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1 Purpose

1.1 Separator is designed for working elastic-element manometers verification and calibration as well as other measuring instruments (MI) used for gauge pressure measurement of gases non-compatible with industrial oils.

1.2 The separator is designed for joint work with deadweight testers (as well as together with hydraulic pressure generators, etc.) and compressed air or nitrogen source (compressor, gas cylinder, etc.).

1.3 Pressure is measured by air (or nitrogen) volume increase/decrease inside the separator cavity.

1.4 The separator is designed for operation in laboratory conditions at the ambient air temperature of 10 to 30 °C and maximum relative humidity of 60±20%.

2 Technical Characteristics

Limit of pressure value to be measured	25 (250) MPa (kgf/cm^2)
Max pressure of compressed air (or nitrogen)	26 (260) MPa (kgf/cm^2)
Working medium	
at inlet	oil[1], water[2]
at outlet	air[3], nitrogen[4]
Volume of working liquid inside the separator	40±5 ml
Overall dimensions (L×W×H), maximum	250×330×200 mm
Weight, no more than	10 kg

3 Scope of supply (in pieces)

Pneumatic-hydraulic separator	1
Connecting nut	
M20×1.5	1
M12×1.5	1
G½	1
G¼	1
Pneumatic hose	1
Rubber-metal sealing	3

[1] Transformer oil as per GOST 10121, GOST 982, TU 38.1011025 or castor oil as per GOST18102, GOST 6757 is allowed.

[2] Distilled water as per GOST 6709 from deadweight tester.

[3] Compressed air cleanliness class as per ISO 8573-1: 6 3 1.

[4] Extra-pure 2nd grade nitrogen as per GOST 9293-74 (OKP 21 1412 0440).

Pilot wheel of connecting nut 1
Valve O-ring 009-013-25-2-2 4
Sealing ring 048-052-25-2-2 2
Connector and hose O-ring 004-007-19 3
Special O-ring 007-010-19-2-2 1
Operation manual, data sheet 1

GOST 9833

4 Design and Principle of Operation

4.1 Separator overview is shown on Fig. 1.

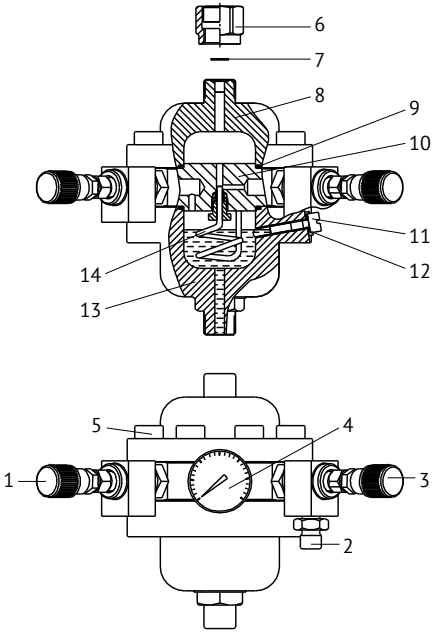

Fig. 1. Separator design

1 — depressurizing valve; 2 — connector; 3 — pressurizing valve; 4 — manometer; 5- screw; 6- connecting nut; 7 — rubber-metal sealing; 8 — upper chamber housing; 9 — sealing ring; 10 — valve block; 11 — screw; 12 — special sealing; 13 — lower chamber housing; 14 — tube

4.2 Upper chamber housing 8 (Fig. 1), valve block 10 and lower chamber housing 13 are connected between each other by means of screws 5, and tightness 3 is assured by sealing rings 8. Inside inner cavity of the lower chamber, there is tube 14 preventing from oil ingress from the lower chamber to the upper one. On the lower chamber housing, there is

threaded hole for screw 11 used for working medium level control. This screw is sealed using special sealing 12 comprising of metal washer and rubber ring. On the valve block 10, there are three threaded holes to connect with manometer 4, pressurizing valve 3 and depressurizing valve 1. MI to be tested shall be fixed on the upper chamber housing 8 using connecting nuts 6. Tightness of connection between MI to be tested and the upper chamber 8 is realized by means of rubber-metal sealing 7.

