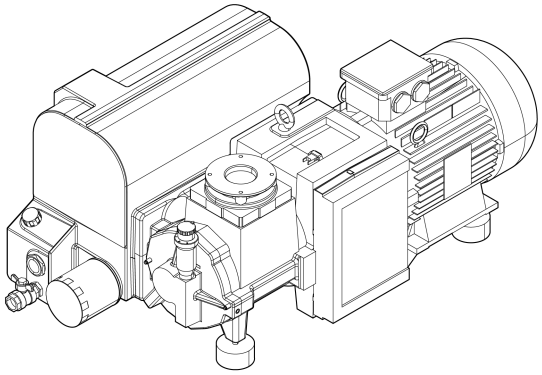

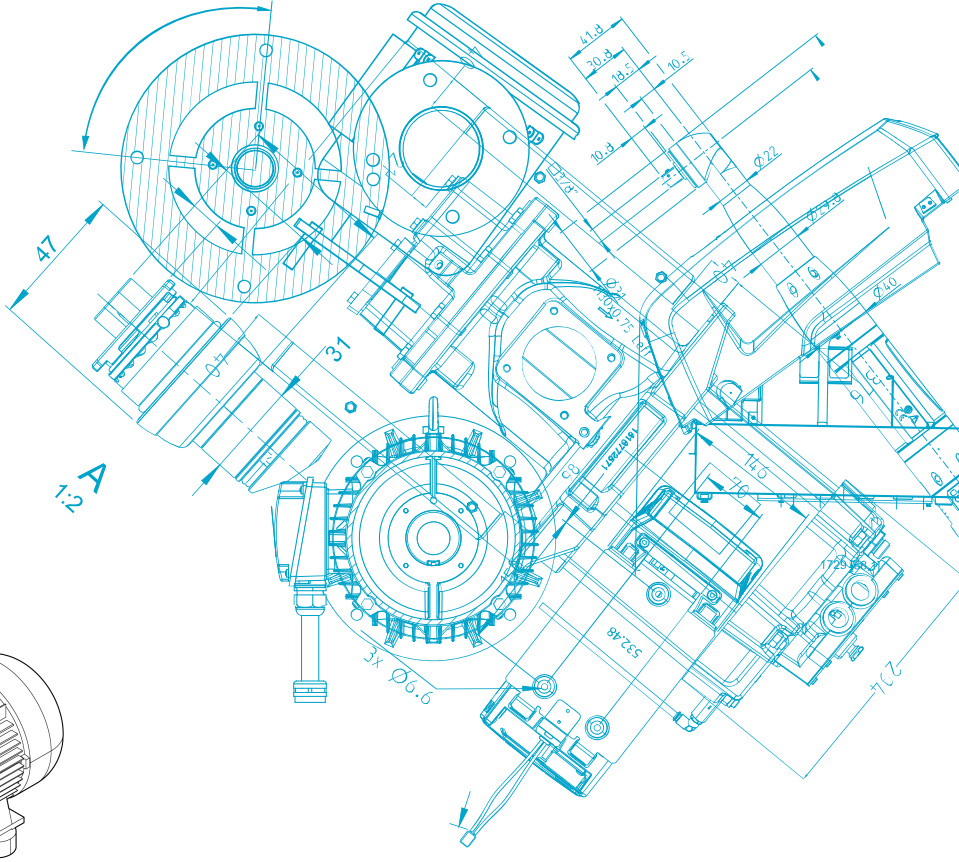

Oil-Sealed Rotary Vane Vacuum Pumps

GVS 16A, GVS 25A, GVS 40A, GVS 60A, GVS 100A, GVS 200A, GVS 220A, GVS 300A, GVS 470A, GVS 630A

INSTRUCTION MANUAL

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Disclaimer

The content of this manual may change from time to time without notice. We accept no liability for any errors that may appear in this manual nor do we make any expressed or implied warranties regarding the content. As far as practical we have ensured that the products have been designed and constructed to be safe and without risks when properly installed and used in accordance with their operating instructions.

We accept no liability for loss of profit, loss of market or any other indirect or consequential loss whatsoever.

Product warranty and limit of liability are dealt with in our standard terms and conditions of sale or negotiated contract under which this document is supplied.

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product.

Contents

List of Figures

1. Safety and compliance

1.1. Definition of Warnings and Cautions

NOTICE:

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use.

Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions. The equipment must only be operated and maintained by trained personnel in the proper condition and as described in this instruction manual.

Obey local and state requirements and regulations. If you have any questions about safety, operation or maintenance of the device, please contact our nearest subsidiary.

Important safety information is highlighted as warning and caution instructions. Obey these instructions.

WARNING:

If you do not obey a warning, there is a risk of injury or death. Different symbols are used according to the type of hazard.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

Keep the instructions for future use.

1.2. Trained personnel

For the operation of this equipment “trained personnel” are:

- skilled workers with knowledge in the fields of mechanics, electrical engineering, pollution abatement and vacuum technology and
- personnel specially trained for the operation of vacuum pumps

1.3. Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that follow are used on the product or in the product documentation.

	Warning/Caution An appropriate safety instruction must be followed or caution to a potential hazard exists.
	Warning - Automatic start up The equipment can be remotely started.

2. Important safety information

2.1. General precautions

1. The operator must employ safe working practices and observe all related work safety requirements and regulations.
2. If any of the following statements does not comply with the applicable legislation, the stricter of the two shall apply.
3. Installation, operation, maintenance and repair work must only be performed by authorized, trained, specialized personnel.
4. The vacuum pump is designed for handling atmospheric air only. No other gases, vapors or fumes should be exposed to the vacuum pump intake or processed by the vacuum pump.
5. Before any maintenance, repair work, adjustment or any other non-routine checks, stop the vacuum pump, press the emergency stop button, switch off the voltage and make sure that the pump system is at atmospheric pressure level. In addition, the power isolating switch must be opened and locked.
6. Avoid contact with pump intake during operation.
7. The owner is responsible for maintaining the unit in safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.
8. It is not allowed to walk or stand on the unit or on its components.

DANGER:

If the machine is equipped with an automatic restart after voltage failure function and if this function is active, be aware that the machine will restart automatically when the power is restored if it was running when the power was interrupted!

2.2. Safety precautions during installation

WARNING:

All responsibility for any damage or injury resulting from neglecting these precautions, or non-observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

1. The machine must only be lifted using suitable equipment in accordance with the applicable safety regulations. Loose or pivoting parts must be securely fastened before lifting. It is strictly forbidden to dwell or stay in the risk zone under a lifted load. Lifting acceleration and deceleration must be kept within safe limits. Wear a safety helmet when working in the area of overhead or lifting equipment.
2. The unit is designed for indoor use. If the unit is installed outdoors, special precautions must be taken; consult your supplier.

3. Place the machine where the ambient air is as cool and clean as possible. If necessary, install a suction duct. Never obstruct the air inlet. Water handling capacity is limited.
4. Any blanking flanges, plugs, caps and desiccant bags must be removed before connecting the pipes.
5. Air hoses must be of correct size and suitable for the working pressure. Never use frayed, damaged or worn hoses. Distribution pipes and connections must be of the correct size and suitable for the working pressure.
6. The aspirated air must be free of flammable fumes, vapours and particles, e.g. paint solvents that can lead to internal fire or explosion.
7. Arrange the air intake so that loose clothing worn by people cannot be sucked in.
8. No external force may be exerted on the inlet and outlet connections; the connected pipes must be free of strain.
9. If remote control is installed, the machine must bear a clear sign stating: DANGER: This machine is remotely controlled and may start without warning.

   The operator has to make sure that the machine is stopped, depressurized and that the electrical isolating switch is open, locked and labelled with a temporary warning before any maintenance or repair. As a further safeguard, persons switching remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the start equipment.
10. Air-cooled machines must be installed in such a way that an adequate flow of cooling air is available and that the exhausted air does not recirculate to the inlet.
11. The electrical connections must correspond to the applicable codes. The machines must be earthed and protected against short circuits by fuses in all phases. A lockable power isolating switch must be installed near the pump.
12. On machines with automatic start/stop system or if the automatic restart function after voltage failure is activated, a sign stating "This machine may start without warning" must be affixed near the instrument panel.
13. In multiple vacuum pump systems, manual valves must be installed to isolate each pump. Non-return valves (check valves) must not be relied upon for isolating multiple systems.
14. Never remove or tamper with the safety devices, guards or insulation fitted on the machine.
15. Piping or other parts with a temperature in excess of 70 ˚C (158 ˚F) and which may be accidentally touched by personnel in normal operation must be guarded or insulated. Other high temperature piping must be clearly marked.
16. For water-cooled machines, the cooling water system installed outside the machine has to be protected by a safety device with set pressure according to the maximum cooling water inlet pressure.
17. If the ground is not level or can be subject to variable inclination, consult the manufacturer.
18. Pump outlet air contains traces of oil mist. Ensure compatibility with the working environment.

19. Whenever air containing hazardous substances is sucked in (i.e. biological or microbiological agents), use abatement systems placed upstream of the vacuum pump.
20. Any vacuum pump placed in an application with inlet gas stream temperatures above the published maximum temperature should be approved by us prior to start-up.

Note:

Also consult Safety precautions during operation on page 11 and Safety precautions during maintenance or repair on page 12 .

These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein.

Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine.

2.3. Safety precautions during operation

WARNING:

All responsibility for any damage or injury resulting from neglecting these precautions, or non-observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

1. Never touch any piping or components of the vacuum pump during operation.
2. Use only the correct type and size of hose end fittings and connections. Make sure that a hose is fully depressurized before disconnecting it.
3. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
4. Never operate the machine when there is a possibility of taking in flammable or toxic fumes, vapours or particles.
5. Never operate the machine below or in excess of its limit ratings.
6. Keep all bodywork doors shut during operation. The doors may be opened for short periods only, e.g. to carry out routine checks. Wear ear protectors when opening a door.
   On vacuum pumps without bodywork, wear ear protection in the vicinity of the machine.
7. People staying in environments or rooms where the sound pressure level reaches or exceeds 80 dB(A) shall wear ear protectors.

8. Periodically check that:
   - All guards are in place and securely fastened
   - All hoses and/or pipes inside the machine are in good condition, secure and not rubbing
   - There are no leaks
   - All fasteners are tight
   - All electrical leads are secure and in good order
   - Safety valves and other pressure relief devices are not obstructed by dirt or paint
   - Air outlet valve and air net, i.e. pipes, couplings, manifolds, valves, hoses, etc. are in good repair, free of wear or abuse
   - Electrical cabinet air cooling filters are not clogged
9. If warm cooling air from vacuum pumps is used in air heating systems, e.g. to warm up a workroom, take precautions against air pollution and possible contamination of the breathing air.
10. On water-cooled vacuum pumps using open circuit cooling towers, protective measures must be taken to avoid the growth of harmful bacteria such as Legionella pneumophila bacteria.
11. Do not remove any of, or tamper with, the sound-damping material.
12. Never remove or tamper with the safety devices, guards or insulations fitted on the machine.
13. The oil separator tank can be slightly pressurized. Do not open and do not leave oil filler or drain plugs open during operation.
14. Do not use the pump as a compressor.
15. Never run the pump without the air intake filter mounted.

Note:

Also consult Safety precautions during installation on page 9 and Safety precautions during maintenance or repair on page 12.

These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein.

Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine.

2.4. Safety precautions during maintenance or repair

WARNING:

All responsibility for any damage or injury resulting from neglecting these precautions, or non-observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

1. Always use the correct safety equipment (such as safety glasses, gloves, safety shoes, etc.).

2. Use only the correct tools for maintenance and repair work.
3. Use only genuine spare parts.
4. All maintenance work shall only be undertaken when the machine has cooled down.
5. A warning sign bearing a legend such as "Work in progress; do not start" shall be attached to the starting equipment.
6. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
7. Before removing any component, effectively isolate the machine from all sources of under- and/or overpressure and make sure that the pump system is at atmospheric pressure level.
8. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapours of cleaning liquids.
9. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
10. Never weld or perform any operation involving heat near the oil system. Oil tanks must be completely purged, e.g. by steam cleaning, before carrying out such operations. Never weld on, or in any way modify, pressure vessels.
11. Whenever there is an indication or any suspicion that an internal part of a machine is overheated, the machine shall be stopped but no inspection covers shall be opened before sufficient cooling time has elapsed; this to avoid the risk of spontaneous ignition of the oil vapour when air is admitted.
12. Never use a light source with open flame for inspecting the interior of a machine, pressure vessel, etc.
13. Make sure that no tools, loose parts or rags are left in or on the machine.
14. All regulating and safety devices shall be maintained with due care to ensure that they function properly. They may not be put out of action.
15. Before clearing the machine for use after maintenance or overhaul, check that operating pressures, temperatures and time settings are correct. Check that all control and shut-down devices are fitted and that they function correctly. If removed, check that the coupling guard of the vacuum pump drive shaft has been reinstalled.
16. Every time the separator element is renewed, examine the discharge and the inside of the oil separator vessel for carbon deposits; if excessive, the deposits should be removed.
17. Protect the motor, air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when steam cleaning.
18. Make sure that all sound damping material and vibration dampers, e.g. damping material on the bodywork and in the air inlet and outlet systems of the vacuum pump are in good condition. If damaged, replace it by genuine material from the manufacturer to prevent the sound pressure level from increasing.
19. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.

20. Faults or wearing of seals may cause oil lubricant leaks. Avoid dispersion in soil and pollution of other materials.

Note:

Also consult Safety precautions during installation on page 9 and Safety precautions during operation on page 11.

These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein.

Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine.

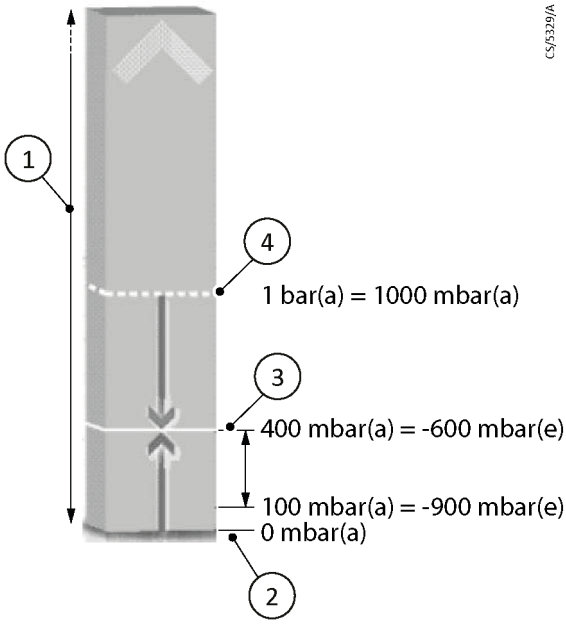
3. Description

3.1. Vacuum and flow rate

A vacuum is any pressure in a system that is below the ambient atmospheric pressure. It can be denoted in absolute terms or in effective (gauge) terms:

- mbar(a) – absolute pressure – denotes how much the pressure is above absolute zero vacuum.
- (minus) mbar(e) – the effective or gauge pressure – denotes how much the pressure is below the local atmospheric pressure.

Figure 1 Vacuum and flow rate



1. *Pressure*
2. *Absolute vacuum*
3. *Typical application working range*
4. *Atmospheric pressure*

Atmospheric pressure at sea level is roughly 1 bar(a) or 1000 mbar(a) or 0 bar(e). The typical working range for pump applications is 400 mbar(a) to 100 mbar(a), for example -600 mbar(e) to -900 mbar(e). This operating pressure range is just indicative. The GVS A vacuum pumps are designed for continuous operation between atmospheric pressure and their ultimate pressure

It is important to understand which type of reference is required before selecting a pressure instrument for measuring the vacuum. It must be noted that the distinction doesn't matter for a pressure difference (delta P; for example, pressure loss), since it is always the result of subtracting 2 pressures (whether stated as absolute or effective pressures).

Flow rate definitions

There are 2 common but different ways to denote flow rate in vacuum. The first one is based on the displacement or volumetric flow rate and the second one is based on the throughput or mass flow rate. The vacuum pumps use volumetric flow rate to denote performance, the unit being actual m^3/h.

Displacement/volumetric flow rate

Over the relevant pressure range, a GVS A pump operates at constant motor speed (rotations per minute) and since the compression chambers have fixed dimensions, the same volume of air is pumped from inlet to outlet with falling pressure level. Over the relevant pressure range, this makes the volumetric flow rate practically independent of the vacuum level. It is the expression of the flow rate inside the piping at the governing vacuum level (in actual m^3/h) and is always higher than the standard flow rate (in Nm^3/h).

Standard flow rate

Although the volumetric flow rate remains practically constant with decreasing (absolute) pressure, the number of molecules in that pumped volume is not. By definition: the deeper the vacuum, the lower the number of molecules in the same volume. This means that the mass flow will decrease with decreasing (absolute) pressure. A flow rate must be stated at a certain vacuum level when using this denotation.

3.2. Overview

The vacuum pumps are single-stage, oil-sealed and air-cooled rotary vane vacuum pumps driven by an electric motor. GVS 100A up to GVS 300A are also available without electric motor. The GVS 470A and GVS 630A are belt driven.

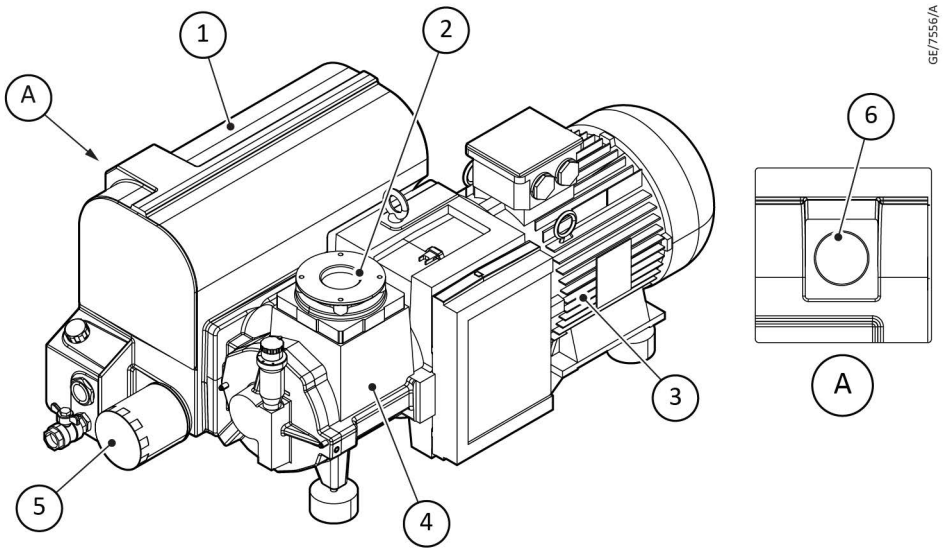
The pumps have been specifically designed to work with clean air, inert gas or small amounts of water vapour. The ambient temperature shall be between 12 °C and 40 °C.

For applications with high oxygen concentration, O_2 - versions are available (GVS 60A up to GVS 630A).

Note:

Lower temperatures are possible with reduced viscosity oil. This temperature range is defined by Pneurop for performance conformity testing, but 8 °C is the critical point from the motor starting view point.

Figure 2 Pump components

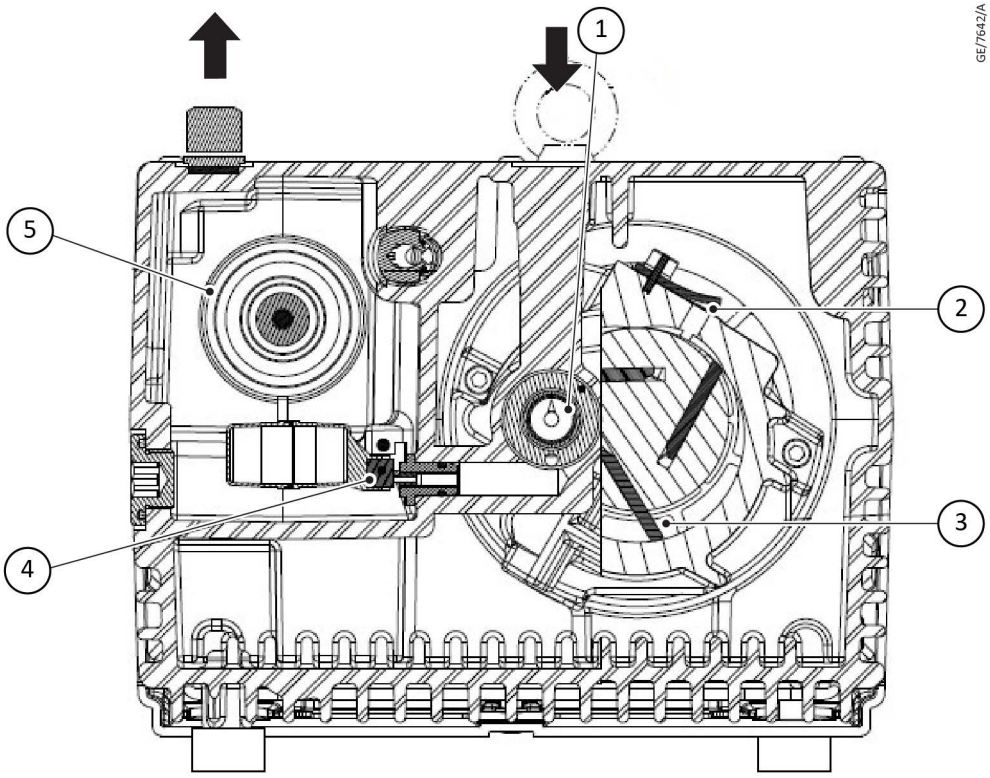


1. *Exhaust filter element housing*
2. *Air intake*
3. *Motor*
4. *Rotary vane element housing*
5. *Oil filter*
6. *Air outlet*

3.3. Air flow

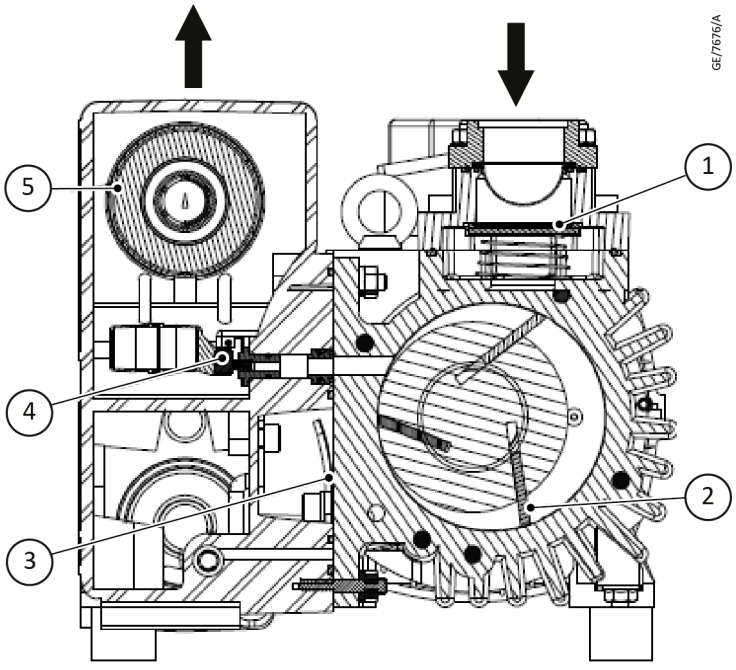
- Air drawn through the air intake filter (optional), the inlet protection screen and the inlet non-return valve is displaced by the vacuum pump element towards the air end exhaust valve. This valve ejects a mixture of air and oil into the exhaust filter element. After passing the exhaust filter element, clean air - conditioned to a few parts per million - is discharged through the outlet.
- The vacuum pump is driven by an electric motor.

