

Universal Charging and Testing Unit **FPU-1**

For Bladder, Piston and Diaphragm Accumulators

1. DESCRIPTION

1.1. FUNCTION

The charging and testing unit FPU-1 is used to charge accumulators with nitrogen or to check or to change the existing pre-charge pressure in accumulators. For this purpose the charging and testing unit is screwed onto the gas valve of the hydraulic accumulator and connected to a commercial nitrogen bottle via a flexible charging hose. If the nitrogen pressure is only to be checked or reduced, the charging hose does not need to be connected. The unit has a screw-type fitting with a built-in gauge, check valve and a spindle for opening the accumulator gas valve to control the pressure.

HYDAC piston and diaphragm accumulators can be charged and checked without the need for adaptors. Bladder accumulators, however, require an adaptor (A3 supplied as standard, see model code on page 2).



1.2. INTERVALS BETWEEN CHECKING

On the whole, nitrogen losses on HYDAC hydraulic accumulators are very low. However, a regular check of the gas pre-charge pressure is recommended to prevent the piston from hitting the cover plate or the bladder or diaphragm from becoming too deformed, if there is a drop in the pressure p_0 .

The pre-charge pressure p_0 as shown on the label or the accumulator body, must be re-set after every new installation or repair and then checked at least once during the following week. If no nitrogen loss is detected, a further check should be made after approx. 4 months. If after this period no change in the pressure is found, a yearly check should be sufficient.

1.3. CONSTRUCTION

The HYDAC charging and testing unit for bladder, piston and diaphragm accumulators consists of:

- Valve body
- Spindle
- Check valve
- Release valve
- Gauge
- Charging hose
- A3 adaptor for bladder accumulators

1.4. ACCESSORIES

● Gas safety valve with intermediate piece

TUV set and lead sealed, it must be fitted between the hydraulic accumulator and the nitrogen bottle by means of the intermediate piece, if the gas pressure in the commercially available nitrogen bottle is higher than the max. permissible operating pressure of the hydraulic accumulator.

● Pressure reducer

for setting the required pre-charge pressure between nitrogen bottle and accumulator.

● Protective case

for storing the charging and testing unit and adaptors.

Different types of case are available, depending on customer requirement.

2. TECHNICAL SPECIFICATIONS

2.1. MODEL CODE (also order example)

Universal charging and testing unit _____ **FPU-1 250 F 2.5 G2 A1 K**

Gauge indication range

| | | |
|-------------|--------------|-----|
| 0 - 10 bar | 0 - 145 psi | 10 |
| 0 - 25 bar | 0 - 363 psi | 25 |
| 0 - 100 bar | 0 - 1450 psi | 100 |
| 0 - 250 bar | 0 - 3626 psi | 250 |
| 0 - 400 bar | 0 - 5714 psi | 400 |

Charging hose

- F = for 200 bar nitrogen bottle
with connection W24.32 x 1/14 (DIN 477, Part 1)
FM = for 300 bar nitrogen bottle
with connection M30 x 1.5 (DIN 477, Part 5)
FW = for 300 bar nitrogen bottle
with connection W30 x 2 (CEN)

Length of charging hose

| | |
|-------|-----|
| 2.5 m | 2.5 |
| 4.0 m | 4 |

Special lengths on request

Adaptor G for nitrogen bottles

See table under point 10 (page 15)

Adaptor A

| | |
|-----|----------------|
| A1 | = M16 x 1.5 |
| A2 | = 5/8 - 18 UNF |
| A3 | = 7/8 - 14 UNF |
| A4 | = 7/8 - 14 UNF |
| A5 | = M8 x 1 |
| A6 | = G 3/4 A |
| A7 | = G 1/4 |
| A8 | = G 3/4 |
| A9 | = Vg 8 |
| A10 | = 7/8 - 14 UNF |
| A11 | = M16 x 2 |
| D4 | = 5/8 - 18 UNF |

(A3 is supplied as standard)

(Material no. 366374)
other adaptors on request

Protective case

Accessories (Please give full details when ordering.)
Gas safety valve with intermediate piece (see point 5.3.).
Pressure reducer (see point 5.1.).
Adaptor for connector D (see point 4.1.).
Wrench 14x15 (material no. 1011065).
Allen key SW6 (material no. 1005164).
Valve tool for gas valve (material no. 616886).

2.2. WEIGHT

Standard model without case:
approx. 1.4 kg

Standard model with case:
approx. 3.0 kg

2.3. FPU-1 STANDARD MODELS

2.3.1 Model without case

| Model code | Material no. |
|-----------------|--------------|
| FPU-1-010F2.5A3 | 2114486 |
| FPU-1-025F2.5A3 | 2114481 |
| FPU-1-100F2.5A3 | 2114310 |
| FPU-1-250F2.5A3 | 2114306 |
| FPU-1-400F2.5A3 | 2115646 |
| FPU-1-010F4A3 | 2115056 |
| FPU-1-025F4A3 | 2116876 |
| FPU-1-100F4A3 | 2115657 |
| FPU-1-250F4A3 | 2114311 |
| FPU-1-400F4A3 | 2119673 |

2.3.2 Model with case

| Model code | Material no. |
|------------------|--------------|
| FPU-1-010F2.5A3K | 2115365 |
| FPU-1-025F2.5A3K | 2114305 |
| FPU-1-100F2.5A3K | 2115314 |
| FPU-1-250F2.5A3K | 2114302 |
| FPU-1-400F2.5A3K | 2114307 |
| FPU-1-010F4A3K | 3013690 |
| FPU-1-025F4A3K | 2116738 |
| FPU-1-100F4A3K | 2114842 |
| FPU-1-250F4A3K | 2114303 |
| FPU-1-400F4A3K | 2114304 |

2.3.3 Model without case with G adaptor

| Model code | Material no. |
|-------------------|--------------|
| FPU-1-250F2.5G2A3 | 2120252 |
| FPU-1-250F2.5G3A3 | 2115555 |
| FPU-1-250F2.5G4A3 | 2124611 |
| FPU-1-250F2.5G9A3 | 2114312 |
| FPU-1-250F4G3A3 | 2123839 |
| FPU-1-250F4G6A3 | 2117532 |
| FPU-1-250F4G10A3 | 2119789 |
| FPU-1-400F2.5G2A3 | 2115823 |
| FPU-1-400F2.5G3A3 | 2121557 |
| FPU-1-400F2.5G8A3 | 2115693 |

