
TECHNICAL INSTRUCTION



MEVAP

Vacuum pumps / Blowers

Type _____

Manufacturing No. _____

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1. GENERAL

This instruction manual is your immediate guide, when operating your SLOMAN MEVAP vacuum pumps/blowers in different situations. It is recommended by SLOMAN to study these instructions from the beginning to the end carefully before mounting and putting into operation, since these may be specifically useful to those who install, maintain and service these vacuum pumps/blowers. To have the full benefit of these instructions, make them accessible to your staff at all times.

The product is under 12 months warranty from the date of product sale or until 18 months from the date of production. Warranty excludes damages occurred due to unprofessional and careless handling, which are determined by the technical service of the producer. SLOMAN assumes no responsibility for any damage and fault of the equipment caused by carelessness and the owner's negligence in implementing the instructions of this guide.

The warranty does not cover operating supplies, such as O-rings and radial shaft seals thus it is recommended to purchase these spare parts, on special request, through the producer's service department.

In case there is any difficulty with your vacuum pumps/blowers, not covered by this guide, don't hesitate to call your SLOMAN representative. We will provide assistance wherever you are.

2. BASIC INFORMATION

The SLOMAN vacuum pumps/blowers are delivered as a single unit or as an aggregate set in monoblock execution or mounted on a base.

If the vacuum pump/blower is delivered with drive unit, the basic standard monoblock design includes the coupling, adapter (protecting grid) and AC motor in IP55 protection class or AC electric motor with integrated frequency inverter, and the technical instructions there of constitutes an integral part of this Instruction.

If the vacuum pump is not delivered with drive unit, slapping is not allowed when assembling transmission elements (coupling, gear, chain, pulley, etc.) on the shaft, but mounting is to be carried out carefully, with the adequate accessories, and by preheating the transmission element hub up to 80 °C. Therefore, the output journal of shaft is supplied with an adequate, threaded centre hole, in compliance with ISO/R775.

The torque moment screws of front cover vacuum pump are 45 Nm.

The vacuum pump/blower and set is delivered ready for operation, filled with lubricating agent and in compliance with the desired mounting arrangement.

Before mounting, the vacuum pump/blower must be stored in a dry room at temperature about 15-25 °C and moisture about 70 % in a position similar to the mounting arrangement. If the vacuum pump/blower is kept stored for a longer time, it is recommended to coat all metal surfaces, which are not protected with paint and are not made of stainless steel, with grease not containing resins or acid. Conservation of drive and coupling to be carried out in compliance with the manufacturer's instruction.

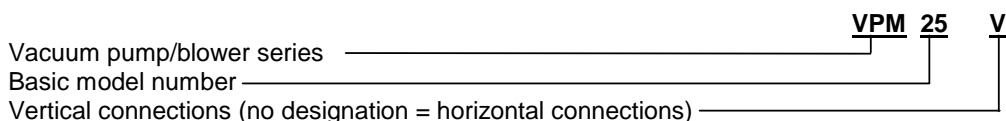
Vacuum pumps/blowers are transported packed in nylon foil and are fixed by screws to the wooden palette.

Vacuum pumps/blowers should be stored in original packing till the moment of mounting.

The packing list is fixed with goods. Please, check all parts according to the packing list.

When ordering spare parts, all data from the vacuum pump/blower nameplate should be indicated.

The type of MEVAP vacuum pump/blower is indicated on the nameplate, as follows:



3. INFORMATION FOR INSTALLERS AND OPERATORS

The direction of the arrow on the motor case shows the direction of vacuum pump flow! Before installation, the vacuum pump/blower should be secured in a way that welding and cutting works are performed externally and the piping system should be rinsed thoroughly.

