

DOLPHIN VX Pump Units

Liquid Ring Vacuum Pump Units

VX 0030 A, VX 0055 A, VX 0110 A, VX 0140 A, VX 0180 A

Instruction Manual Supplement



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1 Safety

Prior to handling the machine, this instruction manual should be read and understood. If anything needs to be clarified, please contact your Busch representative.

Read this manual carefully before use and keep for future reference.

This instruction manual remains valid as long as the customer does not change anything on the product.

The machine is intended for industrial use. It must be handled only by technically trained personnel.

Always wear appropriate personal protective equipment in accordance with the local regulations.

The machine has been designed and manufactured in accordance with the state-of-the-art methods. Nevertheless, residual risks may remain, as described in the following chapters and in accordance with the chapter Intended Use.

This instruction manual highlights potential hazards where appropriate. Safety notes and warning messages are tagged with one of the keywords DANGER, WARNING, CAUTION, NOTICE and NOTE as follows:



DANGER

... indicates an imminent dangerous situation that will result in death or serious injuries if not prevented.



WARNING

... indicates a potentially dangerous situation that could result in death or serious injuries.



CAUTION

... indicates a potentially dangerous situation that could result in minor injuries.



NOTICE

... indicates a potentially dangerous situation that could result in damage to property.

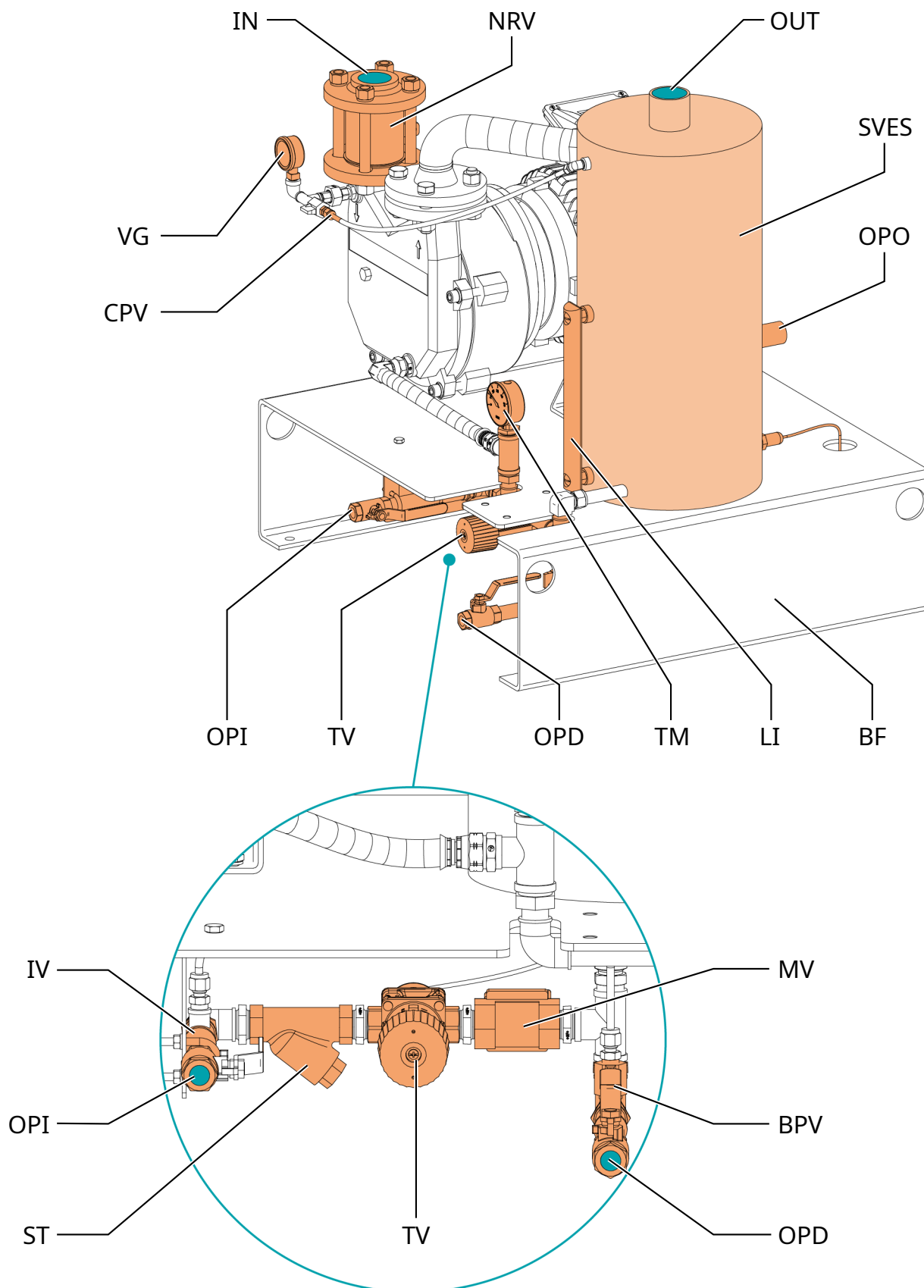


NOTE

... indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.

