

RIVA-STEEL, LLC
95 Chervonotkatska Str., Kyiv
Tel. (044) 277-28-38, (067) 277-28-38

Operation manual

High Pressure Reactors
RVD-1-25; RVD-1-50;
RVD-2-150; RVD-2-250; RVD-2-500;
RVD-2-700; RVD-3-1000; RVD-3-2000;
RVD-3-3000; RVD-3-5000; RVDS-1-1000;
RVDS-1-2000; RVDS-1-3000; RVDS-1-5000



This manual provides recommendations to the user for safe and proper operation of the high pressure laboratory reactor (hereinafter referred to as the reactor). In order to ensure safe operation and learn to use the equipment for its intended purpose, the user must read the relevant sections of this manual.

Before use, read the operating instructions carefully.

After unpacking, carefully inspect the equipment for mechanical damage and parts lost during transportation. In case you find any damage that has occurred during transportation, contact the manufacturer immediately and do not switch on the equipment.

This operation manual does not include repair instructions. In case any repair works are needed, contact your dealer or RIVA-STEEL, LLC representative.

1. General provisions.....	4
1.1. Hazardcategories	4
1.2. Personnelqualifications.....	4
1.3. Equipment proper use	5
1.4. General safety information.....	6
1.5. Safety	7
1.6. Warranty	7
1.7. Defects elimination	8
2. Installation and commissioning.....	9
2.1. Operating conditions.....	9
2.2. Standard supply.....	9
2.3. Unpacking/checking	9
2.4. Installation	10
3. Devicedescription	12
3.1. Basicequipment	12
3.2. Technical specifications.....	13
3.3. Auxiliary equipment	22
3.3.1. Electric heating jacket.....	22
3.3.2. Stirrer (stirrer motor with magnetic coupling)	22
3.4. Sampling liquids and gases (optional)	22
4. Operation procedure.....	23
4.1. Opening andclosing	23
4.2. Filling the reactor tank	24
4.3. Operation procedure.....	24
4.4. Heating	25
4.5. Sampling liquids and gases (optional)	25
5. Service and maintenance	26
5.1. Flushing the reactorout.....	26
5.2. Flushing the magnetic coupling out	27
5.3. Maintenance	28
5.3.1. Periodic tests	30
5.3.2. Reviews	30
5.4. Repairs/Customer service	30

1. General provisions

Read the operation manual carefully before operating the reactor. Failure to follow the instructions in manual could result in equipment failure or personnel injury. Safety instructions are highlighted in bold and marked with the symbols described in the “Hazard categories” section.

1.1. Hazard categories

In this manual, below warning signs are used to ensure personal safety and to avoid equipment failure. The requirements set out in these warnings must be strictly followed! In this manual, safety information is highlighted in bold:



Caution! This means that in case the safety instructions are not followed, workers are likely to be seriously injured, a fatal event is likely to occur, or the equipment is likely to be severely damaged.



Attention! This means that in case the safety precautions are not followed, workers may be seriously injured, a fatal event may occur, or the equipment may be severely damaged.



Attention! This means that in case the safety precautions are not followed, workers may be injured or the equipment may be damaged.



Attention! This symbol indicates the importance of the product information provided or that special attention must be paid to this part of the manual.

1.2. Personnel qualifications

Only qualified users should be allowed to operate this equipment. According to the requirements of this manual, qualified users are specialists who have reached 18 years of age, have undergone special training, and have a sufficient level of knowledge in the field of chemistry and technology. They are also required to be trained in legal issues related to working with pressure vessels and safe handling of chemicals.

1.3. Equipment proper use



Caution! Explosion hazard!

This equipment is not designed for work with chemicals that decompose as a result of exothermic reactions or form explosive vapours when heated.

There are several categories of functional groups, which presence in the composition is a common indicator of explosive potential. The use of reagents containing such functional groups in a high pressure reactor is contraindicated. Some of the function groups are indicated in table 1.

Table 1

Name	Structure
Acetylide	$\text{---C}\equiv\text{C---Metal}$
Amine oxide	$\begin{array}{c} \diagup \\ \text{N}^{\oplus} \text{---O}^{\ominus} \\ \diagdown \end{array}$
Azide	$\text{---N}=\text{N}^{\oplus}=\text{N}^{\ominus}$
Chlorate	---ClO_3
Diazo	$\text{---N}=\text{N---}$
Diazonium	$(\text{---N}\equiv\text{N})^{\oplus}\text{X}^{\ominus}$
Fulminate	$\text{---O}=\text{N}=\text{C}$
N-Haloamine	$\begin{array}{c} \text{Cl} \\ \diagup \\ \text{---N} \\ \diagdown \\ \text{X} \end{array}$
Hydroperoxide	---O---OH
Hypohalite	---O---X
Nitrate	---O---NO_2
Nitrite	---O---NO
Nitro	---NO_2
Nitroso	---NO
Ozonide	$\begin{array}{c} \text{---O---O---} \\ \diagup \quad \diagdown \\ \text{O} \end{array}$
Peracide	$\begin{array}{c} \text{---C---O---OH} \\ \\ \text{O} \end{array}$
Perchlorate	---ClO_4
Peroxide	---O---O---



Attention!

Follow all operating instructions!

Special care is always required when working with pressure vessels. It is necessary to follow the technological instructions strictly, comply with all legislation requirements and general safety regulations related to the handling of a certain list of chemicals.

Only an operator may allow specially trained personnel to operate the reactor and reactor auxiliary equipment.

The operator must prepare appropriate process instructions for workers operating the reactor or auxiliary equipment.

The reactor is intended to work as a reaction vessel for the study of materials and chemical reactions that are performed under excess pressure. The increased pressure in the sealed vessel is formed by injecting gases or heating the reaction solution.

The reactor can be used only:

- For its intended purpose.
- Provided it is in good technical condition.
- Provided no unauthorized changes or additions were made to the design.
- Provided qualified users are working with the equipment.

It is also necessary to comply with all relevant state regulations and orders.

1.4. General safety information

When working with the reactor, it is necessary to follow safety rules and stay within the generally accepted laboratory methods. Therefore, before working with the system, workers should carefully read the general safety information below, and follow it strictly in further work.

The manufacturer accepts no liability for damage resulting from improper handling of the equipment.

The equipment is not intended for work with oxygen. In case flammable substances are used near the reactor, it is also necessary to provide similar protection against possible explosion. In the event that the bursting disk is triggered, the vapours must be safely released in accordance with the requirements set out in the regulations. In case the reactor is equipped with a sampling container, it is also necessary to install safety valves on it.



Vapours!

In case overpressure protection (e. g. a bursting disc or pressure relief valve) is triggered, gases can enter the atmosphere any time, which can pose a threat to workers. Therefore, make sure that the opening of the overpressure protection device is not directed towards the workers. Most often, a high pressure hose is connected to the overpressure protection device to discharge gases safely.

Never open the reactor that is under pressure. Never force the reactor open. Never open the reactor with home-made tools and/or tools not intended for this operation!

After opening, hot gases and vapours can escape the reactor! The reactor can only be opened when the temperature and pressure inside are equal to the ambient temperature and atmospheric pressure. Therefore, wait until the reactor has cooled to room temperature. Only then can pressure be released to atmospheric pressure and the reactor be opened.

Be very careful when working with toxic substances. Be sure to follow all safety requirements!