2.3.4 Model with case and G adaptor

| Model code | Material no. |
|---------------------|--------------|
| FPU-1-010F2.5G2A3K | 2116766 |
| FPU-1-010F2.5G3A3K | 2127228 |
| FPU-1-010F2.5G4A3K | 2125524 |
| FPU-1-010F2.5G6A3K | 2115661 |
| FPU-1-010F2.5G7A3K | 2117851 |
| FPU-1-010F2.5G8A3K | 2117303 |
| FPU-1-010F2.5G9A3K | 2114482 |
| FPU-1-010F2.5G10A3K | 3008015 |
| FPU-1-010F4G7A3K | 2124450 |
| FPU-1-025F2.5G2A3K | 2114401 |
| FPU-1-025F2.5G3A3K | 2121210 |
| FPU-1-025F2.5G4A3K | 2115247 |
| FPU-1-025F2.5G5A3K | 3013724 |
| FPU-1-025F2.5G8A3K | 2119888 |
| FPU-1-025F2.5G9A3K | 2123949 |
| FPU-1-025F2.5G10A3K | 2119564 |
| FPU-1-025F4G9A3K | 2119680 |
| FPU-1-100F2.5G2A3K | 2122515 |
| FPU-1-100F2.5G4A3K | 2122089 |
| FPU-1-100F2.5G6A3K | 3003846 |
| FPU-1-100F2.5G9A3K | 2119883 |
| FPU-1-100F4G3A3K | 2120359 |
| FPU-1-250F2.5G2A3K | 2114309 |
| FPU-1-250F2.5G3A3K | 2114308 |
| FPU-1-250F2.5G4A3K | 2103046 |
| FPU-1-250F2.5G5A3K | 2117038 |
| FPU-1-250F2.5G6A3K | 2115420 |
| FPU-1-250F2.5G7A3K | 2120010 |
| FPU-1-250F2.5G8A3K | 2115216 |
| FPU-1-250F2.5G9A3K | 2115833 |
| FPU-1-250F4G2A3K | 2116743 |
| FPU-1-250F4G3A3K | 2116779 |
| FPU-1-250F4G4A3K | 2128944 |
| FPU-1-250F4G8A3K | 2124860 |
| FPU-1-250F4G9A3K | 2116004 |
| FPU-1-250F4G10A3K | 2125750 |
| FPU-1-400F2.5G2A3K | 2114605 |
| FPU-1-400F2.5G3A3K | 2115692 |
| FPU-1-400F2.5G4A3K | 2128360 |
| FPU-1-400F2.5G5A3K | 2124387 |
| FPU-1-400F2.5G6A3K | 2121984 |
| FPU-1-400F2.5G8A3K | 2116005 |
| FPU-1-400F2.5G9A3K | 2115757 |
| FPU-1-400F4G2A3K | 2122119 |
| FPU-1-400F4G3A3K | 2115656 |
| FPU-1-400F4G7A3K | 2124504 |
| FPU-1-400F4G8A3K | 2119759 |
| FPU-1-400F4G9A3K | 2126309 |
| FPU-1-400F4G10A3K | 2116642 |

2.4. SPECIAL MODELS



For pressures exceeding 400 bar, the following special models are available:

- **FPS 600**
for bladder accumulators up to 600 bar max. pre-charge pressure (see technical information 293715).
- **FPK 600**
for piston, diaphragm and SB800-1.5 accumulators up to 600 bar max. pre-charge pressure (see technical information 297248).
- **FPH 800**
for high pressure bladder accumulators up to 800 bar max. pre-charge pressure (see technical information 292948).

3. OPERATING INSTRUCTIONS

- 3.1. TAKING ACCOUNT OF THE TEMPERATURE EFFECT
In order that the recommended pre-charge pressures are maintained even at relatively high operating temperatures, the pre-charge pressure $p_{0 \text{ charge}}$ for charging and testing a cold accumulator must be selected as follows:

$$p_{0 \text{ charge}} = p_0 \frac{\text{Pre-charge temp.} + 273}{\text{Operating temp.} + 273}$$

Pre-charge temperature [°C]
Operating temperature [°C]

- 3.2. PREPARATION
Prior to each testing, topping-up or re-charging of nitrogen, the accumulator must be isolated from the pressurised system by means of a shut-off valve and the fluid released.

Unscrew the protective caps S and H (only on bladder accumulators). Remove the O-ring O on bladder accumulators.

Slightly loosen the internal hexagon screw P on piston and diaphragm accumulators by means of an Allen key SW 6, DIN 911 (approx. ½ turn).

Place FPU-1 onto the accumulator and screw connector D by hand onto accumulator gas valve. At the same time, ensure that the release B of the FPU-1 is closed. Turn charging unit to a position where the gauge can be easily read.

- 3.3. TESTING
On bladder accumulators

(FPU-1 with A3 or other suitable adaptor) open valve by turning spindle A clockwise.

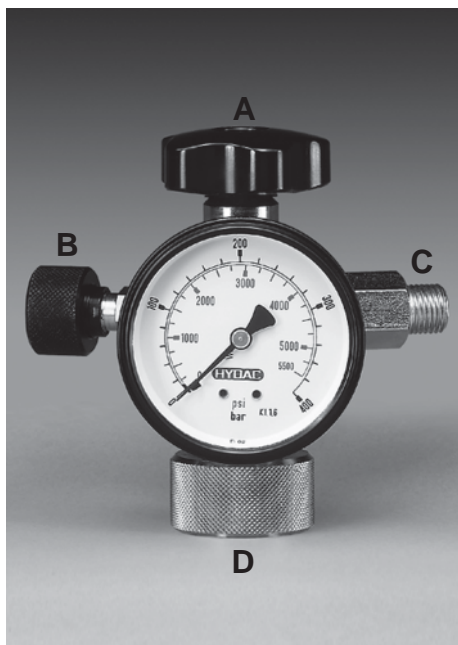
On piston and diaphragm accumulators (FPU-1)

open valve V by turning the internal hexagon screw anti-clockwise with spindle A.

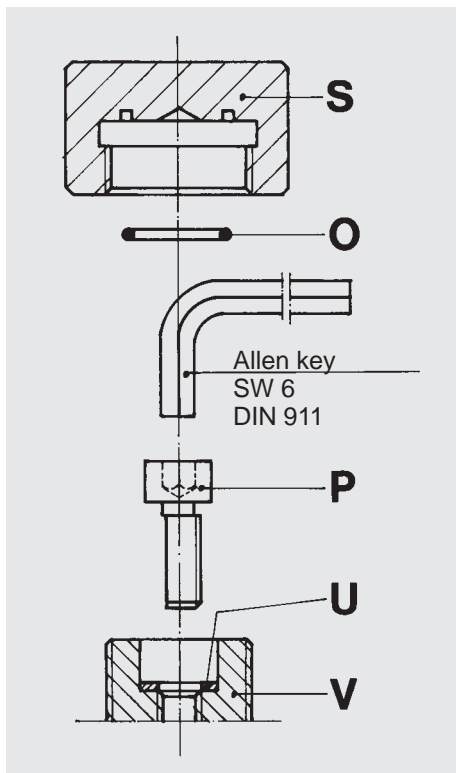
When the needle of the gauge begins to move, give the spindle another complete turn.

The gauge now shows the charging pressure in the accumulator. The check valve C prevents any escape of nitrogen.

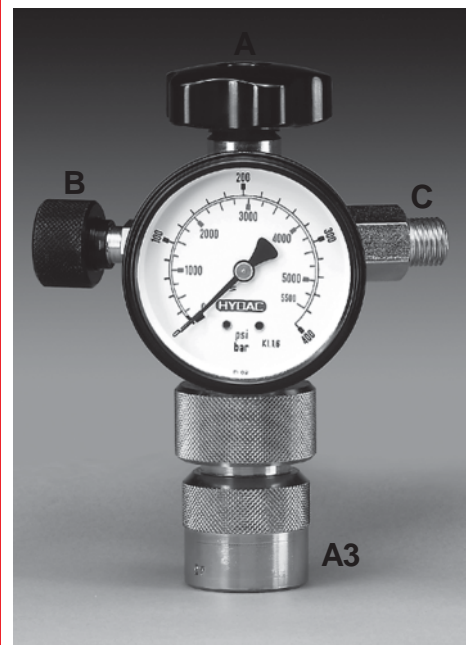
- 3.4. REDUCING THE PRE-CHARGE PRESSURE
Carefully open release B.
The nitrogen escapes into the atmosphere.