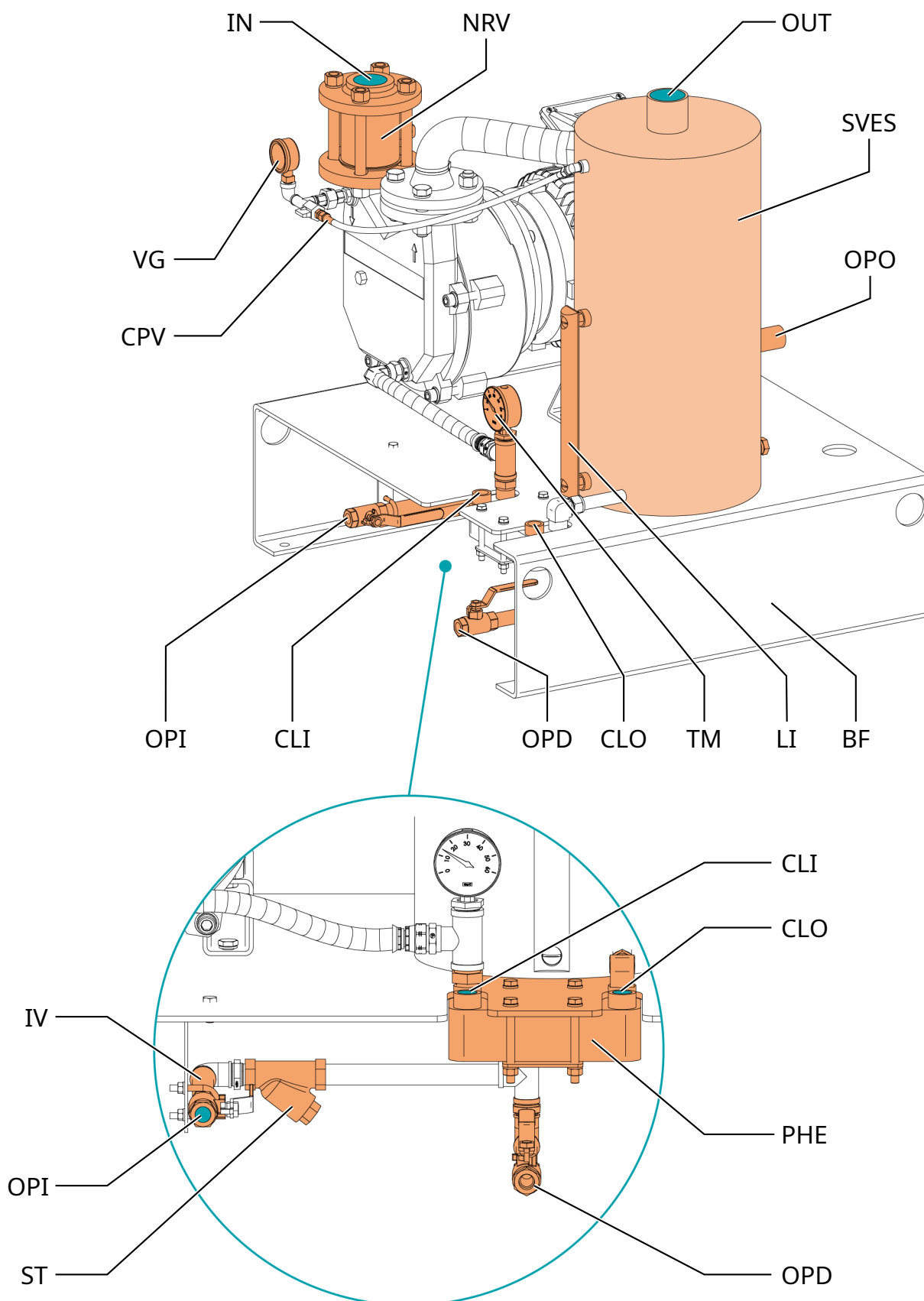
2 Product Description

Partial recovery system



Description			
IN	Inlet connection	OUT	Discharge connection
BPV	Bypass valve	CPV	Cavitation protection valve
BF	Base frame	IV	Isolation valve
LI	Level indicator	MV	Solenoid valve
NRV	Non return valve	OPD	Operating liquid drain
OPI	Operating liquid inlet	OPO	Operating liquid outlet / overflow
ST	Y-Strainer	SVES	Separator vessel
TM	Thermometer	TV	Thermostatic valve
VG	Vacuum gauge		

Total recovery system



Description			
IN	Inlet connection	OUT	Discharge connection
BF	Base frame	CLI	Cooling liquid inlet
CLO	Cooling liquid outlet	CPV	Cavitation protection valve
IV	Isolation valve	LI	Level indicator
NRV	Non return valve	OPD	Operating liquid drain
OPI	Operating liquid inlet	OPO	Operating liquid outlet / overflow
PHE	Plate heat exchanger	ST	Y-Strainer
SVES	Separator vessel	TM	Thermometer
VG	Vacuum gauge		



NOTICE

Drainage of the operating liquid.

- Dispose in compliance with applicable regulations.



NOTE

Illustrations.

In this instruction manual, the illustrations may differ from the appearance of the machine.



NOTE

Technical term.

In this instruction manual, we consider that the term 'machine' refers to the 'Pump Unit'.



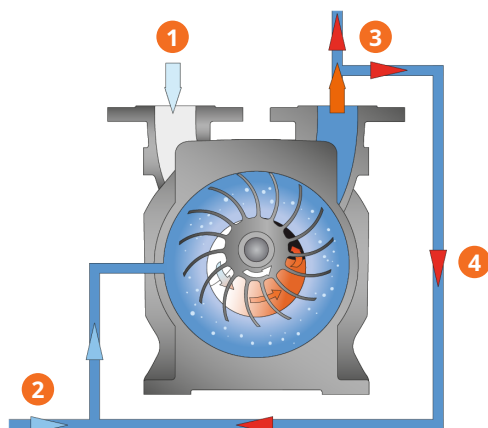
NOTE

Instruction manual supplement.

This document is a supplement to the DOLPHIN LX liquid ring vacuum pump instruction manual whose content remains valid.

2.1 Operating Principle

2.1.1 Partial Recovery (Open Circuit)



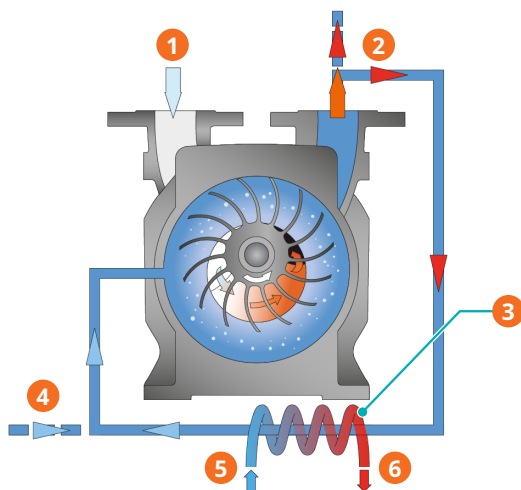
Description

1	Process inlet (IN)	2	Operating liquid inlet (OPI)
3	Gas and operating liquid discharge (OUT) into separator	4	Portion of operating liquid recovered

Partial recirculation liquid system reduces the consumption of fresh liquid by recovering and recirculating up to 85% of the operating liquid.

Fresh operation liquid is added to the system via the operating liquid inlet (OPI) connection using the thermostatic valve (TV) to maintain a constant operating liquid temperature with minimum fresh liquid supply.