In case the reactor is working with strong acids (e. g. nitric acid, hydrochloric acid, sulphuric acid, phosphoric acid, hydrofluoric acid), it cannot be used without a PTFE cup. However, this will not provide vapour protection of exposed metal surfaces.

Regularly inspect all components of the reactor for any damage (corrosion, cracks, etc.). All relevant regulations and provisions related to the operation of high pressure reactors must be complied with.



Caution!

If a clearly dangerous situation develops during the reactor operation, for example, due to an unexpected reaction or dangerous impact of external factors, it is necessary to take all the necessary countermeasures and, if necessary, to decommission the reactor.

A complete detailed inspection of the reactor must be performed if, due to any malfunctions, the pressure exceeds the permissible value by more than 10 %, or if there is a significant excess of the permissible operating temperature, or if the reactor or its fittings have been damaged.



Attention! Maximum operating temperature and operating pressure!

It is forbidden to exceed the maximum internal temperature and the maximum working pressure (see Technical Specifications section). Exceeding the maximum temperature can reduce the reactor strength and damage the sealing.



Attention! Auxiliary equipment!

The reactor can be used only in conjunction with special heating and mixing systems. Try to prevent liquids, especially toxic mixtures, from leaking onto the hot surfaces of the reactor.



Attention! High voltage auxiliary equipment!

Be sure to earth the heating and mixing systems. Earthing is provided by the power supply used by the heating system: its plug socket is connected to the corresponding earthing circuit. In case a long cable is required to connect the system to the power line, make sure it is a three-core cable with a neutral wire.

1.5. Safety

Every reactor manufactured by RIVA-STEEL, LLC is tested under a pressure equal to the maximum operating pressure increased by 1.65 times, and a relevant Test Report is issued. To prevent accidental switching-on of the equipment, it is necessary to disconnect it from the main power line and to block switching-on function in situations as follows:

- In case you find damage signs.
- In case you find out that any parts or components of the equipment are lost.
- In case the equipment does not work.
- In case you had to store the equipment in unsuitable conditions (for example, outdoors or in a very humid room) for a long time.

1.6. Warranty

RIVA-STEEL, LLC guarantees that each product manufactured by the company meets technical conditions TU U 29.2-33345384-002: 2010. Unless otherwise specified, the warranty period is 18 (eighteen) months from the delivery date. The warranty does not cover damage to equipment due to improper installation, maintenance, operation, accident, negligence, replacement of parts and components, improper use of equipment, normal wear and tear, and other reasons. RIVA-STEEL, LLC does not satisfy requests for replacement of physically worn parts and components.

1.7. Defects elimination

According to the warranty, RIVA-STEEL, LLC repairs or replaces any products that, according to RIVA-STEEL, LLC, are defective and covered by the warranty. This is the only and exclusive way to compensate defects to the customer. In case RIVA-STEEL, LLC concludes that the problem may not be solved by repairing or replacing part of the equipment, the buyer has the right, at their sole option, to reimburse the purchase price paid for the disputed product or get another company product. Equipment considered defective must be accompanied by a warranty claim describing the defects.

The description should include the name, address, department (if possible), and telephone number for contact.

If possible, the equipment should be returned in its original packaging. RIVA-STEEL, LLC cannot take responsibility for damage to the equipment that may occur during transportation due to improper packaging.

2. Installation and commissioning

2.1. Operating conditions

Pressure equipment must be installed in such a way as not to endanger operators or other workers. It is necessary to agree upon and take into account all safety zones defined by regulations.

The reactor must be installed in such a way that:

- It is accessible from all sides and could be inspected from any side if necessary.
- It is protected from external mechanical damage and unpredictable damage.
- The access to the reactor by unauthorized persons is impossible.



Attention:

In case you are not sure how the reaction will take place, or if pressure may suddenly rise or an exothermic reaction may start during operation, then the reactor must be installed in a special chamber.

The installation location of the equipment must meet the following requirements:

Ambient temperature of +10 °C to +40 °C

Additionally, the transportation or storage temperature must fall within the range of +10 °C to +50 °C.

2.2. Standard supply

Due to the modular design of the reactor, there is no generally accepted standard supply of this equipment. Therefore, to check the completeness of your equipment, see the accompanying documentation.

2.3. Unpacking/checking

Open the transportation packaging. Please keep all packages so that you could return the equipment in the original package to receive certain services from the manufacturer.

Unpack all other components and accessories and make sure they are complete.

Check the system for any damage that may have occurred during transportation (cracks, scratches, cracks, etc.).



Attention! Visual damage!

For safety reasons, do not start operation if you find obvious signs of damage to the equipment. Contact your local dealer or company representative for appropriate services.



If you find any equipment components missing or damaged after unpacking, contact your local dealer or company representative.

2.4. Installation



Attention! High voltage auxiliary equipment!

Be sure to earth the heating and mixing systems. Earthing is provided by the power supply used by the heating system: its plug socket is connected to the corresponding earthing circuit. In case a long cable is required to connect the system to the power line, make sure it is a three-core cable with a neutral wire.

Installation of the equipment at the workplace

In case the purchased equipment included auxiliary equipment, it is necessary to install it first, in particular, the heating system. Install the reactor in a heating jacket and place the entire system on a predetermined work surface. The work surface must be of appropriate dimensions to sustain the weight of the reactor system.

Assembly

The reactor is delivered fully-assembled. All PTFE inserts, special fittings and optional auxiliary equipment supplied are already installed and secured. However, after unpacking, all fasteners that may loosen during transport must be rechecked. If necessary, tighten loose connections.

Connection

The material supply line (e. g. pressurized gas supply lines) must be connected to the reactor via one of the valves. The connection should be made by crimping a pipe of appropriate diameter in the clamping fitting of one of the valves as shown in clause 5.3.



Attention: The operator must inspect the equipment before starting operation.



Attention:

Users are responsible for installing appropriate ventilation to remove toxic gases. Make sure that the design and installation of ventilation systems comply with the current legislation.

The system is now ready to operate.



3. Device description

3.1. Basic equipment

The reactor is intended to work as a reaction vessel for the study of materials and chemical reactions that are performed under excess pressure. The increased pressure in the sealed vessel is formed by injecting gases or heating the reaction solution.

Depending on individual design features, reactor components are made of the following materials: stainless steel and fluoroplastic.

The minimum set of equipment for each high pressure reactor, depending on the model, consists of:

- cover, metal cup, clamp/clamping nut;
- fluoroplastic parts: cup, insert, screws, gasket;
- sealing gasket: PTFE O-ring, silicone O-ring;
- fittings and measuring instruments: inlet/outlet valve, pressure gauge, bursting disk in a case, thermopocket, fittings set.

Auxiliary equipment may be used as follows: additional shut-off valves, thermostatically controlled heater, magnetic coupling, stirrer, etc.

The reactor is sealed by tightening the clamp/clamping nut, followed by deformation of the O-ring/gasket. The locations of the pressure and temperature sensors are selected so that the change in pressure and temperature can be monitored.

Auxiliary equipment

The temperature of the heating jacket and, consequently, the reactor can be controlled by Riva controller.

The reactor is designed, constructed, and tested in accordance with TU U 29.2-33345384-002: 2010.

Optional equipment supplied:

- Sampler for liquids.
- Sampler for gases.