It is always necessary to reduce losses of suction piping, if possible. Therefore, the length of suction piping must be minimum. Operation safety and simplicity of putting into operation mainly depends on the quality of suction piping design. First of all, full hermetically suction piping is essential, in order to avoid that during operation deep vacuum is formed in it, and, owing to the leakiness of joints, air is drawn in, since this not only that reduces discharge, but also leads to the prevention of vacuum. Suction piping is to be formed so as to avoid forming of "air pads" in it. Hence, the lowest point of suction piping should be 3 m at the most. Also, the suction piping should be mounted with at least 2 % rise toward the vacuum pump/blower and all joints should be tightened well. In design of vacuum pump/blower installation, it is recommended that suction and discharge have same size of ports. If the suction piping is reduced at the inlet of vacuum pump suction pipe, the reducer should have reduction only on its lower part under an angle of 5-6°.

Select installation position which is accessible for later supervision and dismantling.

Piping is to be joined with the vacuum pump/blower only after it is checked and fixed to the base. It is essential to mark and level on the base the surfaces for base plates, with adjusting screws of 12-15 mm thickness. Deviation of these surfaces of the horizontal should not be greater than 10 mm on 1 m, and height top plate should not exceed 10 mm. Deviation of the embedded anchor bolt in concrete from the vertical on the whole height of the protruded part should not exceed 1.5 mm. When checking, it is necessary to provide congruence of the set axis planes and the foundation axis of 10 mm; deviation of the project value of height 10 mm; deviation of the horizontal: 0.3 mm at 1 m.

Hold-down bolts must be cleaned of impurities, corrosion, and slag. It is forbidden to wash hold-down bolts with kerosene or protecting them with machine oil. Fouled threads should be cleaned with steel wire brush, rinse with solvents, wiped with dry cloth, coat with thin layer of consistent grease (e.g. Gleitmo 800 or similar) and nuts are to be turned out. After the vacuum pump/blower is mounted, it is recommended to protect the threads of the hold-down bolts with Esso Rustban 326 grease or similar as a good protection against corrosion. The tightening torque of the hold-down bolts is 12-24 Nm.

The permanent check of the suction and discharge piping fitting's working capacity is essential.

Horizontal vacuum pump/blower distance longer than 10 m from the vessel where the mass is transported from, reduces suction capacity.

At parallel or series operation of vacuum pumps/blowers, the most efficiently work is realised by jointing same type vacuum pumps/blowers with equal head characteristics.

Combined scheme of connection is applied in systems where a wide range of flow and pressure exchange is essential.

4. INSTALLATIONS AND PUTTING INTO OPERATION

After the vacuum pump/blower set is delivered to the place of installation, the presence of measuring-control instruments and the technical documentation are checked suction and discharge pipes are also checked, for any possible damage. The surplus grease from the external surface of vacuum pump/blower is to be removed thereafter.

When assembling the vacuum pump/blower set, the following requirements are to be met:

- Ensure free access to the vacuum pump/blower set for service purposes during exploitation, and also for dismantling and installation;
- Install on the discharge piping the gate valve and check the position (opened or closed);
- Install on the vacuum pump/blower inlet and outlet the pressure gauge for the gas;
- When installing the vacuum pump/blower set there check the horizontal level of the surface, the deviation may not exceed 0.1 mm at a length of 1 m;
- Piping to be connected in a manner, which ensures the exclusion of load transfer to the vacuum pump/blower;
- After centring, the vacuum pump/blower set is to be fixed;
- Perform motor preparation in compliance with the corresponding guide;
- Check the free rotation of rotor (shaft) by making 1-2 rotations;
- Check proper rotor turning by short time switching on the motor.

The vacuum pumps/blowers should be mounted on a flat base with the permitted vibration level according to ISO 2372, and IEC 34-14. The setting of all the machines of the set, except the basic one, includes providing the prescribed horizontal, coaxial and orthogonal of their axes with the basic machine at shaft centring by half-coupling. Parallelism and misalignment of the pump-blower axes and motor may not exceed 0.4 mm. Vacuum/blower pumping sets are adapted to vertical and horizontal mounting arrangement in compliance with IEC 34-7, but they may be fit for any other mounting arrangement.

If the vacuum pump/blower is not delivered as a set, after centring and joining the shaft half-couplings, it is necessary to check free rotor turning.

