



## Piston Accumulators Standard

### 1. DESCRIPTION

#### 1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy. The compressibility of a gas (nitrogen) is utilised in hydraulic accumulators for storing fluids. HYDAC piston accumulators are based on this principle.

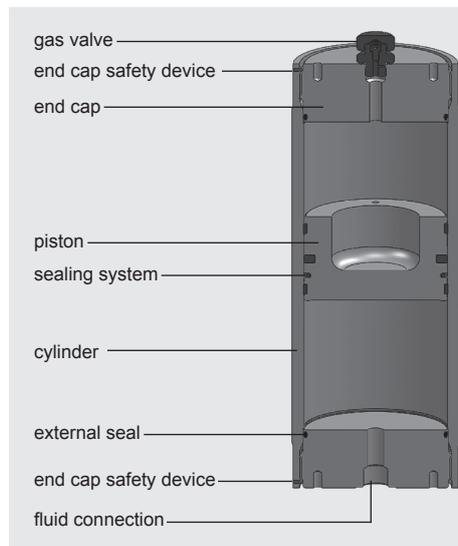
A piston accumulator consists of a fluid section and a gas section with the piston acting as the gas-proof screen.

The gas section is pre-charged with nitrogen.

The fluid section is connected to the hydraulic circuit so that the piston accumulator draws in fluid when the pressure increases and the gas is compressed.

When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

#### 1.2. DESIGN



HYDAC piston accumulators consist of:

- A cylinder with very finely machined internal surface.
- End caps on the gas side and the oil side. Sealed with O-rings.
- A floating steel or aluminium piston which can easily be accelerated due to its low weight.
- A sealing system adapted to the particular application.

The piston floats on two guide rings which prevent metal-to-metal contact between the piston and the accumulator wall.

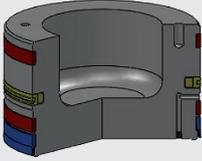
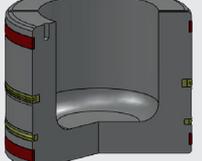
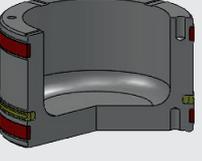
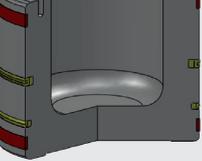
For use with certain aggressive or corrosive fluids, the parts coming into contact with the fluid can be nickel plated for protection, or made entirely from corrosion-resistant material. Suitable materials are also available for low temperature applications.

#### 1.3. SEALING SYSTEMS

Precise information about operating conditions is required in order to select the most appropriate sealing system. Important criteria for this selection are, for example:

- Design pressure,
- Effective pressure differential,
- Switching frequency or cycles,
- Temperature fluctuation,
- Operating fluid,
- Cleanliness of fluid (micron rating of filter),
- Maintenance requirements.

The sealing systems differ according to the type of piston used, each of which has its own type and arrangement of seals. Various elastomers are available as sealing material, depending on the operating conditions, see section 1.7.5.

Piston design type	Application	Degree of contamination in the fluid	Comment
	<p>1</p> <ul style="list-style-type: none"> <li>● For general accumulator operation without special requirements</li> </ul> <p><u>Application limitations:</u> max. piston velocity: 0.5 m/s</p>	<p>Optimized for applications with a high level of contamination</p>	
	<p>2</p> <ul style="list-style-type: none"> <li>● Low-friction design</li> <li>● For high piston speeds</li> <li>● Slow movements without stick-slip effect</li> </ul> <p><u>Application limitations:</u> max. piston velocity: 3.5 m/s</p>		
	<p>3</p> <ul style="list-style-type: none"> <li>● Low-friction design</li> <li>● Simple-to-fit seals</li> <li>● Slow movements without stick-slip effect</li> </ul> <p><u>Application limitations:</u> max. piston velocity: 0.8 m/s</p>	<p><u>Filtration:</u> NAS 1638 - Class 6 ISO 4406 - Class 17/15/12</p>	<p>1 guide ring for pistons with <math>\varnothing \leq 150</math> mm</p>
	<p>4</p> <ul style="list-style-type: none"> <li>● Low-friction design with emergency safety features</li> <li>● Slow movements without stick-slip effect</li> <li>● Very low oil transfer to the gas side</li> </ul> <p><u>Application limitations:</u> max. piston velocity: 5 m/s</p>		<p>2 guide rings for pistons <math>\varnothing \geq 180</math> mm</p>

## 1.4. INSTALLATION POSITION

HYDAC piston accumulators operate in any position.

Vertical installation is preferable with the gas-side at the top, to prevent contamination from the fluid settling on the piston seals. For accumulators with certain piston position indicators vertical installation is essential (see 1.7.). Piston accumulators with a piston diameter  $\geq 355$  mm must only be installed vertically.

## 1.5. TYPE OF INSTALLATION

For strong vibrations and volumes above 1 litre, we recommend the use of two HYDAC accumulator supports, or more as appropriate, ideally in the cover area. See catalogue section:

- Supports for Hydraulic Accumulators No. 3.502

## 1.6. ADVANTAGES OF HYDAC PISTON ACCUMULATORS

- complete range to over 3300 litres nominal volume,
- high ratios possible between pre-charge pressure and max. working pressure,
- economic solution using back-up gas bottles for low pressure differentials,
- high flow rates possible; limitation: max. piston velocity,
- power savings,
- high level of efficiency of the hydraulic installation,
- gas-tight and leakage free,
- no sudden discharge when seals are worn,
- requires little space,
- monitoring of the volume across the entire piston stroke or electrical limit switch.

