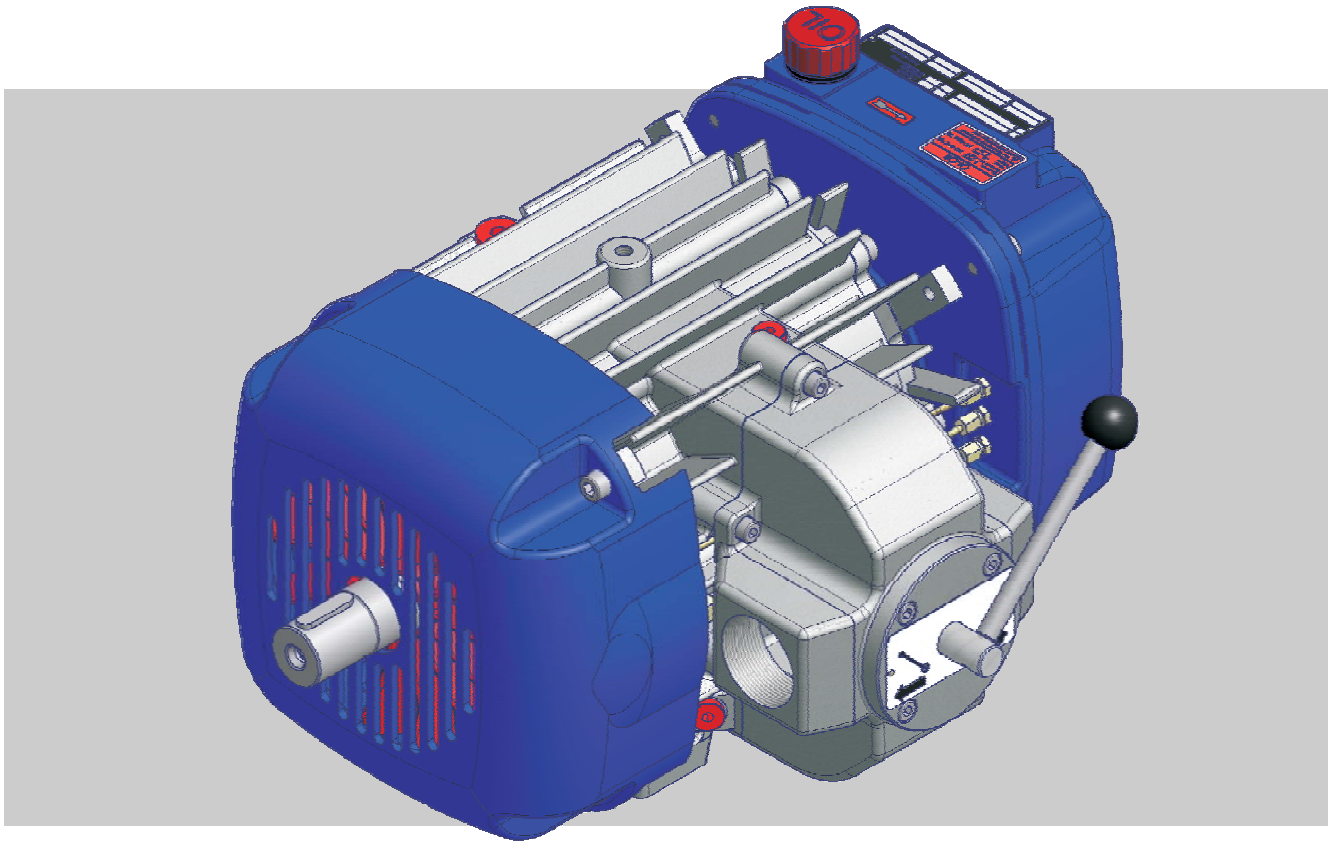
Installation instructions

VacuStar L400
Multi-cell compressor vacuum pump



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Prior to installing the machine and putting it into operation you must have read and understood these instructions.

These instructions are only valid together with the operating instructions, they do not replace them!

Grossmattstraße 14
79618 Rheinfelden / Germany

Phone: +49 (0)7623 71741-0
Customer service: +49 (0)7623 71741-31
E-mail: info@cvs-engineering.de
Internet: www.cvs-eng.de

Created by:
alphatec Technische Dokumentationen
Basler Str.
79639 Grenzach-Wyhlen Deutschland
www.alphatec-dokumentation.de

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1 General

1.1 Information about the installation instructions

These installation instructions provide important information about installation and start-up of the machine. A precondition for safe operation is the observance of all specified safety and handling instructions.

Furthermore, all local accident prevention regulations and general safety regulations valid for the application area of the machine must be observed.

You must have read and understood the installation instructions before you start installing the machine and put it into operation! It is a product component and must be kept in direct proximity of the machine, well accessible to the personnel at all times. All safety instructions of the operating instructions must additionally be observed.

1.2 Pictogram explanation

Warning notes

Warning notes are identified by icons in these operating instructions. The warning notes are marked by signal words expressing the extend of the hazard.
It is absolutely essential to observe the notes and to proceed with caution in order to prevent accidents as well as bodily injuries and property damage.

DANGER!

… points to an immediately dangerous situation, which can lead to death or serious injuries if it is not avoided.

WARNING!

… points to a potentially dangerous situation, which can lead to death or serious injuries if it is not avoided.

ATTENTION!

… points to a potentially dangerous situation, which can lead to minor or light injuries if it is not avoided.