Figure 3 Air flow components - GVS 16A - 25A



1. *Inlet non-return valve*
2. *Exhaust valve*
3. *Vane (vacuum pump element)*
4. *Oil recovery valve*
5. *Exhaust filter element*

Figure 4 Air flow components - GVS 40A - 300A



1. *Inlet non-return valve*
2. *Vane (vacuum pump element)*
3. *Exhaust valve*
4. *Oil recovery valve*
5. *Exhaust filter element*

Figure 5 Flow diagram - GVS 16A and GVS 25A

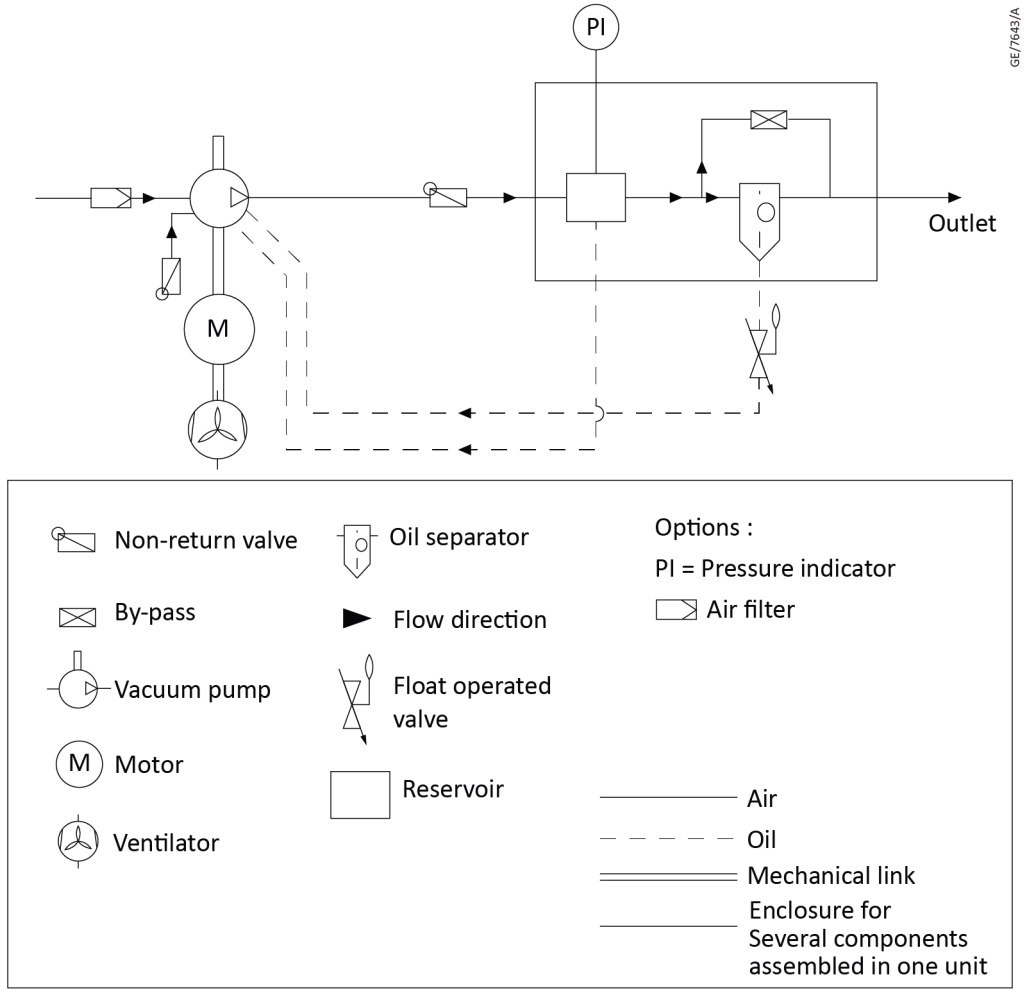


Figure 6 Flow diagram - GVS 40A and GVS 60A

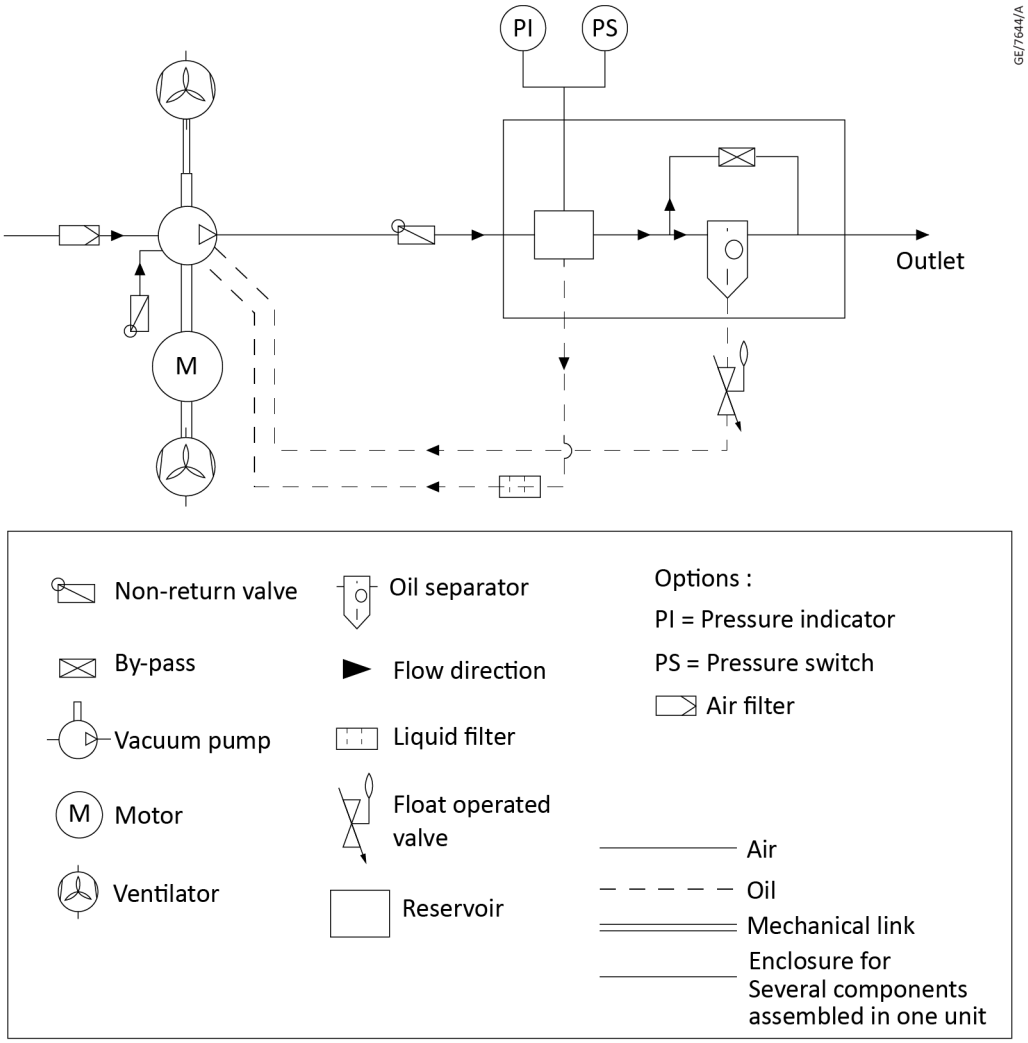


Figure 7 Flow diagram - GVS 100A and GVS 300A

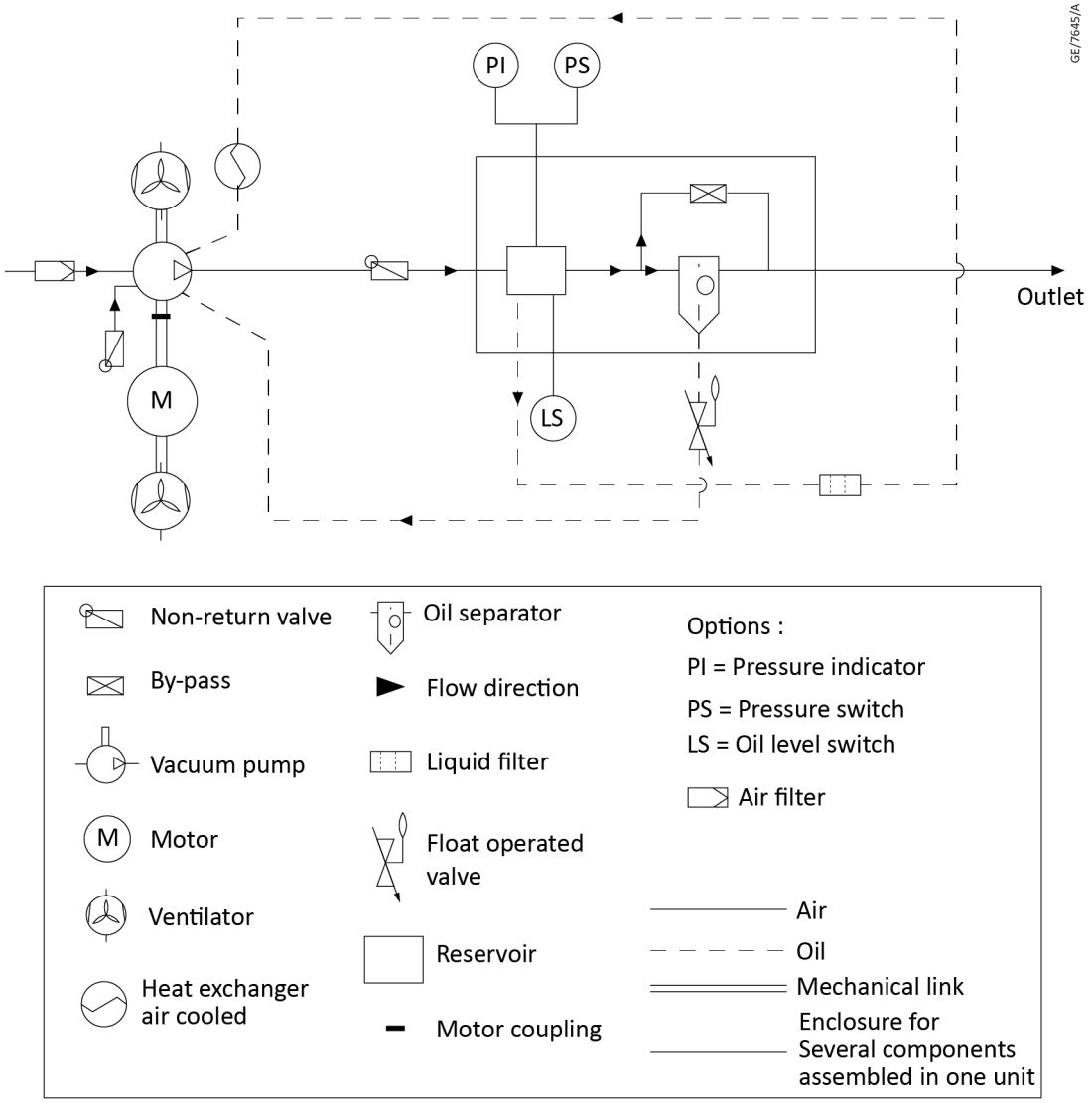


Figure 8 Flow diagram - GVS 200A and GVS 220A

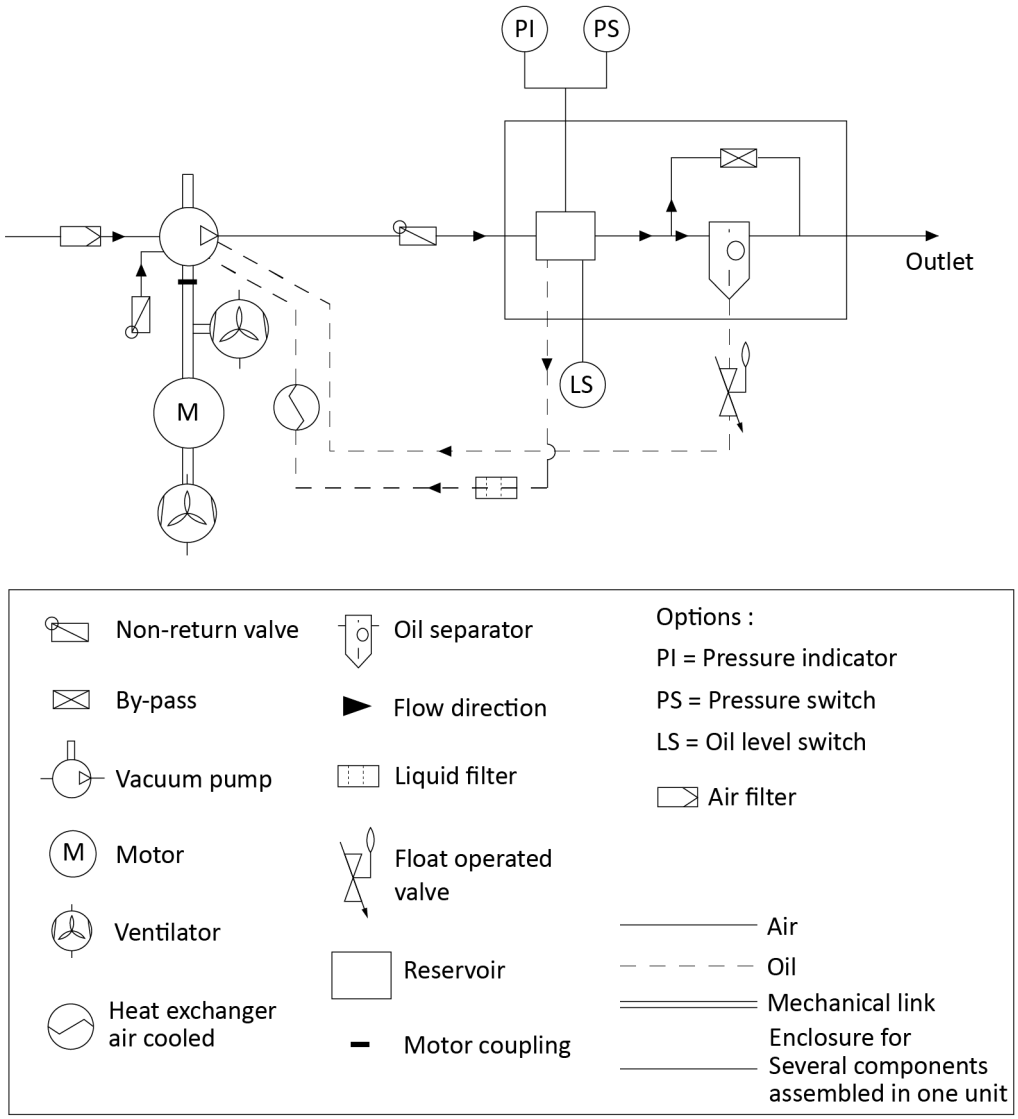
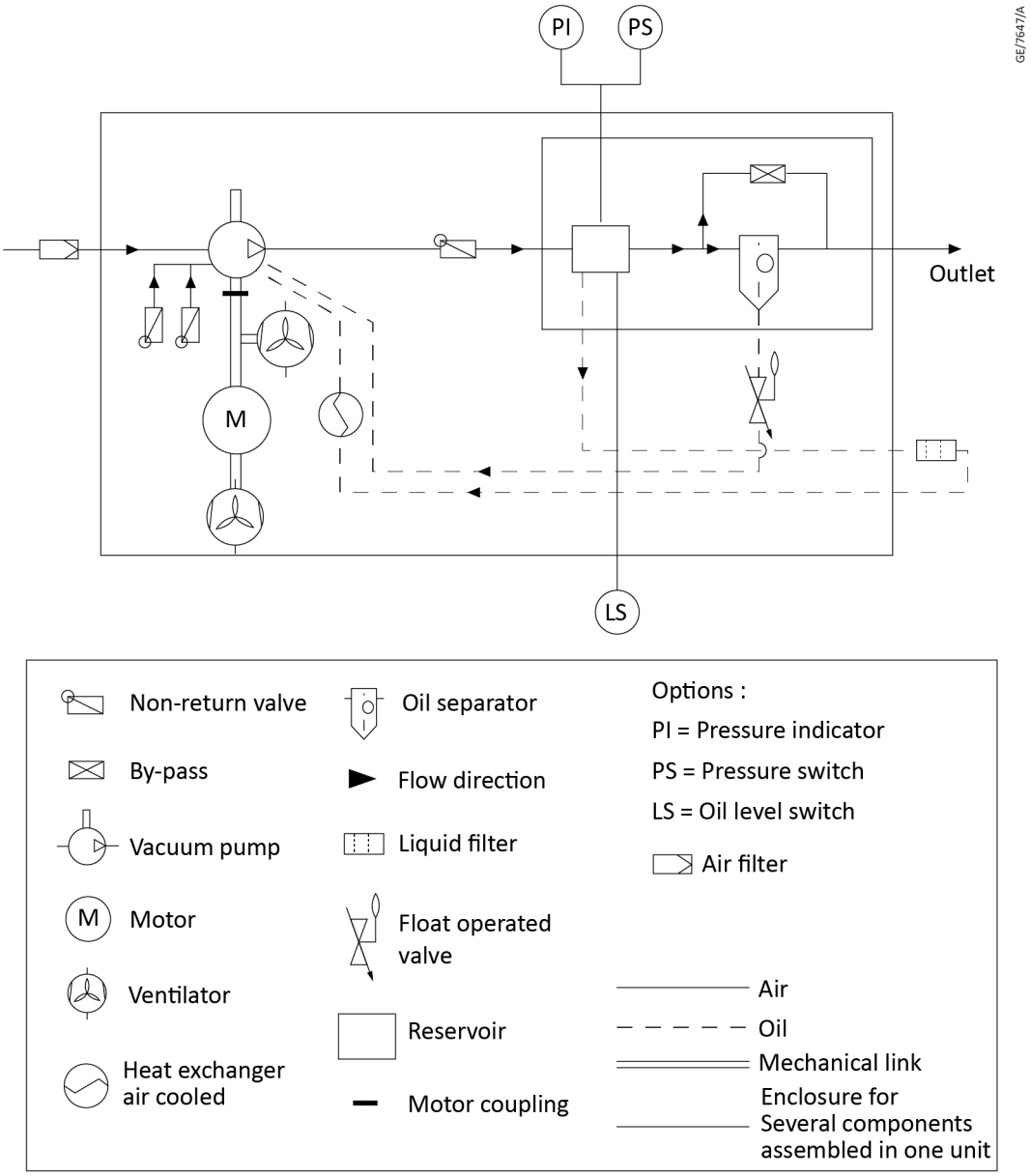


Figure 9 Flow diagram - GVS 470A and GVS 630A



3.4. Oil flow

Oil injected into the pump chamber serves to seal, lubricate and cool the pump. The oil entrained with the compressed gas is coarsely trapped in the bottom part of the oil casing. Oil is finely filtered in the integrated exhaust filter elements. The proportion of oil in the exhaust gas is reduced below the visibility threshold (over 99 % entrapment rate). The oil trapped in the exhaust filters is returned to the generator via an oil return line. To prevent the entry of gas, flowing at atmospheric pressure from the oil reservoir, into the intake port the oil return line is controlled by a float valve. The oil cycle is maintained by the pressure difference between the oil casing (pressure above atmospheric pressure) and the intake port (pressure below atmospheric pressure).

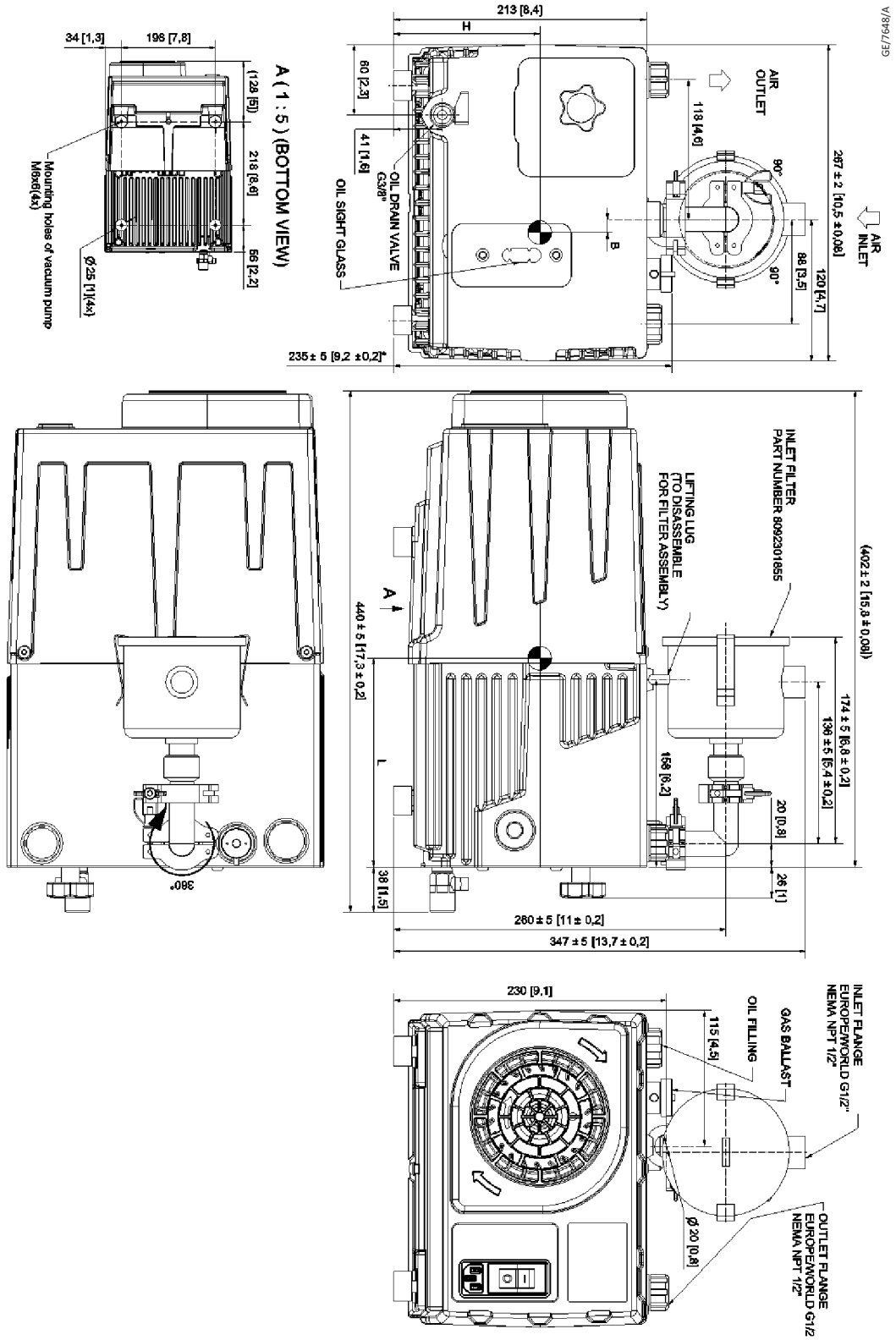
4. Technical data

4.1. Dimension drawings

Note:

All dimensions given are in mm (inch).