2.1.2 Total Recovery (Closed Circuit)



Description

1	Process inlet (IN)	2	Gas and operating liquid discharge (OUT) into separator
3	Heat exchanger (HE)	4	Topping-up operating liquid (OPI)
5	Cooling liquid inlet (CLI)	6	Cooling liquid outlet (CLO)

Total recirculation liquid system recovers all of the operating liquid which is cooled by a heat exchanger.

2.2 System Description

The Pump Unit description is written on the system's nameplate. It is defined as in the following example:



Description			
1	VX = Compact liquid ring vacuum pump unit	2	Size of the vacuum pump
3	Design status of vacuum pump unit	4	DOLPHIN LX standard shaft seal (Viton)
5	K = Cast iron construction / 316 stainless steel, M = 316 stainless steel throughout	6	P = Partial recirculation system, T = Total recirculation system (plate heat exchanger)
7	Motor reference	8	M = Screwed connections
9	X = System suitable for non-hazardous area		

2.3 Start Controls

The machine comes without start controls. The control of the machine is to be provided in the course of installation.

The machine is suitable for operation with a variable speed drive allowing speed control in the operating range 37 to 63 Hz (see *Technical Data* [→ 29]).

2.4 Control Concept

2.4.1 Partial Recovery (Open Circuit)

Operating liquid is recirculated within the system whilst additional liquid is added via the operating liquid inlet (OPI), with thermostatic valve (TV) regulating the fresh liquid to maintain the required operating liquid temperature in the system. For flow range see *Technical Data* [→ 29]. The process gas and operating liquid are discharged from the vacuum pump together into the separator vessel (SVES) where they are separated. The gas leaves through the discharge connection, whilst the operating liquid level is maintained as excess liquid drains from the separator through the operating liquid overflow connection (OPO). The level indicator (LI) provides visual indication of the liquid level in the system.

Through the site control system (provided by others) the solenoid valve (MV) opens when the pump starts and closes on pump stop.

The bypass valve (BPV) allows the thermostatic control valve and operating solenoid isolation valve to be bypassed when filling the system with operating liquid.

At the operating liquid inlet (OPI), the Y-strainer (ST) prevents particles greater than 0.1 mm entering the vacuum pump.

The manual fresh liquid isolation valve (IV) allows the system liquid inlet to be isolated whilst the strainer is cleaned.

The suction non-return valve prevents operating liquid from flowing back into the process when the system stops under vacuum.

The vacuum gauge (VG) indicates the system suction pressure.

The thermometer (TM) indicates the operating liquid temperature into the liquid ring vacuum pump.

2.4.2 Total Recovery (Closed Circuit)

All of the operating liquid is recirculated within the system, allowing liquid other than water to be used as the operating liquid. Constant liquid temperature in the system is maintained by a heat exchanger with a separate cooling liquid supply. The process gas and operating liquid are discharged from the vacuum pump together into the separator vessel (SVES) where they are separated. The gas leaves through the discharge connection whilst high operating liquid level (condensing suction load) is prevented by excess liquid draining from the separator overflow connection (OPO). The level indicator (LI) provides visual indication of the liquid level in the system.

At the operating liquid inlet (OPI), the Y-strainer (ST) prevents particles greater than 0.1 mm entering the vacuum pump.

The manual fresh liquid isolation valve (IV) allows the system liquid inlet to be isolated whilst the Y-strainer is cleaned.

The suction non-return valve (NRV) prevents operating liquid from flowing back into the process when the system stops under vacuum.

The vacuum gauge (VG) indicates the system suction pressure.

The thermometer (TM) indicates the operating liquid temperature into the liquid ring vacuum pump.

3 Transport



WARNING

Suspended load.

Risk of severe injury!

- Do not walk, stand, or work under suspended loads.



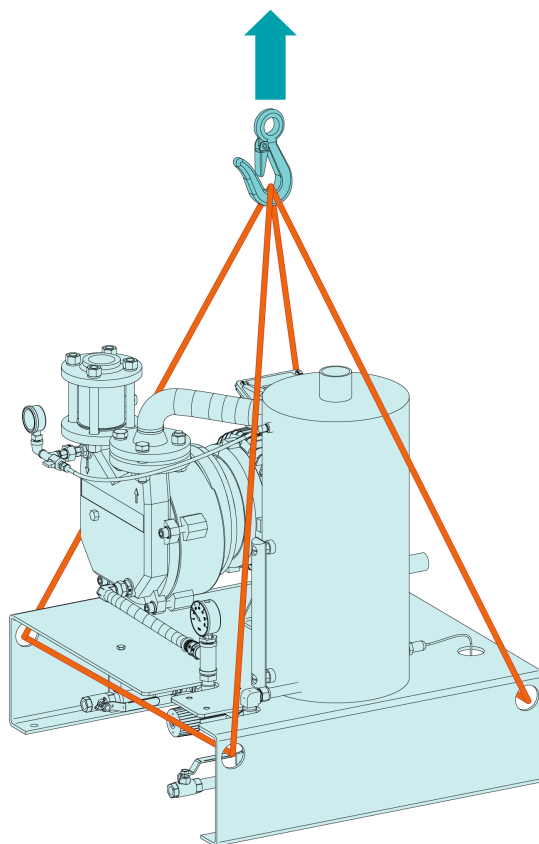
WARNING

Lifting the Pump Unit incorrectly.

Risk of severe injury!

Risk of damage to the machine!

- Make sure to lift the Pump Unit as described in the illustration below.
- Check the machine for transport damage.
- To find out the weight of the machine, refer to the chapter *Technical Data* [→ 29] or the nameplate (NP).
- When disassembling the system lift each component separately.
- Make sure to comply with the suitable lifting method which is described in each instruction manual of the separate machine.



4 Storage



NOTICE

Storage temperature below +5°C.

Risk of damage to the machine!

- Drain the operating liquid from the machine and the system before storage.
 - Or add an anti-freeze solution.
-

After testing, all Busch DOLPHIN vacuum pumps are vented and drained.

Please refer to the DOLPHIN LX manual for detailed machine storage instructions.

5 Installation

5.1 Installation Conditions



NOTICE

Use of the machine outside of the permitted installation conditions.

Risk of premature failure!

Loss of efficiency!