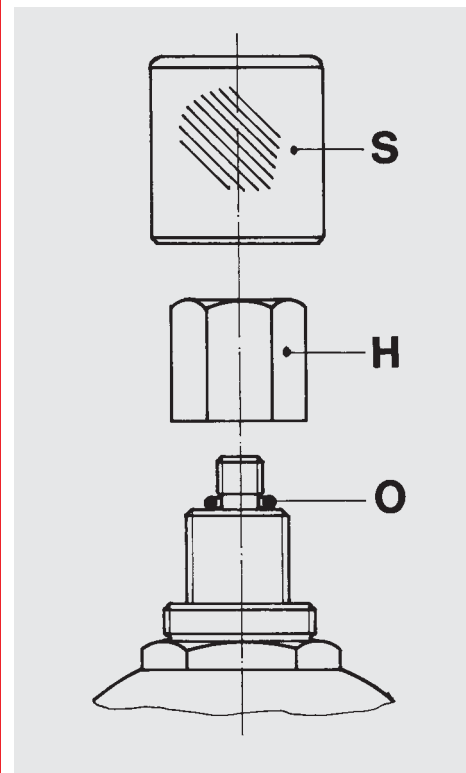
Charging and testing unit FPU-1 for piston and diaphragm accumulators



Gas valve for piston and diaphragm accumulators



Charging and testing unit for bladder accumulators with adaptor A3



Gas valve for bladder accumulators

3.5. INCREASING PRE-CHARGE PRESSURE

Only use nitrogen for charging accumulators

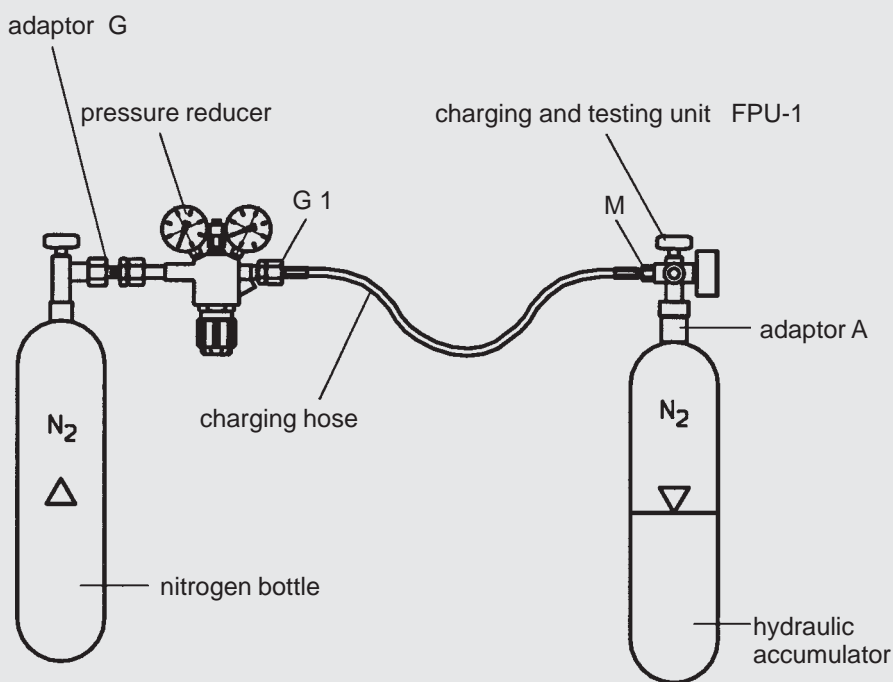
Never use oxygen!

Danger of explosion!

If the gas pressure in the nitrogen bottle is higher than the max. operating pressure of the accumulator, a gas pressure reducer must be fitted.

- Connect the flexible charging hose to the pressure reducer on the nitrogen bottle by means of the connector G1.
For nitrogen bottles from other countries the appropriate adaptor is required (see page 15).
Connect connector M of the charging hose to the check valve C of the charging and testing unit FPU-1. Open the shut-off valve on the nitrogen bottle, and slowly release nitrogen into the accumulator. Wait until approximately 1 bar has been reached before opening the shut-off valve of the nitrogen bottle further to enable faster charging.
- Interrupt the charging process from time to time and check the pre-charge pressure reached. Repeat this process until the required gas pre-charge pressure is achieved. After temperature equalisation has taken place, re-check the pre-charge pressure and adjust if necessary. If the pressure is too high, it can be lowered via the pressure release B of the FPU-1.
- If the required gas pre-charge pressure has been reached, turn the spindle anticlockwise to close the gas valve on bladder accumulators. On piston or diaphragm accumulators close the internal hexagon screw P by turning the spindle clockwise. Discharge the charging and testing unit FPU-1 via the pressure release and remove it by loosening the connector. On bladder accumulators, unscrew the adaptor and replace the O-ring O. On piston and diaphragm accumulators, tighten the internal hexagon screw P with Allen key [20 Nm].
- Check for leakages on the accumulator gas valve using a leak detector spray.
- Screw on cap nut H (only on bladder accumulators) and valve protection cap S onto the gas valve of the accumulator and tighten.

3.6. FPU-1 WITH ACCESSORIES



3.7. WARNING

- Nitrogen and operating fluid can escape when filling or testing the accumulator due to a faulty, i.e. leaking, bladder, diaphragm or piston seals.

Caution!

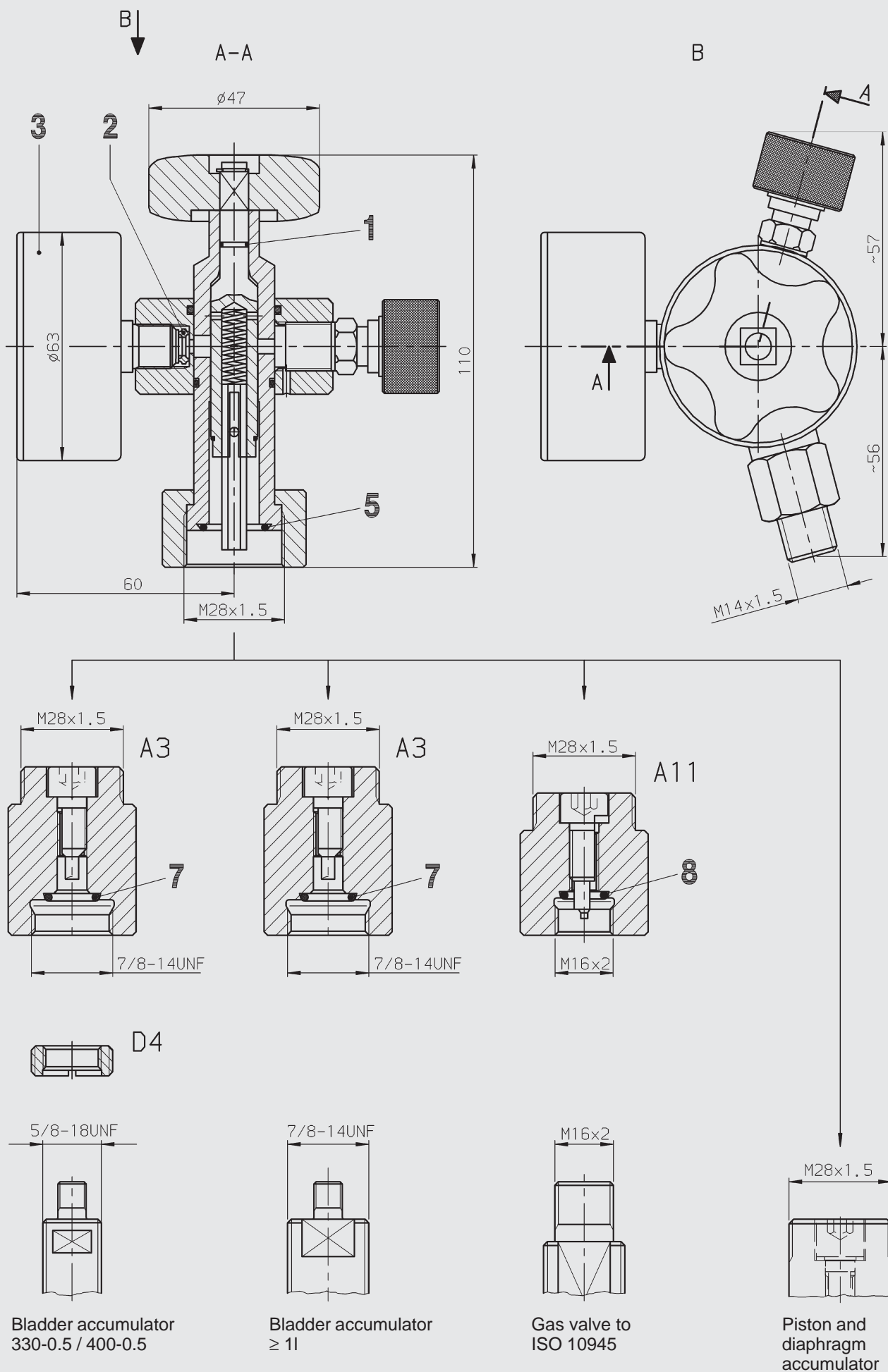
Risk to health in the case of aggressive fluids!

