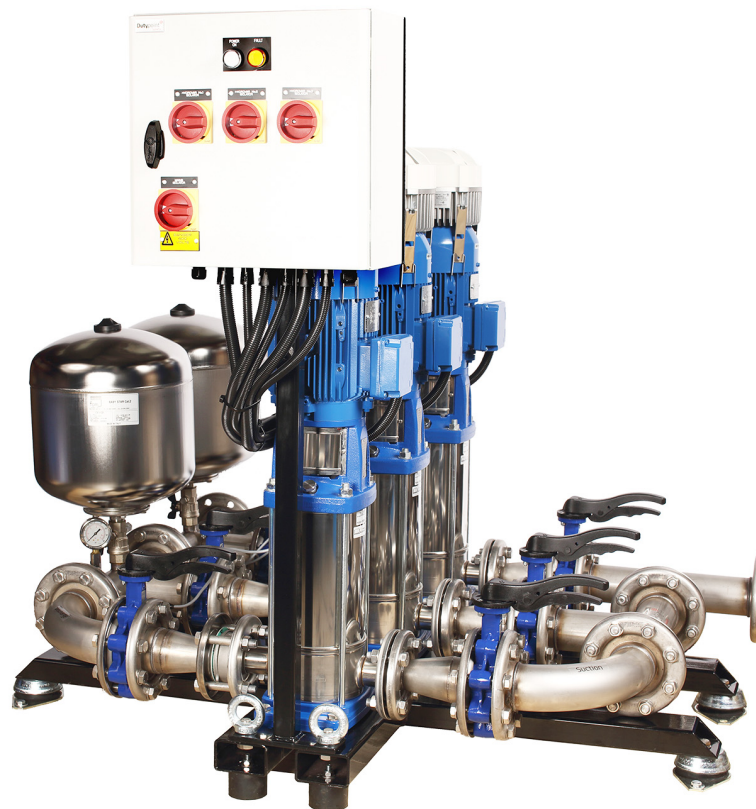




VMV (VASCO) Cold Water Booster Sets



Operation and Maintenance Manual

DOC-VMVVOM1801

Table of Contents

1. Important Safety Information..... 3

2. VMV Booster Set Specifications 7

3. Control Panel Overview..... 9

4. Operating the Pump Set10

5. Control Panel Wiring Diagrams.....12

6. Commissioning.....17

7. User Maintenance21

8. Pressure Vessel.....22

9. Troubleshooting.....24

10. Lowara e-SV Pump O&M Manual.....30

11. VASCO Inverter O&M Manual59

Dutypoint Limited
Shepherd Road
Gloucester
GL2 5EL
United Kingdom

1. Important Safety Information

1.1 Health & Safety at Work Act 1974

Section 6(a) of this Act requires manufacturers to advise their customers on the safety and the handling precautions to be observed when installing, operating, maintaining and servicing their products. The user's attention is therefore drawn to the following:

- The appropriate sections of this manual must be read before working on the equipment.
- Installation, operating and maintenance must only be carried out by suitably trained/qualified personnel.
- Normal safety precautions must be taken and appropriate procedures observed to avoid accidents.

Refer to Dutypoint for any technical advice or product information. It is the responsibility of the customer and/or the contractor:

- To ensure that anyone working on the equipment is wearing all necessary protective gear/clothing;
- Is aware of appropriate health & safety warnings and to read the information in this manual.

1.2 Safety Messages and Hazard Statement

Table 1.1: Hazard Notice Definitions

Message Level	Definition
DANGER	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION	A hazardous situation which, if not avoided, could result in minor injury or moderate injury
ELECTRICAL HAZARD	Risks associated with electricity will cause hazards if not properly avoided
Note	A situation which may arise resulting in undesirable conditions and/or will not cause direct hazards to persons

1.3 Qualified Personnel

WARNING

This product is indented for operation by qualified personnel only

- Only qualified personnel are allowed to install or operate this equipment
- Qualified personnel are defined as trained staff, who are authorised to install, commission and maintain equipment, systems and circuits in accordance with relevant laws and regulations. Personnel must be familiar with the instructions and safety procedures described in this document.
- This product should not be used by anyone with mental disabilities, or anyone without the relevant experience and knowledge, unless they have received instructions on using the equipment and on the associated risks, or are supervised by a responsible person.
- Children must be supervised to ensure they do not play on or around the equipment.

1.4 Environmental Protection

All local regulations and codes regarding emissions and waste disposal must be followed. This may include:

- Reporting of emissions to appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste

- Clean-up of spills
- Separate disposal of electrical components from domestic waste

1.5 Mechanical Device Servicing

- Familiarise yourself with the relevant contents of this manual
- Installation, maintenance and repair work must only be carried out by trained, skilled and suitably qualified personnel.
- Disconnect or lock-out the power source to ensure that the item(s) will remain inoperative. Locking out the equipment by switching off the release mechanism or set value WILL NOT prevent accidental starting.
- Allow the item(s) to cool if over-heated.
- CLOSE the isolating valves on the suction and discharge connections of the affected item(s).
- If working on pump, VENT slowly and cautiously – Refer to the relevant section of this manual.
- DRAIN the pump(s).

1.6 Pump Hand Control Mode (Where Fitted)

In the 'HAND' position the pump(s) controlled by the switch will normally run at full speed and completely independently of any control devices, and can result in pump(s) running against a closed valve head if there is no draw. This can cause the system to be maintained at the maximum pressure produced by the pump plus any incoming pressure and additional pressure caused by water surge and can potentially damage the pump and other parts of the system.

The 'HAND' option should only be used with a competent operator in attendance, or when there is a continued demand sufficient to provide constant flow through the pumps to maintain the running pressure of the system to an acceptable level.

1.7 Personal Protective Equipment

Use personal safety equipment according to the site conditions and employer regulations. This may include, but may not be limited to:

- Hard hat
- Safety goggles with side shields
- Protective footwear
- Protective gloves
- Respirator
- Ear protection
- First aid kit
- Safety devices

1.8 Precautions Before Commencing Work

Ensure that the following safety precautions are complied with before commencing work:

- Provide a suitable barrier around the work area
- Ensure all safety guards are in place and secure
- Ensure you have a clear path of exit
- Ensure that the product cannot roll or fall over and cause damage to persons or property
- Ensure all lifting equipment is in good condition and rated for the intended task
- Use a lifting harness, safety line and respirator as required
- Allow hot components to cool before handling them
- Ensure that product has been thoroughly cleaned
- Disconnect and lock out power supply, ensuring that it cannot be accidentally re-connected
- Check for any risk of explosion before using hand tools

1.9 Precautions During Work

- Never work alone
- Always wear protective clothing and hand protection
- Stay clear of suspended loads
- Always use appropriate lifting devices
- Beware of risks of sudden starts of any automated equipment such as level control
- Beware of starting jerks of electric motors - these can be powerful
- Do not exceed the stated operating limits of equipment
- Do not remove vent plugs from a pressurised system - ensure pressurised components are relieved of pressure before disassembly
- Ensure guards are in place during operation

1.10 Hazardous Fluids and Chemicals

If hazardous chemicals come into contact with skin or eyes, use the following procedures:

Condition	Action
Chemicals or hazardous fluids in eyes	<ol style="list-style-type: none"> 1) Hold your eyelids apart forcibly with your fingers 2) Rinse the eyes with eyewash or running water for at least 15 minutes 3) Seek medical attention
Chemicals or hazardous fluids on skin	<ol style="list-style-type: none"> 1) Remove contaminated clothing 2) Wash the skin with soap and water for at least 1 minute 3) Seek medical attention

1.11 Electrical Safety - High Voltages

This information is especially applicable when Variable Speed Controllers (Inverters) are fitted to pumps.

When the inverter variable speed drive head is connected to the power supply the components of the power unit as well as certain components of the master control unit – are also connected to the power supply.

DANGER!

Touching these components can seriously endanger life!

- Before removing the frequency inverter cover, the system must be disconnected from the power supply
- After switching off the power supply wait at least 5 minutes before starting work on or in the inverter drive head - the capacitors in the intermediate circuit must be given time to discharge completely via the discharge resistors.

ELECTRICAL HAZARD

Up to 800V can be present - if there are faults this can be higher

- All work carried out when the frequency inverter is open must be performed only by suitably qualified and properly authorised personnel.

ELECTRICAL HAZARD

THE SYSTEM MUST ONLY BE OPERATED WHEN IT HAS BEEN CORRECTLY EARTHED AND PIPES BONDED TO EARTH IN ACCORDANCE WITH IEE REGULATIONS

- When connecting external control wires care must be taken not to short circuit adjacent components. Bare cable ends which are not in use must be insulated.
-

1.12 Electronic Safety Devices

- Inverter drives contain electronic safety devices which switch off the control element in the event of a fault developing.
 - A motor can also be stopped by 'mechanical blocking'
 - If it is switched off electronically, the motor is disconnected from the mains voltage supply via the electronics in the inverter drive.
 - Voltage fluctuation and power failures (temporary outages) can cause the motor to switch itself off.
-

WARNING

A motor will have zero current but will remain energised as it stops

- Take necessary precautions - the motor is not voltage-free in the circuit itself
-

WARNING

Repair of faults can cause items to start up again unexpectedly

- Ensure the motor is isolated before commencing any work
-

WARNING

High voltage tests of inverters may damage the electrical components.

- Bridge before the incoming/outgoing terminals L-L2-L3 and U-V-W.
 - To avoid incorrect metering by capacitors incorporated in the electronic circuits, isolate the motor from the inverter drive head.
-

1.13 Spare Parts

WARNING

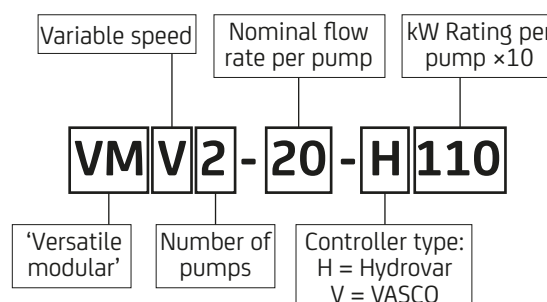
Use of non-genuine spare parts may cause damage to equipment, damage to property and voiding of warranty

- Use genuine, Dutypoint-approved spare parts only
 - If in doubt, contact Dutypoint Service on 01452 300590.
-

2. VMV Booster Set Specifications

2.1 Product Identification

Figure 2.1: VMV Booster Set Type Indicator



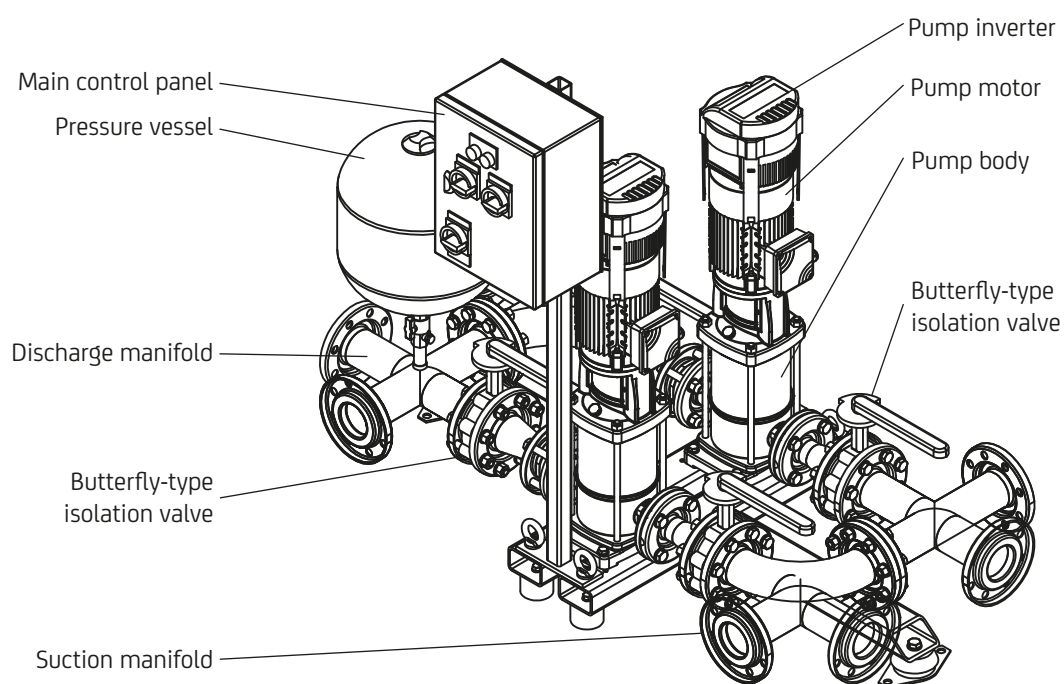
NOTE: Where WIMES specification motors are included, the operation and maintenance manual for the motors should be read in conjunction with this manual. This is provided in the appendix.

2.2 VMV Booster Set Operating Limits

Type of pumped liquids	Water with no gas or aggressive substances
Maximum pumped liquids temperature	+23°C domestic uses (EN 60335-2-41), +40°C other purposes
Minimum pumped liquid temperature	+1°C to avoid icing
Operating ambient temperature	+5°C to 40°C for indoor installation. (CEI EN 60439-1)
Relative humidity	Max 50% at 40°C
Air impurities	The air must be clean and free of acid vapours, corrosive gases and excessive amounts of dust
Storage temperature	+5°C to 50°C
Suction conditions	Minimum positive pressure 0.1 Bar. Maximum positive pressure 0.5 Bar.

2.3 Components Layout

Figure 2.2: VMV Components Layout



3. Control Panel Overview

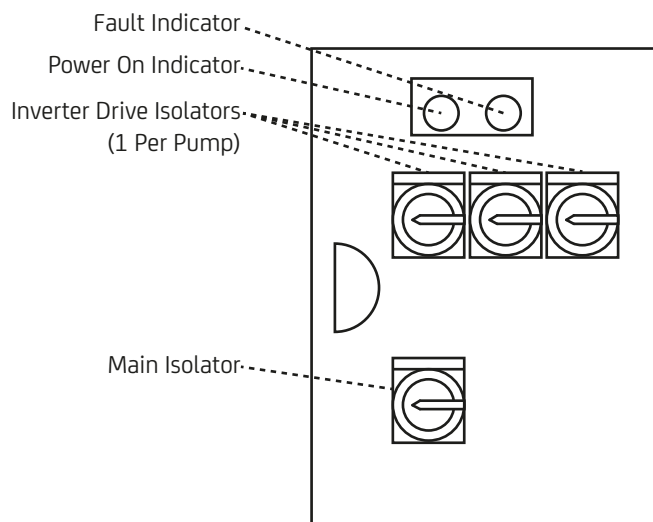
The Dutypoint control panel for booster sets provides external user control, internal protection and fault monitoring circuitry.

3.1 External Features

Externally the panel provides:

- An overall (main) isolator, single phase or three phase as appropriate
- A separate isolator for each inverter drive, used to independently switch each controller and its pump on or off
- A white indicator light to show 'power on' status
- An amber indicator light to show a 'fault condition' warning
- (Optional) hand/off/auto switch per pump

Figure 3.3: Control Panel External Layout



3.2 Internal Features

The internal circuitry provides the following protection and monitoring:

- Power feed via D-type rated magnetic circuit breakers (MCBs) giving overload current protection for each inverter/ pump.
- A low water detection relay triggered by the system low level float switch. This sets the fault indicator on the front of the panel and sends a control signal to each inverter controller.
- A system volt free (0v) alarm line link which is broken in the event of any failure
- A routing to connect the RS485 link between the inverter controllers to allow them to fully interact with each other
- A 24V supply for the protection and indicator circuitry

4. Operating the Pump Set

4.1 VASCO Display

The display screen on the VASCO is a back-lit LCD displaying 2 rows of 16 digits each. Alarms are indicated by an audible signal.

Figure 4.4: VASCO Control Panel

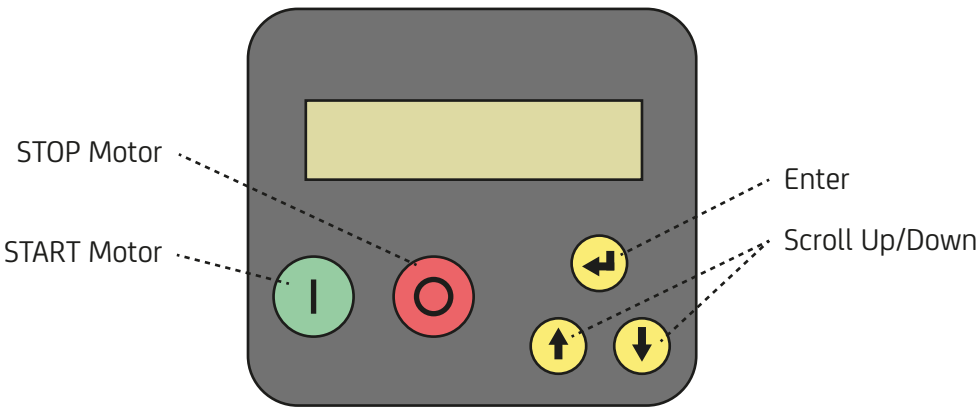


Figure 4.5: Display shown when first powering VASCO

LCD = X.XX
INV = X.XX

Release of display software
Release of inverter software

NOTE: One pump/VASCO combination will have been set as master (display name 00) and others as slaves (e.g. display name 01). The term “INV:” will be replaced by the appropriate display name, “00:” or “01:” etc. Various messages are then displayed.

The first row of the display gives the pump status as follows:

- Inv: ON XXX.X Hz - VASCO is powered and is powering the motor, showing its frequency
- Inv: ON Mot: OFF - VASCO is powered but motor is not running (i.e. motor/pump was stopped due to minimum frequency being reached).
- Inv: OFF Mot: OFF - VASCO is not powered.

The following end user messages are displayed on the second row by pushing the scroll buttons:

Table 4.2: VASCO End User Messages

Inv: ON/OFF Mot: ON/OFF p = XX.X [bar]	p is the pressure value read by the pressure transducer. By pressing ENTER the pressure set vale is displayed
Inv: ON/OFF Mot: ON/OFF f = XXX [Hz]	f value is the supply frequency to the motor. On fox frequency control mode, by pressing ENTER you can change the f value manually (word “set” is displayed), press ENTER again to exit parameter setting (word “set” disappears).
Inv: ON/OFF Mot: ON/OFF V_in = XX.X [V] I=XX.X	V_in is the line voltage. This value is displayed only if motor is OFF. If motor is NO, A value equal to the absorbed motor current.
Inv: ON/OFF Mot: ON/OFF cosphi = XXX	cosphi index means the angle phi between the voltage and current absorbed by the motor
Inv: ON/OFF Mot: ON/OFF P = XXXXX [W]	P is the power in Watts supplied to the pump

Inv: ON/OFF Mot: ON/OFF STATUS: NORMAL	NORMAL status means no alarms. If an alarm occurs, a message blinks on the display and an audible signal is activated. Pressing ENTER accesses: VASCO lifetime, PUMP lifetime, consumption statistic, alarm list. To return to previous views, press ENTER.
Inverter Life xxxxx h : xx m	
Motor Life p = XX.X [bar]	
%f 25 50 75 100 %h XX XX XX XX	
XXXXXXXXXXXXXXXXXX XXXXXXXXXX h : XX m	

WARNING: ADVANCED PARAMETERS. IMPROPER SETTINGS CAN COMPROMISE THE INTEGRITY AND LIFE OF THE CONTROLLER AND PUMP

- You should only access and adjust parameters if you are trained to do so
- All full description of the advanced parameters is available in the appendix of this manual
- For further assistance, call the Dutypoint Technical Service line of 01452 300590.

Pressing ENTER when you are in the initial display will show the following menus:

Table 4.3: VASCO Menus

MENU' Motor param.	Installer password required to enter level 1 (default 001)
MENU' Control. param.	Advanced password required to enter level 2 (default 002)
MENU' IN/OUT. param.	Installer password required to enter level 1 (default 001)
MENU' Connect. param.	Installer password required to enter level 2 (default 001)
MENU' Change init.set. param.	Advanced password required to enter level 2 (default 002)

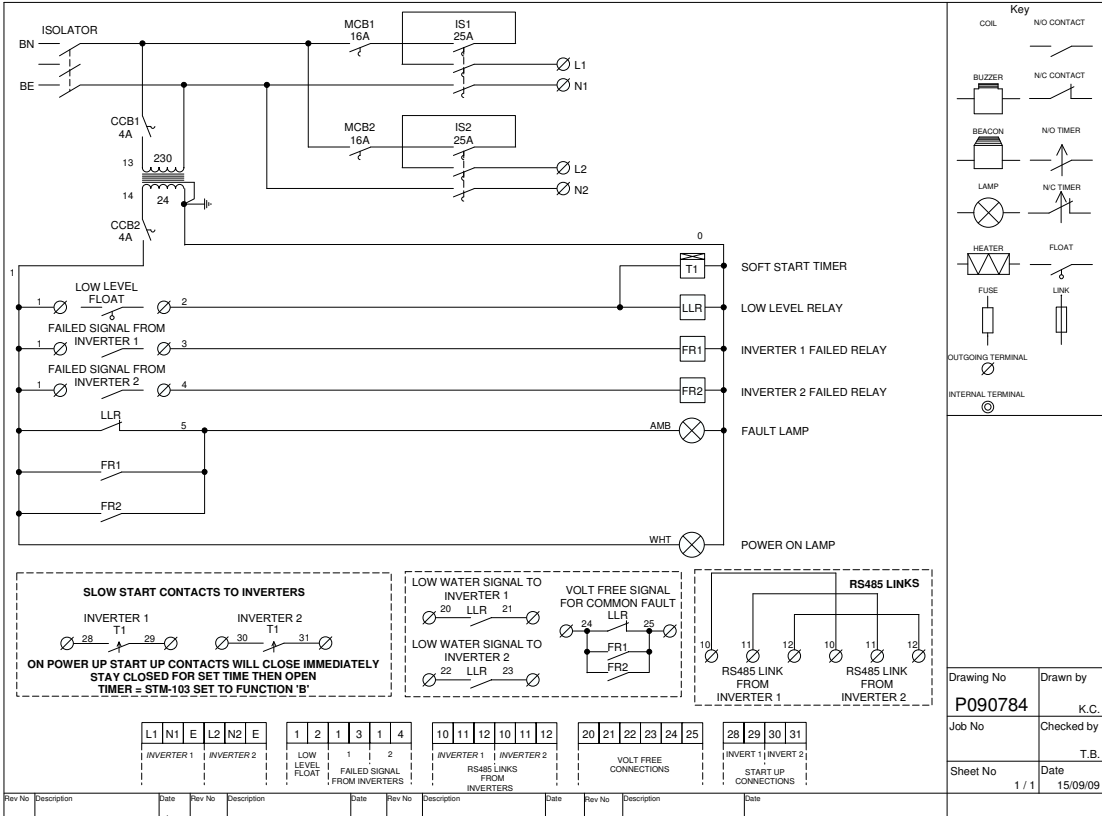
To exit the Menu level and return to the initial display, press STOP button.

For full details on the VASCO controller see [1. VASCO Inverter O&M Manual](#).

5. Control Panel Wiring Diagrams

5.1 Twin Pump Wiring Diagrams

Figure 5.6: Twin Pump, Single Phase



ISOLATOR

BN
BK
GY

CCB1 4A
415
13 14
15 24
CCB2 2A

MCB1 20A
IS1 33A
U1
V1
W1

MCB2 20A
IS2 33A
U2
V2
W2

1
2
3
4
5
6
LLR
FR1
FR2
WHT

0
T1
LLR
FR1
FR2
AMB
WHT

SOFT START TIMER
LOW LEVEL RELAY
INVERTER 1 FAILED RELAY
INVERTER 2 FAILED RELAY
FAULT LAMP
POWER ON LAMP

SLOW START CONTACTS TO INVERTERS

INVERTER 1
T1
28 29
INVERTER 2
T1
30 31

ON POWER UP START UP CONTACTS WILL CLOSE IMMEDIATELY
STAY CLOSED FOR SET TIME THEN OPEN
TIMER = STM-103 SET TO FUNCTION 'B'

LOW WATER SIGNAL TO INVERTER 1

20 LLR 21
22 LLR 23

LOW WATER SIGNAL TO INVERTER 2

20 LLR 21
22 LLR 23

VOLT FREE SIGNAL FOR COMMON FAULT LLR

24 FR1 25 FR2

RS485 LINKS

10 11 12
RS485 LINK FROM INVERTER 1
10 11 12
RS485 LINK FROM INVERTER 2

Rev No Description Date Rev No Description Date Rev No Description Date Rev No Description Date

1 2 3 4 10 11 12 10 11 12 20 21 22 23 24 25 28 29 30 31

INVERTER 1 INVERTER 2 LOW LEVEL FAULT SIGNAL FROM INVERTERS INVERTER 1 INVERTER 2 RS485 LINKS FROM INVERTERS VOLT FREE CONNECTIONS INVERT 1 INVERT 2 START UP CONNECTIONS

Key

COIL NO CONTACT

BUIZZER NO TIMER

BEACON NO TIMER

LAMP N/C TIMER

HEATER FLOAT

FUSE LINK

OUTGOING TERMINAL

INTERNAL TERMINAL

Drawing No Drawn by K.C.

Job No Checked by T.F.