- Make sure that the installation conditions are fully respected.
- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the *Technical Data* [→ 29].
- Make sure that the environmental conditions comply with the protection class of the motor.
- Make sure that the installation space or location is protected from weather and lightning.
- Make sure that the installation space or location is vented such that sufficient cooling of the machine is provided.
- Make sure that cooling air inlets and outlets of the motor fan are not covered or obstructed and that the cooling air flow is not affected adversely in any other way.
- Make sure that enough space remains for maintenance work.
- Make sure that the machine is placed or mounted horizontally on a flat surface.
- Make sure that the machine is connected to an operating and cooling liquid system to suit the machine, see *Connecting Lines / Pipes* [→ 13].
- Make sure that all provided covers, guards, hoods, etc. are mounted.

If the machine is installed at an altitude greater than 1000 meters above sea level:

- Contact your Busch representative, the motor should be derated or the ambient temperature limited.

5.2 Connecting Lines / Pipes

- Remove all protective covers before installation.
- Make sure that the diameter of the connection lines over the entire length is at least as large as the connections of the machine.
- Make sure that the connection lines cause no stress on the machine's connection; if necessary use flexible joints.
- To reduce the impact of (low level) sound emission which can be audible from the discharge connection at certain operating conditions, it is recommended that the discharge is piped away from the unit.

In case of long connection lines:

- Use larger diameters to avoid a loss of efficiency.
- Contact your Busch representative for more information.

! NOTICE

Ingress of foreign objects.

Risk of damage to the machine!

If the inlet gas contains foreign solid particles:

- Install a suitable inlet screen (smaller than 0.1 mm mesh size) upstream of the machine.

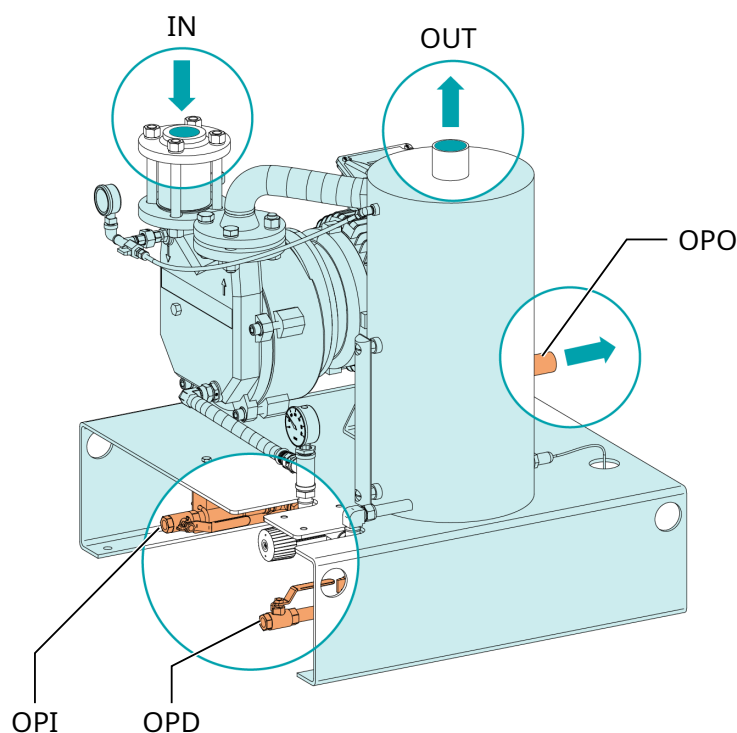
! CAUTION

Restriction of the separator vent.

Will cause back pressure and possible separator failure.

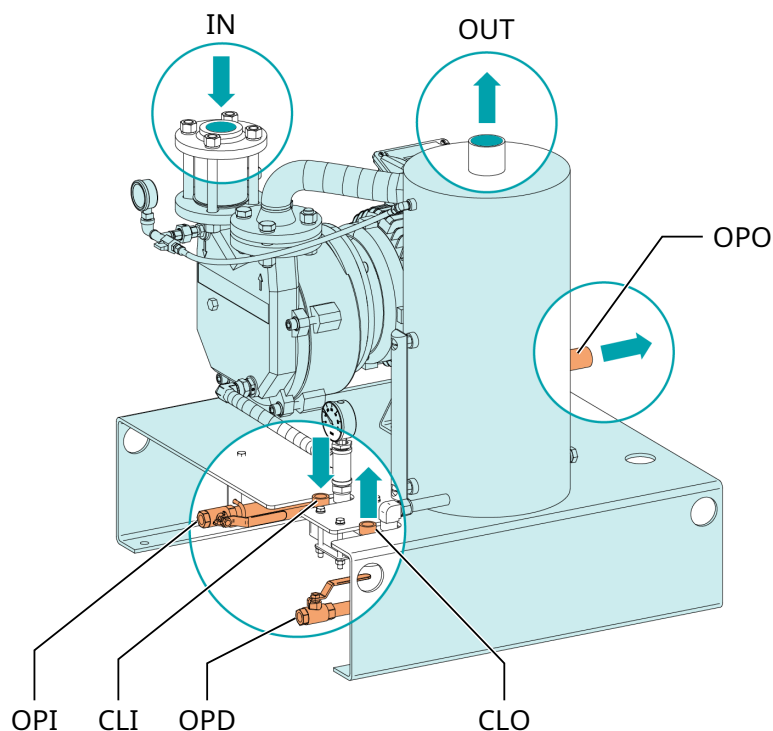
- The separator vent piping should not be restricted as separator vessel is not pressure rated.
- Make sure that the discharged gas will flow without obstruction. Do not shut off or throttle the discharge line or use it as a pressurized air source.

DOLPHIN VX 0030 – 0180 A Partial recovery



Description			
IN	Suction connection	OUT	Discharge connection
OPD	Operating liquid drain	OPI	Operating liquid inlet
OPO	Operating liquid outlet / overflow		

DOLPHIN VX 0030 - 0180 A Total recovery – plate heat exchanger



Description

IN	Suction connection	OUT	Discharge connection
CLI	Cooling liquid inlet	CLO	Cooling liquid outlet
OPD	Operating liquid drain	OPI	Operating liquid inlet
OPO	Operating liquid outlet / overflow		

Connection sizes

Machine type	IN	OUT	OPO	OPI	OPD	CLI	CLO
VX 0030 – 0055 A	G1	R2	R1	G1/2	G1/2	G1/2	G1/2
VX 0110 – 0180 A	G1 1/2	R2	R1	G1/2	G1/2	G1/2	G1/2

Make sure that the cooling liquid complies with the requirements, see *Technical Data* [→ 29].

