNG	2	400 bar	60 l/min	D 7788 BNG

Valve bank (directional seated valve) type SL

- For pipe connection
- For combining with A100 compact hydraulic power packs

Actuation

- Electromagnetic
- With return throttle

Features and advantages

- Requires little space thanks to compact design
- Hold hydraulic actuators in position for long periods of time
- Energy-efficient thanks to low current consumption

Type	Size	p_{max}	Q_{max}	Document
SL	1	200 bar	1.5 l/min	D 6024

Valve bank (directional seated valve) type SLC

- For pipe connection

Actuation

- Electromagnetic
- With return throttle
- With releasable check valves

Features and advantages

- Short switching times
- Requires little space thanks to compact design
- Energy-efficient thanks to low power consumption
- Hold hydraulic actuators in position for long periods of time

Type	Size	p_{max}	Q_{max}	Document
SLC	1	150 bar	1 l/min	D 6033-1

Valve bank (directional seated valve) type VHR

- For pipe connection

Actuation

– Manual

Features and advantages

- Pressures up to 700 bar manually switchable
- Actuation using hand lever with automatic centring in zero position or with notch
- Different arrangements in valve bank possible
- Leakage-free seated valve technology

Type	Size	p_{max}	Q_{max}	Document
VHR	1	700 bar	12 l/min	D 7647
VHR	2	500 bar	25 l/min	D 7647

Valve bank (directional seated valve) type BWN, BWH

- For pipe connection
- For combining with compact hydraulic power packs

Actuation

– Electromagnetic

Features and advantages

- Modular concept
- Adapter plates for flange-mounting on pump units or combining with other valve types
- Valve bank version allows additional functions to be integrated into the sub-plate, e.g. pressure-limiting valves, pressure switches and more
- Energy-efficient solutions in connection with hydraulic accumulators

Type	Size	p_{max}	Q_{max}	Document
BWN	1	350 bar	5 l/min	D 7470 B/1
BWH	1	450 bar	8 l/min	D 7470 B/1
BWH	2	350 bar	15 l/min	D 7470 B/1
BWH	3	350 bar	30 l/min	D 7470 B/1

Valve bank (directional seated valve) type VB

- For pipe connection
- For combining with compact hydraulic power packs

Actuation

– Electromagnetic
– Pressure-actuated
– Manual
– Mechanical

Features and advantages

- Compact hydraulic control systems for operating pressures of up to 700 bar
- Can be combined with compact hydraulic power packs for low-cost complete solutions
- Elimination of time-consuming installation due to combination with hydraulic power packs
- Modular system design makes repairs easy

Type	Size	p_{max}	Q_{max}	Document
VB	01	500 bar	6 l/min	D 7302 D 7302-22
VB	11	700 bar	12 l/min	D 7302 D 7302-22
VB	21	700 bar	25 l/min	D 7302 D 7302-22
VB	22	700 bar	25 l/min	D 7302 D 7302-22
VB	31	400 bar	60 l/min	D 7302 D 7302-22

Valve bank (directional spool valve) type CWL

- For pipe connection

Actuation
- Electromagnetic
- Manual

Features and advantages
- Low-cost load-sensing valve without any individual pressure compensators
- Modular system with many variants and combination options
- One valve for a range of different control functions and small flow quantities
- Compact and robust design
- Robust long-life design

Type	Size	p_{max}	Q_{max}	Document
CWL	2	315 bar	60 l/min	D 7953

Valve bank (directional spool valve) type SMBF

- Monoblock design
- For pipe connection

Actuation
- Electromagnetic

Features and advantages
- Tailored product for industrial vehicles
- Cost-effective system solution designed for large production volumes
- Compact and robust design
- Various versions as 3-fold and 4-fold valve bank
- Energy-efficient load sensing system

Type	Size	p_{max}	Q_{max}	Document
SMBF	2	280 bar	80 l/min	SK 8145 999

3.3 Proportional directional spool valve

Proportional directional spool valve type EDL

- Valve bank design

Actuation
- Electromagnetic

Features and advantages
- One valve for different control functions and small flow quantities
- Energy-saving closed-centre systems
- Compact and lightweight design
- Modular system can be directly combined with PSL

Type	Size	p_{max}	Q_{max}	Document
EDL	2	320 bar	48 l/min	D 8086

Proportional directional spool valve type PSL

- Valve bank design

Actuation

- Manual
- Electro-hydraulic
- CAN bus
- Hydraulic
- Pneumatic

Features and advantages

- Universally usable product for various flow rates and functions
- Extensive modular system with many variants and combination options
- Compact and lightweight design
- Robust and long-lived design for pressures up to 420 bar
- Highest energy efficiency thanks to low Δp and low-energy solutions

Type	Size	p_{max}	Q_{max}	Document
PSL	2	420 bar	60 l/min	D 7700-2
PSL	3	420 bar	120 l/min	D 7700-3
PSL	5	400 bar	240 l/min	D 7700-5

Proportional directional spool valve type PSLF

- Valve bank in flange design

Actuation

- Manual
- Electro-hydraulic
- CAN bus
- Hydraulic
- Pneumatic

Features and advantages

- Flow rates up to 1,000 l/min at 400 bar via input section
- Rear side ports for easy access to valves, even in small installation spaces
- Flange design can be combined across all sizes with fast valve replacement
- Simultaneous operation of several functions at full speed

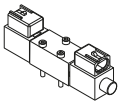
Type	Size	p_{max}	Q_{max}	Document
PSLF	3	420 bar	120 l/min	D 7700-F
PSLF	5	420 bar	240 l/min	D 7700-F
PSLF	7	400 bar	520 l/min	D 7700-7F

4 Valves

4.1 Directional spool valves

4.1.1 On/off directional spool valve

Directional valve type WLA



- Manifold mounting valve

Actuation
– Electromagnetic

Features and advantages
- Small and lightweight
- Low noise, low wear
- Robust and hardy
- Long service life
- Low leakage of 3 to 30 cm³/min, depending on operating conditions and symbol

Type	Size	p_{max}	Q_{max}	Document
WLA	3	250 bar	8 l/min	D 6023

4/2- and 4/3-way directional spool valves type SWPA

- Manifold mounting valve (NG-4)

Actuation
– Electromagnetic

Features and advantages
- Universally usable thanks to standard connections NG 4 (CETOP 2)
- Low pressure losses
- High power density
- Directly controlled
- High flexibility by means of a variety of circuit symbols

Type	Size	p_{max}	Q_{max}	Document
SWPA	4	320 bar	30 l/min	D 6450

4/2- and 4/3-way directional spool valves type SWPM

- Manifold mounting valve (NG-6, NG-10)

Actuation
– Electromagnetic
– Manual

Features and advantages
- Universally usable thanks to standard connections NG 6 (CETOP 3) and NG 10 (CETOP 5)
- Low pressure losses
- High power density
- Directly controlled
- Inductive monitoring of neutral position
- High flexibility by means of a variety of circuit symbols

Type	Size	p_{max}	Q_{max}	Document
SWPM	6	320 bar	60 l/min	D 6420
SWPM	10	320 bar	100 l/min	D 6420

Directional spool valve type SWPN

- Manifold mounting valve (NG-6, NG-10)

Actuation
- Electromagnetic

Features and advantages
- Standard hole pattern
- High flexibility by means of a variety of circuit symbols

Type	Size	p_{max}	Q_{max}	Document
SWPN	21	350 bar	80 l/min	D 7451 AT
SWPN	81	350 bar	150 l/min	D 7451 AT

4/2- and 4/3-way directional spool valves type SWPT

- Manifold mounting valve (NG-6)

Actuation
- Electromagnetic

Features and advantages
- Universally usable thanks to standard connections NG 6 (CETOP 03)
- Low pressure losses
- High power density
- Directly controlled
- Inductive monitoring of neutral position
- High flexibility by means of a variety of circuit symbols

Type	Size	p_{max}	Q_{max}	Document
SWPT	06	320 bar	60 l/min	D 6559

Directional spool valve type SG, SP

- Single valve for pipe connection
- Manifold mounting valve

Actuation
- Electromagnetic
- Manual
- Mechanical
- Pressure-actuated

Features and advantages
- Sturdy design
- For general purpose use
- Wide variety of circuit symbols and types of actuation
- Proven for use even in the maritime environment

Type	Size	p_{max}	Q_{max}	Document
SG	0	400 bar	12 l/min	D 5650/1
SG, SP	1	400 bar	20 l/min	D 5650/1
SG	2	400 bar	30 l/min	D 5650/1
SG, SP	3	400 bar	50 l/min	D 5650/1
SG, SP	5	315 bar	100 l/min	D 5650/1

Directional spool valve type HSL, HSF

- Single valve for pipe connection
- Manifold mounting valve

Actuation
- Electro-hydraulic
- Hydraulic

Features and advantages
- Smooth switching for large flow rate
- Suitable for high pressures due to steel housing
- Optionally also possible with response time adjustment

Type	Size	p_{max}	Q_{max}	Document
HSL, HSF	3	400 bar	80 l/min	D 7493 L D 7493 E
HSL, HSF	4	400 bar	160 l/min	D 7493 L D 7493 E

Directional spool valve type NSWP

- Manifold mounting valve (NG-6)

Actuation

– Electromagnetic

Features and advantages

- Universally usable thanks to standard connections NG 6 (CETOP 3)
- Directly controlled
- Choose between on/off or proportional actuation
- Integrated monitoring of consumer pressure possible using attached pressure switch
- Optionally also available with additional valves in pump, consumer and return line ports

Type	Size	p_{max}	Q_{max}	Document
NSWP	6	315 bar	25 l/min	D 7451 N

Directional spool valve type CWPN

- Manifold mounting valve (NG 6)

Actuation

– Electromagnetic

– Manual

Features and advantages

- Universally usable thanks to standard connection pattern NG 6 (CETOP 3)
- Modular system with various circuit symbols and actuation variants
- Optionally also available with additional valves in pump port

Type	Size	p_{max}	Q_{max}	Document
CWPN	6	315 bar	60 l/min	D 7451 CWPN

4.1.2 Proportional directional spool valve

Proportional directional spool valve type SWPH

- Manifold mounting valve (NG-6, NG-10)

Actuation

– Electromagnetic

Features and advantages

- Excellent repeatability
- Short switching times
- With integrated displacement transducer and centre-position signal

Type	Size	p_{max}	Q_{max}	Document
SWPH	6	350 bar	30 l/min	D 6418
SWPH	10	350 bar	100 l/min	D 6419

Proportional directional spool valve type SWPL

- Manifold mounting valve (NG-6, NG-10)

Actuation
- Electromagnetic

Features and advantages
- High repeatability
- Very good resolution
- Low noise level
- Low hysteresis
- High flexibility by means of a variety of circuit symbols
- Optionally with integrated displacement transducer

Type	Size	p_{max}	Q_{max}	Document
SWPL	6	350 bar	36 l/min	D 6394
SWPL	10	350 bar	100 l/min	D 6395

4.2 Directional seated valves

Directional seated valve type SP

- Plug-in valve

Actuation
- Electromagnetic
- Directly controlled

Features and advantages
- Short switching times
- Minimal installation space
- Low power consumption

Type	Size	p_{max}	Q_{max}	Document
SP	1	200 bar	1.5 l/min	D 6024
SP	3	250 bar	4 l/min	D 6019

Directional seated valve type VP

- Manifold mounting valve
- Combination with connection block for pipe connection

Actuation
- Electromagnetic
- Hydraulic
- Pneumatic
- Mechanical
- Manual

Features and advantages
- Suitable for highly viscous media (e.g. lubricating grease)
- No interaction between actuating elements and media
- Any flow direction
- Explosion-proof version
- Can be combined with sub-plates for directional seated valves size 12

