HYDAC INTERNATIONAL

# Piston accumulators
## Standard design

### 1. DESCRIPTION

#### 1.1. FUNCTION

While fluids are practically incompressible, this does not apply to gases. Hydraulic accumulators use these basic laws of physics to store hydraulic energy. Nitrogen is normally used as the compressible medium.

The various types of hydraulic accumulator are categorised on the basis of the separation element that keeps the gas section separate from the fluid section in the pressure vessel. In the case of the piston accumulator, this is a piston made from aluminium or steel with a sealing system that is compatible with the application.

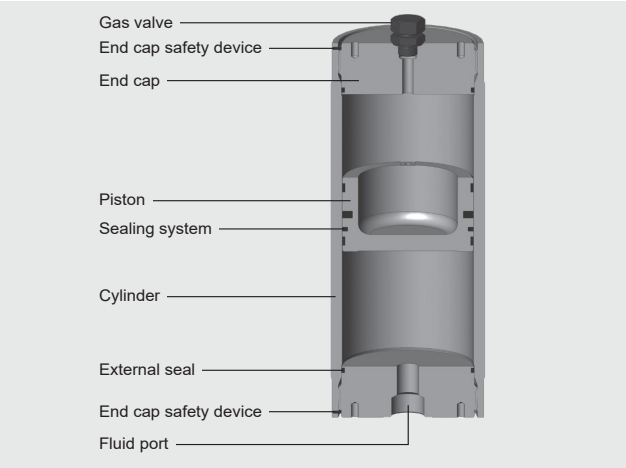
The fluid side of the piston accumulator is connected to the hydraulic circuit so that the piston accumulator draws in fluid when the system pressure increases and the trapped gas is compressed. When the system pressure drops, the compressed gas expands and forces the stored fluid back out into the hydraulic circuit.

HYDAC piston accumulators are available in various designs, see catalogue sections:

- Piston accumulators SK280
  No. 3.303

- Piston accumulators High pressure
  No. 3.302

## 1.2. DESIGN

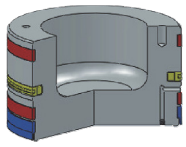
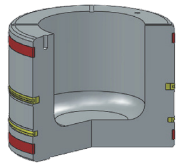
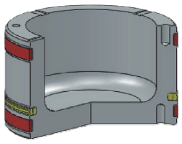
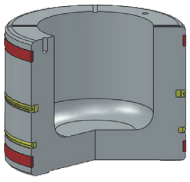



HYDAC piston accumulators consist of the following key individual components:

- Cylinder with a very finely machined internal surface
- Gas side end cap and oil side end cap, both sealed with O-rings
- Steel or aluminium piston
- 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. Suitable materials are available for low temperature applications.

### 1.2.1 Piston design

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

# 2. GENERAL INFORMATION

## 2.1. MATERIALS, CORROSION PROTECTION

**2.1.1 Accumulator shell**
The cylinder and the two end caps are manufactured in carbon steel as standard. 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. When supplied piston accumulators are suitable for short-term storage. Piston accumulators suitable for long-term storage are available on request.

**2.1.2 Pistons with a sealing system**
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, the:

- Design pressure
- Actual pressure differential
- Switching frequency or switching cycle
- Piston velocity
- Operating temperature
- 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 a sealing material, depending on the operating conditions, see section 2.1.3

**2.1.3 Maximum temperature range of elastomer materials**
The permitted working temperature of a piston accumulator is dependent on the application limits of the metal materials and the piston seal. The operating medium must also be taken into account.
The following table shows the main **elastomer materials with their maximum possible temperature ranges** with examples of operating fluids.

| Materials | Material code [1] | Max. possible temperature range [2] | Possible operating fluids, others on request | |
|---|---|---|---|---|
| | | | 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 – Hydraulic fluids from the group HFD-R – Fuels |
| | 5 | -40 °C ... + 80 °C | | |
| PUR Polyurethane | 8 | Standard application<br>-30 °C ... + 80 °C<br>Special application<br>-40 °C ... +100 °C | – Mineral oil (HL, HLP) – Flame-retardant 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) – Hydraulic fluids from the group HFD – Synthetic esters (HEES) – Fuels – Aromatic hydrocarbons – Inorganic acids | – Amines and ketones – Ammonia – Skydrol and HyJet IV – Steam |