CAUTION!

… points to a potentially dangerous situation, which may lead to property damage if it is not avoided.

Hints and recommendations

NOTE!

… highlights useful hints and recommendations as well as information for an efficient and trouble-free operation.

1.3 Limitation of liability

Information regarding the limitation of liability can be found in the operating instructions "VacuStar L400"".

1.4 Copyright protection

Information regarding the copyright protection can be found in the operating instructions "VacuStar L400"".

1.5 Spare parts

Information regarding the copyright protection can be found in the operating instructions "VacuStar L400"".

1.6 Warranty conditions

The warranty conditions are included in the sales documentation as a separate document.

1.7 Customer Service

Our customer service can be contacted for any technical advice.

Information about the responsible contact person can be retrieved by telephone, fax, E-mail or via the Internet at any time, refer to manufacturer's address on page 2.

1.8 Declaration of Incorporation

Declaration of incorporation (pursuant to EC Machinery Directive 2000/42/EC, Part 1, Section B, Annex II) see page 27.

2 Safety

2.1 Intended use

The compressor vacuum pump is intended for the installation in a superior machine (upstream). The manufacturer of the overall system must assess the new risks resulting from the installation. These risks must be included in the operating instructions of the system.

The compressor vacuum pump is intended exclusively for the compression or suctioning of filtered air.

2.2 Acceptance and monitoring

The compressor vacuum pump is not subject to any acceptance and monitoring obligation.

2.3 Operator's responsibility

See operating instructions "VacuStar L400" for information about the responsibility of the operating company.

2.4 Requirements placed upon the specialised staff

The installation instructions specify the following qualification requirements for the different fields of activity:

- **Specialised staff**
  is due to its technical training, knowledge and experience as well as due to its knowledge of the pertinent regulations able to carry out the work assigned to it and to independently recognise potential hazards.
- **Electrical specialists**
  are, due to their technical training, knowledge and experiences and their knowledge of the relevant standards and regulations, able to work on electrical systems and to independently recognize possible hazards.

2.5 Personal protective equipment

Information regarding the personal protection can be found in the operating instructions "VacuStar L400"".

2.6 Occupational safety and special risks

Please observe all safety instructions as per the operating instructions "VacuStar L400", Chapter "Occupational safety and special danger".