Prior to each start of vacuum pump/blower, it is essential to check the free rotation of the vacuum pump/blower rotor by hand as well as the possible lack of contact of rotor and the vacuum pump/blower case, and the correctness of electric installation. Automatic and semi-automatic stations are set into operation in accordance with the worked out scheme. When such stations are put into operation, only controls activities are necessary.

After the vacuum pump/blower turned on, the pressure is to be checked. The operating parameters of vacuum pump/blower are determined according to its characteristics or according to the nameplate data.

In case of operation by means of frequently inverters, the control of the number of revolutions is not permitted when the motor is out of operation. At the beginning of the operation, the frequently inverters should be set to the minimum number of revolutions and the desired vacuum pump capacity is to be selected from that position.

All vacuum pump/blower piping is to be provided with independent supports so to reduce the effects of force on the vacuum pump/blower. The forces can cause deviation of position of vacuum pump/blower parts and excessive wear of vanes, bearings and shafts.

Thermal expansion of piping may cause very large forces. Using thermal dilatation minimizes the force effect on the vacuum pump/blower.

Flexible joints may also be used for limiting the transmission of mechanical vibration. The free ends of the flexible hose in the system need to be fixed.

On the suction side non-return valves should be used for keeping the fluids in the suction connection, especially under operation in start-stop action.

Individual valves allow vacuum pump/blower maintenance and safe removal even without the discharge of the whole system.

A safety valve is to be installed for the protection of vacuum pump/blower and piping system against overpressure.

Filters and impurity separators on the suction side may be used to prevent damages by solid bodies. They are to be selected carefully, in order to prevent outlet and flow stoppage limitations.

User must know that dirty of filters is the greatest in start period working of vacuum pumps/blowers, and then their cleaning must be often.

In operation MEVAP vacuum pumps/blowers, if it is need, shell use stabilisers of flow and noise absorbers.

Whenever possible, installing pressure and vacuum indicators is essential, so that normal and abnormal pressure, overload, flow, change of vacuum pump/blower conditions, piping system and fluid viscosity values may be displayed anytime.

5. SAFETY AT WORK

Electric installations are to be fixed by an authorized expert and are to be made depending on the electric motor type according to the scheme attached to the motor.

Protection against touch over-voltage is provided by protective ear thing.

Motor protection switch is needed only on types without thermal protection.

Since it may cause injury, it is not allowed to start the vacuum pump/blower without cover.

Since it may cause injury, it is not allowed to assembling, maintenance and disassembling the vacuum pump/blower unit, which is connected to voltage.

6. HANDLING AND EXPLOITATION REQUIREMENTS

When transporting gases that may modify their physical state, solid agglomeration, sedimentation, sticking and compressing (crystallization, resin formation, hardening, evaporation, etc.), the temperature must be different from the temperature at which the modification of physical properties occurs, from at least 10 °C (i.e. it is necessary to provide conditions so that the transported medium stays in gas state).

In case of vacuum pumps/blowers with 10-15 m head and long piping, it is recommended to provide a non-return valve directly behind the discharge pipe, in order to protect vacuum pump/blower against reverse movement at accidental shut-down of drive.

It is strongly forbidden to control the vacuum pump/blower operation by choking the suction or discharge pipe.

When the vacuum pump/blower is installed outdoors, attention should be devoted to permanent warming up at low temperatures (cold) in standstill and also to due discharge of the fluid from the vacuum pump/blower and piping.

Most rotor vacuum pumps/blowers are provided with a safety valve to prevent non-permitted pressure increase in the discharge piping so to avoid the damage of the vacuum pump or motor overheating in case the discharge line is closed, or in cases of clogging. At vacuum pump/blower installations without safety valve, it is recommended to provide a valve in the pressure piping.

In their process of exploitation, practically there is no need to service or maintain mechanical seals. Occasional check, external examination, of the required tightness of shaft will suffice. Similarly, during their exploitation the manufacturer's instruction is to be strictly observed.