Sheet No Date 1 / 2 22/06/01

Figure 5.8: Three Pump, Single Phase Sheet 1 of 2

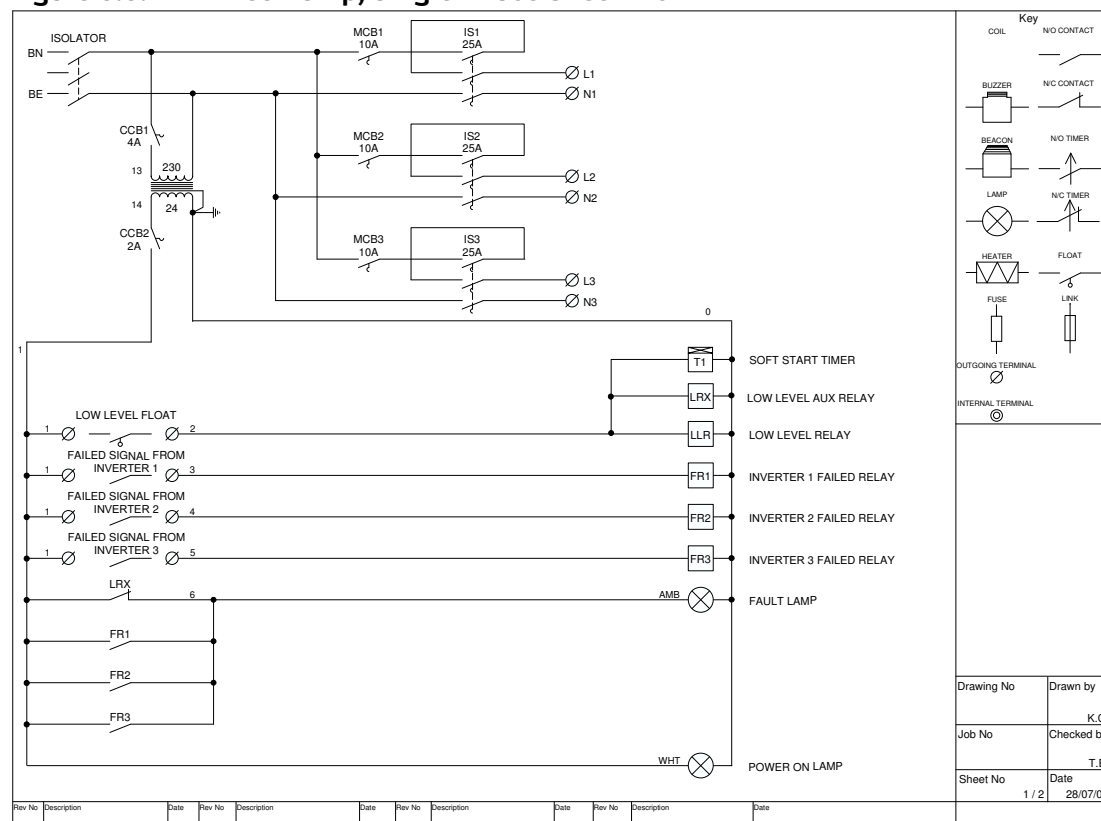
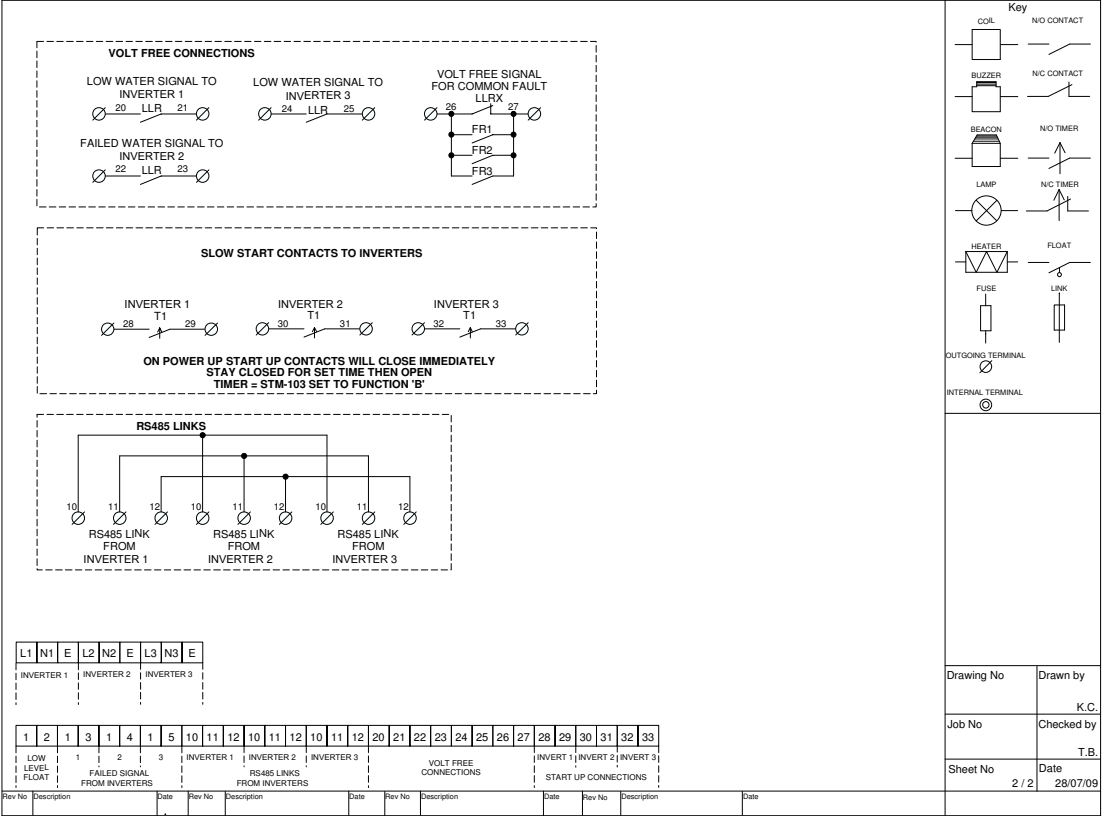


Figure 5.9: Three Pump, Single Phase, Sheet 2 of 2



5.3 Three Pump, Three Phase Wiring Diagrams

Figure 5.10: Three Pump, Three Phase, Sheet 1 of 2

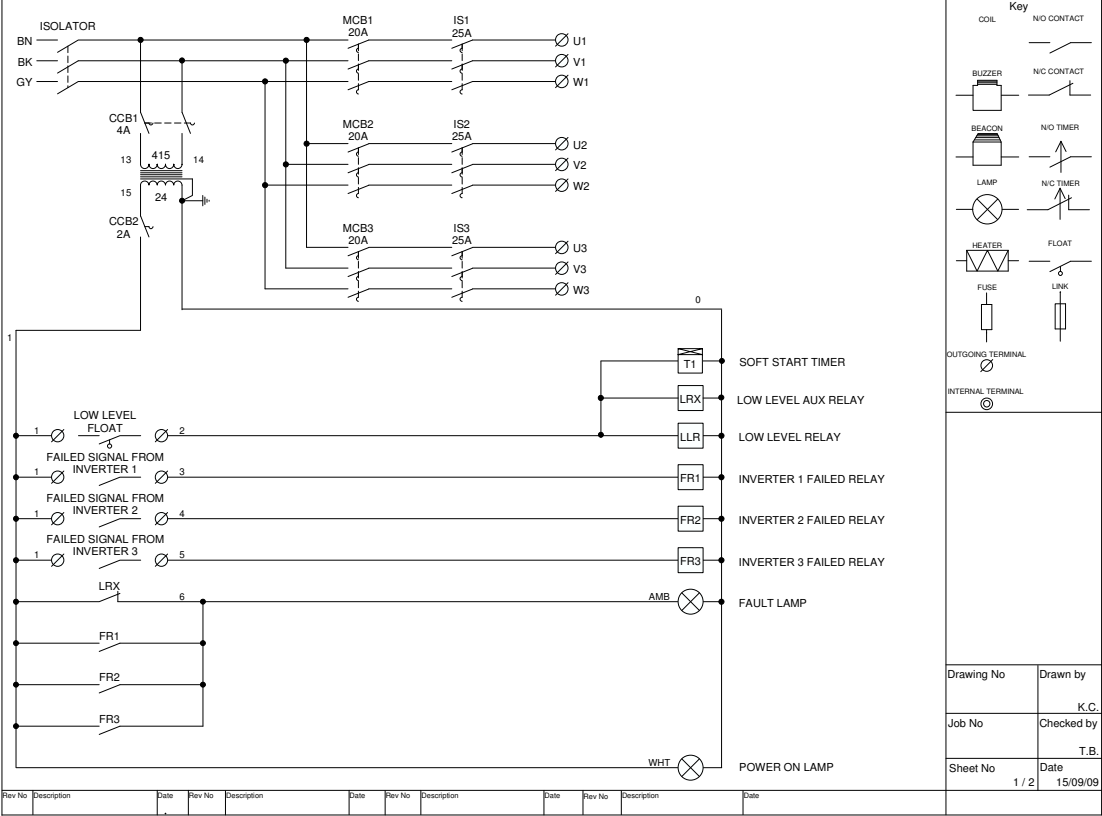
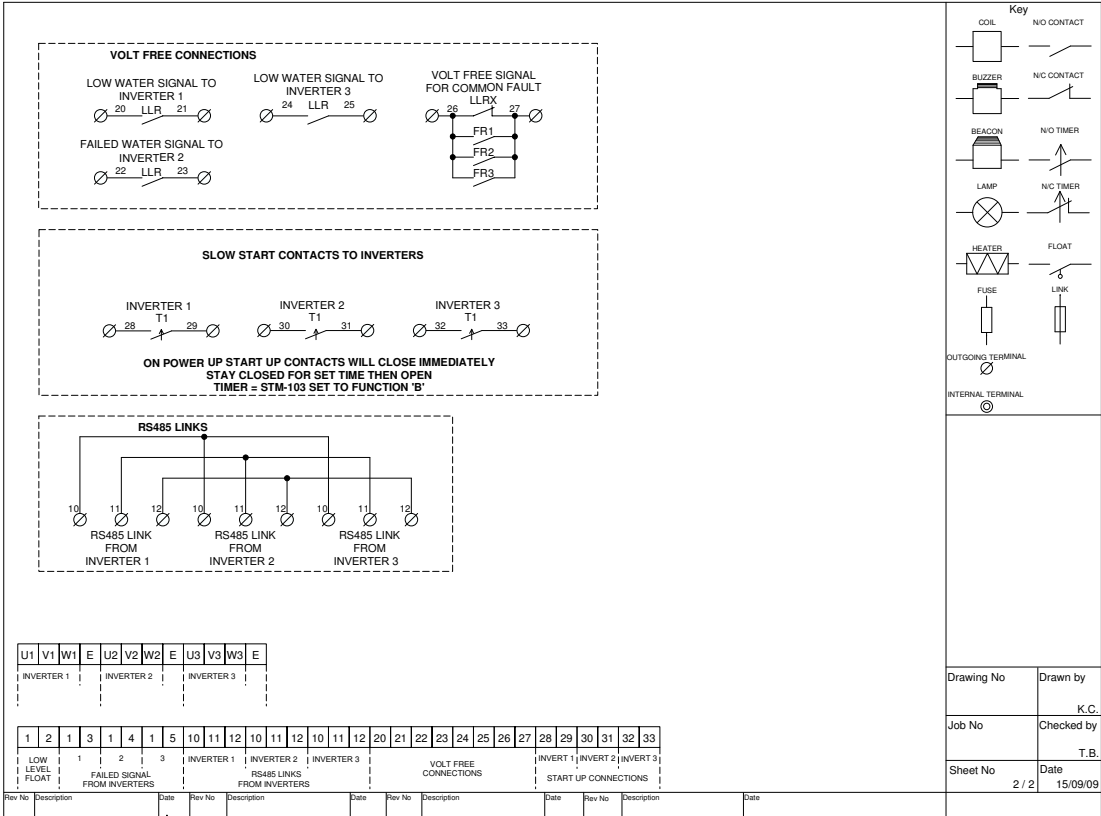


Figure 5.11: Three Pump, Three Phase, Sheet 2 of 2



5.4 Four Pump Wiring Diagrams

Figure 5.12: Four Pump, Three Phase Sheet 1 of 2

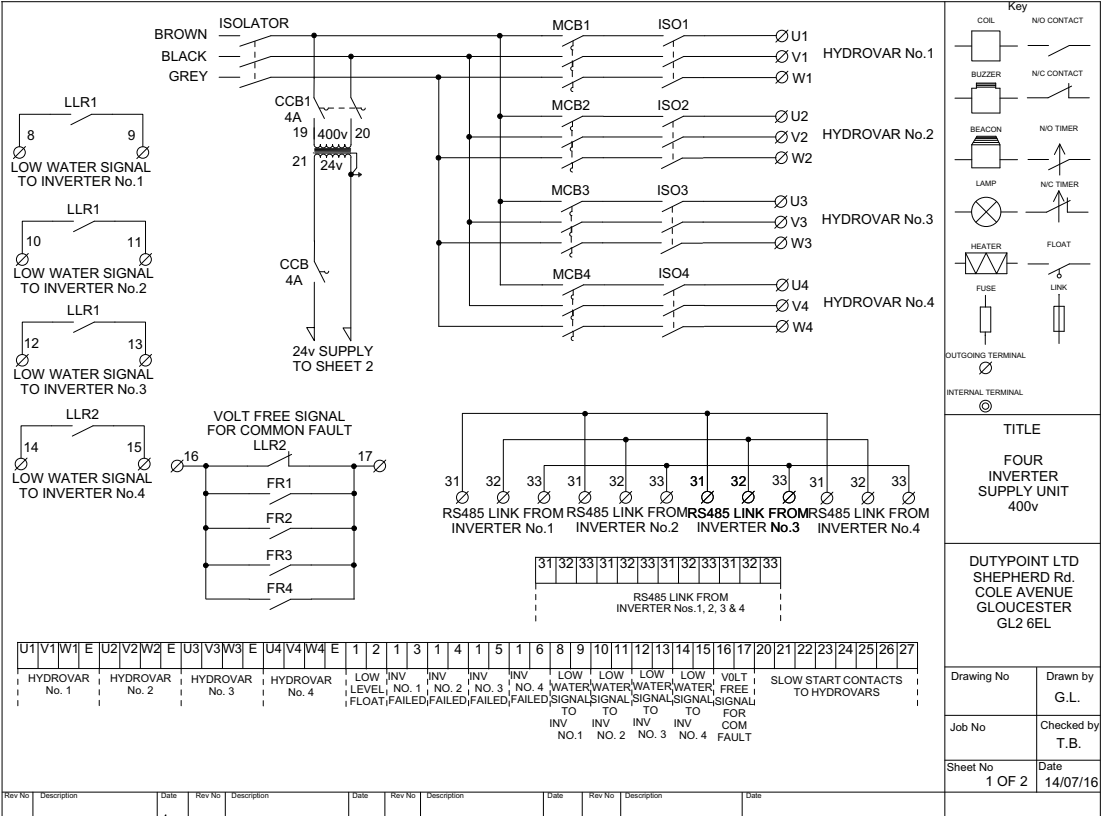
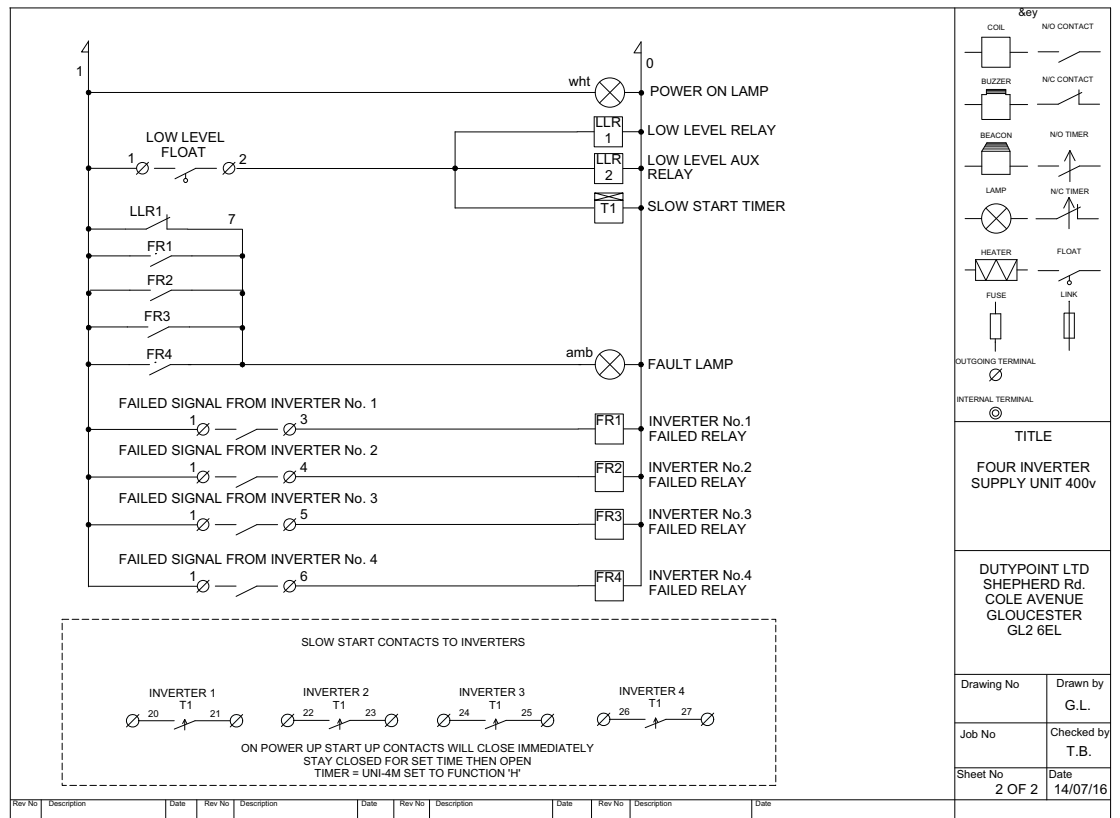


Figure 5.13: Four Pump, Three Phase Sheet 2 of 2



6. Commissioning

6.1 Installation and Commissioning Overview

Before shipment, all Dutypoint pump sets are pre-commissioned. Whilst important procedures such as venting and rotational direction checks need to be carried out on site, initial parameters including pressure settings and delay timers will be adjusted to suit the site conditions previously advised to Dutypoint.

In practice, a system can almost invariably be made to perform more efficiently if further re-commissioning is carried out on site.

Please note that engineer visits by Dutypoint are priced at one visit to commission one pump set. If there are multiple units on a site, special terms can be negotiated. To arrange a commissioning visit, please call the Technical Service Help line 01452 300590.

The following checks should be carried out at the initial installation before any run tests are performed.

WARNING

- Ensure that you have read and understood Section [1. Important Safety Information](#).
-

6.2 Pipework and mechanical components

- 1) Ensure that the mounting area and any associated groundwork provides adequate support for the pump set.
- 2) Ensure all supports/brackets are in place and secure.
- 3) Verify all pipe joints are sealed and tight.

6.3 Electrical

WARNING

- These checks MUST be carried out by a competent electrician.
 - Ensure that the power source is sufficient to allow the running of two (twin pump sets) or three (triple pump sets) pumps together.
-

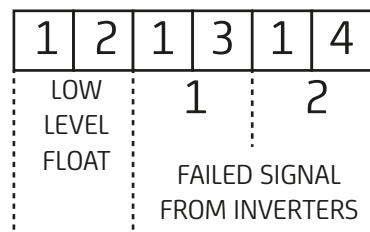
- 1) Check the motor voltage and frequency information on all the motor nameplates and on controllers etc. correspond with that of the source power supply.
- 2) Check that all electrical connections are correctly made and secure. Pay particular attention to Earth and bonding connections.
- 3) Carry out specific checks for Earth bonding.
- 4) Carry out NICEIC certification checks as required for the installation, e.g Earth Loop Impedance, Insulation Tests, etc.
- 5) Carry out any other pre-start checks recommended by the pump manufacturer. Refer to the pump manual in the Appendix of this manual. DO NOT POWER UP AT THIS STAGE.

6.4 Low Level Float Switch Wiring (Optional)

Terminal 1 and 3 require a normally closed contact in order to allow the pump set to operate. To facilitate this the unit will be supplied with a wire loop between 1 and 2. To install a low level float switch this loop has to be removed and the float switch wired to operate as an open on fail scenario.

If 2 or more float switches are required (due to twin compartment or multiple tanks) all float switches are wired into terminals 1 and 2 in parallel.

Figure 6.14: Terminal Wiring



If installing a Dutypoint FS-series float switch, the following terminals should be used:

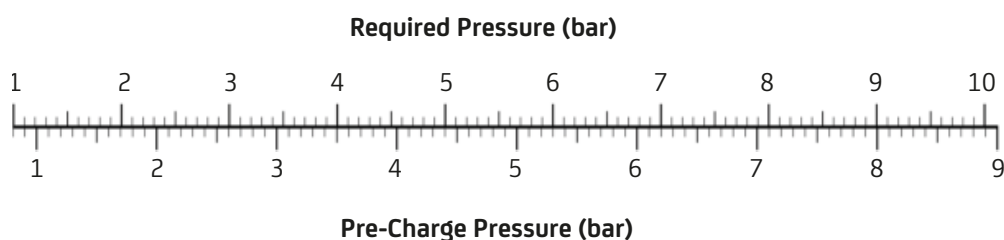
BROWN: Terminal 1
 BLACK: Terminal 2
 BLUE: Not used - terminate safely

6.5 Final Checks Before Commissioning

- 1) Re-check all equipment for any accidental damage caused during installation.
- 2) Carry out the pre-charging and venting procedures described next.

6.6 Pressure Vessel Pre-Charging

Figure 6.15: Pressure Vessel Pre-charge



Before commissioning starts the pre-charge of the pressure vessels should be checked.

On variable speed systems the pre-charge air pressure for vessels should be 90% of the maximum pressure generated by the pump in the pipework system

e.g: If the maximum pressure generated by the pump in a system is 6 bar, this will require a pre-charge pressure of $6 \times 90\% = 5.4$ bar.

To verify the pre-charge pressure:

- 1) First check that the expansion or pressure vessel(s) are totally drained of water, and that the system is switched off and no electrical parts are live.
- 2) Locate the charging valve on each vessel, accessed by removing the plastic cover on the top of the vessel
- 3) Connect a portable pressure gauge with a measuring range compatible with the expected pressures in your application, which has a flexible hose and Schrader-type connector to the charging valve.
- 4) Check the pre-charge pressure above the diaphragm in each pressure vessel correspond to criteria given in the text above.
- 5) If necessary, release or add additional air to correct.

6.7 Venting Pumps

It is important to bleed all air from the pump body before initial start-up.

6.8 Procedure for flooded suction

Flooded Suction is defined as the condition where there is positive pressure on the suction (inlet) side of the pump(s) as is the case where the storage tank water level is at the same or higher level than the pump bleed point.

This procedure should be carried out individually for each pump in the pump set.

- 1) Open all valves on the suction (inlet) side of the pump.
- 2) Using the vent screw at the top of the pump (refer to Appendix to locate), allow any air in the pump body and suction pipework to vent to atmosphere.
- 3) When water (under pressure from the storage tank feeding the pump on the suction side) escapes through the vent screw hole - and no more air bubbles can be seen - close the vent screw.
- 4) Switch on the electrical supply to the pump motor and start the pump in AUTO mode. As each motor starts verify that the direction of rotation correctly corresponds with the direction of the arrow shown on the body of the pump. If rotation is backward STOP, switch off the pump and investigate.
- 5) Slowly open the valve on the discharge manifold outlet to the system allowing water to be pumped into the system.
- 6) Switch off, re-close the discharge valve and repeat steps 3 to 6 several times to ensure that all air is released from the pump body and local pipework.

The above procedure should be carried out individually for each pump in the pump set.

6.9 Procedure for Lift Suction

Lift Suction is defined where the water storage tank is at a lower level than the pump set. In this case a negative pressure condition may exist at the pump suction.

NOTE: The "Lift Suction" mode of operation requires specific venting procedures. Please call Dutypoint Systems Technical Support on +44 (0)1452 300590 for advice before attempting to vent the pump(s).

The advised procedure should then be carried out individually for each pump in the pump set.

6.10 Programming the Controller

Dutypoint Systems fit a design of Inverter/Controller that is most suitable for the design duty of the pump set.

Manufacturer's information for them is detailed in the Appendices to this manual.

Carefully follow the appropriate step-by-step setting-up procedures contained in the manual, ensuring that any data required to be entered by the end user is accurately inserted where requested.

If in doubt please call Dutypoint Systems Technical Support on 01452 300590 for advice.

6.11 Operation and Performance Tests

Having checked that the pump set is installed, pre-charged, vented in accordance with the procedures set out earlier, carry out the following running tests before handing over the pump set for operational use.

- 1) Run each pump by selecting HAND (Manual) control.
- 2) Re-select to AUTO mode.
- 3) Create the conditions for a normal start and run and allow the selected 'Duty' pump to run. Whilst running observe the pressure values. Verify the pump motor speeds up / slows down in accordance with the desired control philosophy.

6.12 Duty/Standby Twin Pump Sets

- 1) On Duty/Standby sets, wait for a normal stop to take place (or create the conditions where this would happen) and check that the 'Duty' pump stops. Whilst stopped simulate a fault by inhibiting the 'Duty' pump and then recreate the conditions for a normal start to take place. Check that the

'Standby' Pump now starts and runs in place of the inhibited 'Duty' pump and observe the pressure values. Verify that the pump motor speeds up / slows down in accordance with the desired control philosophy.

- 2) Wait for a normal stop to take place (or create the conditions where this would happen) and check the 'Standby' pump stops. Whilst stopped undo the inhibit to the 'Duty' pump which should now return to normal.

6.13 Duty/Assist Twin Pump Sets

- 1) For 'Duty/Assist' applications, run the system up to pressure using the 'Duty' Pump only, then deliberately create the condition(s) which will require the 'Assist' Pump to operate as well. (e.g: open taps to reduce the pressure in the system to a point where one pump only cannot maintain the required output. Verify that the 'Assist' Pump starts and runs together with the 'Duty' Pump and that the desired pressure is duly restored and maintained.
- 2) Close the taps again (thereby reducing the demand) and check the 'Assist' Pump slows down and stops, allowing the 'Duty' Pump to continue on its own.

6.14 Commissioning/Handover Check

- 1) Record any indicated voltage / amperage / pressure data / controller passwords for future reference.
- 2) Re-check all isolating valves are fully open and replace any cover(s).
- 3) With all the isolators ON and the switches and/or control programs set to AUTO, the pump set is now fully operational in automatic control mode.

NOTE: No manual operation or attendance is required other than for routine servicing and maintenance checks. Other than for maintenance purposes, the supply to the Controller(s) and the Pump motor(s) should never be switched off.

7. User Maintenance

Routine user maintenance for Dutypoint pump sets.

Dutypoint pump sets have been designed to keep major maintenance requirements to a minimum. Planned maintenance of the pumps and other principal components should therefore be undertaken at the intervals recommended in the manuals referenced below.

It is essential that a full test following the Pre-Commissioning procedure on is carried out on an annual basis.

In addition, the operator in charge should routinely make visual checks of the equipment during use, noting particularly any unusual noises or vibrations. This will give an immediate indication of any irregularity in the operation of the system.

DANGER!

Do not commence any work until:

- You have read [1. Important Safety Information](#)
 - You have the appropriate personal protective equipment
 - You have all necessary safety equipment to hand
-

Refer to the appropriate manufacturer's information that is provided in the appendices of this manual for the equipment being serviced.

Table 7.4: Periodic User Checks for Pump Sets

Timing	Checks
Weekly	1) Visually check the complete pump set 2) Observe the running of the pump(s) and note any unusual vibrations or sounds.
Quarterly	1) Visually check the complete pump set 2) Observe the running of the pump(s) and note any unusual vibration, etc. 3) Check the cooling fan and vents on the Control Unit(s) and clear any dust or other obstructions 4) Operate each manual isolating valve three times to ensure continued efficient working
6-monthly	The pressure vessel should be drained and the pre-charge pressure checked. See 8.4 Pressure Vessel Pre-Charge Instructions for more details.
12-monthly (essential)	Carry out the full pre-commissioning procedure to verify safe operation - see 6. Commissioning .

8. Pressure Vessel

The pressure vessel supplied as part of your Dutypoint product is used to absorb and conserve the potential energy of pressurised liquid. Stored energy from liquid under pressure is transferred to the water system when required.

8.1 Installation Safety Notes

These notes are taken from the pressure vessel installation manual:

- This product is designed to hold water up to +110°C
- Never exceed the maximum working pressure and temperature of the expansion tank; ensure appropriate controls are installed for this purpose.
- During installation prepare adequate systems for drainage to limit damage caused by leakage from the tank, draining and venting.
- During installation the installer should account for external stress such as traffic, wind and earthquakes.
- Always install the appliance in conformity to current legislation.
- This product must be installed and regularly inspected by qualified personnel only.
- The manufacturer shall not be held liable for any personal or material damage caused by the product if installed and/or used improperly or in way anyhow diversely from manufacturer's specifications.
- Exceeding temperature and pressure limits specified by the manufacturer will give cause to cancel any guarantee covering the product as well as any manufacturer's liability.
- For fluids other than water, check compatibility before installing.
- The appliance must be installed in a safe place with access for authorized personnel only.
- The appliance must be protected by an appropriate earthing systems or isolated from the system by a dielectric joint.

8.2 Periodic Maintenance

Periodic maintenance is recommended at least twice a year and should be carried out by authorised specialised personnel only.

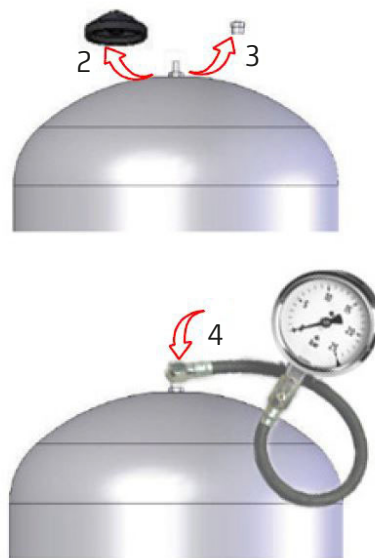
- 1) First check that the expansion or pressure tank is totally drained of water, and that the system is switched off and no electrical parts are live.
- 2) Check and, if necessary reset the pre-charge pressure, using the instruction in [6.6 Pressure Vessel Pre-Charging](#). Ensure that the pressure does not exceed the value specified in the procedure.

8.3 General Maintenance and Repair

Disconnect all electrical equipment before starting on any maintenance jobs or checking the installation pressure and temperature. The pre-charge pressure should be checked and if necessary corrected during any maintenance work.

8.4 Pressure Vessel Pre-Charge Instructions

- 1) First check that the expansion or pressure tank is totally drained of water, and that the system is switched off and no electrical parts are live.
- 2) Refer to [Figure 8.16: Pre-Charging a Pressure Vessel](#). Remove the air vent cover.
- 3) Unscrew the air valve cap.
- 4) Connect a pressure gauge. Verify that the pre-charge pressure is correct. If it is low then the vessel pre-charge must be corrected by additional inflation of the diaphragm.
- 5) When the pre-charge pressure is correct replace the air valve cap and vent cover.

Figure 8.16: Pre-Charging a Pressure Vessel

8.5 Diaphragm Replacement

To replace a diaphragm:

- 1) Empty the expansion tank
- 2) Remove the pre-charging by releasing the air vent.
- 3) Loosen the M8 screws fastening the flange
- 4) Remove the flange
- 5) Extract the diaphragm and replace it

8.6 Installing a Replacement Vessel

Read these instructions carefully before installing the product:

- 1) Make sure the product is in good condition. If the product is damaged do not start on installation but take it back to the seller for immediate replacement.
- 2) The product must be installed in the position (vertical or horizontal) specified in the technical specifications.
- 3) While the system is cold, measure the static pressure with a gauge, at the point where the tank has to be installed.
- 4) Set the pre-charge pressure, using the procedure earlier in this section. Ensure that the pressure does not exceed the value specified in the procedure.
- 5) The appliance must be supplied with efficient and sufficient safety and control facilities, in particular the safety valve must be connected to the appliance and be free from interference and must be gauged to the quantity of fluid to be discharged. The safety valve should also be designed to ensure that the pressure does not permanently exceed the maximum tolerated pressure (a temporary pressure peak, limited to 10% of the maximum tolerated pressure, is allowed).
- 6) Make sure the cap of the valve is fitted tightly after pre-loading and that there is no leakage.

9. Troubleshooting

Troubleshooting VASCO-equipped booster sets. The information in this section is common to all VASCO-equipped Dutypoint booster sets. For more detailed troubleshooting information that is specific to the type and model of pump controller used, please refer to the manufacturer's literature in the Appendix.