Type	Size	p_{max}	Q_{max}	Document
VP	1	400 bar	15 l/min	D 7915

Directional seated valve type BVG, BVP

- Single valve for pipe connection
- Manifold mounting valve

Actuation

- Electromagnetic
- Hydraulic
- Pneumatic
- Manual

Features and advantages

- Compact design
- Pressures up to 700 bar

Type	Size	p_{max}	Q_{max}	Document
BVG, BVP	1	400 bar	20 l/min	D 7765
BVP	17	700 bar	20 l/min	

Directional seated valve type NBVP

- Manifold mounting valve (NG-6)
- Combination with connection block for pipe connection

Actuation

- Electromagnetic
- Hydraulic
- Pneumatic
- Manual

Features and advantages

- 2/2- and 3/2-way directional valve with position monitoring
- Versions with partial notching available
- Mounting pressure switches and pressure gauges possible
- Explosion-proof version
- Fourth switching position for 4/3-way directional valves
- Optionally with 8-watt solenoids

Type	Size	p_{max}	Q_{max}	Document
NBVP	16	400 bar	20 l/min	D 7765 N

Directional seated valve type CVK, CVS, CVD

- Plug-in valve

Actuation

- Hydraulic

Features and advantages

- Two basic positions (opened and closed), several intermediate positions possible
- For assembly into special housings or control blocks
- Entirely pressure-controlled

Type	Size	p_{max}	Q_{max}	Document
CVK, CVS, CVD	10	350 bar	180 l/min	D 6452
CVK, CVS, CVD	16	350 bar	230 l/min	D 6452
CVK, CVS, CVD	32	350 bar	620 l/min	D 6452
CVK, CVS, CVD	40	350 bar	900 l/min	D 6452
CVK, CVS, CVD	50	350 bar	1470 l/min	D 6452

Directional seated valve type VH, VHP

- Single valve for pipe connection
- Manifold mounting valve
- Valve bank

Actuation

– Manual

Features and advantages

- Pressures up to 700 bar manually switchable
- Actuation using hand lever with automatic centring in zero position or with notch
- Different arrangements in valve bank possible
- Leakage-free seated valve technology

Type	Size	p_{max}	Q_{max}	Document
VH, VHP	1	700 bar	12 l/min	D 7647
VH	2	500 bar	25 l/min	D 7647

Directional seated valve type WN, WH

- Manifold mounting valve
- Combination with connection block for pipe connection

Actuation

– Electromagnetic

Features and advantages

- Excellent price/performance ratio
- Compact design
- Directional seated valves with zero leakage
- Solenoid version with 8-watt technology

Type	Size	p_{max}	Q_{max}	Document
WN	1	350 bar	5 l/min	D 7470 A/1
WH	1	450 bar	8 l/min	D 7470 A/1
WH	2	350 bar	15 l/min	D 7470 A/1
WH	3	350 bar	30 l/min	D 7470 A/1

Directional seated valve type SVNE, SVSE

- Screw-in valve
- Combination with connection block for pipe connection

Actuation

– Electromagnetic

Features and advantages

- Compact design
- Short switching times
- Zero leakage in closed switching position
- Choose with or without manual override

Type	Size	p_{max}	Q_{max}	Document
SVNE, SVSE	8	350 bar	30 l/min	D 6354/1
SVNE, SVSE	12	200 bar	100 l/min	D 6354/1

Directional seated valve type G

- Manifold mounting valve
- Combination with connection block for pipe connection

Actuation

– Electromagnetic
– Pressure-actuated
– Manual
– Mechanical

Features and advantages

- Zero-leakage ball valve construction with high switching reliability
- Dirt-resistant design with high switching reliability
- Low shifting forces and smooth, shock-free shifting
- Operating pressures up to 700 bar
- Interchangeable solenoid for greater flexibility and easy servicing
- Version for HFA fluid
- Version with standard connection pattern

Type	Size	p_{max}	Q_{max}	Document
G	0	500 bar	6 l/min	D 7300 D 7300-12
G	1, 12	700 bar	12 l/min	D 7300 D 7300-12 D 7300 N
G	2, 22	700 bar	25 l/min	D 7300 D 7300-12
G	3	400 bar	65 l/min	D 7300 D 7300-12

Directional seated valve type EM, EMP

- Screw-in valve
- Combination with connection block for pipe connection
- Combination with connection block for swivel fitting

Actuation

– Electromagnetic

Features and advantages

- Zero leakage in closed switching position
- Directly switching up to approx. 3 l/min and with pilot-controlled switching up to 160 l/min
- Low flow resistance even at high flow rates
- Long service life thanks to hardened seats

Type	Size	p_{max}	Q_{max}	Document
EM	11, 12	450 bar	20 l/min	D 7490/1
EM	21, 22	400 bar	40 l/min	D 7490/1
EM	31, 32	400 bar	80 l/min	D 7490/1
EM	41, 42	350 bar	160 l/min	D 7490/1
EMP	21	400 bar	40 l/min	D 7490/1
EMP	31	400 bar	80 l/min	D 7490/1
EMP	41	350 bar	160 l/min	D 7490/1

Directional seated valve type BVE

- Screw-in valve
- Combination with connection block for pipe connection
- Combination with connection block for manifold mounting

Actuation

– Electromagnetic

Features and advantages

- Any flow direction
- Large range of plug options
- Long service life thanks to hardened seat
- Large number of single connection blocks
- Version for highly viscous media (e.g. lubricating grease)

Type	Size	p_{max}	Q_{max}	Document
BVE	1	500 bar	20 l/min	D 7921
BVE	3	400 bar	70 l/min	D 7921
BVE	5	400 bar	300 l/min	D 7921

Directional seated valve type MSV, RSV

- Manifold mounting valve

Actuation

– Electromagnetic
– Manual

Features and advantages

- High switching reliability
- Variants for large volume flows available
- Partial flow on both sides
- Various emergency actuations selectable

Type	Size	p_{max}	Q_{max}	Document
MSV, RSV	6	350 bar	10 l/min	D 6407
MSV	16	350 bar	150 l/min	D 6409
MSV	32	350 bar	320 l/min	D 6409

Directional seated valve type ROLV

- Manifold mounting valve (NG 6)
- Single valve for pipe connection

Actuation

– Electromagnetic

Features and advantages

- Dirt-resistant design with high switching reliability
- Interchangeable solenoid for greater flexibility and easy servicing

Type	Size	p_{max}	Q_{max}	Document
ROLV	14	400 bar	25 l/min	D 8144

4.3 Pressure valves

4.3.1 Pressure-limiting valves and pre-load valves

Pressure-limiting valve type MV., SV., DMV

- Single valve for pipe connection
- Manifold mounting valve
- Screw-in valve
- Installation kit

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Operating pressures up to 700 bar
- Various adjustment options
- Numerous configurations

Type	Size	p_{max}	Q_{max}	Document
MV., SV., DMV	4	700 bar	20 l/min	D 7000/1 D 7000 E/1 D 7000 M
MV., SV., DMV	5	700 bar	40 l/min	D 7000/1 D 7000 E/1 D 7000 M
MV., SV., DMV	6	700 bar	75 l/min	D 7000/1 D 7000 E/1 D 7000 M
MV., SV., DMV	8	700 bar	160 l/min	D 7000/1 D 7000 E/1

Pressure-limiting valves and pre-load valves type MVG, MVGC, MVE, MVP

- Single valve for pipe connection
- Screw-in valve
- Individual valve for manifold mounting
- Installation kit

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Operating pressures up to 700 bar
- Various adjustment options
- Numerous configurations

Type	Size	p_{max}	Q_{max}	Document
MVG, MVGC, MVE, MVP	13	700 bar	5 l/min	D 3726
MVG, MVGC, MVE, MVP	14	400 bar	8 l/min	D 3726

Pressure valve type CMV, CSV, CMVZ, CSVZ

- Screw-in valve
- Combination with connection block for pipe connection

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Operating pressures up to 500 bar
- Various adjustment options
- Easily produced mounting hole

Type	Size	p_{max}	Q_{max}	Document
CMV	1	500 bar	20 l/min	D 7710 MV
CMV	2	500 bar	40 l/min	D 7710 MV
CMV	3	500 bar	60 l/min	D 7710 MV
CSV	2	315 bar	40 l/min	D 7710 MV
CSV	3	315 bar	60 l/min	D 7710 MV
CMVZ, CSVZ	2	500 bar	40 l/min	D 7710 MV

Pressure-limiting valve, pilot-controlled type DV, DF, DVE, PV, PG

- Single valve for pipe connection
- Manifold mounting valve

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Various adjustment options
- Various additional functions

Type	Size	p_{max}	Q_{max}	Document
DV, DF	3	420 bar	40 l/min	D 4350
DV, DF	4	420 bar	80 l/min	D 4350
DV, DF	5	420 bar	120 l/min	D 4350
DVE	3	420 bar	40 l/min	D 4350
DVE	4	420 bar	80 l/min	D 4350
DVE	5	420 bar	120 l/min	D 4350
PG, PV	1	420 bar	8 l/min	D 4350

Pre-load check valve type VR

- Screw-in valve
- Housing version

Adjustment
- Fixed

Features and advantages
- Compact screw-in valve

Type	Size	p_{max}	Q_{max}	Document
VR	1	315 bar	15 l/min	D 7340
VR	2	315 bar	40 l/min	D 7340
VR	3	315 bar	65 l/min	D 7340
VR	4	315 bar	120 l/min	D 7340

Pressure-limiting valve type VDB, VUB

- Screw-in valve
- Version component approved

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Version: Plug-in valve, hydraulically pilot-controlled
- Control oil: internal, external upon request
- Easy to convert for magnetic relief
- Sturdy design
- Sealing possible

Type	Size	p_{max}	Q_{max}	Document
VDB	3	350 bar	10 l/min	D 6362
VDB	4	350 bar	20 l/min	D 6363
VDB	6	350 bar	30 l/min	D 6363
VDB	8	420 bar	60 l/min	D 6364
VDB	10	420 bar	120 l/min	D 6364
VDB	16	350 bar	150 l/min	D 6377
VDB	32	350 bar	320 l/min	D 6377
VUB	10	420 bar	120 l/min	D 6384
VUB	16	350 bar	150 l/min	D 6384
VUB	32	350 bar	320 l/min	D 6384

4.3.2 Certified valves

Safety valve with component approval type MVEX, SVX

- Single valve for pipe connection
- Manifold mounting valve
- Screw-in valve

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Operating pressures up to 450 bar
- Easily produced mounting hole

Type	Size	p_{max}	Q_{max}	Document
MVEX	4	450 bar	24 l/min	D 7000 TUV
MVEX	6	450 bar	100 l/min	D 7000 TUV
SVX	41	430 bar	6 l/min	D 7000 TUV

Component approved pressure-limiting valve type CMVX

- Screw-in valve
- Combination with connection block for pipe connection

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Operating pressures up to 500 bar
- Various adjustment options
- Easily produced mounting hole

Type	Size	p_{max}	Q_{max}	Document
CMVX	2	500 bar	28 l/min	D 7710 TUV

4.3.3 Proportional pressure-limiting valves

Proportional pressure-limiting valve type PMV, PMVS, PMVP, PMVPS, NPMVP

- Single valve for pipe connection
- Manifold mounting valve

Adjustment

– Electromagnetic

Features and advantages

- Operating pressures up to 700 bar
- Precise control

Type	Size	p_{max}	Q_{max}	Document
PMV, PMVP, PMVS, PMVPS, NPMVP	4	700 bar	16 l/min	D 7485/1 D 7485 N
PMV, PMVP, PMVS	5	450 bar	60 l/min	D 7485/1
PMV, PMVP	6	320 bar	75 l/min	D 7485/1
PMV, PMVP, PMVPS	8	180 bar	120 l/min	D 7485/1

Proportional pressure-limiting valve and pressure reducing valve type PDV, PDVE, PDM

- Single valve for pipe connection
- Manifold mounting valve

Adjustment

– Electromagnetic

Features and advantages

- Operating pressures up to 350 bar
- Precise control
- Integrated overpressure function

Type	Size	p_{max}	Q_{max}	Document
PDV, PDVE, PDM	3	350 bar	40 l/min	D 7486
PDV, PDVE, PDM	4	350 bar	80 l/min	D 7486
PDV, PDVE, PDM	5	350 bar	120 l/min	D 7486

Proportional pressure-limiting valve type VPDB, SPDB

- Manifold mounting valve
- Insert valve

Adjustment

– Electromagnetic

Features and advantages

- Continuous adjustment of pressure
- As a controller, the electronic digital amplifiers PVR2 and PVR6 by HAWE are recommended - specially designed for this type of valve.