3.2. Technical specifications

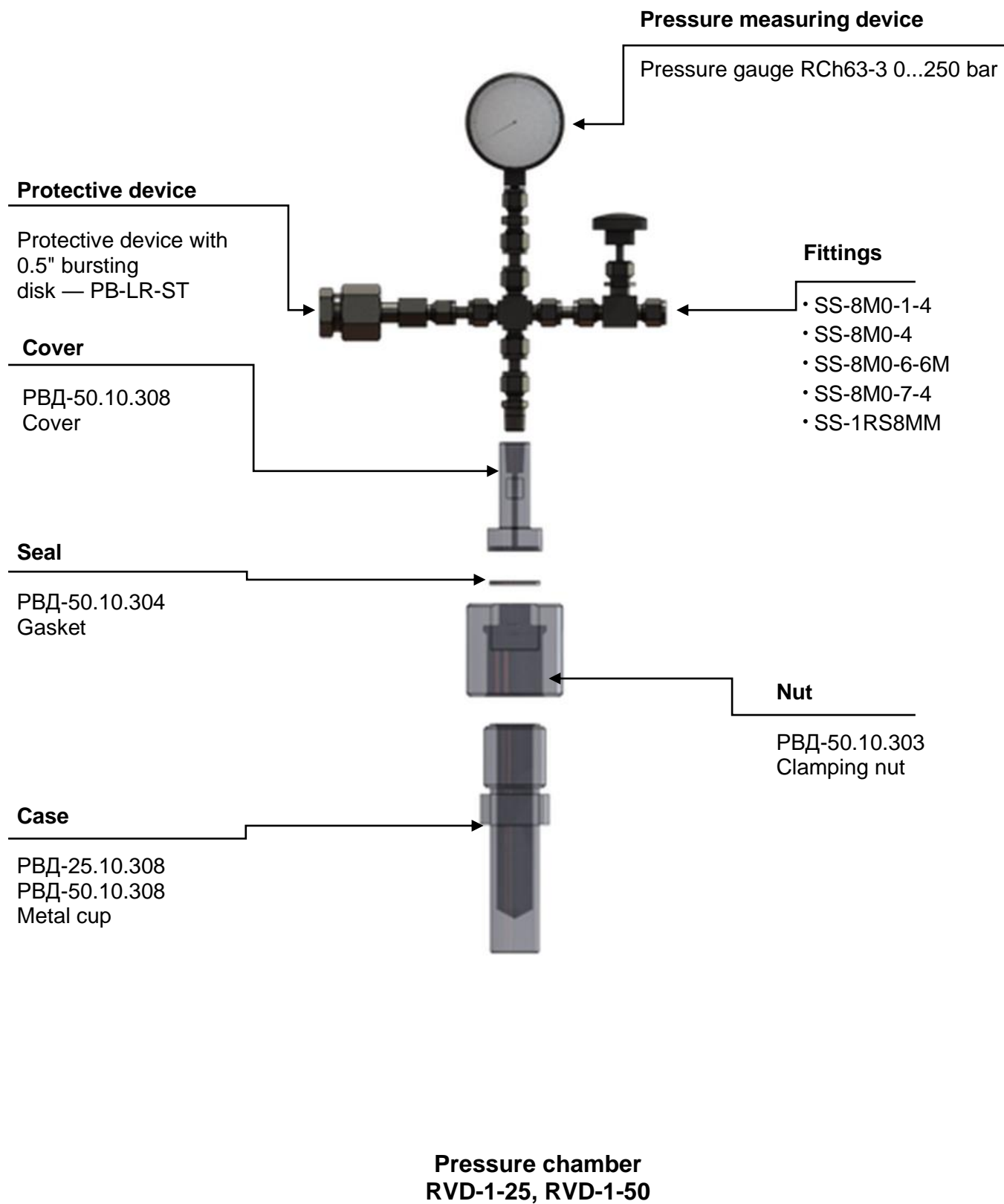
Stainless steel reactors

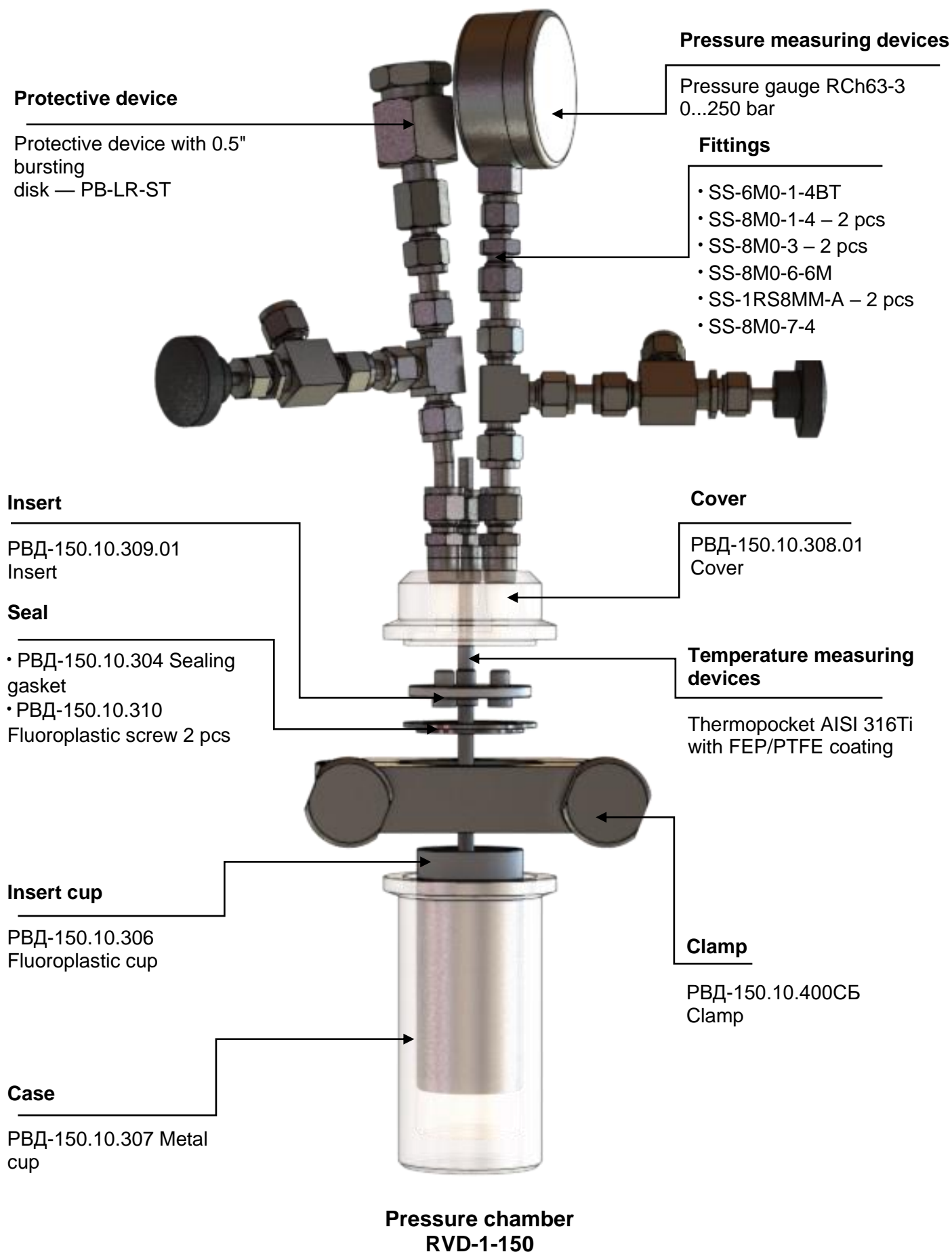
Device type	Metal cup volume, rated, L (mL)	Maximum operating pressure (P), MPa	Maximum operating temperature (T), °C
RVD-1-25	0.025 (25)	20	250
RVD-1-50	0.050 (50)	20	250
RVD-2-150	0.15 (150)	20	250
RVD-2-250	0.25 (250)	20	250
RVD-2-500	0.5 (500)	20	250
RVD-3-700	0.7(700)	20	250
RVD-3-1000	1.0 (1000)	20	250
RVD-3-2000	2.0 (2000)	20	250
RVD-3-3000	3.0 (3000)	20	250
RVD-3-5000	5.0 (5000)	20	250
RVDS-1-1000	1.0 (1000)	6	250
RVDS-1-2000	2.0 (2000)	6	250
RVDS-1-3000	3.0 (3000)	6	250
RVDS-1-5000	5.0 (5000)	6	250