WHEN A FAULT FIRST OCCURS:

- Turn off the main power to the pump set and leave off for 1 minute
 - Switching power back on and re-energising the system may be sufficient to clear the fault
-

WARNING: IF PUMP COSPHI IS LOWER THAT THE DRY-RUNNING COSPHI FOR AS LEAST 2 SECONDS, VASCO WILL STOP THE PUMP. VASCO WILL TRY TO RUN THE PUMP AT 10, 20, 40, 80 AND 160 MINUTES, THEN THE PUMP WILL STOP. IF DRY RUNNING PROTECTION OCCURS, VASCO WILL ATTEMPT TO START THE PUMP AUTOMATICALLY

- Cut the power supply before performing any maintenance
 - VASCO will stop the pump if the input motor current is higher than the set motor current for an extended time. By pressing the START button it is possible to run the pump again.
 - VASCO will stop the pump if the input voltage is higher than the set voltage for an extended time. By pressing the START button it is possible to run the pump again. VASCO will stop the pump if the input voltage is lower than the set voltage for an extended time. By pressing the START button it is possible to run the pump again.
-

Table 9.5: Common Error Messages

Message	Possible Cause(s)	Solutions
ACTIVE DIG. IN. 1	Digital input 1 contact is opened - system indicates 'External On/Off'	1) Verify that an external signal (e.g. BMS) is set to deactivate the pump set 2) The error should reset automatically when Digital Input 1 contact is closed
ACTIVE DIG. IN. 3	Digital input 3 contact is opened - system indicates 'Low Water Level'	1) Check incoming mains pressure is as expected 2) Check water level in tank. 3) The error should reset automatically when Digital Input 3 contact is closed

Message	Possible Cause(s)	Solutions
NO WATER- (DRY RUN COSPHI)	Minimum pressure requirement not reached within set period	1) Turn off main electrical isolator 2) Close discharge isolation valve 3) Vent pumps 4) Turn on main electrical isolator 5) Check unit runs up to set pressure and pump motors shut down 6) Open discharge valve slowly ensuring set pressure is maintained
	Air lock in pump	1) Press the red STOP button on the inverter drive(s) to stop the unit. 2) Disconnect the pump(s) by loosening the union directly underneath the lid, above the pump discharge pipeline. 3) Lean/tilt the pump(s) over as far as possible to enable air to escape. 4) Reconnect the pump union(s). 5) Press the green START buttons to resume normal operation. 6) Verify normal operation.
	No water in break tank	1) Check incoming mains pressure is as expected; 2) Check the water level in the tank.

Table 9.6: Fault Finding

Problems	Possible Causes	Solutions
Pump will not start	No electrical power	Check and rectify
	Blown fuse	Check and rectify
	Overload trip/MCB	Check and (if necessary) reset the overload trip value.
Low (or zero) output discharge rate	The rotating part(s) of the pump is/are partially or completely obstructed e.g: impeller obstructed by foreign matter	Strip the pump to inspect and rectify
	Pump not primed - WARNING: running the pump 'dry' can cause serious damage to the mechanical seal.	Having first checked the mechanical seal for damage, prime and air-bleed the pump and try again
	Valve in suction pipework closed or partially closed	Check all appropriate valves are fully open.
	Incorrect pump rotation	Check and rectify.
Pump vibrates and/or is noisy	Pump is cavitating	Increase the discharge back pressure slightly by progressively closing a manual isolating valve on the discharge side until the cavitation stops.
	The rotating part(s) of the pump is (are) partially or completely obstructed. e.g: impeller obstructed by foreign matter.	Strip the pump to inspect and rectify
	Motor bearings worn	Check and rectify

Problems	Possible Causes	Solutions
Overload Trip	Pipework or the pump chamber has a partial blockage.	Check and rectify
	Momentary loss of one phase of power supply	Check and try again
	Discharge flow rate too high	Reduce the discharge flow rate by increasing the discharge back pressure slightly, progressively closing a manual isolating valve on the discharge side, then try again
	Overload trip setting too low for rated duty	Check and (if necessary) reset the overload trip value
Pump Runs Continuously	Contact Dutypoint Service on 01452 300590	

9.1 Fault Codes: Advanced

WARNING

Improper settings can compromise the integrity and life of the controller and pump

- You should only access the Installer and Advanced menus if you are trained to do so;
- A full description of these is available in the Appendix to this manual;
- For further assistance, call the Dutypoint Technical Service line on 01452 300590.

Table 9.7: VASCO Controller Alarm Messages

Message	Alarm Description	Possible Solutions
OVERCURRENT MOT.	Motor overload: input current of the motor is higher than the rated motor current setting parameter. Motor voltage drop caused by the inverter causes the motor input current to be higher than rated. Contact motor manufacturer to check if motor is capable of accepting this current.	<ul style="list-style-type: none">– Make sure that the motor current setting parameter is higher than rated.– Check other possible causes of over current.

Message	Alarm Description	Possible Solutions
NO WATER (DRY RUN COSPHI)	Motor cosphi is lower than the set value of dry running cosphi	<ul style="list-style-type: none"> – Check pump is primed – Check the set value of dry running cosphi. Dry running cosphi is approximately 60% of the rated cosphi (at rated frequency) listed on the motor plate. <p>If pump's cosphi is lower than the set dry-running cosphi for at least 2 seconds, VASCO stops the pump. VASCO will then attempt to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped.</p> <p>Note: see dry running warning statement</p> <p><i>Warning: if pump cosphi is lower than the dry-running cosphi for at least 2 seconds, Vasco will stop the pump. Vasco will try to run the pump at 10, 20, 40, 80 and 160 minutes, then the pump will stop. if dry running protection occurs, Vasco will attempt to start the pump automatically.</i></p>
OVER TEMP. INV.	Inverter over temperature	<ul style="list-style-type: none"> – Make sure than ambient temperature is less than 40°C (104 °F). – Check if auxiliary cooling fan is working properly and if mounting space is adequate for proper cooling. – Reduce the PWM value (Advance Parameter Menu)
NO COMMUNICATI ON	Communication between Master and slave(s) has been interrupted	<ul style="list-style-type: none"> – Check the wiring connections – Make sure that Master is not in the menu level. If so, exit from the menu level. – In the STATUS of the slave (where alarm is displayed). Try to reset the alarm by pushing the STOP button.
MIN. VALUE ALARM	Measured value has reached the lowest value accepted by the system.	<ul style="list-style-type: none"> – Check possible causes reaching minimum. value (i.e. broken pipe, open pressure relief valve, etc.) – Check the minimum alarm value setting
IGBT TRIP ALARM	The current drawn by the load exceeds the capacity of VASCO. VASCO is still able to continue to power the load for 10 minutes with an output current of 101% of nominal and for 1 minute with an output current of 110% of nominal	<ul style="list-style-type: none"> – Increase the ramp-up time – Make sure that the load current is at least 10% below the VASCO nominal current – Check the voltage drop along the supply cable to the motor
OVER VOLTAGE	Supply voltage too high	Check possible causes of over voltage
UNDER VOLTAGE	Supply voltage too low	Check possible causes of under voltage
ADDRESS ERROR	Same address as other VASCOs in the group	The address of each VASCO needs to be different.
ALARM SLAVE XX	Slave XX error detected by master	Check the status of the slave.
SENSOR FAULT	Sensor error	<ul style="list-style-type: none"> – Check the pressure transducer – Check the wiring of the transducer
NO LOAD	No load	Check is load is properly connected to VASCO terminals

Message	Alarm Description	Possible Solutions
MAX. VALUE ALARM	Measured value has reached the maximum value accepted by the system.	<ul style="list-style-type: none">– Check possible causes of reaching maximum value– Check the max. alarm value setting
KEYBOARD FAULT	A button on the keyboard has been pressed for more than 150 seconds.	<ul style="list-style-type: none">– Make sure buttons are not depressed.– If problem persists, call Dutypoint Technical Service on 01452 300590.
ACTIVE DIG.IN.X	Digital input X opened/closed	Check the input digital configuration (IN/OUT parameters menu)

10. Lowara e-SV Pump O&M Manual

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

1.1.1 Inexperienced users



WARNING:

This product is intended to be operated by qualified personnel only.

Be aware of the following precautions:

- Persons with diminished capacities should not operate the product unless they are supervised or have been properly trained by a professional.
- Children must be supervised to ensure that they do not play on or around the product.




1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels

Hazard level	Indication
 DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	<ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:



WARNING:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard



Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:



CAUTION:

Description of user and installer symbols

	Specific information for personnel in charge of installing the product in the system (plumbing and/or electrical aspects) or in charge of maintenance.
	Specific information for users of the product.

Instructions

The instructions and warnings that are provided in this manual concern the standard version, as described in the sales document. Special version pumps may be supplied with supplementary instruction leaflets. Refer to sales contract for any modifications or special version characteristics. For instructions, situations, or events that is not considered in this manual or the sales document, contact the nearest Lowara Service Center.

1.3 Disposal of packaging and product

Observe the local regulations and codes in force regarding sorted waste disposal.

1.4 Warranty

For information about warranty, see the sales contract.

1.5 Spare parts



WARNING:

Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.



CAUTION:

Always specify the exact product type and part number when requesting technical information or spare parts from the Sales and Service Department.

For more information about the product's spare parts, see *Figure 25*, *Figure 26*, or *Figure 27*.

1.6 EC DECLARATION OF CONFORMITY (TRANSLATION)

LOWARA SRL UNIPERSONALE, WITH HEADQUARTERS IN VIA VITTORIO LOMBARDI 14 - 36075 MONTECCHIO MAGGIORE VI - ITALIA, HEREBY DECLARES THAT THE FOLLOWING PRODUCT:

ELECTRIC PUMP UNIT (SEE LABEL ON FIRST PAGE)

FULFILLS THE RELEVANT PROVISIONS OF THE FOLLOWING EUROPEAN DIRECTIVES:

- MACHINERY DIRECTIVE: 2006/42/EC (THE TECHNICAL FILE IS AVAILABLE FROM LOWARA SRL UNIPERSONALE).
- ELECTROMAGNETIC COMPATIBILITY 2004/108/EC
- ECO-DESIGN 2009/125/CE, REGULATION (EC) 640/2009 (3 ~, 50 Hz, $P_N \geq 0,75$ kW) IF IE2 or IE3 MARKED

AND THE FOLLOWING TECHNICAL STANDARDS

- EN 809, EN 60335-1, EN 60335-2-41, EN 62233
- EN 61000-6-1:2007, EN 61000-6-3:2007
- EN 60034-30

PUMP (SEE LABEL ON THE FIRST PAGE)

FULFILLS THE RELEVANT PROVISIONS OF THE FOLLOWING EUROPEAN DIRECTIVES:

- MACHINERY 2006/42/EC (THE TECHNICAL FILE IS AVAILABLE FROM LOWARA SRL UNIPERSONALE).

AND OF THE FOLLOWING TECHNICAL STANDARDS:

- EN 809

MONTECCHIO MAGGIORE, 16.06.2011

AMEDEO VALENTE

(DIRECTOR OF ENGINEERING AND R&D)

rev.01

Lowara is a trademark of Lowara srl Unipersonale, subsidiary of Xylem Inc.

2 Transportation and Storage

2.1 Inspect the delivery

1. Check the outside of the package for evident signs of damage.
2. Notify our distributor within eight days of the delivery date, if the product bears visible signs of damage.

Unpack the unit

1. Follow applicable step:
 - If the unit is packed in a carton, remove the staples and open the carton.
 - If the unit is packed in a wooden crate, open the cover while paying attention to the nails and straps.
2. Remove the securing screws or the straps from the wooden base.

Inspect the unit

1. Remove packing materials from the product.
2. Dispose of all packing materials in accordance with local regulations.
3. Inspect the product to determine if any parts have been damaged or are missing.
4. If applicable, unfasten the product by removing any screws, bolts, or straps.
5. For your personal safety, be careful when you handle nails and straps.
6. Contact your Sales and Service Department if anything is out of order.

2.2 Transportation guidelines

Precautions



WARNING:

- Observe accident prevention regulations in force.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is securely fastened during transportation, and cannot roll or fall over.



WARNING:

Do not use eyebolts screwed on the motor for handling the whole electric pump unit.

- Use straps surrounding the motor if the power of the motor is between 0.25 kW and 4.0 kW.
- Use ropes or straps that are linked to the two flanges (eye bolts if provided) located near the mating zone between the motor and pump, if the power of the motor is between 5.5 kW and 55.0 kW.
- Eyebolts screwed onto the motor may be exclusively used to handle the individual motor or, in case of a not balanced distribution of weights, to partially lift the unit vertically starting from a horizontal displacement.
- To move the pump unit only, use straps firmly linked to the motor adapter.

For more information about how to securely harness the unit, see *Figure 4*.

Unit without motor

If the unit is not delivered with a motor, the calibrated fork-shaped shim is already inserted between the adapter and the transmission coupling. The

shim is inserted to keep the impeller stack in the correct axial position. In order to prevent damage during transportation the shaft is also held into place with expanded polystyrene and plastic straps.

The bolt and nuts used to fasten the motor are not included. For more information about how to couple the motor, see *Figure 23*.



WARNING:

A pump and motor that are purchased separately and then coupled together results in a new machine under the Machinery directive 2006/42/EC. The person making the coupling is responsible for all safety aspects of the combined unit.

2.3 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

- Protect the product against humidity, heat sources, and mechanical damage.
- Do not place heavy weights on the packed product.

Ambient temperature

The product must be stored at an ambient temperature from -5°C to +40°C (23°F to 104°F).

3 Product Description

3.1 Pump design

This is a vertical, multistage, non-self priming pump, which can be coupled to standard electric motors. The pump can be used to pump:

- Cold water
- Warm water

The metallic parts of the pump that come in contact with water are made of the following:

Series	Material
1, 3, 5, 10, 15, 22	Stainless steel
33, 46, 66, 92, 125	Stainless steel and cast iron A special version is available where all parts are made of stainless steel.

The SV pumps 1, 3, 5, 10, 15, and 22 are available in different versions according to the position of the suction and delivery ports and the shape of the connection flange.

The product can be supplied as a pump unit (pump and electric motor) or only as a pump.

NOTICE:

If you have purchased a pump without motor, make sure that the motor is suitable for coupling to the pump.

Mechanical seal

Series	Basic characteristics
1, 3, 5	Nominal diameter 12 mm (0.47 in.), unbalanced, right hand rotation, K version (EN 12756)
10, 15, 22	Nominal diameter 16 mm (0.63 in.), unbalanced, right hand rotation, K version (EN 12756) Balanced with motor power ≥ 5 kW
33, 46, 66, 92, 125	Nominal diameter 22 mm (0.86 in.), balanced, right hand rotation, K version (EN 12756)

Intended use

The pump is suitable for:

- Civil and industrial water distribution systems
- Irrigation (for example, agriculture and sporting facilities)
- Water treatment
- Boiler feed
- Washing plants
- Cooling (for example, air conditioning and refrigeration)
- Fire fighting applications

Improper use**WARNING:**

Improper use of the pump may create dangerous conditions and cause personal injury and damage to property.

An improper use of the product leads to the loss of the warranty.

Examples of improper use:

- Liquids not compatible with the pump construction materials
- Hazardous liquids (such as toxic, explosive, flammable, or corrosive liquids)
- Potable liquids other than water (for example, wine or milk)

Examples of improper installation:

- Hazardous locations (such as explosive, or corrosive atmospheres).
- Location where the air temperature is very high or there is poor ventilation.
- Outdoor installations where there is no protection against rain or freezing temperatures.

**DANGER:**

Do not use this pump to handle flammable and/or explosive liquids.

NOTICE:

- Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances.
- Do not use the pump for flow rates beyond the specified flow rates on the data plate.

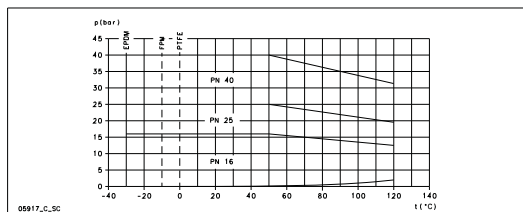
Special applications

Contact the Sales and Service Department in the following cases:

- If the density and/or viscosity value of the pumped liquid exceeds the value of water, such as water with glycol; as it may require a more powerful motor.
- If the pumped liquid is chemically treated (for example softened, deionized, demineralized etc.).
- If the pump will be installed horizontally, a special version and mounting brackets must be requested.
- Any situation that is different from the ones that is described and relate to the nature of the liquid.

3.2 Application limits**Maximum working pressure**

This flow chart shows the maximum working pressure depending on the pump model and the temperature of the pumped liquid.



The following formula is valid for motors that are provided with the drive-end bearing axially locked (such as the Lowara standard motors for e-SV), see Figure 6. For other situations, contact the Sales and Service Department.

$$P_{1\max} + P_{\max} \leq PN$$

$P_{1\max}$	Maximum inlet pressure
P_{\max}	Maximum pressure generated by the pump
PN	Maximum operating pressure

Liquid temperature intervals

Version	Gasket	Minimum	Maximum ⁵	Maximum ⁶
Standard	EPDM	-30°C (-22°F)	90°C (194°F)	120°C (248°F)
Special	FPM (FKM)	-10°C (14°F)	90°C (194°F)	120°C ⁶ (248°F)
Special	PTFE	0°C (32°F)	90°C (194°F)	120°C (248°F)

For special requirements, contact the Sales and Service Department.

Maximum number of starts per hour

This table shows the number of starts allowed per hour for motors supplied by Lowara:

kW	0.25 - 3.00	4.00 - 7.50	11.0 - 15.0	18.5 - 22.0	30.0 - 37.0	45.0	55.0
Starts per hour	60	40	30	24	16	8	4

NOTICE:

If you use a different motor from the standard one supplied with the electric pump, check the relevant instructions to find out the permitted number of starts per hour.

3.3 Data plate

The data plate is a metal label that is located on the adaptor. The data plate lists key product specifications. For more information, see Figure 1.

The data plate provides information regarding the material of the gasket and the mechanical seal. For information about how to interpret the code on the data plate, see Figure 2.

Product denomination

See Figure 3 for an explanation of the identification code for the pump and for an example.

WRAS label - Installation Requirements and Notes (for UK market only)

A WRAS label on the pump means it is a Water Regulations Advisory Scheme approved product. This product is suited to be used with cold potable water for human consumption. For more information, refer to IRNs R001 and R420 in the WRAS Water Fittings and Materials Directory (www.wras.co.uk).

IMQ or TUV or IRAM or other marks (for electric pump only)

Unless otherwise specified, for products with a mark of electrical-related safety approval, the approval refers exclusively to the electrical pump.

4 Installation**Precautions****WARNING:**

- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, and water and power connections.

**WARNING:**

- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

⁵ EN 60335-2-41 is the norm about electric-related safety pumps for household and similar applications

⁶ Maximum 100°C for water

4.1 Earthing grounding



WARNING:

- Always connect the external protection conductor to earth (ground) terminal before making other electrical connections.
- You must earth (ground) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the earth (ground) lead to verify that it is connected correctly.
- If the motor cable is jerked loose by mistake, the earth (ground) conductor should be the last conductor to come loose from its terminal. Make sure that the earth (ground) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
- Add additional protection against lethal shock. Install a high-sensitivity differential switch (30 mA) [residual current device RCD].

4.2 Facility requirements

4.2.1 Pump location



DANGER:

Do not use this pump in environments that may contain flammable/explosive or chemically aggressive gasses or powders.

Guidelines

Observe the following guidelines regarding the location of the product:

- Make sure that no obstructions hinder the normal flow of the cooling air that is delivered by the motor fan.
- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- The ambient temperature must be between 0°C (+32°F) and +40°C (+104°F).
- The relative humidity of the ambient air must be less than 50% at +40°C (+104°F).
- Contact the Sales and Service Department if:
 - The relative air humidity conditions exceed the guidelines.
 - The room temperature exceeds +40°C (+104°F).
 - The unit is located more than 1000 m (3000 ft) above the sea level.
- The motor performance may need to be de-rated or replaced with a more powerful motor.

For information about which value to de-rate the motor with, see *Table 8*.

Pump positions and clearance

NOTICE:

Horizontal mounting of the pump requires special adaptation.

Provide adequate light and clearance around the pump. Make sure that it is easily accessible for installation and maintenance operations.

Installation above liquid source (suction lift)

The theoretical maximum suction height of any pump is 10.33m. In practice, the following affect the suction capacity of the pump:

- Temperature of the liquid
- Elevation above the sea level (in an open system)
- System pressure (in a closed system)
- Resistance of the pipes
- Own intrinsic flow resistance of the pump
- Height differences

The following equation is used to calculate the maximum height above the liquid level which the pump can be installed:

$$(p_b * 10.2 - Z) \geq NPSH + H_f + H_v + 0.5$$

p_b Barometric pressure in bar (in closed system is system pressure)

NPSH Value in meter of the pump intrinsic flow resistance

H_f Total losses in meters caused by passage of liquid in the suction pipe of the pump

H_v Steam pressure in meters that correspond to the temperature of the liquid T °C

0.5 Recommended safety margin (m)

Z Maximum height at which the pump can be installed (m)

For more information, see *Figure 7*.

(p_b * 10.2 - Z) must always be a positive number.

For more information about the performance, see *Figure 5*.

NOTICE:

Do not exceed the pumps suction capacity as this could cause cavitation and damage the pump.

4.2.2 Piping requirements

Precautions



WARNING:

- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.

NOTICE:

Observe all regulations issued by the municipal authorities if the pump is connected to the municipal water system. If required by the authorities, install appropriate backflow-prevention device on the suction side.

Suction and discharge piping checklist

Check that the following requirements are met:

- All piping is independently supported, piping must not place a burden on the unit.
- Flexible pipes or unions are used, in order to avoid transmission of pump vibrations to the pipes and vice versa.
- Use wide bends, avoid using elbows which cause excessive flow resistance.
- The suction piping is perfectly sealed and airtight.
- If the pump is used in an open circuit, then the diameter of the suction pipe is suited to the installation conditions. The suction pipe must not be smaller than the diameter of the suction port.
- If the suction piping must be larger than the suction side of the pump, then an eccentric pipe reducer is installed.
- If the pump is placed above liquid level, a foot valve is installed at the end of the suction piping.
- The foot valve is fully immersed into the liquid so that air cannot enter through the suction vortex, when the liquid is at the minimum level and the pump is installed above the liquid source.
- Appropriately sized on-off valves are installed on the suction piping and on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.
- In order to prevent back flow into the pump when pump is turned off a check valve is installed on the delivery piping.



WARNING:

Do not use the on-off valve on the discharge side in the closed position in order to throttle the pump for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the water inside the pump.

For illustrations that show the piping requirements, see *Figure 12*.

4.3 Electrical requirements

- The local regulations in force overrule these specified requirements.
- In the case of fire fighting systems (hydrants and/or sprinklers), check the local regulations in force.

Electrical connection checklist

Check that the following requirements are met:

- The electrical leads are protected from high temperature, vibrations, and collisions.
- The power supply line is provided with:
 - A short-circuit protection device
 - A high-sensitivity differential switch (30 mA) [residual current device RCD] to provide additional protection against electric shock
 - A mains isolator switch with a contact gap of at least 3 mm

The electrical control panel checklist

NOTICE:

The control panel must match the ratings of the electric pump. Improper combinations could fail to guarantee the protection of the motor.

Check that the following requirements are met:

- The control panel must protect the motor against overload and short-circuit.
- Install the correct overload protection (thermal relay or motor protector).

Pump Type	Protection
Single phase standard electric pump $\leq 1,5$ kW	<ul style="list-style-type: none"> Built-in automatic reset thermal-ampereometric protection (motor protector) Short circuit protection (must be supplied by the installer)⁷
Three phase electric pump and other single phase pumps ⁸	<ul style="list-style-type: none"> Thermal protection (must be supplied by the installer) Short circuit protection (must be supplied by the installer)

- The control panel must be equipped with a dry-running protection system to which a pressure switch, float switch, probes, or other suitable device is connected.
- The following devices are recommended for use on the suction side of the pump:
 - When the water is pumped from a water system, use a pressure switch.
 - When the water is pumped from a storage tank or reservoir, use a float switch or probes.
- When thermal relays are used, relays that are sensitive to phase failure are recommended.

The motor checklist



WARNING:

- Read the operating instructions in order to ensure whether a protection device is provided if another motor other than the standard is used.
- If the motor is equipped with automatic thermal protectors, be aware of the risk of unexpected starts in connection to overload. Do not use such motors for fire-fighting applications and sprinkler systems.

NOTICE:

- Only use dynamically balanced motors with a half-sized key in the shaft extension (IEC 60034-14) and with normal vibration rate (N).
- The mains voltage and frequency must agree with the specifications on the data plate.
- Only use single-phase or three-phase motors whose size and power comply with the European standards.

In general, motors can operate under the following mains voltage tolerances:

Frequency Hz	Phase ~	UN [V] \pm %
50	1	220 – 240 \pm 6
	3	230/400 \pm 10 400/690 \pm 10
60	1	220 – 230 \pm 6
	3	220/380 \pm 5 380/660 \pm 10

Use cable according to rules with 3 leads (2+earth/ground) for single phase versions and with 4 leads (3+earth/ground) for three phase version.

Electric pump with motor:

Type	Cable gland Outer cable diameter range in mm		
	M20 x 1,5, 6–12	M25 x 1,5, 13–18	M32 x 1,5, 18–25
SM	X	–	–
PLM	X	X	X
LLM	X	X	X

4.4 Install the pump

⁷ fuses aM (motor starting), or magneto-thermal switch with curve C and $I_{cn} \geq 4,5$ kA or other equivalent device.

⁸ Overload thermal relay with operation class 10A + fuses aM (motor starting) or motor protection magneto-thermal switch with operation class 10A.

4.4.1 Mechanical installation

For information about the pump base and anchor holes, see *Figure 13*.

- Put the pump onto the concrete foundation or equivalent metal structure.
If the transmission of vibrations can be disturbing, provide vibration-damping supports between the pump and the foundation.
- Remove the plugs covering the ports.
- Align the pump and piping flanges on both sides of the pump.
Check the alignment of the bolts.
- Fasten the piping with bolts to the pump.
Do not force the piping into place.
- Anchor the pump securely with bolts to the concrete foundation or metal structure.

4.4.2 Electrical installation

- To facilitate the connection, the motor can be rotated to obtain the most convenient position for the connection:
 - Remove the four bolts that attach the motor to the pump.
 - Rotate the motor to the desired position. Do not remove the coupling between the motor shaft and the pump shaft.
 - Replace the four bolts and tighten them.
- Remove the screws of the terminal box cover.
- Connect and fasten the power cables according to the applicable wiring diagram.
For wiring diagrams, see *Figure 14*. The diagrams are also available on the back of the terminal box cover.
 - Connect the earth (ground) lead.
Make sure that the earth (ground) lead is longer than the phase leads.
 - Connect the phase leads.
- Replace the terminal box cover.

NOTICE:

Tighten the cable glands carefully to ensure protection against cable slipping and humidity entering the terminal box.

- If the motor is not equipped with automatic reset thermal protection, then adjust the overload protection according to the list below:
 - If the motor is used with full load, then set the value to the nominal current value of electric pump (data plate)
 - If the motor is used with partial load, then set the value to the operating current (for example measured with a current pincer).
 - If the pump has a star-delta starting system, then adjust the thermal relay to 58% of the nominal current or operating current (only for three-phase motors).

5 Commissioning, Startup, Operation, and Shutdown



Precautions



WARNING:

- Make sure that the drained liquid does not cause damage or injuries.
- The motor protectors can cause the motor to restart unexpectedly. This could result in serious injury.
- Never operate the pump without the coupling guard correctly installed.



CAUTION:

- The outer surfaces of the pump and motor can exceed 40°C (104°F) during operation. Do not touch with any part of the body without protective gear.
- Do not put any combustible material near the pump.

NOTICE:

- Never operate the pump below the minimum rated flow, when dry, or without prime.
- Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds.
- Never operate the pump with the suction ON-OFF valve closed.
- To prevent overheating of the internal pump-components, make sure that a minimum water flow is always guaranteed when the pump is running. If this cannot be achieved, then a bypass or re-circulate line is recommended. Refer to the minimal nominal flow rate values given in the Appendix.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The sum of the pressure on the suction side (water mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure allowed (nominal pressure PN) for the pump.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.
- If you pump hot water, you must guarantee a minimum pressure on the suction side to prevent cavitation.

Noise level

For information about noise levels emitted by units equipped with a Lowara supplied motor, see *Table 10*.

5.1 Prime the pump

For information about plug placement, see *Figure 15*.

Installations with liquid level above the pump (suction head)

For an illustration that shows the pump parts, see *Figure 16*.

1. Close the on-off valve located downstream from the pump. Select the applicable steps:
 - a) Loosen the drain plug pin (2).
 - b) Remove the fill and vent plug (1) and open the on-off valve upstream until the water flows out of the hole.
 - c) Tighten the drain plug pin (2).
 - d) Replace the fill and vent plug (1).
2. Series 1, 3, 5:
 - a) Loosen the drain plug pin (2).
 - b) Remove the fill and vent plug (1) and open the on/off valve upstream until the water flows out of the hole.
 - c) Tighten the drain plug pin (2).
 - d) Replace the fill and vent plug (1).
3. Series 10, 15, 22, 33, 46, 66, 92, 125:
 - a) Remove the fill and vent plug (1) and open the on/off valve upstream until the water flows out of the hole.
 - b) Close the fill and vent plug (1). Fill plug (3) can be used instead of (1).

Installations with liquid level below the pump (suction lift)

For an illustration that shows the pump parts, see *Figure 17*.

1. Open the on-off valve located upstream from the pump and close the on-off valve downstream. Select the applicable steps:
 - a) Loosen the drain plug pin (2).
 - b) Remove the fill and vent plug (1) and use a funnel to fill the pump until water flows out of the hole.
 - c) Replace the fill and vent plug (1).
 - d) Tighten the drain plug pin (2).
2. Series 1, 3, 5:
 - a) Loosen the drain plug pin (2).
 - b) Remove the fill and vent plug (1) and use a funnel to fill the pump until water flows out of the hole.
 - c) Replace the fill and vent plug (1).
 - d) Tighten the drain plug pin (2).
3. Series 10, 15, 22, 33, 46, 66, 92, 125:
 - a) Remove the fill and vent plug (1) and use a funnel (4) to fill the pump until water flows out of the hole.
 - b) Replace the fill and vent plug (1). Fill plug (3) can be used instead of (1).

5.2 Check the rotation direction (three-phase motor)

Follow this procedure before startup.