[1] The material code (MC) is described in more detail in the model code, see section 3.
[2] The specified temperature range relates to the particular elastomer material, not to the operating range of the hydraulic accumulator, see section 4.1.1

## 2.2. 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.

## 2.3. TYPE OF INSTALLATION

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

- Mounting elements for hydraulic accumulators No. 3.502

## 2.4. CHARGING GAS

- Charging gas: Nitrogen
- Specification: min. Class 2.8

If other gases are to be used or if these specifications are deviated from, please contact HYDAC.

## 2.5. HYDRAULIC FLUID

Hydraulic accumulators must only be operated with operating fluids with a minimum cleanliness class of:

- NAS 1638 Class 6 or
- ISO 4406 Class 17/15/12

## 2.6. CERTIFICATES

Hydraulic accumulators that are installed outside of Germany are supplied with the relevant test certificate documentation. The country of installation must be stated at the time of ordering. HYDAC pressure vessels can be supplied with almost any approval classification. The permitted operating pressure may differ from the nominal pressure.
The following table provides some examples of the code in the model code:

| Country | Certificate code (CC) |
|---|---|
| EU member states | U |
| Australia | F [1)] |
| Belarus | A6 |
| Canada | S1 [1)] |
| China | A9 |
| Great Britain | Y |
| Hong Kong | A9 |
| Iceland | U |
| Japan | P |
| Korea (Republic of) | 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

## 2.7. 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.

## 2.8. PERMITTED VELOCITIES

**Gas velocity**

The flow velocities in the gas side 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.

## 2.9. 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 component. In the case of piston accumulators, important information on gas density and the service life of seals is gained from such tests.
Vital data for use in accumulator sizing is gained by altering the working pressure and switching cycles.

## 2.10. FURTHER INFORMATION

- Operating instructions for piston accumulators No. 3.301.BA

**The operating instructions must be observed!**
All work on HYDAC piston accumulators must only be carried out by suitably trained staff. Incorrect installation or handling can lead to serious accidents.

- Assembly and repair instructions piston accumulators No. 3.301.M For repairs to be performed on hydraulic accumulators, we provide corresponding assembly and repair instructions.

Further information such as accumulator sizing, safety information and extracts from the acceptance specifications can be found in our overview catalogue section:

- HYDAC Accumulator Technology No. 3.000

This document and others are available from our Download Center at www.hydac.com.

## 3. 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 (MC)**
Dependent on operating fluid
Standard design = 2212 for mineral oil
Others on request

**Piston design** (see section 1.2.1)

**Piston material**
1 = aluminium 2 = carbon steel
2 = 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 sealing system, including piston seal**
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)
For others, see section 2.6.

**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 for connection type V)
Size of connection (see Table 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 [3)]**
Detailed technical data on request, see flyer “Monitoring equipment for hydraulic accumulators”, No. 3.506
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
L = linear position measurement system
LA = laser linear position measurement system
M = magnetic flap indication
S = cable tension measurement system
UP..= piston position switch (e.g. UP2 = 2 position switches)
W = limit switch with linear position measurement system

**Safety equipment [3)]**
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, must be stated clearly, if required!**

[1)] Dependent on type and pressure rating [2)]
Observe temperature ranges, see section 2.1.3 [3)]
If required, please state at time of ordering

**Table 1, Connection type**

| Code letter | Description |
|---|---|
| A | Threaded connection (internal thread) |
| B Threaded connection (external thread) | |
| 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 rating + 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 version: connection sizes**

| Type listed in 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 | 1 1/2-11 1/2 NPTF | 2-11 1/2 NPTF | 2 1/2 - NPTF |

**Table 5, Flange version: connection sizes**

| Type listed in 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 G 3/4 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 G 3/4 male, with 7/8-14UNF-VG8 |
| F | Gas valve in end cap M42x1.5/M12 |

# 4. STANDARD ITEMS

## 4.1. TECHNICAL DATA

The piston accumulators and spare parts described below are manufactured in carbon steel with a design 2 piston (aluminium or carbon steel, depending on the version) and a sealing system made from NBR/PTFE (MC = 2212 / 2112).