Figure 10 Dimension drawing - GVS 16A and GVS 25A

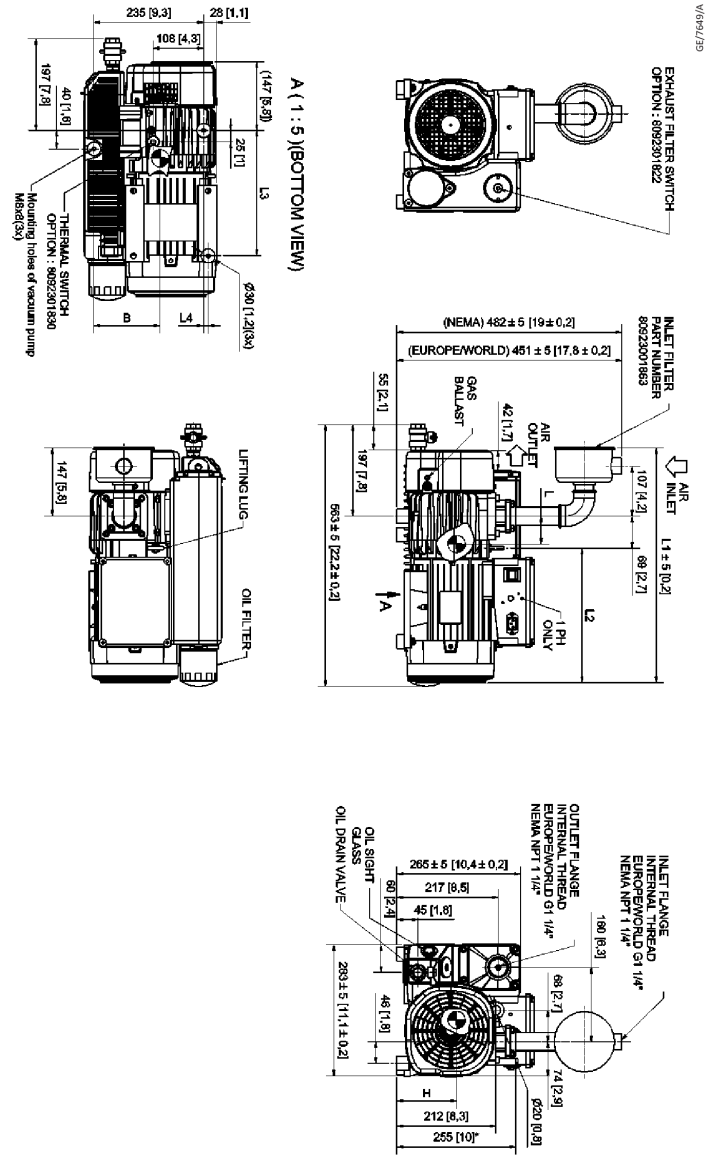


Note:

Approximate weight - 68.3 lbs

Height without inlet filter.

Figure 11 Dimension drawing - GVS 40A



Pump	L1 mm (inch)	L2 mm (inch)
3 phase	457 (18)	241 (9.5)
1 phase	502 (19.8)	266 (11.3)

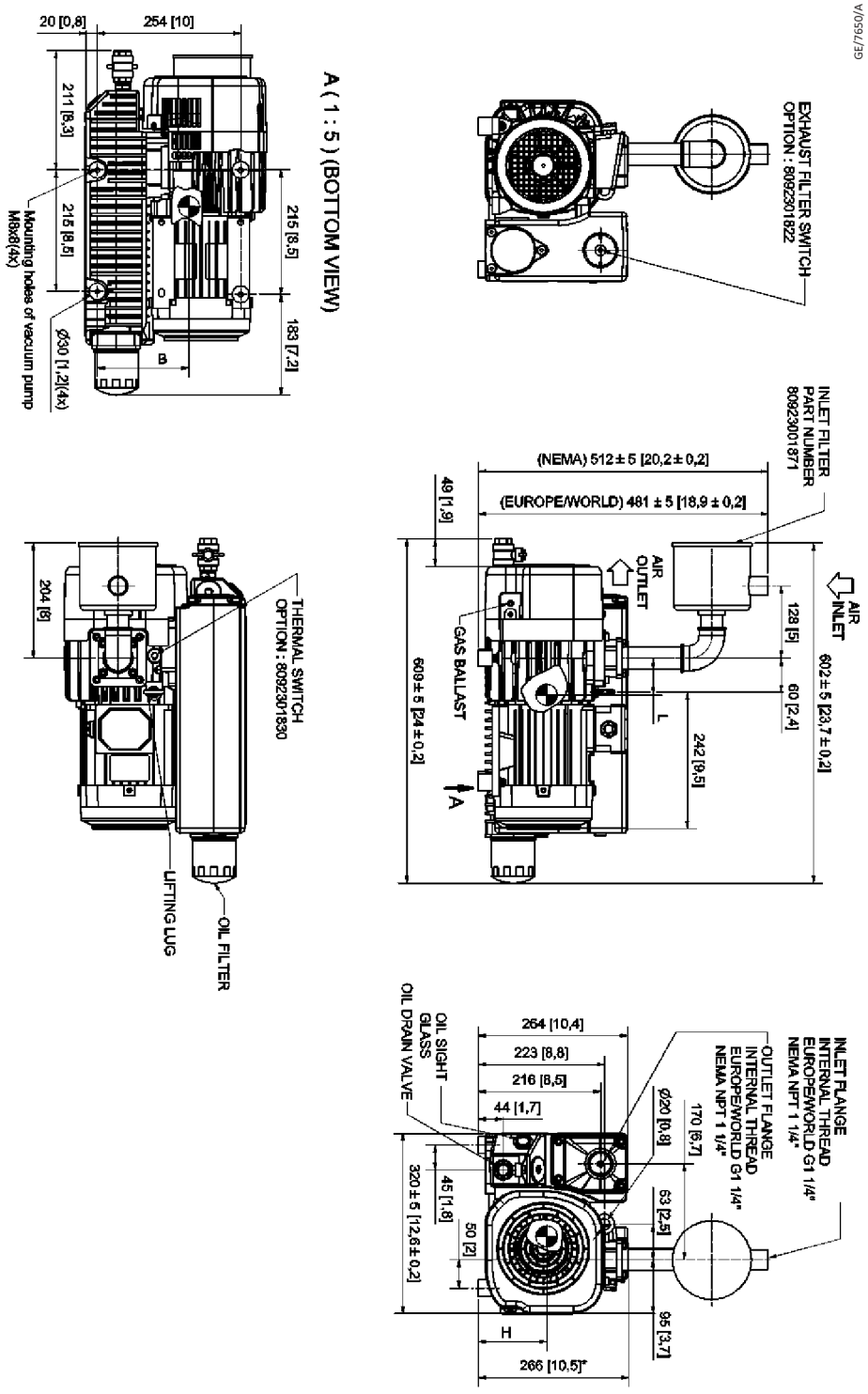
Pump	L3 mm (inch)	L4 mm (inch)
3 phase (USA/World)	226 (8.9)	0 (0)
3 phase (Europe)	220 (8.7)	0 (0)
1 phase	266 (10.5)	10 (0.4)

Note:

Approximate weight - 92.6 lbs

Height without inlet filter.

Figure 12 Dimension drawing - GVS 60A

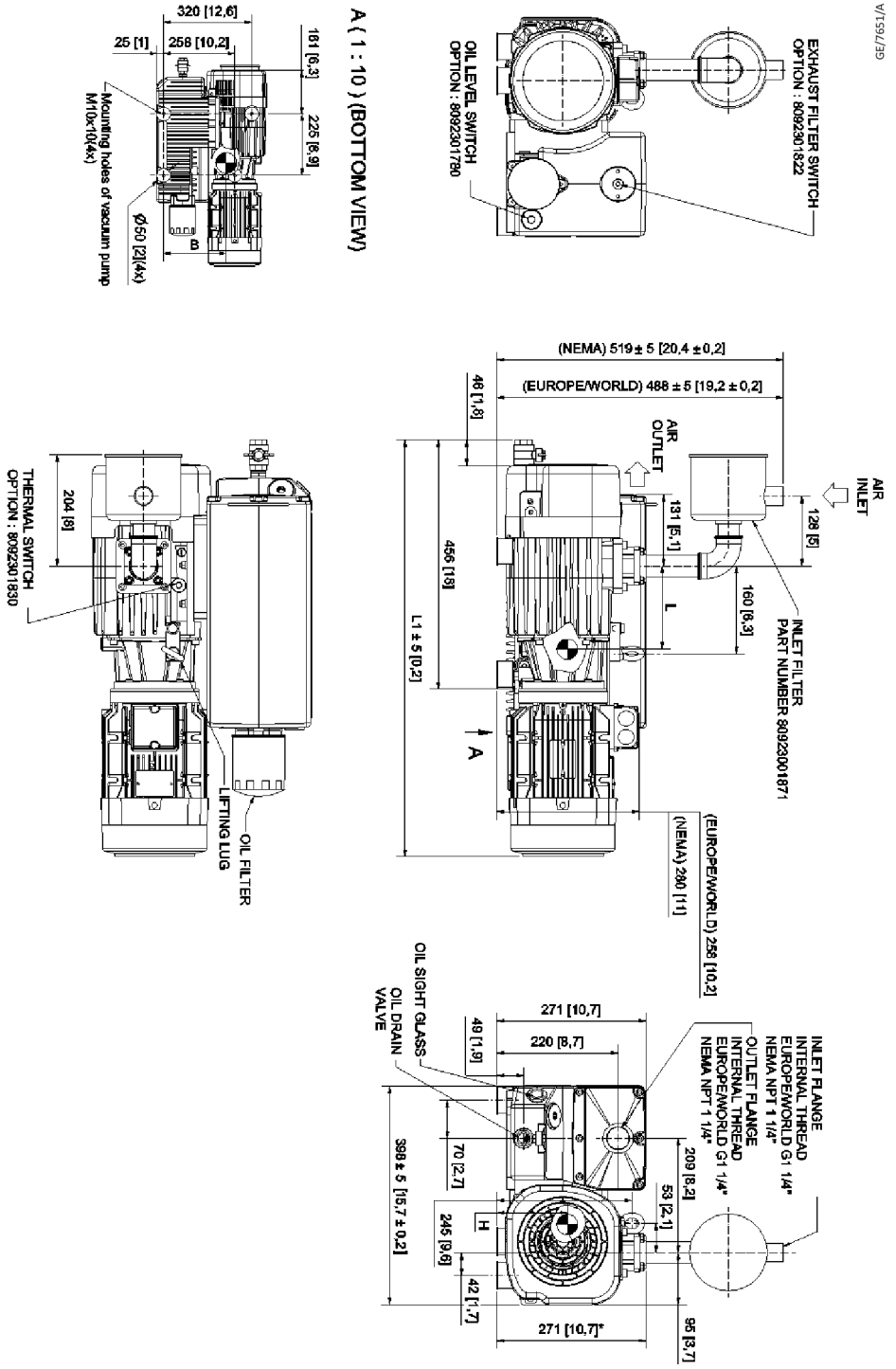


Note:

Approximate weight - 125.7 lbs

Height without inlet filter.

Figure 13 Dimension drawing GVS 60A



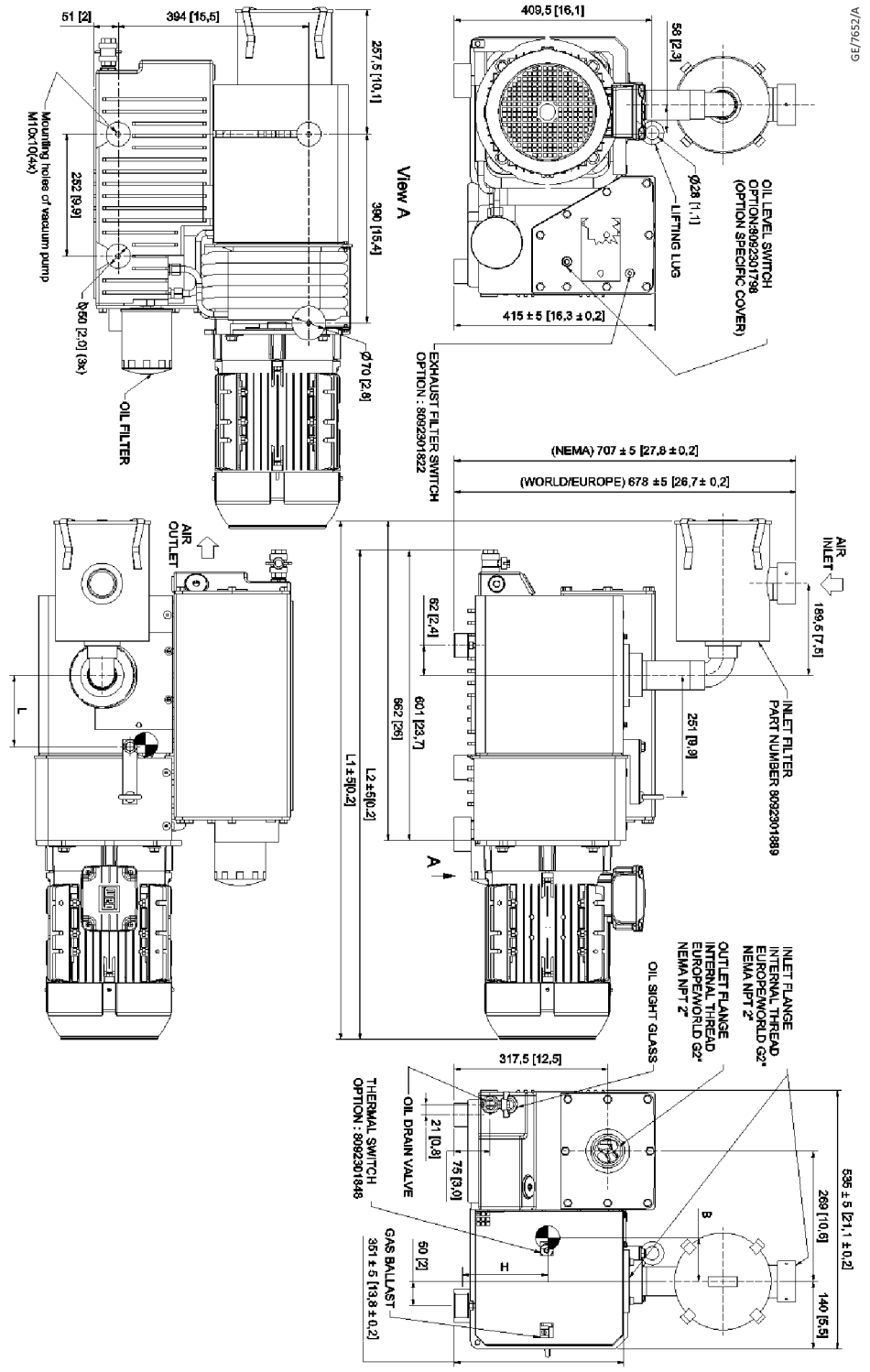
Pump	L1 mm (inch)
NEMA	825 (32.5)
Europe	762 (30)
World	791 (31.1)

Note:

Approximate weight - 180.8 lbs

Height without inlet filter.

Figure 14 Dimension drawing - GVS 200A



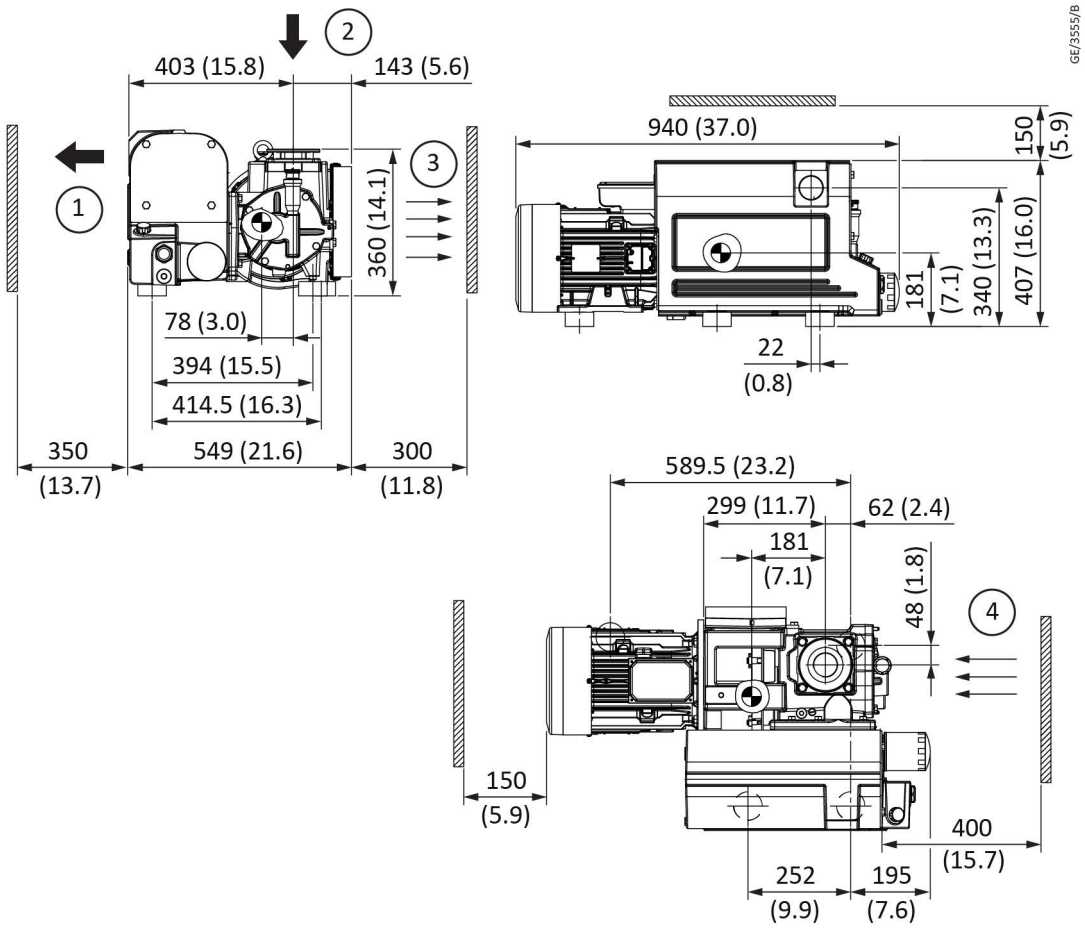
Pump	L1 mm (inch)	L2 mm (inch)
Europe	1088 (42.8)	1023 (40.3)
NEMA	1080 (42.5)	1015 (40)
World	1078 (42.4)	1013 (39.9)

Note:

Approximate weight - 374.8 lbs

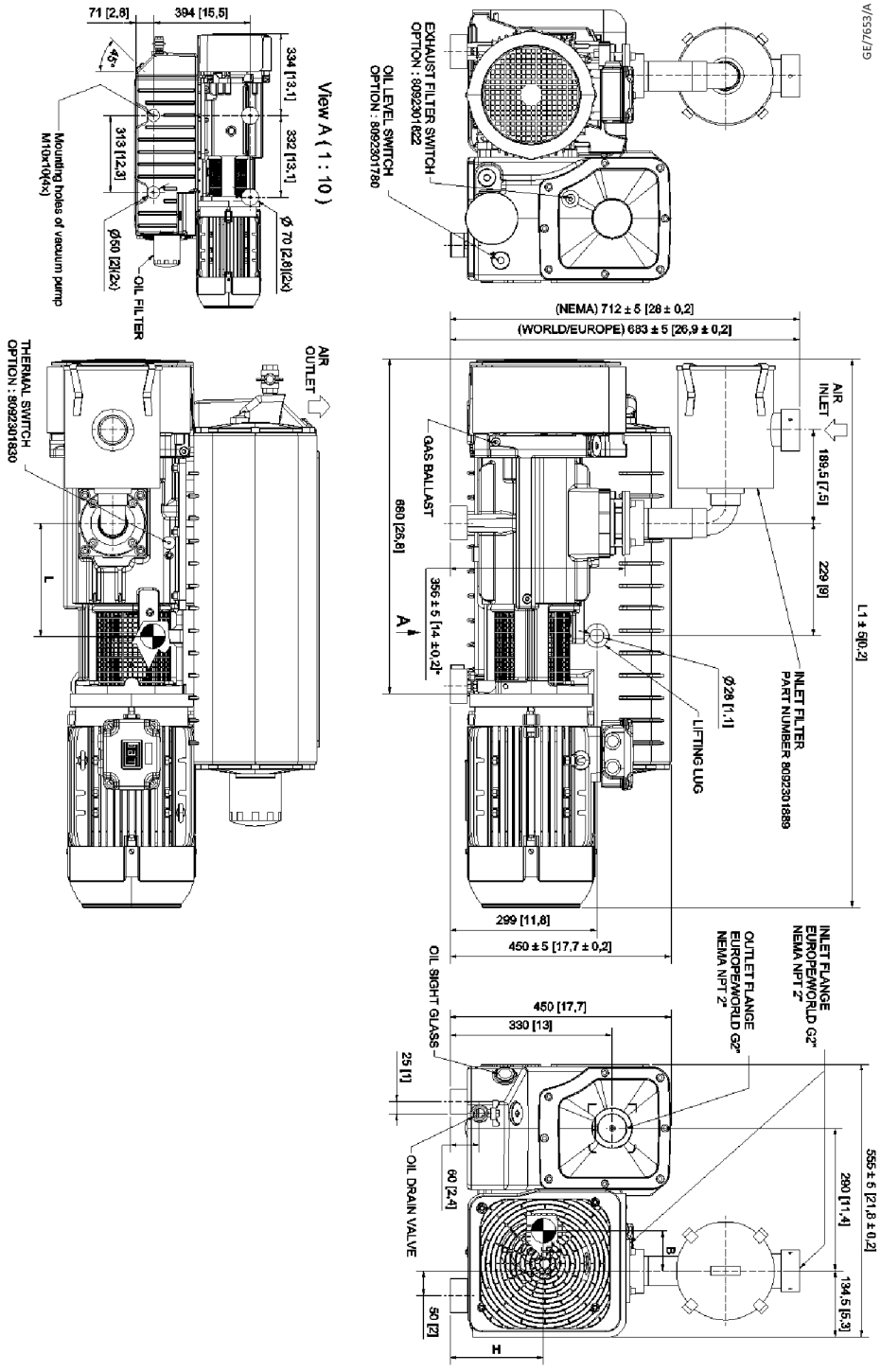
Height without inlet filter.