6 Electrical Connection



DANGER

Live wires.

Risk of electrical shock!

- Electrical installation work must only be executed by qualified personnel.

INSTALLATION(S) CURRENT PROTECTION:



DANGER

Missing current protection.

Risk of electrical shock!

- Provide current protection in accordance with EN 60204-1 on your installation(s).
- The electrical installation must comply with the applicable national and international standards.



NOTICE

Electromagnetic compatibility.

- Make sure that the motor of the machine will not be affected by electric or electromagnetic disturbance from the mains. If necessary, contact your Busch representative for more information.
- Make sure that the EMC of the machine is compliant with the requirements of your supply network system, if necessary, provide further interference suppression (EMC of the machine, see *EU Declaration of Conformity* [→ 31] or *UK Declaration of Conformity* [→ 32]).

6.1 Machine delivered without Control Box or Variable Speed Drive (VSD)



DANGER

Live wires.

Risk of electrical shock!

- Electrical installation work must only be executed by qualified personnel.
- Make sure that the power supply for the motor is compatible with the data on the nameplate of the motor.
- If the machine is equipped with a power connector, install a residual current protective device to protect persons in case of a defective insulation.
 - Busch recommends installing a type B residual protective device suitable for the electrical installation.
- Provide a lockable disconnect switch or an emergency stop switch on the power line so that the machine is completely secured in case of an emergency situation.

- Provide a lockable disconnect switch on the power line so that the machine is completely secured during maintenance tasks.
- Provide an overload protection according to EN 60204-1 for the motor.
- Connect the protective earth conductor.
- Electrically connect the motor.

NOTICE

The motor frequency is too low.

Loss of efficiency, not enough power to create the sealing liquid ring.

- The motor speed must always be higher than the minimum speeds shown in the *Technical Data* [→ 29].

6.2 Wiring Diagram Three-Phase Motor

NOTICE

Incorrect direction of rotation.

Risk of damage to the machine!

- Operation in the wrong direction of rotation can destroy the machine in a short time! Prior to start-up, ensure that the machine is operated in the right direction.

NOTICE

Incorrect direction of rotation.

Risk of damage to the vacuum system!

- Operating the vacuum system with the rotation in the wrong direction can result in the operating liquid flowing back to the vacuum system. Prior to start-up, check for correct direction of rotation.

If the rotation of the motor must be changed:

- Switch any two of the motor phase wires.

6.3 Electrical Connection of the Monitoring Devices



NOTE

The accessories below are considered as standard.

If other specific components should be used, refer to the instruction manual of the accessory in question.

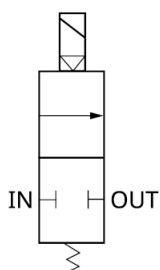
6.3.1 Wiring Diagram Solenoid Valve

Part no.: 2000185615

Supplier reference: Model CLO3EB13T Pilot Diaphragm

Electrical data: $U_i = 24 \text{ VDC}$; $P_i = 5.5 \text{ W}$; IP 65

Contact: Normally closed



IN: In / OUT: Out

- Coil de-energized : IN and OUT close
- Coil energized : IN to OUT

7

Commissioning



CAUTION

During operation the surface of the machine may reach temperatures of more than 70°C.

Risk of burns!

- Avoid contact with the machine during and directly after operation.



NOTICE

The machine is running without operating liquid system.

Will ruin the machine in short time!

- Prior to commissioning, the operating liquid and cooling liquid system must be connected and open.



NOTICE

The machine is operated with closed inlet.

Will ruin the machine in short time!

- Prior to commissioning, ensure the inlet line is open.

- Make sure that the Installation Conditions are met.

Before operating the machine:

Partial recovery system:

- Fill with operating liquid.
 - Open fresh liquid isolation (IV) and bypass (BPV) valves.
 - Close the valves once the level is at the vacuum pump shaft center in line with the operating liquid overflow connection (OPO). The liquid level can be checked visually using the level indicator (LI).

Total recovery system:

- Fill with operating liquid.
- Open fresh liquid isolation valve (IV).
- Close the valves once the level is at the vacuum pump shaft center in line with the operating liquid overflow connection (OPO). The liquid level can be checked visually using the level indicator (LI).
- Check the operation of all automatic valves before start up.
- Start the machine.
- Make sure that the maximum permissible number of starts does not exceed the recommendation from the motor manufacturer.
- Make sure that the operating conditions comply with the *Technical Data* [→ 29] or the Operating Limits.

As soon as the machine is operated under normal operating conditions:

- Measure the motor current and record it as reference for future maintenance and troubleshooting work.

7.1 Preventing Cavitation



NOTICE

Cavitation.**Risk of damage to the machine!**

If you hear crackling noise:

- Control the pressure.
-

At very low pressures and sufficiently high temperatures the operating liquid can locally transfer into the vapor phase, creating bubbles within the operating liquid. As the pressure rises towards the outlet slot the bubbles collapse. This process is called cavitation.

In case of bubbles that have been located on surfaces the operating liquid cannot intrude the cavity left by the bubble equally from all directions. Instead the inflowing liquid hits the surface with high speed. This causes erosion, which can destroy the machine rapidly. The formation of bubbles also deteriorates the pump performance. Cavitation is clearly audible by its crackling noise.

The working pressure of the vacuum pump shall therefore be sufficiently above the vapor pressure of the operating liquid. In particular the pressure control in the vacuum system must by no means be achieved by throttling or even closing of the suction line!

The vapor pressure of the operating liquid and consequently the ultimate pressure can be reduced by cooling. However, this increases the cooling water flow considerably. In most cases the low ultimate pressure is not required and cavitation shall be avoided by means of vacuum limitation rather than cooling.

The machine is fitted with an anti-cavitation line and valve (CPV). When cavitation is observed, open the valve to bleed gas into the vacuum pump to reduce cavitation.

8 Maintenance



DANGER

Live wires.

Risk of electrical shock!

- Electrical installation work must only be executed by qualified personnel.



WARNING



The machine is contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.



CAUTION

Hot surface.

Risk of burns!

- Before doing anything that requires touching the machine, let it cool down first.

- Stop the machine and lock it to prevent accidental start-up.
- Turn off the operating liquid system.
- Vent the connected lines to atmospheric pressure.

If necessary:

- Drain the operating liquid
- Disconnect all connections

8.1 Maintenance Schedule

The maintenance intervals depend very much on the individual operating conditions. The intervals given below are considered as starting values which should be individually shortened or extended as appropriate.