Further advantages of using the low-friction sealing system:

- minimum friction,
- also suitable for low pressure differentials,
- no start-up friction,
- no stick-slip,
- low noise, no vibration,
- high piston velocity up to 5 m/s for piston type 4,
- improved accumulator efficiency,
- good life expectancy of seals because of low wear,
- suitable for large temperature fluctuations,
- low maintenance requirement.

## 1.7. TECHNICAL REQUIREMENTS

HYDAC piston accumulators are suitable for high flow rates. With the largest piston accumulator diameter made to date of 800 mm, a flow rate of 1000 l/s can be achieved at a piston velocity of 2 m/s.

### 1.7.1 Effect of sealing friction

The permitted piston velocity depends on the sealing friction.

Higher piston velocities are possible where there is less sealing friction.

HYDAC piston accumulators of piston design type 2 allow velocities of up to 3,5 m/s.

### 1.7.2 Permitted velocities

#### Gas velocity

The flow velocities in the gas connection and pipe system should be limited to 30 m/s when using piston accumulators of the back-up type. Gas velocities of over 50 m/s should be avoided at all costs.

### Oil velocity

In order to limit the pressure losses when the operating fluid is displaced, the flow velocity should not exceed 10 m/s in the adapter cross-section.

### 1.7.3 Function tests and fatigue tests

Function tests and fatigue tests are carried out to ensure continuous improvement of our piston accumulators.

By subjecting the accumulators to endurance tests under realistic as well as extreme working conditions, important data can be obtained about the long-term behaviour of the components. In the case of piston accumulators, important information on gas density and the life expectancy of seals is gained from such tests.

Vital data for use in accumulator sizing is gained by altering the working pressure and switching cycles.

### 1.7.4 Gas charging

Hydraulic accumulators must only be charged with nitrogen. Never use other gases.

#### Risk of explosion!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to  $< 3 \mu\text{m}$ .

If other gases are to be used, please contact HYDAC for advice.

### 1.7.5 Operating temperature and operating fluid

The permitted operating temperature of a piston accumulator is dependent on the application limits of the metal materials and the piston. Outside this temperature range, special materials must be used. The operating fluid must also be taken into account. The following table shows the standard selection of elastomer materials with temperature range and a rough overview of resistant and non-resistant fluids:

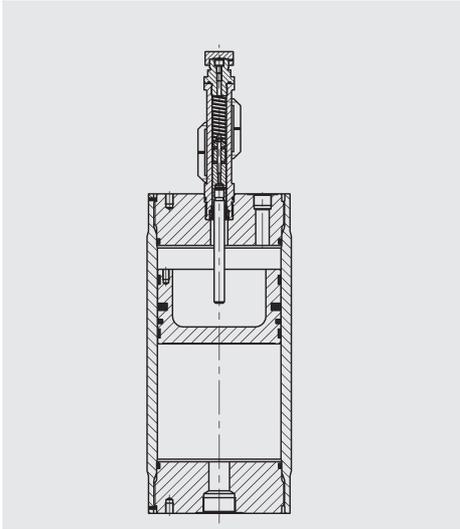
Materials		Material code <sup>1)</sup>	Temperature range	Overview of the fluids <sup>2)</sup>	
				Resistant to	Not resistant to
NBR	Acrylonitrile butadiene rubber	2	-20 °C ... + 80 °C	<ul style="list-style-type: none"> <li>● Mineral oil (HL, HLP)</li> <li>● Flame-resistant fluids of the groups HFA, HFB, HFC</li> <li>● Synthetic ester (HEES)</li> </ul>	<ul style="list-style-type: none"> <li>● Aromatic hydrocarbons</li> <li>● Chlorinated hydrocarbons (HFD-S)</li> <li>● Amines and ketones</li> </ul>
		5	-40 °C ... + 80 °C	<ul style="list-style-type: none"> <li>● Water</li> <li>● Sea water</li> </ul>	<ul style="list-style-type: none"> <li>● Hydraulic fluids of the group HFD-R</li> <li>● Fuels</li> </ul>
PUR	Polyurethane	8	Standard application -30 °C ... + 80 °C	<ul style="list-style-type: none"> <li>● Mineral oil (HL, HLP)</li> <li>● Flame-resistant fluids of the group HFA</li> </ul>	<ul style="list-style-type: none"> <li>● Water and water-glycol mixture HFC</li> <li>● Alkalis</li> <li>● Acids</li> </ul>
			Special application -40 °C ... +100 °C		
FKM	Fluorine rubber	6	-15 °C ... +160 °C	<ul style="list-style-type: none"> <li>● Mineral oil (HL, HLP)</li> <li>● Hydraulic fluids of the group HFD</li> <li>● Synthetic ester (HEES)</li> <li>● Fuels</li> <li>● Aromatic hydrocarbons</li> <li>● Inorganic acids</li> </ul>	<ul style="list-style-type: none"> <li>● Amines and ketones</li> <li>● Ammonia</li> <li>● Skydrol and HyJet IV</li> <li>● Steam</li> </ul>

<sup>1)</sup> see section 2.2. Model code, material and piston code, material seals incl. piston

<sup>2)</sup> others available on request

## 1.8. PISTON POSITION INDICATORS

### 1.8.1 Electrical limit switch



The electrical limit switch usually monitors the max. charged condition of the piston accumulator.

It can, however, also permit control functions of the attached hydraulics to be carried out over a certain stroke length.

The limit switch consists of the switching rod with a permanent solenoid which is not attached to the piston and can only achieve a limited stroke, and an anti-magnetic housing and two or more switches.

These switches can be normally closed or normally open or bistable. An N/C or N/O and a bistable switch cannot be fitted simultaneously to a limit switch. Our standard limit switch is fitted with a N/C and a N/O switch.