The table provides the most important data and dimensions for the following series: SK210/350

The part numbers provided refer to piston accumulators in accordance with PED (CC = U).
Designs that differ from the standard types described below can be requested from HYDAC.

**4.1.1 Permissible operating temperature**
As standard, a piston accumulator can be operated in the following temperature range:

-10 °C ... +80 °C

Other operating temperatures on request.

**4.1.2 Permitted operating pressure**
The permitted operating pressure may differ from the nominal pressure in the case of other certifications. The table in section 4.2. shows the permitted operating pressure in accordance with the European Pressure Equipment Directive.

**4.1.3 Nominal volume**
HYDAC piston accumulators are available with set nominal volumes, as described in the table in section 4.2.

**4.1.4 Effective gas volume**
The effective gas volume differs slightly from the nominal volume and forms the basis of the calculated effective fluid volume.

The gas volume V is larger than the nominal volume by the amounts shown below.

| Piston Ø D1 | Piston design | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| [mm] | Δ[l] | | | |
| 50 | – | – | 0.014 | – |
| 60 | – | 0.04 | 0.04 | 0.04 |
| 80 | – | 0.04 | 0.08 | 0.04 |
| 100 | 0.06 | 0.06 | 0.26 | 0.06 |
| 125 | – | 0.17 | 0.5 | 0.17 |
| 150 | – | 0.65 | 0.78 | 0.65 |
| 180 | 1.21 | 1.21 | 1.21 | 1.21 |
| 200 | – | 1 | 1.6 | 1 |
| 250 | 3.03 | 3.03 | 3.58 | 3.03 |
| 310 | – | 6.22 | – | 6.22 |
| 355 | 4.51 | 4.51 | – | 4.51 |
| 490 | – | 12.71 | – | 12.71 |