Particularly harsh applications or heavy duty operation, such as high dust loads in the environment or in the process gas, other contamination or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

Interval	Maintenance work
Daily	<ul style="list-style-type: none"> • Check the operating liquid level • Check vacuum pump running condition, temperature and any abnormal noise.
Monthly	<ul style="list-style-type: none"> • Check the machine for liquid leaks - in case of leaks have the machine repaired (contact Busch). • Check gauges are functioning – replace if damaged.
Yearly	<ul style="list-style-type: none"> • Clean Y-strainer. • Clean inlet screen if installed. • Drain and clean level indicator. • Flush and clean heat exchanger. • Check function of electrical control devices.

9

Overhaul

**WARNING**

The machine is contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

**NOTICE**

Improper assembly.

Risk of premature failure!

Loss of efficiency!

- Any dismantling of the machine that goes beyond anything that is described in this manual should be done by Busch authorized technicians.

If the machine has conveyed gas contaminated with foreign materials which are hazardous to health:

- Decontaminate the machine as much as possible and state the contamination status in a 'Declaration of Contamination'.

Busch will only accept machine accompanied by a signed, fully completed and legally binding "declaration of contamination", downloadable from the following link: buschvacuum.com/declaration-of-contamination.

10 Decommissioning



DANGER

Live wires.

Risk of electrical shock!

- Electrical installation work must only be executed by qualified personnel.
-



CAUTION

Hot surface.

Risk of burns!

- Before doing anything that requires touching the machine, let it cool down first.
-

- Stop the machine and lock it to prevent accidental start-up.
- Disconnect the power supply.
- Vent the connected lines to atmospheric pressure.
- Disconnect all connections.

If the machine is to be stored:

- See Storage.

10.1 Dismantling and Disposal

- Separate special waste from the machine.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the machine as scrap metal.

11 Spare Parts



NOTICE

Use of non-Busch original spare parts.

Risk of premature failure!

Loss of efficiency!

- Use only original Busch spare parts, consumables and supplies to ensure correct operation of the machine and to validate the warranty.

Spare parts	Description	Part no.
Heat exchanger for: VX 0030 A VX 0055 A VX 0110 A VX 0140 A VX 0180 A	Intended for all applications, used in total recirculation systems. 1x plate type heat exchanger – stainless steel, brazed plates	2000185828
Thermostatic valve for: VX 0030 A VX 0055 A VX 0110 A VX 0140 A VX 0180 A	Intended for all applications, used in partial recirculation systems. 1x thermostatic valve – brass complete with stainless steel sensor pocket	2000185617
Vacuum gauge for: VX 0030 A VX 0055 A VX 0110 A VX 0140 A VX 0180 A	Intended for all applications. 1x gauge – stainless steel	2000206921
Thermometer for: VX 0030 A VX 0055 A VX 0110 A VX 0140 A VX 0180 A	Intended for all applications. 1x Thermometer – stainless steel	2000185867

If other parts are required:

- Contact your Busch representative.

12 Troubleshooting

Problem	Possible Cause	Remedy
The machine does not start.	The motor is not supplied with the correct voltage.	<ul style="list-style-type: none"> • Check the power supply.
	Corrosion between the rotor and the housing.	<ul style="list-style-type: none"> • Eliminate by use of anti-corrosion liquid. • Repair the machine (contact Busch).
	Solid foreign matter has entered the machine.	<ul style="list-style-type: none"> • Remove the solid foreign matter or repair the machine (contact Busch). • Install an inlet screen if necessary.
	Ice in the machine, the operating liquid has frozen.	<ul style="list-style-type: none"> • Carefully warm up the machine. • Defrost the operating liquid.
	The motor is defective.	<ul style="list-style-type: none"> • Replace the motor.
Pump trip	If seized during commissioning, welding slag or other foreign matter may have been drawn in from new pipes with incoming gas.	<ul style="list-style-type: none"> • Flush the machine and check rotation by hand. If trouble persists, contact Busch.
	Heavy lime deposit build-up	<ul style="list-style-type: none"> • Flush the machine and check rotation by hand. If trouble persists, contact Busch.
	Discharge pressure too high	<ul style="list-style-type: none"> • Make sure the vent line is free of restrictions.
The machine does not reach the usual pressure on the suction connection.	Suction or discharge lines too long or section diameter too small.	<ul style="list-style-type: none"> • Use larger diameter or shorter lines. • Seek advice from your local Busch representative.
	The operating liquid is too warm. (the characteristic curves are based on 15°C warm water as operating liquid, with higher temperatures the achieved pressure and the flow rate deteriorate)	<ul style="list-style-type: none"> • Adjust cooling liquid flow rate to reduce the temperature of the operating liquid. • Check heat exchanger for blockage. • Check cooling liquid supply temperature and flow <i>Technical Data</i> [→ 29]. • Check thermostatic valve operation – replace if damaged.
	Partial clogging in the suction, discharge or pressure line.	<ul style="list-style-type: none"> • Remove the blockage.
	If an inlet screen is installed, it can be partially clogged.	<ul style="list-style-type: none"> • Clean the inlet screen.
	Leakage occurring in the system.	<ul style="list-style-type: none"> • Check the joints are sealed sufficiently.

Problem	Possible Cause	Remedy
The machine runs very noisily or rattles.	The operating liquid level is too high.	<ul style="list-style-type: none"> Adjust the regulating valves to drain the pump down to center line.
	Density or viscosity of the operating liquid too high.	<ul style="list-style-type: none"> Check Operating Liquid Settings. Provide a different operating liquid or a stronger drive motor.
	The machine runs in the wrong direction.	<ul style="list-style-type: none"> Check the direction of rotation, see <i>Wiring Diagram Three-Phase Motor</i> [→ 17].
	Defective bearings.	<ul style="list-style-type: none"> Repair the machine (contact Busch).
	The vacuum pump cavitates (periodic formation and collapsing of steam bubbles in the operating liquid).	<ul style="list-style-type: none"> Adjust the cavitation protection valve (CPV). Adjust cooling liquid flow rate to reduce the temperature of the operating liquid. Adjust thermostatic valve (TV) setting to reduce the temperature of the operating liquid.
The machine runs too hot.	Insufficient air ventilation.	<ul style="list-style-type: none"> Make sure that the cooling of the machine is not impeded by dust/dirt. Clean the fan cowling, the fan, the ventilation grill and the cooling fins of the motor.
	Ambient temperature too high.	<ul style="list-style-type: none"> Observe the permitted ambient temperature, see <i>Technical Data</i> [→ 29].
	Temperature of the process gases at the inlet too high.	<ul style="list-style-type: none"> Observe the permitted gas inlet temperature, see <i>Technical Data</i> [→ 29].
	Insufficient gas transfer.	<ul style="list-style-type: none"> Introduce a suitable inert gas or air via the anti-cavitation connection.
	Partial blockage in the suction, discharge or pressure line.	<ul style="list-style-type: none"> Remove the blockage.
	Operating liquid not cooled sufficiently by the heat exchanger.	<ul style="list-style-type: none"> Check cooling liquid flow <i>Technical Data</i> [→ 29]. Clean heat exchanger. Reduce cooling liquid temperature.