3 Technical data

3.1 Dimensions

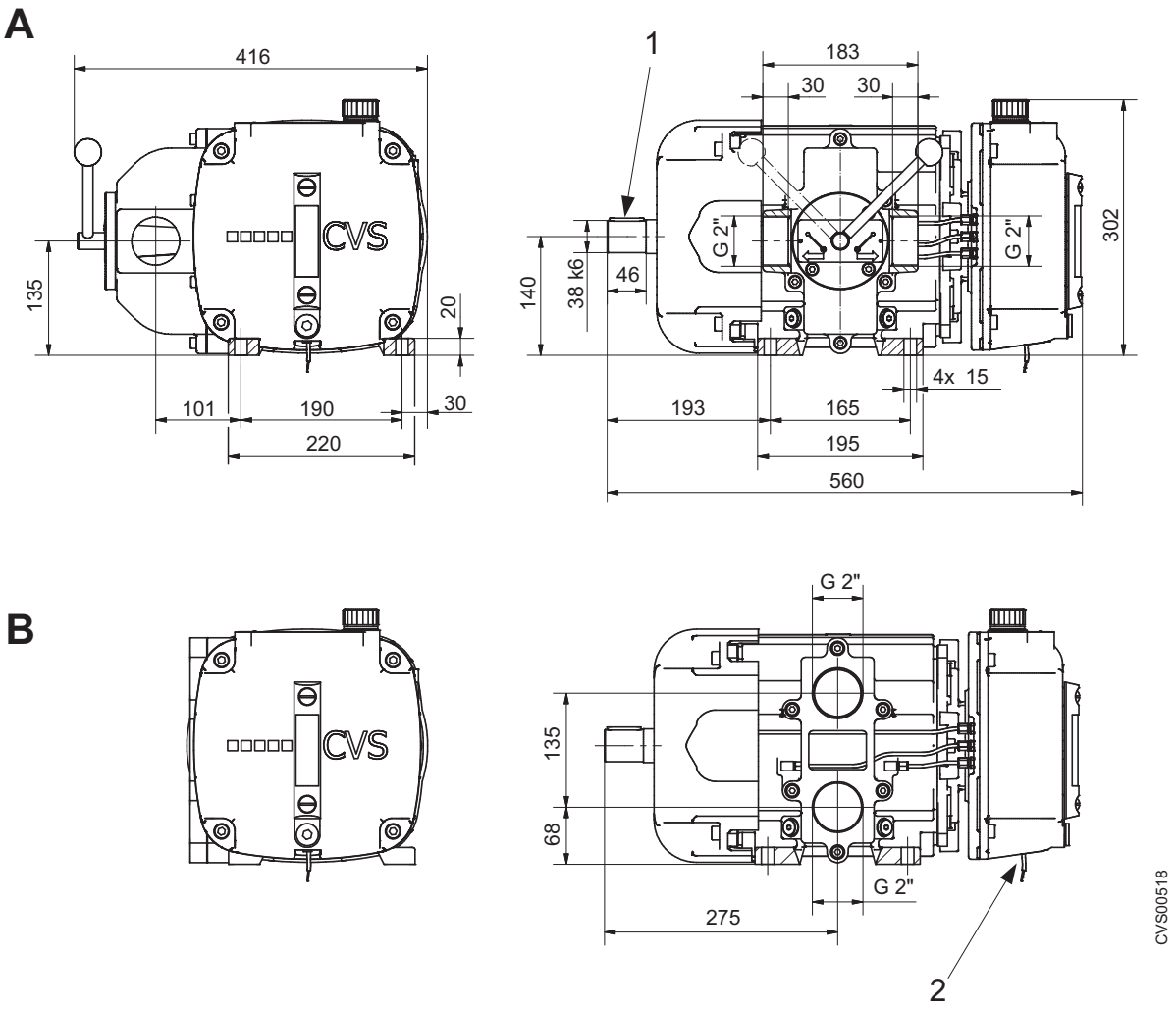

Fig. 1: Dimensions of VacuStar L400

A: Pressure vacuum design with four-way switching valve (can be switched between suction and pressure operation)

B: Pressure or vacuum design

1 Feather key DIN 6885 A10x8x40

2 Oil level switch, option

3.2 Technical data

General data	Unit	VacuStar L400
Angular momentum on the drive shaft	[kgm2]	0,074
Rated speed / Speed range	[1/min]	1500 / 1000 to 1500
Suction temperature	[°C]	–20…+40
Geodetic height	[m]	0…1000
Oil container contents	[Litres]	4,6
Oil consumption	[ml/h]	85
Weight compressor without accessories	[kg]	76

Table 1: General Data

Operating data compressor vacuum pump at rated speed	Unit	VacuStar L400
Vacuum without cell venting / with cell venting [1)]	[mbar]	200 / 100
Final overpressure at the pressure flange [2)]	[bar]	0 to 0.5
Intake volume flow at 400 / 1000 mbar	[m3/h]	320 / 345
Power requirement at 400 mbar / 0.5 bar excess pressure	[kW]	7,4 / 10
Sound pressure level (at 7m distance) with 200 mbar / 0.5 bar overpressure	[dB]	70 / 78
Weight compressor with four-way switching valve	[kg]	85

1) Final excess pressure at the pressure flange = 0 bar, suction and ambient temperature = 20 °C

2) Intake pressure at the suction flange = 1 bar, suction and ambient temperature = 20 °C

Table 2: Operating data compressor vacuum pump at rated speed

Operating data compressor at rated speed	Unit	VacuStar L400
Intake pressure	[mbar]	1000
Final overpressure at the pressure flange [1)]	[bar]	0 to 2.0
Intake pressure at 0 / 2.0 bar excess pressure [2)]	[m3/h]	345 / 305
Power requirement at 0 / 2.0 bar excess pressure [2)]	[kW]	8 / 19,0
Sound pressure level (at 7 m distance) with 2.0 bar overpressure [2)]	[dB]	77
Weight compressor with mounting flange for suction and pressure line	[kg]	79

1) Suction and ambient temperature = 20 °C

2) at rated speed

Table 3: Operating data compressor at rated speed

Lubricating oils

Only single grade oils with the following specification are permitted for operation:

Specification	Value
API	CD/SF or higher
MIL	L2104 C or higher.

Table 4: Lubricating oil

Lubricating oil types

Brand	Suction temp. > 10 °C	Suction temp. < 10 °C
ARAL	Basic Turboral SAE 40	Basic Turboral SAE 30
AVIA	Cronos Super SAE 40	Special HDC 30
BP	Vanellus C3-40 Energol C-DG 40	Vanellus C3-30 Energol C-DG 30
ESSO	Essolube XD-3 Motor Oil 40 Essolube X-301 Motor Oil 40	Essolube XD-3 Motor Oil 30 Essolube X-301 Motor Oil 30
FUCHS	Titan Universal HD 40	Titan Universal HD 30
MOBIL	Delvac 1340	Delvac 1330
SHELL	Rimula X Monograde 40	Rimula X Monograde 30

