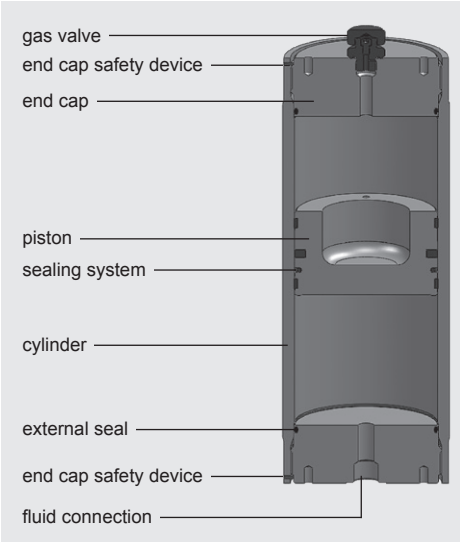
Piston Accumulators
Standard design

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 a gas-proof separation element. 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 field of application.

The piston floats on 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.

Piston accumulators are supplied with short-term preservative.

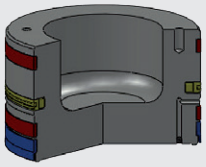
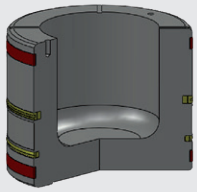
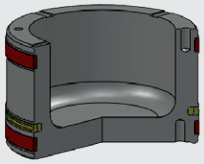
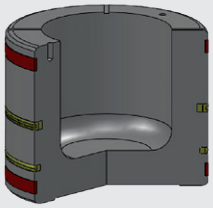
Long-term preservative is available on request.

1.3. SEALING SYSTEMS

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

- design pressure,
- effective pressure differential,
- switching frequency or switching cycle,
- temperature fluctuation,
- operating fluid,
- cleanliness of fluid (filtration rating),
- 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.

Design		Application	Contamination level of fluid	Comment
	1	● For general accumulator operation without special requirements Application limitations: max. piston velocity: 0.5 m/s	optimised for applications with a high level of contamination	
	2	● low-friction design ● for high piston speeds ● slow movements without stick-slip effect Application limitations: max. piston velocity: 3.5 m/s	Filtration: NAS 1638 - Class 6 ISO 4406 - Class 17/15/12	
	3	● low-friction design ● simple-to-fit seals ● slow movements without stick-slip effect Application limitations: max. piston velocity: 0.8 m/s		1 guide ring for pistons with Ø ≤ 150 mm 2 guide rings for pistons with Ø ≥ 180 mm
	4	● low-friction design with emergency safety features ● slow movements without stick-slip effect ● very low oil transfer to the gas side Application limitations: max. piston velocity: 5 m/s		

1.4. INSTALLATION POSITION

HYDAC piston accumulators operate in any position.
Vertical installation is preferable with the gas side at the top, to prevent contaminant particles from the fluid settling on the piston seals. For hydraulic accumulators with certain piston position indicators, vertical installation is essential. Piston accumulators with a piston diameter ≥ 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 end cap 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 system
- no sudden discharge when seals are worn
- low space requirements
- 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 (e.g. 1000 l/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 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 fitting 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, only use nitrogen of at least Class 4.0 (filtration < 3 µm).
If other gases are to be used, please contact HYDAC for advice.

1.7.5 **Working temperature and operating medium**

The permitted working temperature of a piston accumulator is dependent on the application limits of the metal materials and the piston seal. Outside this temperature range, special materials must be used. The operating medium must also be taken into account.
The following table displays a selection of elastomer materials including max. temperature range and a rough overview of resistant and non-resistant fluids. Please contact us for help in selecting a suitable elastomer.