(special charging and testing unit available on request)

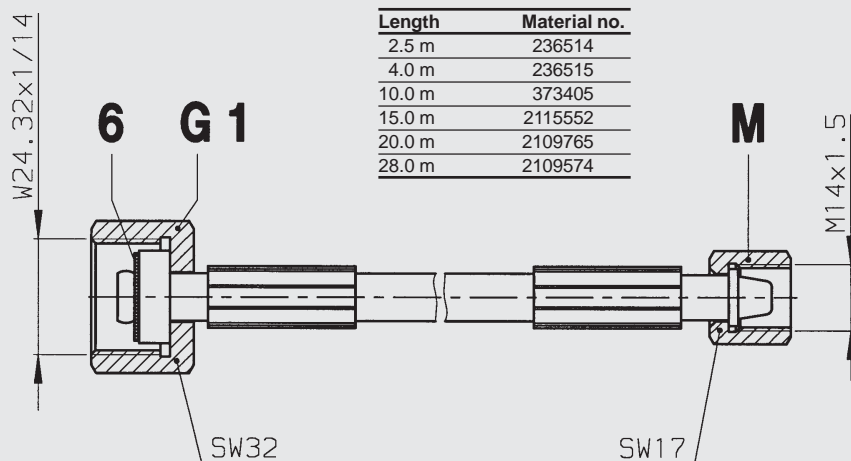
- The check valve C must not be dismantled. The valve has a safety function for the whole charging and testing unit.

4. DIMENSIONS

4.1. CHARGING AND TESTING UNIT FPU-1 WITH ADAPTOR FOR HYDAC ACCUMULATORS



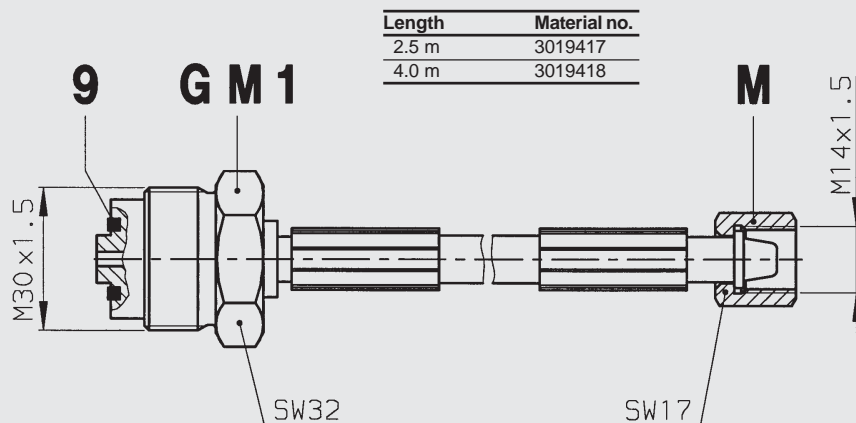
4.2. CHARGING HOSE F
(200 bar nitrogen bottle - connection to DIN 477, part 1)



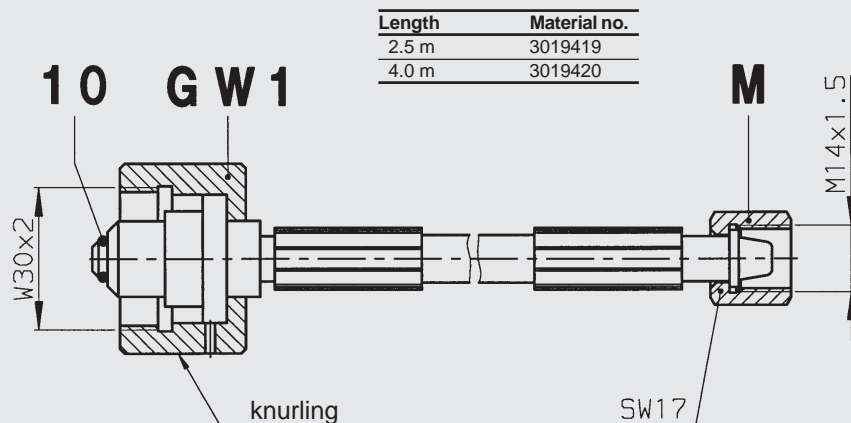
Charging hoses are suitable for the respective published maximum permissible operating pressures and 10,000 charging processes.

(HYDAC charging hoses comply with the EC machine directive and with DIN EN 982 and DIN EN 853 to 857).

4.3. CHARGING HOSE FM
(300 bar nitrogen bottle - connection to DIN 477, part 5)



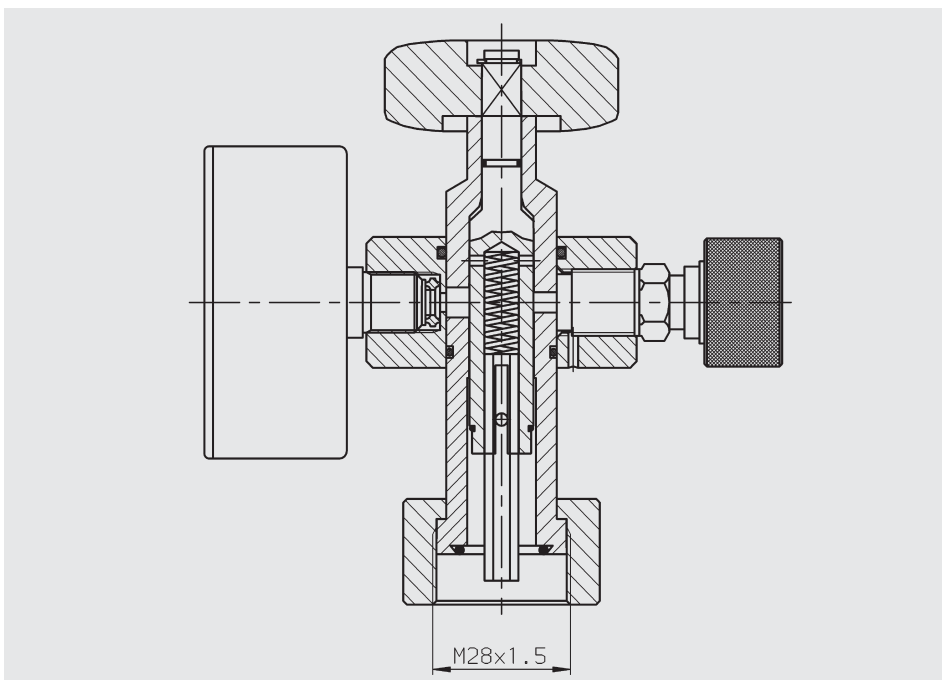
4.4. CHARGING HOSE FW
(300 bar nitrogen bottle - connection to CEN)