4.3 Separator's lower chamber housing shall be connected with deadweight tester, and compressed air (or nitrogen) source shall be connected with feeding valve 3 using connector 2.

4.4 Separator's lower part is filled with working medium (oil or distilled water), and the upper part of the separator is fed with air or nitrogen. Both parts of the separator are connected by means of channels providing pressure equilibrium in any part. Pressure adjustment is performed using valve 1 and 3.

5 Safety Precautions

Attention

The Section is intended for the personnel safe operation, safekeeping of the separator and the pressure metering devices used with the unit.

5.1 The unit must not be used for any operations not specified in the manual.

5.2 Prior to MI installation make sure that they are clean and connecting nozzles are serviceable.

5.3 Use only standard O-rings.

5.4 Manually tighten connecting nuts to notable stop.

5.5 Compressed air (or nitrogen) sources with no max pressure of 26 MPa (260 kgf/cm2) limitation are prohibited to be used.

5.6 Pressure exceeding 25 MPa (250 kgf/cm^2) is prohibited to be generated.

5.7 Oxygen or other gaseous, mixture with working medium of which may be explosive, are prohibited to be used.

5.8 Do not use separator with mechanical damages.

5.9 Do not mount MI to be tested intended for hydraulic liquids on this separator.

5.10 Instruments can be removed from the separator only after complete pressure release.

5.11 Do not leave pressurized separator.

5.12 Separator may be removed only after complete pressure release. Wait oil is fully drained from the lower chamber before removing.

5.13 Fast depressurizing is prohibited. This may result in working medium foaming and ingress into MI under test.

6 Preparation for Operation

6.1 The separator is supplied pre-assembled.

6.2 Using connecting nut supplied with the deadweight tester, mount the separator on deadweight tester rack (or on hydraulic pressure generator, etc.) (there is threaded hole M20x1.5 in the lower chamber housing).

6.3 Undo screw 11 (Fig. 1).

6.4 Using connecting nut 6, mount the MI to be tested on the upper chamber housing.

Attention

Oxygen or other gaseous, mixture with working medium of which may be explosive, are prohibited to be used. Separator working pressure shall not be exceeded.

6.5 Using deadweight tester pump (by working liquid bleeding) fill the separator with working liquid up to the lower side of the liquid level control hole, as shown at Fig. 2. Compressed air (or nitrogen) source shall be set for max pressure of 26 MPa (260 kgf/cm^2).

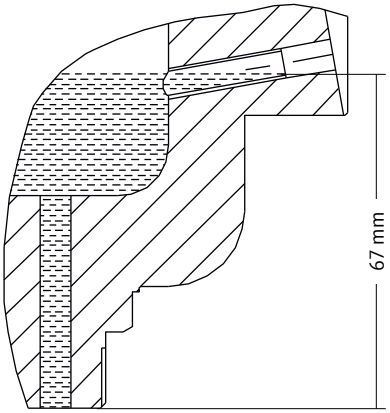

Fig. 2. Working liquid level:
In this case, height of a liquid column will be 67 mm

6.6 Tighten screw 11 and insert special sealing 12 (Fig. 1).

6.7 Connect compression air (or nitrogen) source hose to connector 2 at feeding valve 3.

Attention

Manually tighten the hose until noticeable stop. Tightness of connection depends on the rubber ring and not on the tightening force.

7 Operation Procedure

7.1 Prepare the separator for operation as per section 6.2 instructions.

Attention

Inside the unit, on which separator is installed (press, deadweight tester, etc.), residual air shall be. Standards to be connected with the pressure generator shall be filled with working liquid used in this pressure unit. Use unit specific Operation Manuals when handling these devices.