**4.1.5 Effective volume**
Volume (fluid side) between operating pressures $p_2$ and $p_1$.

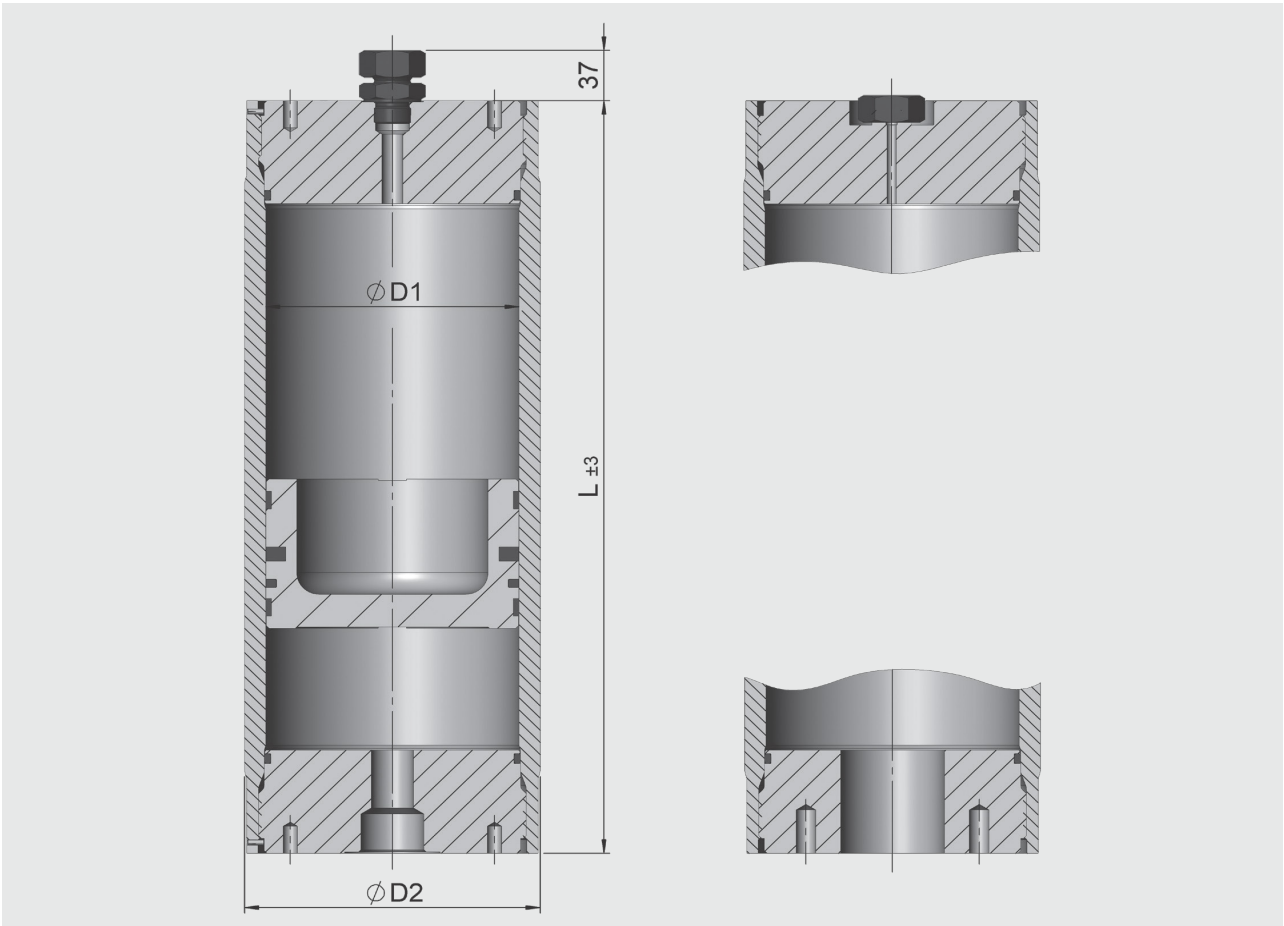
**4.1.6 Limits for gas pre-charge pressure**
For more information, see catalogue section:

- HYDAC Accumulator Technology
  No. 3.000

## 4.2. TABLES AND DRAWINGS

| Nom. 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– 3 5 |
| 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 | 47 – 280 |
| | SK350 | 350 | | | 234 | | 52 – 285 |
| 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 | 100 – 690 |
| | SK350 | 350 | | | | | |
| 10 – 200 | SK210 | 210 | 250 | 286 | 408 | 20.4 | 173 – 731 |
| | SK350 | 350 | | 300 | | | 204 – 999 |
| 25 – 400 | SK350 | 350 | 310 | 350 | 462 | 13.2 | 390 – 1110 |
| 25 – 750 | SK210 | 210 | 355 | 404 | 534 | 10.1 | 472 – 2154 |
| | SK350 | 350 | | 434 | | | 594 – 3413 |
| 200 – 1300 | SK210 | 210 | 490 | 570 | 700 | 5.3 | 1589 – 4492 |
| | SK350 | 350 | | | | | 1641 – 4696 |
| 300 – 3300 | SK210 | 210 | 610 | 691 | 856 | 3.42 | 2500 – 11000 |
| | SK350 | 350 | | 710 | 950 | | |

1) The lengths calculated are normally rounded up or down in 5 mm increments
2) Intermediate weights can be calculated approximately depending on the length/diameter required



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

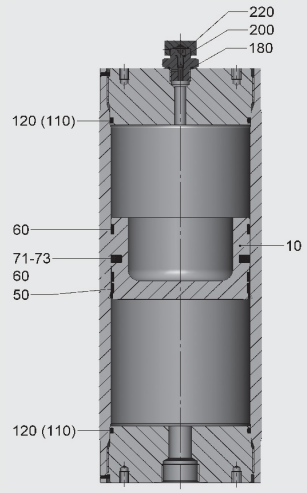
1) Preferred models, others on request
2) Material and piston code (MC) = 2112, see section 3.
3) Gas side connection, see section 3.