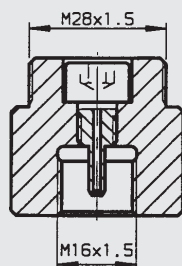
4.5. ADAPTORS A1 TO A11

The universality of the FPU-1 is guaranteed because as well as HYDAC piston and diaphragm accumulators, bladder accumulators can also be charged and tested using the A3 adaptor.

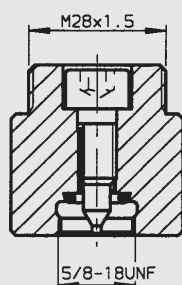
By using additional adaptors other makes of accumulator can also be charged and tested.



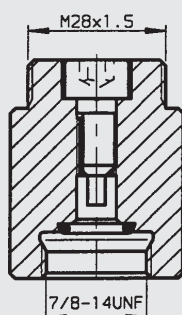
A1 (Material no. 361619)



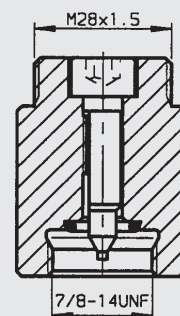
A2 (Material no. 361605)



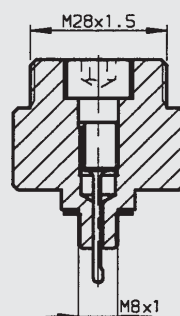
A3 (Material no. 291533)



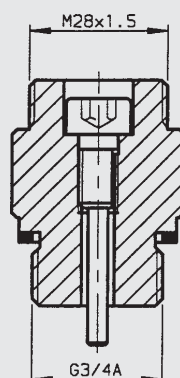
A4 (Material no. 291536)



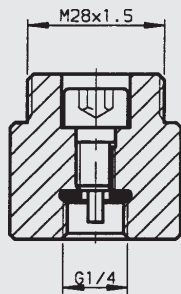
A5 (Material no. 291531)



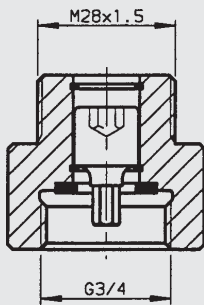
A6 (Material no. 2108819)



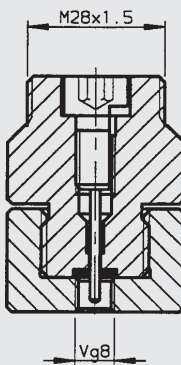
A7 (Material no. 2110629)



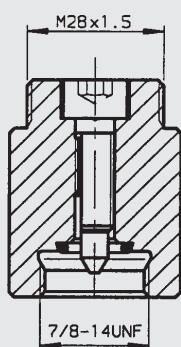
A8 (Material no. 2124524)



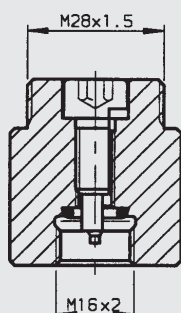
A9 (Material no. 2128638)



A10 (Material no. 2128849)

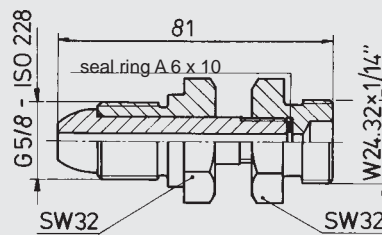


A11 (Material no. 3018210)

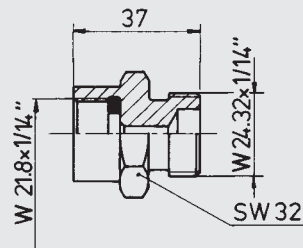


4.6. ADAPTORS G2 TO G11

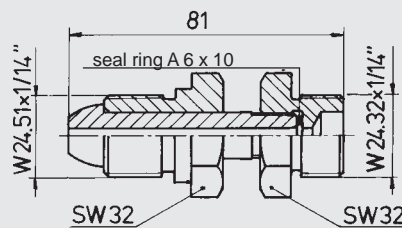
G 2 (Material no. 236376)



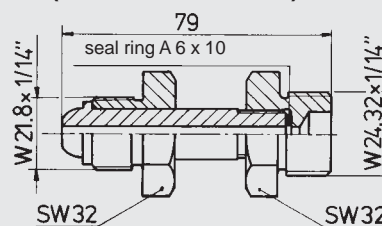
G 3 (Material no. 2103421)



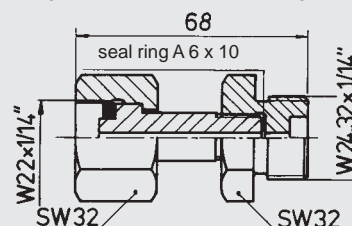
G 4 (Material no. 236374)



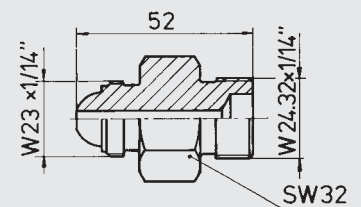
G 5 (Material no. 236373)



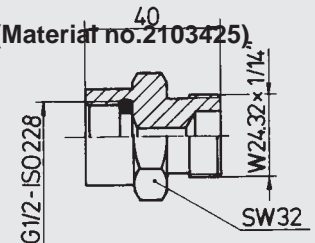
G 6 (Material no. 2103423)



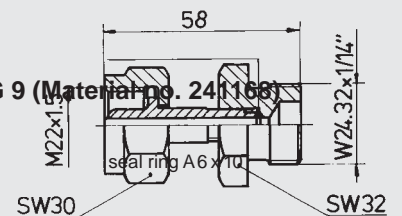
G 7 (Material no.236377)



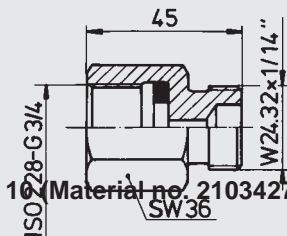
G 8 (Material no.2103425)



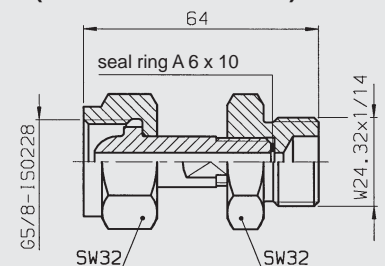
G 9 (Material no. 241168)



G 10 (Material no. 2103427)