1. Locate the arrows on the adaptor or the motor fan cover to determine the correct rotation direction.
2. Start the motor.
3. Quickly check the direction of rotation through the coupling guard or through the motor fan cover.
4. Stop the motor.
5. If the rotation direction is incorrect, do as follows:
 - a) Disconnect the power supply.
 - b) In the terminal board of the motor or in the electric control panel, exchange the position of two of the three wires of the supply cable. For the wiring diagrams, see *Figure 14*.
 - c) Check the direction of rotation again.

5.3 Start the pump

Before starting the pump, make sure that:

- The pump is correctly connected to the power supply.
 - The pump is correctly primed according to instruction in the *Prime the pump*.
 - The on-off valve located downstream from the pump is closed.
1. Start the motor.
 2. Gradually open the on-off valve on the discharge side of the pump. At the expected operating conditions, the pump must run smoothly and quietly. If not, refer to *Troubleshooting*.

6 Maintenance



Precautions



WARNING:

Disconnect and lock out electrical power before installing or servicing the pump.



WARNING:

- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Make sure that the drained liquid does not cause damage or injuries.

6.1 Service

The pump does not require any scheduled routine maintenance. If the user wishes to schedule regular maintenance deadlines, they are dependent on the type of pumped liquid and on the operating conditions of the pump.

Contact the Sales and Service Department for any requests or information regarding routine maintenance or service.

Extraordinary maintenance may be necessary to clean the liquid end and/or replace worn parts.

6.2 Torque values

For information about torque values, see *Table 18*, *Table 19*, or *Table 20*.

For information about the applicable thrust and torques on the flanges by the piping, see *Figure 21*.

6.3 Replace the electric motor

The pump is supplied with a calibrated fork-shaped shim designed to facilitate the motor coupling and replacement operations.

- See instructions about how to replace the motor in *Figure 23*. If the calibrated fork-shaped shim is not available use a 5 ± 0.1 mm (0.2 ± 0.004 in.) shim.

6.4 Replace the mechanical seal

Series	Instruction
1, 3, 5	Contact the Sales and Service Department.
10, 15, 22: ≤ 4 kW	Contact the Sales and Service Department.
10, 15, 22: > 4 kW	See the instructions in <i>Figure 24</i> . Use alcohol for cleaning and lubrication.
33, 46, 66, 92, 125	See the instructions in <i>Figure 24</i> . Use alcohol for cleaning and lubrication.

7 Troubleshooting

7.1 Troubleshooting for users



The main switch is on, but the electric pump does not start.

Cause	Remedy
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.

Cause	Remedy
The protective device against dry running has tripped.	Check the water level in the tank, or the mains pressure.

The electric pump starts, but the thermal protection trips a varying time after.

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the Sales and Service Department.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and then contact the Sales and Service Department.

The pump runs but delivers too little or no water.

Cause	Remedy
The pump is clogged.	Contact the Sales and Service Department.

The troubleshooting instructions in the tables below are for installers only.

7.2 The main switch is on, but the electric pump does not start



Cause	Remedy
There is no power supply.	<ul style="list-style-type: none"> Restore the power supply. Make sure all electrical connections to the power supply are intact.
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The thermal relay or motor protector in the electric control panel has tripped.	Reset the thermal protection.
The protective device against dry running has tripped.	Check the: <ul style="list-style-type: none"> water level in the tank, or the mains pressure protective device and its connecting cables
The fuses for the pump or auxiliary circuits are blown.	Replace the fuses.

7.3 The electric pump starts, but the thermal protector trips or the fuses blow immediately after



Cause	Remedy
The power supply cable is damaged.	Check the cable and replace as necessary.
The thermal protection or fuses are not suited for the motor current.	Check the components and replace as necessary.
The electric motor is short circuited.	Check the components and replace as necessary.
The motor overloads.	Check the operating conditions of the pump and reset the protection.

7.4 The electric pump starts, but the thermal protector trips or the fuses blow a short time after



Cause	Remedy
The electrical panel is situated in an excessively heated area or is exposed to direct sunlight.	Protect the electrical panel from heat source and direct sunlight.
The power supply voltage is not within the working limits of the motor.	Check the operating conditions of the motor.
A power phase is missing.	Check the <ul style="list-style-type: none"> power supply electrical connection

7.5 The electric pump starts, but the thermal protector trips a varying time after



Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the Sales and Service Department.
The pumps delivery rate is higher than the limits specified on the data plate.	Partially close the on-off valve down stream until the delivery rate is equal or less than the limits specified on the data plate.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and replace the motor accordingly.
The motor bearings are worn.	Contact the Sales and Service Department.

7.6 The electric pump starts, but the system's general protection is activated



Cause	Remedy
A short circuit in the electrical system.	Check the electrical system.

7.7 The electric pump starts, but the system's residual current device (RCD) is activated



Cause	Remedy
There is an earth (ground) leakage.	Check the insulation of the electrical system components.

7.8 The pump runs but delivers too little or no water



Cause	Remedy
There is air inside the pump or the piping.	<ul style="list-style-type: none"> Bleed the air
The pump is not correctly primed.	Stop the pump and repeat the prime procedure. If the problem continues: <ul style="list-style-type: none"> Check that the mechanical seal is not leaking. Check the suction pipe for perfect tightness. Replace any valves that are leaking.
The throttling on the delivery side is too extensive.	Open the valve.
Valves are locked in closed or partially closed position.	Disassemble and clean the valves.
The pump is clogged.	Contact the Sales and Service Department.
The piping is clogged.	Check and clean the pipes.
The rotation direction of the impeller is wrong (three-phase version).	Change the position of two of the phases on the terminal board of the motor or in the electric control panel.
The suction lift is too high or the flow resistance in the suction pipes is too great.	Check the operating conditions of the pump. If necessary, do the following: <ul style="list-style-type: none"> Decrease the suction lift Increase the diameter of the suction pipe

7.9 The electric pump stops, and then rotates in the wrong direction



Cause	Remedy
There is a leakage in one or both of the following components: <ul style="list-style-type: none"> The suction pipe The foot valve or the check valve 	Repair or replace the faulty component.
There is air in the suction pipe.	Bleed the air.

7.10 The pump starts up too frequently



Cause	Remedy
There is a leakage in one or both of the following components: <ul style="list-style-type: none"> The suction pipe The foot valve or the check valve 	Repair or replace the faulty component.
There is a ruptured membrane or no air pre-charge in the pressure tank.	See the relevant instructions in the pressure tank manual.

7.11 The pump vibrates and generates too much noise

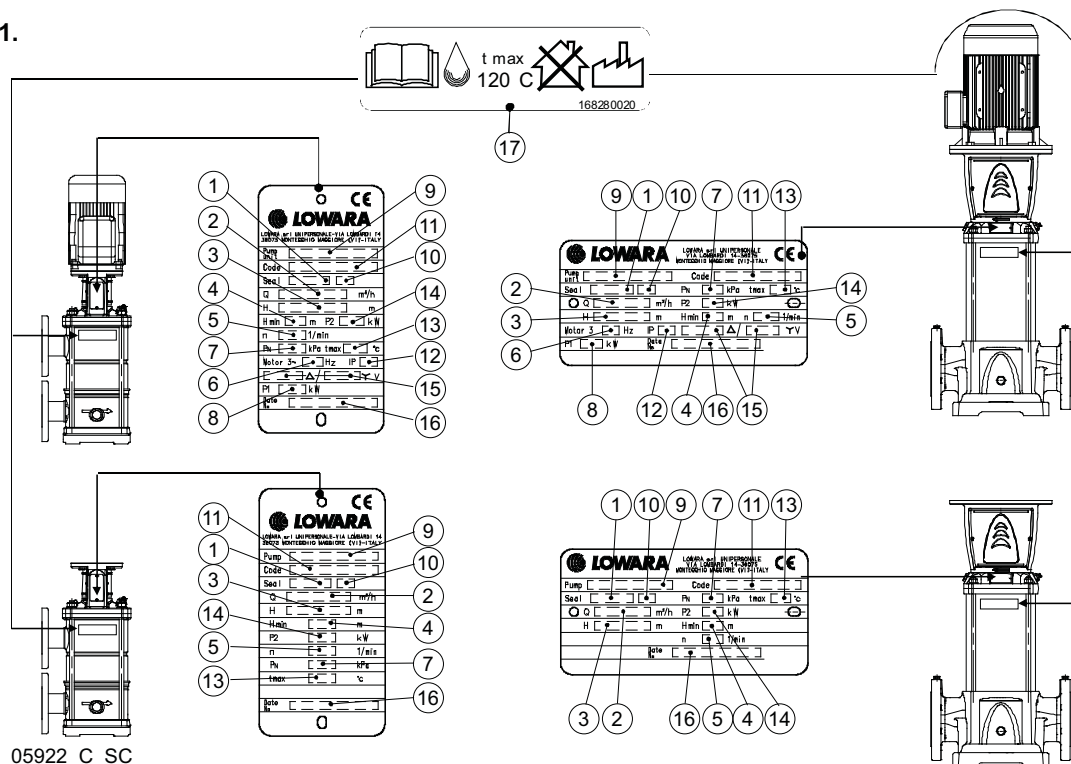


Cause	Remedy
Pump cavitation	Reduce the required flow rate by partially closing the on-off valve downstream from the pump. If the problem persists check the operating conditions of the pump (for example height difference, flow resistance, liquid temperature).
The motor bearings are worn.	Contact the Sales and Service Department.
There are foreign objects inside the pump.	Contact the Sales and Service Department.

For any other situation, refer to the Sales and Service Department.

Technical appendix

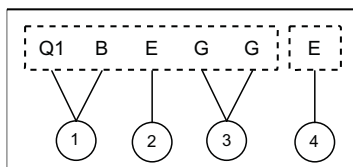
1.



05922_C_SC

1. Mechanical seal material identification code
2. Capacity range
3. Head range
4. Minimum head (IEC 60335-2-41)
5. Speed
6. Frequency
7. Maximum operating pressure
8. Electric pump unit absorbed power
9. Pump/electric pump unit type
10. O-ring material identification code
11. Electric pump unit/ pump part number
12. Protection class
13. Maximum operating liquid temperature (uses as IEC 60335-2-41)
14. Motor nominal power
15. Rated voltage range
16. Serial number (date + progressive number)
17. Maximum operating liquid temperature (uses other than IEC 60335-2-41)

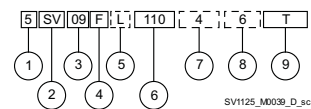
2.



SV1125_M0005_A_sc

1. Mechanical Seal
 - A Metal impregnated carbon
 - B Resin impregnated carbon
 - C Special resin impregnated carbon
 - Q1 Silicon carbide
2.
 - E EPDM
 - T PTFE
 - V FPM (FKM)
3. 1.4401 (AISI 316)
4. Other o-ring gaskets
 - E EPDM
 - T PTFE
 - V FPM (FKM)

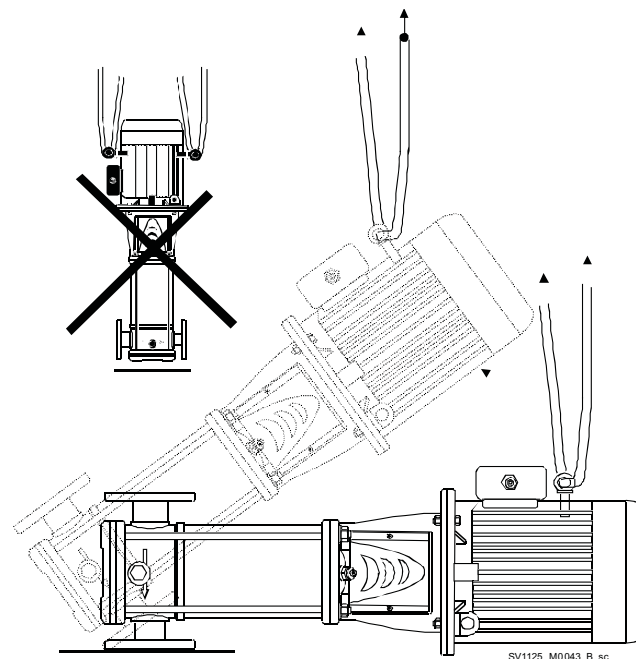
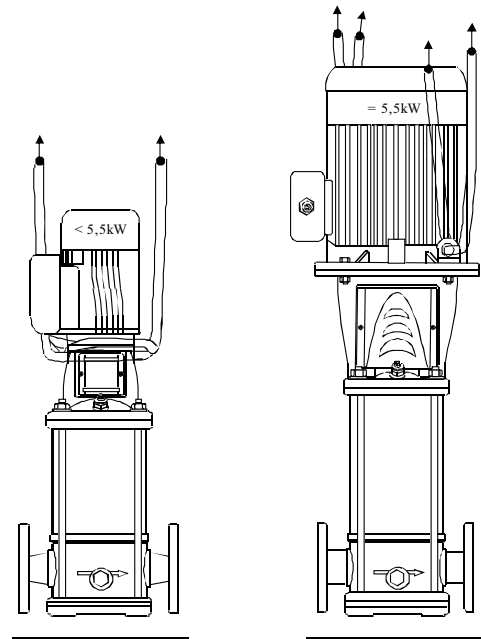
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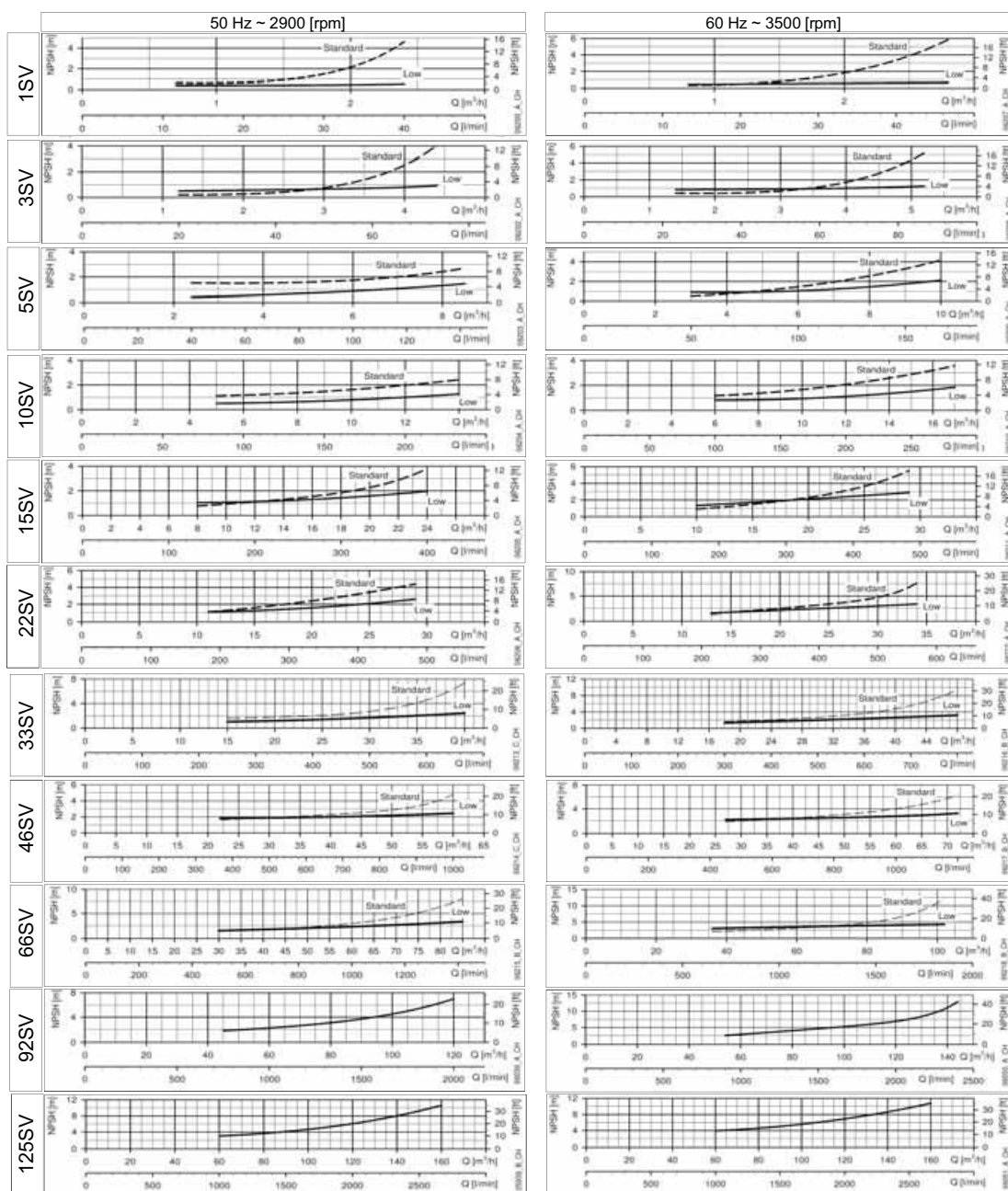
1. Flow rate in m³/h
2. Series name
3. Number of impellers
8/2A 8 impellers, 2 with outer diameter reduced
A or B Reduction type
1, 3, 5, 10, 15, 22
4. **F** AISI 304, round flanges (PN25) **T** AISI 304, oval flanges (PN16)
R AISI 304, discharge port above suction, round flanges (PPN25)
N AISI 316, round flanges (PN25) **V** AISI 316, Victaulic® couplings (PN25)
P AISI 316, Victaulic® couplings (PN40)
C AISI 316, clamp couplings (PN40)
DIN32676 (PN25)
K AISI 316, threaded couplings (PN25)
DIN11851 (PN25)
33, 46, 66, 92, 125
G AISI 304/Cast Iron, round flanges **N** AISI 316, round flanges
P AISI 316, round flanges (PN40)
5. **1, 3, 5, 10, 15, 22**
Blank Standard version
L Low NPSH, round flanges, PN25 (F, N versions)
H High temperature, 150°C, round flanges, PN25 (F, N versions)
B High temperature, 180°C, round flanges, PN25 (N version)
E Passivated and electro-polished (N, V, C, K versions)
33, 46, 66, 92, 125
Blank Standard version
L Low NPSH, round flanges (G, N versions)
H High temperature, 150°C, round flanges, PN25 (G, N versions)
B High temperature, 180°C, round flanges, PN25 (N version)
E Passivated and electro-polished (N version)
6. Rated motor power (kW x 10)
7. **Blank** 2-pole
4 4-pole
8. **Blank** 50 Hz
6 60 Hz
9. **M** Single-phase
T Three-phase

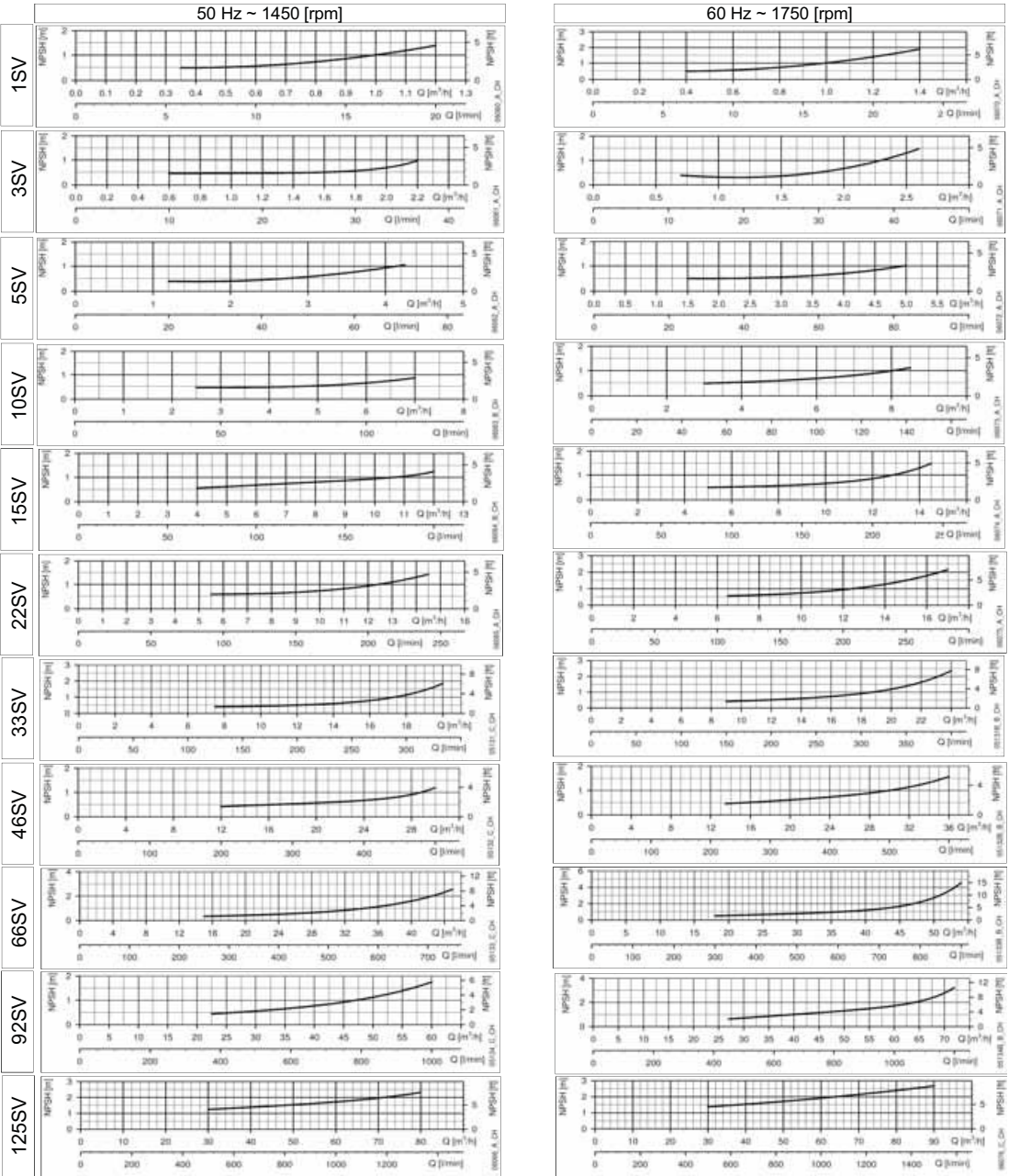
Victaulic® is a trademark of Victaulic Company

4.

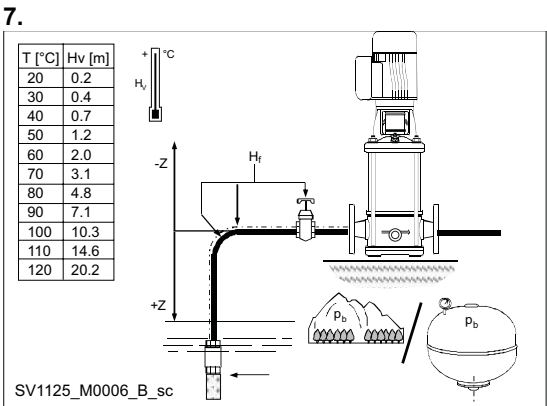
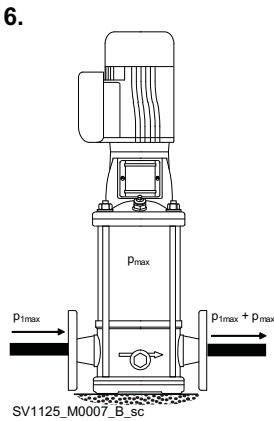


5.



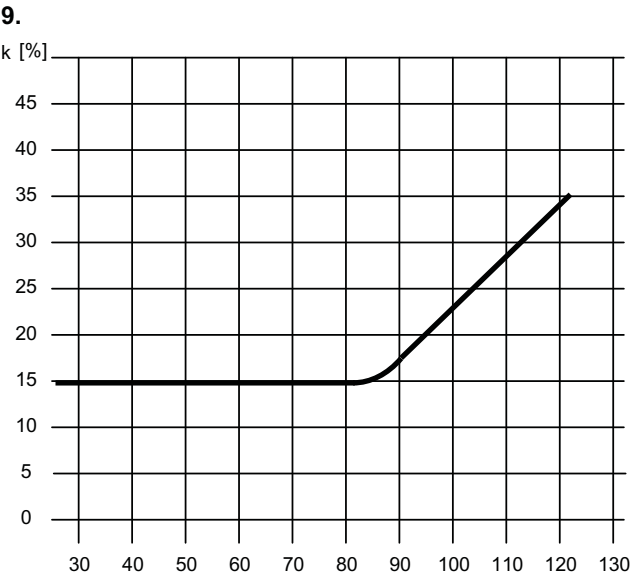


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8.

H (m)	0°C	10°C	20°C	30°C	40°C	45°C	50°C	55°C	60°C
0	1,00	1,00	1,00	1,00	1,00	0,95	0,90	0,85	0,80
500	1,00	1,00	1,00	1,00	1,00	0,95	0,90	0,85	0,80
1000	1,00	1,00	1,00	1,00	1,00	0,95	0,90	0,85	0,80
1500	0,97	0,97	0,97	0,97	0,97	0,92	0,87	0,82	0,78
2000	0,95	0,95	0,95	0,95	0,95	0,90	0,85	0,80	0,76



LOWARA srl UNIPERSONALE
VIA LOMBARDI 14-36075
MONTECCHIO MAGGIORE (VI)-ITALY

Pump unit (NN)SV XX X...XXX.... ..X

$Q_{min} = (NN) \cdot k \text{ [m}^3\text{/h]}$

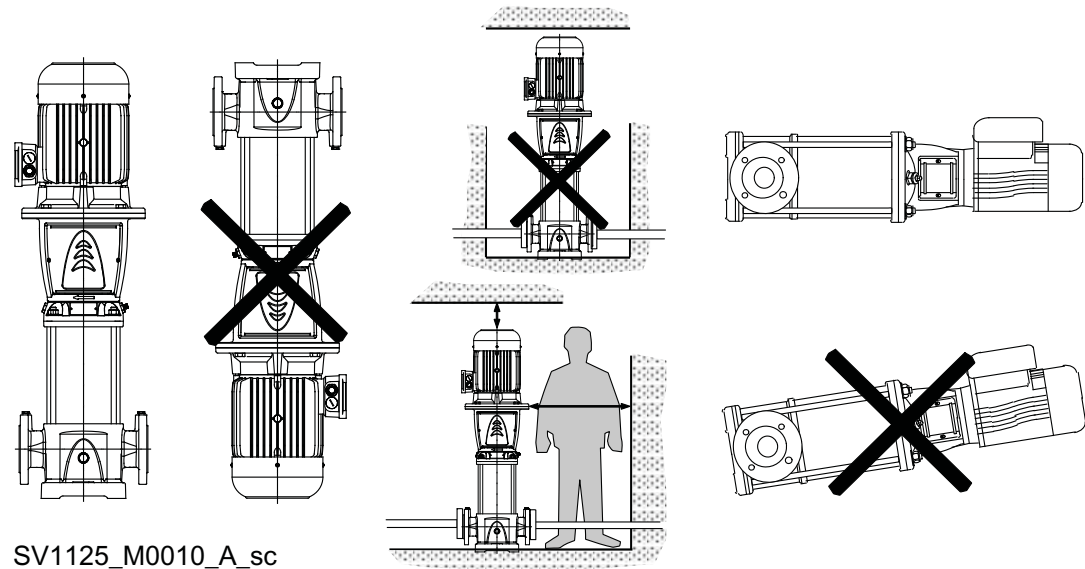
10.

P2 (kW)	dB ± 2							
	50 Hz 2900 min ⁻¹		50 Hz 1450 min ⁻¹		60 Hz 3500 min ⁻¹		60 Hz 1750 min ⁻¹	
	IEC	LpA*	IEC	LpA*	IEC	LpA*	IEC	LpA*
0,25	-	<70	71	<70	-	-	71	<70
0,37	71R	<70	71	<70	-	-	71	<70
0,55	71	<70	80	<70	71	<70	80	<70
0,75	80R	<70	80	<70	80R	<70	80	<70
1,00	80	<70	90	<70	80	<70	90	<70
1,50	90R	<70	90	<70	90R	<70	90	<70
2,20	90R	<70	100	<70	90R	70	100	<70
3,00	100R	<70	100	<70	100R	70	100	<70
4,00	112R	<70	112	<70	112R	71	112	<70

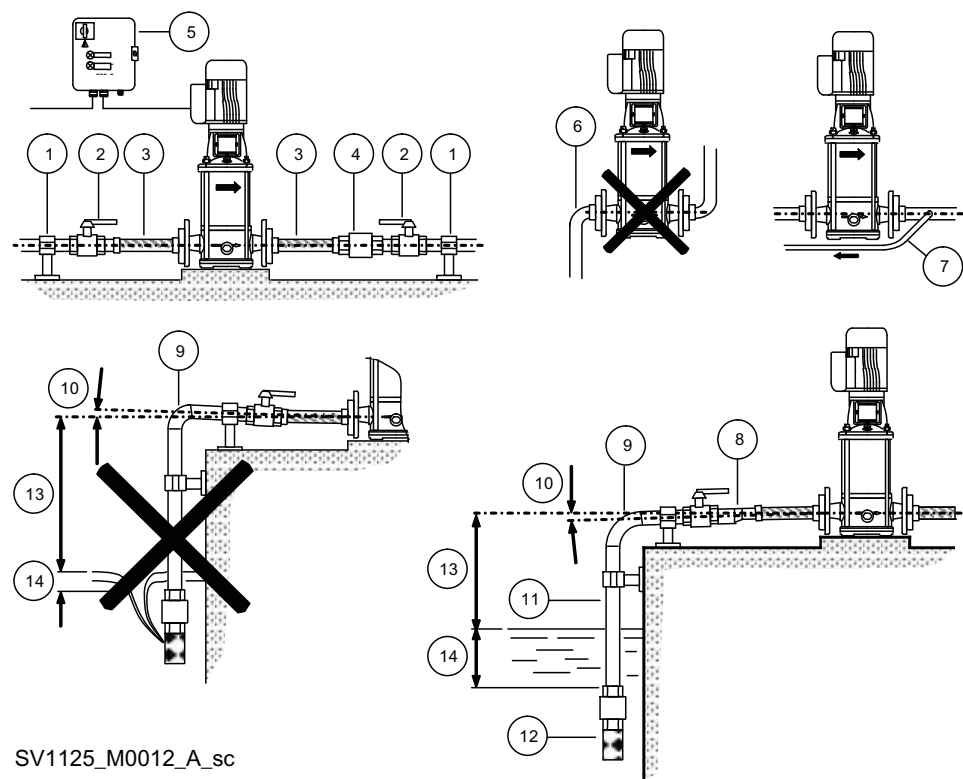
P2 (kW)	dB ± 2							
5,50	132R	<70	132	<70	132R	73	132	<70
7,50	132R	<70	132	<70	132R	73	132	<70
11,00	160R	73	-	-	160R	79	160	<70
15,00	160	75	-	-	160	80	160	<70
18,50	160	75	-	-	160	80	-	-
22,00	180R	75	-	-	180R	80	-	-
30,00	200	74	-	-	200	78	-	-
37,00	200	74	-	-	200	78	-	-
45,00	225	78	-	-	225	83	-	-
55,00	250	84	-	-	250	89	-	-

Sound pressure level measured in a free field at 1 m distance from the electric pump.