7.2 Mount the MI to be tested on the separator. Using connecting nut 6 (Fig. 1), fasten it on the upper chamber housing.

7.3 Slowly open pressurizing valve 3 until required gauge pressure is generated within the separator (in case of deadweight tester — until weights are rising). When required pressure is achieved, close pressurizing valve 3. For additional pressure control, use manometer 4.

Attention

Manometer 4 is indicator and is not required to be calibrated.

7.4 Using deadweight tester hand wheel (or hydraulic pressure generator or similar), finally adjust pressure.

Attention

Do not make more than three turns of deadweight tester hand wheel because it may result in significant liquid column increase in the lower chamber of the separator.

7.5 Read values of MI under test.

Note

As liquid column height in the separator (Fig. 2) used for pressure calculation may slightly influence on the accuracy of measurement, when more precise pressure measurement is required, please use equation and method provided in Appendix A. When reference elastic-element manometer is used, working liquid level may significantly change in dependence on filled volume.

In the lower chamber of the separator, there is 40 ml of working liquid. Due to this, reference manometer shall be filled with working liquid as much as possible.

7.6 For another calibration point or for higher pressure calibration, repeat items 7.3–7.5.

7.7 For lower pressure point, decrease pressure in the separator to required value (pressure shall be checked at the manometer under calibration) by slowly opening depressurizing valve 1 (Fig. 1).

Attention

Fast depressurizing is prohibited. This may result in working medium foaming and ingress into MI under test.

Do not make more than three turns of deadweight tester hand wheel because it may result in significant liquid column increase in the lower chamber of the separator.

7.8 Using deadweight tester hand wheel (or hydraulic pressure generator or similar), finally adjust pressure.

7.9 Read values of MI under test.

7.10 For another calibration point or for lower pressure calibration, repeat items 7.7–7.9.

7.11 Final system depressurization is realized by slowly opening and closing of depressurizing valve 1.

7.12 When work is done, disconnect compressed air (nitrogen) source and open pressurizing / depressurizing valves.

8 Maintenance

8.1 In order to keep the separator in the good working order, daily and routine maintenance is required.

8.2 Daily maintenance

8.2.1 Before operation, wipe the dust out of the separator.

8.2.2 Make sure that there is no working liquid leakage.

8.2.3 Check feed valve and depressurizing valve for smooth operation.

8.2.4 Check rubber-metal sealing 6 (Fig. 1) integrity; if required, replace it.

8.2.5 Check connecting hose integrity.

8.3 Routine maintenance

8.3.1 Undo crews 5 and remove the upper chamber 8 and the lower chamber 13 from the vent valve 10.

8.3.2 Flush upper chamber housing 8, lower chamber housing 13 and valve block with synthetic detergent. Using syringe, wash the tube 14 and then blow it with compressed air. Flush with fresh water.

8.3.3 Dry washed components of the separator.

8.3.4 Before the separator assembly, check integrity of sealing rings of the upper and lower chamber 9; replace them, if required.

8.3.5 Check hose nozzle rubber sealing integrity; replace it, if necessary. To mount the rubber ring, using flat end of any cylindrical object, press on the ring and tilt it from one side to another.

8.4 Maintenance shall be performed as required, but no less than once every 3 months.

Attention

Depressurizing valve 1 and feeding valve 3 do not require to be dismounted and flushed. It is not required to screw manometer 4 out of the valve block 10.

8.5 Assemble the separator in reverse order.

8.6 Crews 5 tightening torque shall be at most 1 kg/m.

9 Storage

9.1 Separator storage in laboratory environment.

9.1.1 When storing the separator in laboratory environment, wipe it with clean cloth and cover it with a polyethylene cap.

9.1.2 Provide for separator stable position on the table, shelf or device protecting it against falling down and personal injury.