Materials		Material code [1]	Temperature range	Overview of the fluids [2]	
				Resistant to	Not resistant to
NBR	Acrylonitrile butadiene rubber	2	-20 °C ... + 80 °C	● Mineral oil (HL, HLP) ● Flame-retardant fluids from the groups HFA, HFB, HFC ● Synthetic esters (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Operating fluids from the group HFD-R ● Fuels
		5	-40 °C ... + 80 °C		
PUR	Polyurethane	8	Standard application -30 °C ... + 80 °C Special application -40 °C ... +100 °C	● Mineral oil (HL, HLP) ● Flame-resistant fluids from the HFA group	● Water and water-glycol mixture HFC ● Alkalis ● acids
FKM	Fluorine rubber	6	-15 °C ... +160 °C	● Mineral oil (HL, HLP) ● Operating fluids from the group HFD ● Synthetic esters (HEES) ● Fuels ● Aromatic hydrocarbons ● Inorganic acids	● Amines and ketones ● Ammonia ● Skydrol and HyJet IV ● Steam

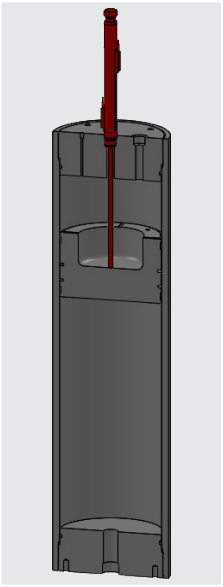
[1] see section 2.2. Model code, material code and piston code, material of seals incl. piston

[2] others available on request

1.8. PISTON POSITION INDICATORS

Detailed technical data available on request.

1.8.1 Electrical limit switch

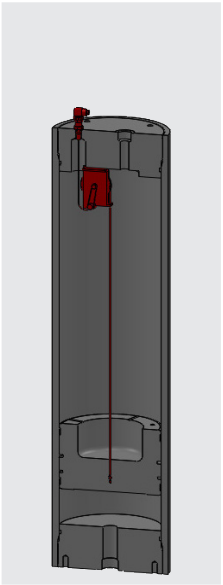


What is measured?
Max. or set fill level of the piston accumulator

How are measurements taken?
As point measurements

Where to measure?
Gas side

1.8.2 Cable tension measurement system

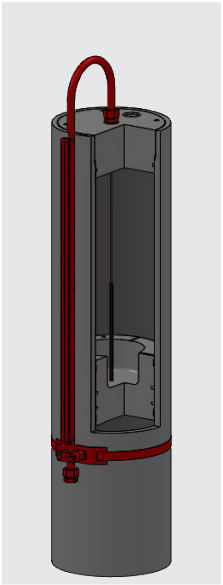


What is measured?
Piston position on basis of a cable fastened to the piston

How are measurements taken?
Continuously

Where to measure?
Gas side

1.8.3 Magnetic flapper indication

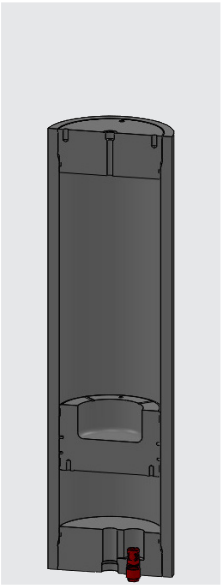


What is measured?
Piston position on basis of a magnet fastened to the cable that moves coloured flaps that can be read from the outside

How are measurements taken?
Continuously

Where to measure?
Gas side

1.8.4 Ultrasonic measurement system

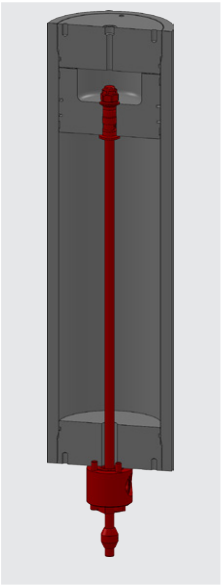


What is measured?
Piston position on basis of ultrasonic measurement

How are measurements taken?
Continuously

Where to measure?
Fluid side

1.8.5 Protruding piston rod

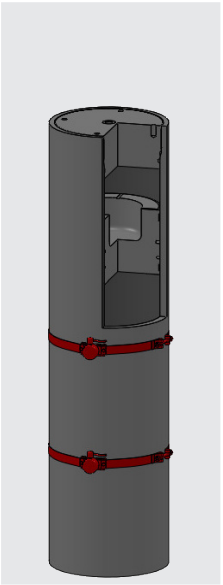


What is measured?
Piston position on basis of a piston rod fastened to the piston