Type	Size	p_{max}	Q_{max}	Document
VPDB, SPDB	06	350 bar	10 l/min	D 6385
VPDB	16	350 bar	150 l/min	D 6386 D 6387
VPDB	32	350 bar	320 l/min	D 6387

Proportional pressure-limiting valve type PMVE

- Screw-in valve
- Combination with connection block for pipe connection
- Combination with connection block for manifold mounting

Adjustment

– Electromagnetic

Features and advantages

- Rising and falling characteristic line
- Excellent repeatability and control tuning
- Low dynamic pressure
- Various block and solenoid versions
- For general purpose use

Type	Size	p_{max}	Q_{max}	Document
PMVE	1	420 bar	10 l/min	D 8143

4.3.4 Pressure reducing valves

Pressure reducing valve type ADC, ADM, ADME, AM

- Single valve for pipe connection
- Manifold mounting valve
- Screw-in valve

Adjustment
– Fixed

Features and advantages
- Compact design
- Numerous configurations

Type	Size	p_{max}	p_A	Q_{max}	Document
ADC	1	315 bar	25 bar	2 l/min	D 7458
AM	1	400 bar	100 bar	2 l/min	D 7458
ADM	1	315 bar	70 bar	10 l/min	D 7458
ADME	1	315 bar	70 bar	2 l/min	D 7458

Pressure reducing valve type ADM

- Single valve for pipe connection
- Manifold mounting valve
- Directly controlled

Adjustment
– Fixed, tool adjustable
– Manually adjustable

Features and advantages
- Integrated overpressure function
- Various adjustment options

Type	Size	p_{max}	p_A	Q_{max}	Document
ADM	1	320 bar	250 bar	12 l/min	D 7120
ADM	2	320 bar	250 bar	25 l/min	D 7120
ADM	3	320 bar	250 bar	60 l/min	D 7120

Pressure reducing valves type VDM, VDX

- Single valve for pipe connection
- Manifold mounting valve
- Pilot-controlled

Adjustment
– Fixed, tool adjustable
– Manually adjustable

Features and advantages
- Integrated overpressure function
- Various adjustment options
- Various additional functions

Type	Size	p_{max}	p_A	Q_{max}	Document
VDM, VDX	3	400 bar	300 bar	40 l/min	D 5579
VDM, VDX	4	400 bar	300 bar	80 l/min	D 5579 D 6427
VDM, VDX	5	400 bar	300 bar	120 l/min	D 5579

Pressure reducing valve type CDK

- Screw-in valve
- Versions with single connection block for pipe connection and manifold mounting

Adjustment
– Fixed, tool adjustable
– Manually adjustable

Features and advantages
- Zero leakage when closed
- Connection blocks for pipe connection
- Zinc-nickel corrosion protection as standard

Type	Size	p_{max}	p_A	Q_{max}	Document
CDK	3	500 bar	500 bar	22 l/min	D 7745

Pressure reducing valve type CLK

- With integrated overpressure function
- Screw-in valve
- Version with single connection block for pipe connection and manifold mounting

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Zero leakage when closed
- Connection blocks for pipe connection
- Zinc-nickel corrosion protection as standard

Type	Size	p_{max}	p_A	Q_{max}	Document
CLK	3	500 bar	500 bar	22 l/min	D 7745 L

Pressure reducing valve type DK, DZ, DLZ

- Screw-in valve according to the 2-way principle
- Combination with connection block

Adjustment
- Fixed, tool adjustable
- Manually adjustable
- Lockable

Features and advantages
- Zero leakage when closed
- Version with tracked pressure switch

Type	Size	p_{max}	p_A	Q_{max}	Document
DK, DZ, DLZ	3	500 bar	500 bar	22 l/min	D 7941

4.3.5 Proportional pressure reducing valves

Proportional pressure reducing valve type PM, PMZ

- Insert valve
- Manifold mounting valve

Adjustment
- Electromagnetic

Features and advantages
- Compact design
- Numerous configurations
- Explosion-proof versions

Type	Size	p_{max}	p_A	Q_{max}	Document
PM, PMZ	1	40 bar	30 bar	2 l/min	D 7625

Proportional pressure reducing valve type PDM, PDMP

- Single valve for pipe connection
- Manifold mounting valve

Adjustment
- Electromagnetic

Features and advantages
- Operating pressures up to 350 bar
- Precise control
- Integrated overpressure function

Type	Size	p_{max}	p_A	Q_{max}	Document
PDM, PDMP	1	320 bar	320 bar	12 l/min	D 7584/1
PDM, PDMP	2	320 bar	180 bar	20 l/min	D 7584/1
PDM	3	350 bar	350 bar	40 l/min	D 7486
PDM	4	350 bar	350 bar	80 l/min	D 7486
PDM	5	350 bar	350 bar	120 l/min	D 7486

Proportional pressure reducing valve type VPDM

- Manifold mounting valve

Adjustment

– Electromagnetic

Features and advantages

- Precise pressure reduction
- Size NG06 directly controlled (no control oil required)

Type	Size	p_{max}	p_A	Q_{max}	Document
VPDM	6	350 bar	300 bar	20 l/min	D 6530
VPDM	10	350 bar	210 bar	100 l/min	D 6531

4.3.6 Switch-off and shut-off valves, two-stage valves

Two-stage valve type NE

- Two-stage valve (high-pressure/ low-pressure stage)
- Single valve for pipe connection

Adjustment

– Fixed, tool adjustable

Features and advantages

- Operating pressures up to 700 bar
- Direct mounting on hydraulic power packs
- Direct combination with valve banks

Type	Size	p_{max} HP	p_{max} LP	Q_{max} HP	Q_{max} LP	Document
NE	2	700 bar	80 bar	10 l/min	40 l/min	D 7161
NE	7	500 bar	60 bar	16 l/min	100 l/min	D 7161
NE	8	500 bar	30 bar	25 l/min	180 l/min	D 7161

Pressure-controlled shut-off valve type CNE

- 2-way idle circulation valve
- Screw-in valve

Adjustment

– Fixed

Features and advantages

- Compact design
- Easily produced mounting hole

Type	Size	p_{max}	Q_{max}	Document
CNE	2	500 bar	30 l/min	D 7710 NE

Shut-off valve type LV

- Shut-off valve (idle circulation valve, directly controlled or pilot-controlled)
- Single valve for pipe connection or manifold mounting

Adjustment

– Fixed

– Adjustable

Features and advantages

- Various adjustment options
- Various additional functions

Type	Size	p_{max}	Q_{max}	Document
LV	1	350 bar	12 l/min	D 7529
LV	2	350 bar	25 l/min	D 7529

Shut-off valve type ALZ

- Shut-off valve (idle circulation valve, directly controlled or pilot-controlled)
- Single valve for pipe connection or manifold mounting

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Flexible interface between the hydraulic power pack and valve controls
- Space-saving due to direct mounting on the hydraulic power pack
- Integrated pressure-limiting valve

Type	Size	p_{max}	Q_{max}	Document
ALZ	3	350 bar	50 l/min	D 6170 ALZ
ALZ	4	350 bar	80 l/min	D 6170 ALZ
ALZ	5	350 bar	120 l/min	D 6170 ALZ

Pressure-controlled shut-off valve type DSV, DSVP

- Single valve for pipe connection
- Manifold mounting valve
- Screw-in valve

Adjustment
- Fixed
- Manual

Features and advantages
- Various adjustment options
- Various additional functions

Type	Size	p_{max}	Q_{max}	Document
DSV, DSVP	1	600 bar	20 l/min	D 3990
DSV	2	400 bar	40 l/min	D 3990
DSV	3	400 bar	60 l/min	D 3990

Pressure-controlled shut-off valve type CDSV

- Single valve for pipe connection
- Manifold mounting valve
- Screw-in valve

Adjustment
- Fixed
- Manual

Features and advantages
- Various adjustment options

Type	Size	p_{max}	Q_{max}	Document
CDSV	1	600 bar	8 l/min	D 7876

4.3.7 Load-holding valves

Load-holding valve type LHK

- Single or twin valve for pipe connection
- Manifold mounting valve
- Screw-in valve, version for banjo bolt mounting

Adjustment
- Fixed, tool adjustable

Features and advantages
- Operating pressures up to 400 bar
- Various adjustment options
- Various models

Type	Size	p_{max}	Q_{max}	Document
LHK	2	400 bar	20 l/min	D 7100
LHK	3	360 bar	60 l/min	D 7100
LHK	4	350 bar	100 l/min	D 7100

Load-holding valve type LHT, LHTE

- Single valve for pipe connection
- Manifold mounting valve
- Screw-in valve, version for banjo bolt mounting

Adjustment

– Fixed, tool adjustable

Features and advantages

- Operating pressures up to 450 bar
- Various adjustment options
- Various models

Type	Size	p_{max}	Q_{max}	Document
LHT	2	400 bar	28 l/min	D 7918
LHT	3	400 bar	130 l/min	D 7918
LHT	5	450 bar	250 l/min	D 7918
LHTE	3	450 bar	130 l/min	SK 7918-LHTE 30P-11

Load-holding valve type LHDV

- Single or twin valve for pipe connection
- Manifold mounting valve
- Screw-in valve, version for banjo bolt mounting
- With special vibration isolators

Adjustment

– Fixed, tool adjustable

Features and advantages

- Operating pressures up to 420 bar
- Various adjustment options
- Various models

Type	Size	p_{max}	Q_{max}	Document
LHDV	33	420 bar	80 l/min	D 7770

Load-holding valve type CLHV

- Screw-in valve
- Single or twin valve for pipe connection or manifold mounting

Adjustment

– Fixed, tool adjustable
– Fixed

Features and advantages

- Four sizes
- Various adjustment options
- Various types of relief
- Various models

Type	Size	p_{max}	Q_{max}	Document
CLHV	2.C	350 bar	30 l/min	D 7918-VI-C
CLHV	2.PIB	350 bar	40 l/min	D 7918-VI-PIB
CLHV	3.C	350 bar	75 l/min	D 7918-VI-C
CLHV	3.PIB	350 bar	90 l/min	D 7918-VI-PIB
CLHV	5.C	350 bar	150 l/min	D 7918-VI-C
CLHV	5.PIB	350 bar	150 l/min	D 7918-VI-PIB
CLHV	7.C	350 bar	320 l/min	D 7918-VI-C
CLHV	7.PIB	350 bar	350 l/min	D 7918-VI-PIB

Load-holding valve type OSCA

- Screw-in valve
- Single connection blocks

Adjustment

– Fixed, tool adjustable

Features and advantages

- Pressure settings up to 500 bar with 4-fold structural safety
- High stability to resist vibration
- Zero leakage holding in the working area
- Pressure adjustment is simple
- Zinc-nickel corrosion protection as standard