11.



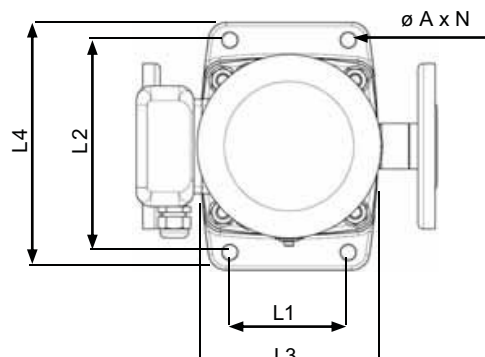
12.



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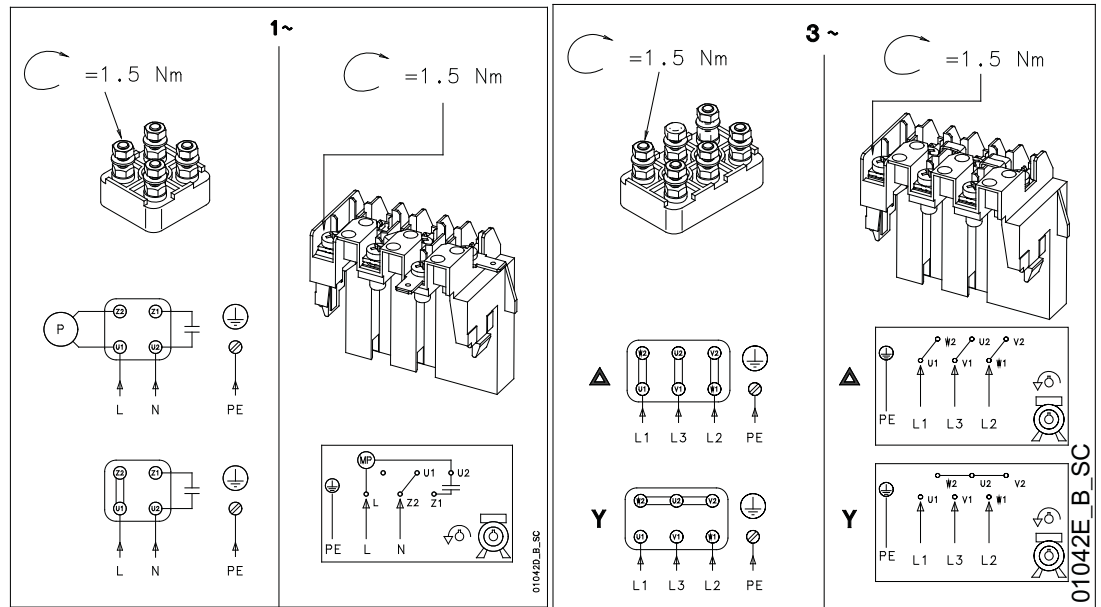
- 1. Piping support
- 2. On-off valve
- 3. Flexible pipe or joint
- 4. Check valve
- 5. Control panel
- 6. Do not install elbows close to the pump
- 7. Bypass circuit
- 8. Eccentric reducer
- 9. Use wide bends
- 10. Positive gradient
- 11. Piping with equal or greater diameter than the suction port
- 12. Use foot valve
- 13. Do not exceed maximum height difference
- 14. Ensure adequate submersion depth

13.

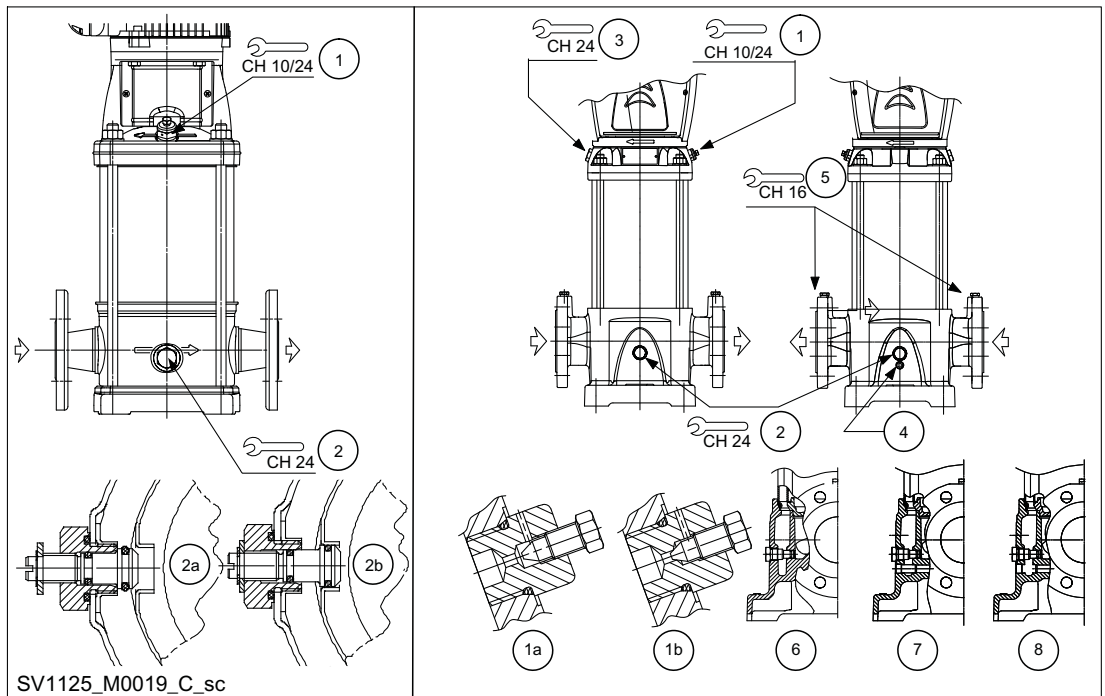


	1, 3, 5SV	10, 15, 22SV	33SV	46, 66, 92SV	125SV
	[mm]				
L1	100	130	170	190	275
L2	180	215	240	265	380
L3	150	185	220	240	330
L4	210	245	290	315	450
ØA	13		15		19
N	4				

14.



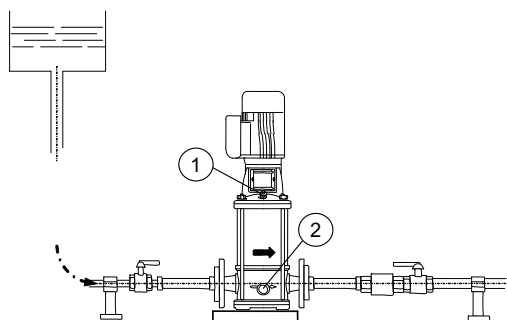
15.



1. Fill and vent plug (a: vent open, b: vent closed)
 - 1, 3, 5, 10, 15, 22 SV: G 3/8
 - 33, 46, 66, 92, 125 SV: G 1/2
2. Drain plug (a: central pin open, b: central pin closed)
 - 1, 3, 5, 10, 15 22 SV: G 3/8
 - 33, 46, 66, 92, 125 SV: G 1/2
3. Fill plug
 - 10, 15, 22 SV: G 3/8
 - 33, 46, 66, 92, 125 SV: G 1/2
4. Plug for drum, if present (do not unscrew)
5. Gauge connection plug, only 33, 46, 66, 92, 125 SV: G 3/8
6. Version without plug and drum, only 33, 46, 66, 92, 125 SV
7. Version with plug but no drum (do not unscrew), only 33, 46, 66, 92, 125 SV

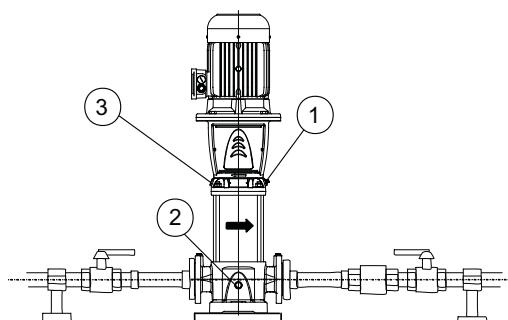
16.

1, 3, 5SV

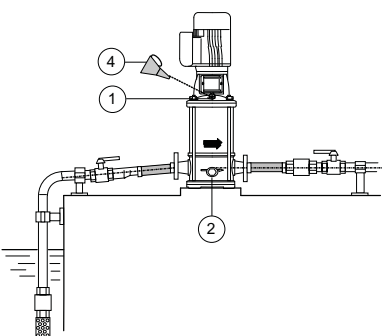


SV1125_M0014_A_sc

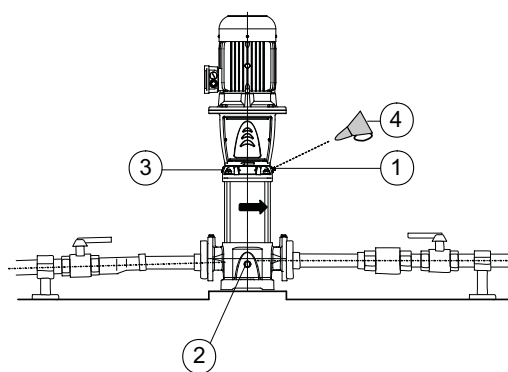
10, 15, 22, 33, 46, 66, 92, 125SV



SV1125_M0014_A_sc

17.

SV1125_M0015_A_sc



SV1125_M0015_A_sc

1. Fill and vent plug
2. Drain plug
3. Fill plug
4. Funnel

18.

	A		B		C		D		E		F		G		H		I	
	Ø	Nm	Ø	Nm	Ø	Nm	Ø	Nm	Ø	Nm	Ø	Nm	Ø	Nm	Ø	Nm	Ø	Nm
1SV	M8	20	M12	25	-	-	-	-	-	-	G3/8	25	-	-	M12	50	M10	30
3SV																		
5SV																		
10SV	M10	35	M14	30			M8	25							M16	100	M12	50
15SV																		
22SV																		
33SV	M12	55	M16	60	M6	8	M10	35	G1/2	40	G1/2	40	R3/8	40	M16	100	-	-
46SV																		
66SV- PN16																		
66SV- PN25															M20	200		
92SV- PN16															M16	100		
92SV- PN25															M20	200		
125SV- PN16															M16	100		
125SV- PN25															M24	350		

A Impeller locking screws

B Tie rod nuts

C Drum (33, 46, 66, 92, 125 SV) and diffuser bushings (125 SV) locking plate screws

D Mechanical seal housing (33, 46, 66, 92, 125 SV) and diffuser (125 SV) locking screws

E Fill and vent plug

F Fill or drain plugs


G Gauge connection plugs
Ø Diameter

H Round counter flange screws
Nm Torque


I Oval counter flange screws

Ø Diameter

19.

A		71	80	90	100	112	132	160	180	200	225	250
B	Ø	M6			M8			M12	M16			
	Nm	6			15			50	75			
CH		10			13			19	24			

20.

		1, 3, 5, 10, 15, 22 SV					1, 3, 5 SV	10, 15, 22 SV		33, 46, 66, 92, 125 SV								
A		71	80	90	100	112	132	132	160	90	100	112	132	160	180	200	225	250
C	Ø	M6			M8		M8	M10		M10			M12					
	Nm	15			25		25	50		50			75					
CH		5			6		6	8		8			10					

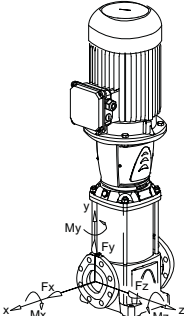
A Motor size

B Adapter/motor screw

C Coupling screw

Ø Diameter

21.

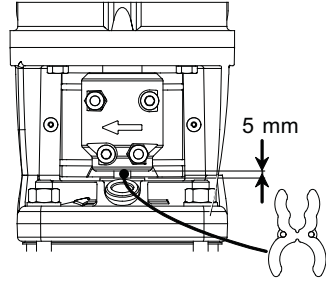


PUMP TYPE	DN	Forces (N)			Moments (Nm)		
		F _x	F _y	F _z	M _x	M _y	M _z
1-3 SV	25	200	180	230	240	160	190
5 SV	32	260	240	300	310	210	250
10 SV	40	330	300	370	390	270	310
15-22 SV	50	450	400	490	420	300	340
33 SV	65	1800	1700	2000	1500	1050	1200
46 SV	80	2250	2050	2500	1600	1150	1300
66-92 SV	100	3000	2700	3350	1750	1250	1450
125 SV	125	3700	3300	4100	2100	1500	1750

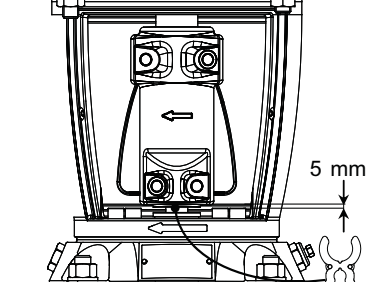
1-125sv-forza-FNG-en_a_td_a_td

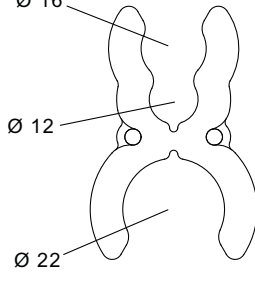
22.

1, 3, 5, 10, 15SV

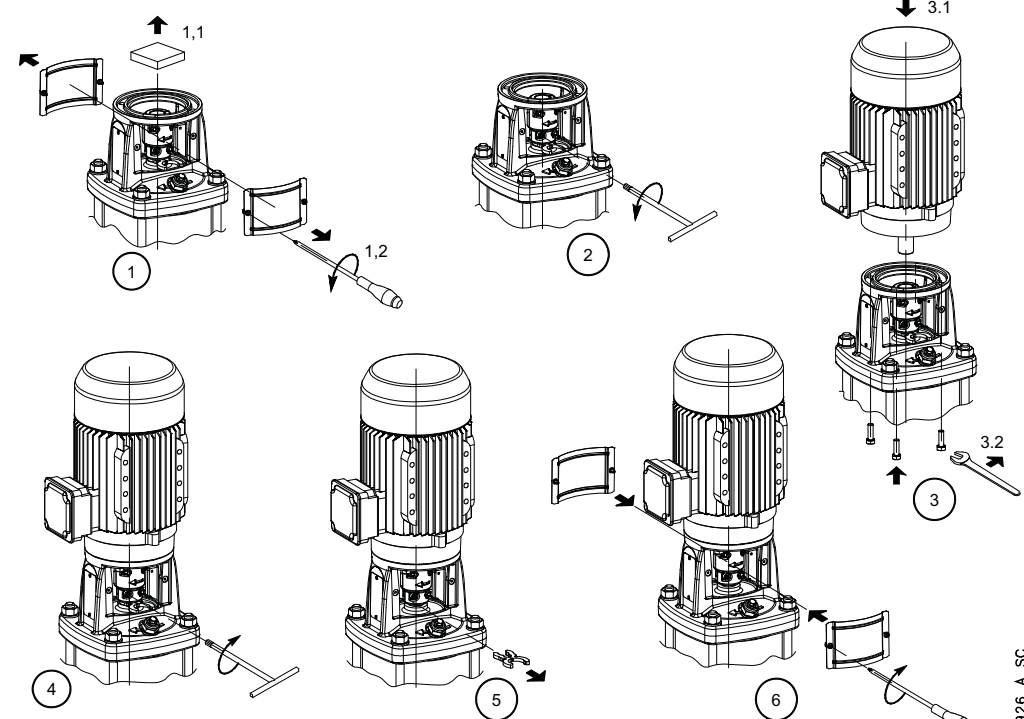


33, 46, 66, 92, 125SV





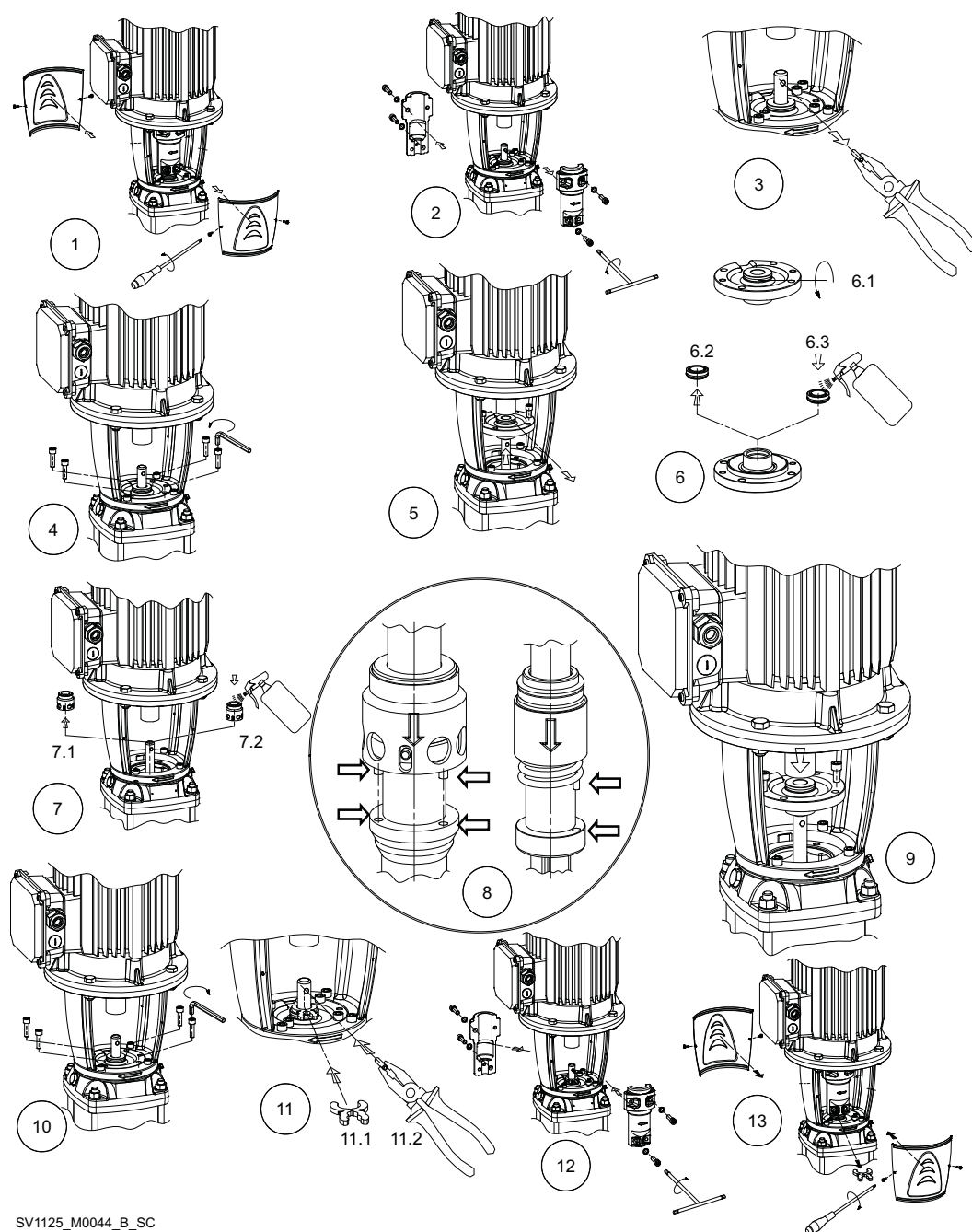
23.



SV4495 ME006 A 00

15926_A_SC

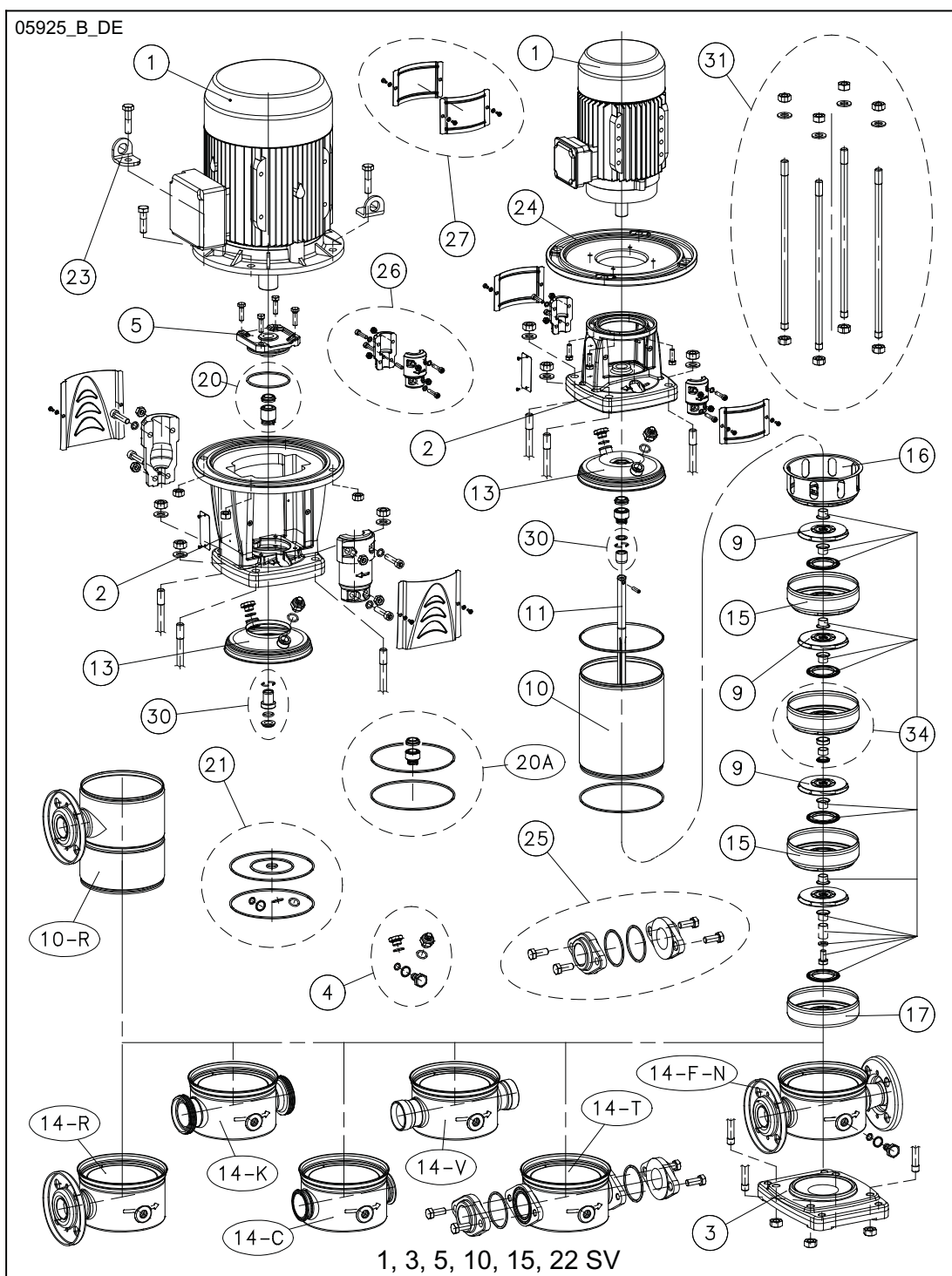
24.



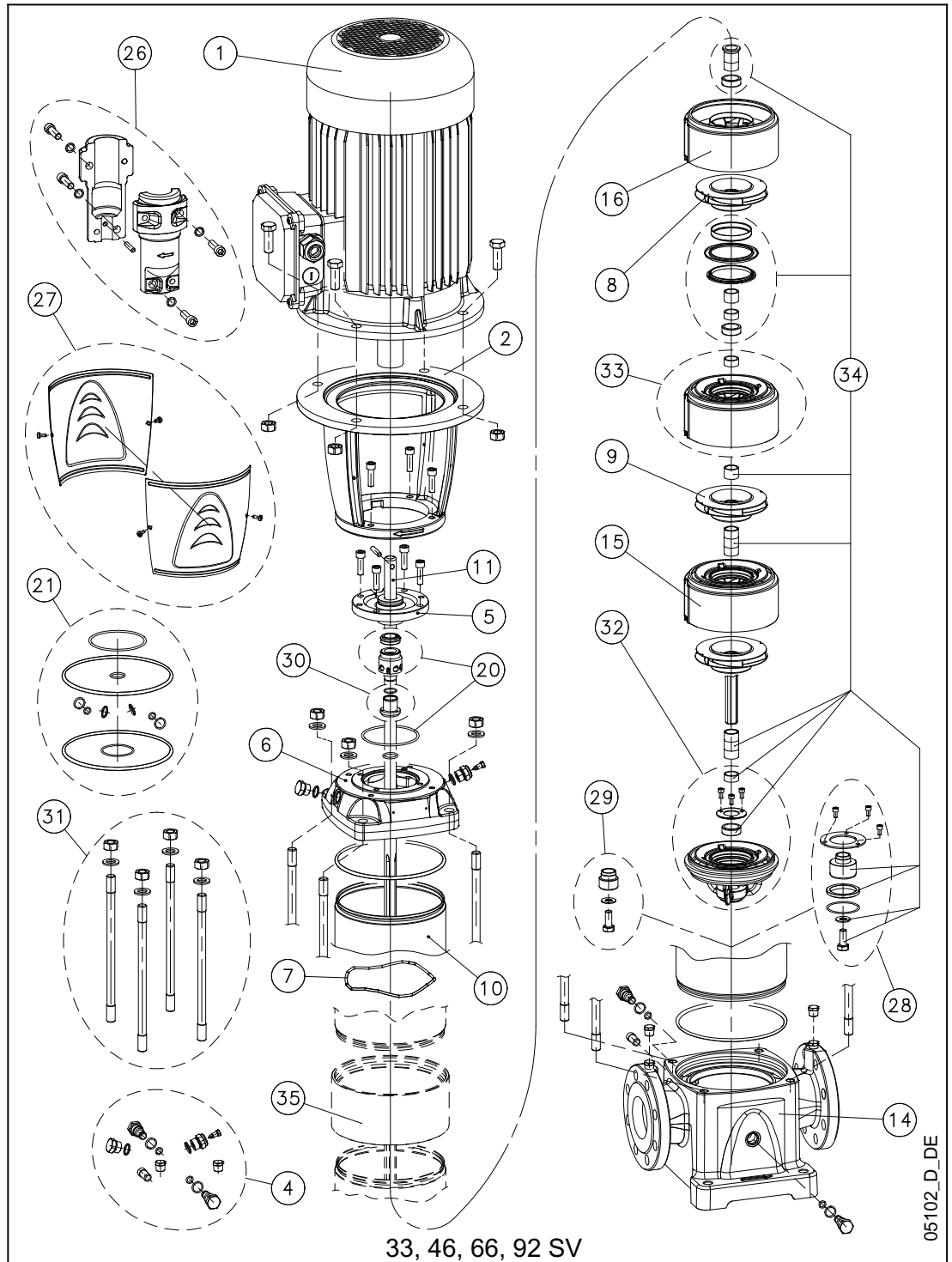
SV1125_M0044_B_SC

25.