Table 5: Lubricating oil types

4 Design

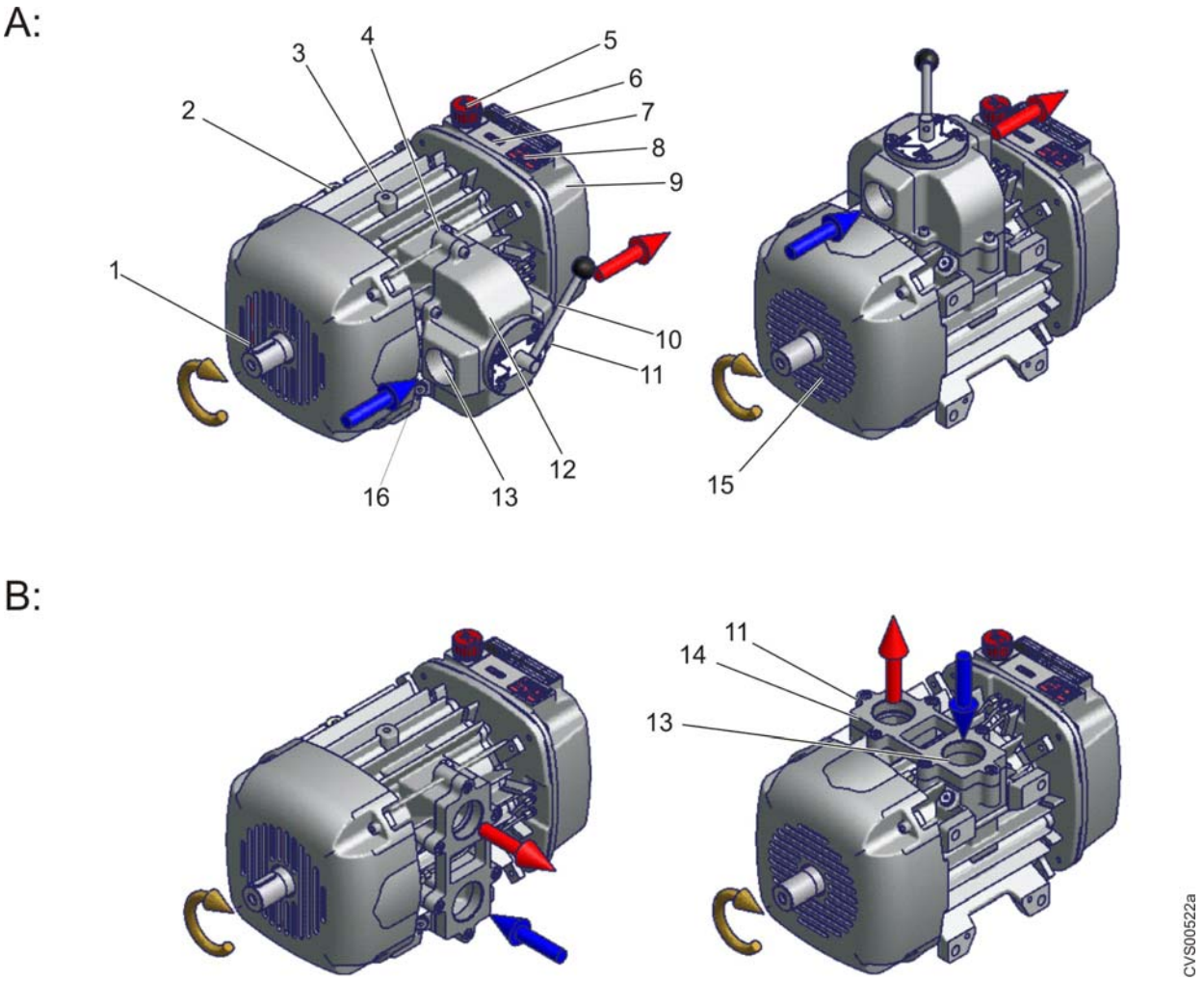

Fig. 2: Design with four-way switching valve

A: Compressor vacuum pump with four-way switching valve
The position of the switching lever selects the air feed direction (suction or pressure).

B: Compressor or vacuum pump with mounting flange for suction and pressure line

1 Drive shaft
2 Cell ventilation connection
3 Thread for eye bolt
4 Temperature and pressure measuring point
5 Oil filling
6 Rating plate machine
7 Rotation arrow
8 Rating plate oil
9 Oil reservoir
10 Switching lever
11 Pressure connection (for illustrated lever setting)
12 Four-way switching valve
13 Suction connection (for illustrated lever setting)
14 Mounting flange for lines
15 Suction opening for cooling air
16 Connection for measuring control line

4.1 Function

Functional principle

In the working area of the compressor vacuum pump, rotor vanes in conjunction with the impeller and the casing form cells that are separated from each other and steadily grow (sucking) or shrink (compressing) with each revolution.

Lubrication

Lubrication is performed by economic lubrication at four points via an oil pump from an oil supply container.

Cooling

The machine is air-cooled. Heat removal is performed by casing ribs on the lid and casing surface with targeted cooling air guidance, via a ventilation wheel on the drive shaft.

Drive

The machine is driven by an articulated shaft, hydro motor, V-belt or directly by an elastic coupling.

4.2 Sense of rotation

The compressor must only be operated in the indicated rotational direction. The rotational direction is determined by the customer in the order.

5 Transport and storage

5.1 Safety notes for transport

Improper transport

DANGER!
Danger by falling down or tilting of the machine!

The weight of the machine may injure a person and cause serious bruising!

Therefore:

– Use suitable lifting gear for lifting up the machine.
– Use the attachment point at the ring screw.

Also observe the safety instructions in the operating instructions "VacuStar L400", Chapter "Occupational safety and special danger"!

5.2 Transport

For future transports:

- Seal all open connections with protective caps (prevents penetration of dirt and water)
- Secure against vibrations
- Securely fasten the machine prior to transport.

5.3 Storage

Storage of packages

Store packages under the following conditions:

- Do not store outdoors.
- Store dry and dust free.
- Do not expose to aggressive media.
- Protect against solar irradiation
- Avoid mechanical vibrations.
- Storage temperature: –10…+60 °C
- Relative humidity: max. 95%, non-condensing
- If storage lasts longer than 3 months, regularly check the general condition of all parts and of the packaging. If necessary, brush up or recondition the preservation.
- In case of extended storage or extended downtimes, one desiccant bag each should be inserted in the inlets and outlets. The bags must be removed again before the compressor is started.