Type	Size	p_{max}	Q_{max}	Document
OSCA	2	500 bar	40 l/min	D 7920 D

4.4 Flow valves

4.4.1 Restrictors, throttles, throttle shut-off valves

Throttle valve and restrictor check valve type Q, QR, QV

- Screw-in valve
- Angle valve for pipe connection
- Banjo bolt
- Swivel fitting

Adjustment

– Fixed, tool adjustable

Features and advantages

- Different installation options
- Simple design

Type	Size	p_{max}	Q_{max}	Document
Q, QR, QV	20	400 bar	12 l/min	D 7730
Q, QR, QV	30	400 bar	25 l/min	D 7730
Q, QR, QV	40	400 bar	50 l/min	D 7730
Q, QR, QV	50	400 bar	90 l/min	D 7730
Q, QR, QV	60	400 bar	120 l/min	D 7730

Throttle valve and restrictor check valve type FG, FGS

- Screw-in valve
- Single valve for pipe connection
- Angle valve
- Banjo bolt
- Swivel fitting

Adjustment

– Fixed, tool adjustable

– Manually adjustable

Features and advantages

- Different installation options
- Simple design

Type	Size	p_{max}	Q_{max}	Document
FG	--	300 bar	0.8 l/min	D 7275
FGS	--	400 bar	0.8 l/min	D 7275

Throttle valve and restrictor check valve type ED, RD, RDF

- Single valve for pipe connection

Adjustment

– Fixed, tool adjustable

– Manually adjustable

Features and advantages

- Sensitive adjustment
- Wear-resistant

Type	Size	p_{max}	Q_{max}	Document
ED, RD	11	500 bar	15 l/min	D 7540
ED, RD	21	500 bar	35 l/min	D 7540
ED, RD	31	500 bar	60 l/min	D 7540
ED, RD	41	500 bar	100 l/min	D 7540
ED, RD	51	500 bar	130 l/min	D 7540
RDF	11	500 bar	15 l/min	D 7540
RDF	21	500 bar	35 l/min	D 7540
RDF	31	500 bar	60 l/min	D 7540
RDF	41	500 bar	100 l/min	D 7540
RDF	51	500 bar	130 l/min	D 7540

Throttle valve and restrictor check valve type CQ, CQR, CQV

- Screw-in valve

Adjustment

– Fixed, tool adjustable

Features and advantages

- Zero leakage adjustment when under pressure
- Operating pressure up to 700 bar
- Various precision control ranges

Type	Size	p_{max}	Q_{max}	Document
CQ, CQR, CQV	2	700 bar	50 l/min	D 7713

Throttle valve and shut-off valve type AV

- Single valve for pipe connection
- Screw-in valve

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Various models
- Sensitive adjustment and complete shut off possible

Type	Size	p_{max}	Q_{max}	Document
AV	2	500 bar	40 l/min	D 4583
AV	3	400 bar	100 l/min	D 4583

Shut-off valve type AVT, AVM

- Single valve for pipe connection
- Screw-in valve

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Various models
- Sensitive adjustment and complete shut off possible

Type	Size	p_{max}	Q_{max}	Document
AVT	6	630 bar	50 l/min	D 7690
AVT, AVM	8	630 bar	50 l/min	D 7690
AVT	10	630 bar	50 l/min	D 7690
AVT	12	630 bar	50 l/min	D 7690

Throttle valve and shut-off valve CAV

- Single valve for pipe connection
- Screw-in valve

Adjustment
- Fixed, tool adjustable
- Manually adjustable

Features and advantages
- Various models
- Sensitive adjustment and complete shut off possible

Type	Size	p_{max}	Q_{max}	Document
CAV	1	500 bar	30 l/min	D 7711
CAV	2	500 bar	50 l/min	D 7711

Restrictor check valve type BE

- Screw-in valve
- Combination with housing for pipe connection

Features and advantages
- Up to 500 bar
- Simple design and assembly

Type	Size	p_{max}	Q_{max}	Document
BE	0	500 bar	12 l/min	D 7555 B
BE	1	500 bar	25 l/min	D 7555 B
BE	2	500 bar	40 l/min	D 7555 B
BE	3	450 bar	80 l/min	D 7555 B
BE	4	400 bar	120 l/min	D 7555 B

Restrictor check valve type BC

- Screw-in valve
- Combination with housing for pipe connection

Features and advantages
- Up to 700 bar
- Simple design and assembly

Type	Size	p_{max}	Q_{max}	Document
BC	1	700 bar	20 l/min	D 6969 B
BC	2	700 bar	35 l/min	D 6969 B
BC	3	500 bar	60 l/min	D 6969 B

4.4.2 Flow control valves

Flow control valve type SD, SF, SK, SKR

- Single valve for pipe connection
- Manifold mounting valve

Adjustment

– Mechanical

Features and advantages

- Various actuation types
- Can be combined with bypass check valves
- Precise adjustment

Type	Size	p_{max}	Q_{max}	Document
SD, SF, SK, SKR	3	315 bar	60 l/min	D 6233
SD, SF, SK, SKR	4	315 bar	90 l/min	D 6233
SD, SF, SK, SKR	5	315 bar	130 l/min	D 6233

Flow control valve (counterbalance valve) type SB, SQ

- Screw-in valve
- Single valve for pipe connection

Adjustment

– Fixed

Features and advantages

- Compact screw-in valve
- Vibration isolating and load-independent
- Available in various housing versions
- 5 sizes from 1 to 400 l/min

Type	Size	p_{max}	Q_{max}	Document
SB, SQ	0	315 bar	15 l/min	D 6920
SB, SQ	1	315 bar	35 l/min	D 6920
SB, SQ	2	315 bar	67 l/min	D 6920
SB, SQ	3	315 bar	150 l/min	D 6920
SB	4	315 bar	250 l/min	D 6920
SB	5	315 bar	400 l/min	D 6920

Flow control valve type CSJ

- Screw-in valve
- Single valve for pipe connection

Adjustment

– Fixed, tool adjustable

– Manually adjustable

Features and advantages

- Oscillation damping and load-independent
- Compact screw-in valve

Type	Size	p_{max}	Q_{max}	Document
CSJ	0	420 bar	2 l/min	D 7736

Flow control valve type DSJ

- Screw-in valve
- Single valve for pipe connection

Adjustment

– Fixed, tool adjustable

– Manually adjustable

Features and advantages

- Oscillation damping and load-independent
- Compact screw-in valve

Type	Size	p_{max}	Q_{max}	Document
DSJ	1	315 bar	21 l/min	D 7825

Flow control valve type SJ

- Screw-in valve
- Single valve for pipe connection

Adjustment

– Fixed

Features and advantages

- Oscillation damping and load-independent
- Compact screw-in valve

Type	Size	p_{max}	Q_{max}	Document
SJ	0	315 bar	15 l/min	D 7395

Flow control valve type SR2, SR3

- Manifold mounting valve
- Screw-in valve

Adjustment

– Mechanical

Features and advantages

- Excellent reproducibility

Type	Size	p_{max}	Q_{max}	Document
SR2, SR3	6	320 bar	35 l/min	D 6403 D 6404
SR2	8	350 bar	13.5 l/min	D 6402

4.4.3 Proportional flow control valves

Proportional flow control valves type SE, SEH

- Single valve for pipe connection
- Manifold mounting valve

Adjustment

– Electromagnetic

Features and advantages

- Electric control of consumer working speeds
- Automation of operating cycles

Type	Size	p_{max}	Q_{max}	Document
SE	3	315 bar	50 l/min	D 7557/1
SE	4	315 bar	90 l/min	D 7557/1
SEH	2	315 bar	36 l/min	D 7557/1
SEH	3	315 bar	50 l/min	D 7557/1
SEH	4	315 bar	90 l/min	D 7557/1
SEH	5	315 bar	120 l/min	D 7557/1

4.4.4 Flow dividers

Flow divider type TQ

- Single valve for pipe connection
- Manifold mounting valve

Features and advantages

- High dividing accuracy

Type	Size	p_{max}	Q_{max}	Document
TQ	2	350 bar	70 l/min	D 7381
TQ	3	350 bar	70 l/min	D 7381
TQ	4	350 bar	120 l/min	D 7381
TQ	5	350 bar	200 l/min	D 7381

4.5 Check valves

4.5.1 Check valves

Check valve type RK, RB

- Screw-in valve
- Combination with housing for pipe connection

Features and advantages

- Operating pressures up to 700 bar
- Simple mounting holes
- Robust and dirt resistance
- Type RK, RB also available with different pre-load pressures

Type	Size	p_{max}	Q_{max}	Document
RK, RB	0	700 bar	10 l/min	D 7445
RK, RB	1	700 bar	20 l/min	D 7445
RK, RB	2	700 bar	50 l/min	D 7445
RK, RB	3	500 bar	80 l/min	D 7445
RK, RB	4	500 bar	120 l/min	D 7445
RK	5	500 bar	240 l/min	D 7445
RK	6	420 bar	400 l/min	D 7445
RK	7	420 bar	620 l/min	D 7445

Check valve type RC

- Screw-in valve
- Combination with housing for pipe connection

Features and advantages
- Operating pressures up to 700 bar
- Simple mounting holes
- Robust and dirt resistance
- Especially suitable for rapid switching sequences

Type	Size	p_{max}	Q_{max}	Document
RC	1	700 bar	20 l/min	D 6969 R
RC	2	700 bar	35 l/min	D 6969 R
RC	3	500 bar	60 l/min	D 6969 R

Check valve type RE

- Screw-in valve
- Combination with housing for pipe connection

Features and advantages
- Simple mounting holes
- Robust and dirt resistance

Type	Size	p_{max}	Q_{max}	Document
RE	0	500 bar	12 l/min	D 7555 R
RE	1	500 bar	25 l/min	D 7555 R
RE	2	500 bar	40 l/min	D 7555 R
RE	3	450 bar	80 l/min	D 7555 R
RE	4	400 bar	120 l/min	D 7555 R

Check valve type ER, EK

- Plug-in valve

Features and advantages
- Operating pressures up to 700 bar
- Simple mounting holes
- Robust and dirt resistance

Type	Size	p_{max}	Q_{max}	Document
ER	01	700 bar	6 l/min	D 7325
ER	11, 12, 13	700 bar	12 l/min	D 7325
ER	21	500 bar	30 l/min	D 7325
ER	31	500 bar	65 l/min	D 7325
ER	41	400 bar	120 l/min	D 7325
EK	1	500 bar	10 l/min	D 7325

Check valve type CRK, CRB

- Screw-in valve
- Combination with housing for pipe connection

Features and advantages
- Minimal installation space
- Easy to install and remove
- Robust and dirt resistance

Type	Size	p_{max}	Q_{max}	Document
CRK, CRB	1	500 bar	30 l/min	D 7712
CRK, CRB	2	500 bar	50 l/min	D 7712
CRK, CRB	3	500 bar	80 l/min	D 7712

4.5.2 Releasable check valves

Releasable check valve type CRH

- Screw-in valve

Actuation
- Hydraulic

Features and advantages
- Minimal installation space
- Easy to install and remove
- Robust and dirt resistant

Type	Size	p_{max}	Q_{max}	Document
CRH	1	500 bar	20 l/min	D 7712
CRH	2	500 bar	30 l/min	D 7712
CRH	3	500 bar	55 l/min	D 7712

Releasable check valve type RHC, RHCE

- Screw-in valve

Actuation

– Hydraulic

Features and advantages

- Pressures up to 700 bar
- Flows up to 200 l/min
- Robust

Type	Size	p_{max}	Q_{max}	Document
RHC, RHCE	1	700 bar	15 l/min	D 7165
RHC, RHCE	2	700 bar	35 l/min	D 7165
RHC, RHCE	3	700 bar	55 l/min	D 7165
RHC, RHCE	4	500 bar	100 l/min	D 7165
RHC, RHCE	5	500 bar	150 l/min	D 7165
RHC, RHCE	6	500 bar	200 l/min	D 7165