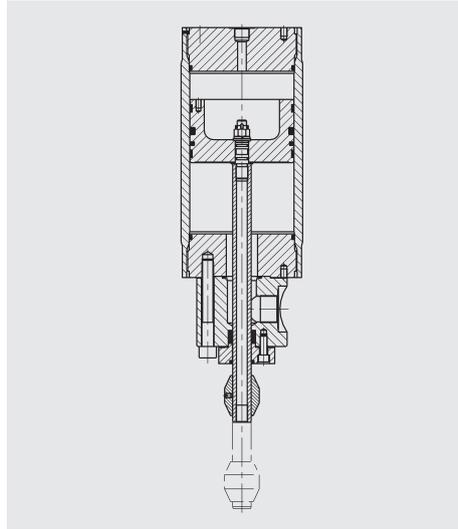
On another model, switching is carried out by inductive proximity switches.

The switch is reset by a spring or the force of gravity. Vertical mounting is preferable, due to the friction and possible wear and tear in the rod guide.

For limit switches with a stroke of > 200 mm, vertical mounting with the gas side at the top is essential.

The maximum piston velocity must not exceed 0.5 m/s over the stroke range of the limit switch.

### 1.8.2 Protruding piston rod



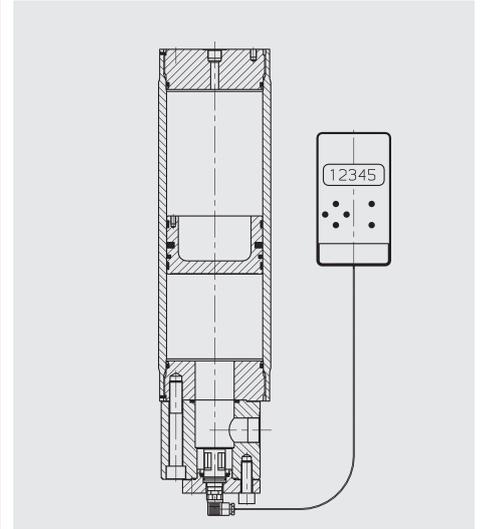
The protruding piston rod permits the position of the piston to be monitored over the whole stroke. It consists of the piston rod, which is fixed to the piston and sealed in, and what is known as the trip cam which actuates the limit switches.

The position of the piston can be monitored at any point using the trip cam. This facility is used mainly to switch the pump on and off.

Normally the piston rod protrudes from the accumulator on the fluid side to avoid possible points of leakage on the gas side. On the protruding piston rod version, the hydraulic connection will be on the side if the size of the end cap does not permit otherwise.

The protruding piston rod functions in any mounting position. There must however be sufficient space available for the piston to move in and out. The maximum piston velocity should not exceed 0.5 m/s.

### 1.8.3 Ultrasonic distance measurement



The piston position is determined by ultrasonic measurement.

It is only possible to take the measurements from the fluid side because a continuous sound carrier medium is required for ultrasound. In order to eliminate false readings, the fluid must be as free of air bubbles as possible. The piston should be mounted so that no air can collect under the sensor.

The measurement data is evaluated by a microprocessor and is converted into a continuous measurement signal. It is possible to pick up interim measurement results to switch system parts e.g. turn the pump on and off.

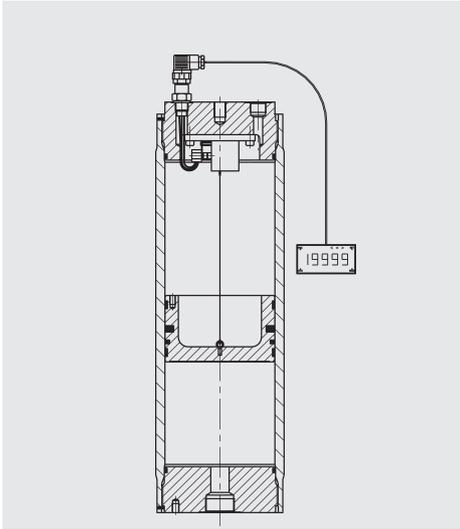
The most important features of the system are:

- Protection class  
IP 65 according to DIN 40050
- LCD display
- Outputs
  - 5 floating relay change-over switches (with 125 V, 1A rating), of which 1 is error output, and 4 are user-adjustable switching thresholds between 0 and 100%
  - 4 - 20 mA

The maximum pressure for the sensor must not exceed 350 bar.

- Measuring frequency: 15 Hz
- Signal: no control signal
- max. measuring section: 5 m

### 1.8.4 Cable tension measurement system



Using the cable tension measurement system, the position of the piston can be determined by means of a cable which is fixed to the piston.

The cable is attached to a wheel which is tensioned by a spring. This wheel alters an electrical resistance via an attached rotary potentiometer during the piston movement. This resistance is converted by a transducer into an electrical signal so that it can be processed directly by a PLC system. The signal is supplied through the end cap via a pressure-tight cable gland. Alternatively various digital display units and transmitters can be connected.

- Digital display unit:  
Supply voltage 230 V AC  
(or 24 V DC )  
4-channel limit comparator  
4 optical coupler outputs  
2 relay contact outputs  
1 RS 232 interface  
(optionally with analogue output  
4 - 20 mA)
- Measuring transducer:  
Supply voltage 24 V DC  
Analogue output 4 - 20 mA

The maximum pressure must not exceed 350 bar. The piston acceleration is limited to certain values according to measurement system forces, approx. 7 ... 30 g, and is limited to a max. velocity of 0.5 m/s. The measuring system is not suitable for intensive load reversal or rapid fluctuations in volume.