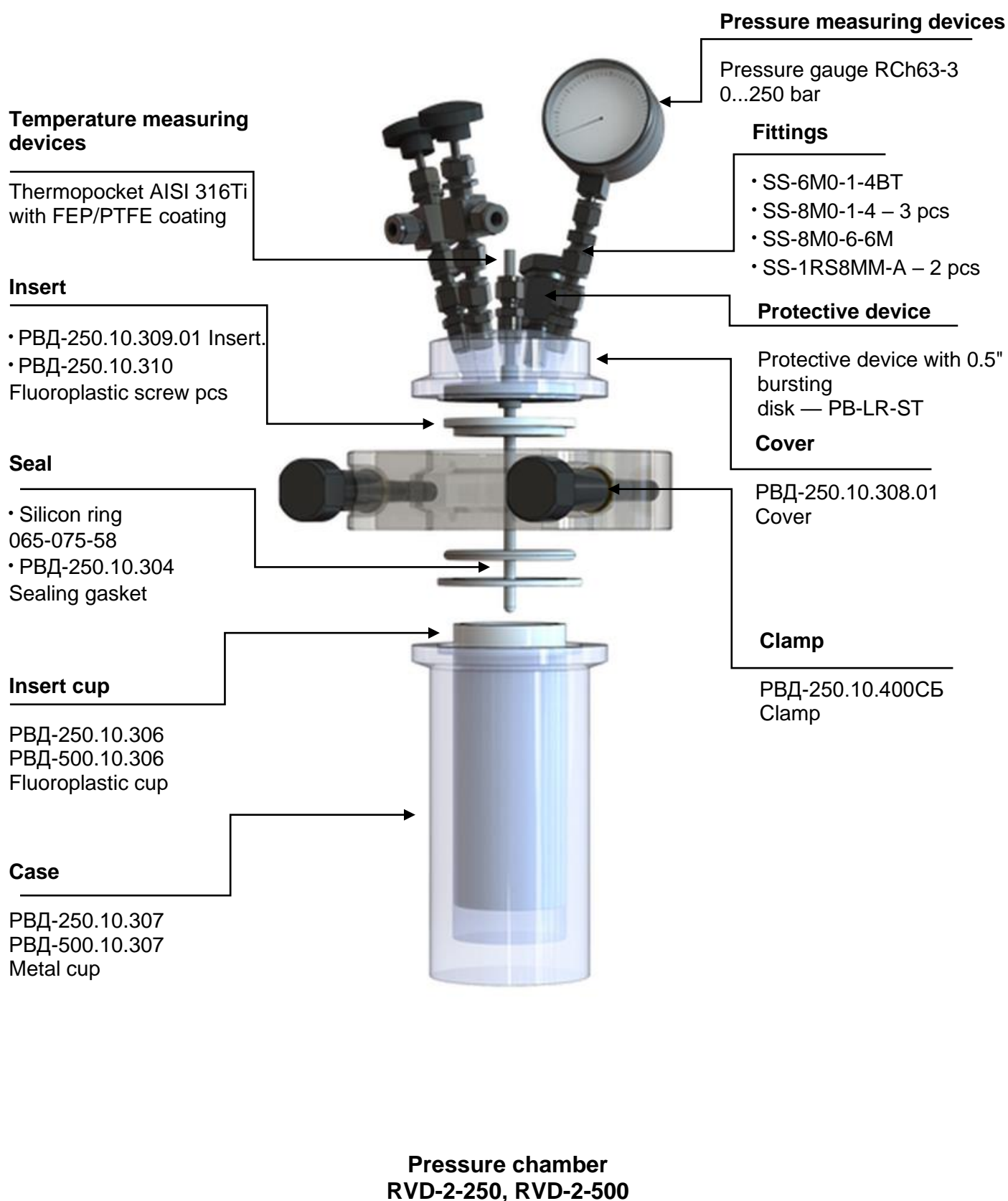
The O-ring material is selected at the customer's request



Each reactor is factory-tested under pressure and checked for leaks, which is confirmed by a relevant hydraulic test report.