Problem	Possible Cause	Remedy
Separator liquid level not maintained.	Partial blockage in the liquid outlet/overflow line.	<ul style="list-style-type: none">• Remove the blockage.
	Solenoid operation.	<ul style="list-style-type: none">• Check solenoid valve operation - replace if damaged.
	Thermostatic valve operation.	<ul style="list-style-type: none">• Check thermostatic control valve operation - replace if damaged.
	Y-strainer clogged.	<ul style="list-style-type: none">• Clean the Y-strainer screen.

13 Technical Data

		VX 0030 A	VX 0055 A
Nominal pumping speed (50 / 60 Hz) *	m ³ /h	25 / 31	47 / 56
Ultimate pressure (50 / 60 Hz) *	hPa (mbar) abs.	33 / 33	
Max. overpressure (50 / 60 Hz)	bar(g)	0.5 / 0.5	
Nominal motor rating IEC (50 / 60 Hz)	kW	1.1 / 1.5	1.5 / 2.2
Nominal motor speed (50 / 60 Hz)	min ⁻¹	2900 / 3500	
Permitted motor speed range	min ⁻¹	2200 ... 3800 (~37 ... 63 Hz)	
Sound pressure level (ISO 3744), 1 m distance, at medium load (50 Hz / 60 Hz)	dB(A)	≤ 70	
Design pressure	bar (g)	0.5	
Design temperature	°C	0 ... 120	
Max. gas inlet temperature	°C	Gas dry at 100	
		Gas saturated at 80	
Ambient temperature range	°C	5 ... 40	
Relative humidity	at 30°C	90 %	
Ambient pressure		Atmospheric pressure	
Fresh liquid flow rate - partial recirculation system	m ³ /h	0.05 ... 0.3	0.05 ... 0.3
Cooling liquid flow rate plate heat exchanger - total recirculation system	m ³ /h	0.3 / 0.35	0.35 / 0.67
Cooling liquid pressure (max.)	bar(g)	10	
Operating liquid density (min.)	g/cm ³	1	
Operating liquid viscosity (max.)	cP	2	
Instrument electrical supply		24 V DC	
Weight - Partial recovery 50 Hz / (50 / 60 Hz)	kg	75 / 83	85 / 93
Weight - Total recovery, plate heat exchanger 50 Hz / (50 / 60 Hz)	kg	73 / 81	83 / 91

		VX 0110 A	VX 0140 A	VX 0180 A
Nominal pumping speed (50 / 60 Hz) *	m ³ /h	72 / 83	100 / 120	122 / 144
Ultimate pressure (50 / 60 Hz)	hPa (mbar) abs.	33 / 33		
Max. overpressure (50 / 60 Hz)	bar(g)	0.5 / 0.5		
Nominal motor rating IEC (50 / 60 Hz)	kW	2.2 / 3.0	3.0 / 4.0	4.0 / 5.5
Nominal motor speed (50 / 60 Hz)	min ⁻¹	1450 / 1750		
Permitted motor speed range	min ⁻¹	1200 ... 1800 (~41 ... 60 Hz)		
Sound pressure level (ISO 3744), 1 m distance, at medium load (50 Hz / 60 Hz)	dB(A)	≤ 70		
Design pressure	bar(g)	0.5		
Design temperature	°C	0 ... 120		
Max. gas inlet temperature	°C	Gas dry at 100		
		Gas saturated at 80		
Ambient temperature range	°C	5 ... 40		
Relative humidity	at 30°C	90 %		
Ambient pressure		Atmospheric pressure		
Fresh liquid flow rate - partial recir- culation system	m ³ /h	0.14 ... 0.9	0.15 ... 1.0	0.16 ... 1.08
Cooling liquid flow rate plate heat exchanger - total recirculation sys- tem	m ³ /h	0.63 / 0.86	0.86 / 1.15	1.15 / 1.58
Cooling liquid pressure (max.)	bar(g)	10		
Operating liquid density (min.)	g/cm ³	1		
Operating liquid viscosity (max.)	cP	2		
Instrument electrical supply		24 V DC		
Weight - Partial recovery 50 Hz / (50 / 60 Hz)	kg	160 / 168	171 / 177	180 / 197
Weight - Total recovery, plate heat exchanger 50 Hz / (50 / 60 Hz)	kg	159 / 166	169 / 175	178 / 195

* Pumping speed and ultimate pressure based on water as the operating liquid at 15°C. Higher operating liquid temperatures will reduce the pumping speed and limit the ultimate pressure that can be achieved.

14 EU Declaration of Conformity

This Declaration of Conformity and the CE-markings affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer.

When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the CE-marking.

The manufacturer is determined by the serial number:

Serial number starts with **600...**

Busch GVT Ltd.
Westmere Drive, Crewe Business Park
Crewe, Cheshire, CW1 6ZD
United Kingdom

Serial number starts with **INM1...**

Busch Manufacturing India Pvt Ltd
B100, Indospace Logistic Park
Chakan, Khed-Taluka, Pune - 410501
Maharashtra, India

declares that the machine: DOLPHIN VX 0030 A; DOLPHIN VX 0055 A; DOLPHIN VX 0110 A; DOLPHIN VX 0140 A; DOLPHIN VX 0180 A

fulfill(s) all the relevant provisions from EU directives:

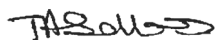
- 'Machinery' 2006/42/EC
- 'Electromagnetic Compatibility' (EMC) 2014/30/EU
- 'RoHS' 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (incl. all related applicable amendments)

and comply(-ies) with the following harmonized standards that have been used to fulfill those provisions:

Standard	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN ISO 2151 : 2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
EN IEC 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments
ISO 21940-1 : 2019	Mechanical vibration – Rotor balancing

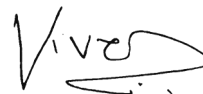
Legal person authorized to compile the technical file and authorized representative in the EU (if the manufacturer is not located in the EU): **Busch Dienste GmbH**
Schauinslandstr. 1
DE-79689 Maulburg

Crewe, 15.02.2023



Tracey Sellars, General Manager

Chakan Khed-Taluka, Pune-Maharashtra, 15.02.2023



Vivek Jaripatke, Plant Operations Manager

15 UK Declaration of Conformity

This Declaration of Conformity and the UKCA-markings affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer.