**Notice:**

Dimensions, particularly lengths, are approximate and dependent on various factors (e.g. piston design, approval). The specified values are maximum values and must not be considered as referring to a permanent load. The tolerable pressure ratio is influenced by the geometry, temperature, fluid and flow rate as well as any gas losses due to physical properties.

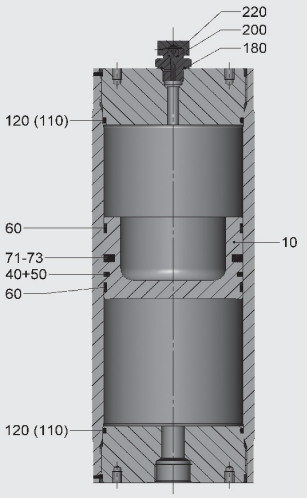
### 4.2.1 Spare parts

**Piston design 1**



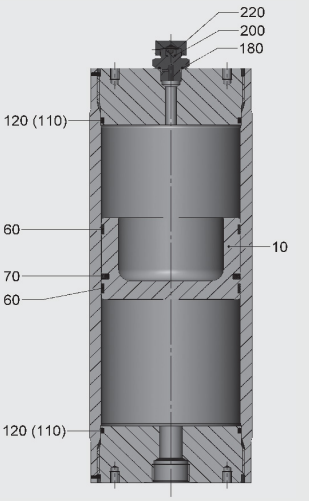

| Description | Qty. | Item |
|---|---|---|
| **Piston assembly** 2) consisting of: | | |
| Piston | 1 | 10 |
| Seal ring | 1 | 50 |
| Guide ring | 2 | 60 |
| Centre seal | 1 | 71-73 |
| **Seal kit** consisting of: | | |
| Seal ring | 1 | 50 |
| Guide ring | 2 | 60 |
| Centre seal | 1 | 71-73 |
| (Support ring) | 1 (2) | (110) |
| O-ring | 2 | 120 |
| O-ring | 1 | 180 |
| Seal ring | 1 | 200 |
| O-ring | 1 | 220 |

**Piston design 2**




| Description | 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** consisting of: | | |
| Seal ring | 1 | 40+50 |
| Guide ring | 2 | 60 |
| (Support ring) | (2) | 71-73 |
| O-ring | 2 | 120 |
| O-ring | 1 | 180 |
| Seal ring | 1 | 200 |
| O-ring | 1 | 220 |

**Piston design 3**



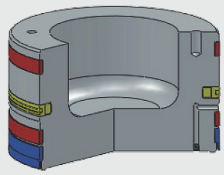

| Description **Piston assembly** 2) consisting of: | Qty. | Item |
|---|---|---|
| Piston | 1 | 10 |
| Guide ring 1) | 1/2 | 60 |
| Seal ring | 1 | 70 |
| **Seal kit** consisting of: | | |
| Guide ring 1) | 1/2 | 60 |
| Seal ring | 1 | 70 |
| (Support ring) | (2) | (110) |
| O-ring | 2 | 120 |
| O-ring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

Pressure-bearing parts cannot be supplied as spares.
(…) for SK690 and standard SK, internal diameters 310 mm and above
1) The bottom guide ring for internal diameters 180 mm and above
2) Items (110), 120, 180, 200 and 220 are enclosed unassembled

Spare parts for piston design 4 are available on request.