Releasable check valve type HRP

- Manifold mounting valve

Actuation

– Hydraulic

– Electro-hydraulic

Features and advantages

- Pressures up to 700 bar
- Flows up to 400 l/min
- Can be controlled electrically
- With hydraulic release for smooth switching

Type	Size	p_{max}	Q_{max}	Document
HRP	1	700 bar	20 l/min	D 5116
HRP	2	700 bar	35 l/min	D 5116
HRP	3	500 bar	50 l/min	D 5116
HRP	4	500 bar	80 l/min	D 5116
HRP	5	500 bar	140 l/min	D 5116
HRP	7	500 bar	400 l/min	D 5116

Releasable check valve type RH

- Single valve for pipe connection

Actuation

– Hydraulic

Features and advantages

- Pressures up to 700 bar
- With hydraulic release for smooth switching

Type	Size	p_{max}	Q_{max}	Document
RH	1	700 bar	15 l/min	D 6105
RH	2	700 bar	35 l/min	D 6105
RH	3	500 bar	55 l/min	D 6105
RH	4	500 bar	100 l/min	D 6105
RH	5	500 bar	160 l/min	D 6105

Releasable twin check valve type DRH

- Pipe installation
- Manifold mounting valve

Actuation

– Hydraulic

Features and advantages

- Pressures up to 500 bar
- With hydraulic release for smooth switching

Type	Size	p_{max}	Q_{max}	Document
DRH	1	500 bar	16 l/min	D 6110
DRH	2	500 bar	30 l/min	D 6110
DRH	3	500 bar	60 l/min	D 6110
DRH	4	400 bar	90 l/min	D 6110
DRH	5	400 bar	140 l/min	D 6110

Releasable check valve type GRV

- Pipe installation

Actuation

– Hydraulic

Features and advantages

- With hydraulic release in locking direction
- Metal seals
- A and B must be connected to T when the respective control slider is at middle position.

Type	Size	p_{max}	Q_{max}	Document
GRV	10	350 bar	80 l/min	D 6399

4.5.3 Line rupture protection valves, shuttle valves

Line rupture protection valve type LB

- Screw-in valve
- Combination with housing for pipe connection

Adjustment

– Fixed, tool adjustable

Features and advantages

- Operating pressures up to 500 bar
- Reduction in screw fittings in the case of E-version
- Maintenance free
- Pre-adjusted valves available
- Different sizes and designs available

Type	Size	p_{max}	Q_{max}	Document
LB	1	500 bar	30 l/min	D 6990
LB	1 E	500 bar	30 l/min	D 6990
LB	2	500 bar	50 l/min	D 6990
LB	2 E	500 bar	50 l/min	D 6990
LB	3	500 bar	80 l/min	D 6990
LB	3 E	500 bar	80 l/min	D 6990
LB	4	500 bar	160 l/min	D 6990
LB	4 E	500 bar	175 l/min	D 6990
LB	5	300 bar	250 l/min	D 6990

Shuttle valve type WV, WVC, WVE, WVH

- Single valve for pipe connection
- Screw-in valve

Features and advantages

- Operating pressures up to 700 bar
- Insert and housing versions

Type	Size	p_{max}	Q_{max}	Document
WV	6	700 bar	6 l/min	D 7016
WV	8	700 bar	15 l/min	D 7016
WV	10	500 bar	25 l/min	D 7016
WV	12	500 bar	40 l/min	D 7016
WV	14	500 bar	60 l/min	D 7016
WV	16	500 bar	100 l/min	D 7016
WV	18	315 bar	125 l/min	D 7016
WVC	1	315 bar	6 l/min	D 7016
WVE	2	500 bar	25 l/min	D 7016
WVH	1	700 bar	3 l/min	D 7016

4.5.4 Anti-cavitation and pre-fill valves

Check valve and pre-fill valve type F

- Valve in intermediate flange version

Actuation

– Hydraulic

Features and advantages

- Wafer design
- Extremely high flow rates up to 7,000 l/min

Type	Size	p_{max}	Q_{max}	Document
F	25	400 bar	100 l/min	D 6960
F	32	400 bar	160 l/min	D 6960
F	40	400 bar	250 l/min	D 6960
F	50	400 bar	480 l/min	D 6960
F	63	400 bar	630 l/min	D 6960
F	64	400 bar	760 l/min	D 6960
F	80	400 bar	1000 l/min	D 6960
F	81	400 bar	1200 l/min	D 6960
F	100	400 bar	1600 l/min	D 6960
F	101	400 bar	1920 l/min	D 6960
F	125	400 bar	2500 l/min	D 6960
F	126	400 bar	3000 l/min	D 6960
F	160	400 bar	4000 l/min	D 6960
F	161	400 bar	4800 l/min	D 6960
F	200	320 bar	7000 l/min	D 6960

Anti-cavitation valve type NSV

- Manifold mounting
- Insert valve

Actuation

– Hydraulic

Features and advantages

- Normally open contact (NO)
- Any installation position
- Easy-to-implement safety function

Type	Size	p_{max}	Q_{max}	Document
NSV	32	320 bar	150 l/min	D 6368
NSV	50	320 bar	300 l/min	D 6368
NSV	75	320 bar	500 l/min	D 6368
NSV	100	320 bar	900 l/min	D 6368

5 Electronics

5.1 Control systems

Mobile controller type ESX

Mobile controller

Features and advantages
- Freely programmable in logi.CAD, C and Codesys
- Extensive function module library
- CAN bus and Ethernet interfaces
- PLd and SIL 2 certified
- Simple commissioning, service and optimisation with the user friendly HAWE Visual Tool
- Customised training and software development available

Document
ESX-3CM
ESX-3CS
ESX-3IOS
ESX-4CS-GW

Valve control type CAN-IO 14

Compact controller/IO module

Features and advantages
- Up to 8 IPWM outputs
- Up to 16 analogue inputs
- High protection class
- Up to 2 CAN bus interfaces
- Flexible programming in HAWE eDesign or C
- Configurable as CAN slave
- Free parametrization of all inputs and outputs

Document
D 7845-IO 14

5.2 Proportional amplifiers

Proportional amplifier type EV22K

Card version with 32-pin terminal block according to DIN EN 60603

Features and advantages
- Short-circuit-proof fixed voltage regulator ±5 V DC or ±10 V DC
- Compact design
- Easy commissioning
- Functions tailored to HAWE products
- LEDs for status monitoring

Document
D 7817/2

Proportional amplifier type EV2D

Top-hat rail housing with connection clips

Features and advantages
- Compact design
- LAN interface
- CAN interface
- EtherCAT interface
- UL-approved
- SIL 3-certified (ST0)

Document
D 7821

Proportional amplifier type EV2S

Line connector

Features and advantages
- Direct assembly onto the solenoid valves
- Easy commissioning
- Up to two analogue inputs for target value signals
- Control of twin and single valves
- CAN bus interface
- Bluetooth interface (optional)
- Simple diagnostics and status monitoring
- Functions and settings tailored to HAWE products

Document
D 7818/1

Proportional amplifier type EV1D, EV1M3

Board (module) with connectors

Features and advantages
- Compact design
- Easy commissioning
- Functions tailored to HAWE products

Document
D 7831 D
D 7831/2

5.3 Line connector

Line connector type MSD, SVS, MSE

Line connector
- With rectifier circuit
- With clamp diode
- With LED
- With economy circuit

Features and advantages
- Simple installation
- Energy savings during continuous operation
- Use of HAWE valves in AC grids

Type	Operating voltage U_{max}	Document
MSD, SVS, MSE	12...250 V DC/AC	D 7163

Line connector with economy circuit type MSD 4 P

Line connector

Features and advantages
- Switching monitoring with LED
- Simple installation
- Energy savings during continuous operation
- Use of HAWE valves in AC grids

Type	Operating voltage U_{max}	Document
MSD 4 P53	230 V AC	D 7813
MSD 4 P63	115 V AC	D 7813

Line connector with economy circuit type MSD 4 ECO

Line connector

Features and advantages
- Switching monitoring with LED
- Simple installation
- Energy savings during continuous operation

Type	Operating voltage U_{max}	Document
MSD 4 ECO	24 V DC	D 7833/1

5.4 Battery and battery management

Battery pack type IEP

Self-contained energy store

Features and advantages
- Various nominal voltages (50 V DC, 100 V DC)
- Compact design with very high energy density
- Patented quick-change system
- CAN bus interface
- Integrated battery management with thermal management
- High safety and vibration stability thanks to wire bonding

Document
D 6130

6 Monitoring, sensors

6.1 Pressure switches

Pressure switch type DG

- Manifold mounting
- Screw-in version
- Pipe connection

Features and advantages
- Compact design
- Option of integration with the HAWE modular system
- Switching current up to 2 A
- Available as N/O or N/C contact version

Type	p_{max}	Document
DG 1	600 bar	D 5440
DG 3	700 bar	D 5440

6.2 Electric pressure switches

Electric pressure switches type DG

- Screw-in version

Features and advantages
- Two switch outputs as normally closed contact or normally open contact, PNP or NPN programmable
- Process data, output signal and diagnostic messages available via IO-Link
- Compact design
- Shorter commissioning times

Type	p_{max}	Document
DG 51 E	800 bar	D 5440 E/2
DG 6	600 bar	D 5440 F
DG 7	1000 bar	D 5440 G

6.3 Pressure transducers

Electronic pressure transducer type DT

- Screw-in version

Features and advantages
- Plastic or stainless steel housing
- Accuracy class 1%
- Analogue output signal (4 to 20 mA, 0 to 5 V DC, 0 to 10 V DC)
- M12 male connector
- G 1/4 A pressure port

Type	p_{max}	Document
DT 2	600 bar	D 5440 T/1
DT 11	1000 bar	D 5440 T/2

7 Cylinders and motors

7.1 Hydraulic motor

7.1.1 Axial piston motor

Axial piston motor type M60N

- Axial piston fixed motor

Features and advantages

- Optimised power-to-weight ratio
- High speed capacity
- Different shaft and flange versions

Size	Nominal pressure p_{max}	Peak pressure p_{max}	$V_{g\ max}$	Document
12	350 bar	400 bar	12.6 cm³/U	D 7960 M
17	350 bar	400 bar	17 cm³/U	D 7960 M
25	350 bar	400 bar	25.4 cm³/U	D 7960 M
34	350 bar	400 bar	34.2 cm³/U	D 7960 M
47	350 bar	400 bar	47.1 cm³/U	D 7960 M
64	350 bar	400 bar	63.5 cm³/U	D 7960 M
84	350 bar	400 bar	83.6 cm³/U	D 7960 M
90	350 bar	400 bar	90.7 cm³/U	D 7960 M
108	350 bar	400 bar	108 cm³/U	D 7960 M

7.2 Hydraulic cylinders

Differential cylinder type LVM

Double-acting cylinder with single-ended piston rod

Features and advantages

- Suitable for high loads (made of steel)
- The compressed design enables free positioning of the hydraulic connections over 360 degrees and is cost-efficient
- Piston diameters 20, 25, 32 and 40 mm
- Stroke 15 to 400 mm, depending on the size
- Internally and externally technically leak-proof over an extended period of time
- Short and compact design

Type	Size	p_{max}	H_{Stroke}	Document
LVM	20, 25, 32, 40	160 bar	400 mm	D 6053

Standardised hydraulic cylinder type DZ25

- Double-acting cylinder with differential piston

Features and advantages

- With or without soft-stop function
- Piston diameter 32, 40, 50, 63, 80, 100 or 125 mm
- Stroke 45 to 1,000 mm, depending on size
- Four different mounting styles