Magnetic coupling

MMKP-9

Temperature measuring devices

Thermopocket AISI 316Ti with FEP/PTFE coating

Insert

- PВД-1000.10.309 Insert
- PВД-1000.10.310 Fluoroplastic screw 5 pcs

Seal

- Silicon ring 085-095-58
- PВД-1000.10.304 Seal pad

Insert cup

PВД-700.10.306
PВД-1000.10.306
Fluoroplastic cup

Case

PВД-1000.10.307
PВД-700.10.307
Metal cup

Pressure measuring device

Pressure gauge RCh63-3
0...250 bar

Fittings

- SS-6M0-1-4BT
- SS-8M0-1-4 – 3 pcs
- SS-8M0-6-6M
- SS-1RS8MM-A – 2 pcs

Protective device

Protective device with
0.5" bursting
disk — PB-LR-ST

Cover

PВД-1000.10.308.01
Cover

Clamp

PВД-1000.10.400CБ
Clamp

Stirrers

Stirrer PВД-700.500CБ
Stirrer PВД-1000.500CБ
AISI 316 with PTFE coating

Pressure chamber
RVD-2-700, RVD-3-1000

Pressure measuring devices

Pressure gauge
RCh63-3 0...250 bar

Protective device

Protective device with
0.5" bursting
disk — PB-LR-ST

Insert

- ПВД-2000.10.309 Insert
- ПВД-1000.10.310
Fluoroplastic screw 6 pcs

Seal

- Silicon ring
120-130-58
- ПВД-2000.10.304
Seal pad

Stirrers

Stirrer ПВД-2000.500СБ
Stirrer ПВД-3000.500СБ
AISI 316 with PTFE coating

Magnetic coupling

MMKP-9

Fittings

- SS-6M0-1-4BT
- SS-8M0-1-4 – 5 pcs
- SS-8M0-6-6M
- SS-1RS8MM-A – 2 pcs
- SS-8M0-P
- SS-8M0-7-4

Cover

ПВД-2000.10.308
Cover

Temperature measuring devices

Thermopocket AISI 316Ti
with FEP/PTFE coating

Clamp

ПВД-2000.10.400СБ

Insert cup

ПВД-2000.10.306
ПВД-3000.10.306
Fluoroplastic cup

Case

ПВД-2000.10.307
ПВД-3000.10.307
Metal cup

Pressure chamber
RVD-3-2000, RVD-3-3000

Protective device

Protective device with
0.5" bursting
disk — PB-LR-ST

Magnetic coupling

MMKP-9

Seal

- PTFE O-ring 149-163
- ПВД-5000.10.304
Sealing gasket

Insert

- ПВД-5000.10.309
Insert
- ПВД-1000.10.310
Fluoroplastic screw
6 pcs

Stirrers

Stirrer ПВД-
5000.500СБ
AISI 316 with PTFE
coating

Insert cup

ПВД-5000.10.306
Fluoroplastic cup

Pressure measuring device

Pressure gauge RCh63-3
0...250 bar

Fittings

- SS-6M0-1-4BT
- SS-8M0-1-4 – 5 pcs
- SS-8M0-6-6M
- SS-1RS8MM-A – 2 pcs
- SS-8M0-P
- SS-8M0-7-4

Cover

ПВД-5000.10.308
Cover

Clamp

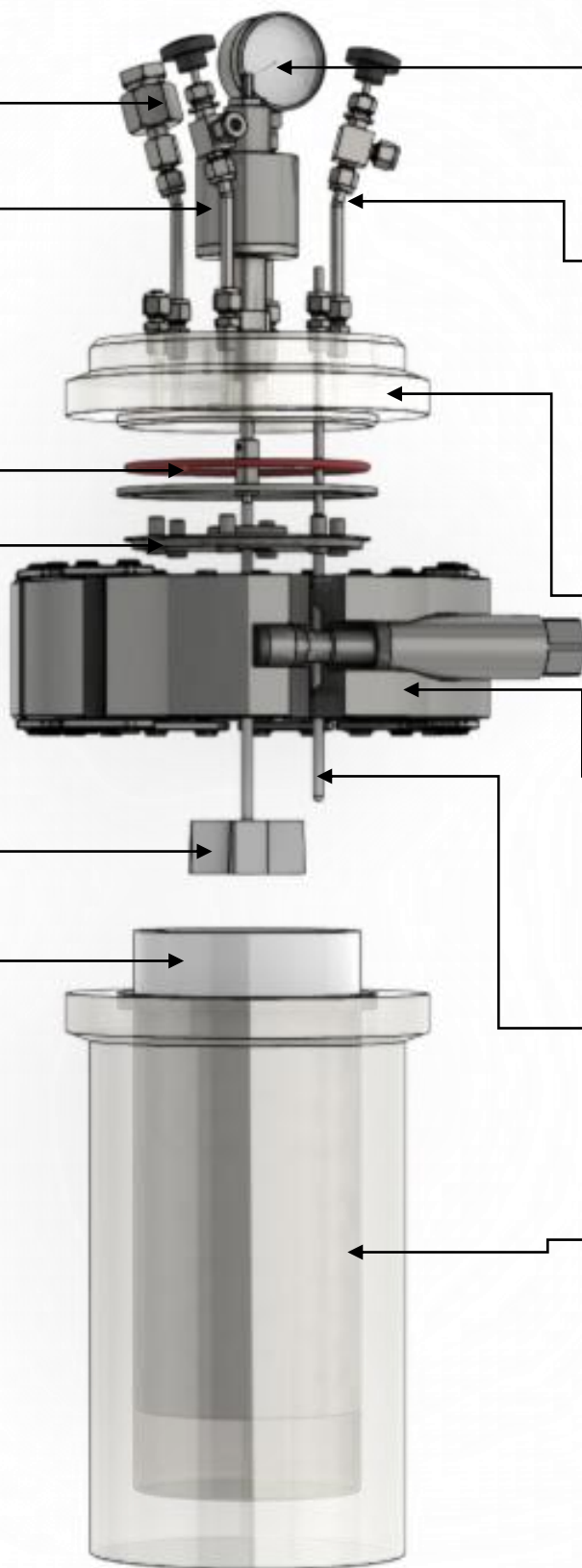
ПВД-5000.10.400СБ
Clamp

Temperature measuring devices

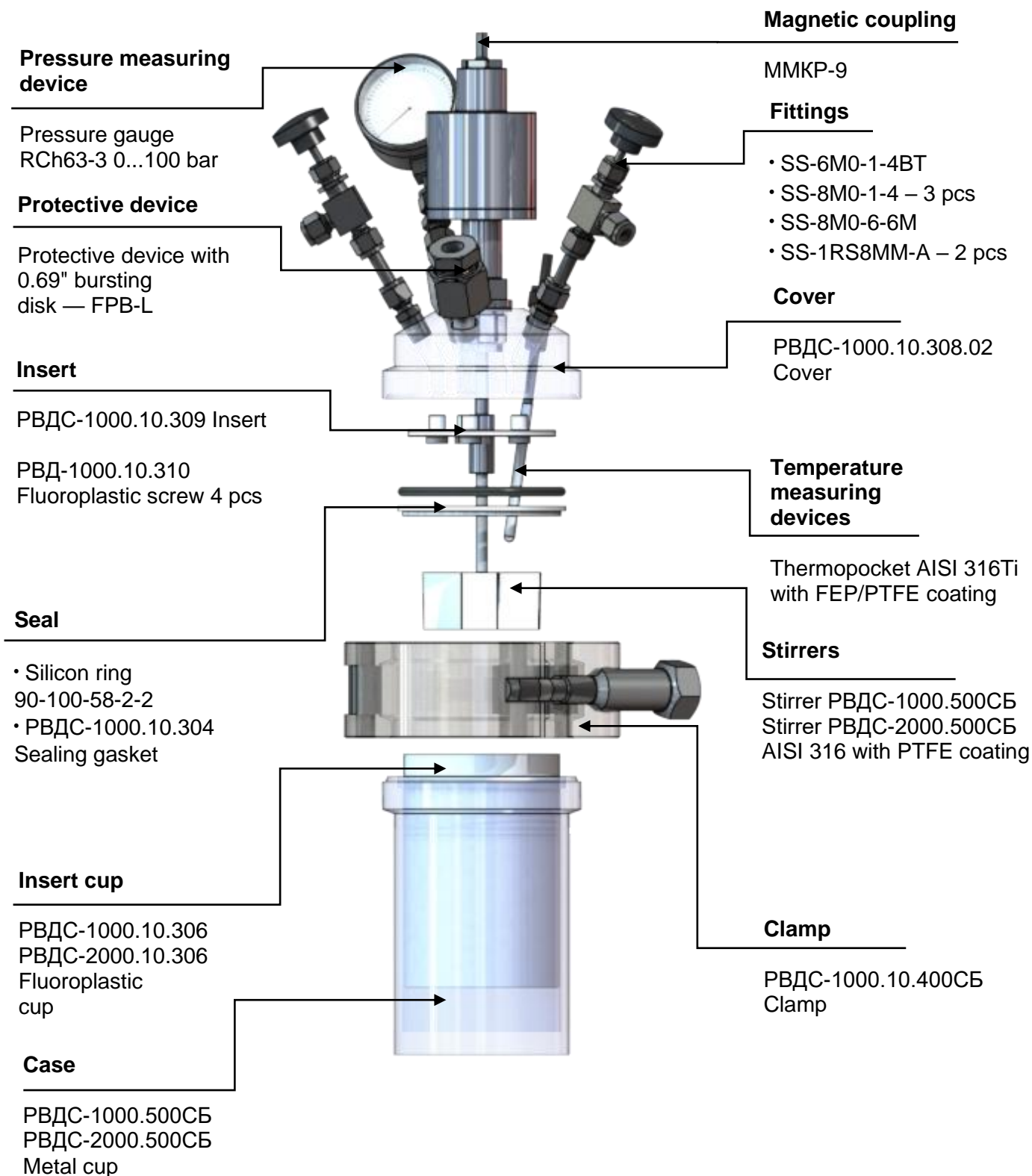
Thermopocket AISI
316Ti
with FEP/PTFE coating