Figure 15 Dimension drawing - GVS 220A



1. *Exhaust port*
2. *Inlet port*
3. *Cooling air pump*
4. *Cooling air pump*

Figure 16 Dimension drawing - GVS 300A



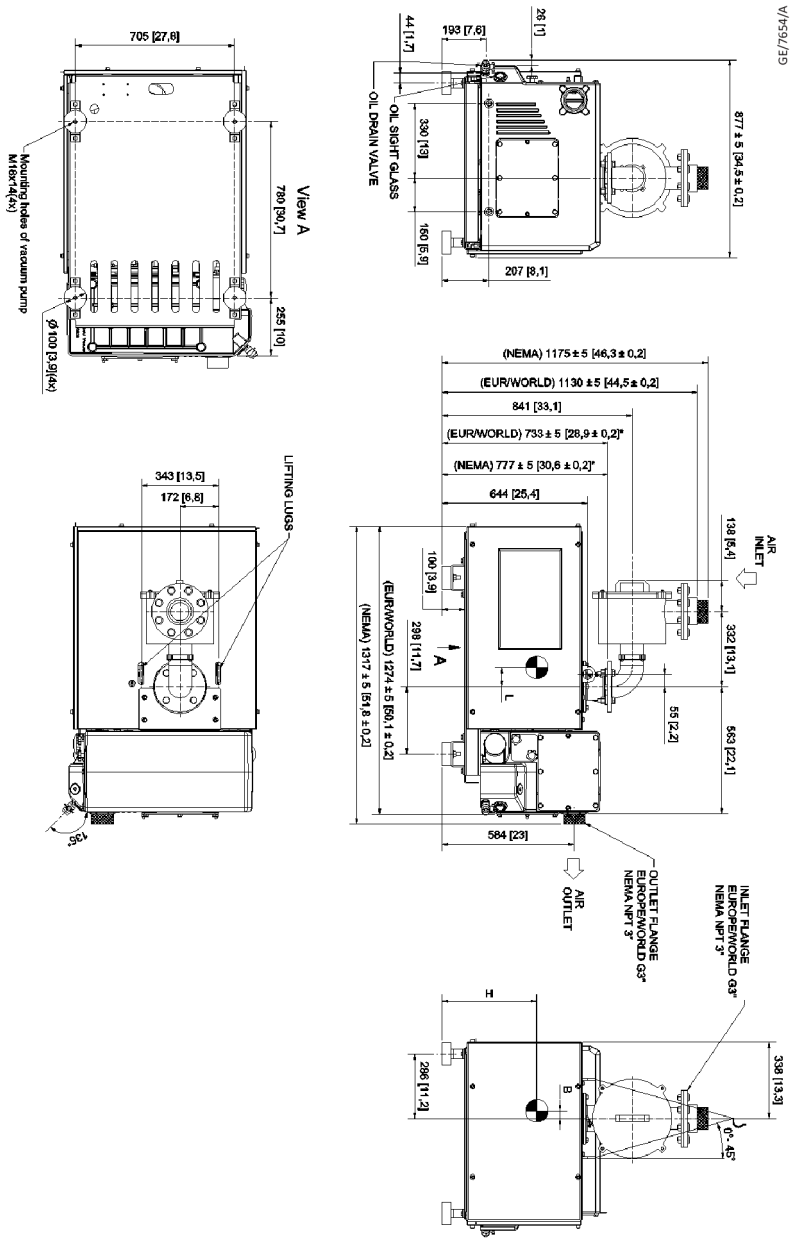
Pump	L1 mm (inch)
NEMA	1100 (43.3)
Europe	1160 (45.7)
World	1120 (44.1)

Note:

Approximate weight - 485 lbs

Height without inlet filter.

Figure 17 Dimension drawing - GVS 470A

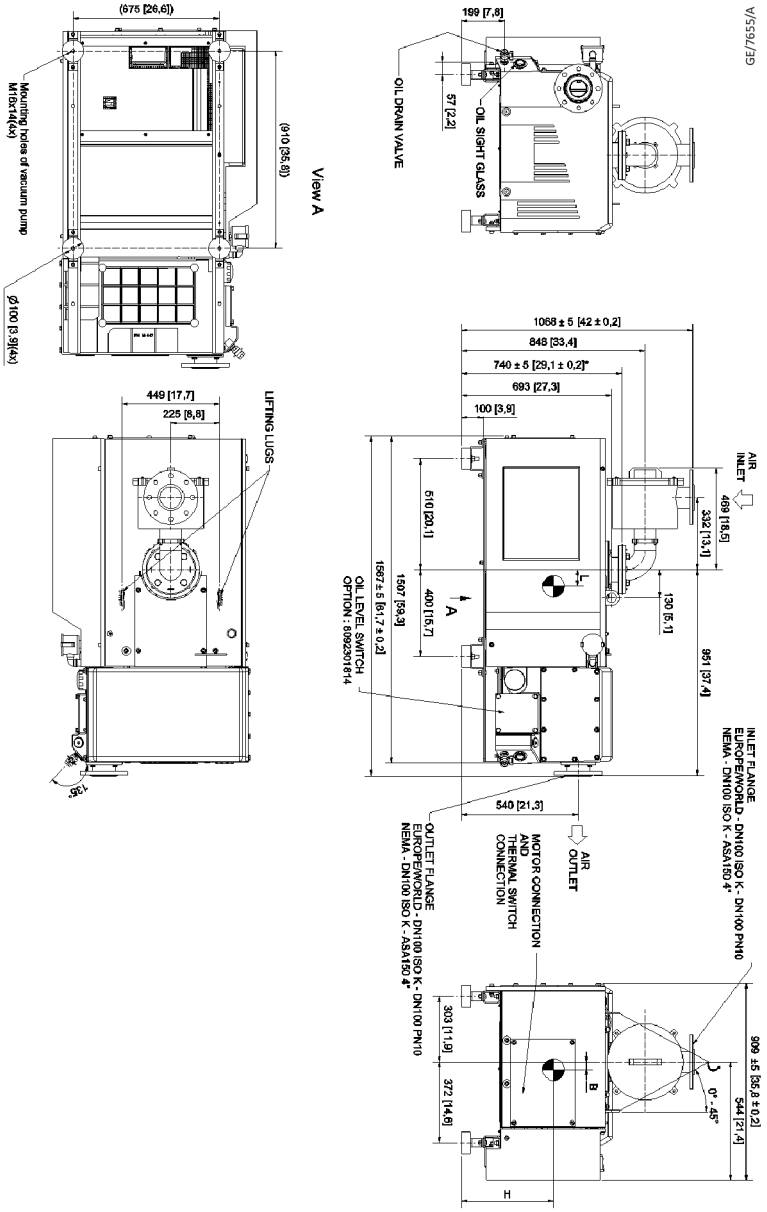


Note:

Approximate weight - 1241.2 lbs

Height without inlet filter.

Figure 18 Dimension drawing - GVS 630A



Note:

Approximate weight - 1717.4 lbs

Height without inlet filter.