In order to decrease noise and vibration, it is recommended to mount the vacuum pump/blower on the floating base having a mass greater for 3-5 times than the mass of vacuum pump/blower set. In order to decrease the transfer of vibration from vacuum pump/blower to the piping and further to the installation, inlet and outlet parts of piping are to be provided with flexible inserts (compensators, connections, hoses, etc.) The permitted non-parallel of the vacuum pump/blower connections may not exceed 0.1 mm.

Vacuum pumps/blowers may not be put into operation when the gate valve on the discharge piping is closed, since non-permitted pressure increase may cause damage. Gate valves on the suction and discharge piping remain open. It is recommended, that on vacuum pumps/blowers having high suction height the gate valve is kept closed on the suction line after stopping the vacuum pump/blower, in order to prevent vacuum pump/blower idle running when the suction (feeding) valve is not fully closed.

Grey cast fittings are not permitted for explosive and toxic fluids.

7. CONTROLS AND MONITORING

In view of the exploitation safety of the vacuum pump/blower, it is necessary to ensure its permanent control:

- Inlet pipe pressure;
- Discharge pipe pressure;
- Power, consumed by the electric motor.

In addition to the control of the vacuum pump/blower aggregate set parameters the following is also required:

- To monitor the accuracy of the measuring-control equipment;
- To monitor the tightness of flanges, joints and leakage of seals;
- To follow the position of rotor according to the visual demonstration of axis moving.

At the same time, it is very important to strictly observe the instructions on technical handling given in this guide; in general, operation control and monitoring is required only in the first 3000 h of vacuum pump/blower operation.

Working shift maintenance-basic and decisive prophylactic measures is called upon to provide safe operation of equipment between overhauls. Observation is a basic method of maintenance, and during this time the technical state of the vital plant elements is determined, and on the base of it the scope of the forthcoming overhaul is precisely determined.

Regular maintenance during shifts is carried out as a rule, without stoppage in the technological process.

The following activities are to be accomplished during a shift: wiping, cleaning, regular external observation, check of seal state, check of bearing state, monitoring the state of component parts, connections and their tightening, removal of minor defects, partial regulation, check of state of protecting devices for the purpose of providing safe operating conditions, etc.

In this regard, the shift register must contain the following: results of control of the observed plant; all defects, disorders and malfunction, disturbances of normal operation of the plant or safety of operating condition; measures, taken to clear the faults and disorders; disarranged rules of technical exploitation of plant by technological personnel and families of perturbation; note on removal of defects and inaccuracies.

Periodical maintenance is a maintenance implemented in the intervals of 720 h with a period of stoppage of 8 h.

For plant with continuous maintenance process technological maintenance may be carried out at plan-periodic stoppage of operation in compliance with the requirements of technological regulations.

The basic task of the periodic maintenance is the elimination of defects, which were not possible to discover or remove in the period of plant operation, and small services (removal of small defects, seal rings, adjustment, check of fastening of vacuum pump/blower to the base, check of state of coupling, etc.; replacement of spare parts is not foreseen). Given instructions may be exploited by exploitation characteristics depending on concrete conditions and duty.

8. TECHNICAL MAINTENANCE

Maintenance, washing and mechanical cleaning of the vacuum pump/blower is made "on site", and depending on the transported medium it is implemented by washing with water, water jet under pressure or water steam of temperature up to 120 °C and pressure up to 2 bar, without dismantling the vacuum pump/blower, only by removing the cover from the vacuum pump/blower head.

Vanes of rotor, worn-out for more than 8% prime width, must be replaced.

The standard exploitation temperature of bearings is 45-60 °C, and the maximum allowed temperature is 80 °C. If it is reached or exceeded, the vacuum pump/blower is to be switched off, the bearings are to be disassembled and their state is to be checked. Bearing temperature should be controlled permanently. Overheating of bearings is caused by the lack of grease or if the quality of the grease is inadequate. Bearings are filled with grease up to 1/3 of their internal space. No bearing grease refill is necessary.

At least one per year must be checked all installed manometers, mano-vacuum-meters, thermometers and observe safety valves and check their regularity.

Too, periodically clean all valves and gate valves of dirt is needed.