Type	Size	p_{max}	H_{Stroke}	Document
DZ25	32, 40, 50, 63, 80, 100, 125	250 bar	1000 mm	D 6446

7.3 Clamping cylinders

Clamping cylinder type HSE, HSA

- Screw-in version
- Manifold mounting

Features and advantages

- Strong clamping force
- Extremely small dimensions and low weight
- Virtually maintenance free
- Operating pressures up to 500 bar

Type	Size	p_{max}	H_{Stroke}	Document
HSE	12	500 bar	8 mm	D 4711
HSE	16	500 bar	12 mm	D 4711
HSE	20	500 bar	20 mm	D 4711
HSE	24	500 bar	20 mm	D 4711
HSA	32	500 bar	20 mm	D 4711
HSA	40	500 bar	25 mm	D 4711

8 Accessories

8.1 Accumulator

8.1.1 Diaphragm accumulator

Diaphragm accumulator type AC, ACS (mini)

- Hydraulic accumulators
- Screw-in version

Features and advantages

- Compact design
- Option of integration with the HAWE modular system
- Operating pressures up to 500 bar

Type	p_{max}	Nominal volume V_0	Document
AC, ACS 13	500 bar	0.01 dm³	D 7571
AC 40	400 bar	0.04 dm³	D 7571

Diaphragm accumulator type AC

- Hydraulic accumulators
- Screw-in version

Features and advantages

- Compact design
- Option of integration with the HAWE modular system
- Operating pressures up to 350 bar

Type	p_{max}	Nominal volume V_0	Document
AC 0725	250 bar	0.075 dm³	D 7969
AC 1002	210 bar	1 dm³	D 7969
AC 3503	350 bar	3.5 dm³	D 7969
and others			D 7969

8.1.2 Piston type accumulator

Piston type accumulator type HPS

- In-line installation

Features and advantages

- Compact design
- Piston diameter 50 to 180 mm
- Option of integration into the HAWE modular system

Type	p_{max}	Nominal volume V_0	Document
HPS 10	350 bar	40 dm³	D 7969 HPS

8.2 Filter elements

Screen and filter elements type HFC, HF, HFE

Features and advantages

- Version as an installation kit or integrated in the housing
- Different sizes available
- Any flow direction

Type	p_{max}	Q_{max}	Document
HFC	700 bar	100 l/min	D 7235
HF	700 bar	20 l/min	D 7235
HFE	700 bar	100 l/min	D 7235

8.3 Fittings

Reducing connector type G

- Screw-in reducer

Features and advantages
- Compact design
- Option of integration into the HAWE modular system
- Operating pressures up to 700 bar

p_{max}	Document
700 bar	D 845

Fittings type X

- Screw-in version
- Version for pipe connection

Features and advantages
- Compact design
- Option of integration into the HAWE modular system

p_{max}	Document
630 bar	D 7065

Fittings type X84

- Screw-in version
- Version for pipe connection

Features and advantages
- Compact design
- Option of integration into the HAWE modular system
- Operating pressures up to 700 bar

p_{max}	Document
700 bar	D 7077

8.4 Pipe and hose

8.4.1 Hose lines

Hose lines type H3, H4

Features and advantages
- High-quality material
- DIN 20 024 approved → service life > 1 million pressure pulses when used as intended
- Easy to install and space-saving thanks to minimal outer diameters and bending radii

p_{max}	Document
280 bar	D 6027

9 System solutions

9.1 Hydraulic locking units

Hydraulic locking unit type HLU

Actuation
- Electro-hydraulic
- Manual

Features and advantages
- Plug & Play delivery – easy to install and ready for use immediately
- Closed, low-maintenance hydraulic system
- Electric unlocking and manual emergency actuation
- Simplified acceptance process thanks to TÜV Süd component certificate in accordance with the latest standards
- High degree of comfort for passengers thanks to stepless and silent bar adjustment mechanism
- Convenient locking mechanism: Passengers can use retaining bars as an aid when entering and disembarking the ride (depends on model)
- Easier bar opening system: The energy applied to close the bar is re-used when opening it (depends on model)

Size	Fatigue load	$H_{stroke\ max}$	Document
LE25	10500 N	140 mm	D 6052
LE32	10500 N	150 mm	D 6052
LE-X	10500 N	250 mm	D 6052

9.2 Press control systems

Press control system type SAKB

- Compact block

Actuation
- Electro-proportional

Features and advantages
- For press brakes up to beam length 3.5 m
- Cost-optimised solution
- For use with anti-cavitation valves type NSV
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
SAKB	6	280 bar	60 l/min	D 6335

Press control system type SPVM

- Pump power module

Actuation

– Electro-proportional

Features and advantages

- For press brakes up to beam length 3.5 m
- Really easy to install by direct flange-mounting on standard motor
- Includes internal gear pump, pressure filter, electric contamination indicator and coupling
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
SPVM	2	320 bar	36.3 l/min	D 6338
SPVM	3	320 bar	60 l/min	D 6338

Press control systems type SPLM

- Pump power module

Actuation

– Electro-proportional

Features and advantages

- Really easy to install by direct flange-mounting on standard motor
- Includes internal gear pump, pressure filter, electric contamination indicator and coupling
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
SPLM	2	320 bar	36.3 l/min	D 6337
SPLM	3	320 bar	72.5 l/min	D 6337

Press control system type MACB, MPLM

- Cylinder manifold

Actuation

– Electro-proportional

Features and advantages

- Suitable for press brakes of any beam length
- Really easy to install by direct flange-mounting on standard motor
- Includes internal gear pump, pressure filter, electric contamination indicator and coupling
- Anti-cavitation valves integrated in manifold
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
MACB	06	320 bar	30 l/min	D 6334
MACB	10	320 bar	100 l/min	D 6334
MPLM	2	320 bar	36.3 l/min	D 6334
MPLM	3	320 bar	72.5 l/min	D 6334

Press control system type SAMB, SAPB

- Cylinder manifold

Actuation

– Electro-proportional

Features and advantages

- Suitable for press brakes of any beam length
- Anti-cavitation valves for cylinder installation
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
SAMB	6	320 bar	30 l/min	D 6336 D 6337
SAMB	10	320 bar	100 l/min	D 6336 D 6337
SAPB	6	320 bar	80 l/min	D 6336
SAPB	10	320 bar	200 l/min	D 6336

Press control system type ePRAX© modular

- Electro-hydraulic drive (without cylinder)

Actuation

– Speed-controlled

Features and advantages

- Suitable for press brakes of any beam length
- Anti-cavitation valves integrated in manifold
- Simple cylindrical interface
- Energy-efficient thanks to servo hydraulics
- Certified according to DIN EN 12622

Type	Size	p_{max}	Q_{max}	Document
modular	06	320 bar	30 l/min	D 6340
modular	10	320 bar	50 l/min	D 6340

Press control system Type ePRAX© basic

- Cylinder manifold

Actuation

– Electro-proportional

– Optionally additionally speed-controlled

Features and advantages

- Suitable for press brakes of any beam length or tonnage
- Entirely separate axes cut down on piping requirements
- Load-dependent pressure reduction for greater energy efficiency
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
basic	06	320 bar	30 l/min	D 6339
basic	10	320 bar	100 l/min	D 6339
basic	25	320 bar	200 l/min	D 6339

Press control system type ePRAX© max

- Electro-hydraulic drive

Actuation

– Speed-controlled

Features and advantages

- Plug & play supply – easy to install and ready straight away
- Closed, low-maintenance hydraulic system
- Long service intervals of at least 15,000 hours
- Energy-efficient thanks to servo hydraulics
- Certified according to DIN 12622

Type	Size	Working/ rapid speed	Pressing force	Document
max	15	10 mm/s / 230 mm/s	1100 kN	D 6341
max	19	10 mm/s / 230 mm/s	1700 kN	D 6341

Press control system type ePRAX© control

- Electro-hydraulic drive (without cylinder)

Actuation

– Speed-controlled

Features and advantages

- Suitable for press brakes of any beam length
- Cost-optimised solution
- Minimal installation workload thanks to ready-to-install system
- Energy-efficient thanks to servo hydraulics
- Certified according to DIN 12622

Type	Size	p_{max}	Q_{max}	Document
control	15	320 bar	22.5 l/min	D 6360
control	19	320 bar	36.5 l/min	D 6360

9.3 Other system solutions

Servo power module type SPM

Servo power module

- With integrated pressure filtering

Actuation

– Speed-controlled

Features and advantages

- Minimum installation effort thanks to ready-to-install, fully tested unit

Type	Size	p_{max}	Q_{max}	Document
SPM	2	320 bar	50 l/min	D 6340

10 Annex

10.1 Hydraulic fluids – types, notes and selection range

The performance of a hydraulic system depends to a large extent on the quality of the hydraulic fluid used.

The hydraulic fluid should essentially be selected according to the operating conditions, such as

- Temperature (see viscosity classes)
- Nomenclature (possible ban on certain hydraulic fluids due to undesired reactions with metals etc.)
- Usage type (e.g. environmentally compatible hydraulic fluids)
- Surroundings (other hydraulic fluids already in use)

10.1.1 Overview of temperature and viscosity

Temperature range	Ambient conditions: -40 to +80°C **Exceptions:** Air-powered pumps type LP (+5 to +80°C) Hydraulic fluid: -25 to +80°C Please observe viscosity range and any additional restrictions. Compact hydraulic power packs type A, hydraulic locking units type LE 25/32, directional seated valves type SP3, linear actuator type LV, valve bank type SLC1, valve bank type TLC3 and hose lines type H3 (-10°C to +60°C)
Start temperature	Down to -40°C permissible Observe start viscosities as long as the steady-state temperature is at least 20K higher for subsequent operation! Biologically degradable or fire inhibiting hydraulic fluids generally not over max. +60 to +70°C.
Viscosity range	Min. approx. 4 mm^2/s, Max. approx. 1500 mm^2/s Optimal operating range approx. 10...500 mm^2/s

10.1.2 Mineral oils

Hydraulic fluid	Characteristics	Unusual features / restrictions
▪ HLP hydraulic fluids (DIN 51524-2)	Mineral oil with additives improving corrosion, oxidation and wear protection	Common hydraulic fluid
▪ HL hydraulic fluids (DIN 51524-1)	Mineral oil without wear protecting additives	Not suitable for any types of gear pump due to the lack of wear protection additives. ▪ No pumps or hydraulic power packs with gear pumps type RZ, Z ▪ No compact hydraulic power packs HC, KA, INKA, MPN, HK, HKL
▪ HVLP hydraulic fluids (DIN 51524-3)	Mineral oil with same additives as HLP, but with increased viscosity index for use in higher temperature ranges	The viscosity index correctors have a negative effect on shear strength (viscosity loss approx. 30% when loaded), demulsifying behaviour and air release characteristics, for example. Only use if required due to temperature range. Oil manufacturer must be consulted!
▪ H unalloyed oils, e.g. - lubricating oils (DIN 51524-1) - white oils (e.g. NSF H1)	Mineral oil without additives	Due to lack of additives only suitable for systems in the standby mode (S2 or S3 mode) (low lubricity). White oils are mostly used in systems with possible contact with foodstuffs.