05925_B_DE

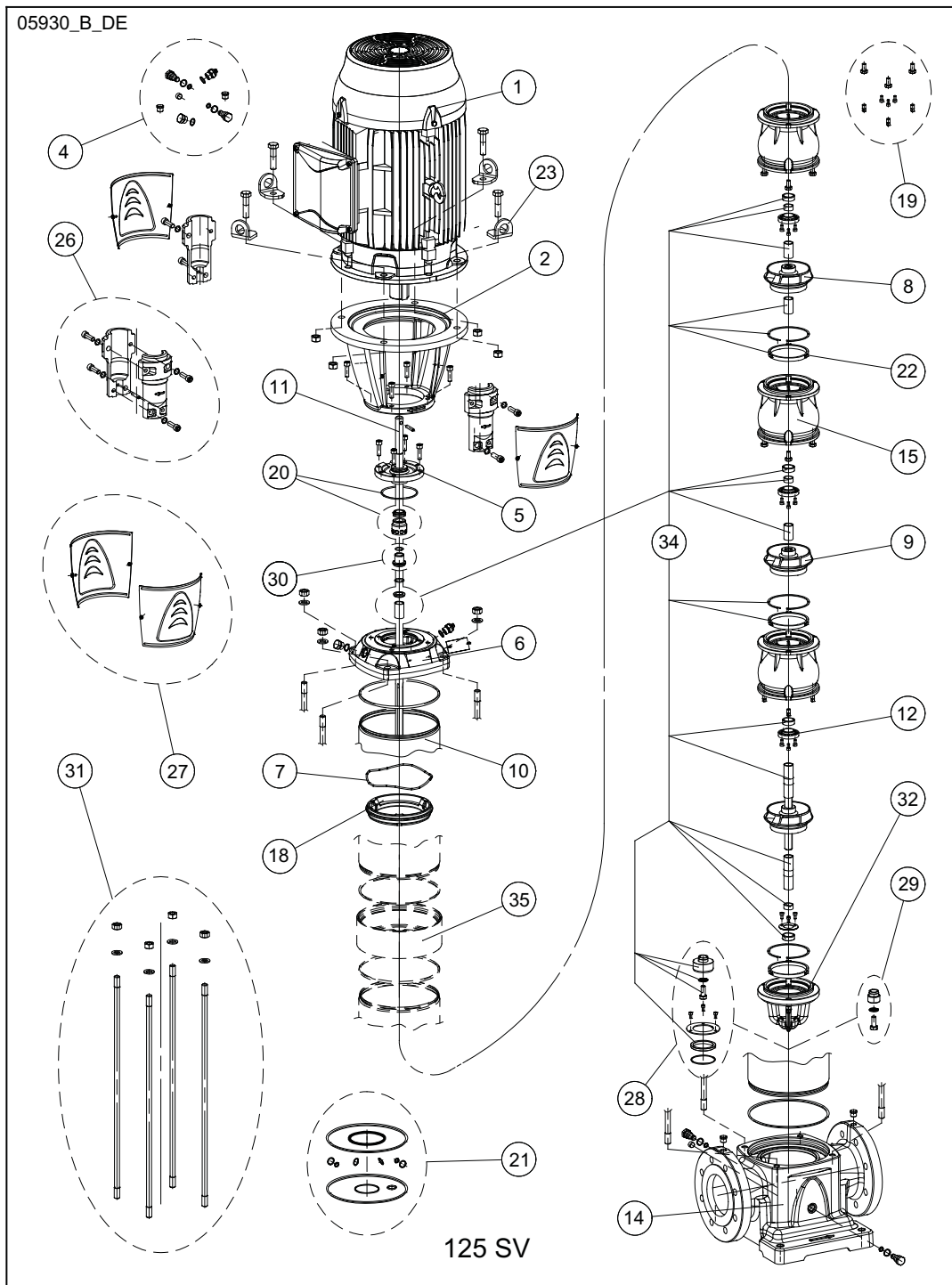


26.



05102_D_DE

05930_B_DE



- | | | | | |
|---------------------------|---|-------------------------------------|--|--------------------------------|
| 1. Motor | 9. Impeller (full diameter) | 16. Last stage diffuser kit | 24. Flange for motor | 30. Mechanical seal bush kit |
| 2. Adapter | 10. Sleeve | 17. First stage box | 25. Oval counterflange & O-ring kit (for T type) | 31. Tie rods kit |
| 3. Base | 11. Shaft | 18. Adapter ring | 26. Pair of half couplings kit | 32. Lower support and bush kit |
| 4. Plug & o-ring kit | 12. Bush locking cover | 19. Diffuser bolts kit | 27. Coupling guards | 33. Diffuser and bush kit |
| 5. Seal Housing Plate | 13. Upper pressed holder with connections | 20. Mechanical seal | 28. Thrust drum and impeller stack locking kit | 34. Wear parts kit |
| 6. Upper Head | 14. Pump body F, N, R, K, C, V, T type | 21. O-ring kit | | 35. Ring for sleeve |
| 7. Diffusers stack spring | | 22. Diffuser wear ring support ring | | |

28.

T				T			
50 Hz 2900 min-1				50 Hz 2900 min-1			
1~	H (m)*	3~	H (m)*	1~	H (m)*	3~	H (m)*
1SV02F003M	12,2	1SV02F003T	12,2	5SV13F022M	98,3	5SV13F022T	98,3
1SV03F003M	18	1SV03F003T	18	5SV14F022M	105,7	5SV14F022T	105,7
1SV04F003M	23,7	1SV04F003T	23,7	5SV15F022M	113,1	5SV15F022T	113,1
1SV05F003M	29,3	1SV05F003T	29,3	5SV16F022M	120,5	5SV16F022T	120,5
1SV06F003M	34,8	1SV06F003T	34,8	-	-	5SV18F030T	135,8
1SV07F003M	40,2	1SV07F003T	40,2	-	-	5SV21F030T	157,9
1SV08F005M	48,1	1SV08F005T	48,1	-	-	5SV23F040T	174,4
1SV09F005M	53,7	1SV09F005T	53,7	-	-	5SV25F040T	189,2
1SV10F005M	59,4	1SV10F005T	59,4	-	-	5SV28F040T	211,5
1SV11F005M	65,1	1SV11F005T	65,1	-	-	5SV30F055T	227
1SV12F007M	73,3	1SV12F007T	73,3	-	-	5SV33F055T	249,2
1SV13F007M	79,2	1SV13F007T	79,2	10SV01F007M	11,8	10SV01F007T	11,8
1SV15F007M	90,9	1SV15F007T	90,9	10SV02F007M	23,6	10SV02F007T	23,6
1SV17F011M	105,2	1SV17F011T	105,2	10SV03F011M	35,7	10SV03F011T	35,7
1SV19F011M	117	1SV19F011T	117	10SV04F015M	47,7	10SV04F015T	47,7
1SV22F011M	134,6	1SV22F011T	134,6	10SV05F022M	60	10SV05F022T	60
1SV25F015M	152,6	1SV25F015T	152,6	10SV06F022M	71,	10SV06F022T	71,8
1SV27F015M	164,3	1SV27F015T	164,3	-	-	10SV07F030T	83,6

T				T			
50 Hz 2900 min-1				50 Hz 2900 min-1			
1~	H (m)*	3~	H (m)*	1~	H (m)*	3~	H (m)*
1SV30F015M	181,7	1SV30F015T	181,7	-	-	10SV08F030T	95,3
1SV32F022M	197,2	1SV32F022T	197,2	-	-	10SV09F040T	106,3
1SV34F022M	209,2	1SV34F022T	209,2	-	-	10SV10F040T	118
1SV37F022M	225,9	1SV37F022T	225,9	-	-	10SV11F040T	129,6
3SV02F003M	14,9	3SV02F003T	14,9	-	-	10SV13F055T	156
3SV03F003M	22	3SV03F003T	22	-	-	10SV15F055T	179,5
3SV04F003M	28,9	3SV04F003T	28,9	-	-	10SV17F075T	205
3SV05F005M	37,2	3SV05F005T	37,2	-	-	10SV18F075T	216,9
3SV06F005M	44,4	3SV06F005T	44,4	-	-	10SV20F075T	240,6
3SV07F007M	52,5	3SV07F007T	52,5	-	-	10SV21F110T	253,6
3SV08F007M	60	3SV08F007T	60	15SV01F011M	14	15SV01F011T	14
3SV09F011M	67,7	3SV09F011T	67,7	15SV02F022M	28,7	15SV02F022T	28,7
3SV10F011M	75	3SV10F011T	75	-	-	15SV03F030T	43,3
3SV11F011M	82,3	3SV11F011T	82,3	-	-	15SV04F040T	58,4
3SV12F011M	89,6	3SV12F011T	89,6	-	-	15SV05F040T	72,7
3SV13F015M	98,1	3SV13F015T	98,1	-	-	15SV06F055T	87,6
3SV14F015M	105,6	3SV14F015T	105,6	-	-	15SV07F055T	101,9
3SV16F015M	119,9	3SV16F015T	119,9	-	-	15SV08F075T	117,4
3SV19F022M	144,3	3SV19F022T	144,3	-	-	15SV09F075T	131,9
3SV21F022M	159,3	3SV21F022T	159,3	-	-	15SV10F110T	147,7
3SV23F022M	174	3SV23F022T	174	-	-	15SV11F110T	162,3
3SV25F022M	188,5	3SV25F022T	188,5	-	-	15SV13F110T	191,3
-	-	3SV27F030T	204,4	-	-	15SV15F150T	222,1
-	-	3SV29F030T	219,3	-	-	15SV17F150T	251,6
-	-	3SV31F030T	233,8	22SV01F011M	14,7	22SV01F011T	14,7
-	-	3SV33F030T	248,5	22SV02F022M	30,4	22SV02F022T	30,4
5SV02F003M	14,8	5SV02F003T	14,8	-	-	22SV03F030T	45,4
5SV03F005M	21,8	5SV03F005T	21,8	-	-	22SV04F040T	60,9
5SV04F005M	30	5SV04F005T	30	-	-	22SV05F055T	76
5SV05F007M	38	5SV05F007T	38	-	-	22SV06F075T	93,2
5SV06F011M	45,3	5SV06F011T	45,3	-	-	22SV07F075T	108,5
5SV07F011M	52,7	5SV07F011T	52,7	-	-	22SV08F110T	124,6
5SV08F011M	60,1	5SV08F011T	60,1	-	-	22SV09F110T	140,1
5SV09F015M	68	5SV09F015T	68	-	-	22SV10F110T	155,4
5SV10F015M	75,5	5SV10F015T	75,5	-	-	22SV12F150T	186,1
5SV11F015M	82,8	5SV11F015T	82,8	-	-	22SV14F150T	216,6
5SV12F022M	90,8	5SV12F022T	90,8	-	-	22SV17F185T	263,5

T				T			
50 Hz 2900 min-1				50 Hz 1,450 min-1			
3~	H (m)*	3~	H (m)*	3~	H (m)*	3~	H (m)*
33SV1/1AG022T	17,4	46SV9/2AG300T	224,8	1SV02F0024T	3,1	22SV14F0224T	53,9
33SV1G030T	23,8	46SV9G370T	240,9	1SV05F0024T	7,7	22SV17F0304T	65,3
33SV2/2AG040T	35,1	46SV10/2AG370T	252,7	1SV08F0024T	12,2	33SV3/2AG0114T	14,4
33SV2/1AG040T	40,8	46SV10G370T	267,6	1SV11F0024T	16,7	33SV4/1AG0114T	21,8
33SV2G055T	47,8	46SV11/2AG450T	280,4	1SV15F0024T	22,6	33SV5G0154T	29,4
33SV3/2AG055T	57,7	46SV11G450T	295,5	1SV19F0024T	28,8	33SV6G0224T	35,9
33SV3/1AG075T	64,5	46SV12/2AG450T	307,3	1SV22F0024T	33,2	33SV7G0224T	41,6
33SV3G075T	71,5	46SV12G450T	321,8	1SV27F0024T	40,1	33SV8G0304T	47,9
33SV4/2AG075T	82	46SV13/2AG450T	332,5	1SV30F0024T	44,4	33SV9G0304T	53,3
33SV4/1AG110T	88,9	66SV1/1AG040T	23,8	1SV34F0024T	50	33SV10G0304T	59
33SV4G110T	95,9	66SV1G055T	29,2	1SV37F0024T	54,2	33SV11G0404T	65,7
33SV5/2AG110T	106	66SV2/2AG075T	47,5	3SV02F0024T	3,8	33SV12G0404T	71,5
33SV5/1AG110T	112,7	66SV2/1AG110T	54,2	3SV05F0024T	9,5	33SV13G0404T	77,2
33SV5G150T	120,4	66SV2G110T	60,4	3SV08F0024T	15,1	46SV2G0114T	13
33SV6/2AG150T	131,2	66SV3/2AG150T	78,4	3SV11F0024T	20,6	46SV3G0154T	19,8
33SV6/1AG150T	139,1	66SV3/1AG150T	84,7	3SV14F0024T	26,1	46SV4G0224T	26,3
33SV6G150T	145,6	66SV3G185T	91,4	3SV19F0024T	33,3	46SV5G0224T	32,6
33SV7/2AG150T	156	66SV4/2AG185T	108,9	3SV23F0024T	42,2	46SV6G0304T	39,3
33SV7/1AG185T	163,3	66SV4/1AG220T	115,2	3SV27F0034T	49,7	46SV7G0304T	45,5
33SV7G185T	170,3	66SV4G220T	121,6	3SV33F0034T	60,2	46SV8G0404T	52,5
33SV8/2AG185T	180,6	66SV5/2AG300T	139,1	5SV03F0024T	5,7	46SV9G0404T	58,9
33SV8/1AG185T	187,4	66SV5/1AG300T	145,6	5SV06F0024T	11,3	46SV10G0554T	66,2
33SV8G220T	194,1	66SV5G300T	152	5SV09F0024T	16,8	46SV11G0554T	72,6
33SV9/2AG220T	202,1	66SV6/2AG300T	169,5	5SV12F0024T	22,2	46SV12G0554T	78,9
33SV9/1AG220T	210,2	66SV6/1AG300T	176	5SV15F0034T	27,5	66SV1G0114T	7,3

T				T			
50 Hz 2900 min-1				50 Hz 1,450 min-1			
3~	H (m)*	3~	H (m)*	3~	H (m)*	3~	H (m)*
33SV9G220T	216,8	66SV6G370T	182,4	5SV18F0034T	33,1	66SV2G0154T	14,8
33SV10/2AG220T	226,4	66SV7/2AG370T	199,9	5SV21F0034T	38,4	66SV3G0224T	22,3
33SV10/1AG300T	234,5	66SV7/1AG370T	206,4	5SV25F0054T	45,3	66SV4G0304T	29,7
33SV10G300T	241,8	66SV7G450T	212,8	5SV28F0054T	51,7	66SV5G0404T	37,5
33SV11/2AG300T	252	66SV8/2AG450T	230,3	5SV33F0074T	60,5	66SV6G0404T	44,7
33SV11/1AG300T	259	66SV8/1AG450T	236,8	10SV03F0054T	9	66SV7G0554T	52,8
33SV11G300T	265,7	66SV8G450T	243,2	10SV04F0054T	12	66SV8G0554T	60,1
33SV12/2AG300T	275,9	92SV1/1AG055T	24,5	10SV06F0054T	17,9	92SV1G0114T	8,3
33SV12/1AG300T	282,8	92SV1G075T	33,5	10SV08F0054T	23,6	92SV2G0224T	16,3
33SV12G300T	289,8	92SV2/2AG110T	49,4	10SV10F0054T	28,9	92SV3G0304T	24,4
33SV13/2AG300T	300,5	92SV2G150T	67,8	10SV13F0074T	37,9	92SV4G0404T	32,9
33SV13/1AG300T	306,9	92SV3/2AG185T	82,4	10SV15F0074T	44,1	92SV5G0554T	41,6
46SV1/1AG030T	19,5	92SV3G220T	102,2	10SV17F0114T	49,6	92SV6G0554T	49,5
46SV1G040T	27,2	92SV4/2AG300T	115,7	92SV19F0114T	55,2	92SV7G0754T	58
46SV2/2AG055T	38,8	92SV4G300T	133,1	10SV21F0114T	62,8	92SV8G0754T	65,9
46SV2G075T	52,6	92SV5/2AG370T	149	15SV03F0054T	10,7	125SV1G0114T	6,9
46SV3/2AG110T	64,7	92SV5G370T	166,4	15SV05F0054T	17,8	125SV2G0224T	13,5
46SV3G110T	80,8	92SV6/2AG450T	183,3	15SV07F0074T	24,6	125SV3/3BG0224T	17,5
46SV4/2AG150T	92,4	92SV6G450T	200,9	15SV09F0114T	32,8	125SV4/4BG030T	23,3
46SV4G150T	107,3	92SV7/2AG450T	216,8	15SV11F0114T	40,1	125SV5/5AG040T	31,4
46SV5/2AG185T	117,2	125SV1G075T	27,6	15SV13F0154T	47,6	125SV6G055T	40,4
46SV5G185T	134,5	125SV2G150T	53,8	15SV15F0154T	54,8	125SV7G075T	47,1
46SV6/2AG220T	143,7	125SV3G220T	80,7	15SV17F0224T	62,5	125SV8G075T	53,8
46SV6G220T	161	125SV4G300T	107,6	22SV04F0054T	14,9		
46SV7/2AG300T	171,3	125SV5G370T	134,5	22SV06F0114T	22,6		
46SV7G300T	188,6	125SV6G450T	161,4	22SV08F0114T	30,8		
46SV8/2AG300T	198,2	125SV7G550T	188,3	22SV10F0154T	38,6		
46SV8G300T	213,1	125SV8/2AG550T	211,5	22SV12F0224T	46		

T				T			
60 Hz 3500 min-1				60 Hz 3500 min-1			
1~	H (m)*	3~	H (m)*	1~	H (m)*	3~	H (m)*
1SV02F0036M	17,4	1SV02F0036T	17,4	-	-	5SV10F0306T	109,2
1SV03F0036M	25,7	1SV03F0036T	25,7	-	-	5SV11F0306T	119,9
1SV04F0036M	33,9	1SV04F0036T	33,9	-	-	5SV12F0306T	130,6
1SV05F0056M	43,6	1SV05F0056T	43,6	-	-	5SV13F0406T	142,5
1SV06F0056M	52,1	1SV06F0056T	52,1	-	-	5SV14F0406T	153,4
1SV07F0076M	61	1SV07F0076T	61	-	-	5SV15F0406T	164,2
1SV08F0076M	69,4	1SV08F0076T	69,4	-	-	5SV16F0406T	174,9
1SV09F0076M	77,9	1SV09F0076T	77,9	-	-	5SV17F0556T	186,4
1SV10F0116M	87,6	1SV10F0116T	87,6	-	-	5SV19F0556T	208
1SV11F0116M	96,2	1SV11F0116T	96,2	-	-	5SV21F0556T	229,6
1SV12F0116M	104,7	1SV12F0116T	104,7	-	-	5SV23F0556T	251
1SV13F0116M	113,2	1SV13F0116T	113,2	10SV01F0076M	17	10SV01F0076T	17
1SV15F0156M	131,2	1SV15F0156T	131,2	10SV02F0156M	34,2	10SV02F0156T	34,2
1SV17F0156M	148,3	1SV17F0156T	148,3	10SV03F0226M	51,8	10SV03F0226T	51,8
1SV18F0226M	158,4	1SV18F0226T	158,4	-	-	10SV04F0306T	69,2
1SV20F0226M	175,7	1SV20F0226T	175,7	-	-	10SV05F0406T	87,3
1SV22F0226M	192,9	1SV22F0226T	192,9	-	-	10SV06F0406T	104,5
1SV24F0226M	210,1	1SV24F0226T	210,1	-	-	10SV07F0556T	122,1
1SV26F0226M	227,3	1SV26F0226T	227,3	-	-	10SV08F0556T	139,2
1SV28F0306M	245,4	1SV28F0306T	245,4	-	-	10SV09F0756T	157,4
3SV02F0036M	21,3	3SV02F0036T	21,3	-	-	10SV10F0756T	174,7
3SV03F0056M	32,6	3SV03F0056T	32,6	-	-	10SV11F0756T	192
3SV04F0076M	43,4	3SV04F0076T	43,4	-	-	10SV13F1106T	226,7
3SV05F0116M	54,7	3SV05F0116T	54,7	-	-	10SV15F1106T	261,2
3SV06F0116M	65,4	3SV06F0116T	65,4	15SV01F0156M	19,9	15SV01F0156T	19,9
3SV07F0116M	76,1	3SV07F0116T	76,1	-	-	15SV02F0306T	41,9
3SV08F0156M	87,2	3SV08F0156T	87,2	-	-	15SV03F0406T	63
3SV09F0156M	97,8	3SV09F0156T	97,8	-	-	15SV04F0556T	83,9
3SV10F0226M	109,5	3SV10F0226T	109,5	-	-	15SV05F0756T	105,4
3SV11F0226M	120,3	3SV11F0226T	120,3	-	-	15SV06F1106T	126,7
3SV12F0226M	131	3SV12F0226T	131	-	-	15SV07F1106T	147,6
3SV13F0226M	141,8	3SV13F0226T	141,8	-	-	15SV08F1506T	171,9
3SV14F0226M	152,5	3SV14F0226T	152,5	-	-	15SV09F1506T	193,2
-	-	3SV15F0306T	164,4	-	-	15SV10F1506T	214,4

T				T			
60 Hz 3500 min-1				60 Hz 3500 min-1			
~	H (m)*	3~	H (m)*	1~	H (m)*	3~	H (m)*
-	-	3SV17F0306T	185,9	-	-	15SV11F1856T	236,4
-	-	3SV19F0306T	207,3	-	-	15SV12F1856T	257,8
-	-	3SV21F0406T	230,9	22SV01F0226M	22,2	22SV01F0226T	22,2
-	-	3SV23F0406T	252,5	-	-	22SV02F0406T	44,5
5SV02F0056M	21,9	5SV02F0056T	21,9	-	-	22SV03F0556T	66,7
5SV03F0076M	32,7	5SV03F0076T	32,7	-	-	22SV04F0756T	89
5SV04F0116M	43,9	5SV04F0116T	43,9	-	-	22SV05F1106T	111,5
5SV05F0156M	55	5SV05F0156T	55	-	-	22SV06F1106T	133,5
5SV06F0156M	65,9	5SV06F0156T	65,9	-	-	22SV07F1506T	156,4
5SV07F0226M	76,5	5SV07F0226T	76,5	-	-	22SV08F1506T	178,6
5SV08F0226M	87,2	5SV08F0226T	87,2	-	-	22SV09F1856T	201,3
5SV09F0226M	97,8	5SV09F0226T	97,8	-	-	22SV10F1856T	223,5

T				T			
60 Hz 3500 min-1				60 Hz 3500 min-1			
3~	H (m)*	3~	H (m)*	3~	H (m)*	3~	H (m)*
33SV1/1AG0306T	24,5	33SV7/1AG3006T	233,9	46SV5G3706T	194,6	66SV5/2AG4506T	191,9
33SV1G0556T	34,5	33SV7G3006T	243,3	46SV6/2AG3706T	210,5	66SV5/1AG4506T	202
33SV2/2AG0556T	49,6	33SV8/2AG3706T	259,3	46SV6/1AG3706T	222	66SV5G4506T	212,2
33SV2/1AG0756T	59,6	33SV8/1AG3706T	268,7	46SV6G3706T	233,6	92SV1/1AG1106T	36,4
33SV2G1106T	69,4	33SV8G3706T	278,1	46SV7/2AG4506T	250,3	92SV1G1506T	49,5
33SV3/2AG1106T	86	46SV1/1AG0556T	29,1	46SV7/1AG4506T	261,8	92SV2/2AG1856T	69,9
33SV3/1AG1106T	94,7	46SV1G0756T	39,9	46SV7G4506T	273,4	92SV2/1AG2206T	83,6
33SV3G1506T	104,2	46SV2/2AG1106T	56,7	66SV1/1AG0756T	31,4	92SV2G3006T	97,9
33SV4/2AG1506T	119,8	46SV2/1AG1106T	67,8	66SV1G1106T	43,8	92SV3/2AG3706T	117,4
33SV4/1AG1506T	128,9	46SV2G1506T	78,2	66SV2/2AG1506T	64,5	92SV3/1AG3706T	131,5
33SV4G1856T	138,3	46SV3/2AG1856T	95,5	66SV2/1AG1856T	74,9	92SV3G4506T	144,9
33SV5/2AG1856T	155,8	46SV3/1AG1856T	106,1	66SV2G1856T	85,4	92SV4/2AG4506T	163
33SV5/1AG2206T	163,9	46SV3G1856T	117,2	66SV3/2AG2206T	106,6	125SV1G1506T	40,1
33SV5G2206T	173	46SV4/2AG2206T	134,1	66SV3/1AG3006T	117,4	125SV2/2AG2206T	73
33SV6/2AG2206T	189	46SV4/1AG3006T	144,2	66SV3G3006T	127,8	125SV3/3BG3006T	101,9
33SV6/1AG3006T	199,2	46SV4G3006T	155,7	66SV4/2AG3706T	149,1	125SV3G3706T	117,5
33SV6G3006T	208,5	46SV5/2AG3006T	171,6	66SV4/1AG3706T	159,2	125SV4/4AG4506T	146,1
33SV7/2AG3006T	224,6	46SV5/1AG3006T	183,1	66SV4G3706T	169,3	125SV5/5AG5506T	182,6

T				T			
60 Hz 1,750 min-1				60 Hz 1,750 min-1			
3~	H (m)*	3~	H (m)*	3~	H (m)*	3~	H (m)*
1SV03F00246T	6,6	5SV07F00246T	18,8	22SV04F01146T	22,2	46SV11G11046T	105,7
1SV05F00246T	11	5SV09F00346T	24	22SV05F01546T	27,7	46SV12G11046T	115,3
1SV07F00246T	15,3	5SV11F00346T	29,5	22SV06F01546T	33,3	46SV13G11046T	124,9
1SV09F00246T	19,6	5SV13F00546T	34,7	22SV07F02246T	39,1	66SV1G01546T	10,8
1SV11F00246T	23,9	5SV15F00546T	40,4	22SV08F02246T	44,6	66SV2G03046T	21,1
1SV13F00246T	28,2	5SV17F00546T	45,6	22SV09F02246T	50,1	66SV3G04046T	31,4
1SV15F00246T	32,4	5SV19F00746T	50,8	22SV10F03046T	55,6	66SV4G05546T	42
1SV17F00246T	36,6	5SV21F00746T	56,7	33SV2G01146T	17	66SV5G07546T	52,5
1SV18F00246T	38,7	5SV23F00746T	61,9	33SV3G01546T	25,7	66SV6G07546T	62,7
1SV20F00246T	42,9	10SV03F00546T	13	33SV4G02246T	34	66SV7G11046T	73,2
1SV22F00246T	47	10SV05F00546T	21,6	33SV5G03046T	42,7	66SV8G11046T	83,7
1SV24F00246T	51,1	10SV07F00746T	29,9	33SV6G03046T	51,5	92SV1G01546T	11,8
1SV26F00346T	55,2	10SV09F00746T	38,5	33SV7G04046T	59,9	92SV2G03046T	23,4
1SV28F00346T	60	10SV11F01146T	47,8	33SV8G05546T	69	92SV3G05546T	35,4
3SV02F00246T	5,5	10SV13F01146T	56,2	33SV9G05546T	77,5	92SV4G07546T	47,2
3SV04F00246T	10,9	10SV15F01546T	65,1	33SV10G05546T	85,9	92SV5G07546T	58,5
3SV06F00246T	16,3	15SV03F00546T	15,4	33SV11G07546T	94,9	92SV6G11046T	70,2
3SV08F00246T	21,6	15SV04F00746T	20,6	33SV12G07546T	103,3	92SV7G11046T	81,9
3SV10F00246T	26,8	15SV05F01146T	26,2	33SV13G07546T	111,8	92SV8G15046T	93,6
3SV12F00246T	32	15SV06F01146T	31,3	46SV2G01546T	19	125SV1G02246T	10
3SV14F00346T	37,6	15SV07F01546T	36,7	46SV3G02246T	28,8	125SV2/2AG03046T	18,3
3SV15F00346T	40,4	15SV08F01546T	42,4	46SV4G03046T	37,9	125SV3/3BG04046T	25,5
3SV17F00346T	45,5	15SV09F02246T	48	46SV5G04046T	47,6	125SV4/4AG05546T	36,5
3SV19F00346T	50,7	15SV10F02246T	53,3	46SV6G05546T	57,7	125SV5/5AG07546T	45,6
3SV21F00546T	55,8	15SV11F02246T	58,5	46SV7G05546T	67,1	125SV6G11046T	58,7
3SV23F00546T	61,9	15SV12F02246T	63,8	46SV8G07546T	77	125SV7G11046T	68,5
5SV03F00246T	8,3	22SV02F00546T	11	46SV9G07546T	86,4	125SV8G15046T	78,3
5SV05F00246T	13,7	22SV03F00746T	16,5	46SV10G07546T	95,7		

T				T			
60 Hz 3500 min-1				60 Hz 3500 min-1			
~	H (m)*	3~	H (m)*	1~	H (m)*	3~	H (m)*
-	-	3SV17F0306T	185,9	-	-	15SV11F1856T	236,4
-	-	3SV19F0306T	207,3	-	-	15SV12F1856T	257,8
-	-	3SV21F0406T	230,9	22SV01F0226M	22,2	22SV01F0226T	22,2
-	-	3SV23F0406T	252,5	-	-	22SV02F0406T	44,5
5SV02F0056M	21,9	5SV02F0056T	21,9	-	-	22SV03F0556T	66,7
5SV03F0076M	32,7	5SV03F0076T	32,7	-	-	22SV04F0756T	89
5SV04F0116M	43,9	5SV04F0116T	43,9	-	-	22SV05F1106T	111,5
5SV05F0156M	55	5SV05F0156T	55	-	-	22SV06F1106T	133,5
5SV06F0156M	65,9	5SV06F0156T	65,9	-	-	22SV07F1506T	156,4
5SV07F0226M	76,5	5SV07F0226T	76,5	-	-	22SV08F1506T	178,6
5SV08F0226M	87,2	5SV08F0226T	87,2	-	-	22SV09F1856T	201,3
5SV09F0226M	97,8	5SV09F0226T	97,8	-	-	22SV10F1856T	223,5