9. TROUBLESHOOTING OF VACUUM PUMPS/BLOWERS

Malfunction	Causes	Way of elimination
Decrease of discharge pressure	Increased gap between rotor and case or between the rotor and vanes	Check the state of vacuum pump/blower case, rotor and vanes, change worn-out components
	Direct consolidation of suction and discharge hole (erosion of case)	Dismantle and check the vacuum pump/blower, change worn-out elements or have a manufacturer's overhaul
	Under-suction of air or unsealing in discharge piping	Check tightness of suction and discharge piping during the necessary sealing.
	Leakiness of seals	Fit or change seals
	Decreased rotation speed	Measure the number of revolutions, check voltage on supply lead of electric motor
	Faulty rotation direction	Check direction of rotation; change electric motor poles
	Extreme pressure is significantly higher than the one showed by the manometer	Repair or change the manometer, check discharge piping
	Increased viscosity of the transported gas	Increase (take account of the max. allowed) temperature of the transported gas
	Improper indication of manometer	Repair or change the manometer
	Plugged of suction piping and filter	Check and clean suction piping and filter
	Leakiness of suction valve or its dirtiness	Check valve, clean it, if necessary
	Leakiness of suction piping	Check tightness of suction piping
	Low revolution number	Change rotation number, check voltage on the supply side of the electric motor
Decrease of flow	Suction height above the allowed	Decrease geometric height of suction, check and clean suction piping
	Increased gap between rotor and case or between rotor and vanes	Check the vacuum pump/blower rotor, case and vanes, change elements if in excessive worn out condition
	Direct consolidation of suction and discharge hole (erosion of case)	Disassemble vacuum pump/blower and check, replace damaged elements or have a manufacturer's overhaul
	Under-suction of air or leakiness in discharge piping	Check suction and discharge piping sealing
	Leakiness of seals	Fit or change seals
	Decreased number of revolution	Measure number of revolution, check voltage on supply of electric motor
	Choked suction piping and filter	Check and clean suction piping and filter
	Leakiness of suction valve or its dirtiness	Check valve, if necessary clean it
	Safety valve opens at operating pressure, leakiness in valve seat	Change valve, check dirtiness of valve seat and clean it
	Leakiness of suction piping	Check and seal suction piping
	Low rotation speed	Change revolution number, check voltage on supply of electric motor
	Suction height higher than the allowed	Reduce geometric height of suction, check and clean suction piping

Troubleshooting of vacuum pumps/blowers

Malfunction	Causes	Way of elimination
Too large power is needed	Defects in the manufacturing of the drive motor	Check the motor and its power
	Operating pressure significantly higher than the manometer pressure	Repair or change manometer, decrease pressure
	Viscosity of transport gas is significantly higher than the nominal one	Increase (keep in mind the permitted) temperature of the transported gas, install motor of larger power
	Knocking of rotor	Disassemble vacuum pump/blower and check, replace damaged elements
Non-stable vacuum pump/blower operation, vacuum pump/blower noise	Gate valve on the discharge piping is not opened fully	Open gate valve or valve totally
	Discharge piping is choked or it is too long	Control and provide initial state of piping
	Height of suction larger than the allowed	Set to initial level in the piping, check suction piping and valve on suction piping, clean them if necessary
	Formation of steam in the vacuum pump/blower	Decrease height of suction or increase pressure in the feeding tank
Increased vibration of vacuum pump/blower	Penetration of air into the vacuum pump/blower through the suction line	Seal suction line, control the seal
	Characteristic worn-out state of rotary elements and bearings	Dismantle vacuum pump/blower, check rotating elements and bearings, and change them, if necessary
	Very high flow or very small total head	Regulate vacuum pump/blower operation by valve till noise disappears
	Increase of rotor knocking	Check rotor knocking
	Disturbed rotor balancing	Check rotor on the balancing base
	Coupling in de-balance or not even	Adjust or centre the coupling
	De-centred rotor with drive unit	Centre rotor and drive unit
	Defect in base manufacturing	Change base, insulate base, if necessary with cork or felt inserts
	Oscillation of piping	Fix piping carefully
	Reaching air in vacuum pump/blower	Check tightness of piping
Vacuum pump/blower wears out quickly	Insufficient fixing of vacuum pump/blower on the base	Retighten base screws
	Worked out gaps for lubrication in bearings carriers	Change bearings carriers, provide (secure) gap for lubrication
	Vibration of piping	Eliminate vibration
	Mixtures in transport gas in front of suction piping	Clean piping
	Mixtures in transport gas in front of discharge rotor	Take out the rotor and clean it
	Abrasive and aggressive mixtures	Check the material quality on resistance to transported gas
	Stress of piping is transferred to vacuum pump/blower	Change fixing to piping, providing tacking of vacuum pumps/blowers without tightening; check aggregate set centricity
	Dry friction in bearings	Disassemble bearing, clean and reassemble, fill with new grease
Vacuum pump/blower wears out quickly	Wear out state of rotor and vanes	Replace rotor/vanes
	Increased pressure in the vacuum pump/blower head due to poured under rotor	Check points of sealed joints (connections)