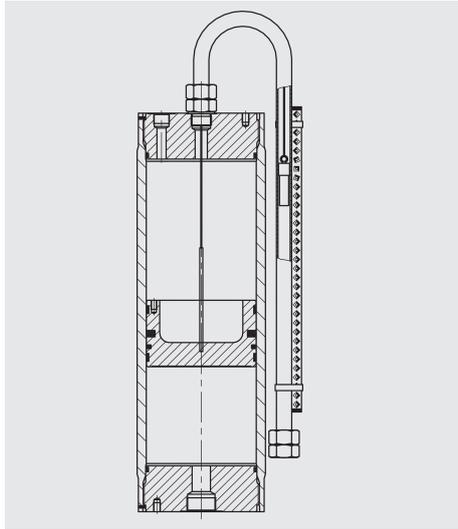
For such loads, please contact the technical department at our Head Office or your local HYDAC agent. The preferred installation position is with the gas side at the top.

The cable tension measurement system can only be fitted to the gas side of the piston accumulator.

#### Note:

For the potentiometer in the cable tension measurement system, as little current as possible should flow over the wiper. Input currents > 0.1 nA lead to a reduced service life and are therefore not recommended. The digital display unit and the measuring transducer have been designed accordingly.

### 1.8.5 Magnetic flap indication



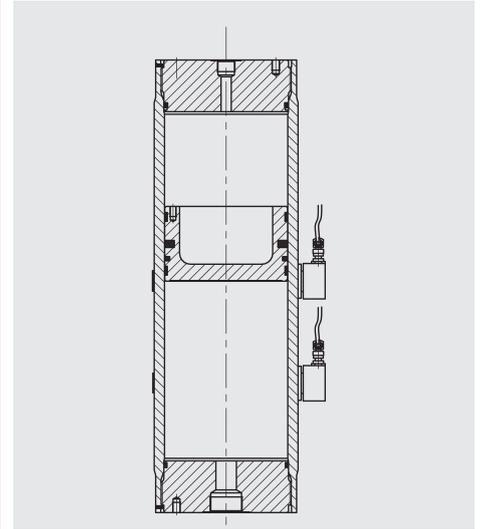
With magnetic flap indication, the position of a piston can be determined by the colour indicated by a set of magnetic flaps which are visible externally.

A non-magnetic tube installed externally on the piston accumulator contains a cable, one end of which is fastened to the gas side of the piston, and the other end is attached to a magnet. Movement in the cable causes red and white magnetic flaps to turn over.

As the piston moves, the change in colour of the flaps indicates the piston's position. When the piston moves in the direction of the gas side, the indicator moves towards the oil-side. In addition, reed switches can be fitted to switch system parts or measurement scales can be fitted to the tube.

The maximum piston velocity must not exceed 0.5 m/s. No more than 5 cycles per day on average should be carried out. Piston accumulators with magnetic flap indication must only be installed vertically, gas-side at the top.

### 1.8.6 Piston position switch



With the piston position switch it is possible to detect the piston position in a piston accumulator using ultrasound.

The indicator can be retrofitted using a clamp. No other modification is required. It is possible to fit without disrupting the operation.

The piston position switch detects the change-over from oil to piston at which point the signal is switched off. This is the case if the piston is in the sound path or has passed it.

There are three different versions available:

- Standard version for hydraulic fluid with a viscosity of 100 cSt.
- Special version for hydraulic fluid with a viscosity of 500 cSt.
- Special version for use in explosion protected areas.

Supply voltage  
18 ... 30 V DC  
Switching output:  
NPN (or PNP)

## 2. TECHNICAL SPECIFICATIONS

### 2.1. EXPLANATORY NOTES

2.1.1 **Nominal volume [l]**  
see table at section 3.1.

2.1.2 **Eff. gas volume  $V_p$  [l]**  
These differ slightly from the nominal volume and form the basis of the calculations of the effective fluid volume.

see section 3.1.1.

2.1.3 **Effective fluid volume  $\Delta V$  [l]**

The volume (on the fluid side) between the working pressure  $p_2$  and  $p_1$ .

2.1.4 **Permitted operating temperature (fluid)**

-10 °C ... +80 °C

263 K ... 353 K

Standard material, others on request

2.1.5 **Certificate codes**

Country	Certificate code (AKZ)
EU member states	U
Australia	F <sup>1)</sup>
Belarus	A6
Canada	S1 <sup>1)</sup>
China	A9
Hong Kong	A9
Iceland	U
Japan	P
Korea (Republic)	A11
New Zealand	T
Norway	U
Russia	A6
South Africa	S2
Switzerland	U
Turkey	U
Ukraine	A10
USA	S

<sup>1)</sup> Registration required in the individual territories or provinces

other fluids on request

### 2.2. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SK350 - 20 / 2212 U - 350 AAG - VA - 18 A - 1 - 050

**Series**

**Nominal volume [l]**

**Material and piston code**

**Piston design type** (see section 1.3.)

**Piston material**

- 1 = aluminium
- 2 = carbon steel
- 3 = stainless steel

**Material of cylinder and end caps**

- 1 = carbon steel
- 2 = carbon steel coated
- 3 = stainless steel
- 6 = carbon steel (low temperature)

**Material seals incl. piston seals**

- 2 = NBR<sup>1)</sup> / PTFE compound
- 5 = NBR<sup>1)</sup> / PTFE compound
- 6 = FKM / PTFE compound
- 8 = NBR<sup>1)</sup> / PUR
- 9 = special qualities

**Certification code**

- U = European Pressure Equipment Directive (PED)

**Permitted operating pressure [bar]**

**Fluid connection**

Type of connection (see Table 1)

Standard or specification of the type of connection (see Table 2 + 3)

Size of connection (see Table 4 + 5)

**Gas side connection or gas valve**

Type of connection (see Table 1)

Standard or specification of the type of connection (see Table 2 + 3)

(no letter required with connection type V)

Size of connection (see Table 4; 5 + 6)