How are measurements taken?
Continuously

Where to measure?
Fluid side

1.8.6 Piston position switch



What is measured?
Piston position on basis of ultrasonic measurement

How are measurements taken?
As point measurements

Where to measure?
Fluid side

2. SPECIFICATIONS

2.1. EXPLANATIONS, NOTES

2.1.1 **Nominal volume [l]**
see table at section 3.2.

2.1.2 **Eff. gas volume V_0 [l]**
These differ slightly from the nominal volume and form the basis of the calculations of the effective fluid volume.

See section 3.3.

2.1.3 **Effective volume ΔV [l]**
The volume (on the fluid side) between the working pressure p_2 and p_1.

2.1.4 **Permitted operating temperature of the hydraulic accumulator**
-10 °C ... +80 °C
standard design,
others on request

2.1.5 **Certificate codes**

Country	Certificate code (AKZ)
EU member states	U
Australia	F [1]
Belarus	A6
Canada	S1 [1]
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

[1] registration required in the individual territories or provinces

others 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 (see section 1.3.)

Piston material
1 = aluminium
2 = carbon steel
3 = stainless steel [1]

Material of cylinder and end cap
1 = carbon steel
2 = carbon steel with surface protection
3 = stainless steel [1]
6 = carbon steel (low temperature)

Material of seals incl. piston seals
2 = NBR [2] / PTFE compound
5 = NBR [2] / PTFE compound
6 = FKM / PTFE compound
8 = NBR [2] / PUR
9 = special qualities

Certification code
U = European Pressure Equipment Directive (PED)

Permitted operating pressure [bar]

Fluid port
Type of connection (see Table 1)
Standard or specification of the type of connection (see Tables 2 + 3)
Size of connection (see Tables 4 + 5)

Gas-side connection or gas valve
Type of connection (see Table 1)
Standard or specification of the type of connection (see Tables 2 + 3)
(no letter required with connection type V)
Size of connection (see Tables 4; 5 + 6)

Piston diameter

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

Additional equipment *
detailed technical data on request
A = electrical limit switch – 35 mm stroke
B = electrical limit switch – 200 mm stroke
C = electrical limit switch – 500 mm stroke
E.. = other electrical limit switch, fixed or adjustable
K = protruding piston rod
M = magnetic flapper indication
S = cable tension measurement system
U = ultrasonic measurement system
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 plug

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

* if required, please state at time of ordering!
[1] dependent on type and pressure level
[2] observe temperate ranges, see section 1.7.

Table 1, Connection type

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

Table 2, Standard or specification, Threaded connection

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, Standard or specification, Flange connection

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) PN320

Table 4, Threaded model connection sizes

Type Table 2	Code letter, 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	G 1 1/4	G 1 1/2	G 2	G 2 1/2	G 3
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 letter, 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

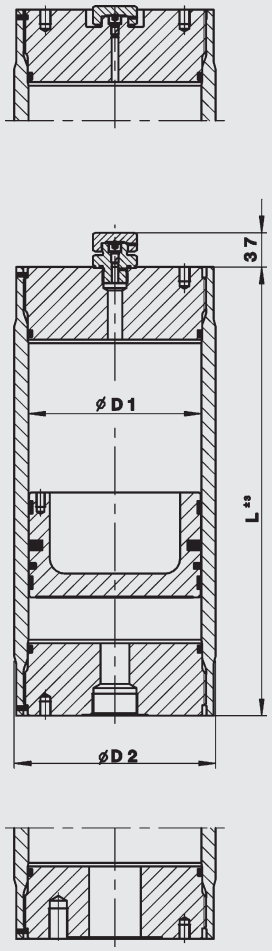
Code letter	Description
A	Gas valve G3/4 male, with M28x1.5/M8
B	Gas valve in end cap M28x1.5/M8
C	Gas valve 1/2"-20UNF, male, with M16x2 (ISO 10945)
D	Gas valve M14x1.5, male, with male M16x1.5 (Minimess)
E	Gas valve G3/4 male, with 7/8-14UNF-VG8
F	Gas valve in end cap M42x1.5/M12