Malfunction	Causes	Way of elimination
When putting the vacuum pump/blower into operation, gas flow doesn't disappear and there is no pressure in the discharge	The lateral side of valve on the inlet piping is broken off	Dismount gate valve
	Dirty filter on the inlet piping	Clean the filter
	Leakiness in the suction piping	Check the connection on the joint of suction piping
	Suction height is greater than the allowed	Establish the level in the feeding tank, check suction piping and feeding valve, clean if necessary

10. TECHNICAL ASSISTANCE

If failure in the operation of the vacuum pump/blower may not be eliminated even despite individual attempts, the SLOMAN service should be contacted. All claims should state the detailed description of vacuum pump/blower stoppage.

This Technical instruction is accompanied to each SLOMAN vacuum pump/blower separately and the manufacturing number there of is indicated on the front page.

When using this guide, first control if manufacture number of vacuum pump/blower on the front page is identical with the number on the vacuum pump/blower nameplate.

In all contacts with SLOMAN, please indicate the manufacture number to facilitate the proper identification of SLOMAN vacuum pump/blower.

11. TECHNICAL REQUIREMENTS AT OVERHAULING AND DISMANTLING

In case of failure, the dismantling and mounting of the vacuum pump/blower is required in conformity with exploitation documentation for vacuum pump/blower and electric motor.

Vacuum pump/blower and its component parts (elements) are given to capital overhaul after 25920 h of operation, with standstill in duration of 96 h for vacuum pumps/blowers with flow of 10 m³/h, and 120 h for greater flows. When due to the technical state there is not provided exploitation deviation of vacuum pump/blower total head at least -12 % at nominal flow or in case of operation drop out due to cancellation, overhauling is carried out before this period.

Deprecation of vacuum pump/blower elements follows after 10000 h operation.

Warranty period of overhauled vacuum pumps/blowers is 6 months from the date of mounting and putting into operation and 12 months from the date of delivery. At the same time, replacement of mechanical seals due to wearing doesn't represent a claim of overhauled vacuum pump/blower.

9. SPARE PARTS LIST

Spare parts list include a complete listing of parts that can be used to build any type of vacuum pumps/blowers. Therefore, for some items you will find a number of options. As an example, rotors are available in various lengths, but in your vacuum pump/blower only one length is used.