6 Installation and assembly

6.1 General setup with drive variants and accessories

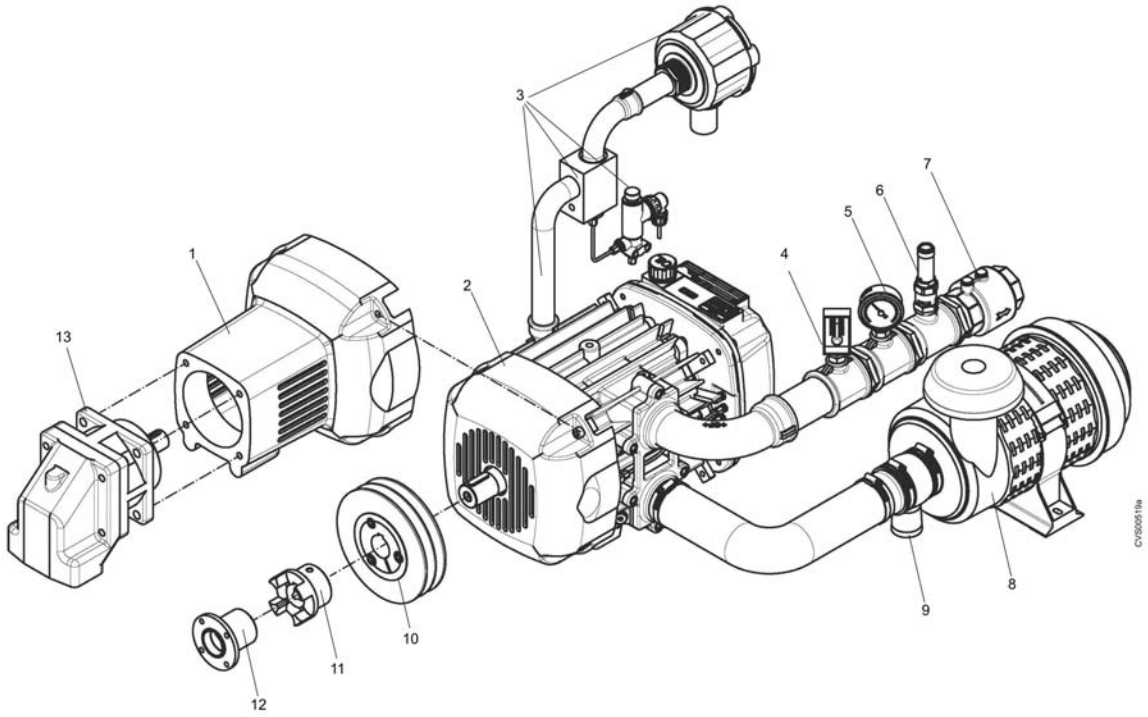

Fig. 3: General setup with drive variants and accessories

1	Intermediate flange for hydraulic motor	5	Manometer installation point	10	V belt drive
2	Compressor	6	Safety valve	11	Flexible coupling
3	Cell ventilation unit	7	Non-return valve	12	Articulated shaft mounting flange
4	Thermometer installation point	8	Suction air filter	13	Hydraulic motor
		9	Vacuum display		

6.2 Setup example for compressor vacuum pump

The illustration shows an example of a system with an installed compressed vacuum pump.