T				T			
60 Hz 3500 min-1				60 Hz 3500 min-1			
3~	H (m)*	3~	H (m)*	3~	H (m)*	3~	H (m)*
33SV1/1AG0306T	24,5	33SV7/1AG3006T	233,9	46SV5G3706T	194,6	66SV5/2AG4506T	191,9
33SV1G0556T	34,5	33SV7G3006T	243,3	46SV6/2AG3706T	210,5	66SV5/1AG4506T	202
33SV2/2AG0556T	49,6	33SV8/2AG3706T	259,3	46SV6/1AG3706T	222	66SV5G4506T	212,2
33SV2/1AG0756T	59,6	33SV8/1AG3706T	268,7	46SV6G3706T	233,6	92SV1/1AG1106T	36,4
33SV2G1106T	69,4	33SV8G3706T	278,1	46SV7/2AG4506T	250,3	92SV1G1506T	49,5
33SV3/2AG1106T	86	46SV1/1AG0556T	29,1	46SV7/1AG4506T	261,8	92SV2/2AG1856T	69,9
33SV3/1AG1106T	94,7	46SV1G0756T	39,9	46SV7G4506T	273,4	92SV2/1AG2206T	83,6
33SV3G1506T	104,2	46SV2/2AG1106T	56,7	66SV1/1AG0756T	31,4	92SV2G3006T	97,9
33SV4/2AG1506T	119,8	46SV2/1AG1106T	67,8	66SV1G1106T	43,8	92SV3/2AG3706T	117,4
33SV4/1AG1506T	128,9	46SV2G1506T	78,2	66SV2/2AG1506T	64,5	92SV3/1AG3706T	131,5
33SV4G1856T	138,3	46SV3/2AG1856T	95,5	66SV2/1AG1856T	74,9	92SV3G4506T	144,9
33SV5/2AG1856T	155,8	46SV3/1AG1856T	106,1	66SV2G1856T	85,4	92SV4/2AG4506T	163
33SV5/1AG2206T	163,9	46SV3G1856T	117,2	66SV3/2AG2206T	106,6	125SV1G1506T	40,1
33SV5G2206T	173	46SV4/2AG2206T	134,1	66SV3/1AG3006T	117,4	125SV2/2AG2206T	73
33SV6/2AG2206T	189	46SV4/1AG3006T	144,2	66SV3G3006T	127,8	125SV3/3BG3006T	101,9
33SV6/1AG3006T	199,2	46SV4G3006T	155,7	66SV4/2AG3706T	149,1	125SV3G3706T	117,5
33SV6G3006T	208,5	46SV5/2AG3006T	171,6	66SV4/1AG3706T	159,2	125SV4/4AG4506T	146,1
33SV7/2AG3006T	224,6	46SV5/1AG3006T	183,1	66SV4G3706T	169,3	125SV5/5AG5506T	182,6

T				T			
60 Hz 1,750 min-1				60 Hz 1,750 min-1			
3~	H (m)*	3~	H (m)*	3~	H (m)*	3~	H (m)*
1SV03F00246T	6,6	5SV07F00246T	18,8	22SV04F01146T	22,2	46SV11G11046T	105,7
1SV05F00246T	11	5SV09F00346T	24	22SV05F01546T	27,7	46SV12G11046T	115,3
1SV07F00246T	15,3	5SV11F00346T	29,5	22SV06F01546T	33,3	46SV13G11046T	124,9
1SV09F00246T	19,6	5SV13F00546T	34,7	22SV07F02246T	39,1	66SV1G01546T	10,8
1SV11F00246T	23,9	5SV15F00546T	40,4	22SV08F02246T	44,6	66SV2G03046T	21,1
1SV13F00246T	28,2	5SV17F00546T	45,6	22SV09F02246T	50,1	66SV3G04046T	31,4
1SV15F00246T	32,4	5SV19F00746T	50,8	22SV10F03046T	55,6	66SV4G05546T	42
1SV17F00246T	36,6	5SV21F00746T	56,7	33SV2G01146T	17	66SV5G07546T	52,5
1SV18F00246T	38,7	5SV23F00746T	61,9	33SV3G01546T	25,7	66SV6G07546T	62,7
1SV20F00246T	42,9	10SV03F00546T	13	33SV4G02246T	34	66SV7G11046T	73,2
1SV22F00246T	47	10SV05F00546T	21,6	33SV5G03046T	42,7	66SV8G11046T	83,7
1SV24F00246T	51,1	10SV07F00746T	29,9	33SV6G03046T	51,5	92SV1G01546T	11,8
1SV26F00346T	55,2	10SV09F00746T	38,5	33SV7G04046T	59,9	92SV2G03046T	23,4
1SV28F00346T	60	10SV11F01146T	47,8	33SV8G05546T	69	92SV3G05546T	35,4
3SV02F00246T	5,5	10SV13F01146T	56,2	33SV9G05546T	77,5	92SV4G07546T	47,2
3SV04F00246T	10,9	10SV15F01546T	65,1	33SV10G05546T	85,9	92SV5G07546T	58,5
3SV06F00246T	16,3	15SV03F00546T	15,4	33SV11G07546T	94,9	92SV6G11046T	70,2
3SV08F00246T	21,6	15SV04F00746T	20,6	33SV12G07546T	103,3	92SV7G11046T	81,9
3SV10F00246T	26,8	15SV05F01146T	26,2	33SV13G07546T	111,8	92SV8G15046T	93,6
3SV12F00246T	32	15SV06F01146T	31,3	46SV2G01546T	19	125SV1G02246T	10
3SV14F00346T	37,6	15SV07F01546T	36,7	46SV3G02246T	28,8	125SV2/2AG03046T	18,3
3SV15F00346T	40,4	15SV08F01546T	42,4	46SV4G03046T	37,9	125SV3/3BG04046T	25,5
3SV17F00346T	45,5	15SV09F02246T	48	46SV5G04046T	47,6	125SV4/4AG05546T	36,5
3SV19F00346T	50,7	15SV10F02246T	53,3	46SV6G05546T	57,7	125SV5/5AG07546T	45,6
3SV21F00546T	55,8	15SV11F02246T	58,5	46SV7G05546T	67,1	125SV6G11046T	58,7
3SV23F00546T	61,9	15SV12F02246T	63,8	46SV8G07546T	77	125SV7G11046T	68,5
5SV03F00246T	8,3	22SV02F00546T	11	46SV9G07546T	86,4	125SV8G15046T	78,3
5SV05F00246T	13,7	22SV03F00746T	16,5	46SV10G07546T	95,7		

11. VASCO Inverter O&M Manual

3. Technical Characteristics

Model	Vin +/- 15% [V]	Max V out [V]	Max I in [A]	Max I out [A]	P2 motor power* [kW]	Size
VASCO 209	1 x 230	1 x Vin	15	9	1,1	1
		3 x Vin		7	1,5	1
VASCO 214	1 x 230	1 x Vin	20	9	1,1	1
		3 x Vin		11	3	1
VASCO 218	1 x 230	3 x Vin	38	18	4	2
VASCO 225	1 x 230	3 x Vin	53	25	5,5	2
VASCO 306	3 x 230	3 x Vin	10	6	1,1	1
VASCO 309	3 x 230	3 x Vin	13,5	9	2,2	1
VASCO 314	3 x 230	3 x Vin	16	14	3	2
VASCO 318	3 x 230	3 x Vin	21	18	4	2
VASCO 325	3 x 230	3 x Vin	31	25	5,5	2
VASCO 330	3 x 230	3 x Vin	35	30	7,5	2
VASCO 338	3 x 230	3 x Vin	42	38	9,2	3
VASCO 348	3 x 230	3 x Vin	52	48	11	3
VASCO 365	3 x 230	3 x Vin	68	65	15	3
VASCO 375	3 x 230	3 x Vin	78	75	18,5	3
VASCO 385	3 x 230	3 x Vin	88	85	22	3
VASCO 406	3 x 380 - 460	3 x Vin	10	6	2,2	1
VASCO 409	3 x 380 - 460	3 x Vin	13,5	9	4	1
VASCO 414	3 x 380 - 460	3 x Vin	16	14	5,5	2
VASCO 418	3 x 380 - 460	3 x Vin	21	18	7,5	2
VASCO 425	3 x 380 - 460	3 x Vin	31	25	11	2
VASCO 430	3 x 380 - 460	3 x Vin	35	30	15	2
VASCO 438	3 x 380 - 460	3 x Vin	42	38	18,5	3
VASCO 448	3 x 380 - 460	3 x Vin	52	48	22	3
VASCO 465	3 x 380 - 460	3 x Vin	68	65	30	3
VASCO 475	3 x 380 - 460	3 x Vin	78	75	37	3
VASCO 485	3 x 380 - 460	3 x Vin	88	85	45	3

- Power frequency: 50 - 60 Hz (+/- 2%)
- Max. ambient temperature at nominal current: 40°C (104 °F)
- Max. altitude at nominal current: 1000 m
- Grade of protection: IP55 (SIZE 1,2) , IP54 (SIZE 3) *
- RS485 serial communication

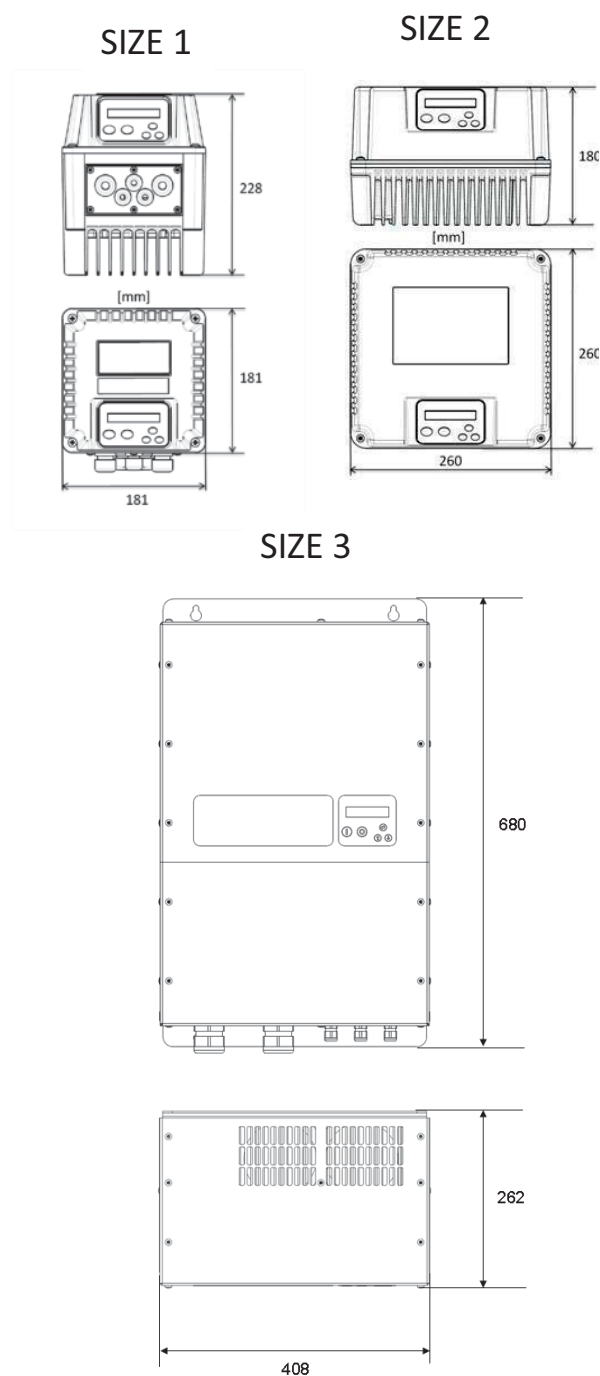
* auxiliary cooling fan of the VASCO, used in wall mounted applications, has a protection rating of IP54.

VASCO is able to power the motor with a higher current for a short period of time according to the linear relation: 101% of the nominal current for 10min., 110% nominal current for 1 min.

3.1 Weight and dimensions

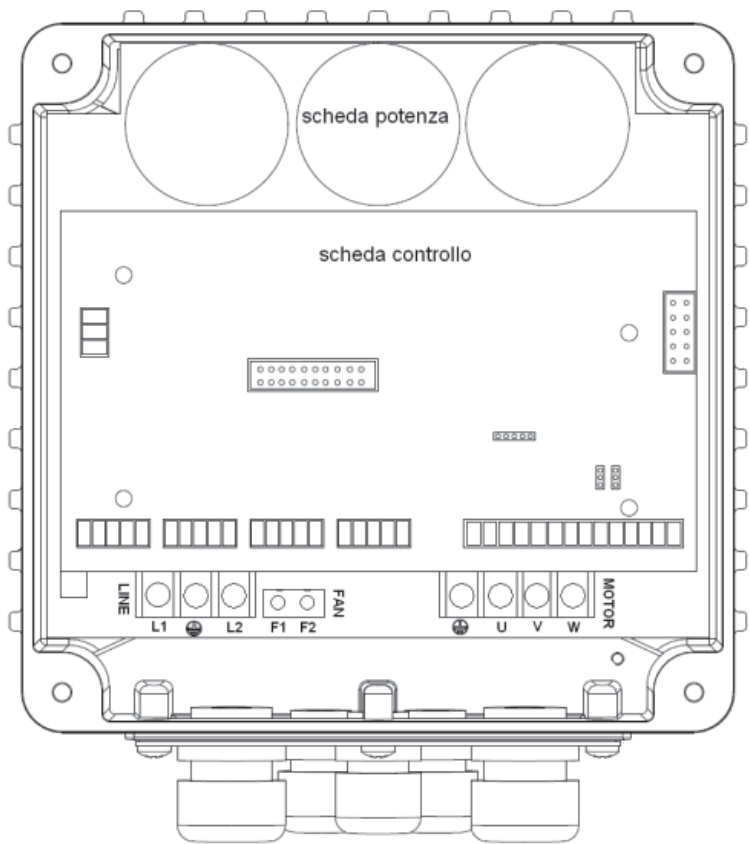
Model	Weight *	Size
	[Kg]	
VASCO 209	4	1
VASCO 214	4,3	1
VASCO 218	7,2	2
VASCO 225	7,2	2
VASCO 306	4,4	1
VASCO 309	4,4	1
VASCO 314	7	2
VASCO 318	7	2
VASCO 325	7	2
VASCO 330	7,2	2
VASCO 338	33	3
VASCO 348	33	3
VASCO 465	34	3
VASCO 375	34	3
VASCO 385	34	3
VASCO 406	4,4	1
VASCO 409	4,4	1
VASCO 414	7	2
VASCO 418	7	2
VASCO 425	7	2
VASCO 430	7,2	2
VASCO 438	33	3
VASCO 448	33	3
VASCO 465	34	3
VASCO 475	34	3
VASCO 485	34	3

* Weight without packing.



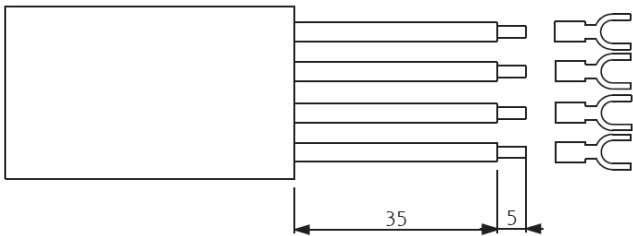
4. Electric wiring

Power board VASCO 209,214

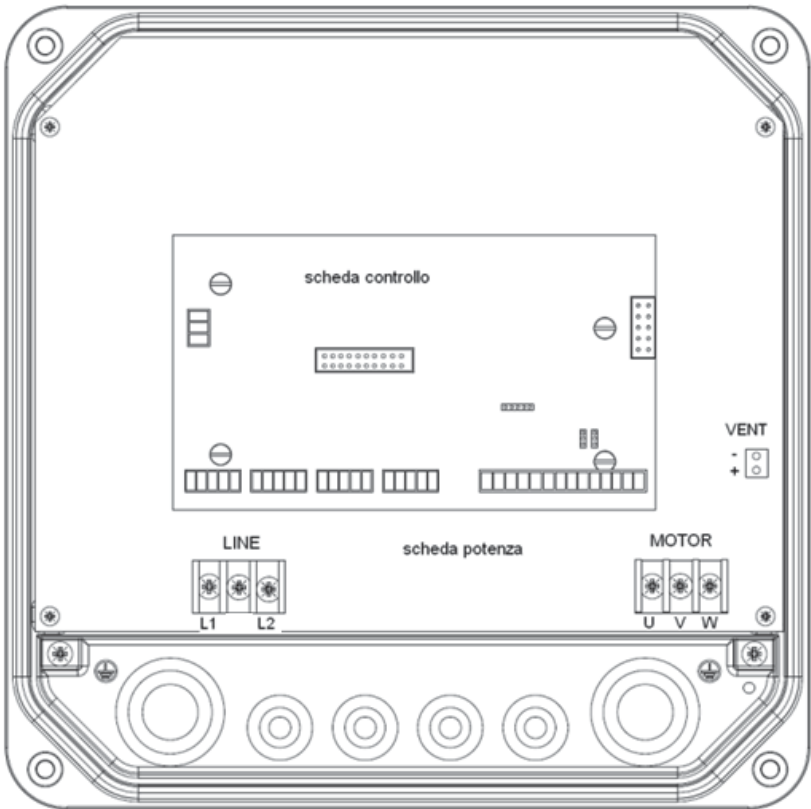


Power supply: LINE: L1, L2,GND It is recommended to use cable lugs	Output: 3 ph motor: GND,U,V,W, 1 ph motor: earth, U (running), V (common) It is recommended to use cable lugs.	230 V AC auxiliary fans (wall mounting kit) FAN: F1, F2
---	---	--

Recommended line and motor cables stripping

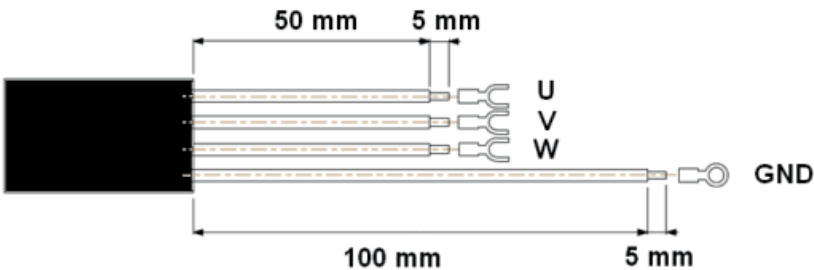


Power board VASCO 218, 225

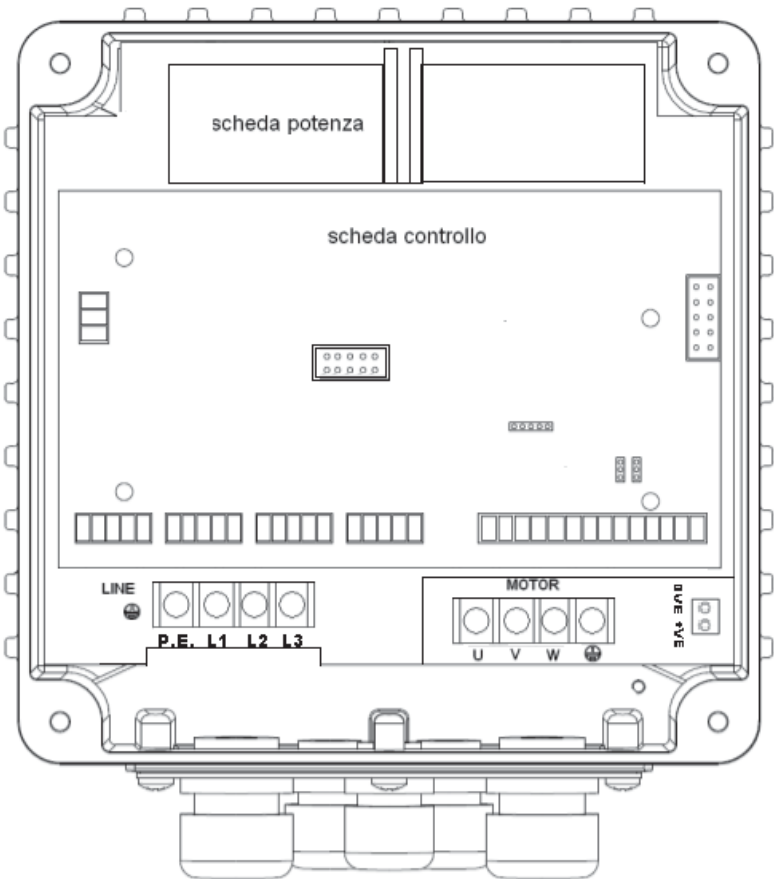


Power supply: LINE: L1, L2, GND It is recommended to use cable lugs.	Motor output: MOTOR: U, V, W, GND It is recommended to use cable lugs.	12 V dc auxiliary fans (wall mounting kit) VENT: +, - WARNING: respect the polarity.
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Cable stripping recommended for line input and output to the motor.

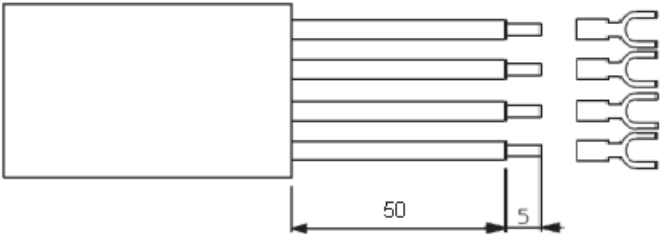


Power board VASCO 306,309,406,409

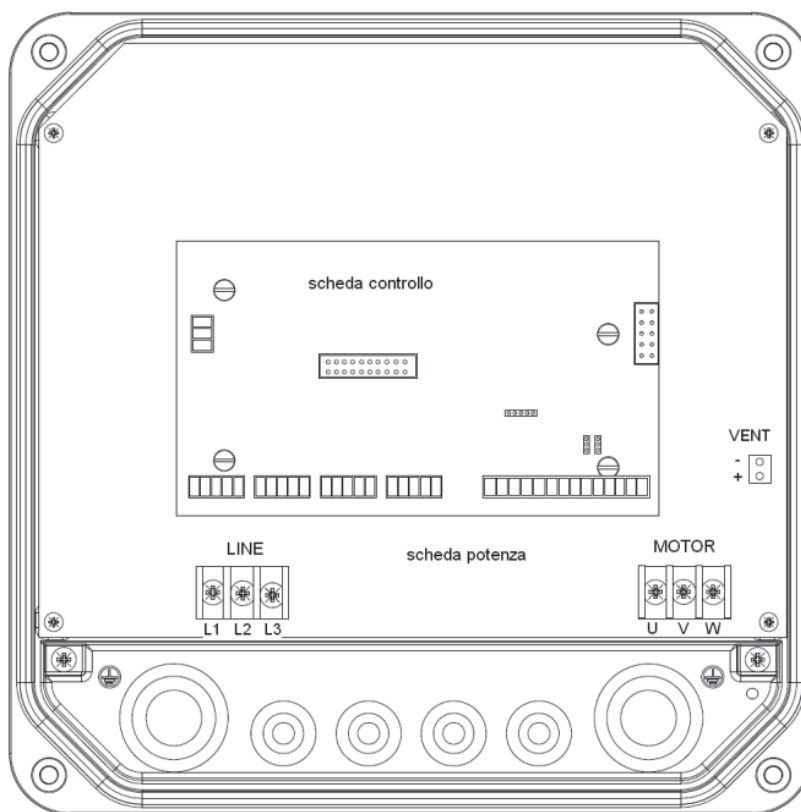


<p>Power supply:</p> <p>LINE: GND , L1, L2, L3,</p> <p>It is recommended to use cable lugs.</p>	<p>Motor output:</p> <p>MOTOR: U, V, W, GND</p> <p>It is recommended to use cable lugs.</p>	<p>12 V dc auxiliary fan (wall mounting kit) :</p> <p>OVE, + VE</p> <p>WARNING: respect the polarity.</p>
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Cable stripping recommended for line input and output to the motor.

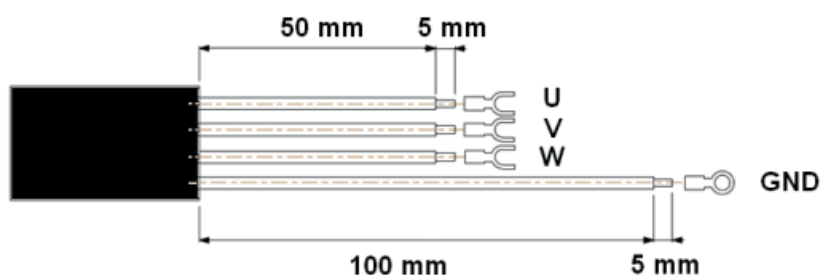


Power board VASCO 314,318,325,330,414,418,425,430

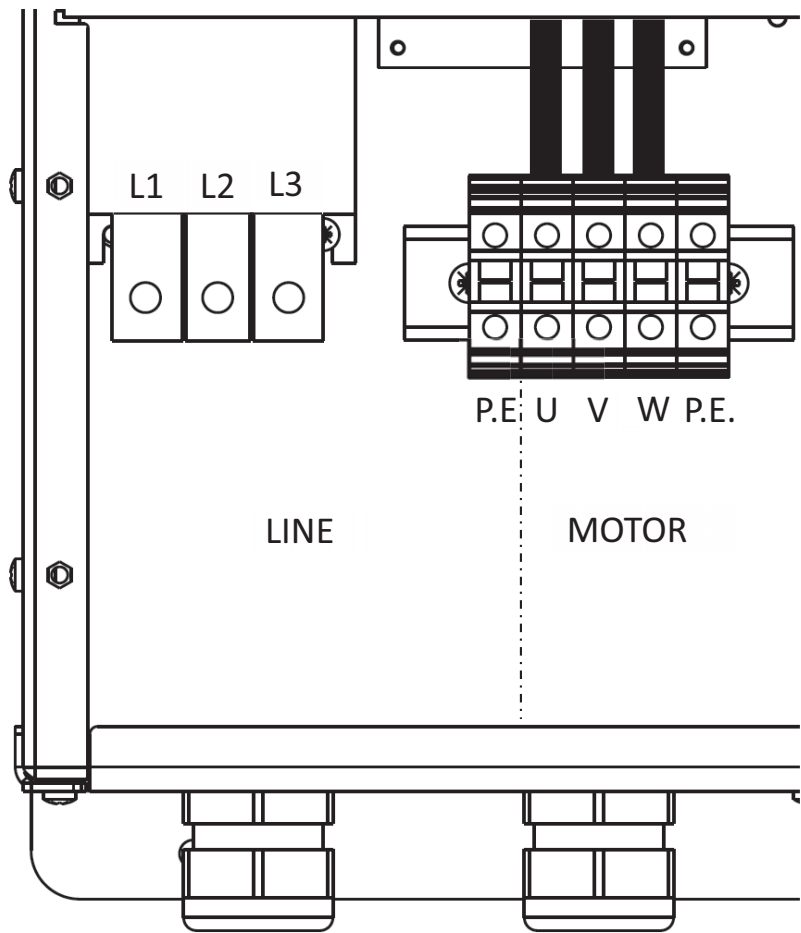


Power supply: LINE: L1, L2, L3, GND It is recommended to use cable lugs.	Motor output: MOTOR: U, V, W, GND It is recommended to use cable lugs.	12 V dc auxiliary fans (wall mounting kit) VENT: +, - WARNING: respect the polarity.
--	--	--

Cable stripping recommended for line input and output to the motor.



Power board VASCO 338,348,365,375,385,438,448,465,475,485

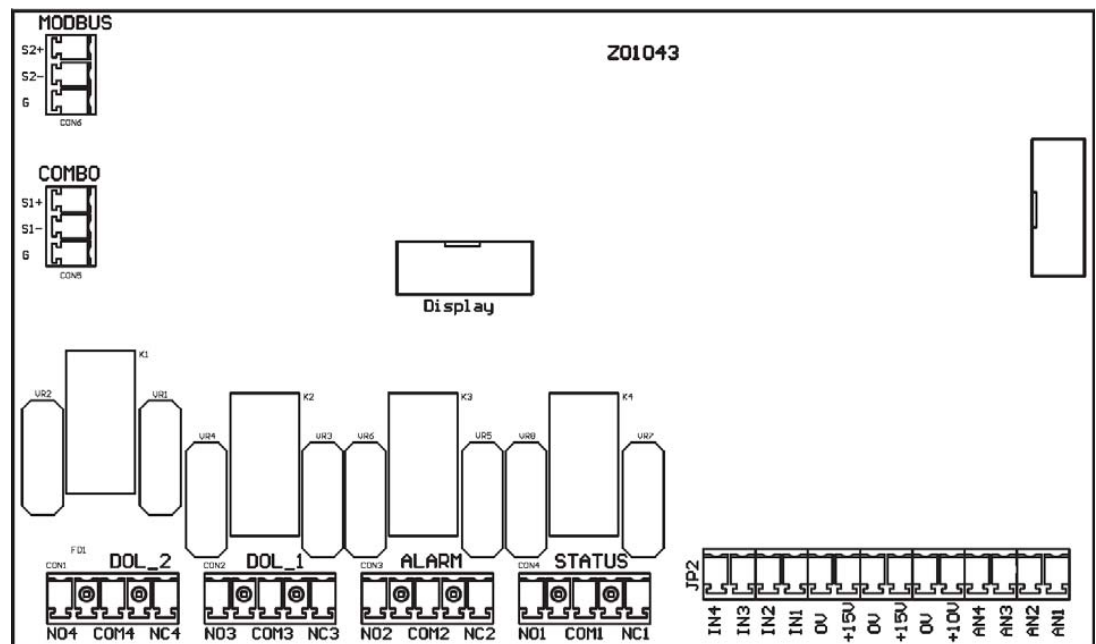


Power supply: LINE: L1, L2, L3, P.E. It is recommended to use cable lugs.	Motor output: MOTOR: U, V, W, P.E. It is recommended to use cable lugs.
--	--

Cable stripping recommended for line input and output to the motor.