Hydraulic fluid	Characteristics	Unusual features / restrictions
▪ PAO hydraulic fluids (tested based on DIN 51524-1 and DIN 51524-2)	mineral oil-free synthetic oil with additives improving corrosion, oxidation and wear protection	See information on hydraulic oils HVLP
▪ Special fluids for aviation (MIL H-5606) for off-shore applications (NATO H 540)	Mineral oils are based as a rule on naphthenic oil with wide temperature range	Seals made of FPM fluoride rubber may be required, depending on the hydraulic fluid. Consult the oil manufacturer!
▪ Other mineral oils HD engine oils ATF automatic transmission fluid (AQ A, suffix A) Diesel Test oil for diesel injection pump test	Mineral oils actually developed for other application purposes	More or less suitable hydraulic fluids. Pay attention to the presence of oxidation and corrosion protection as well as material compatibility (above all in relation to the seals). Important: increased leakage with directional spool valves. Oil manufacturer must be consulted!

10.1.3 Environmentally compatible hydraulic fluids ISO 15380

Hydraulic fluid	Characteristics	Unusual features / restrictions
▪ HETG fluids (Hydraulic Oil Environmental Triglyceride)	Fluids based on seed oils e.g. rape or sunflower with additives show only low temperature resistance (< 60 to 70°C)	Not suitable for compact hydraulic power packs type HC, KA, INKA, MPN, HK, HKL, all valves with wet armature solenoids as well as control systems with high throttle rates. At higher temperatures (> 60...70°C), HETG fluids show a tendency to gum and set and to age prematurely. Their use should be avoided!
▪ HEPG polyethylene glycols PEG polyethylene (water-soluble) PPG polypropylene (not water-soluble)	Fluids based on polyethylene glycol (PEG) Properties similar to mineral oil with regard to service life, lubricity and pressure resistance	No restrictions with regard to the operation behaviour, but ▪ dissolves standard enamels/paintwork (does not apply to two-component enamels) ▪ Do not use paper filters. Risk of blockage! (only fibre-glass or metal-mesh filters possible) ▪ Steel-to-aluminium (or steel-to-non-ferrous) bearing mating surface couples are problematic (dissolution effects) ▪ No pumps or hydraulic power packs with gear pumps type RZ or Z ▪ Do not use compact hydraulic power packs type HC, KA, INKA, MPN, HK, HKL ▪ No connection blocks with return line filter type A.F.., AF, BF, EF, FF
▪ HEES synthetic esters (carboxylic acid ester, diester, polyester)	Similar qualities i.e. service life, lubricating characteristics and pressure resistance, like mineral oil	No restrictions with regard to the operation behaviour. Contact with PVC should be avoided.

10.1.4 Flame-resistant hydraulic fluids ISO 12922

Hydraulic fluid	Characteristics	Unusual features / restrictions
▪ HFA (pressurised water, emulsions)	Oil in water emulsion (water content > 80%) max. temp. range approx. 60°C	High risk of corrosion and cavitation due to the high water content, only use devices specially designed accordingly (radial piston pump type R, directional seated valves type G..) max. pump pressure 50 to 60% – risk of cavitation – minimum content of mineral oil > 4% ▪ Do not use compact hydraulic power packs HC, KA, INKA, MPN, HK, HKL – risk of short circuit ▪ No paper filters – risk of blockage No connection blocks with return line filter type A.F.., AF, BF, EF, FF
▪ HFC	(Poly)glycol/water solution (water content > 35%) max. temp. range approx. 60°C	Generally usable as “standard” hydraulic fluid Restrictions: ▪ Incompatible with zinc ▪ No paper filters – risk of blockage No connection blocks with return line filter type A.F.., AF, BF, EF, FF ▪ Steel-to-aluminium bearing mating surface couples are problematic No pumps type Z, RZ ▪ Aggressive to simple enamels and paintwork (Two-component enamels are fine) ▪ No compact hydraulic power packs HC, KA, INKA, MPN, HK, HKL
▪ HFD HFDR phosphoric ester HFDU polyolester	Fluids without water content, properties similar to mineral oil	Normal operation possible Restrictions: ▪ Use only devices with FPM (FKM) seals ▪ Oil manufacturer must be consulted!

10.1.5 Special fluids

Hydraulic fluid	Characteristics	Unusual features / restrictions
▪ AT-Brake fluid	Brake fluid based on glycol (DOT 4)	Can be used, but only with devices equipped with EPDM or SBR seals No compact hydraulic power packs type HC, KA, INKA, MPN, HK, HKL

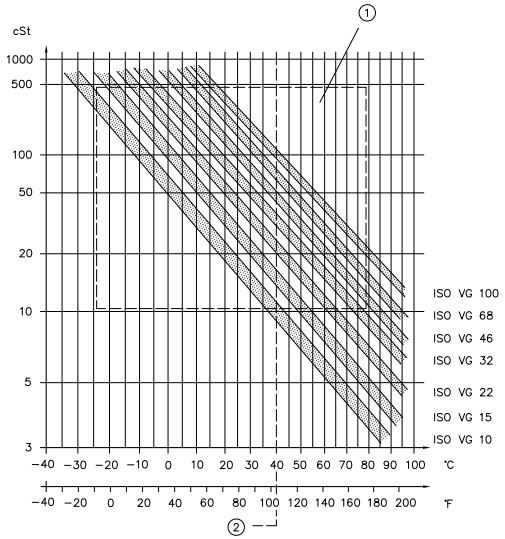
10.1.6 Viscosity grade selection

Of the 18 viscosity grades (ISO VG) listed in the standard "Industrial liquid lubricants; ISO viscosity classification" (DIN ISO 3448), the range ISO VG10 to ISO VG68 is relevant for hydraulic systems. The number after "ISO VG" corresponds to the nominal viscosity at a reference temperature of 40°C. The temperature behaviour displayed in the diagram corresponds to that of mineral hydraulic fluids. The characteristic curve gradient of HVLP and the environmentally compatible hydraulic fluids is flatter, indicating that the temperature effect is lower.

Due to manufacturer-related differences, the following benchmark figures are to be clarified and compared with the permissible viscosity ranges:

- Viscosity at 40°C
- Viscosity at lowest (assumed, specified) temperature
- Viscosity at the highest (presumed, required) temperature (to guarantee a good seal life ≤ 80°C!)

10.1.7 Temperature/viscosity diagram



Reference values for selection

- VG10, VG15
  System used for short period operation outdoors or for clamping fixtures
  System in continuous operation
  (if used outdoors, winter operation only)
- VG22, VG32
  General application
  (when used outdoors, only summer operation)
- VG46, VG68
  Systems in closed rooms at
  ambient temperatures up to 40°C or tropical conditions

1 Optimum range

2 Reference temperature DIN ISO 3448

10.1.8 Purity of the hydraulic fluid and correct filtering

Fine contamination (e.g. debris and dust) or contamination in the macro range (e.g. chippings, rubber particles from hoses and seals) may significantly impair the function of a hydraulic system.

Maintain the following hydraulic fluid purities (assuming a thorough flushing has taken place prior to the date of initial commissioning):

Recommended purity of the hydraulic fluid	Recommended filter fineness	Devices	Comment
ISO 4406			
21/18/15...19/17/13	$\beta_{16\text{ to }25} \geq 75$	Radial piston and gear pumps, valves, cylinders (use in general mechanical engineering)	The purity degree of the hydraulic fluid is especially important for the repeatability accuracy with proportional valves. It should be noted that new hydraulic fluid "from the barrel" does not necessarily fulfil the highest cleanliness requirements.
20/17/14...18/15/12	$\beta_{6\text{ to }16} \geq 75$	Prop. pressure and flow valves	
19/17/14	$\beta_{6\text{ to }16} \geq 75$	Variable displacement axial piston pumps	

Lower limits must be applied for pressure above 250 bar

10.1.9 Usage duration of hydraulic fluid

Hydraulic fluids “age”. This is caused by, among other issues, shear processes, breakdown at excessive temperatures (resinification), mixing with (condensation) water or reaction with other materials (e.g. metals) that are part of the system (sludge formation).

Besides the properties of the hydraulic fluid itself (e.g. due to additives for high shear stability), the design of the hydraulic control system (e.g. tank size, steady-state temperature, number and type of throttling points) has a major influence on this.

The following points are to be noted:

- Operating temperature in the tank < 80°C (applies to mineral oils, is lower for hydraulic fluids with water content)
  Avoid higher temperatures – service life reduction – (+10K corresponds to half service life)
- Rotational conditions of hydraulic fluid $\frac{Q_{pump}[l/min]}{V_{System}[l]}$ (*reference values*)
  - Approx. 0.2 to 0.4/min for conventional hydraulic power packs
  - Approx. up to 1/min in mobile hydraulics
  - Approx. up to 4/min for compact hydraulic power packs in standby or load/no-load operation
- Regular inspection of hydraulic fluid (fluid level, contamination, colour index, neutralisation number and others)
- Regular fluid change (depends on hydraulic fluid and conditions of use)
  Reference values:
  - approx. 4,000 to 8,000 h (mineral oil)
  - approx. 2,000 h (other hydraulic fluids)
  - or at least once per year
  Observe oil manufacturer's notes!

10.1.10 Switching to another hydraulic fluid

Do not mix different types of hydraulic fluids! This may lead to undesirable chemical reactions causing sludge, resinification etc.

Always consult the respective manufacturers when switching between different hydraulic fluids. In all cases, the whole hydraulic system should be thoroughly flushed.

10.1.11 Interaction with seals

Before using hydraulic fluids (except for mineral oil and synthetic esters), always consult with the oil manufacturer concerning seal compatibility. The table at the beginning of this chapter provides an overview to start from. Standard seals are made of the materials:

- NBR (nitrile butadiene rubber, e.g. Bunan, Perbunan) or HNBR (hydrated NBR).

Upon request, devices are available with seals made of:

- FPM (also FKM, fluoride rubber), e.g. for HFD fluids
  - HAWE devices coding: suffix ...-PYD, e.g. WN1H-G24-PYD
- EPDM (ethylene propylene diene rubber) or SBR (styrene butadiene rubber)
  - HAWE devices coding: suffix ...-AT, e.g. WN1H-G24-AT (for brake fluid)

INFORMATION

- For the seal specification coding -PYD and -AT, the maximum operating pressure is limited to 250 bar.
- This limitation conditionally applies to other values specified in the relevant product documentation.

10.1.12 Storing hydraulic fluids and hydraulic components

The storage suitability of hydraulic components depends primarily on the following factors:

- seals utilised, moistening with oil during the factory functional test

The storability of rubber materials is generally influenced by the following factors:

- Warmth, light, humidity, oxygen, ozone

As far as possible, components should be de-energised and without deformation when stored. 15 to 20°C is the optimum storage temperature range. Relative humidity approx. 65% (+-10%). Exposure to direct sunlight or a light source with strong UV rays should be avoided.

Ozone-producing equipment (electric drives, high-voltage equipment) and similar devices must not be present in the storage room.

If seals are packaged in plastic bags, these should not contain any plasticisers and, if necessary, should be impermeable to UV light.

For details on storing elastomers, see also these standards:
DIN 7716, MIL-HDBK-695, SAE ARP5316D, SAE AS 1933, DIN 9088.

Hydraulic fluids can be stored for an unlimited period in sealed containers supplied by the manufacturer, as no chemical reactions take place. The presence of atmospheric oxygen, dust and moisture can lead to more or less rapid oxidation and resinification, depending on the type of oil and its additives.

A dark room with virtually constant temperature and humidity is recommended for storage of hydraulic components. The parts should be kept in a plastic bag to protect them from dust and continuous air exchange.

A functional test (manual override, dry switching) should be carried out at least once a year to ensure operation. Safety-related components: A six-monthly functional test on site and a regular factory inspection including seal replacement every 2 years.

When hydraulic components are stored as described above, the risk of corrosion is low. Most external parts of HAWE components are coated with a protective layer (galvanised, nitrided) as well as with oil.