4.2. Performance curves

Figure 19 Performance curve - GVS 16A

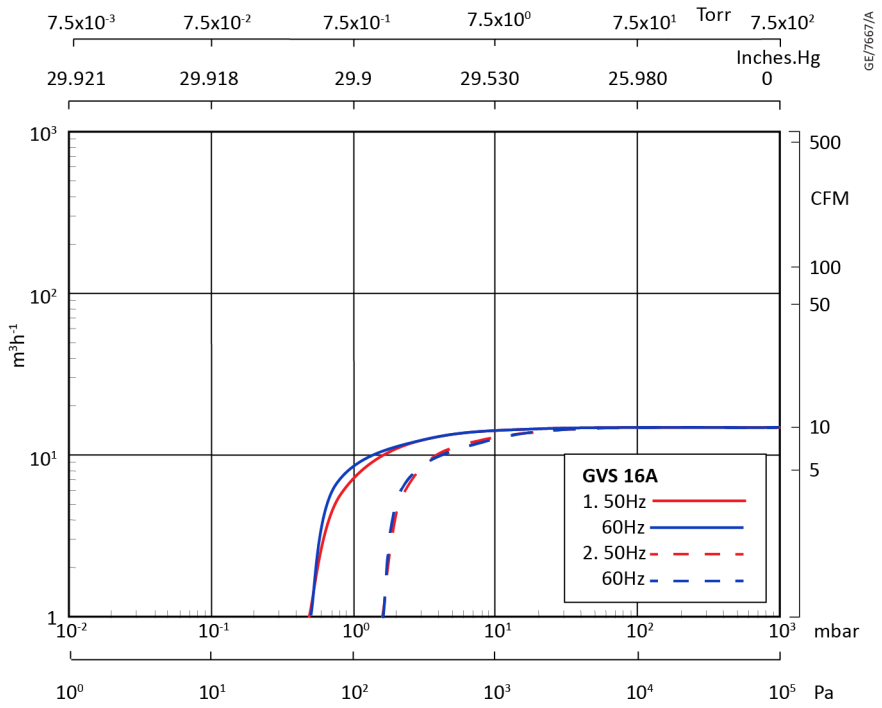


Figure 20 Performance curve - GVS 25A

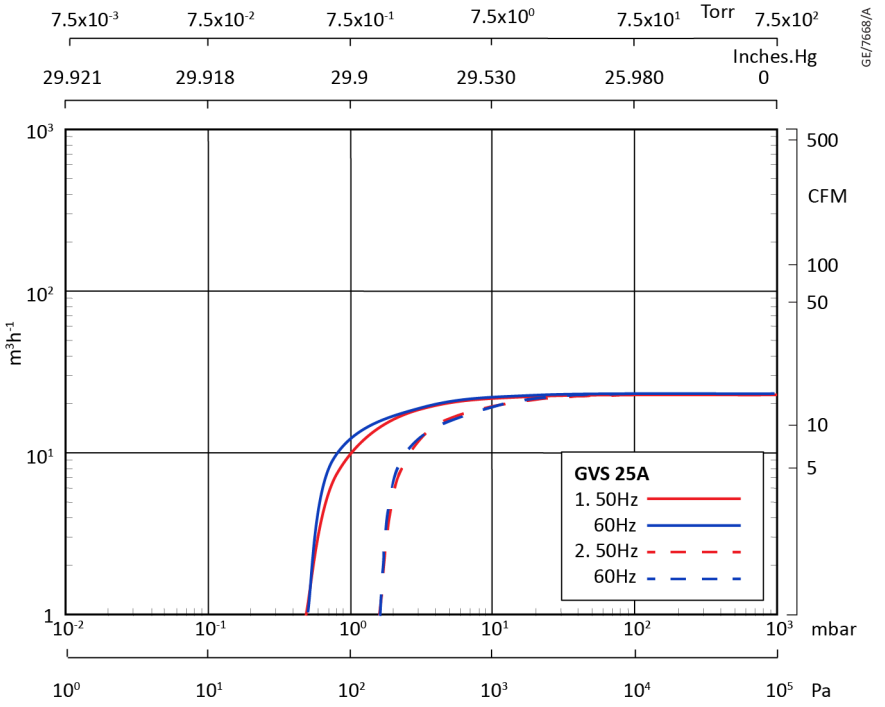


Figure 21 Performance curve - GVS 40A

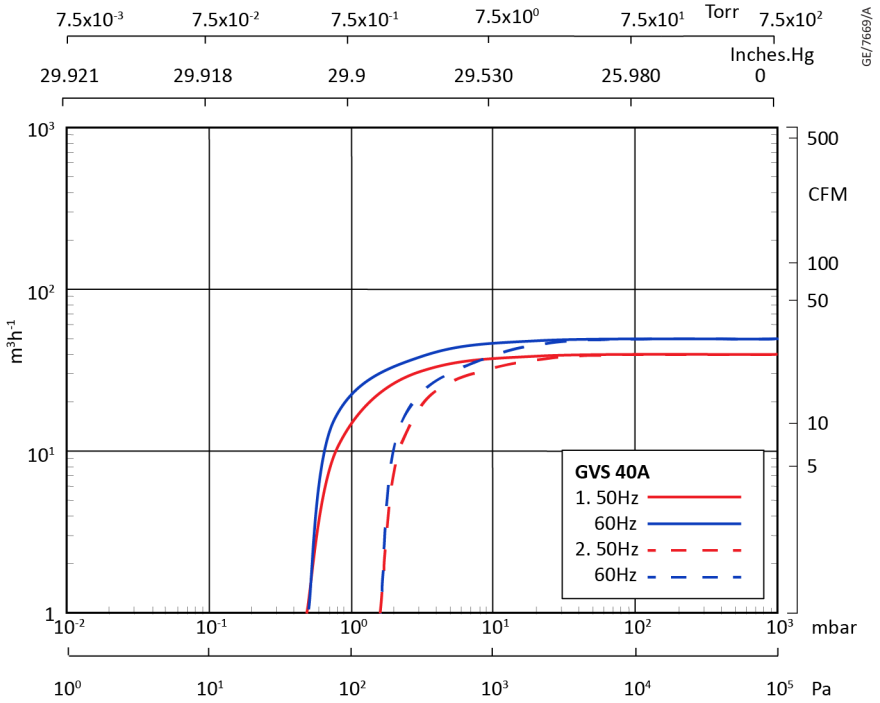


Figure 22 Performance curve - GVS 60A

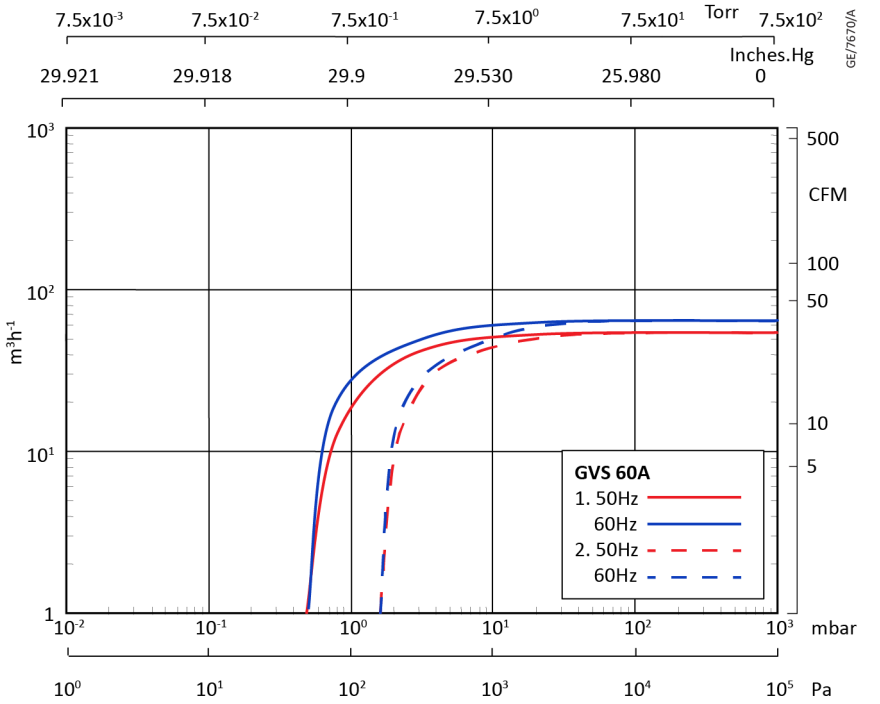


Figure 23 Performance curve - GVS 100A

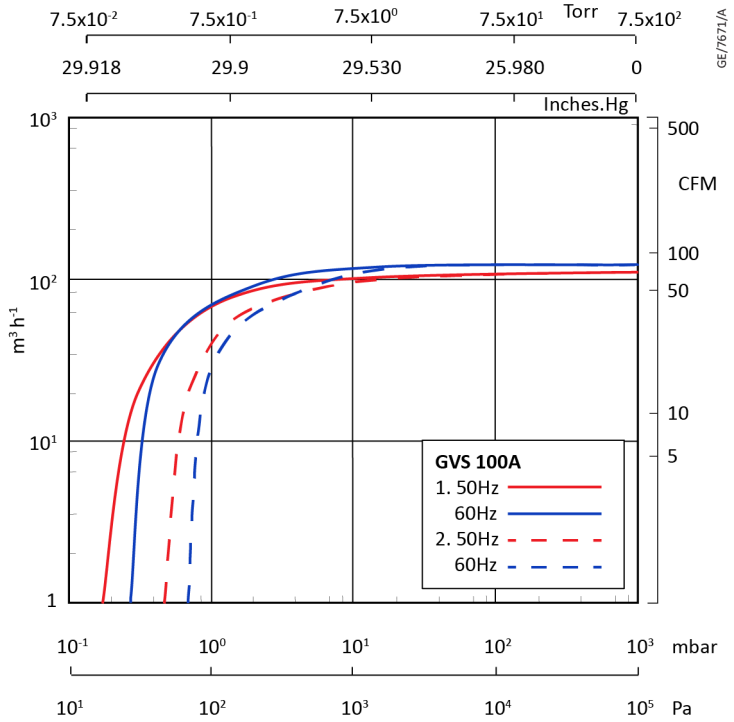


Figure 24 Performance curve - GVS 200A

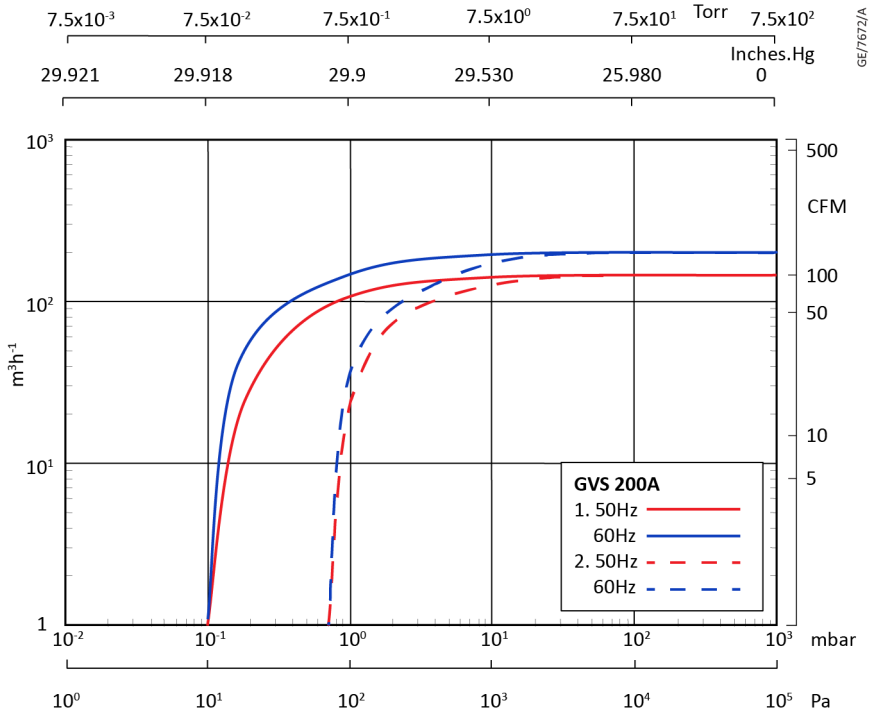


Figure 25 Performance curve - GVS 220A

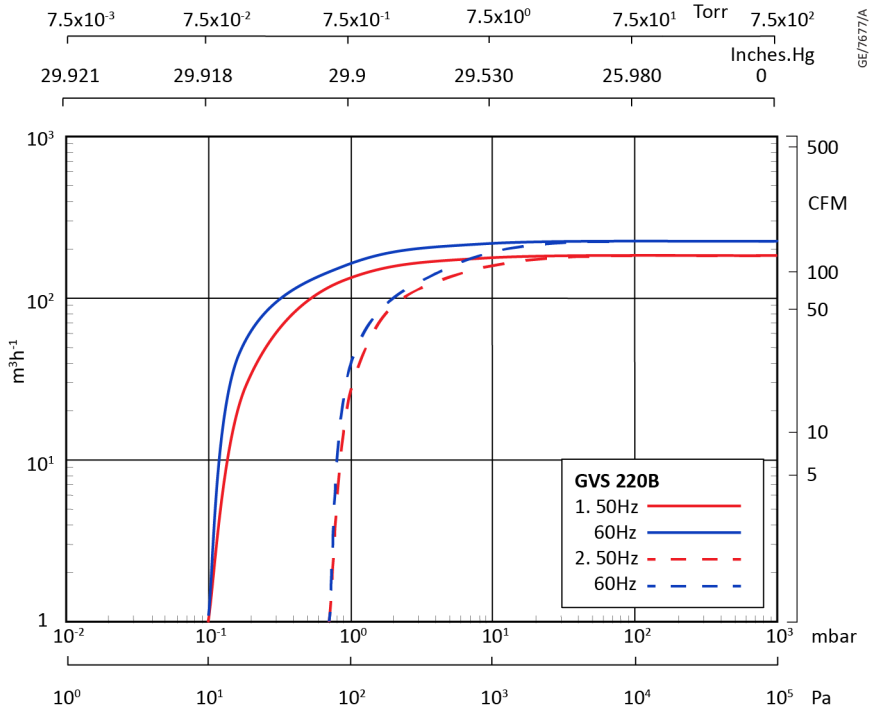


Figure 26 Performance curve - GVS 300A

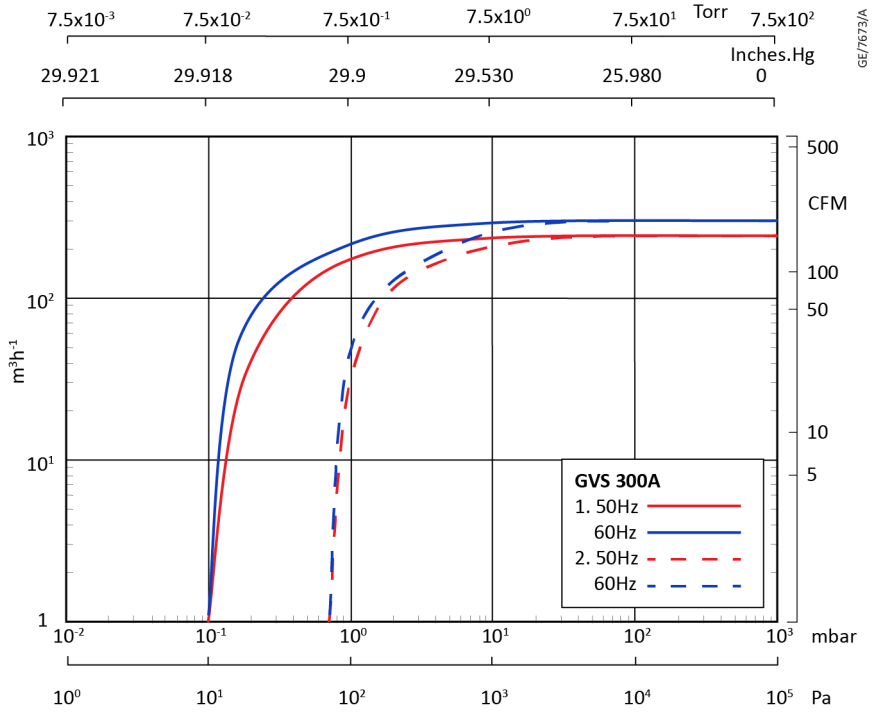


Figure 27 Performance curve - GVS 470A

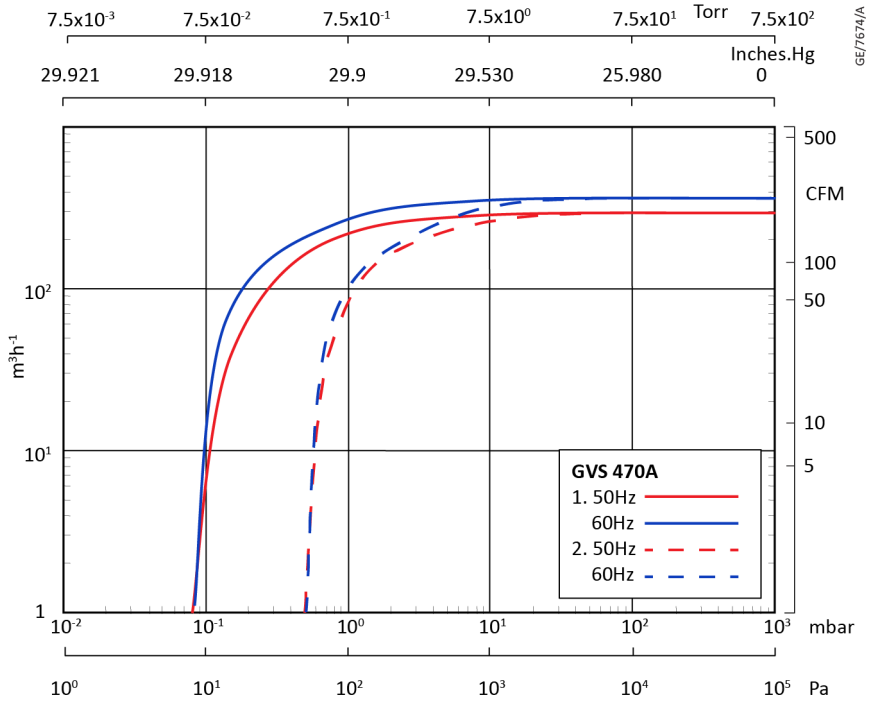
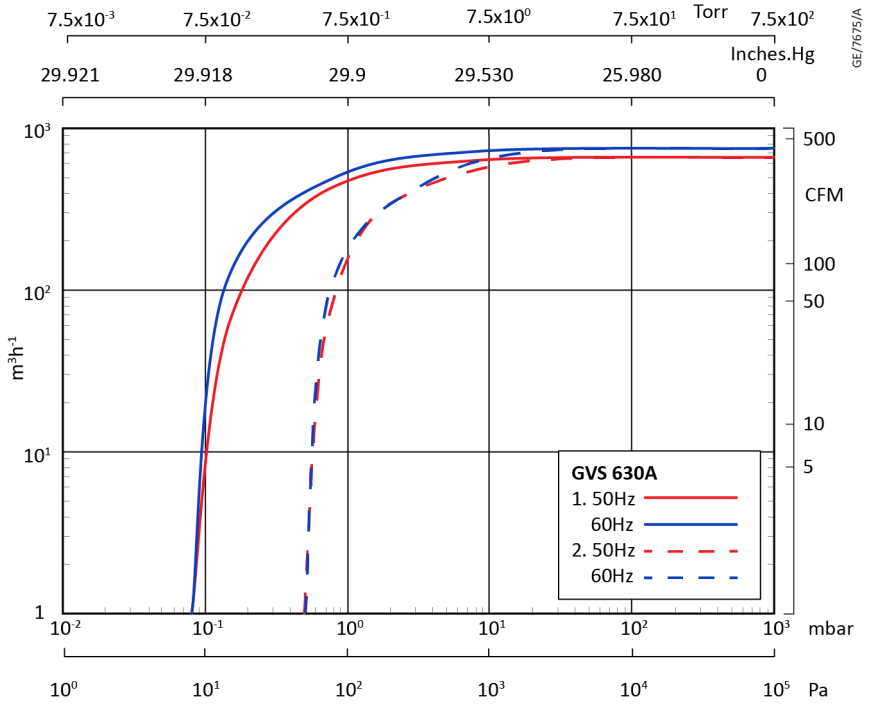


Figure 28 Performance curve - GVS 630A



4.3. Reference conditions and limitations

Table 1 Reference conditions

Parameter	Unit	GVS 16A	GVS 25A	GVS 40A	GVS 60A	GVS 100A	GVS 200A	GVS 220A	GVS 300A	GVS 470A	GVS 630A
Ambient barometric pressure	mbar(a)	1013	1013	1013	1013	1013	1013	1013	1013	1013	1013
	Torr (mmHg)	760	760	760	760	760	760	760	760	760	760
Relative air humidity	%	0	0	0	0	0	0	0	0	0	0
Air inlet temperature	°C	20	20	20	20	20	20	20	20	20	20
	°F	68	68	68	68	68	68	68	68	68	68
Exhaust back pressure	mbar(e)	0	0	0	0	0	0	0	0	0	0
	psi(g)	0	0	0	0	0	0	0	0	0	0
Ambient temperature	°C	20	20	20	20	20	20	20	20	20	20
	°F	68	68	68	68	68	68	68	68	68	68
Motor speed 50 Hz	rpm	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Motor speed 60 Hz	rpm	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Mineral oil viscosity 1 ph	ISO	VG32	VG32	VG32	-	-	-	-	-	-	-
Mineral oil viscosity 3 ph	ISO	VG32	VG32	VG68	VG68	VG68	VG68	VG68	VG68	VG68	VG68
Synthetic viscosity/ PFPE oil viscosity 1 ph	ISO	VG32	VG32	VG32	-	-	-	-	-	-	-

Parameter	Unit	GVS 16A	GVS 25A	GVS 40A	GVS 60A	GVS 100A	GVS 200A	GVS 220A	GVS 300A	GVS 470A	GVS 630A
Synthetic viscosity/ PFPE oil viscosity 3 ph	ISO	VG32	VG32	VG100	VG100	VG100	VG100	VG100	VG100	VG100	VG100
Maximum inlet pressure for continuous operation	mbar(a)	1013	1013	1013	1013	1013	1013	1013	1013	1013	1013
	torr (mmHg)	760	760	760	760	760	760	760	760	760	760
Maximum ambient temperature	°C	40	40	40	40	40	40	40	40	40	40
	°F	104	104	104	104	104	104	104	104	104	104
Minimum ambient temperature (see note)	°C	12	12	12	12	12	12	12	12	12	12
	°F	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6
Maximum gas inlet temperature	°C	40	40	40	40	40	40	40	40	40	40
	°F	104	104	104	104	104	104	104	104	104	104
Minimum gas inlet temperature	°C	12	12	12	12	12	12	12	12	12	12
	°F	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6
Maximum exhaust back pressure	mbar(e)	150	150	150	150	150	150	150	150	150	150
	psi(g)	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Minimum exhaust back pressure	mbar(e)	-15	-15	-15	-15	-15	-15	-15	-15	-15	-15
	psi(g)	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22
Maximum inlet pressure for water vapour with standard gas ballast	mbar(a)	15	15	30	30	30	30	10	10	15	40
	torr (mmHg)	11.2	11.2	22.5	22.5	22.5	22.5	7.5	7.5	11	30

Parameter	Unit	GVS 16A	GVS 25A	GVS 40A	GVS 60A	GVS 100A	GVS 200A	GVS 220A	GVS 300A	GVS 470A	GVS 630A
Maximum inlet pressure for water vapour with big gas ballast (or 2 GB)	mbar(a)	N/A	N/A	N/A	60	60	50	40	70	40	60
	torr (mmHg)	N/A	N/A	N/A	45	45	37.5	30	52.5	30	45
Maximum water vapour pumping rate vapour with standard gas ballast	kg/h	0.05	0.08	0.76	1	1.6	3.4	5	1.3	5	17

Note:

Lower temperatures are possible with reduced viscosity oil. This temperature range is defined by Pneurop for performance conformity testing, but 8 °C is the critical point from the motor starting view point.

4.4. Pump data

Table 2 Pump data

Description	Unit	GVS 16A	GVS 25A	GVS 40A	GVS 60A	GVS 100A	GVS 200A	GVS 220A	GVS 300A	GVS 470A	GVS 630A
Volumetric flow rate 50 Hz	m³/h	16	25	44	59	97.5	180	200	280	470	700
	cfm	9.4	14.5	25.9	34.8	57.4	106	117	165	277	412
Volumetric flow rate 60 Hz	m³/h	18.7	29	53	71	117	220	240	340	570	840
	cfm	11	17.1	31.2	41.8	68.9	130	141	200	366	494
Pumping speed versus pressure	Refer to *Performance curves* on page 34.										
Ultimate pressure without gas ballast	mbar(a)	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1
	torr (mmHg)	0.4	0.4	0.4	0.4	0.4	0.08	0.08	0.08	0.08	0.08
Ultimate pressure with open gas ballast	mbar(a)	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7
	torr (mmHg)	1.1	1.1	1.1	1.1	1.1	0.5	0.5	0.5	0.5	0.5
Ultimate pressure without gas ballast for oxygen versions	mbar(a)	N/A	N/A	N/A	1	1	1	1	1	1	1
	torr (mmHg)	N/A	N/A	N/A	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Ultimate pressure with open gas ballast for oxygen versions	mbar(a)	N/A	N/A	N/A	2.5	2.5	1.5	-	1.5	1.5	1.5
	torr (mmHg)	N/A	N/A	N/A	1.9	1.9	1.2	-	1.2	1.2	1.2
Nominal motor power 50 Hz	kW	0.75	0.75	1.1	1.5	2.2	4	4.5	5.5	9.2	15
	hp	1	1	1.5	2.2	3	6	6	7.5	12	20

Description	Unit	GVS 16A	GVS 25A	GVS 40A	GVS 60A	GVS 100A	GVS 200A	GVS 220A	GVS 300A	GVS 470A	GVS 630A
Nominal motor power 60 Hz	kW	0.9	0.9	1.5	1.8	3.5	5.5	5.1	6.3	11	18.5
	hp	1.2	1.2	2	3	5	7.5	6.8	8.6	15	25
Mean sound pressure level at 1 m distance 50 Hz	dB(A)	59	59	58	60	61	69	69	72	72	72
Mean sound pressure level at 1 m distance 60 Hz	dB(A)	59	59	60	64	64	73	73	76	75	75
Rotor speed 50 Hz	rpm	1500	1500	1500	1500	1500	1500	1500	1500	820	820
Rotor speed 60 Hz	rpm	1800	1800	1800	1800	1800	1800	1800	1800	1000	1000
Oil capacity	l	2	2	1	2	2	5.0-9.0	7.5	8.5-11.5	20	20-23
	US quart	2.1	2.1	1.05	2.1	2.1	5.3-9.5	7.9	9.0-12.2	21	21-25
Weight net mass	kg	25	25	45	52	93	160	180	224	480	760
	lb	55	55	99.3	115	205	353	397	495	1100	1678
Weight total shipping mass units	kg	37	37	55	61	105	190	216	260	550	820
	lb	78	78	115	128	220	400	476	546	1155	1722

4.5. Motor data

Table 3 Motor data

Model	Type	Motor voltage supply range (V)		Nominal current (A)		Service factor
		50 Hz	60 Hz	50 Hz	60 Hz	
GVS 16A	1 phase Wide	180-264 1 ph	180-264 1 ph	5.4	3.6	1
	3 phase Wide	200/240±10% (Δ) 380/415±10% (Y)	200/240±10% (Δ) 380/460±10% (Y)	5.0 (Δ) / 2.2 (Y)	4.3 (Δ) / 2.2 (Y)	1
GVS 25A	1 phase Wide	198-253 1 ph	198-253 1 ph	5.2	3.2	1
	3 phase Wide	200/240±10% (Δ) 380/415±10% (Y)	200/240±10% (Δ) 380/460±10% (Y)	5.0 (Δ) / 2.2 (Y)	4.3 (Δ) / 2.2 (Y)	1
GVS 40A	1 phase Wide	180-264 1 ph	180-264 1 ph	8.5	10.5	1
	3 phase Europe	230±10% (Δ) 400±10% (Y)	460±10% (Y)	4.7 (Δ) / 2.7 (Y)	2.7 (Y)	1
	3 phase NEMA	400±10% (Y)	230±10% (YY) 460±10% (Y)	3.7 (Y)	6.4 (YY) / 3.2 (Y)	1
	3 phase Wide	220/230±10% (Δ) 380/400±10% (Y)	220/230±10% (Δ) 380/400/440/460±10% (Y)	5.2 (Δ) / 3.0 (Y)	5.2 (Δ) / 3.0 (Y)	1
GVS 60A	3 phase Europe	230±10% (Δ) 400±10% (Y)	460±10% (Y)	6.6 (Δ) / 3.8 (Y)	3.6 (Y)	1
	3 phase NEMA	400±10% (Y)	230±10% (YY) 460±10% (Y)	5.0 (Y)	9.0 (YY) / 4.5 (Y)	1
	3 phase Wide	220/230±10% (Δ) 380/400±10% (Y)	220/230±10% (Δ) 380/400/440/460±10% (Y)	7.5 (Δ) / 4.3 (Y)	6.9 (Δ) / 4.0 (Y)	1

Model	Type	Motor voltage supply range (V)		Nominal current (A)		Service factor
		50 Hz	60 Hz	50 Hz	60 Hz	
GVS 100A	3 phase Europe	220/230±10% (Δ) 400±10% (Y)	460±10% (Y)	8.1 (Δ) / 4.7 (Y)	4.7 (Y)	1
	3 phase NEMA		208/230±10% (YY) 460±10% (Y)		14.1 (YY) / 7.0 (Y)	1.15
	3 phase Wide	220/230/240±10% (Δ) 380/400/415±10% (Y)	220/230±10% (Δ) 380/400/460±10% (Y)	9.7 (Δ) / 5.6 (Y) IE2	12.0 (Δ) / 6.9 (Y) IE2	1
GVS 200A	3 phase Europe	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/440/460±10% (Y)	20.7 (YY) 18.3 (Δ) 10.6 (Y)	21.4 (YY) 19 (Δ) 11.0 (Y)	1
	3 phase NEMA	400±10% (Δ)	208/230±10% (ΔΔ) 460±10% (Δ)	10.6 (Δ)	20.6 (ΔΔ) / 9.3 (Δ)	1.25
	3 phase Wide	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/440/460±10% (Y)	20.7 (YY) 18.3 (Δ) 10.6 (Y)	21.4 (YY) 19 (Δ) 11.0 (Y)	1
GVS 220A	3 phase Europe	220/230/240±10% (Δ) 380/400/415±10% (Y)	440/460±10% (Y)	16.3 (Δ) 9.4 (Y)	10.3 (Y)	1.15
	3 phase Wide	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/440/460±10% (Y)	22.5 (YY) 19.8 (Δ) 11.5 (Y)	24.3 (YY) 25.1 (Δ) 12.4 (Y)	1.15

Model	Type	Motor voltage supply range (V)		Nominal current (A)		Service factor
		50 Hz	60 Hz	50 Hz	60 Hz	
GVS 300A	3 phase Europe	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/460±10% (Y)	24.6 (YY) 21.4 (Δ) 12.3 (Y)	26 (YY) 23.6 (Δ) 13.5 (Y)	1
	3 phase NEMA	400±10% (Δ)	208/230±10% (ΔΔ) 460±10% (Δ)	14.6 (Δ)	27.8 (ΔΔ) / 12.7 (Δ)	1.25
	3 phase Wide	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/460±10% (Y)	24.6 (YY) 21.4 (Δ) 12.3 (Y)	26 (YY) 23.6 (Δ) 13.5 (Y)	1
GVS 470A	3 phase NEMA	400±10% (Δ)	230±10% (ΔΔ) 440/460/480±10% (Δ)	20.4 (Δ)	36.0 (ΔΔ) / 18.6 (Δ)	1.25
	3phase Wide	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/460±10% (Y)	46.2 (YY) 40.4 (Δ 23.4 (Y)	49.4 (YY) 44.3 (Δ) 25.7 (Y)	1
GVS 630A	3 phase NEMA	400±10% (Δ)	230±10% (ΔΔ) 440/460/480±10% (Δ)	33.9 (Δ)	59.1 (ΔΔ) / 30.2 (Δ)	1.25
	3 phase Wide	200±10% (YY) 220/230/240±10% (Δ) 380/400/415±10% (Y)	200±10% (YY) 220/230±10% (Δ) 380/400/460±10% (Y)	76.8 (YY) 67.1 (Δ) 38.8 (Y)	69.6 (YY) 62.5 (Δ) 36.2 (Y)	1

5. Installation

5.1. Installation proposal

Note:

Installation drawing of standard drawing is shown.

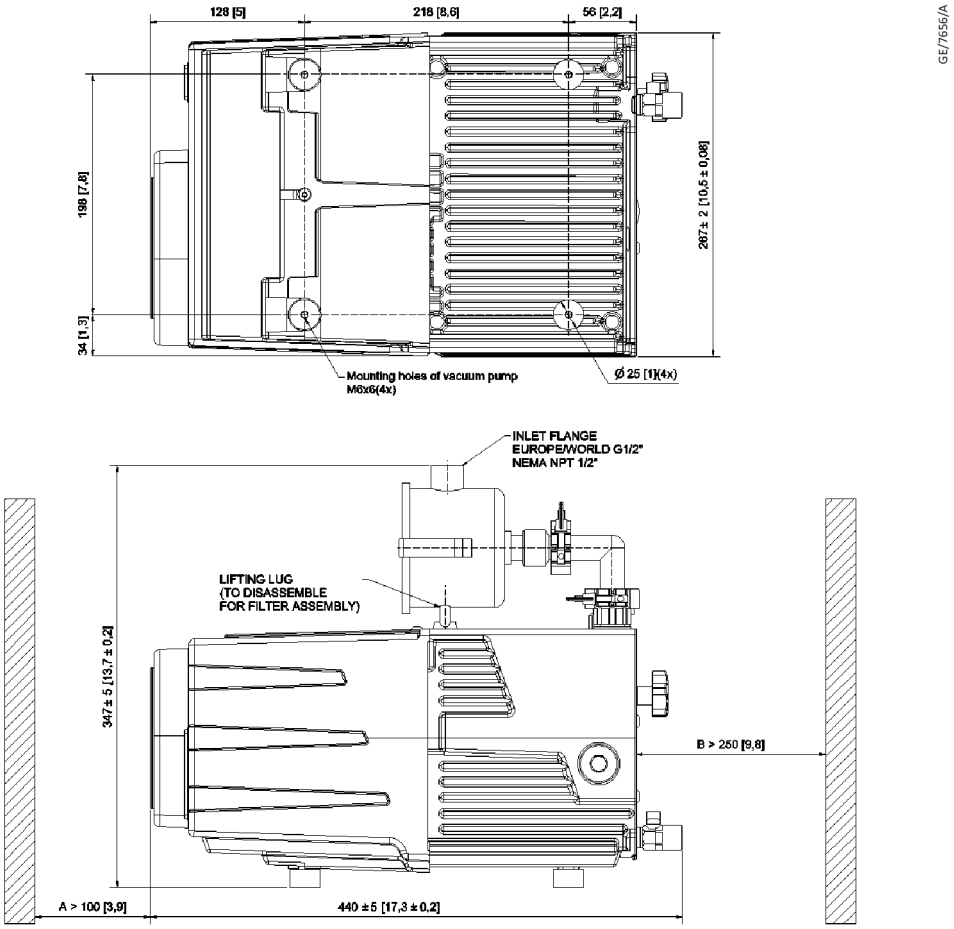
The vacuum pump must be installed on a level horizontal floor.

Use correct process pipe sizes to prevent restrictions and pressure drops.

Ambient and inlet temperature must not exceed the limits of the pump's working range.