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

- HYDAC Accumulator Technology
  No. 3.000

3. TECHNICAL DATA

3.1. DRAWING



3.2. DIMENSIONS

Nominal volume V min. - max. [l]	Series	Perm. operating pressure (PED) [bar]	Ø D1 [mm]	Ø D2 [mm]	Length calculation [1] L = a + (b • V) a [mm]	b [mm/l]	Weight [2] min. - max. [kg]
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			79 – 458
2.5 – 200	SK210	210	200	235	290	31.8	86 – 452
	SK350	350					
10 – 200	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	570	700	5.3	1760 – 3180
	SK350	350					
300 – 3300	SK210	210	610	691	856	3.42	2500 – 11000
	SK350	350		710	950		

[1] the lengths calculated are usually rounded up or down in 5 mm increments
[2] intermediate weights can be calculated approximately depending on the length/diameter required

other pressures, volumes, approvals etc. possible on request

3.3. EFFECTIVE GAS VOLUME V_0

The gas volume V is larger than the nominal volume given in the tables in section 3.2. by the amount shown below.

Piston Ø D1	Piston design			
	1	2	3	4
[mm]	Δ [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

3.4. PREFERRED MODELS

NBR, carbon steel
piston design 2

Nominal volume [l]	Series	Perm. operating pressure (PED) [bar]	Part no. [1]	Ø D1 [mm]	Ø D2 ±3 [mm]	L [mm]	Gas side connection	Fluid side connection ISO 228	Weight [kg]
10	SK350	350	3946133	150	180	800	M28x1.5	G 3/4	76
			3946157				G 3/4		
			3946158				Gas valve		77
20	SK350	350	3946159	150	180	1365	M28x1.5	G 3/4	111
			3946161				G 3/4		
			3946164				Gas valve		112
	SK210	210	3946260	180	210	1050	G 3/4	G 3/4	119
			3946262					G 1 1/2	120
			3586466				Gas valve	G 3/4	
			3123789					G 1 1/2	118
32	SK350	350	3946195	150	180	2045	M28x1.5	G 3/4	152
			3946196				G 3/4		
			3946198				Gas valve		153
			3946330	180	220	1520	G 3/4	G 3/4	193
			3112126					G 1 1/2	189
			3946331				Gas valve	G 3/4	194
			3123473					G 1 1/2	190
	SK210	210	3946297	180	210	1520	G 3/4	G 3/4	153
			3152988					G 1 1/2	
			3946298				Gas valve	G 3/4	
			3123470					G 1 1/2	150
	SK350	350	3946383	200	235	1310	G 3/4	G 3/4	174
			3946396				Gas valve		175
50	SK350	350	3946332	180	220	2225	G 3/4	G 3/4	262
			3213717					G 1 1/2	250
			3946333				Gas valve	G 3/4	262
			3123505					G 1 1/2	251
	SK210	210	3946301	180	210	2225	G 3/4	G 3/4	203
			3823656					G 1 1/2	
			3946302				Gas valve	G 3/4	
			3280844					G 1 1/2	201
	SK350	350	3946399	200	235	1880	G 3/4	G 3/4	228
			3946402				Gas valve		229
			3221083	250	300	1425	G 3/4	G 1 1/2	339
			3946442				Gas valve		341
75	SK350	350	3946403	200	235	2675	G 3/4	G 3/4	302
			3946438				Gas valve		303
100	SK350	350	3484504	250	300	2445	G 3/4	G 1 1/2	512
			3946475				Gas valve		514