Case

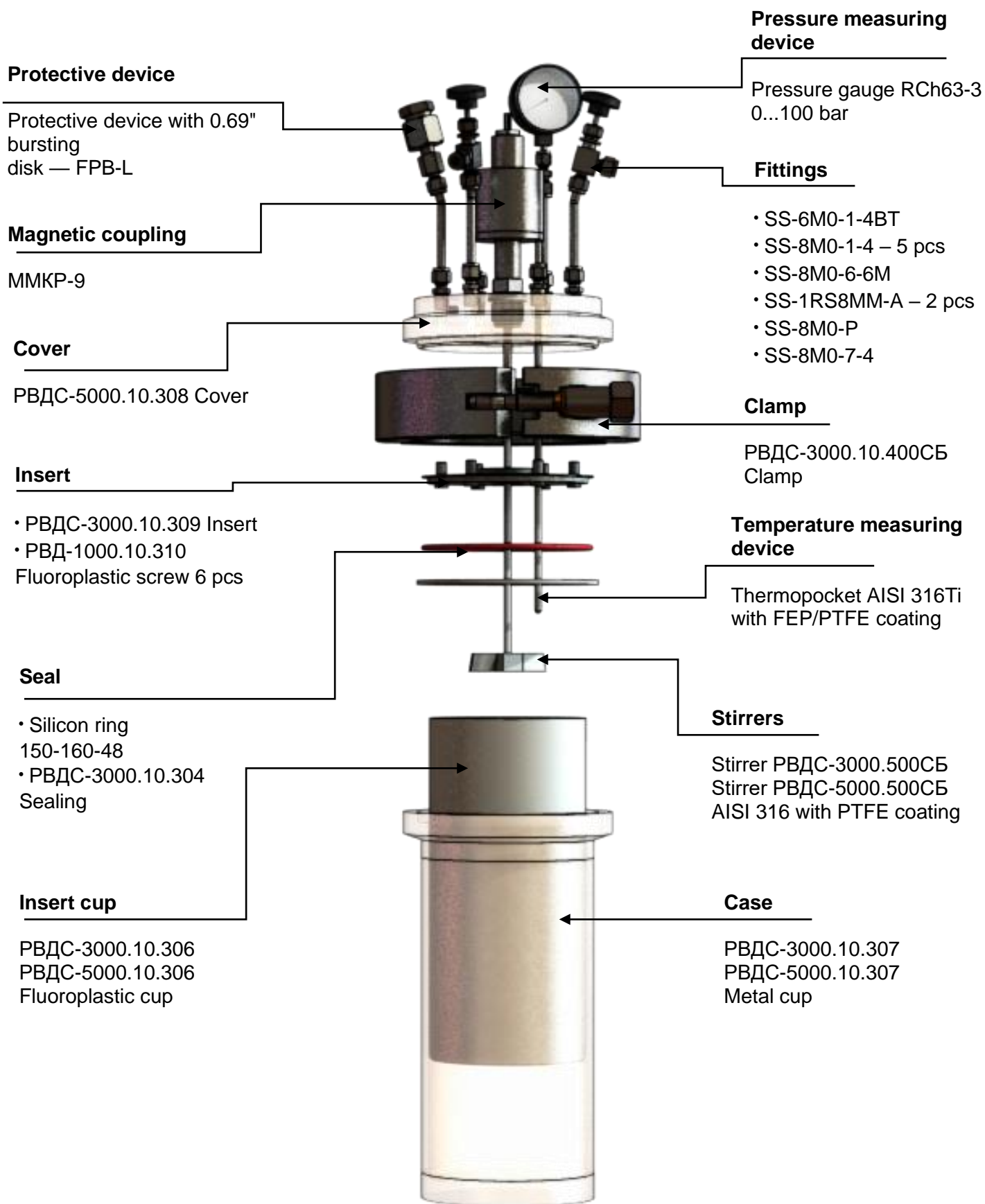
ПВД-5000.10.307
Metal cup



**Pressure chamber
RVD-3-5000**



**Pressure chamber
RVDS-1-1000, RVDS-1-2000**



Pressure chamber
RVDS-1-3000, RVDS-1-5000

3.3. Auxiliary equipment

3.3.1. Electric heating jacket

The main components of the electric heating jacket include a sleeve, a heating element, a protective cover with a powder coating, and a built-in capillary thermostat, which provides mechanical protection against overheating. Temperature control and regulation is carried out by the Riva regulator.

3.3.2. Stirrer (stirrer motor with magnetic coupling)

Substances contained in the laboratory high-pressure reactor can be stirred using a stirrer shaft fitted with blades of different design and different purpose or with a stirring bar. The stirrer is driven by an external motor, which uses a magnetic coupling to transmit torque to the stirrer shaft located inside the reactor. The stirring bar is actuated by a magnetic stirrer. The control functions, i. e. the regulation of the stirring speed, are performed by the stirrer motor.

3.4. Sampling liquids and gases (optional)

Valves for sampling gases and liquids are labelled appropriately and are designed for sampling gases and liquids from the reactor, which is under operating pressure. The sampling tube is immersed into the fluoroplastic cup. The sampling is performed by means of valve opening.

Technical specifications of the sampler

Material	SS 316
Operating temperature	<250 °C
Operating pressure	<200 bar
Sampling tube material	PFA or SS 316L

4. Operation procedure

4.1. Opening and closing



Caution! Vessel operating under pressure!

Never open the reactor that is under pressure. Never force the reactor open. After opening, hot gases and vapours can escape the reactor! Therefore, wait until the reactor has cooled to room temperature. Only then can pressure be released to atmospheric pressure and the reactor be opened.

Be especially careful when working with toxic materials and be sure to follow the technical and safety requirements.

Attention! General operation instructions!

Pressure vessels must be closed properly. Sealing surfaces must be clean and free of damage.

It is necessary that the clamping elements are tightened neatly, with the same force and only enough to ensure tightness.

It is forbidden to tighten or loosen the clamping elements during the operation of the reactor.



Release of gases!

Wait until the reactor has cooled to room temperature.

Carefully open the pressure relief valve and slowly release the excess pressure. As soon as the gases are released and the pressure indicator shows no residual pressure, the reactor is not pressurized. For safety reasons, keep the valves open to prevent an unexpected increase in pressure.



Attention!

If gases are released from the reactor too quickly, the gas cushion between the reactor vessel and the PTFE cup can cause deformation of the PTFE cup.

Opening (clamping ring)

To open the reactor, release the clamping elements.