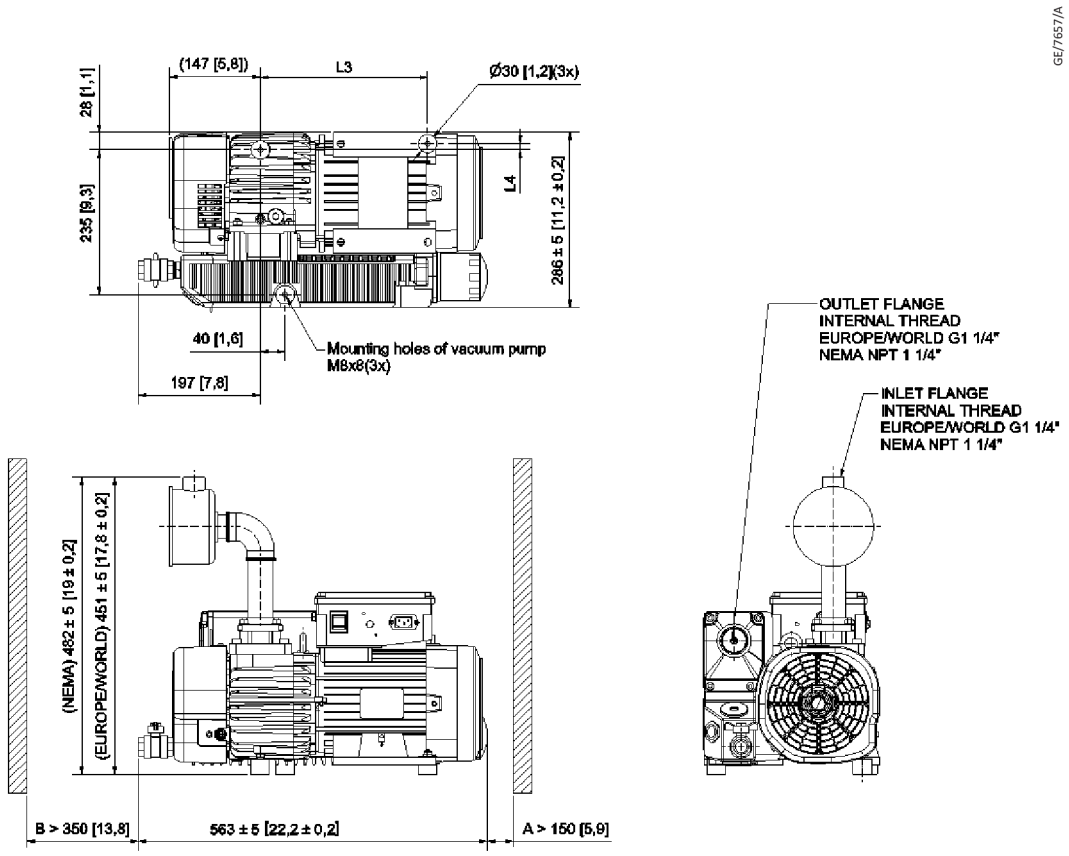
All dimensions given are in mm (inch).

Figure 29 Installation proposal - GVS 16A and GVS 25A



A. Space for motor ventilation *B. Space for exhaust filter exchange*

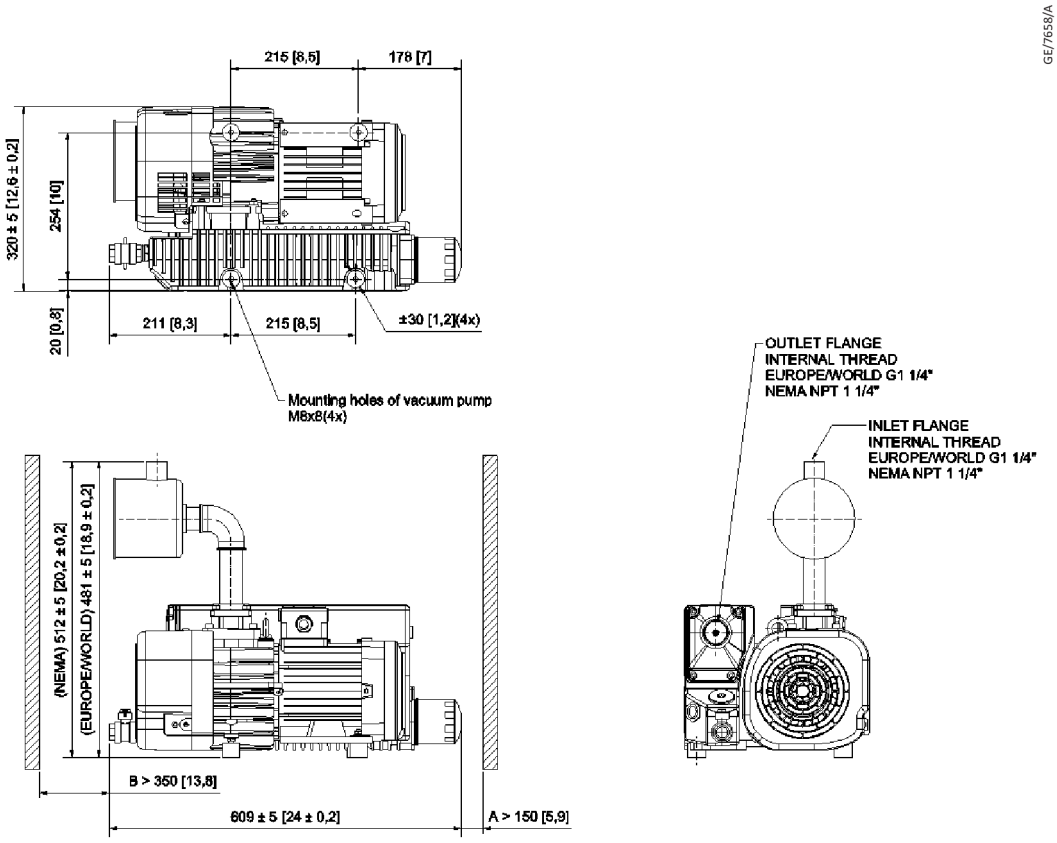
Figure 30 Installation proposal - GVS 40A



A. Space for motor ventilation

B. Space for exhaust filter exchange and cooling air flow

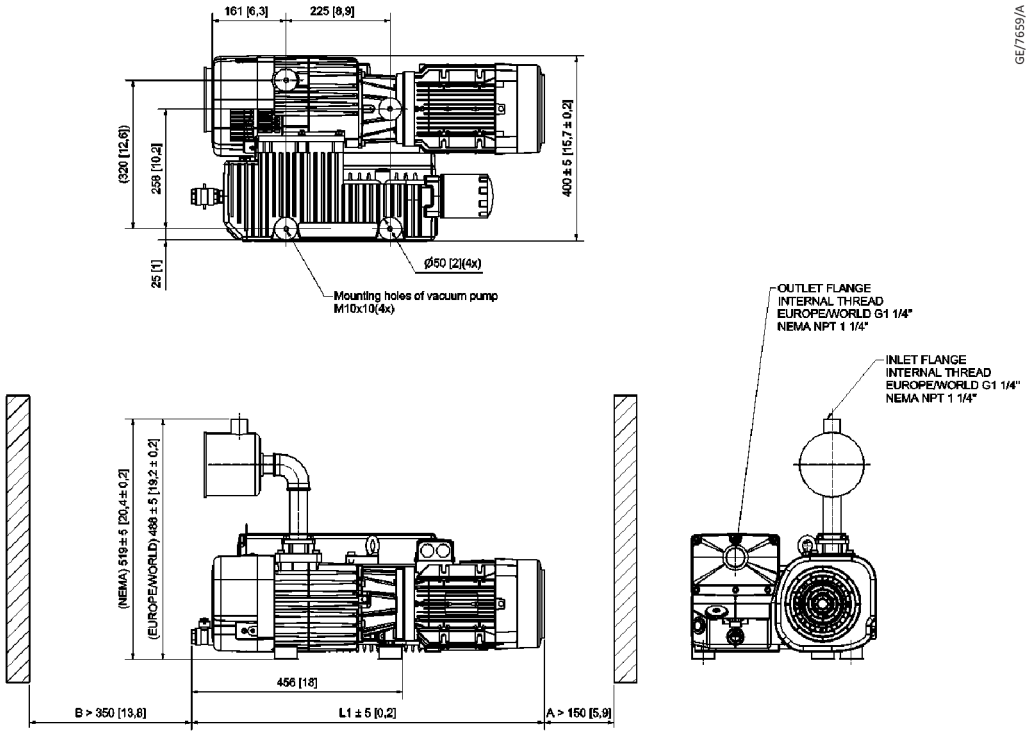
Figure 31 Installation proposal - GVS 60A



A. Space for motor ventilation

B. Space for exhaust filter exchange and cooling air flow

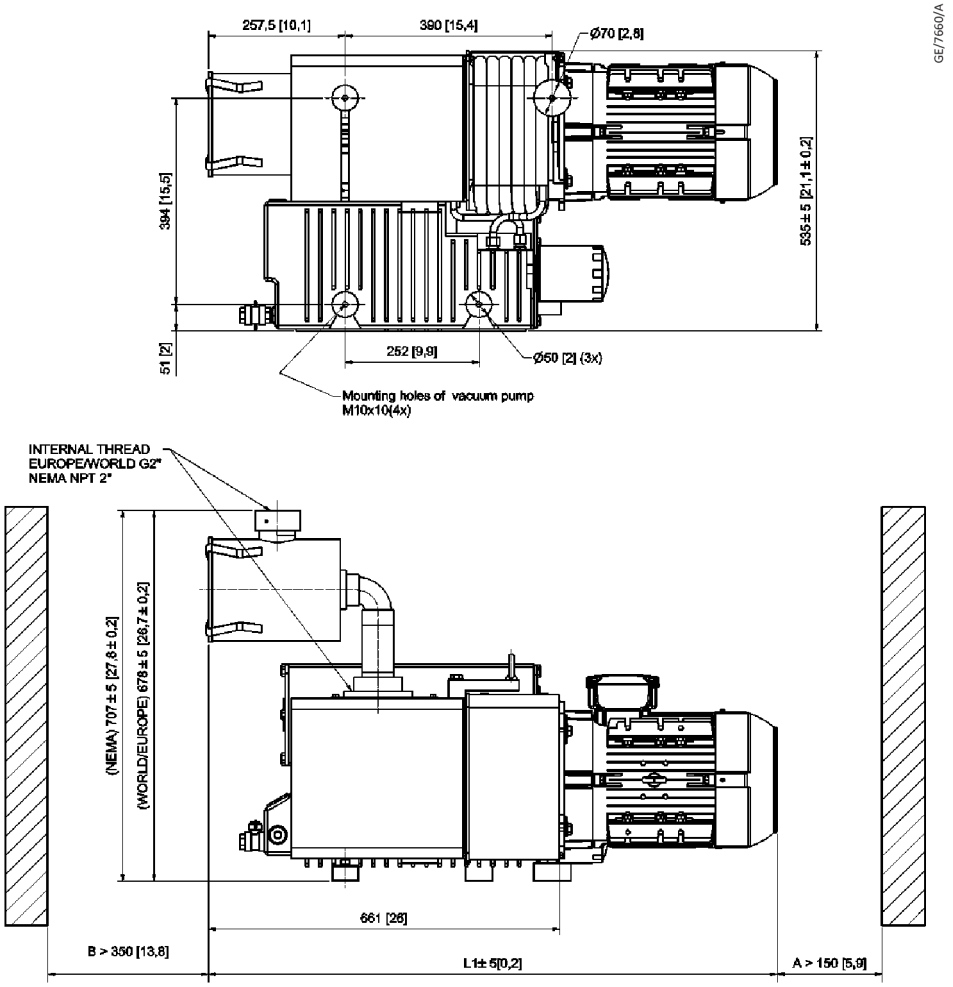
Figure 32 Installation proposal - GVS 100A



A. Space for motor ventilation

B. Space for exhaust filter exchange and cooling air flow

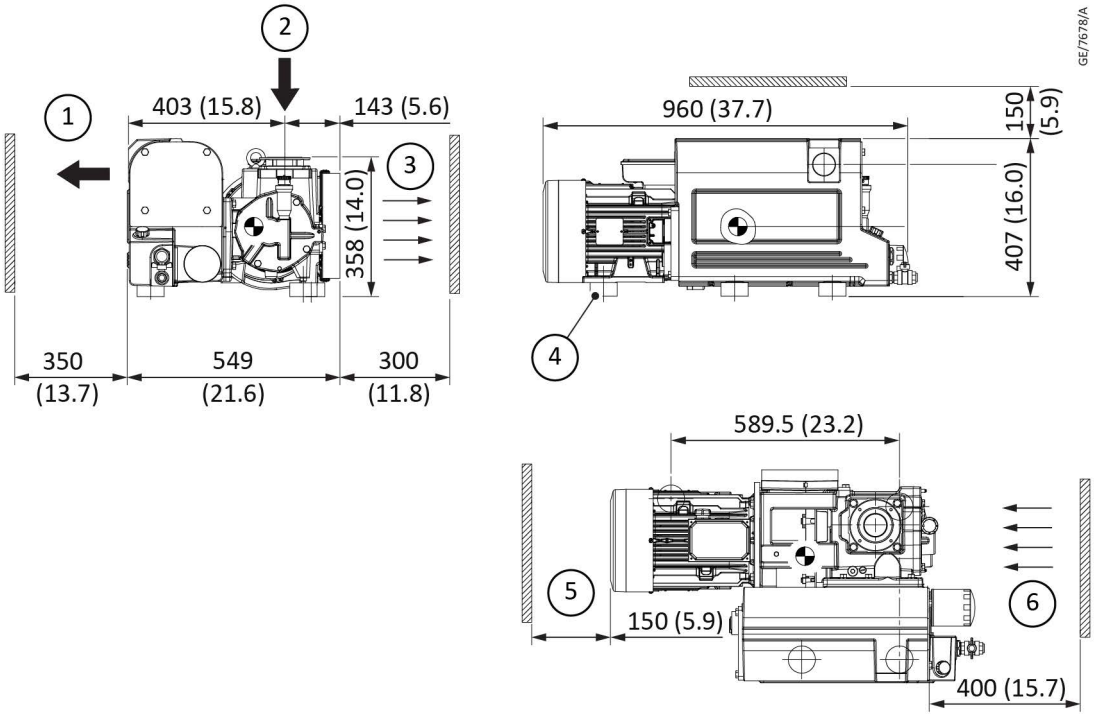
Figure 33 Installation proposal - GVS 200A



A. Space for motor ventilation

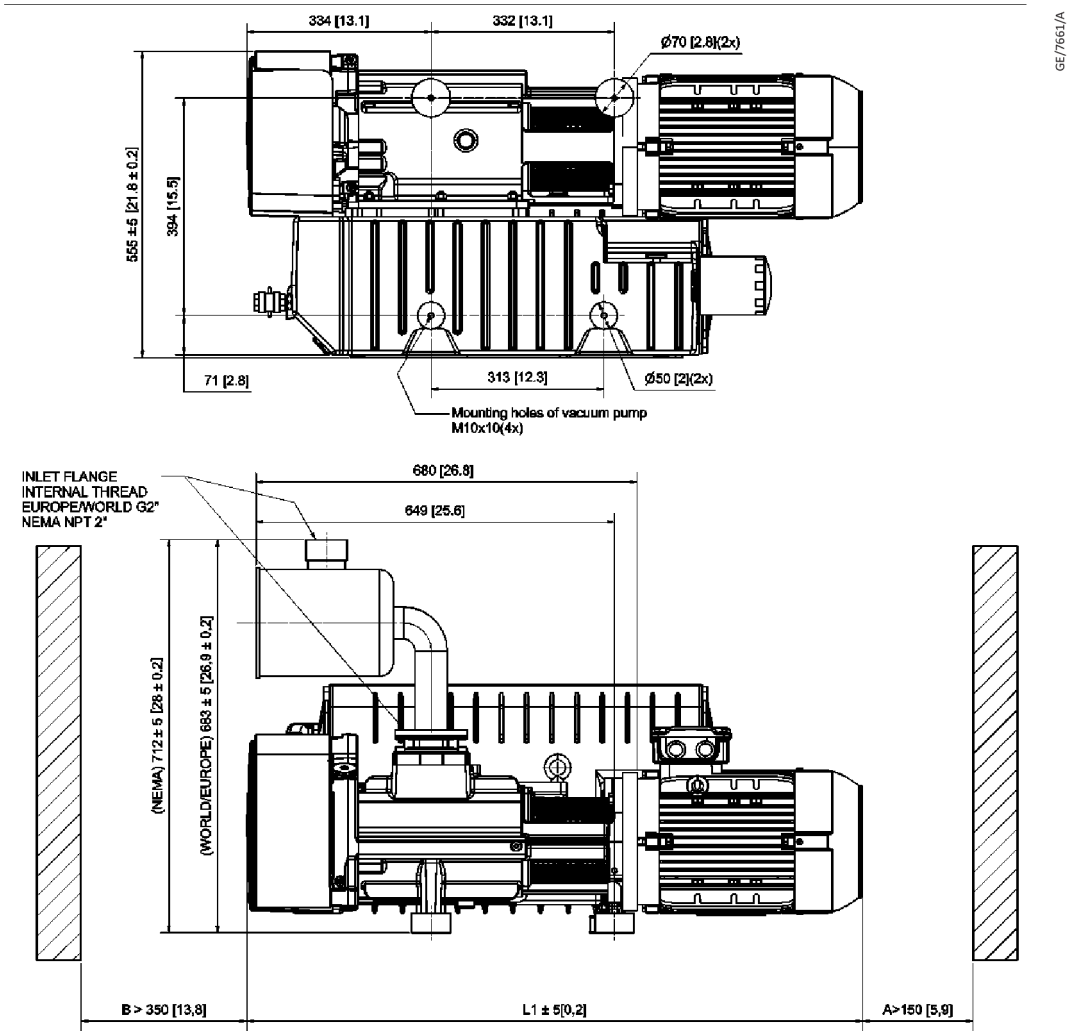
B. Space for exhaust filter exchange and cooling air flow

Figure 34 Installation proposal - GVS 220A



1. *Exhaust port*
2. *Inlet port*
3. *Cooling air pump*
4. *Mounting fixation*
5. *Space for motor ventilation*

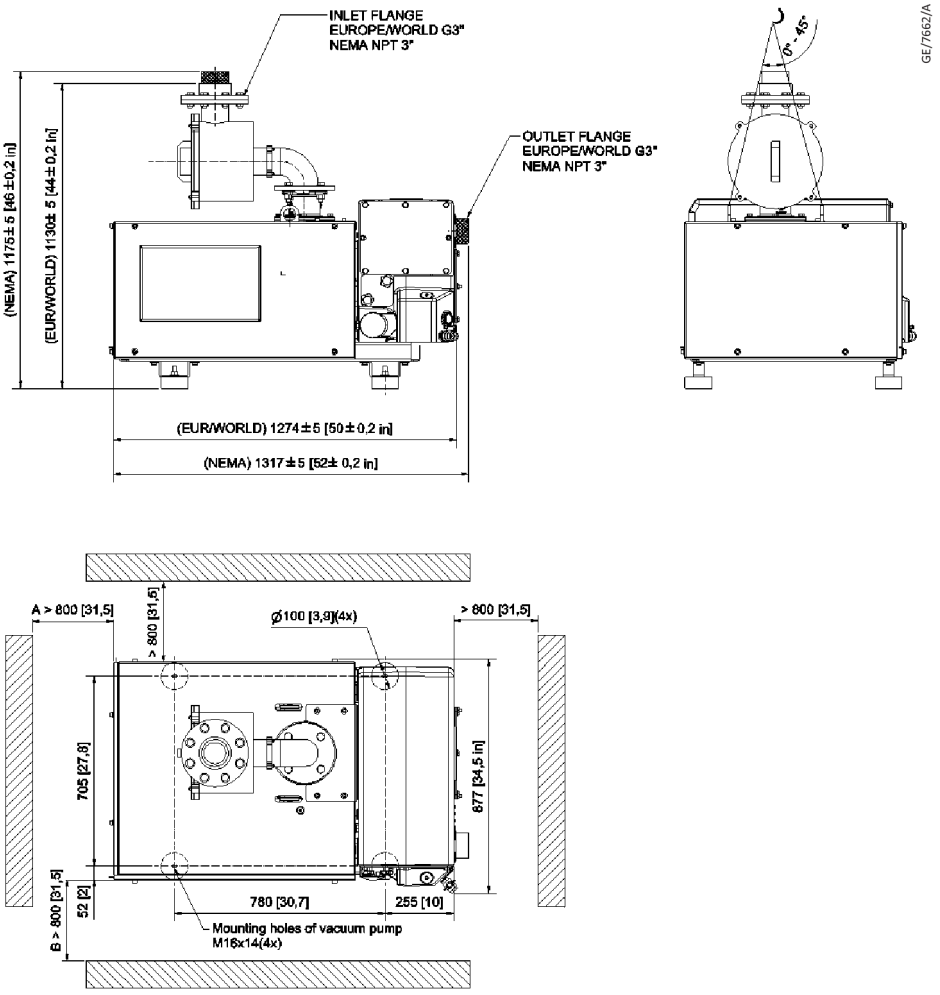
Figure 35 Installation proposal - GVS 300A



A. Space for motor ventilation

B. Space for exhaust filter exchange and cooling air flow

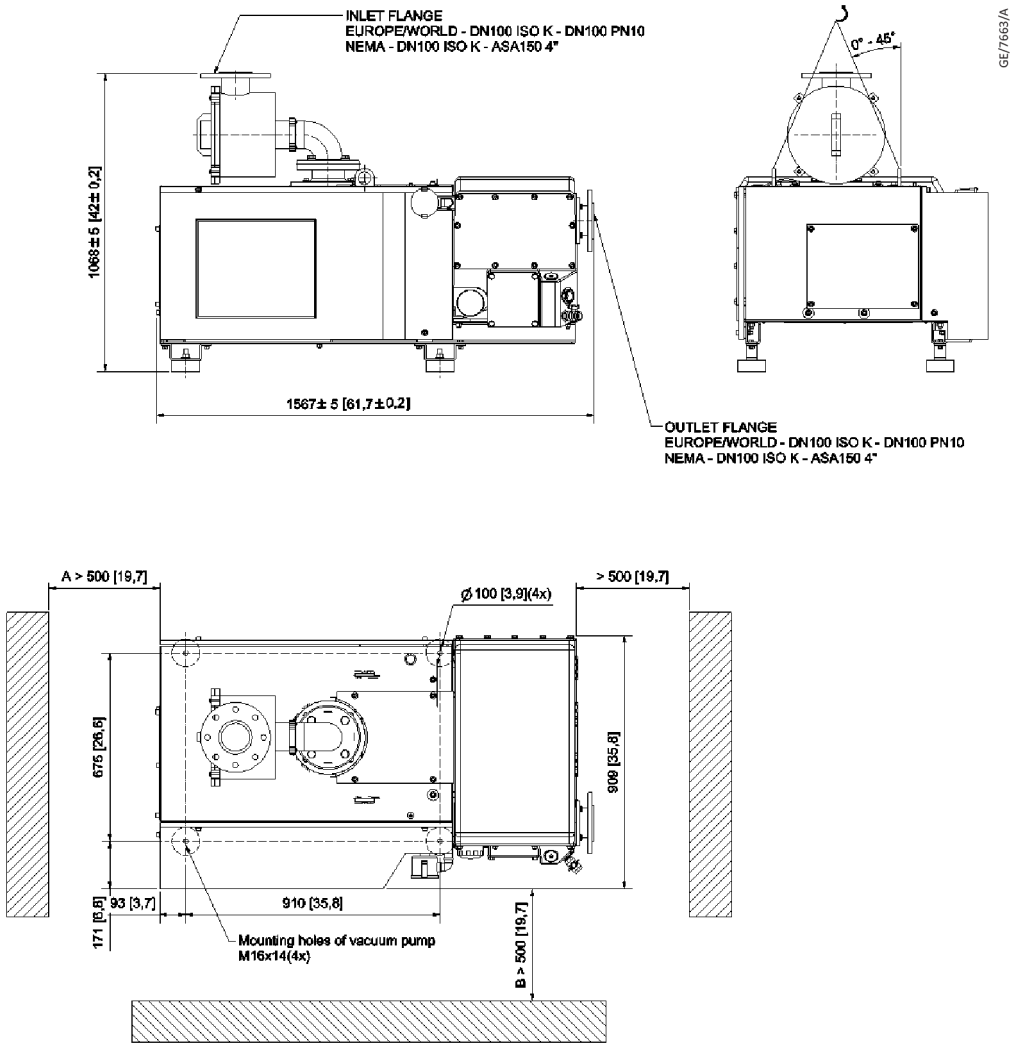
Figure 36 Installation proposal - GVS 470A



A. Space for access to electrical connection

B. Space for exhaust filter exchange and cooling air flow

Figure 37 Installation proposal - GVS 630A



A. Space for access to electrical connection

B. Space for exhaust filter exchange and cooling air flow

5.2. Installation guidelines

The following list must be used as a guide for the installation of GVS vacuum pumps. The list is not exhaustive. Every vacuum pump installation is unique and care must be exercised in the placement of each pump. If you are unsure of any installation variable, please consult us.