9.2 Separator storage in warehouse environment.

9.2.1 Before separator storage, maintenance operations under item 3.3 shall be done.

9.2.2 Wipe it down with clean cloth and pack in original packaging (or similar).

9.2.3 Cases with separators shall be stored in accordance with handling signs.

9.2.4 The separator shall be stored in a dry heated room at an air temperature no lower than +5 °C and relative humidity 80±20%.

10 Troubleshooting

Malfunction	Cause of the malfunction	Repair method
Air release beneath connecting nut	Rubber-metal sealing is damaged or incorrectly installed under manometer	Replace or change rubber-metal sealing
	The end surface of a manometer union is damaged	Replace or repair the manometer
Air release between the lower chamber, valve block and the upper chamber of the separator	Damage of rubber seal	Replace the seal, tightening torque of bolts 8 (Fig. 1) shall be 0.5kg ×m
Air release from pressurizing / depressurizing valve	Loose valve sealing	Tighten hex-nut (at the end of the valve) until air stops releasing

11 Warranty Obligations

11.1 The manufacturer guarantees compliance of the separator with the requirements of TU 4212-004-91357274-2011, provided that the customer observes the conditions of transportation, storage, installation, and operation.

11.2 The warranty service life is 18 months from the date of the separator shipment to the customer.

11.3 The average service life is at least 8 years.

11.4 Warranty does not cover any sealing damages as well as defects due to intensive operation.

12 Claim Details

In case of the separator failure, prepare a certificate of required repair and submit it to the following address: «Alfapascal» LLC, 36, 2nd Paveletskaya, Chelyabinsk, 454047, Russia, phone: +7 (351) 725-74-50, e-mail: q@alfapascal.ru

13 Acceptance Certificate

Pneumatic-hydraulic separator RPG, serial number _____, complies with TU 4212-004-91357274-2011 and is approved as fit for operation

Date of issue

Responsible person _____ _____ LS
Signature Surname

14 Packing Certificate

Pneumatic-hydraulic separator RPG, serial number _____, was packed at «Alfapascal» LLC in accordance with TU 4212-004-91357274-2011 and is approved as fit for operation

Date of packing

Responsible person _____ _____ LS
Signature Surname

Note

Manufacturer reserves the right to incorporate changes in the instrument structure that do not affect major properties without any additional notification.

Additional information may be found at: alfapascal.ru/products/rgbrpg

Annex A (Informative)

Additional error due to difference between PCA piston lower cut-off (or reference MI connector) and working liquid level in the separator.

The error is due to the presence of a working liquid column between the levels of the lower cut-off of the PCA piston (or reference MI connector) and the level of the working liquid in the separator and exerting hydrostatic pressure.

In case of levels difference, correction calculated as per the equation below shall be made:

$$\Delta=\rho \cdot g_m \cdot H \quad (0)$$

where, Δ— correction value, Pa;
ρ — working liquid density, kg/m^3;
g_m — local gravity acceleration, m/s^2;
H — difference between levels, m.

In practice, the following equation is more convenient:

$$\Delta=H \cdot g_m \cdot K \quad (1)$$

where, Δ — correction value;
K — coefficient for transformer oil density (ρ=895 kg/m^3) and multiplier for converting to other units;
g_m — local gravity acceleration, m/s^2;
H — difference between levels, cm.

Coefficient K values for different units are provided in Table 1.

Table 1. Coefficient K value

Units of measurement	**Coefficient K**
MPa	$8{,}95 \cdot 10^{-6}$
bar	$8{,}95 \cdot 10^{-5}$
kgf/cm^2	$9{,}12646 \cdot 10^{-5}$

By putting K value (as per units required), local gravity acceleration value, and value of difference between levels to equation (1), correction factor may be calculated for required pressure units.

Additional correction factor may be deducted from pressure value generated by weights, in case the connector of the instrument under test is upper than the lower cut-off of the PCA piston (or reference MI connector) and vice versa.