Opening (of the reactor)

In case the clamp is not removed after the previous step is completed, lightly tap it with a rubber or plastic hammer. Carefully remove the cover and O-ring. When performing these operations, try not to damage the reactor components involved.

PTFE cup

It is forbidden to operate without a PTFE cup.



Attention!

When the reactor is heated, the presence of a gas cushion between the reactor vessel and the PTFE cup can cause deformation of the cup.

Closing (of the reactor)

Install the O-ring before installing the reactor cover.

Closure (of the ring)

The reactor cover is centred by means of a guide ridge and closed by installing a clamping ring and tightening the nut/flywheel

4.2. Filling the reactor tank



Attention!

Be sure to wear goggles and protective gloves!

When performing work involving contact with chemicals, work with acids, pressure vessels, or when washing vessels, etc., be sure to wear goggles and gloves!

The substance involved in the reaction can be added in the PTFE cup by removing the cup from the reactor vessel, or directly in the cup installed in the reactor vessel. After filling, check if the sealing surfaces are clean.

Adding gases

In case the reactor needs to be filled with gas, this operation is performed after sealing the reactor through appropriate gas injection valves. To prevent a sudden increase in pressure inside the reactor, add gases slowly and carefully.

Do not exceed the maximum allowable operating pressure of the reactor.



Attention!

Remember that during the formation of gas as a result of the reaction, during the exothermic reaction, or due to the heating of the reactor during its operation, the pressure in it increases.

4.3. Operation procedure



Caution! Explosion hazard!

Overpressure protection (e. g. bursting disc or pressure relief valve) does not protect against detonation.



Attention!

Be sure to wear goggles and protective gloves!

When performing work involving contact with chemicals, work with acids, pressure vessels, or when washing vessels, etc., be sure to wear goggles and gloves!



Caution! Explosion hazard!

It is forbidden to use the equipment without adequate protection against overpressure (for example, without a bursting disc or pressure relief valve).

This equipment is not designed to work with chemicals that decompose as a result of exothermic reactions or form explosive vapours when heated (e. g. perchloric acid, alcohols, esters, etc.).



Attention! Vapours!

In case overpressure protection (e. g. a bursting disc or pressure relief valve) is triggered, gases can enter the atmosphere any time, which can pose a threat to workers. Therefore, make sure that the opening of the overpressure protection device is not directed towards the workers.



Protect the reactor from possible recoil that can occur when the bursting disk is activated.

4.4. Heating



Attention!

Do not exceed the maximum internal temperature of +250 °C.

The reactor is heated by a specially designed heating jacket. The reactor vessel must be inserted into the heating jacket carefully and evenly.



Attention!

The heating jacket is equipped with a capillary temperature regulator, which prevents exceeding the maximum temperature of the heating jacket of +300 °C (572 °F). The process of temperature adjustment by means of a temperature regulator is described in a corresponding manual.

4.5. Sampling liquids and gases (optional)



Attention!

When performing work involving contact with chemicals, work with acids, pressure vessels, or when washing vessels, etc., be sure to wear goggles and gloves!

Sampling valves for gases and liquids are labelled appropriately. The sampler valve must be opened very slowly so that any connected test line is not under pressure for as long as possible.

5. Service and maintenance

All necessary inspections, maintenance and repair work must be performed in accordance with the relevant regulations and orders.

It is forbidden to reuse any damaged items of equipment, such as stretched, cracked or broken bolts, curved or broken studs, deformed clamps or staples, damaged gaskets, etc. All damaged parts must be replaced.

5.1. Flushing the reactor out

Never open the reactor that is under pressure. Never force the reactor open. Never open the reactor with home-made tools and/or tools not intended for this operation!

After opening, hot gases and vapours can escape the reactor! Therefore, wait until the reactor has cooled to room temperature, and only then open it.



Attention!

All components of the reactor are made of high quality stainless steel, and some parts are made of PTFE. However, we cannot rule out wear and corrosion caused by handling aggressive substances and their vapours.

Therefore, it is very important to wash the PTFE cup after each use and, if necessary, scald with water or rinse with solvent. It is also necessary to thoroughly wash the outer surfaces of the PTFE cup. Rinse the pressure vessel and fittings after each synthesis. After rinsing and before reinstalling the elements, make sure that they are completely dry. Particular care should be taken to ensure that there is no moisture between the PTFE cup and the pressure vessel.

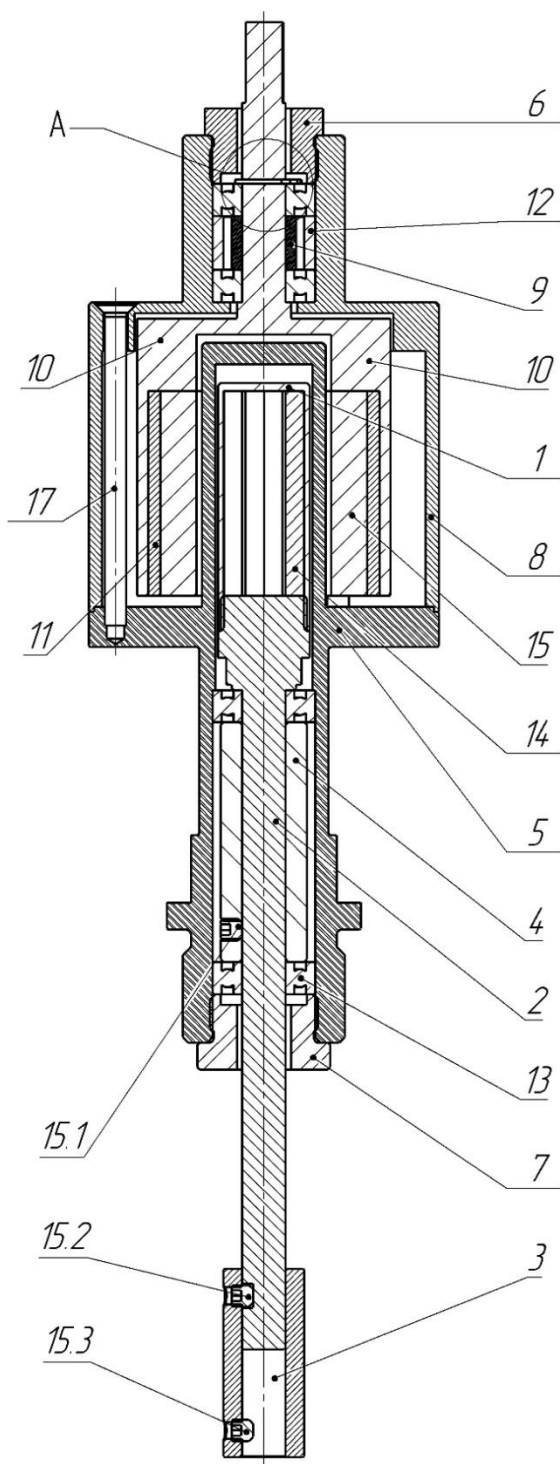
To ensure proper sealing of the reactor, it is essential that all sealing surfaces in the closure zone are clean and smooth. Be sure to replace the O-ring after several cycles of reactor use. After several cycles of thermal loading check fittings, make sure that all knots are securely fixed, and, if necessary, tighten any loose fastenings. After several cycles of operation under excess pressure, there may be signs of bursting disk material wear, which may change the pressure of its activation. Therefore, this element must also be changed. Grease threaded connections of valves periodically.