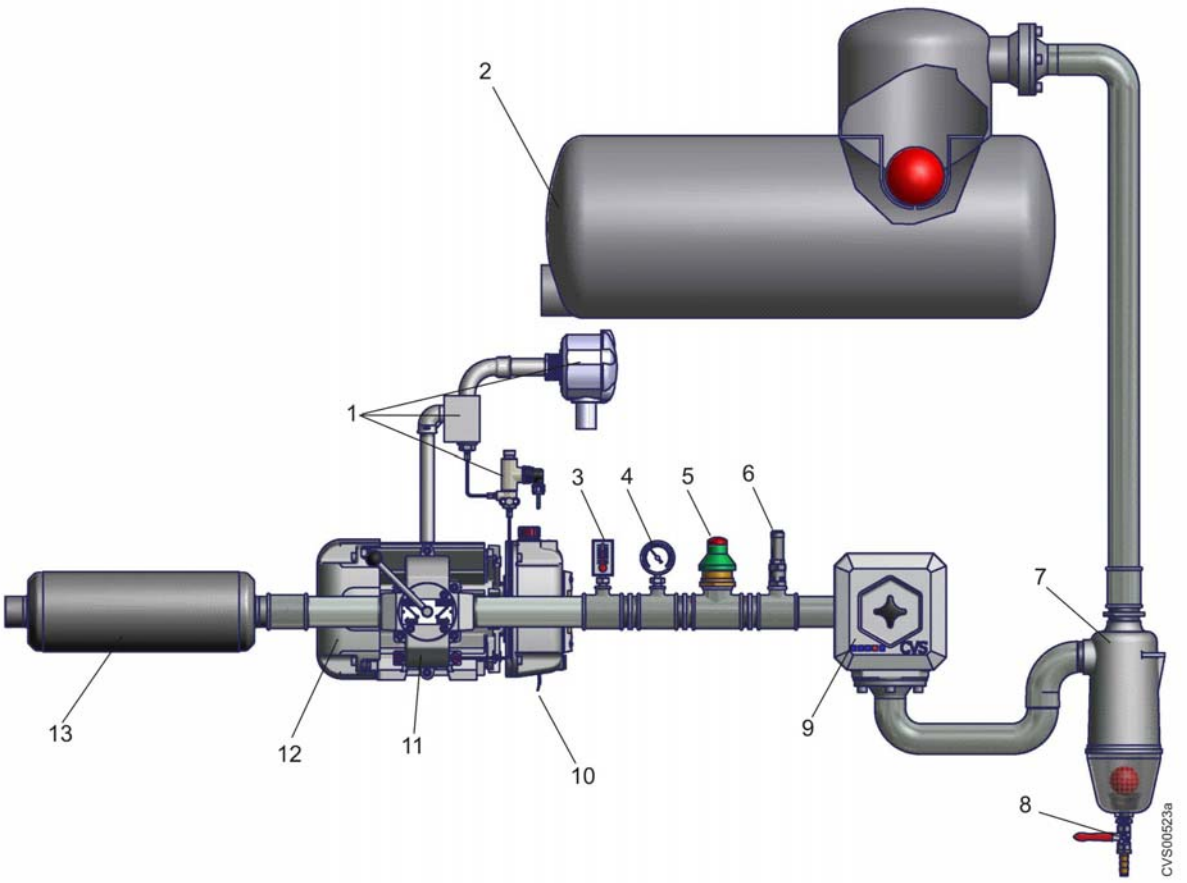

Fig. 4: Setup example for compressor vacuum pump

1 Cell ventilation unit
2 Vehicle tank
3 Thermometer
4 Pressure gauge
5 Ventilating valve
6 Safety valve
7 Safety tank
8 Drain tap
9 Vacuum suction filter
10 Oil level switch
11 Four-way switching valve with selection lever
12 Compressor vacuum pump
13 Muffler

6.3 Necessary work

The following work is necessary to install the compressor:

- Connecting the compressor with suction and pressure lines.
- Installing safety and monitoring equipment.
- Installing accessories.
- Connecting the drive with the compressor. Observing sense of rotation and speed range.

6.4 Sound insulation

Measures for sound insulation

You can avoid or reduce the triggering of adjacent vehicle components by body sound or media sound as follows:

- Downstream installation of a muffler
- Compensators in the suction and pressure lines

6.5 Attachment and installation space

Requirements placed upon the installation point

- The attachment points on the vehicle must feature a sufficient load capacity and rigidness.
- The attachment points must be on the same level.

Requirements placed upon the installation point

The installation location must fulfil the following requirements:

- protect from dirt, falling rocks and spray water.
- offer sufficient space for accidental contact protection.
- Sufficient space for the connections of the suction and pressure lines.
- ensure good legibility of the instruments.
- Accessible for maintenance and repair work (e.g. for replacing the air filter, or for checking the safety and non-return valve).
- The compressor vacuum pump must not be installed on a closed ground plate. There must be sufficient free space for discharge of cooling air.

Installation at the vehicle

The machine is attached to the vehicle with four screws M12-8.8 via the compressor bases.

6.6 Suction and pressure lines

Assembly

- Connect suction and pressure pipe at the 2“ thread
- Observe that pipes connected to the connection flange do not protrude over the sealing face to the compressor vacuum pump. Max. screw-in depth. 19mm.

Requirements

- Corrosion-proof
- Pressure and temperature resistance (up to 240 °C)
- Rated diameter DN 50 (2“)

Installation

Install the lines as follows:

- The connected lines must not have any reaction force on the compressor. Support the lines, if necessary.
- Lay the suction line rising to the compressor; pressure line falling away from the compressor. The condensate must be able to be drained.
- Remove dirt, welding residues and rust, if necessary, before commissioning.
- If intake-side initial contamination is expected from the intake line, install a corresponding filter.

6.7 Safety equipment

The following safety equipment must be installed:

- Safety valve
- Ventilating valve
- The non-return valve (for compressor vacuum pumps, the non-return valve is already integrated in the four-way switching valve)
- Protection against contact

6.7.1 Safety valve

Risk of explosion

DANGER!
Risk of injury by explosions!

Explosions can cause severe injuries!

Therefore:

– Install the safety valve as instructed. Observe the manufacturer's instructions.
– Use the safety valve only as intended.
– Never block the safety valve.

The German accident prevention regulations require a non-lockable safety valve to be installed after the compressor at the pressure side. This valve must be selected such that it prevents the pressure to exceed the highest permissible operating pressure by more than 10 %. It must be identified with a TÜV component test number and be equipped with a manual venting element.

Assembly

- Install the safety valve directly after the compressor.
- The nominal opening pressure must not exceed the maximum permissible final overpressure of the compressor (table 2) or the permissible system pressure, provided the latter is lower.
- Protect the settings against unauthorised or erroneous changes.

6.7.2 Ventilation valve

The ventilation valve is used as a safety feature in the suction line. When the set vacuum is reached, the ventilating valve opens and admits atmospheric auxiliary air into the system.

Assembly

1. Install the ventilation valve on the suction side of the machine.
2. Set minimum permissible vacuum:
   –for system without cell ventilation 200...1000 mbar
   –for system with cell ventilation: 100…1000 mbar.

6.7.3 Non-return valve

The non-return valve prevents a backflow of air from the pressure line into the compressor when the machine is stopped.

Assembly

- The non-return valve (min DN 50) is to be installed after the safety valve.

6.7.4 Suction filter

Liquids and solids must not be sucked in.

Requirements to compressor

- Provide combination filter with integrated cyclone
- Filter mesh < 5 Micron
- Filter resistance when it is new < 15 mbar
- Use filter with dust extraction valve, control flap and maintenance display.

Requirements to vacuum pump

- The filter casing must be vacuum-resistant.

Requirements to compressor vacuum pump

- The filter casing must be pressure and vacuum-resistant.
- The installation on suction vehicles, the filter mesh must be lower than 0.1 mm.