When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the UKCA-marking.

The manufacturer is determined by the serial number:

Serial number starts with **600...**

Busch GVT Ltd.
Westmere Drive, Crewe Business Park
Crewe, Cheshire, CW1 6ZD
United Kingdom

Serial number starts with **INM1...**

Busch Manufacturing India Pvt Ltd
B100, Indospace Logistic Park
Chakan, Khed-Taluka, Pune - 410501
Maharashtra, India

declares that the machine: DOLPHIN VX 0030 A; DOLPHIN VX 0055 A; DOLPHIN VX 0110 A; DOLPHIN VX 0140 A; DOLPHIN VX 0180 A

fulfill(s) all the relevant provisions from UK legislations:

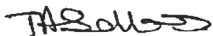
- Supply of Machinery (Safety) Regulations 2008
- Electromagnetic Compatibility Regulations 2016
- Restriction of the use of certain hazardous substances in Electrical and Electronic Equipment Regulations 2012

and comply(-ies) with the following designated standards that have been used to fulfill those provisions:

Standard	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN ISO 2151 : 2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
EN IEC 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments
ISO 21940-1 : 2019	Mechanical vibration - Rotor balancing

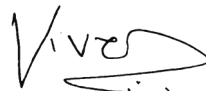
Legal person authorized to compile the technical file and importer in the UK (if the manufacturer is not located in the UK): **Busch GVT Ltd**
Westmere Drive, Crewe Business Park
Crewe, Cheshire - UK

Crewe, 15.02.2023



Tracey Sellars, General Manager

Chakan Khed-Taluka, Pune-Maharashtra, 15.02.2023



Vivek Jaripatke, Plant Operations Manager

Notes

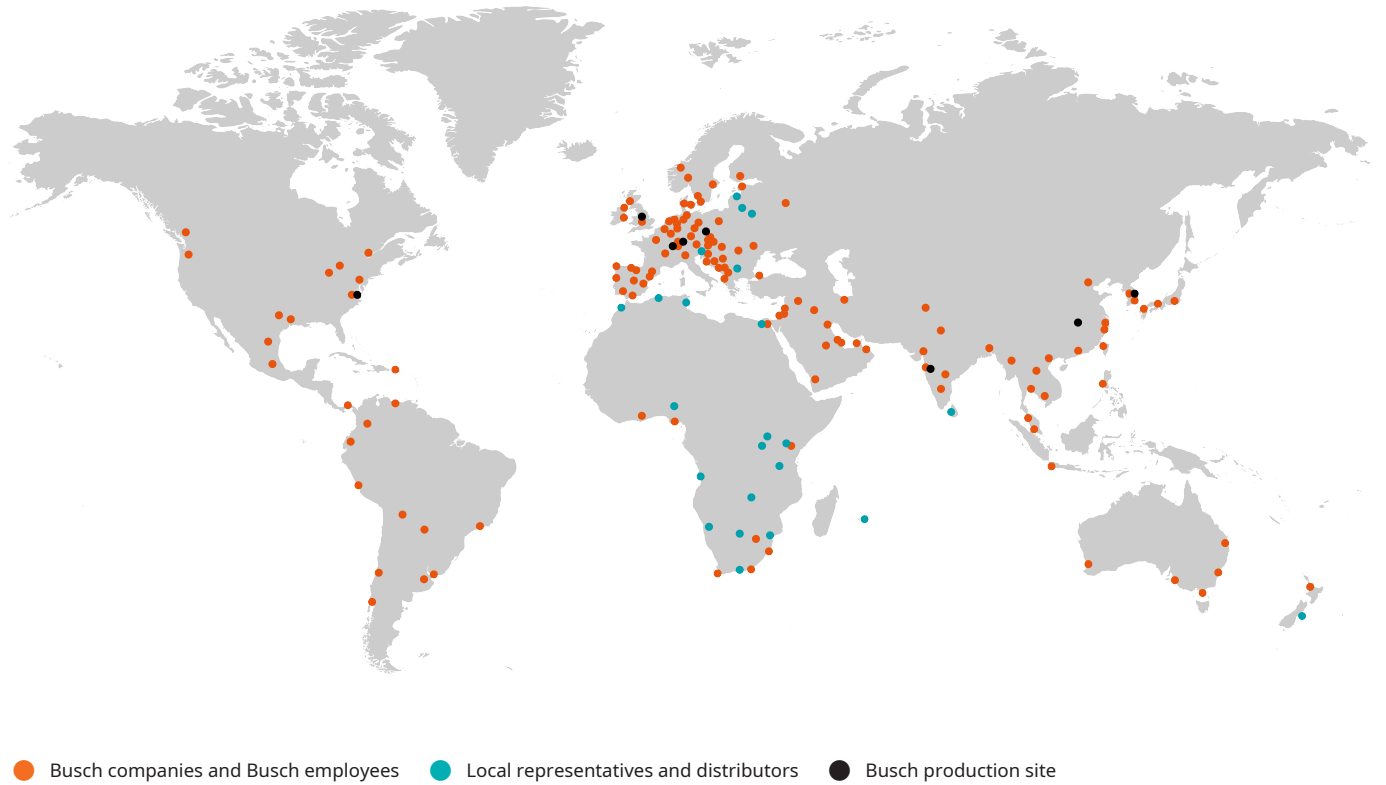
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Busch Vacuum Solutions

With a network of over 60 companies in more than 40 countries and agencies worldwide, Busch has a global presence. In every country, highly competent local personnel delivers custom-tailored support backed by a global network of expertise. Wherever you are. Whatever your business. We are there for you.



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