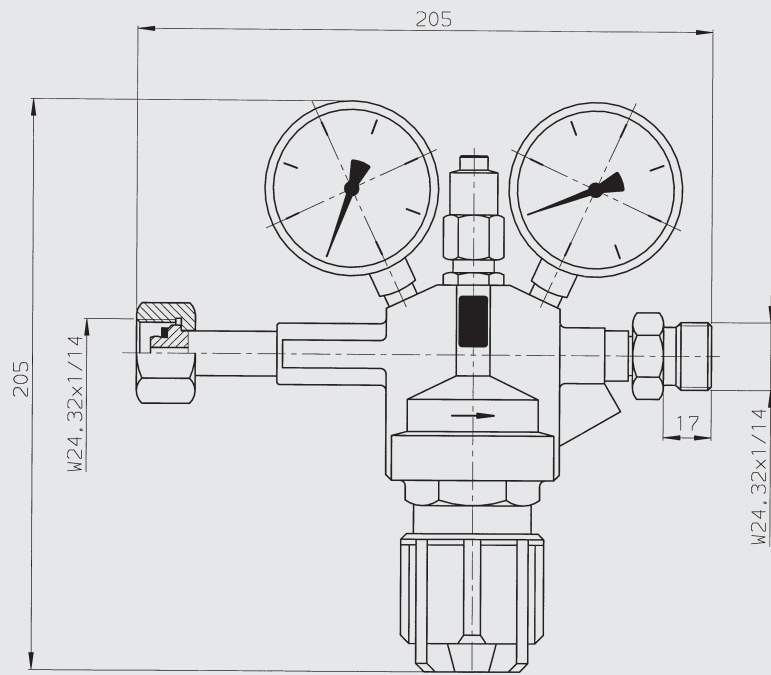


G 11 (Material no. 3018678)



5. ACCESSORIES

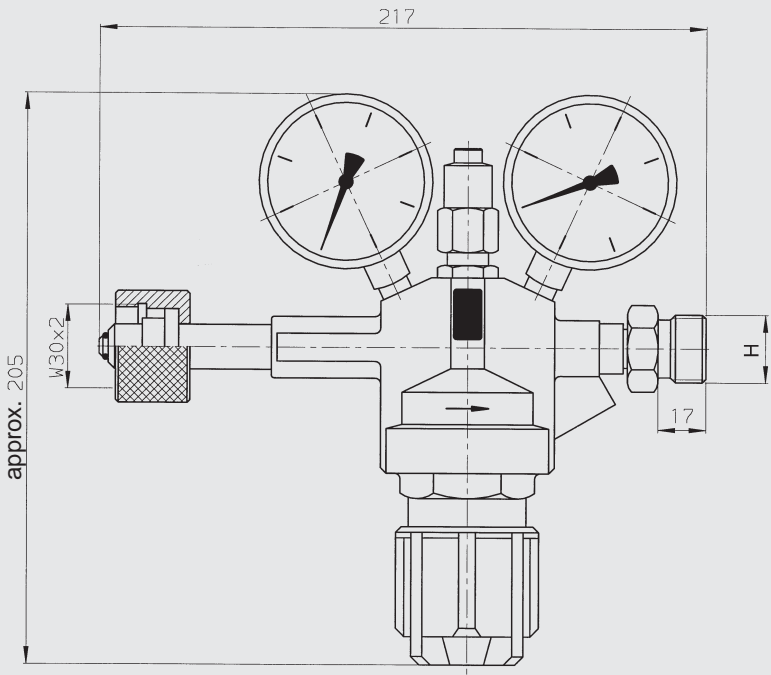
5.1. PRESSURE REDUCER FOR 200 BAR NITROGEN BOTTLES
(Connection W24.32 x 1/14 - DIN 477, Part 1)



| Bottle pressure [bar] | Reduces pressure to between [bar] | Material no. |
|-----------------------|-----------------------------------|--------------|
| 200 | 0- 20 | 635409 |
| 200 | 0-100 | 635411 |
| 200 | 0-200 | 635412 |

Weight: 2.3 kg

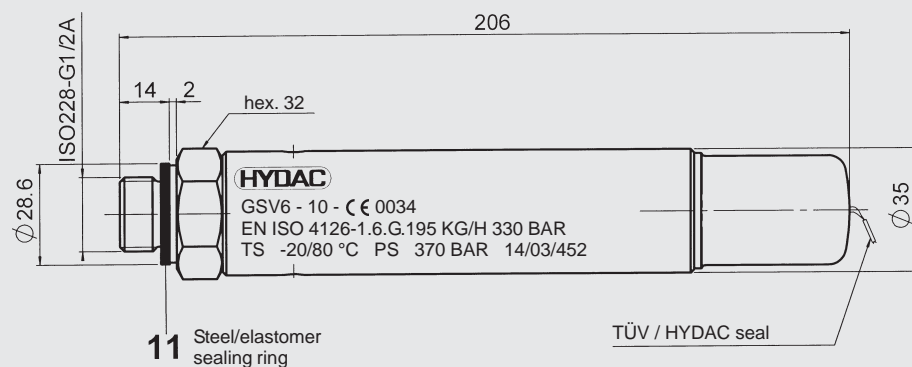
5.2. PRESSURE REDUCER FOR 300 BAR NITROGEN BOTTLES
(Connection W30 x 2 - CEN)



| Bottle pressure [bar] | Reduces pressure to between [bar] | Connection H | Material no. |
|-----------------------|-----------------------------------|--------------|--------------|
| 300 | 0 - 20 | W24.32x1/14 | 6004020 |
| 300 | 0-100 | W24.32x1/14 | 6004021 |
| 300 | 0-200 | W24.32x1/14 | 6004022 |

Weight: 2.3 kg

5.3. GAS SAFETY VALVE GSV6



5.3.1 Model code

(also ordering example)

GSV6 - 10 - CE0034.ENISO4126-1.6.G. 195. 330

Gas safety valve

Component code

Flow rate Q in kg/h
(see table, point 5.3.2)

Pressure setting p in bar
(see table, point 5.3.2)

5.3.2 Types of GSV6

| Q [kg/h] | p [bar] | Mat. no. |
|----------|---------|----------|
| 15 | 30 | 3123965 |
| 20 | 40 | 3123966 |
| 28 | 50 | 3123967 |
| 35 | 60 | 3124028 |
| 40 | 70 | 3124029 |
| 45 | 80 | 3124030 |
| 50 | 90 | 3124031 |
| 58 | 100 | 3124032 |
| 65 | 110 | 3124033 |
| 70 | 120 | 3124034 |
| 75 | 130 | 3124035 |
| 83 | 140 | 3124036 |
| 88 | 150 | 3124037 |
| 95 | 160 | 3124038 |
| 100 | 170 | 3124039 |
| 105 | 180 | 3124040 |
| 110 | 190 | 3124041 |
| 118 | 200 | 3124042 |
| 125 | 210 | 3124043 |
| 130 | 220 | 3124044 |
| 135 | 230 | 3124045 |
| 140 | 240 | 3124046 |
| 148 | 250 | 3124047 |
| 155 | 260 | 3124048 |
| 160 | 270 | 3124049 |
| 165 | 280 | 3124050 |
| 170 | 290 | 3124051 |
| 178 | 300 | 3124052 |
| 185 | 310 | 3124053 |
| 190 | 320 | 3124054 |
| 195 | 330 | 3124055 |
| 200 | 340 | 3124056 |
| 205 | 350 | 3124057 |
| 210 | 360 | 3153706 |
| 216 | 370 | 3143015 |

others on request

> 350 bar = additional price for EC
individual testing

5.3.3 Type of construction

Direct-acting gas safety valve
nominal width 6 mm

5.3.4 Design

PED 97/23/EC,
EN ISO41236-1, EN 13445-6
Others on request

5.3.5 Module category

IV to PED 97/23/EC
Module B + D (EC prototype test)
module G (EC individual test)
on request