10.2 Formulas and units

10.2.1 Conversion table

	Coding	Unit	Factor X	Unit
Pressure	p	$1\frac{N}{mm^2}$	10	bar
		1 MPa	10	bar
		$1\frac{kgf}{cm^2}$	1	bar
		1 psi	0,07	bar
Force	F	$1\frac{kg \cdot m}{s^2}$	1	N
		1 lbf	4,45	N
Length, travel, stroke	l, s, h	1 in	25,4	mm
		1 ft	304,8	mm
Torque	M	$1\frac{kg \cdot m^2}{s^2}$	1	Nm
Power	P	1 PS, 1 hp	0,74	kW
Area	A	1 ft^2	92903	mm^2
		1 in^2	645,16	mm^2
Volume	V	1 ft^3	28,92	l
		1 in^3	$1{,}64 \cdot 10^{-2}$	l
		1 UK gal	4,55	l
		1 US gal	3,79	l
Temperatures	T, ϑ	5 (°F-32)/9	1	°C
Weight	m	1 lb	0,45	kg
Cinematic viscosity	v	1 cST	1	$\frac{mm^2}{s}$

11 Contact

HAWE Hydraulik is your partner worldwide.
Refer to hawe.com/contact to find your regional contact's details.

■ HAWE subsidiaries and service repair shops ● HAWE sales partners

12 Product index

Type	Designation	Document	page
CWPN	Directional spool valve type CWPN	D 7451 CWPN	25
CWS	Valve bank (directional spool valve) type CWS	D 7951 CWS	18
DG	Electric pressure switches type DG	D 5440 E/2, D 5440 F, D 5440 G	49
DG 1, DG 3	Pressure switch type DG	D 5440	49
DK, DZ, DLZ	Pressure reducing valve type DK, DZ, DLZ	D 7941	35
DRH	Releasable twin check valve type DRH	D 6110	44
DSJ	Flow control valve type DSJ	D 7825	41
DSV, DSVP	Pressure-controlled shut-off valve type DSV, DSVP	D 3990	37
DT	Electronic pressure transducer type DT	D 5440 T/1, D 5440 T/2	49
DV, DF, DVE, PV, PG	Pressure-limiting valve, pilot-controlled type DV, DF, DVE, PV, PG	D 4350	31
DZ25	Standardised hydraulic cylinder type DZ25	D 6446	50
ED, RD, RDF	Throttle valve and restrictor check valve type ED, RD, RDF	D 7540	39
EDL	Proportional directional spool valve type EDL	D 8086	21
EM, EMP	Directional seated valve type EM, EMP	D 7490/1	29
ER, EK	Check valve type ER, EK	D 7325	43
ESX	Mobile controller type ESX	ESX-3CM, ESX-3CS, ESX-3IOS, ESX-4CS-GW	47
EV1D, EV1M3	Proportional amplifier type EV1D, EV1M3	D 7831 D, D 7831/2	48
EV22K	Proportional amplifier type EV22K	D 7817/2	47
EV2D	Proportional amplifier type EV2D	D 7821	47
EV2S	Proportional amplifier type EV2S	D 7818/1	47
F	Check valve and pre-fill valve type F	D 6960	45
FG, FGS	Throttle valve and restrictor check valve type FG, FGS	D 7275	39
FXU	Hydraulic power pack type FXU	D 6020	15
G	Reducing connector type G	D 845	53
G	Directional seated valve type G	D 7300, D 7300-12	29
GRV	Check valve type GRV	D 6399, D 6432, D 6433, D 6434, D 6435, D 6436	17
GRV	Releasable check valve type GRV	D 6399	44
H	Compact hydraulic power pack type H	D 6344, D 6345	12
H	Hose lines type H3, H4	D 6027	53
H, HD, HE, DH	Hand pump type H, HE, HD	D 7147/1	9
HC, HCW	Compact hydraulic power pack type HC, HCW	D 7900	12
HFC, HF, HFE	Screen and filter elements type HFC, HF, HFE	D 7235	52
HICON	Compact hydraulic power pack type HICON	D 8543	14
HK, HKF	Compact hydraulic power pack type HK, HKF	D 7600-3, D 7600-4 D, 7600-4 FU	13
HKL	Compact hydraulic power pack type HKL	D 7600-3L	13
HLU	Hydraulic locking unit type HLU	D 6052	54
HPS	Piston type accumulator type HPS	D 7969 HPS	52

Type	Designation	Document	page
HR	Mini hydraulic power pack type HR	D 6014, D 6342, D 6343	11
HRP	Releasable check valve type HRP	D 5116	44
HS	Servo hydraulic power pack type HS	D 6347	15
HSE, HSA	Clamping cylinder type HSE, HSA	D 4711	51
HSL, HSF	Directional spool valve type HSL, HSF	D 7493 L, D 7493 E	24
HSV, HZV	Lifting/lowering valves type HSV, HZV	D 7032	17
IEP	Battery pack type IEP	D 6130	48
INKA 1	Compact hydraulic power pack type INKA 1	D 8132-1	14
K60N, K61N	Fixed displacement axial piston pump type K60N, K61N	D 7960 K, D 7961 K	9
KA, KAW	Compact hydraulic power pack type KA, KAW	D 8010, D 8010-4	12
LB	Line rupture protection valve type LB	D 6990	45
LHDV	Load-holding valve type LHDV	D 7770	38
LHK	Load-holding valve type LHK	D 7100	37
LHT, LHTE	Load-holding valve type LHT, LHTE	D 7918	38
LP	Air-driven hydraulic pump type LP	D 7280	9
LP	Hydraulic power pack type LP	D 7280 H	16
LV	Shut-off valve type LV	D 7529	36
LVM	Differential cylinder type LVM	D 6053	50
M60N	Axial piston motor type M60N	D 7960 M	50
MACB, MPLM	Press control system type MACB, MPLM	D 6334	55
max	Press control system type ePRAX© max	D 6341	56
modular	Press control system type ePRAX© modular	D 6340	56
MPN, MPNW	Compact hydraulic power pack type MPN, MPNW	D 7207	14
MSD, SVS, MSE	Line connector type MSD, SVS, MSE	D 7163	48
MSD 4 ECO	Line connector with economy circuit type MSD 4 ECO	D 7833/1	48
MSD 4 P	Line connector with economy circuit type MSD 4 P	D 7813	48
MSV, RSV	Directional seated valve type MSV, RSV	D 6407, D 6409	30
MV., SV., DMV	Pressure-limiting valve type MV., SV., DMV	D 7000/1, D 7000 E/1, D 7000 M, D 7000 TUV	31
MVEX	Safety valve with component approval type MVEX, SVX	D 7000 TÜV	32
MVG, MVGC, MVE, MVP	Pressure-limiting valves and pre-load valves type MVG, MVGC, MVE, MVP	D 3726	31
NBVP	Directional seated valve type NBVP	D 7765 N	27
NE	Two-stage valve type NE	D 7161	36
NPC	Compact hydraulic power pack type NPC	D 7940	11
NSV	Anti-cavitation valve type NSV	D 6368	46
NSWP	Directional spool valve type NSWP	D 7450, D 7451, D 7451 N	25
OSCA	Load-holding valve type OSCA	D 7920 D	38
PDM, PDMP	Proportional pressure reducing valve type PDM, PDMP	D 7584/1	35
PDV, PDVE, PDM	Proportional pressure-limiting valve and pressure reducing valve type PDV, PDVE, PDM	D 7486	33
PM, PMZ	Proportional pressure reducing valve type PM, PMZ	D 7625	35

Type	Designation	Document	page
PMV, PMVS, PMVP, PMVPS, NPMVP	Proportional pressure-limiting valve type PMV, PMVS, PMVP, PMVPS, NPMVP	D 7485/1, D 7485 N	33
PMVE	Proportional pressure-limiting valve type PMVE	D 8143	33
PSL	Proportional directional spool valve type PSL	D 7700-2, D 7700 CAN	22
PSLF	Proportional directional spool valve type PSLF	D 7700-7F	22
Q, QR, QV	Throttle valve and restrictor check valve type Q, QR, QV	D 7730	39
R, RG	Radial piston pump type R, RG	D 6010, D 6010 H	7
RC	Check valve type RC	D 6969 R	43
RE	Check valve type RE	D 7555 R	43
RH	Releasable check valve type RH	D 6105	44
RHC, RHCE	Releasable check valve type RHC, RHCE	D 7165	44
RK, RB	Check valve type RK, RB	D 7445	42
ROLV	Directional seated valve type ROLV	D 8144	30
RZ	Radial piston pump type RZ	D 6910, D 6910 H	7
SAKB	Press control system type SAKB	D 6335	54
SAMB, SAPB	Press control system type SAMB, SAPB	D 6336, D 6337	55
SB, SQ	Flow control valve (counterbalance valve) type SB, SQ	D 6920	41
SD, SF, SK, SKR	Flow control valve type SD, SF, SK, SKR	D 6233	41
SE, SEH	Proportional flow control valves type SE, SEH	D 7557/1	42
SG, SP	Directional spool valve type SG, SP	D 5650/1	24
SJ	Flow control valve type SJ	D 7395	41
SL	Valve bank (directional seated valve) type SL	D 6024	19
SLC	Valve bank (directional seated valve) type SLC	D 6033/1	19
SMBF	Valve bank (directional spool valve) type SMBF	SK 8145 999	21
SP	Directional seated valve type SP	D 6024, D 6019	26
SPLM	Press control systems type SPLM	D 6337	55
SPM	Servo power module type SPM	D 6340	57
SPVM	Press control system type SPVM	D 6338	55
SR2, SR3	Flow control valve type SR2, SR3	D 6402, D 6403, D 6404	42
SVNE, SVSE	Directional seated valve type SVNE, SVSE	D 6354/1	28
SWPA	4/2- and 4/3-way directional spool valves type SWPA	D 6450	23
SWPH	Proportional directional spool valve type SWPH	D 6418, D 6419	25
SWPL	Proportional directional spool valve type SWPL	D 6394, D 6395	26
SWPM	4/2- and 4/3-way directional spool valves type SWPM	D 6420	23
SWPN	Directional spool valve type SWPN	D 7451 AT	24
SWPT	4/2- and 4/3-way directional spool valves type SWPT	D 6559/1	24
TLC	Valve bank (directional seated valve), type TLC	D 6020 TLC	18
TQ	Flow divider type TQ	D 7381	42
V30D	Variable displacement axial piston pump V30D	D 7960	8
V30E, V80M	Variable displacement axial piston pump type V30E, V80M	D 7960 E, D 7962 M	8
V60N	Variable displacement axial piston pump type V60N	D 7960 N	8

Type	Designation	Document	page
VB	Valve bank (directional seated valve) type VB	D 7302, D 7302-22	20
VDB, VUB	Pressure-limiting valve type VDB, VUB	D 6362, D 6363, D 6364, D 6377, D 6384	32
VDM, VDX	Pressure reducing valves type VDM, VDX	D 5579	34
VH, VHP	Directional seated valve type VH, VHP	D 7647	28
VHR	Valve bank (directional seated valve) type VHR	D 7647	20
VP	Directional seated valve type VP	D 7915	26
VPDB, SPDB	Proportional pressure-limiting valve type VPDB, SPDB	D 6385, D 6386, D 6387	33
VPDM, VPDR	Proportional pressure reducing valve type VPDM	D 6530, D 6531	36
VR	Pre-load check valve type VR	D 7340	32
WLA	Directional valve type WLA	D 6023	23
WN, WH	Directional seated valve type WN, WH	D 7470 A/1	28
WV, WVC, WVE, WVH	Shuttle valve type WV, WVC, WVE, WVH	D 7016	45
X	Fittings type X	D 7065	53
X84	Fittings type X84	D 7077	53
Z	Gear pump type Z	D 6820	7

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