- Install the pump on a solid, level surface, suitable for taking its weight. Respect the minimal distance between the pump and the walls (Refer to *Dimension drawings* on page 24).
- Correct process lines sizes have to be used to prevent restrictions and resulting pressure drops. As a rule of thumb, the inlet diameter of the pump should be maintained as far into the process as possible. Consult us for piping recommendations.
- The required ventilation capacity to limit the vacuum pump room temperature can be calculated from Qv = 0.2 N/Δt, with

  Qv = required ventilation capacity in m^3/s

N = shaft input of the vacuum pump in kW.

Δt = temperature increase of the incoming ventilation air in the vacuum pump room in °C

- Make sure all piping connections from the pump to the point of use are leak tight and secure. Leaks add load to the vacuum pump. They decrease the available pump capacity and spoil the attainable ultimate pressure. All welds must be vacuum compatible.
- Vacuum rated isolation valves must be used. Compressed air valves and vacuum valves differ in their sealing characteristics and compressed air valves may leak in vacuum applications.
- All piping should be as straight as possible with non-restrictive diameters. Elbows, bends, tees and tapers should be used only when absolutely necessary.
- Keep plumbing and system free of fluids, water, dirt, and debris that are not part of the process. These can cause obstructions in the vacuum flow through the piping and can reduce available pumping capacity.
- Exhaust piping should be installed in such a manner that it does not create additional back pressure on the vacuum pump. Also, the exhaust piping should be installed sloping away from the vacuum pump.
- A recommended alternative is the use of a drip leg with drain point provision, to prevent condensate from running back into the fluid reservoir.
- Take extreme care in selecting the proper inlet filtration system for the vacuum pump. Liquids, solids and abrasive powders must be prevented from entering the vacuum pump to prevent mechanical failure or reduced lifetime. Inlet filtration must be installed on every pump. The potential for particulate contamination in rough vacuum applications is significant. The particle micron retention of the filter element must be smaller than the smallest possible particle load. Also, the inlet filter should be mounted in such a way to prevent particles from falling into the inlet of the vacuum pump during cleaning or changing of the filter element.
- If there is a risk for liquids to be drawn into the vacuum system, a liquid separator should be used to separate these liquids from the incoming air. In applications where there is significant amount of liquid, consult us.
- Keep the vacuum pump room dry and free from contamination.
- Follow recommended lubricant change schedules in normal applications (air) and watch closely the condition and appearance of the fluid in chemical or harsh applications. Check the leak rate of the system by pumping down to the ultimate pressure and then valve off the vacuum pump. Monitor the pressure rise over a period of five or ten minutes and record this rate of rise for future reference. This value is a good tool to have if you believe there are pump or system problems. Compare new value with the original.
- When pumping condensable vapours and particulates, more frequent fluid changes are required to maintain pump life. Consult us for types and styles of filtration units.
- Be sure there is no back pressure on the exhaust line of the vacuum pump. Vacuum pumps are not specifically designed to compress exhaust gas above atmospheric pressure. Significant back pressure can overheat the pump and cause motor overloading. Back pressure on the pump should not exceed 0.15 bar(e) under normal operating conditions.

- Maintain system seals on a regular basis. Damaged O-rings and gaskets must be replaced immediately. All flange faces must be free of dirt, lubricant and scratches.
- Do not use collapsible tubing to plumb the vacuum system. Any restrictions in line diameter caused by tube collapse will reduce available pumping capacity.
- In multiple pump installations, check valves should be installed in the inlet piping. This will prevent fluid from being drawn from an 'off' unit into an operating unit. Check valves should be properly sized so as not to "chatter" during operation. Spring loaded, elastomer seated check valves are recommended. These should be mounted in a horizontal flow orientation. Using properly sized actuated valves is even a better solution. This generally results in a lower pressure drop when open and in a better sealing when closed.
- Vacuum gauge ports and gauges should be installed in each leg of central vacuum piping. This provides a diagnostic tool for troubleshooting both the application and any pump related problems.
- Make sure that no temperature sensitive parts (plastic, wood, cardboard, paper, electronics) will touch the surface of the vacuum pumps.
- Ambient and inlet temperature may never exceed the limits of the pump's working range. Make sure the installation location is vented such that a sufficient cooling of the vacuum pump(s) is available.

Special recommendations for using oxygen prepared pumps, filled with PFPE fluid

At the customer’s site, it must be taken care of the following points:

- Pump exhaust must be collected and gases handled according applicable regulations.
- Use of only genuine spares and consumables. Use only dedicated PFPE Service kits for oxygen pumps.
- Accessories retrofitted on oxygen pumps must be hydrocarbon degreased using an adapted solvent. Take all required precautions.
- Use of PFPE fluid provided by us only.
- Making sure that PFPE fluid level in the pump is correct before switching on.
- When changing the exhaust filters, the pump must be operated for half an hour with closed intake but open GB sucking ambient air or inert gas for wetting the exhaust filters with PFPE. In case no gas ballast is provided, let the pump run for 5 minutes at atmospheric pressure on ambient air or inert gas.

For the pumps using perfluoropolyether (PFPE) as lubricant and when handling PFPE observe the following:

- During thermal decomposition (at temperatures over 290 °C) toxic and corrosive gases are released. This is not likely to happen in a GVS pump. When handling PFPE keep it way from open fires. Do not smoke with PFPE on your fingers.
- Touch the inner sections of the pumps only while wearing clean gloves, and use clean tools; do the necessary work in clean and dry rooms.

- The grease of the bearings has to be changed once a year for an operating time higher than 5000 h per year or every 5000 hours for an operating time lower than 5000 h/year.
- Clean the bearings before regreasing.

5.3. Motor installation (if applicable)

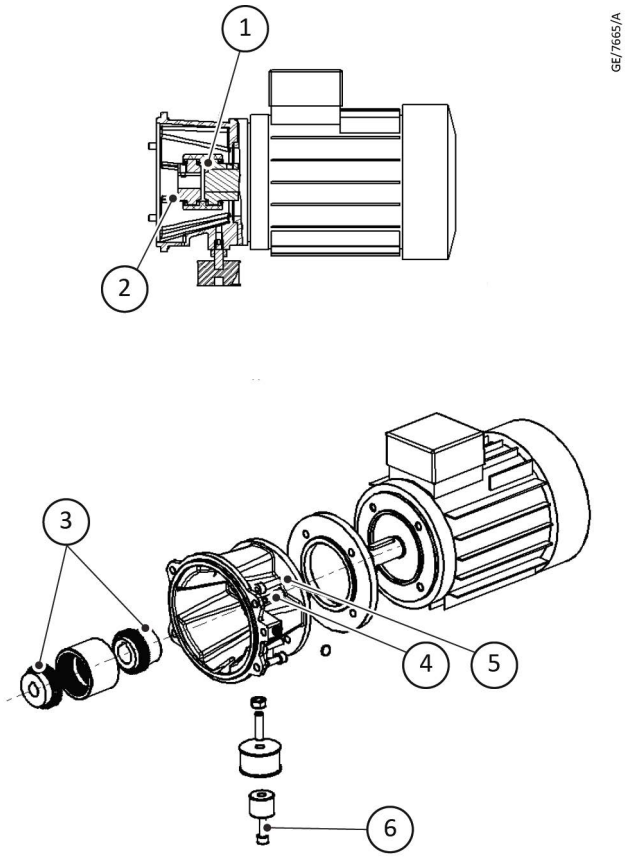
It is possible to install any type of electric or hydraulic motor of which the specifications comply to the technical data, with flange and shaft corresponding to:

- M112 – B14 (FT130) size as per standard IEC60072-1 (for Europe and Wide motor versions) and motor frame size 213 with 184 TCH flange for NEMA motor version for GVS 100A
- M112 – B5 (FF215) size as per standard IEC60072-1 (for Europe and Wide motor versions) and motor frame size 213 TC for NEMA motor version for GVS 200A
- M132 – B14 (FT215) size as per standard IEC60072-1 (for Europe and Wide motor versions) and motor frame size 256 TC with 215 TC flange for Nema motor version for GVS 300A

Motor installation instructions

1. Remove the fixing clamp from the connecting joint on the pump.
2. Install the assembly on the motor shaft taking into account the stated measure.
3. Tighten the screw to firmly fix the assembly to the shaft.

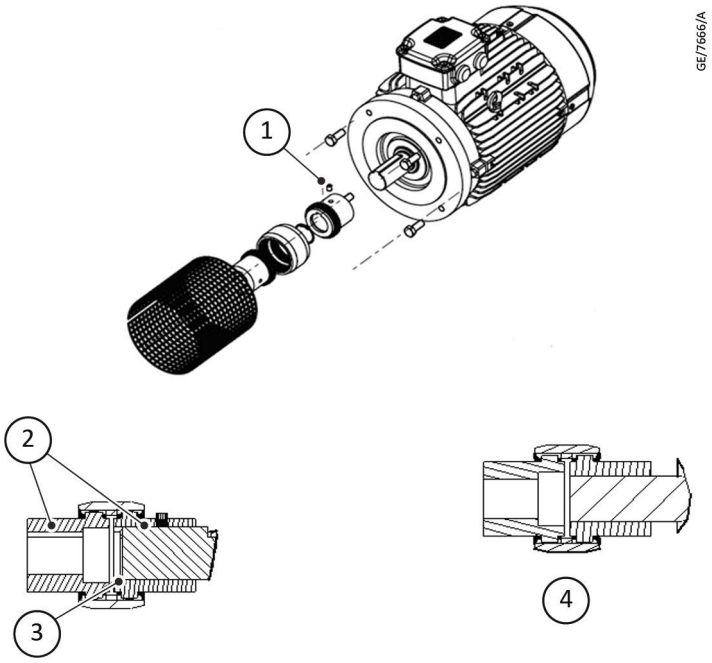
Figure 38 Motor coupling half position - GVS 100A



1. *Mounted on the motor shaft end*
2. *Stroke limit on the rotor's bushing*
3. *Torque for press screw: 2 Nm (for M5 screw), 16 Nm (for M8 screw)**
4. *M8 X 30 Q8.8 (4 quantity)*
5. *M8 X 20 Q8.8 (4 quantity)*
6. *M8 X 30 Q8.8 (1 quantity)*

** Glued with LOCTITE 243*

Figure 39 Motor coupling half position - GVS 300A



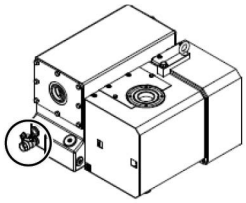
1. *18 Nm**
2. *Never seize for anti-fretting corrosion*
3. *Lock ring in contact with end of shaft*
4. *Never seize for anti-fretting corrosion*

** Glued with LOCTITE 243*

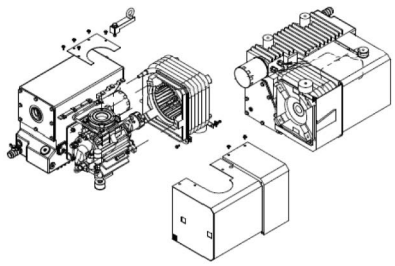
Motor installation instructions for GVS 200A

1. Place a suitable container under the pump to collect the draining oil. Remove the drain plug.

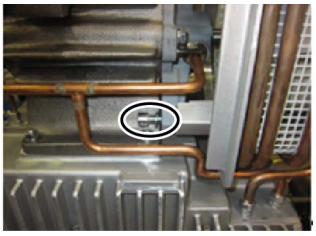
   Drain the pump.



2. Remove the pump coupling housing, disconnect the finned oil cooler and unscrew the two connectors (1 on oil casing and 1 on tube) as explained in the following steps:



   A. Remove three screws securing coupling housing. Remove coupling housing.

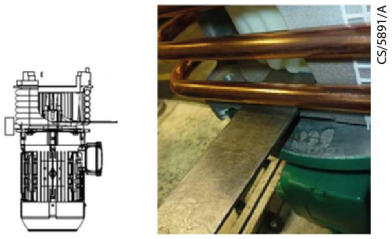


B. Unscrew the oil cooler connector on casing.

C. Unscrew the oil cooler connector on tube.

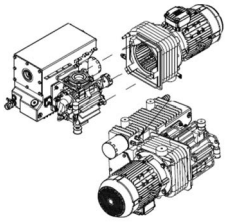
3. Place the motor in vertical orientation so that motor shaft facing upwards.

4. Make sure that the turbine support is on a 3 mm (0.11 inch) thickness spacer.

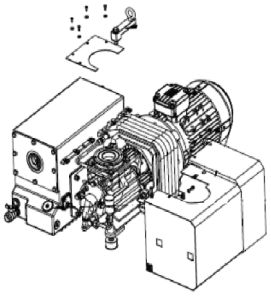


5. Tighten the screw to 2 Nm torque. Apply LOCTITE 243.

6. To assemble motor and coupling housing on the pump, follow step 2 in reverse order.



7. Cover the pump. Mount lifting bar on the pump.



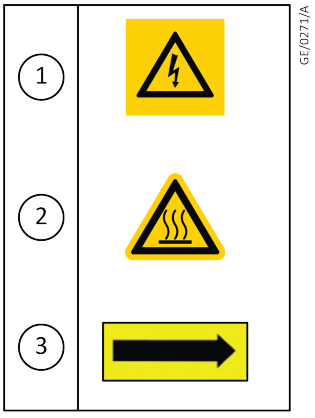
8. Re-install the drain plug. Fill the recommended quantity of oil in the pump.

5.4. Electrical connections

Always use a protection system, including an overcurrent protection and an electrical disconnecting device, between the pump and the electric power supply. Motor currents can be found on the motor data plate. The pump is normally delivered without electrical cable and without switch. For the electrical connection, check the diagram inside the terminal box or on the motor data plate.

Additional safety devices are available as options including an oil pump temperature switch.

5.5. Pictographs



1. *Warning: Voltage*
2. *Warning: Hot surface*
3. *Rotation direction of fan*

6. Operation

6.1. Initial start-up preparation

Note:

The pump is supplied filled with oil.

- Check the process lines for the correct size to prevent high pressure drop and for cleanliness to protect the vacuum pump.
- Make sure the pump outlet is not obstructed.
- Check that the electrical connections correspond to the applicable codes and that all wires are clamped tight to their terminals. The installation must be earthed and protected against short circuits by fuses of the inert type in all phases. An isolating switch must be installed near the vacuum pump.
- Switch on the voltage and switch it off immediately. Check the direction of drive motor rotation while the motor is about to stop. The correct direction of rotation of the drive motor is indicated by an arrow shown on the motor fan cowl. If the direction of the drive motor is incorrect, open the isolating switch and reverse two incoming electric lines. Incorrect rotation of the drive motor may cause damage to the vacuum pump.
- Start and run the vacuum pump for a few minutes. Check that the vacuum pump operates normally.

  Note:

  If you intend to apply the vacuum pump on humid applications, it is recommended that the unit can achieve optimal running temperature before it is effectively put in operation. This can be done by running the unit against a closed suction line for 30 minutes with open gas ballast.

  Gas ballast location and use is indicated on the pump data plate.

If the air intake filter (optional) is delivered loose, mount it in a leak-tight manner.

Install the air intake filter (optional) in a horizontal position to prevent filtered dust falling into the pump inlet when replacing the air intake filter element and resulting damage to the pump.

6.2. Start the pump

CAUTION: EXCESSIVE ENERGY CONSUMPTION

Risk of damage to equipment. To avoid excessive energy consumption and damage to the vacuum pump the maximum allowed starting frequency is 6 starts per hour.

For more frequent operation, let the pump operate continuously and control the vacuum demand by a pitot valve on the pump inlet.

To start the pump:

1. Check oil level and oil condition.

2. Turn on the power.

6.3. During operation

Note:

The operator must apply all relevant safety precautions. Refer to Safety precautions during operation on page 11 and Fault finding on page 75.

Regularly check the oil level and the oil condition. The oil level should be in the middle of the oil sight glass. Refer to *Preventive maintenance schedule* on page 66.

6.4. Stop the pump

We recommend running the unit off-line for typically 30 minutes with closed inlet valve but open gas ballast prior to switching off. This will condition the oil ready for the next start-up. If the gas stream was heavily contaminated with water vapour, a longer period of running the unit off-line will extend the oil lifetime.

If the pump is stopped before all the condensed vapour has been disposed off, it will be deposited by gravity separation from the oil on the bottom of the oil after about 8 to 10 hours.

Before restarting, check for any water in the oil tank-leads to an increase of the oil level through the oil viewer (high water handling capability versions only). If there is water, follow the instructions in *Preventive maintenance schedule* on page 66.

In case of long machine downtime, refer to *Taking out of operation* on page 65.

6.5. Taking out of operation

Note:

The operator must apply all relevant safety precautions. Refer to Safety precautions during operation on page 11 and Fault finding on page 75.

Procedure

1. Switch off the voltage and disconnect the vacuum pump from the mains.
2. Drain the oil.
3. Recycle the oil, oil filter and exhaust filters as per the local environmental regulations for waste disposal and recycling.

7. Maintenance

7.1. Preventive maintenance schedule

Before carrying out any maintenance, repair work or adjustments, proceed as follow:

- Stop the vacuum pump.
- Switch off the voltage.
- Effectively isolate the machine from all sources of under and/or overpressure and make sure that the pump system is at atmospheric pressure level.

Warranty - Product Liability

Use only authorized parts. Any damage or malfunction caused by the use of unauthorized parts is not covered by Warranty or Product Liability.

Service kits

For overhauling or carrying out preventive maintenance, service kits are available (see *Service kits* on page 68).

Service contracts

We offer several types of service contracts, relieving you of all preventive maintenance work. Consult your nearest Customer Centre.

General

When servicing, replace all removed O-rings and washers.

Interval

The local Customer Centre may overrule the maintenance schedule, especially the service intervals, depending on the environmental and working conditions of the vacuum pump.

The longer interval checks must also include the shorter interval checks.

Table 4 Preventive maintenance schedule

Operation	Duty**		
	Normal	**Medium**	**Harsh**
Check oil level and condition	24 h	24 h	24 h
Clean dirt trap at pump inlet	Monthly	Monthly	Monthly
Clean anti suck back valve at pump inlet	Yearly	Yearly	Yearly
Change oil*, oil filter (if installed) and exhaust filter			
▪ Mineral oil	4000 h	2000 h	1000 h
▪ Synthetic oil	8000 h	4000 h	1000 h
Clean the pump, the radiator and the motor fan guard	2000 h	1000 h	500 h
Check the vanes. Replace them, if needed	15000 h	10000 h	5000 h

Operation	Duty**		
	Normal	Medium	Harsh
Check belt condition (GVS 470 - 630A)	Every 2000 h or 6 months	Every 2000 h or 6 months	Every 2000 h or 6 months

** Just oil filtration in case of PFPE oil.*

*** 4000 running hours or 1 year or whatever comes first.*

Note:

We recommend monitoring the oil condition through the sight glass and to change the oil when it becomes discolored or milky. Not changing oil in time can lead to premature blocking of the air exhaust filter and even failure of the vacuum pump.

Also check for condensed water vapour on the bottom of the oil tank through the oil viewer (high water handling capability versions only). If there is condensed water vapour, open the oil discharge valve slightly, let the condensed water vapour flow out and close it again as soon as oil starts to come out. Check the oil level and top up if necessary.

7.2. Oil specifications

CAUTION: LUBRICANTS COMPATIBILITY

Risk of injury and damage to equipment. Avoid mixing lubricants of different brands or types as they may not be compatible and the oil mix will have inferior properties. Always drain the pump as good as possible. Used oil left in the pump shortens the lifetime of the new oil.

It is strongly recommended to use only the genuine recommended lubricants. They are the result of years of field experience and research. Refer to *Preventive maintenance schedule* on page 66 for the advised replacement intervals and consult your spare parts list for part number information.

The pumps are delivered with the mineral vacuum pump oil, and synthetic oil as an option.