5.2. Flushing the magnetic coupling out



Attention!

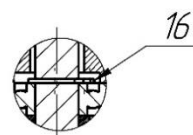
Before flushing out, carefully read the attached specification of the magnetic coupling.



Специфікація

ПОЗ.	НАЙМ.	КІЛ.
1	Ротор внутрішній корпус магнітоб	1
2	Ротор внутрішній ось	1
3	Муфта соединительная	1
4	Ротор внутрішній втулка опорная	1
5	Корпус промежуточный	1
6	Гайка стопорная AISI 304	1
7	Гайка стопорная AISI 316	1
8	Крышка корпуса	1
9	Втулка разделительная	1
10	Ротор наружный	1
11	Кольцо наружных магнитов	1
12	Втулка разделительная наружная	1
13	Підшипник SKF W 619/8-2Z	4
14	ММКР9 Магнит 39 мм	6
15	ММКР9 Магнит 39 мм δ	6
15	Гвинт M4 x 4 DIN 913 A4	3
16	Кільце стопорне 8 x 0.8 DIN 471 A4	1
17	Винт M4x60 DIN965	3

A
(1 : 1)



1. To remove the inner rotor (2) of the magnetic coupling, use: 2 mm hex key and 22 mm tubular key.
2. Disconnect the stirrer from the rotor (2) by unscrewing the screw (15.3) from the coupling (3) using a hex key.

3. Use a tubular wrench to unscrew the lock nut (7) and pull the coupling (3) to remove the rotor (2).
4. After loosening the screws (15.1 and 15.2), remove the coupling (3), lock nut (7), bearing (12), support sleeve (4), and another bearing (12) from the inner rotor (2).
5. Wash all parts and the inner surface of the intermediate housing (5) with mild detergents. In case the desired result is not achieved the first time, use an acid solution (hydrochloric, orthophosphoric, oxalic) or detergent to remove plaque and rust.
6. Dry everything off.
7. Check the condition of the bearings (12) (a bearing must not wedge or make a “crunching” sound, all balls must be in place) and the surface of the inner hexagon screw (15.1.2.3) (make sure it is not broken or corroded). Replace in case defects are found.
8. Put the bearing (12) and the support sleeve (4) on the rotor shaft, tighten the screw (15.1), put on another bearing (12), lock nut (7), coupling (3), and tighten the screw (15.2).
9. If possible, lubricate the inner surface of the intermediate housing (5) and the thread of the lock nut (6) using fluorinated lubricants only.
10. Install the assembled rotor (2) into the intermediate housing (5) and tighten the lock nut (7).
11. Install the blade into the coupling (3) by clamping the screw (15.3).

5.3. Maintenance



Attention! General operation instructions!

It is necessary that the clamping elements are tightened neatly, with the same force and only enough to ensure tightness.

Do not tighten or loosen the mounting bolts during reactor operation.

In order to ensure complete long-term tightness of the reactor under the planned operating conditions and unexpected mechanical, chemical and thermal loads, maintenance of the reactor should be performed by qualified users on a periodic basis. Operators, based on their experience and in accordance with the operating manual, must also include the necessary measures for maintenance and inspection of equipment into their process instructions.

When performing the necessary inspections and maintenance of equipment, special attention should be paid to the inspection and verification of the following elements and parameters:

- Tightness of pressurized equipment.
- Working area and safety zones condition.
- Labels and other signs.
- Correct operation of protective devices and alarm systems.
- Walls thickness in areas where the device is corroded quickly.

Bursting disk replacement

To replace a worn disc, you will need a 29 mm socket head and a torque wrench. Insert the new bursting disk in the order shown below. The PTFE foil inside the bursting disk protects it from the aggressive environment impact. Use fluorinated lubricants to reduce friction. Set the wrench to 180 N·m and tighten the nut.



Attention!

Use original parts only!

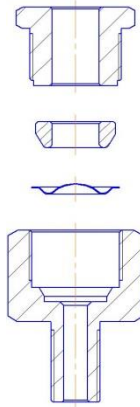


Fig. 1

Only RIVA-STAL recommended bursting discs can be installed in your reactor. This equipment can be purchased from your local dealer or directly from RIVA-STAL.

Components replacement

All reactor components are connected by threaded connectors and clamping rings. Threaded connectors and clamping rings consist of a front and rear crimp ring and a nut.

Installation order:

Insert the tube into the fitting as far as it will go; tighten the nut by hand. Fig. 1.

Mark the nut in a 6 o'clock position. Fig. 2.

Hold the fitting body firmly and tighten the nut for 1-1/4 of a turn to a 9 o'clock position. Fig. 3.

Note: in the case of 2, 3 and 4 mm and 1/16, 1/8 and 3/16 inch pipe fittings, tighten the nut for 3/4 of a turn to a 3 o'clock position.

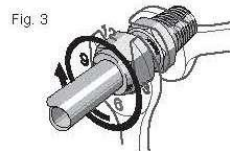
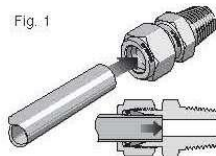


Fig.2

Reassembly:

Before disassembling, mark the tube relative to the face of the nut; draw a line along the planes of the nut and the body of the fitting. Fig. 5.

Install the tube with the crimp rings seated into the fitting body until the front crimp ring is firmly seated in the fitting body. Fig. 6.

Hold the fitting body firmly and turn the nut with a wrench to the pre-tightening position in accordance with the marks on the tube and on the plane. You can feel a significant increase in resistance at this point. Fig. 7.

Slightly tighten the nut.

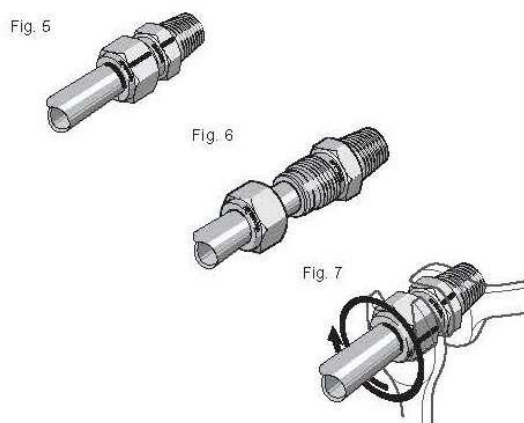


Fig.3

5.3.1. Periodic tests

The reactor operator must conduct periodic tests of the equipment in accordance with the applicable law only under the guidance and with the participation of specialists from a certified test centre.

5.3.2. Reviews

Inspect the outer and inner surfaces of the reactor after each use. It is forbidden to reuse any damaged items of equipment, such as stretched, cracked or broken bolts, curved or broken studs, deformed clamps or staples, damaged gaskets, etc. All damaged parts must be replaced.

To check pressure tightness of the reactor and its fittings, fill the reactor system with nitrogen/argon under pressure. A leak detector can be used to check the fitting, but it must be carefully removed after checking.

5.4. Repairs/Customer service

Repair and maintenance operations should be carried out by qualified personnel only.

For technical support, contact your regional RIVA-STEEL, LLC dealer or directly RIVA-STEEL, LLC.

When contacting with repair questions or sending a repair order, indicate the serial number of your equipment. The serial number is indicated on the metal cup of the reactor.