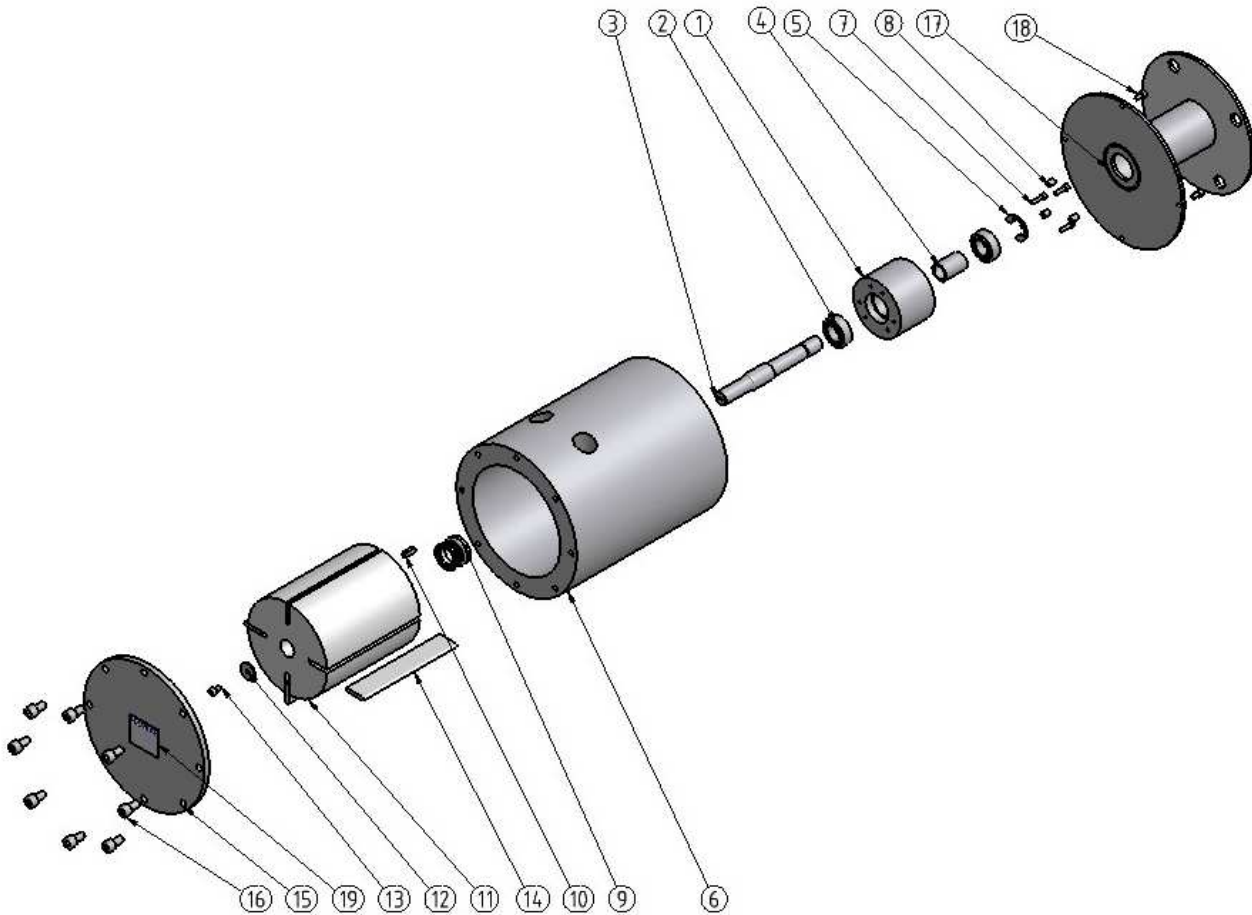
For identification and ordering of spare parts please refer, consistently spare parts list, following:

- Item and name of the spare part of vacuum pump/blower;
- Type of vacuum pump/blower;
- Manufacturing no. of vacuum pump/blower.

Additional spare parts (items) which not standard, i.e. not included a listing of spare parts, ordering by special request.

Spare parts list

ITEM	QTY	PART NAME	DESCRIPTION
1	1	Bearings carrier	
2	2	Ball bearing	
3	1	Shaft	
4	1	Distant sleeve	
5	1	Circlip	
6	1	Case	
7	3	Cylinder head cap screw	
8	3	Socket set screw flat point	
9	1	Mechanical seal	
10	1	Key	
11	1	Rotor	
12	1	Washer	
13	1	Cylinder head cap screw	
14	4	Vane	
15	1	Cover	
16	8	Cylinder head cap screw	
17	1	Adapter	
18	4	Cylinder head cap screw	
19	1	Nameplate	





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