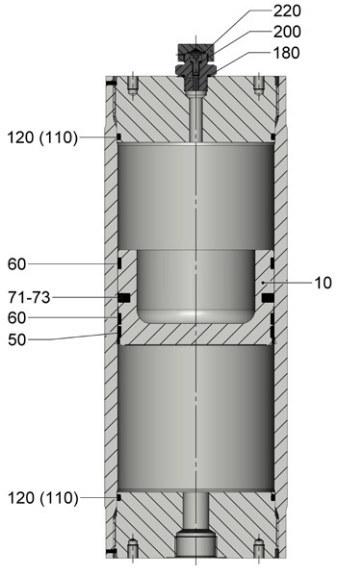
[1] others on request

Notice:
Dimensions, particularly lengths, are approximate and dependent on various factors (e.g. piston design, approval).

4. SPARE PARTS

4.1. PISTON

4.1.1 Piston design 1



Designation	Qty.	Item
Piston assembly [2] consisting of:		
Piston	1	10
Seal ring	1	50
Guide ring	2	60
Centre seal	1	71-73
Seal kit, complete consisting of:		
Seal ring	1	50
Guide ring	2	60
Centre seal	1	71-73
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

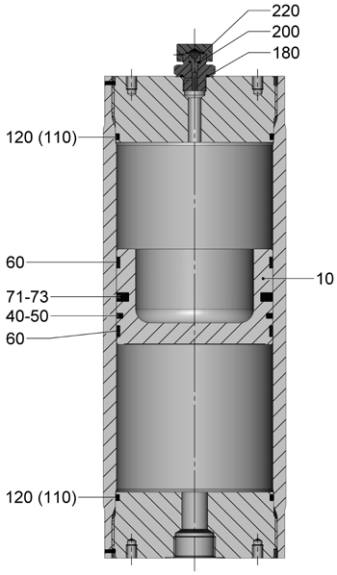
Piston assembly

Piston Ø [mm]	NBR Part no.	FPM Part no.	PUR Part no.
60	–	–	–
80	–	–	–
100	3128922	3128926	–
125	–	–	–
150	–	–	–
180	3141888	3182493	–
200	–	–	–
250	3128924	3128938	–
310	–	–	–
355	3128925	3128939	–
490	–	–	–

Seal kit assembly

Piston Ø [mm]	NBR Part no.	FPM Part no.	PUR Part no.
60	–	–	–
80	–	–	–
100	3128940	3128944	–
125	–	–	–
150	–	–	–
180	3128941	3128945	–
200	–	–	–
250	3128942	3128946	–
310	–	–	–
355	3128943	3128947	–
490	–	–	–

4.1.2 Piston design 2



Designation	Qty.	Item
Piston assembly [2] consisting of:		
Piston	1	10
Seal ring	1	40+50
Guide ring	2	60
Centre seal	1	71-73
Seal kit, complete consisting of:		
Seal ring	1	40+50
Guide ring	2	60
Centre seal	1	70-73
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

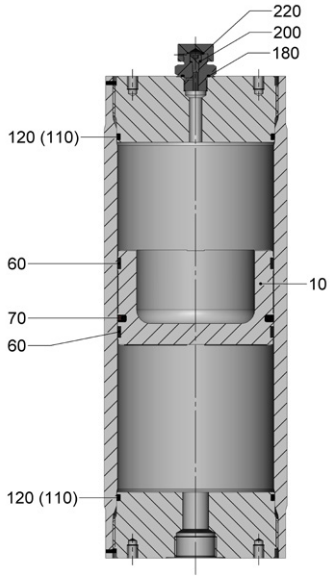
Piston assembly

Piston Ø [mm]	NBR Part no.	FPM Part no.	PUR Part no.
60	3183495	–	–
80	3183496	3183497	–
100	3175476	3183117	–
125	3016232	3016253	–
150	3016228	3016229	–
180	2118451	2112535	–
200	3110811	3016215	–
250	353980	353981	–
310	3016195	3016197	–
355	356382	354079	–
490	3128989	3128990	–