Installation

- Connect filter via stiff line or hose at the inlet.
- Protect the filter from spray water, e.g. from wheels, exhaust gases and heat.
- Observe the flow direction.
- Mount the filter horizontally.
- Provide removal space for filter insert.

6.7.5 Protection against contact

Rotating or hot parts of the system must be equipped with a protection against contact.

Please note that the German accident prevention regulations do not allow a maximum surface temperature of 80 °C to be exceeded.

Observe DIN EN ISO 13857, for example, for the distances and the layout of the protective grid.

6.7.6 Cell ventilation

Assembly

The VacuStar has been prepared for operation with cell ventilation.

Observe the following points during installation:

1. Install fresh air line (6) between the compressor (fig. 2, item. 4) and cell ventilation valve (4).
2. Install cell ventilation valve (4) vertically.
3. Install fresh air line (3) between the cell ventilation valve and suction air filter (1).
4. Install control line between the connection at the inlet (fig. 2, item. 16) and the connection (8) at the cell ventilation valve.

   The cell ventilation valve is set fixed ex works (opening starts at approx. 350 mbar, full opening at 200 mbar) and cannot be changed.

   Reverse rotation of the machine when standing still is prevented by the following measures:

   - Operation with a four-way switching valve (fig. 2): The control line (8) must be closed right when shutting down the machine with a valve (e.g. electric or solenoid valve).
   - In operation as a pure vacuum pump (fig. 3), the shut-off valve (9) can be dispensed with when a 2" non-return valve is installed in the vacuum pump suction line.

Cell ventilation valve and suction filter can be purchased from CVS.

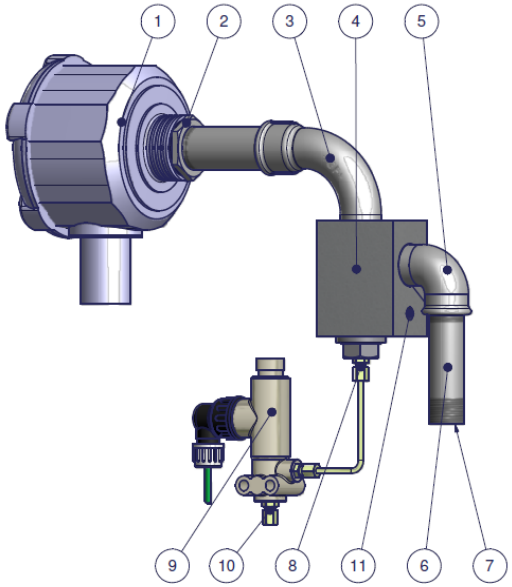

Fig. 5: Setup compressor or vacuum pump

1 Air filter (suction opening downwards)
2 Reducer nipple 1 ¼“ - 1“
3 Connection line 1“ (length max. 500mm)
4 Cell ventilation valve (installed vertically as illustrated)
5 Reducer nipple 1- ¾“
6 Connection line ¾“ to VakuStar (length max. 200mm)
7 Connection to VacuStar ¾“
8 Control line with connection (G1/8") to shut-off valve (pipe diameter 8 x 1 mm)
9 Solenoid or pneumatics shut-off valve
10 Connection control line to VakuStar, screw-connection (G1/8“, pipe diameter 8 x 1 mm)
11 Bore M12 for additional attachment

6.7.7 Display and monitoring equipment

Pressure gauge, maintenance display and thermometer must be provided to ensure smooth and trouble-free operation.

We also recommend the installation of a speed counter.

Designation	Monitoring parameters	Place of installation (s. Fig. 4)	Measuring range
Pressure gauge	Positive working pressure	Pressure line, right after outlet	According to the operating pressure to be ensured
Maintenance display	Degree of contamination of the suction filter	Between suction filter and compressor	0…65 mbars
Thermometer	Condenser end temperature	Pressure line, right after outlet	0…250 □
Speed counter (option)	Speed	Drive shaft	1000…1500 min^{-1}
Oil level monitor	Oil supply	Oil reservoir	Lack of oil

Table 6: Display and monitoring equipment

6.8 Drive

CAUTION!

- The drive components must not exert any axial forces on the compressor shaft.
- Do not exert any axial forces on the compressor during assembly work at the drive shaft.
- Do not hammer or knock connecting components on the shaft, but pull them instead.
- Check the torque and the sense of rotation.

6.8.1 V belt drive

CAUTION!

The maximum permissible belt tensile force must not exceed 2,500 N.

Observe the ratings, installation instructions and inspection intervals from the manufacturer.

Assembly

- Select V-belt drive according to Table 6.
- Align the V belt pulleys accurately.
- Install V-belt pulley (e.g. with Taper-Lock clamping bushes) and V-belt with pretension according to the manufacturer specifications.
- To ensure sufficient air supply for the ventilator, observe a minimum distance of A = 11 mm to the V belt pulley.

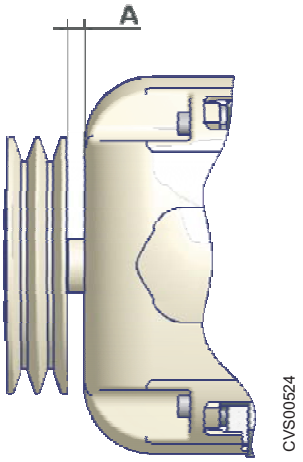

Fig. 6: Minimum distance V-belt pulley

Belt pulleys

Only single grade oils with the following specification are permitted for operation:

Belt pulleys	Unit	Data
Smallest pulley diameter	[mm]	180
Belt profile	–	XPB
Number of belts	–	2

Table 6: Belt pulleys

6.8.2 Articulated shaft drive

CAUTION!