**Piston diameter**

- 04 = 40 mm
- 05 = 50 mm
- 06 = 60 mm
- 08 = 80 mm
- 10 = 100 mm
- 12 = 125 mm
- 15 = 150 mm
- 18 = 180 mm
- 20 = 200 mm
- 25 = 250 mm
- 31 = 310 mm
- 35 = 355 mm
- 49 = 490 mm
- 54 = 540 mm
- 61 = 610 mm

**Supplementary equipment\***

- A = electrical limit switch – 35 mm stroke
- B = electrical limit switch – 200 mm stroke
- C = electrical limit switch – 500 mm stroke
- K = protruding piston rod
- M = magnetic flap indication
- S = cable tension measurement system
- U = ultrasonic measurement system
- E.. = special switch fixed or adjustable
- P = magnetic piston
- UP.. = piston position switch  
(e.g. UP2 = 2 position switches, UPEX = ATEX version)
- W = limit switch with linear distance sensor

**Safety equipment\***

- 1 = burst disc (please give nominal pressure and temperature)
- 2 = gas safety valve
- 3 = temperature fuse

**Pre-charge pressure  $p_0$  [bar] at 20 °C\***

\* if required, please state at time of ordering!

<sup>1)</sup> observe temperature ranges, see section 1.7.

**Table 1, Connection type**

Code letter	Description
A	Threaded connection (female)
B	Threaded connection (male)
F	Flange connection
H	Protruding flange
K, S	Combination connection / Special connection
V	Gas valve type

**Table 2, Threaded connection: standard or specification**

Code letter	Description
A	Thread to ISO 228 (BSP)
B	Thread to DIN 13 or ISO 965/1 (metric)
C	Thread to ANSI B1.1 (UN...-2B, seal SAE J 514)
D	Thread to ANSI B1.20.3 (NPTF)

**Table 3, Flange connection: standard or specification**

Code letter	Description
A	Flanges to DIN standards (pressure range + standard)
B	Flanges to ANSI B 16.5
C	SAE flange 3000 psi
D	SAE flange 6000 psi
E	High pressure block flange (Bosch-Rexroth) PN320
F	High pressure block flange (AVIT, HAVIT)

**Table 4, Threaded model connection sizes**

Type Table 2	Code, size										
	A	B	C	D	E	F	G	H	J	K	L
A	G 1/8	G 1/4	G 3/8	G 1/2	G 3/4	G 1	G1 1/4	G1 1/2	G2	G2 1/2	G3
B	M10x1	M12x1.5	M14x1.5	M16x1.5	M18x1.5	M22x1.5	M27x2	M33x2	M42x2	M48x2	M60x2
C	5/16- 24UNF	3/8- 24UNF	7/16- 20UNF	1/2- 20UNF	9/16- 18UNF	3/4- 16UNF	7/8- 14UNF	1 1/16- 12UNF	1 3/16- 12UNF	1 5/16- 12UNF	1 5/8- 12UNF
D	1/16- NPTF	1/8- NPTF	1/4- NPTF	3/8- NPTF	1/2- NPTF	3/4- NPTF	1-11 1/2 NPTF	1 1/4-11 1/2 NPTF	11/2-11 1/2 NPTF	2-11 1/2 NPTF	2 1/2 - NPTF

**Table 5, Flange model connection sizes**

Type Table 3	Code, size										
	A	B	C	D	E	F	G	H	J	K	L
A	DN15	DN25	DN40	DN50	DN65	DN80	DN100	DN125	DN150	DN200	–
B	1/2" - 1500 psi	1" - 1500 psi	1 1/2" - 1500 psi	2" - 1500 psi	2 1/2" - 1500 psi	3" - 1500 psi	1/2" - 2500 psi	1" - 2500 psi	1 1/2" - 2500 psi	2" - 2500 psi	2 1/2" - 2500 psi
C	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"
D							–	–	–	–	–
E	DN32	DN40	DN50	DN65	DN80	DN100	DN125	DN150	–	DN25	–
F											

**Table 6, Gas valve models**

Code letter	Description
A	Gas valve G3/4 male, with M28x1.5/M8
B	Gas valve end connection M28x1.5/M8
C	Gas valve 1/2"-20UNF, male, with M16x2 (ISO 10945)
D	Gas valve M14x1.5 male with external M16x1.5 (Minimes)
E	Gas valve G3/4 male with 7/8-14UNF-VG8
F	Gas valve end connection M42x1.5/M12

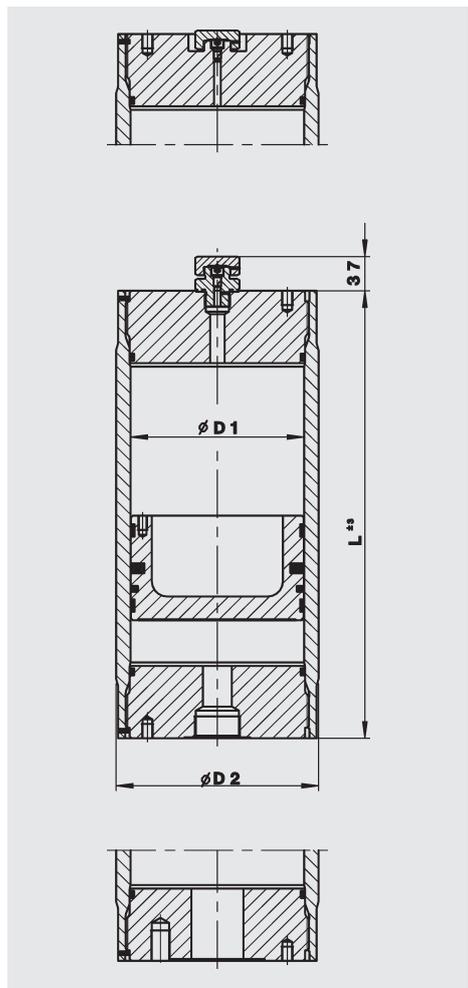
**Note:**

Application examples, accumulator sizing and extracts from approvals regulations relating to hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology  
No. 3.000