Seal kit assembly

Piston Ø [mm]	NBR Part no.	FPM Part no.	PUR Part no.
60	3090507	–	–
80	3041573	3015745	–
100	363268	363269	–
125	3116665	3016234	–
150	3016235	3016237	–
180	363270	363271	–
200	3110810	3016242	–
250	363266	363267	–
310	3016200	3016201	–
355	363272	363273	–
490	3104100	3128991	–

4.1.3 Piston design 3



Designation	Qty.	Item
Piston assembly [2] consisting of:		
Piston	1	10
Guide ring [1]	1/2	60
Seal ring	1	70
Seal kit, complete consisting of:		
Guide ring [1]	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

Piston assembly

Piston Ø [mm]	NBR Part no.	FPM Part no.	PUR Part no.
60	–	–	3009372
80	–	–	2119931
100	–	–	2115547
125	–	–	3016150
150	–	–	3016231
180	–	–	3046277
200	–	–	3016218
250	–	–	3016171
310	–	–	–
355	–	–	4323005
490	–	–	4323006

Seal kit assembly

Piston Ø [mm]	NBR Part no.	FPM Part no.	PUR Part no.
60	–	–	3016210
80	–	–	3013230
100	–	–	2123414
125	–	–	2128104
150	–	–	3007546
180	–	–	2123415
200	–	–	3113127
250	–	–	3016213
310	–	–	–
355	–	–	3726888
490	–	–	3894300

Pressure resistant parts cannot be supplied as spares.
(…) for SK690, for standard SK internal Ø ≥310 mm
[1] the bottom guide ring for internal Ø ≥180 mm
[2] Items (110,) 120, 180, 200 and 220 are enclosed separately

Spare parts for piston design 4 are available on request.

4.2. ASSEMBLY INSTRUCTIONS

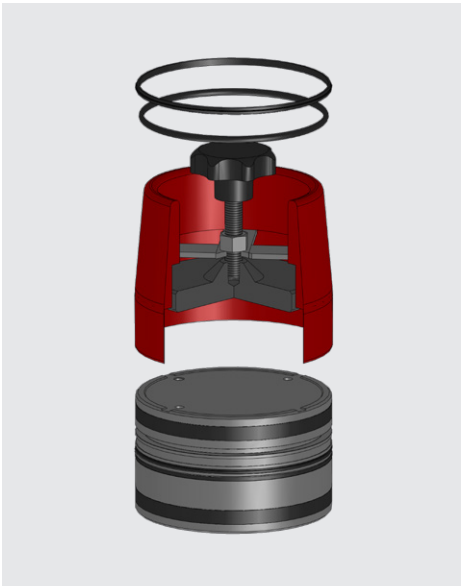
Before assembling or disassembling a piston accumulator or piston accumulator station, the system must always be depressurised.
The gas and the fluid side must be depressurised and the gas valve unscrewed or opened before the accumulator is disassembled. Before the end caps are removed, ensure that the 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 parts flying off.
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 piston accumulator.
The operating instruction must be observed!
No. 3.301.BA

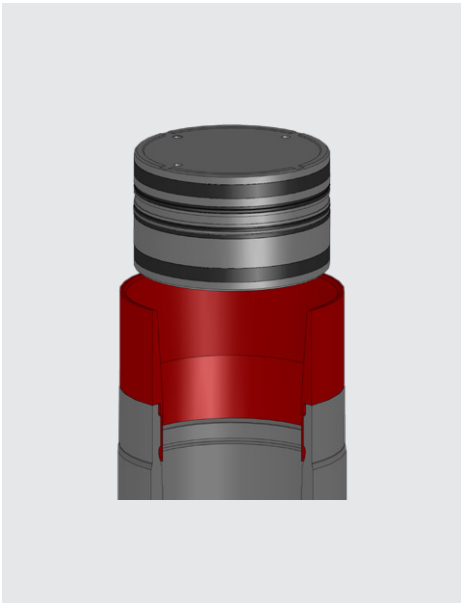
Assembly sleeves for piston accumulators (Table 11)

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 fields of application described.
For fields of application and operating conditions not described, please contact the relevant technical department.
Subject to technical modifications.

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