Observe the ratings, installation instructions and inspection intervals from the manufacturer.

Requirement articulated shaft

- Bending angle of the joint shafts: max. 15°.
- Articulated shaft must be:
  - a spline shaft and
  - balanced.
- The central axles of the articulated shafts must be parallel to each other.

Installing the articulated shaft flange

1. Coat all threads with anti-fretting paste.
2. Install articulated shaft flange with attachment screw M8-8.8 with a tightening torque of 23 Nm.

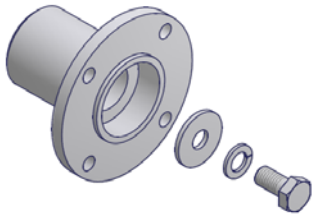

Fig. 7: Installing the articulated shaft flange

6.8.3 Drive via flexible coupling and hydraulic motor

CAUTION!

Observe the ratings, installation instructions and inspection intervals from the manufacturer.

The hydraulic motor is installed to the compressor via an intermediate flange. The power is transmitted via a flexible coupling.

Components that match the compressor can be ordered from CVS.

7 Start-up

7.1 Safety notes for start-up

Start-up, operation

WARNING!
Risk of injury due to improper start-up and operation

Improper start-up and operation can lead to serious bodily injuries or property damage.

Therefore:

- Have all work during initial operation exclusively performed by the manufacturer's employees or by his authorized representatives or by trained personnel.
- Start-up and operation may only be performed by adequately qualified personnel who have been authorized and instructed by the operator.
- Before the start of any work, ensure that all covers and protective devices are correctly installed and function correctly.
- Never override any protective equipment during operation.
- Pay attention to tidiness and cleanliness in the working area! Loosely stacked or scattered components and tools are accident sources.

Please observe all safety instructions as per the operating instructions "VacuStar L400", Chapter "Occupational safety and special danger".

7.2 Start-up

Inspection prior to initial start-up

The following points must be checked prior to initial start-up:

- Transport damage to the compressor
- Conduits for free passage and leak tightness.
- Screw connections for tightness.
- Drive's sense of rotation by briefly switching it on and off (observe rotation direction arrow).
- Direction of installation and function of non-return valve.
- Safety valve function.
- Accidental contact protection function.
- All oil pipes in the oil reservoir (Fig. 2, item 9) must be filled with oil, (Check at empty oil reservoir through the oil filler hole, Fig. 2, item 5)[1].
- Oil level in the reservoir until at least mid-oil level glass.

Start-up

Proceed as follows during start-up:

- Pay attention to permissible compressor inclination
- Open shut-off devices
- Switch on drive (engage gently)
- Adjust input speed

Inspections during operation

The following inspections have to be carried out during operation:

- The speed must be between 1000…1,500 min^{-1}
- Check positive working pressure at the pressure gauge (permissible pressure refer to rating plate).

7.3 Switching off

Switching off of the compressor

- Switch off drive.
- Close shut-off valves.
- Drain the condensate tank.

[1] The oil pipes in new machines are usually filled with oil. After replacing of oil pump you have to add oil (about 100 ml oil for about 0,5 hours) on the suction while the machine is running, for example via connection (Fig. 2, item 16). During this time the machine must not operate with vacuum or pressure.

8 Declaration of Incorporation

Declaration of Incorporation
(pursuant to EC Machinery Directive 2006/42/EC, Annex II, part 1, Section B)

Manufacturer:	**CVS engineering GmbH Grossmattstraße 14 79618 Rheinfelden / Germany**	**Documentation authorised by:**	**Rolf Jäger Grossmattstraße 14 79618 Rheinfelden / Germany**

The manufacturer declares herewith that the “partial machine", type "VacuStar L400", complies with the requirements of Directive 2006/42/EC up to the interfaces described in the enclosed operating instructions, data sheets and technical documents.

The manufacturer undertakes to furnish the special technical documents of the partial machine to the national authorities on request.
The special technical documents for the machine have been created according to Annex VII, part B.

The special technical documentation according to Annex VII B of the Machinery Directive is available for a possible inspection by the responsible supervisory body.

Start-up of the partial machine is not permitted until it has been determined that the machine or machinery into which this partial machine has been integrated or of which it constitutes a component complies with the basic safety requirements and provisions of Directive 2006/42/EC.

Machine design:	**Multi-cell compressor or vacuum pump for extraction of filtered air for pressure or vacuum operation. With air cooling via the casing surface and fresh oil lubrication. Suitable for direct drive via elastic coupling or by means of V-belt or articulated shaft.**
Machine models:	**VacuStar L400**
Applied harmonized standards:	**DIN EN ISO 12100-1/-2** Safety of machinery, basic concepts, general design Part 1: Basic terminology Part 2: Technical guidelines **DIN EN ISO 14121-1** Safety of machinery - Risk assessment Part 1: Guidelines **DIN EN 1012 Part 1 / 2** Compressors and vacuum pumps - Safety requirements Part 1: Compressors Part 2: Vacuum pumps

The validity of this declaration shall lapse with immediate effect in case of conversions or changes to the machine as a whole or to individual components

Rheinfelden, 17 February 10

i.V. Rolf Jäger

Design and Development Manager

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