### 3. DIMENSIONS

#### 3.1. PISTON ACCUMULATORS



Nominal volume V min. - max. [l]	Series	Perm. operating pressure (PED) [bar]	$\varnothing D1$ [mm]	$\varnothing D2$ [mm]	Length calculation <sup>1)</sup> $L = a + (b \cdot V)$		Weight <sup>2)</sup> min. - max. [kg]
					a [mm]	b [mm/l]	
0.2 – 5	SK350	350	60	80	126	353.7	6 – 35
0.5 – 10	SK350	350	80	100	157	198.9	11 – 48
0.5 – 15	SK350	350	100	125	184	127.3	19 – 85
1 – 50	SK350	350	125	160	185	81.5	32 – 280
2.5 – 70	SK210	210	150	180	210	56.6	45 – 280
	SK350	350			234		49 – 283
2.5 – 100	SK210	210	180	210	262	39.3	70 – 346
	SK350	350					220
2.5 – 200	SK210	210	200	235	290	31.8	86 – 452
	SK350	350					
10 – 550	SK210	210	250	286	408	20.4	170 – 631
	SK350	350		300			200 – 860
25 – 400	SK350	350	310	350	462	13.2	390 – 1110
25 – 750	SK210	210	355	404	534	10.1	468 – 1338
	SK350	350		434			590 – 2048
200 – 1300	SK210	210	490	580	700	5.3	1760 – 3180
	SK350	350					
300 – 3300	SK210	210	610	691	856	3.42	2500 – 11000
	SK350	350		710			

<sup>1)</sup> The lengths calculated are usually rounded up or down in 5 mm increments

<sup>2)</sup> Intermediate weights can be calculated approximately depending on the length/diameter required

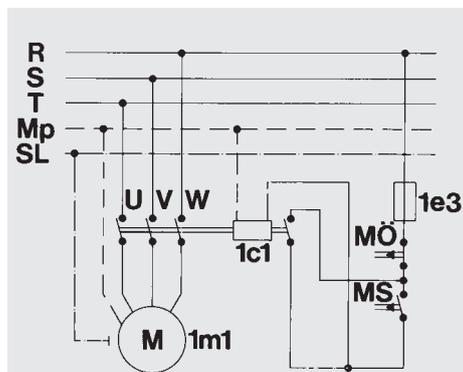
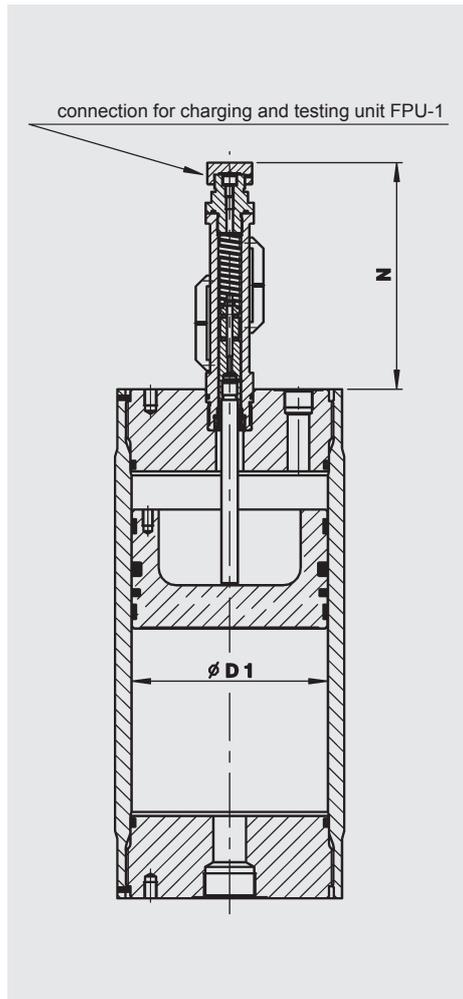
Other pressures, volumes, approvals etc possible on request.

##### 3.1.1 Effective gas volume $V_0$

The gas volume  $V$  is larger than the nominal volume given in the tables in section 3.1. by the amount shown below.

Piston $\varnothing D1$ [mm]	Piston design type			
	1	2	3	4
	$\Delta$ [l]			
60	–	0.040	–	0.040
80	–	0.044	0.081	0.044
100	0.062	0.062	0.270	0.062
125	–	0.169	0.546	0.169
150	–	0.653	0.824	0.653
180	1.213	1.213	1.286	1.213
200	–	0.999	1.601	0.999
250	3.034	3.034	2.617	3.034
310	–	6.221	–	6.221
355	4.514	4.514	–	4.514
490	–	12.705	–	12.705

### 3.2. PISTON ACCUMULATOR WITH ELECTRICAL LIMIT SWITCH



- 1m1 = Motor
- 1c1 = Motor contactor
- 1e3 = Control cut-out
- Mö = Solenoid switch - N/C
- Ms = Solenoid switch - N/O

**Table 7, Supplementary seal**

Piston Ø [mm]	Type	NBR	FKM
		Part no.	Part no.
All diam.	1	601078	601109
	2		
	3		
	4	on request	