5.3.6 Materials

stainless steel,
closing element with flexible
seat seal

5.3.7 Operating pressure range

30 to 370 bar

5.3.8 Temperature range

-20 to +80 °C

5.3.9 Operating fluid

Nitrogen (N₂)

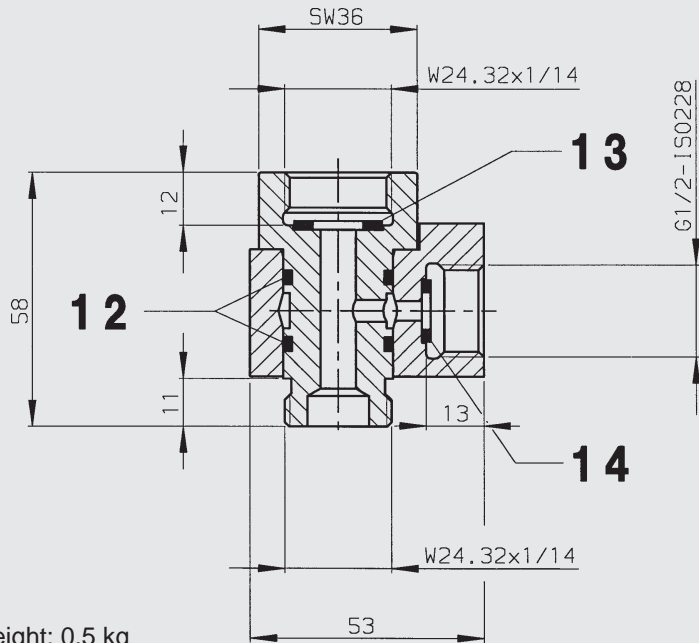
5.3.10 Mounting position

optional

5.3.11 Weight

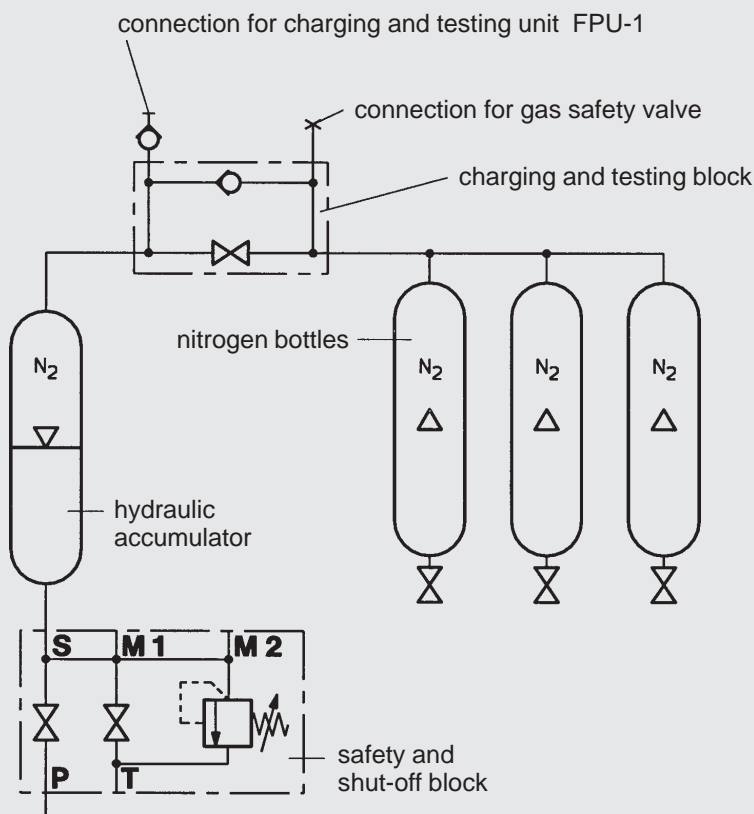
1.1 kg

5.4. **INTERMEDIATE PIECE GSV6-10-CE**
Intermediate piece for fitting the gas safety valve GSV6 between the 200 bar nitrogen bottle and the charging and testing unit FPU-1 (material no. 242558)

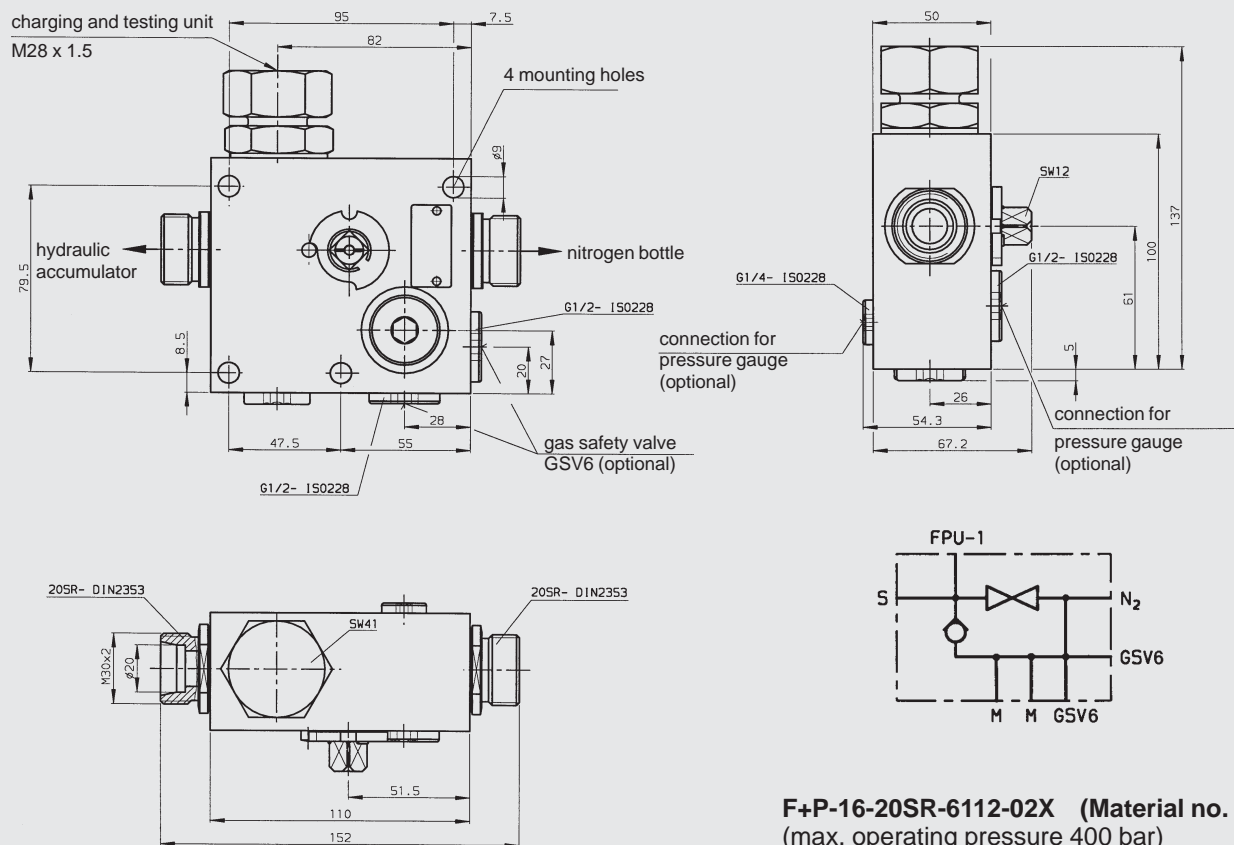


6. **CHARGING AND TESTING BLOCK F + P**
The HYDAC charging and testing block F+P is used to charge and test back-up type hydraulic accumulators. It has connections for the charging and testing unit FPU-1 and for pressure gauges. As a safety function, a gas safety valve GSV6 can be fitted. In addition it allows the back-up nitrogen bottles to be shut off from the hydraulic accumulator.