Pump	Oil
GVS 16-25A Europe	Vacuum Vane Fluid 32 (Mineral)
GVS 16-25A World	Vacuum Vane Fluid Plus 32 (Synthetic)
GVS 40-630A Europe	Vacuum Vane Fluid 68 (Mineral)
GVS 40-630A World	Vacuum Vane Fluid Prime 100 (Synthetic)

7.3. Storage

In order to keep rubber parts and lip seals efficient and properly working, we recommend you to operate the pump for at least 30 minutes every 6 months with the intake closed.

Store the pump in its packing in a covered, dry place at a temperature between -20 °C (-4 °F) and 50 °C (122 °F).

If the vacuum pump is going to be stored without operating from time to time, protective measures must be taken. Consult us.

7.4. Service kits

For overhauling and for preventive maintenance, a wide range of service kits is available. Service kits comprise all parts required for servicing the component and offer the benefits of genuine parts while keeping the maintenance budget low.

Also, a full range of extensively tested lubricants, suitable for your specific needs is available to keep the vacuum pump in excellent condition.

Refer to Spare Parts List for part numbers.

7.5. Disposal of used material

Used filters or any other used material (for example, lubricants, cleaning rags, machine parts, etc.) must be disposed of in an environmentally friendly and safe manner, and in line with the local recommendations and environmental legislation.

7.6. Adjustments and servicing

7.6.1. Drive motor

On GVS 100 - 630A (GVS 16 - 60A do not have motor bearings) the motor bearings must be changed every 20000 hours. Check recommendations on the motor supplier's website. If installed, remove the motor condensate drain plug yearly. Keep the motor free from dust for optimal cooling.

7.6.2. Exhaust filter replacement

GVS 16A and GVS 25A

1. Unscrew the 4 screws of filter cover and remove the filter cover together with the gasket.
2. Loosen 1 screw of friction spring and remove the friction spring.
3. Remove the exhaust filter.
4. Clean the contact surface of the filter cover O-ring before reassembling the new parts.
5. Insert the new exhaust filter with handle of filter towards the top of oil casing in their lodge.
6. Install the friction spring.
7. Turn screw on friction spring to contact with filter then turn another 4 cycles.
8. Re-assemble the filter cover.

GVS 40A, GVS 60A and GVS 100A

1. Unscrew the 4 or 6 screws of the filter cover and remove the filter cover together with the O-ring.
2. Remove the exhaust filter(s) from the filter cover.
3. Clean the exhaust filter O-ring lodge and the filter cover O-ring before reassembling the new parts.
4. Install the new exhaust filter(s) following the instructions delivered with them.
5. Re-assemble the filter cover.

GVS 200A

1. When the exhaust filter elements are clogged, the valves open and the filters are bypassed. Oil mist at the exhaust, and/or high oil consumption are signs that the exhaust filters are clogged.
2. The exhaust filters must be replaced more frequently if subject to increased oil cracking products at high operating temperatures and/or aggressive media.
3. Remove the exhaust flange with gasket. Unscrew the lock nut and remove spring between its both washers: take out the exhaust filter element(s).
4. Take out the pressure relief valves and check that they move freely, and seal properly.
5. Re-assemble in the reverse sequence. Make sure that the exhaust filter elements are properly centered and positioned. Install spring between its both

washers, and tighten stop nut, fully home with the 10 mm (0.39 inch) box wrench.

GVS 220A

1. Remove the screws of the exhaust plate with a 16 mm wrench.
2. Move the filter up and down, once it is unlocked, remove it from the oil casing.
3. Check the filter hole, if deposit are visible clean it.
4. Make sure that the new exhaust filter has the O-ring (opposite side of the overpressure valve) and grease them using our vacuum grease.
5. Apply the grease to the groove.
6. Replace the O-ring of the exhaust plate.
7. Insert the new exhaust filter recovery lip down.
8. Fix the exhaust plate on the oil casing with a 16 mm wrench.

GVS 300A

1. Remove the screws of the exhaust plate using an 8 mm (0.31 inch) allen key.
2. Lift the 3 exhaust filters from the W shaped metal sheet holder and remove them from the oil casing.
3. Make sure that the new exhaust filters have the O-ring (opposite side of the overpressure valve) and grease them using our vacuum grease.
4. Replace the O-ring of the exhaust plate.
5. Insert new exhaust filters. They are guided in the oil casing correct position. Make sure the compression springs are behind the W shaped metal sheet holder.
6. Plug the exhaust plate on the W shaped metal sheet holder with the 2 location pins and screw the exhaust plate on the oil casing using an 8 mm (0.31 inch) allen key.

GVS 630A

Tools required: tubular box wrench 16 mm (0.62 inch)

1. When the exhaust filter elements are clogged, the integrated by-pass opens and the filters are bypassed.
2. Oil mist at the exhaust, and/or high oil consumption are signs that the exhaust filters are clogged.
3. The exhaust filters must be replaced more often if subjected to increased oil cracking products at high operating temperatures and/or aggressive media.
4. Remove the cover with gasket. Remove the exhaust deflector by unscrewing the bolt. Remove both demister support units by unscrewing the nuts.
5. The exhaust filters can be removed individually. Check also the float valve.
6. Plug new exhaust filters into the oil casing. Insert carefully the demister support units over the new exhaust filters threaded bars (M6) and compress slightly the demister springs.
7. Tighten the demister support units and the exhaust deflector. If necessary mount a new seal and mount the cover.

7.6.3. Oil and oil filter change

CAUTION: LUBRICANTS COMPATIBILITY

Risk of injury and damage to equipment. Avoid mixing lubricants of different brands or types as they may not be compatible and the oil mix will have inferior properties.

CAUTION: OIL CONTAMINATION

Risk of injury and damage to equipment. Always drain the oil at all drain points. Used oil left in the pump can contaminate the oil system and can shorten the lifetime of the new oil.

If the oil is replaced, replace the oil filter (if applicable) and exhaust filter(s) too.

Oil change procedure

1. If the pump is cold, run the pump with closed suction intake for 10 minutes to warm up the oil.
2. Stop the pump and disconnect it from the mains.
3. Remove the oil filler plug.
4. Open the oil drain valve and drain the oil completely into a container large enough to hold all the oil and tilt the pump slightly (if possible).
5. Close the oil drain valve and fill with new oil through the filler plug up to the middle of the oil sight glass. The oil level must not exceed the allowed maximum level.
6. Close the oil filler plug.
7. Wipe off eventual oil spills from the pump and/or the floor.
8. Connect to mains again and verify correct rotation direction of the pump.
9. Let the pump run with closed intake for a few minutes, stop the pump and check the oil level. Top up if necessary.

Oil filter change

1. Drain the used oil completely following above instructions.
2. Remove the oil filter.
3. Apply a thin film of oil on the gasket of the new oil filter.
4. Clean carefully the contact surface of the gasket on the tank and install the new oil filter.
5. Fill with new oil following above mentioned instructions.

Note:

Oil filter change is not applicable to GVS 16A and GVS 25A.

Oil type change

To prevent the oil dissolving residual oil sludge (and hence blocking channels), strictly follow the following procedure:

1. Drain the used oil completely (tilt the pump slightly if possible).

2. Clean the exhaust filter housing inside manually as good as possible (for example, with clean dry cloth).
3. Change the oil filter but leave the existing exhaust filters inside the housing.
4. Fill the pump with the correct amount of new synthetic oil.
5. Run the pump for about 2 hours, then stop it. Drain the oil, clean inside as before and change the oil filter again.
6. Refill with new oil and change the exhaust filters. Repeat this procedure until the oil remains clean (sight glass).

7.6.4. Cleaning radiator, motor fan guard and pump

Radiator, motor fan guard and pump must be kept clean. This can be done using compressed air and a dry cloth. Be careful not to damage the oil cooler (if applicable) by cleaning with compressed air or by exerting excessive pressure with the cloth.

Do not use fluids or substances other than those indicated.

7.6.5. Cleaning the intake filter (optional) element

1. Remove the intake filter element from the housing.
2. Clean the intake filter element in one of the following ways:
   - Hand washing:

     Soak and agitate element in a warm water and mild detergent solution. Allow adequate time for the element to air dry (24 hours minimum). Do not install a damp element. This will cause higher initial pressure loss and rapid dirt loading.
   - Compressed air cleaning:

     Using approximately 7 bar(e) (100 psi(g) or 5.25 Torr(e)), direct air flow at inside of element towards pleats. Blow off the outside of the element directing the air flow down to avoid embedding dirt in the media. Blow off the inside again to remove any dirt that might be on the clean side of the element.
   - Vacuum cleaning:

     Point the vacuum cleaner to the dirty side (outside of element) only, using a vacuum of approximately 100 mbar(a) (75 Torr(a)). A crevice tool is recommended.
   - Hand cleaning:

     Hold element down with one hand and move other hand across the fins in a strumming motion. This action will dislodge most of the dirt.
3. The element is ready to be reused.

7.6.6. Replacing V-belts

GVS 470A

Tools required: Key 19 and 24.

1. In normal operating conditions, the belt has a lifetime of 30000 hours. Wear characterizes by slip, abnormal wear or cracks. In case of wear, the correct alignment of the pulleys has to be checked. Tolerance ±1.3 mm.

2. A dismounted belt has to be replaced with a new one.
3. Take off the hood.
4. Loosen the applicable nuts.
5. Replace the belt.
6. Reassemble in reverse sequence.
7. Stretch the V-belts with the V-belt tension meter.

Refer to *V-belt tensioning* on page 73 for details.

GVS 630A

Tools required: Key 19 and 24.

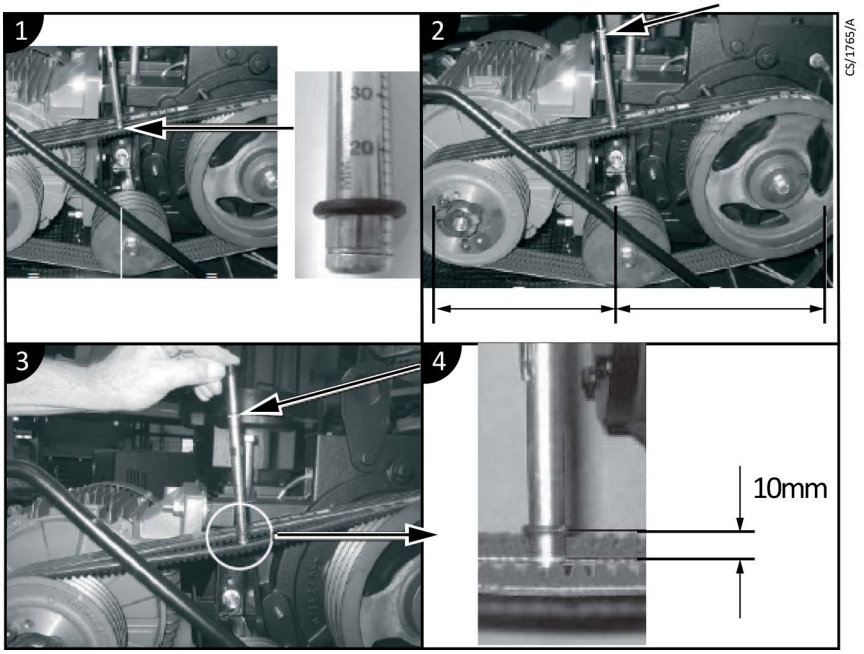
1. Take off the hood. Loosen the applicable nuts.
2. Loosen the push rod.
3. Remove the V belts.
4. Reassemble in reverse sequence.
5. Stretch the V-Belts with the V-belt tension meter.

7.6.7. V-belt tensioning

How to use the V-belt tension meter

- The tension meter is a tool designed to check and re-tighten the V-belts. It is made of two sliding pipes with a graded spring inside.
- Refer to *Figure: Belt tensioning*. Set the first O-ring at 1 mm (0.03 inch) (PIX) on the millimetre scale or 25 inches of span, as shown in picture 3, and the other O-ring on position 0 on the Newton scale.
- Install the tension meter as shown in picture 1, in the middle, halfway between the V-belt contacts point of the V-belts and the two pulleys.
- Push the Newton scale's black rubber down to reach a 10 mm (0.39 inch) bending of the V-belt as shown in pictures 2 and 4.

Figure 40 Belt tensioning



1. Set the O-ring to 10 mm (0.39 inch) position.
2. Place the tool on the centre of the longest V-belt and mark the belt.
3. Push the tool downward until you reach a 10 mm (0.39 inch) bending. The result of the measurement should be between 35 N and 58 N.
4. Check the result of your measurement. Tighten the belt tightener to reach the value given in the table:

Belt tension	**Before run-in**	**Re-tightening (after 10 to 24 h)**	**Regular check (approximately 6 months or 3000 h) Value under which a re-tension is necessary**
	F (kg)	F (kg)	F (kg)
All pumps	5	4.5	3.5

Always measure on the same belt.

Note:

Do not loosen a belt if the measurement is over the values shown. In this instance, do not change the V-belt tension.

8. Fault finding

Table 5 Fault finding

Conditions
The pump does not run on page 75
The pump cannot reach stated vacuum on page 75
Pump is noisy on page 76
Pump runs hot on page 76
High oil consumption on page 76
Pump does not maintain vacuum after power-off on page 77
Pump leaks oil on page 77
The expected process vacuum level is not reached on page 77

Fault The pump does not run

Cause **There is no voltage**

Remedy Provide power supply

Cause **Thermal switch has tripped**

Remedy Identify cause and reset switch

Cause **Room temperature is too low**

Remedy Restore temperature to allowed value

Cause **Motor is damaged**

Remedy Contact us.

Fault The pump cannot reach stated vacuum

Cause **Low oil level**

Remedy Top up oil

Cause **Oil is contaminated**

Remedy Contact us

Cause **Pump gaskets is damaged**

Remedy Contact us

Cause **Discharge is clogged**

Remedy Check couplings and outlet

Fault	Pump is noisy
Cause	**Exhaust filter element is clogged**
Remedy	Replace the filter element
Cause	**Bearings are damaged**
Remedy	Contact us
Cause	**Motor coupling is damaged (if applicable)**
Remedy	Contact us
Cause	**Vanes are worn out**
Remedy	Contact us
Cause	**Solid particles in the oil**
Remedy	Change oil

Fault	Pump runs hot
Cause	**Wrong oil type**
Remedy	Replace oil
Cause	**Poor room ventilation**
Remedy	Install an auxiliary fan
Cause	**Fan is defective**
Remedy	Contact us
Cause	**Wrong power supply to motor**
Remedy	Check the power supply
Cause	**Discharge is clogged**
Remedy	Check couplings at outlet

Fault	High oil consumption
Cause	**High working pressure (close to atmospheric pressure)**
Remedy	Check oil level frequently
Cause	**Pump runs hot**
Remedy	Refer to *Pump runs hot* on page 76
Cause	**Exhaust filter element clogged**
Remedy	Replace the filter element

Fault	Pump does not maintain vacuum after power-off
Cause	**Check valve damage**
Remedy	Contact us

Fault	Pump leaks oil
Cause	**Tank screws or plugs loose**
Remedy	Tighten
Cause	**Tank gaskets damaged**
Remedy	Contact Service Department
Cause	**Oil sight glass loose**
Remedy	Tighten

Fault	The expected process vacuum level is not reached
Cause	**Too high pressure drop between process and pump inlet**
Remedy	Check the process lines for the correct size and leaks and correct if necessary.
Cause	**Clogged air intake filter element.**
Remedy	Replace the filter
Cause	**The pump cannot reach stated vacuum**
Remedy	Refer to *The pump cannot reach stated vacuum* on page 75

9. Service

9.1. Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must complete a Declaration of Contamination Form. The form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

If you are returning equipment note the following:

- If the equipment is configured to suit the application, make a record of the configuration before returning it. All replacement equipment will be supplied with default factory settings.
- Do not return equipment with accessories fitted. Remove all accessories and retain them for future use.
- The instruction in the returns procedure to drain all fluids does not apply to the lubricant in pump oil reservoirs.

Download the latest documents from *atlascopco.com/en-uk/vacuum-solutions/vacuum-pump-service/health-and-safety-forms*, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to us.

NOTICE:

If we do not receive a completed form, your equipment cannot be serviced.

EU DECLARATION OF CONFORMITY

We, Atlas Copco Airpower n.v., declare under our sole responsibility, that the product
Machine name VACUUM PUMP
Machine type *GVS 16A, GVS 25A, GVS 40A, GVS 60A, GVS 100A, GVS 200A, GVS 300A, GVS 470A, GVS 630A*
Serial number *This declaration covers all product serial numbers from the date this Declaration was signed onwards.*

Which falls under the provisions of article 12.2 of the EC Directive 2006/42/EC on the approximation of the laws of the Member States relating to machinery, is in conformity with the relevant Essential Health and Safety Requirements of this directive.

The machinery complies also with the requirements of the following directives and their amendments as indicated.

	Directive on the approximation of laws of the Member States relating to		Harmonized and/or Technical Standards used		Att' mnt
a.	Machinery safety	2006/42/EC	EN 1012 – 2 :	1996/A1:2009	
b.	Electromagnetic compatibility	2014/30/EU	EN 61000-6-2 : EN 61000-6-4 :	2005 2007/A1:2011	
c.	Low voltage equipment	2014/35/EU	EN 60204-1 :	2006/A1:2009	
d.	RoHS	2011/65/EU 2015/863/EU	EN 50581 :	2012	

The harmonized and the technical standards used are identified in the attachments hereafter

Atlas Copco Airpower n.v. is authorized to compile the technical file.

Conformity of the product to the specification and by implication to the directives

Issued by Engineering

Name Andries Desiron

Signature 

Date 30-02-2017

Place Valence

P20050056A

EU Declaration of Conformity

CE

Atlas Copco Vacuum Belgium n.v.
Industrielaan 40
B-3730 Hoeselt
Belgium

Documentation Officer
Jana Sigmunda 300
Lutín , 78349
Czech Republic
T: +42(0) 580 582 728
documentation@vt.atlascopco.com

The product specified and listed below

- *Vacuum pump*
- *GVS 220A Air-cooled "Europe" (4kW,50Hz / 4.8kW,60Hz)*
- *GVS 220A Air-cooled "World" (4,5kW,50Hz / 5,5kW,60Hz)*
- *Pump family codes :*
  - *30026150x*

  Where
  x can be 10 to 13, 56, 57
  defining their variants

Is in conformity with the relevant requirements of European CE legislation:

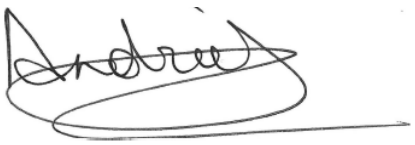
2006/42/EC	Machinery directive *Note: The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Annex 1 No. 1.5.1 of this directive.*
2014/30/EU	Electromagnetic compatibility (EMC) directive Class A Emissions, Industrial Immunity
2011/65/EU	Restriction of certain hazardous substances (RoHS) directive as amended by Delegated Directive (EU) 2015/863

Based on the relevant requirements of harmonised standards:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Industrial Immunity Standard
EN 61000-6-4:2007	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Industrial Emission Standard

This declaration, based on the requirements of the listed Directives and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: 2021-11-09

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.



Andries de Bock - VP Engineering
Industrial Vacuum Division
Cologne

François Bouillot - General Manager
Product Company Valence

P20050056A

Declaration of Conformity

Atlas Copco Vacuum Belgium n.v.
Industrielaan 40
B-3730 Hoeselt
Belgium

Documentation Officer
Innovation Drive
Burgess Hill
West Sussex
RH15 9TW
documentation@vt.atlascopco.com

This declaration of conformity is issued under the sole responsibility of the manufacturer.

The product specified and listed below

- *Vacuum pump*
- *GVS 220A Air-cooled "Europe" (4kW,50Hz / 4.8kW,60Hz)*
- *GVS 220A Air-cooled "World" (4,5kW,50Hz / 5,5kW,60Hz)*
- *Pump family codes :*
  - *30026150x*

  Where
  x can be 10 to 13, 56, 57
  defining their variants

The object of the declaration described above is in conformity with relevant statutory requirements:

Supply of Machinery (Safety) Regulations 2008
The objectives of the Electrical Equipment (Safety) Regulations 2016 are governed by Annex 1 1.5.1 of this regulation.

Electromagnetic Compatibility Regulations 2016
Class A Emissions, Industrial Immunity

Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Based on the relevant requirements of harmonised standards:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Industrial Immunity Standard
EN 61000-6-4:2007	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Industrial Emission Standard

This declaration, based on the requirements of the listed Statutory Instruments and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: 2021-11-09

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.

Signed for and on behalf of Atlas Copco

Andries de Bock - VP Engineering
Industrial Vacuum Division
Cologne

François Bouillot - General Manager
Product Company Valence

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION

EMC (EU, UK): Class A/B Industrial equipment

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

RoHS (EU, UK): Material Exemption Information

This product is compliant with the following Exemptions
Annex III:

- 6(a) **Lead** as an alloying element in steel for machining purposes and in galvanised steel containing up to 0.35 % lead by weight
- 6(b) **Lead** as an alloying element in aluminium containing up to 0.4% by weight
- 6(c) Copper alloy containing up to 4% **lead** by weight

REACH (EU, UK)

This product is a complex article which is not designed for intentional substance release. To the best of our knowledge the materials used comply with the requirements of REACH. The product manual provides information and instruction to ensure the safe storage, use, maintenance and disposal of the product including any substance based requirements.

Article 33.1 Declaration (EU, UK)

This product contains Candidate List Substances of Very High Concern above 0.1%ww by article as clarified under the 2015 European Court of Justice ruling in case C-106/14.

- Lead (Pb)
  This substance is present in certain steel / aluminium / brass components.

Compliance Information – incorporated products and assemblies

Motors	2009/125/EC Ecodesign directive requirements for energy-related products *To 1 July 2021:* Regulation (EC) No 640/2009 requirements for electric motors *From 1 July 2021:* Regulation (EU) No 2019/1781 electric motors and variable speed drives *Based in the requirements of harmonised standard:* EN 60034-30:2009: Rotating electrical machines -- Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)

Additional Applicable Requirements

The product is in scope for and complies with the requirements of the following:

2012/19/EU	Directive on waste electrical and electronic equipment (WEEE)

材料成分声明
China Material Content Declaration

	有害物质 Hazardous Substances					
部件名称 Part name 	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
铸铝及铝合金制品 Aluminium alloys	X	O	O	O	O	O
o钢合金制品 Steel alloys	X	O	O	O	O	O
铜管管件 Brass pipe fitting	X	O	O	O	O	O
铜接头 Brass connectors	X	O	O	O	O	O
铜衬套轴承 Brass bush bearing	X	O	O	O	O	O

O: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。
O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X: 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求。
X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.