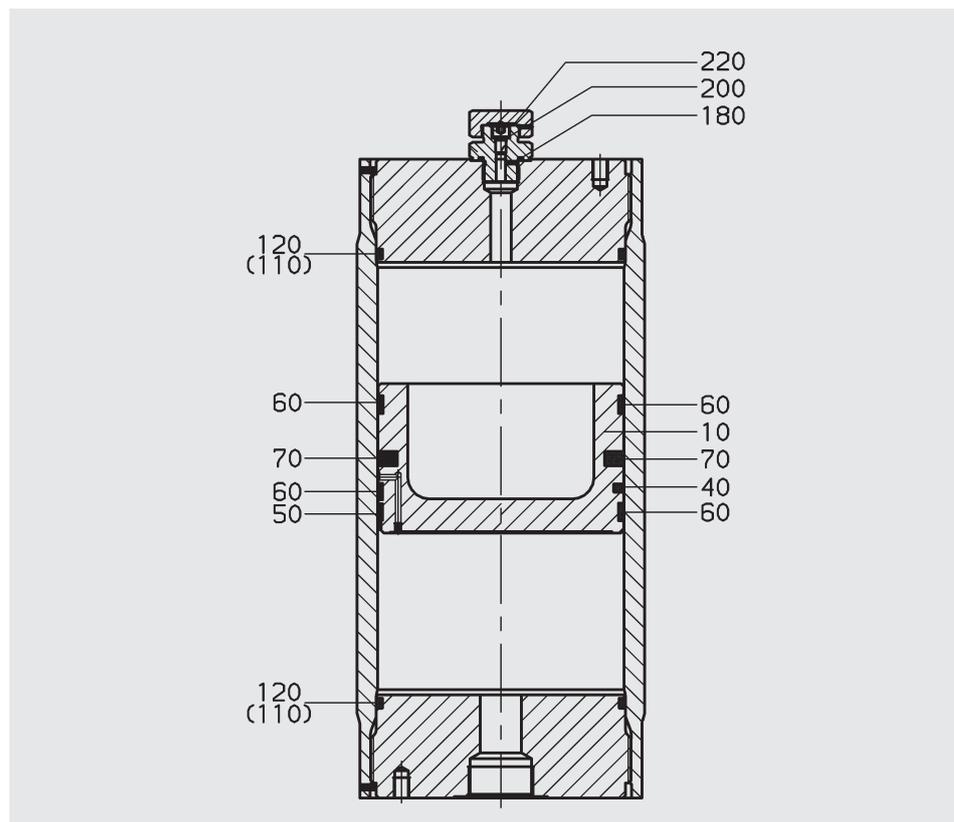
**Note:**  
The supplementary seal must be ordered in addition to the seal kit (section 4.).

Nominal volume <sup>1)</sup>	Series	Certification code U								
		Ø D1	Gas side connection <sup>2)</sup>	Fluid side connection <sup>3)</sup>	Electrical limit switch stroke					
					A = 35 mm		B = 200 mm		C = 500 mm	
					N	extra weight	N	extra weight	N	extra weight
[l]		[mm]	ISO228		[mm]	[kg]	[mm]	[kg]	[mm]	[kg]
0.2	SK350	60	-	-	electrical limit switch not possible					
0.5										
1										
0.5	SK350	80	-	-	electrical limit switch not possible					
1										
2										
2.5	SK350	100	G 3/4 lateral	G 1	209	2.55	439	4.85	679	7.15
5										
7.5										
2	SK350	125	G 3/4 lateral	G 1	209	2.55	439	4.85	679	7.15
5										
15										
6	SK350	150	G 3/4	G 1 1/2	209	2.6	439	4.9	679	7.2
20										
40										
10	SK210	180	G 1	G 1 1/2	209	2.6	439	4.9	679	7.2
	SK350									
20	SK210									
	SK350									
50	SK210	250	G 1 1/4	G 2	209	2.8	439	5.1	679	7.4
	SK350									
80	SK210									
	SK350									
120	SK210	310	G 1 1/4	NW50	209	2.9	439	5.2	679	7.5
	SK350									
120	SK210									
	SK350									
130	SK210	355	G 1 1/2	NW50	209	2.8	439	5.1	679	7.4
	SK350									
180	SK210									
	SK350									
250	SK210	490	G 2	-	209	3	439	5.3	679	7.6
	SK350									
200	SK210									
	SK350									
400	SK350	490	G 2	-	209	3	439	5.3	679	7.6
600	SK350									

<sup>1)</sup> volume details are examples, for others see section 3.1.  
<sup>2)</sup> standard connection for back-up type, others on request  
<sup>3)</sup> others on request  
for further information, see section 1.7.

## 4. SPARE PARTS

### 4.1. PISTON ACCUMULATORS



**Piston assembly (Table 8)**

Piston Ø [mm]	Piston	NBR Part no.	FPM Part no.	PUR Part no.
60	1	-	-	-
	2	3183495	-	-
	3	-	-	3009372
80	1	-	-	-
	2	3183496	3183497	-
	3	-	-	2119931
100	1	3128922	3128926	-
	2	3175476	3183117	-
	3	-	-	2115547
125	1	-	-	-
	2	3016232	3016253	-
	3	-	-	3016150
150	1	-	-	-
	2	3016228	3016229	-
	3	-	-	3016231
180	1	3141888	3182493	-
	2	2118451	2112535	-
	3	-	-	3046277
200	1	-	-	-
	2	3110811	3016215	-
	3	-	-	3016218
250	1	3128924	3128938	-
	2	353980	353981	-
	3	-	-	3016171
310	1	-	-	-
	2	3016195	3016197	-
	3	-	-	-
355	1	3128925	3128939	-
	2	356382	354079	-
	3	-	-	-
490	1	-	-	-
	2	3128989	3128990	-
	3	-	-	-