6.1. **BACK-UP TYPE HYDRAULIC ACCUMULATOR WITH CHARGING AND TESTING BLOCK**



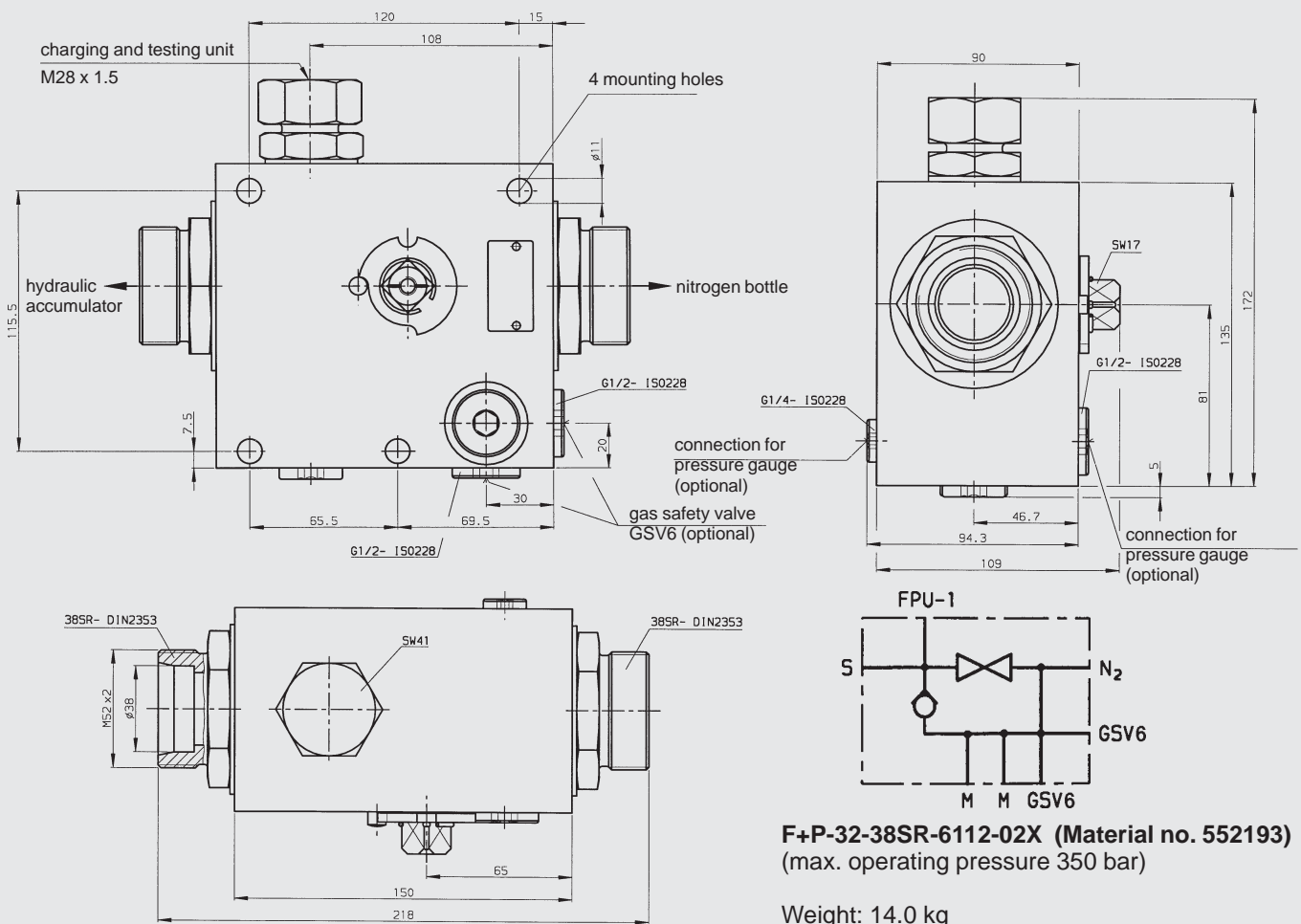
6.2. CHARGING AND TESTING BLOCK DN 16



F+P-16-20SR-6112-02X (Material no. 850233)
(max. operating pressure 400 bar)

Weight: 4.3 kg

6.3. CHARGING AND TESTING BLOCK DN 32



F+P-32-38SR-6112-02X (Material no. 552193)
(max. operating pressure 350 bar)

Weight: 14.0 kg

7. SPARE PARTS

CHARGING AND TESTING UNIT FPU-1

| Item | Quantity | Designation | Material no. |
|------|----------|------------------|-----------------------------------------------------------------------|
| 1 | 1 | O-ring 6 x 1 | 601 032 |
| 2 | 1 | Seal ring | 612 730 |
| 3 | 1 | Pressure gauge | 0 - 10 bar 0 - 25 bar 0 - 100 bar 0 - 250 bar 0 - 400 bar |
| 5 | 1 | O-ring 15 x 2 | 601 049 |
| 6 | 1 | Seal ring | 601 456 |
| 7 | 1 | O-ring 11 x 2 | 601 043 |
| 8 | 1 | O-ring 9 x 2 | 601 040 |
| 9 | 1 | O-ring 11 x 2.5 | 603 681 |
| 10 | 1 | O-ring 5.7 x 1.9 | 6004009 |
| | | Seal kit FPU-1 | 2117669 |

GAS SAFETY VALVE GSV6-10-CE

| Item | Quantity | Designation | Material no. |
|------|----------|--------------------------------|--------------|
| 11 | | Seal ring 21.54 x 28.58 x 2.47 | 6018877 |

When mounting onto the HYDAC charging and testing block, O-ring 18 x 2.5 (Material no. 601 057) must be fitted.

INTERMEDIATE PIECE GSV6-10-CE

| Item | Quantity | Designation | Material no. |
|------|----------|-----------------------------|--------------|
| 12 | 2 | O-ring 20 x 2.5 | 601 058 |
| 13 | 1 | Seal ring 20 x 11.5 x 2 | 614 706 |
| 14 | 1 | Seal ring 14 x 8.5 x 2 | 612 735 |
| | | Seal kit intermediate piece | 2117287 |

CHARGING AND TESTING BLOCK

| | | |
|--|--------------------|---------|
| | Seal kit F+P DN 16 | 2115776 |
| | Seal kit F+P DN 32 | 2112088 |

8. NITROGEN CHARGING UNIT



HYDAC nitrogen charging units facilitate fast and cost-effective filling or testing of the required gas pre-charge pressure in bladder, diaphragm or piston accumulators. They guarantee optimum use of commercially available nitrogen bottles up to a residual pressure of 20 bar and a maximum accumulator pressure of 350 bar. Portable, mobile and stationary types of N₂ Server are available. For further details and technical specifications, see HYDAC brochure "Nitrogen Charging Unit N₂ Server", no.: E 2.201.

9. NOTE

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