### 4.2.2 Piston and seal kit

**Piston design 1**



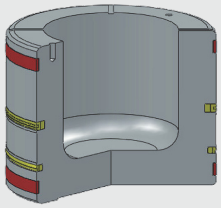
**Piston assembly**

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

**Seal kit**

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

**Piston design 2**



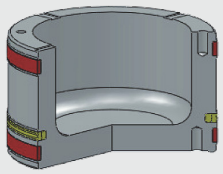
**Piston assembly**

| Piston Ø [mm] | NBR / PTFE Part no. | FKM / PTFE 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**

| Piston Ø [mm] | NBR / PTFE Part no. | FKM / PTFE 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 |

**Piston design 3**



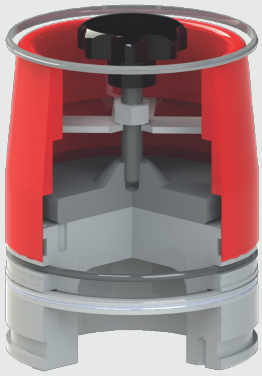
**Piston assembly**

| Piston Ø [mm] | NBR / 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**

| Piston Ø [mm] | NBR / PUR Part no. |
|---|---|
| 60 | 3016210 |
| 80 | 3013230 |
| 100 | 2123414 |
| 125 | 2128104 |
| 150 | 3007546 |
| 180 | 2123415 |
| 200 | 3113127 |
| 250 | 3016213 |
| 310 | 4374872 |
| 355 | 3726888 |
| 490 | 3894300 |

### 4.2.3 Assembly sleeves



Special assembly sleeves are needed to assemble the piston and seals, see:

- Assembly and repair instructions for piston accumulators No. 3.301.M

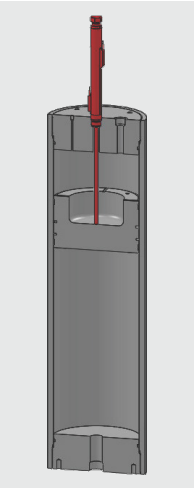
# 5. ACCESSORIES

## 5.1. PISTON POSITION INDICATORS

Examples of piston monitoring devices. Further options for determining the piston position and detailed technical data available on request. See also flyer:

- Monitoring equipment for hydraulic accumulators No. 3.506

### 5.1.1 Electrical limit switch



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

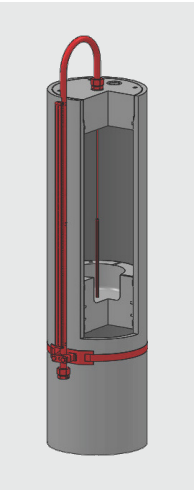
**How are measurements taken?**
As point measurements

**Where to measure?**
Gas side

**Identification in the model code:**
A, B, C, ..., depending on stroke

**Product information:**
No. 10000769094

### 5.1.2 Magnetic flap indication



**What is measured?**
Piston position via 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

**Identification in the model code:**
M

**Product information:**
No. 10000769200

### 5.1.3 Cable tension measurement system

**What is measured?**

Piston position via a cable fastened to the piston

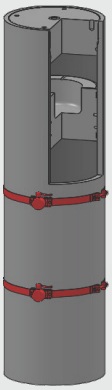
**How are measurements taken?**
Continuously

**Where to measure?**
Gas side

**Identification in the model code:**
S

**Product information:**
No. 10000641374

### 5.1.4 Piston position switch



**What is measured?**
Piston position via ultrasonic measurement

**How are measurements taken?**
As point measurements

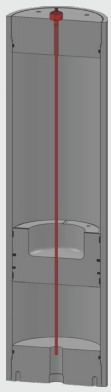
**Where to measure?**
Fluid side

**Identification in the model code:**
UP...

**Product information:**
No. 10000769179

### 5.1.5 Linear position measurement system

**What is measured?**



Piston position via elapsed time measurement

**How are measurements taken?**
Continuously

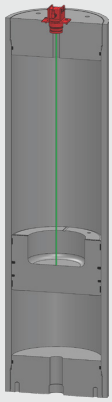
**Where to measure?**
Gas side

**Identification in the model code:**
L

**Product information:**
No. 10000810655

### 5.1.6 Laser linear position measurement system

**What is measured?**



Piston position via laser elapsed time measurement

**How are measurements taken?**
Continuously

**Where to measure?**
Gas side

**Identification in the model code:**
LA

**Product information:**
No. 10000810664

## 6. NOTE

The information in this brochure relates to the operating conditions and fields of application described. For applications and/or operating conditions not described, please contact the relevant technical department.
Subject to technical modifications.