**Seal kit, complete (Table 9)**

Piston Ø [mm]	Piston	NBR Part no.	FPM Part no.	PUR Part no.
60	1	-	-	-
	2	3090507	-	-
	3	-	-	3016210
80	1	-	-	-
	2	3041573	3015745	-
	3	-	-	3013230
100	1	3128940	3128944	-
	2	363268	363269	-
	3	-	-	2123414
125	1	-	-	-
	2	3116665	3016234	-
	3	-	-	2128104
150	1	-	-	-
	2	3016235	3016237	-
	3	-	-	3007546
180	1	3128941	3128945	-
	2	363270	363271	-
	3	-	-	2123415
200	1	-	-	-
	2	3110810	3016242	-
	3	-	-	3113127
250	1	3128942	3128946	-
	2	363266	363267	-
	3	-	-	3016213
310	1	-	-	-
	2	3016200	3016201	-
	3	-	-	-
355	1	3128943	3128947	-
	2	363272	363273	-
	3	-	-	3726888
490	1	-	-	-
	2	3104100	3128991	-
	3	-	-	3894300

#### 4.1.1 Piston type 1

Description	Qty.	Item
<b>Piston assembly <sup>2)</sup></b>		
consisting of:		
Piston	1	10
Seal ring	1	50
Guide ring	2	60
Centre seal	1	70
<b>Seal kit assembly</b>		
consisting of:		
Seal ring	1	50
Guide ring	2	60
Centre seal	1	70
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

#### 4.1.2 Piston type 2

Description	Qty.	Item
<b>Piston assembly <sup>2)</sup></b>		
consisting of:		
Piston	1	10
Seal ring	1	40
Guide ring	2	60
Centre seal	1	70
<b>Seal kit assembly</b>		
consisting of:		
Seal ring	1	40
Guide ring	2	60
Centre seal	1	70
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

#### 4.1.3 Piston type 3

Description	Qty.	Item
<b>Piston assembly <sup>2)</sup></b>		
consisting of:		
Piston	1	10
Guide ring <sup>1)</sup>	1/2	60
Seal ring	1	70
<b>Seal kit assembly</b>		
consisting of:		
Guide ring <sup>1)</sup>	1/2	60
Seal ring	1	70
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

(...) for SK690, for Standard SK int. Ø ≥ 310 mm  
<sup>1)</sup> Bottom guide ring, only for int. Ø = 180 mm and above  
<sup>2)</sup> Items (110,) 120, 180, 200 and 220 are supplied loose.  
 Pressure resistant parts cannot be supplied as spares.

Spare parts for piston type 4 are available on request.

## 4.2. ASSEMBLY INSTRUCTIONS

Before assembling or disassembling a piston accumulator or piston accumulator station, the system must always be depressurised.

The gas and fluid side must be depressurized and the gas valve unscrewed or opened before the accumulator is disassembled. Before the end caps are removed, ensure that the piston is moving freely. This may be achieved by using a rod. Only authorised persons should repair piston accumulators where the piston is jammed.

Piston accumulators with internal diameters up to 250 mm are fitted with a securing pin. This pin is to prevent the end cap being removed incorrectly. It must be taken out before removing the end cap. There may be a danger to life due to stray components.

All work must only be carried out by suitably trained staff.

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell.

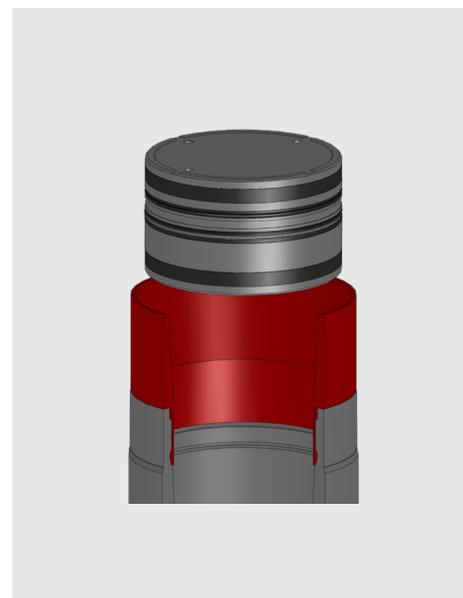
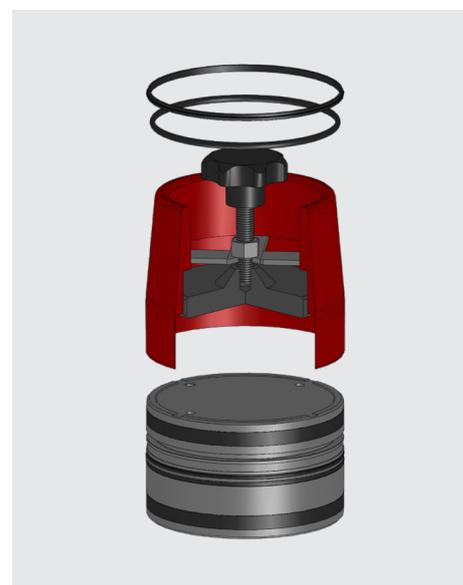
**Please read the Operating Manual! No. 3.301.BA**

### Assembly sleeves for piston accumulators (Table 11)

Piston Ø [mm]	To fit the seals
60	297430
80	244991
100	352198
125	370734
150	2124157
180	3713269
200	3644938
250	3715658
310	3721000
355	3728790
490	3114220

Piston Ø [mm]	To install the piston
60	2120188
80	359614
100	290056 (M105x2) 2117672 (M110x3)
125	2128223
150	2124161 (SK210) 3680195 (SK350)
180	290049 (M186x3) 3028679 (M190x4)
200	3600690
250	3026807
310	3027403
355	3389677
490	3440695

**When replacing seals and/or pistons, please read the Instructions for Assembly and Repair (No. 3.301.M).**



## 5. NOTE

The information in this brochure relates to the operating conditions and applications described.

For applications and/or operating conditions not described, please contact the relevant technical department.

Subject to technical modifications.

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