Control board



<p>Analog inputs (10 or 15 Vdc):</p> <ol style="list-style-type: none"> 1. AN1: 4-20 mA: sensor 1 2. AN2: 4-20 mA: sensor 2 3. AN3: 4-20 mA / 0 - 10 Vdc (settable by jumper C.C.): external set 4. AN4: 4-20 mA / 0 - 10 Vdc (settable by C.C.): trimmer for frequency regulation / external set 2 	<p>Digital outputs:</p> <ul style="list-style-type: none"> • motor run signal: NO1, COM1: closed contact with motor running. NC1, COM1: closed contact with motor stopped. • alarm signal NO2, COM2: closed contact without alarm. NC2, COM2: closed contact with alarm or no power supply. • DOL1 pump relay: NO3, COM3: closed contact with DOL1 running. NC3, COM3: opened contact with DOL1 running. • DOL2 pump relay: NO4, COM4: closed contact with DOL2 running. NC4, COM4: opened contact with DOL2 running. 	<p>RS485 for COMBO:</p> <ul style="list-style-type: none"> • S1+ • S1- • G <p>It is recommended to respect the polarity linking more VASCOs in series.</p>
<p>Digital inputs:</p> <ul style="list-style-type: none"> • IN1 : motor start & stop • IN2: value set 1 & 2 switching • IN3: sensor 1 & 2 switching • IN4 : motor start & stop + alarms reset • 0V <p>We recommend using only no voltage contacts. Opening or closing the digital contacts (depending on software configuration set (see IN/OUT. parameters) you can start or stop the motor.</p>	<p>Relays are no voltage contacts. Max. voltage to the contacts is 250 V with max current of 5 A.</p>	<p>RS485 for MODBUS:</p> <ul style="list-style-type: none"> • S2+ • S2- • G <p>It is recommended to respect the polarity.</p>

4.1 Protections

The protections required upstream each VASCOs depends on the type of installation, and local regulations. We recommend to use overload protection with the characteristic curve of type C and type B circuit breaker, sensitive to both AC and DC current.

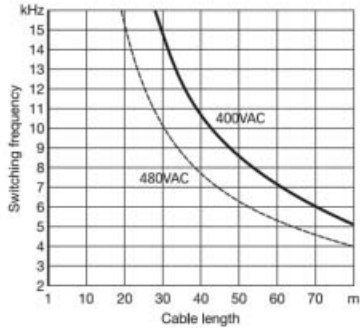

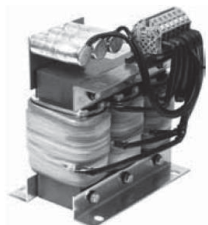
4.2 Electromagnetic compliance

To ensure electromagnetic compatibility (EMC) of the system, it is necessary to apply the following measures:

- Always connect the device to ground
- Use shielded signal cables by placing the screen at one end.
- Use motor cable as short as possible (<1 m / <3 ft). For longer lengths, it is recommended to use shielded cables connecting the screen at both ends.
- Separate signal, motor, and power supply cables.

Note: To enable the restoration of the display screen when there are electromagnetic interference, VASCO periodically provides some fast "refresh" of the display.

4.3 Installation with long motor cables

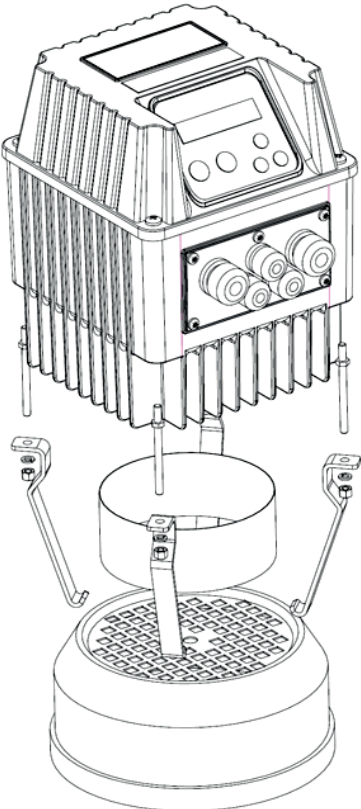
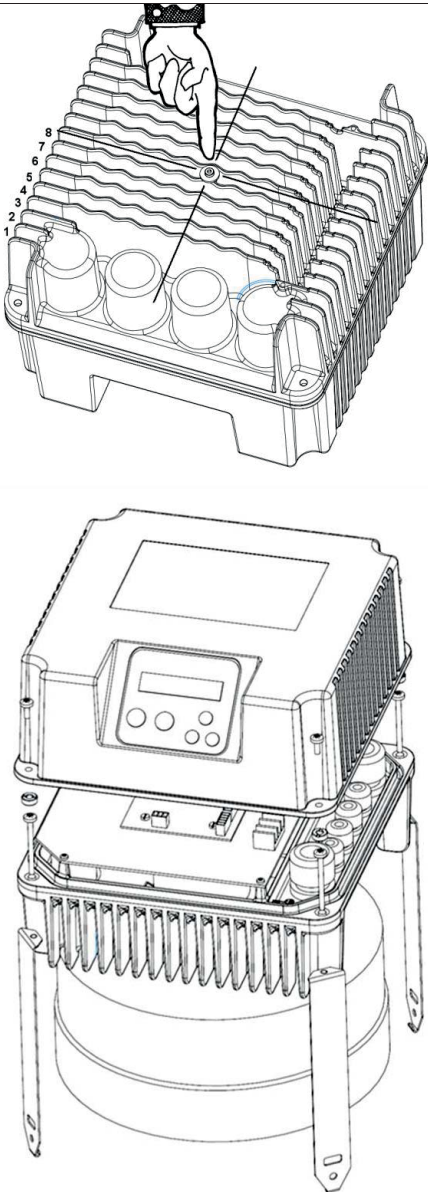
<p>With long motor cables it's recommended to decrease the commutation frequency from 10 kHz (default) to 2.5 kHz (Motor parameters). This reduces the probability of voltage spikes in the motor windings which may damage the insulation.</p>	<div data-bbox="986 891 1347 1218"></div> <p>To prevent dangerous overheating of dv / dt and sinusoidal filters it is recommended to set the correct PWM value in relation to the cable length.</p>
<p>For motor cable lengths up to 50 meters it's recommended to place between VASCO and motor a dv / dt reactance, available on request.</p> <div data-bbox="539 1473 708 1688"></div>	<p>For motor cable lengths greater than 50 meters it's recommended to place between VASCO and motor a sinusoidal filter, available on request.</p> <div data-bbox="1059 1473 1267 1697"></div>

5. VASCO installation

VASCO can be installed directly on the fan cover of the motor or mounted on the wall.

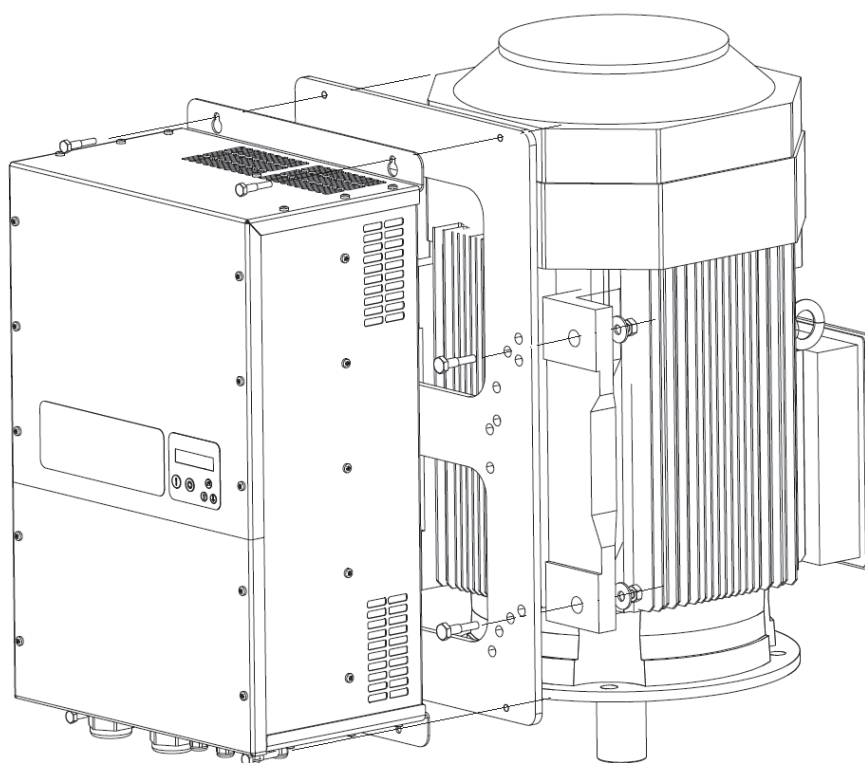
Motor mounting kit

In this application VASCO is cooled by the motor fan. Motor kit (available upon request) allows a solid coupling of the two units and it is composed of:

VASCO SIZE 1	VASCO SIZE 2
<ul style="list-style-type: none">n.° 4 rodsn.° 4 M5 nutsn.° 4 hooksn.° 1 cooling ring	<ul style="list-style-type: none">n.° 4 M5 screws.n.° 4 clampsn.° 4 clips to add if necessaryn.° 1 centre pin
<div><p>Use the cooling ring for best cooling of VASCO during operation. Warning: when using the cooling ring, the cooling air of the motor is slightly warmer than without the VASCO; if the resulting motor temperature exceeds the indicated maximum allowable value, remove the cooling ring, leaving the VASCO to be cooled by itself.</p></div>	<div></div>

VASCO SIZE 3

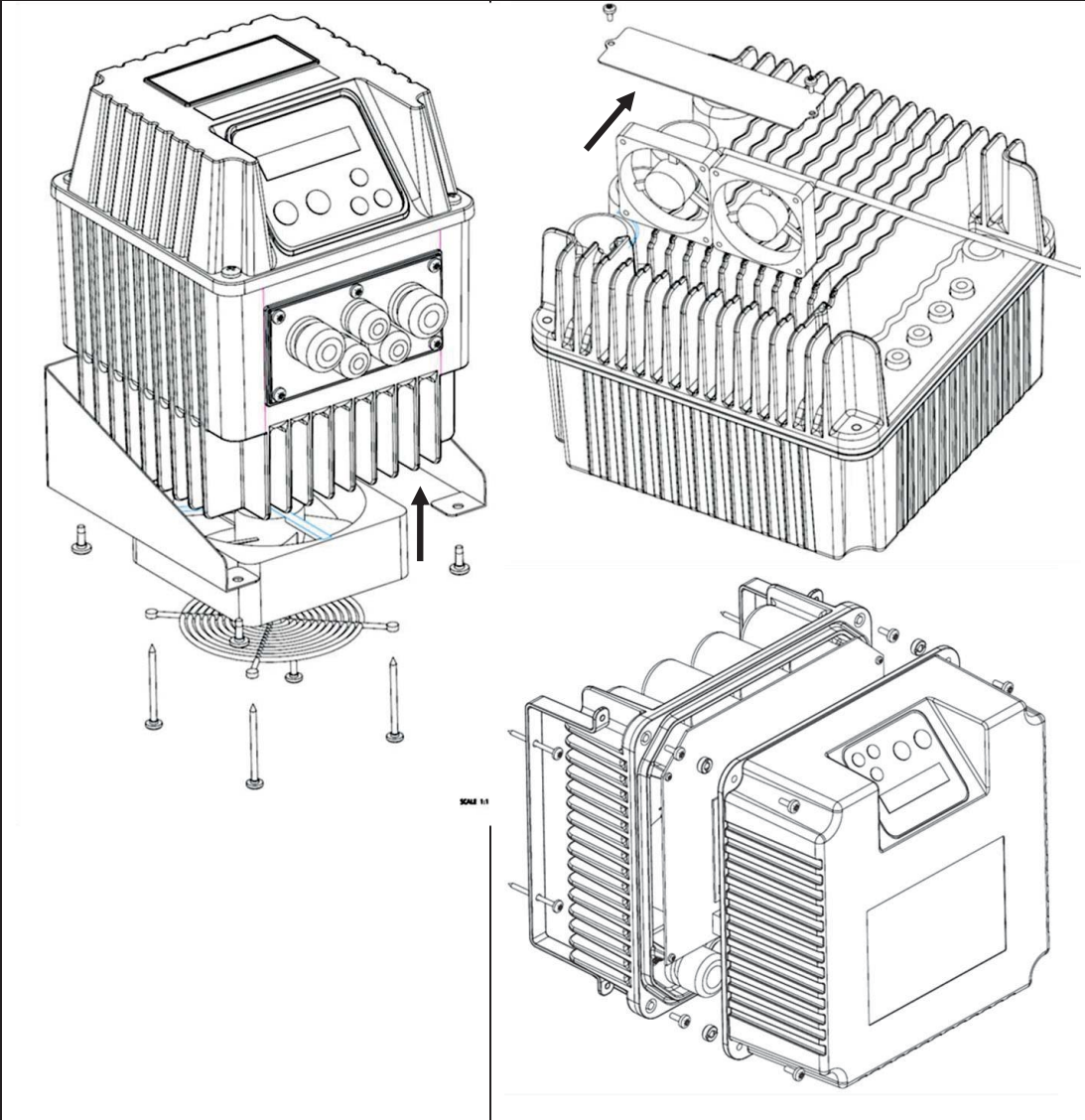
- n.° 1 motor feet adaptor for MEC160,180,200,225
- n.° 4 M8 bolts,
- n.° 4 M10 bolts, nuts and washer



Wall mounting kit

In this application VASCO is cooled independently by its auxiliary cooling fan integrated in the radiator.
Wall-mounted kit is composed of:

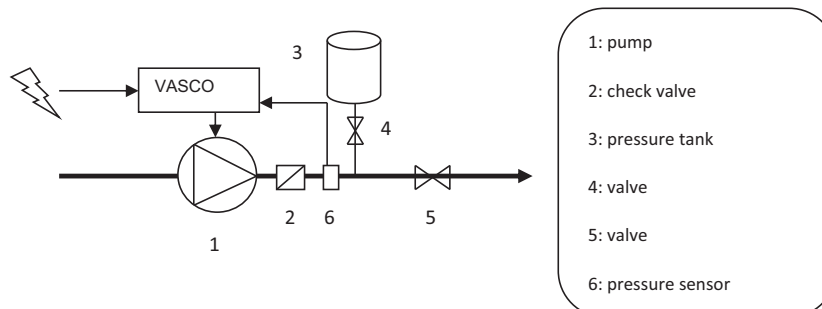
VASCO SIZE 1	VASCO SIZE 2
<ul style="list-style-type: none">n.° 1 auxiliary fan 230V AC (VASCO 209,214) or 12 VDC (VASCO 306,309,406,409)n.° 4 screws to fix cooling fann.° 1 protection grilln.° 1 metal bracket in AISI 304n.° 4 screws to fix VASCO to wall bracket	<ul style="list-style-type: none">n.° 2 12 V DC fans.n.° 1 fans cover.n.° 2 fans cover fixing screwsn.° 2 wall fixing bracketsn.° 4 M5 screws for VASCO fixing to the bracketsn.° 1 holes reference sheet



Make sure the manufacturer that the electric motor is suited for operation in the inverter
Make sure to properly attach the grid of the auxiliary cooling fan.
Make sure to remove the auxiliary cooling fan if VASCO is coupled to a motor. Failure to do so creates a high risk of overheating the motor and VASCO unit.

5.1 VASCO Installation for constant pressure control

VASCO controls the pump speed to maintain constant pressure at a set point independent of the water demand in the system. A basic schematic is shown below:



5.1.1 Pressure tank

Installation of a pressure tank in the hydraulic system is recommended to compensate leakage of water in the system (or during minimum water demand) and to avoid continuous start/stop cycling of the pump (check the appendix for more information). Selecting the proper volume and pre-charge pressure of the tank is very important; smaller tank volumes will not compensate adequately for minimum water usage or leakage, while larger volumes make it more difficult for VASCO to control the pressure evenly.

Recommended tank volume is equal to the 10% of the maximum water flow of the system (expressed in volume unit/min)

Example: if the max water flow is 50 liters/min, the pressure tank should have a capacity of 5 liters

If the max water flow is 20 gpm, the pressure tank should have a capacity of 2 gallons

Pre-charge pressure of the pressure tank should be at least 80% than the set-pressure of the system.

Example: if the set-pressure of the system is 4 bar, the pre-charge pressure of the tank should be 3.2 bar

If the set-pressure of the system is 60 psi, the pre-charge pressure of the tank should be 48 psi

5.1.2 Pressure sensor

VASCO requires a pressure sensor with a linear output signal within the range 4 – 20 mA. The pressure transducer can be powered by any range of DC Voltage which includes the value 15 V dc.

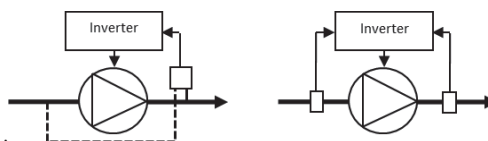
VASCO accepts the signal of a second pressure sensor in order to:

- realize constant differential pressure (AN1 – AN2).
- substitute first pressure sensor when it fails
- switch pressure sensor by closing digital input IN2

SENSOR 1	<ul style="list-style-type: none"> • AN1: 4-20 mA (-) signal • +15V: 15 Vdc (+) power supply
SENSOR 2	<ul style="list-style-type: none"> • AN2: 4-20 mA (-) signal • +15V: 15 Vdc (+) power supply

5.2 VASCO installation for differential constant pressure applications

VASCO can manage the pump speed in order to keep constant the pressure difference between the discharge and suction side of the pump in circulation systems. To do this, it is usually installed a differential pressure sensor. Alternatively, it is possible to use two identical pressure sensors: one in suction side and one in discharge side of the pump. The difference of values is performed by the VASCO itself.



N.B. If during the operation it is expected that the pressure in the suction side falls below the atmospheric pressure, it is necessary to use absolute pressure sensors and not relative ones.

5.2.1 Sensors wiring

The VASCO can be connected to linear pressure sensors with 4 - 20 mA output. The supply voltage range of the sensors must include the 15 VDC with which the VASCO feeds the analog inputs.

If you are using a differential pressure sensor it is necessary to connect the sensor to the analog input 1:

DIFFERENTIAL SENSOR	<ul style="list-style-type: none"> AN1: 4-20 mA (-) signal +15V: 15 Vdc (+) supply
---------------------	--

In case two pressure sensors are used, the pressure sensor in the discharge side must be connected to the analog input 1 while the pressure sensor in the suction side must be connected to the analog input 2:

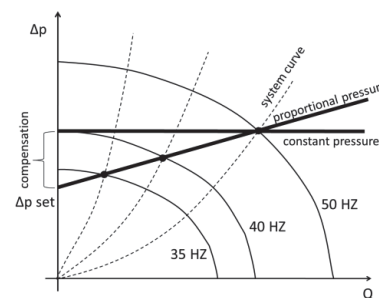
SENSOR 1 (discharge)	<ul style="list-style-type: none"> AN1: 4-20 mA (-) signal +15V: 15 Vdc (+) supply
SENSOR 2 (suction)	<ul style="list-style-type: none"> AN2: 4-20 mA (-) signal +15V: 15 Vdc (+) supply

In the IN/OUT parameters menu it is therefore necessary to set the logic AN1, AN2 as "difference".

5.2.2 Programming

In circulation systems pump starting and stopping is usually controlled by an external contact that can be connected to the digital input 1 (IN1, 0V) and configured as N.O or N.C in the IN/OUT parameters menu. It is then recommended to set the following parameters:

Control parameter	Recommended value
Freq. min control	Same as minimum motor frequency
Delta control	0 bar
Delta start	0 bar
Stop delay	99 sec
IN/OUT parameter	Recommended value
Function AN1,AN2	Difference 1-2



Constant differential pressure

The "set value" corresponds to the differential pressure to be kept constant.

Set the "set value" equal to the pressure difference measured between the discharge and the suction side of the pump at maximum load (all utilities opened) and at maximum frequency (50 Hz).

Proportional differential pressure

In case it is needed to use a control logic based on proportional differential pressure (in order to achieve a further energy saving), it is necessary to set the "set value" equal to the pressure difference between the discharge and suction side of the pump at minimum frequency (20 Hz) and "compensation" in order to reach the maximum set value at maximum frequency (50 Hz) and maximum load (all utilities opened).

6. VASCO Use and Programming

VASCO software is extremely simple to use, but allows a wide variety of parameters to be set for ideal system calibration. Setting Parameters are organized in 2 levels:

1: Installer level (MENU' CONTROL PARAMETERS, MENU' IN/OUT PARAMETERS, MENU' CONNECTIVITY PARAM.)

A password is required for this level; these parameters are adjustable by trained professionals

Default password: **001**

From the menu a different password can be set up.

2. Advanced level (MENU' MOTOR PARAMETERS)

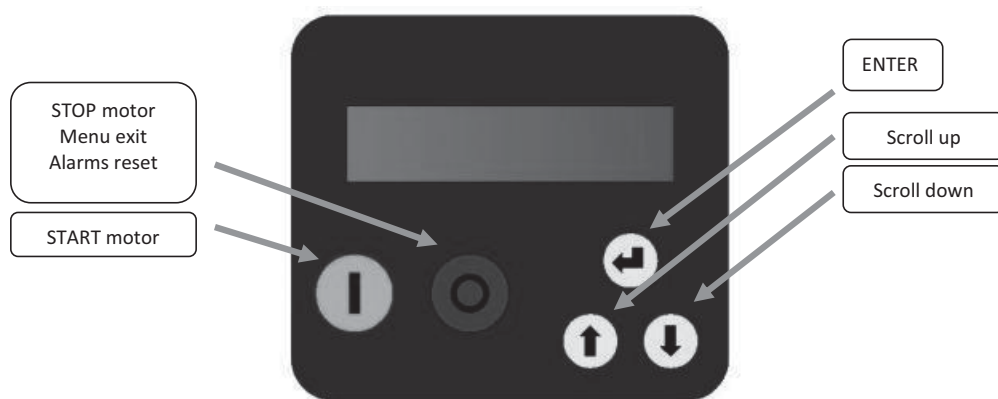
A second and different password is required; improper setting of these advanced parameters could compromise the integrity and the life of VASCO and pump;

Default password **002**

It is possible to set up a different password.

Installer and Advanced levels can be entered only with the correct password; otherwise, it is impossible to set up and/or modify any parameters (they can be only displayed).

6.1 VASCO display



Screen is a back-lit LCD displaying 2 rows of 16 digits each. Alarms are indicated by an audible signal.

6.2 Initial configuration

When VASCO is switched on for the first time, the initial setting menu is displayed for the initial setting of parameters to configure pump characteristics, pressure sensor range, and system characteristics.

If the initial setting procedure is not completed properly, it is impossible to run the pump. Initial setting procedure can be repeated if necessary.

The initial setting procedure can be repeated (by using the 2nd level password) to reconfigure VASCO or if VASCO is installed in a different system.

A brief description of parameters and their allowable ranges are listed below:

Parameter		Default	Description
Language XXXXXX		XXXX	End user communication language
Unit XXXXX		bar	Unit
Motor type singlephase/threephase		threephase	Type of motor connected (VASCO 209,214)
Rated motor Amp. $I = XX.X \text{ [A]}$		XX	Rated current of the motor per it's nameplate indication increased by 10%. The voltage drop caused by the inverter leads to higher input current than nominal. Make sure motor is capable of accepting increased current.
Rated motor freq $f = XXX \text{ [Hz]}$		50	Rated frequency of the motor per its nameplate.
Control mode: Constant value [bar]			
F. scale sensor $p = XX.X \text{ [bar]}$		16	Sensor full scale.
Sensor test Press ENT			If the transducer is not connected or connected improperly, the signal SENSOR OFF is activated when pressing ENTER.
Max alarm value $p = XX.X \text{ [bar]}$		10	Maximum pressure allowed in the system. If the pressure goes over this value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the pressure goes below the maximum value for a period of at least 5 seconds.
Set value $p = XX.X \text{ [bar]}$		3	The pressure value to be kept constant.
Motor test START/STOP			Press START/STOP to run a test at rated frequency Warning: make sure to run the system without damaging pump and system
Rotation sense ---> / <---		--->	If, during the test, the motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires at the terminals.
COMBO ON/OFF		OFF	Activation or deactivation of COMBO operation.
Autorestart ON/OFF		OFF	If ON is selected, after a lack of voltage, VASCO returns to its normal status; if VASCO was powering the pump before the voltage drop, it resumes powering the pump automatically. <u>Warning</u> , review the advice in chapter 1
INITIAL SETUP COMPLETED			Once the Setting procedure is completed you will get this indication on the display; setting parameters are recorded by VASCO; these parameters can be set up individually in the parameters menu.

6.3 Initial view

When first powering the VASCO, the display shows : release of display software (LCD = X.XX) and the release of inverter software (INV = X.XX) as shown below:

LCD = X.XX

INV = X.XX

The following End User messages are displayed by pushing the scroll buttons:

<div>Inv: ON/OFF Mot: ON/OFF</div> <div>p = XX.X [bar]</div>	<p><i>p is the pressure value read by the pressure transducer.</i> By pressing ENTER the pressure set value is displayed <XXX.X></p>
<div>Inv: ON/OFF Mot: ON/OFF</div> <div>f = XXX [Hz]</div>	<p>f value is the supply frequency to the motor; On fix frequency control mode, by pressing ENTER you can change the f value manually (word "set" is displayed) , press ENTER again to exit parameter setting (word "set" disappeared).</p>
<div>Inv: ON/OFF Mot: ON/OFF</div> <div>V_in = X.XX [V] I= XX.X</div>	<p>V_in is the line voltage. This value is displayed only if motor is OFF; if motor is ON, A value equal to the absorbed motor current.</p>
<div>Inv: ON/OFF Mot: ON/OFF</div> <div>cosphi = XXX</div>	<p>cosphi index means the angle phi between the voltage and current absorbed by the motor</p>
<div>Inv: ON/OFF Mot: ON/OFF</div> <div>P = XXXXX [W]</div>	<p>P is the power in Watts supplied to the pump.</p>
<div>Inv: ON/OFF Mot: ON/OFF</div> <div>STATUS: NORMAL</div> <div>Inverter Life</div> <div>xxxxx h : xx m</div> <div>Motor Life</div> <div>xxxxx h : xx m</div> <div>%f 25 50 75 100</div> <div>%h XX XX XX XX</div> <div>XXXXXXXXXXXXXXXXXX</div> <div>XXXXXXXX h : XX m</div>	<p>NORMAL status means no alarms. If an alarm occurs, a message blinks on the display and an audible signal is activated. Pressing ENTER accesses: VASCO lifetime, PUMP lifetime, consumption statistic, alarm list. To return to previous views, press ENTER.</p>
<div>Menù</div> <div>ENT to access</div>	

First row gives the VASCO status:

- **Inv: ON XXX.X Hz** VASCO is powered and is powering the motor showing its frequency.
- **Inv: ON Mot: OFF** VASCO is powered but motor is not running (i.e. motor/pump was stopped due to minimum frequency being reached)
- **Inv: OFF Mot: OFF** VASCO is not powered

If COMBO function is activated, the VASCO address is placed close to indication “Inv”.

6.4 Menu view

Pressing ENTER when you are in [MENU' / ENT to access] in initial display, will display the following MENUS:

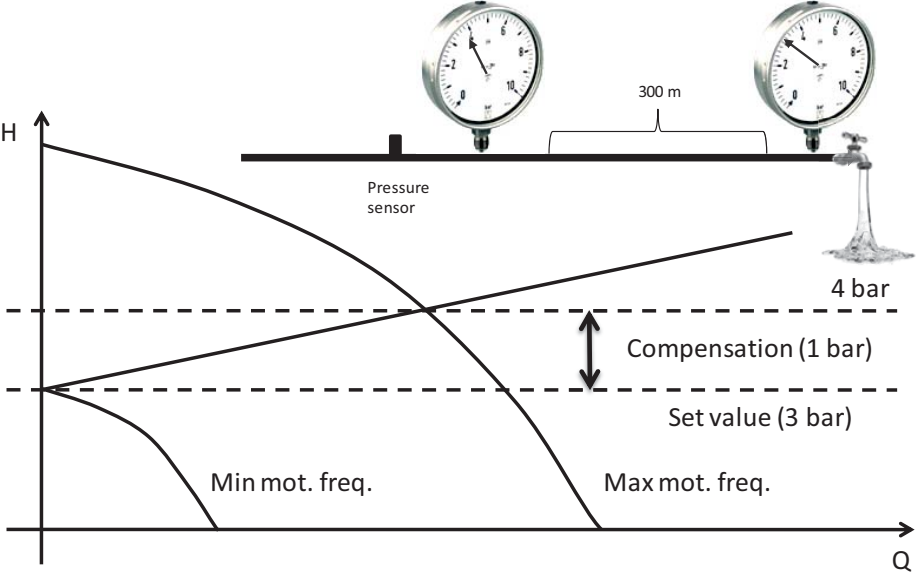
	MENU' Control. param.		Installer password required to enter level 1 (default 001)
	MENU' Motor param.		Advanced password required to enter level 2 (default 002)
	MENU' IN/OUT. param.		Installer password required to enter level 1 (default 001)
	MENU' Connect. param.		Installer password required to enter level 1 (default 001)
	MENU' Change init.set.		Advanced password required to enter level 2 (default 002)

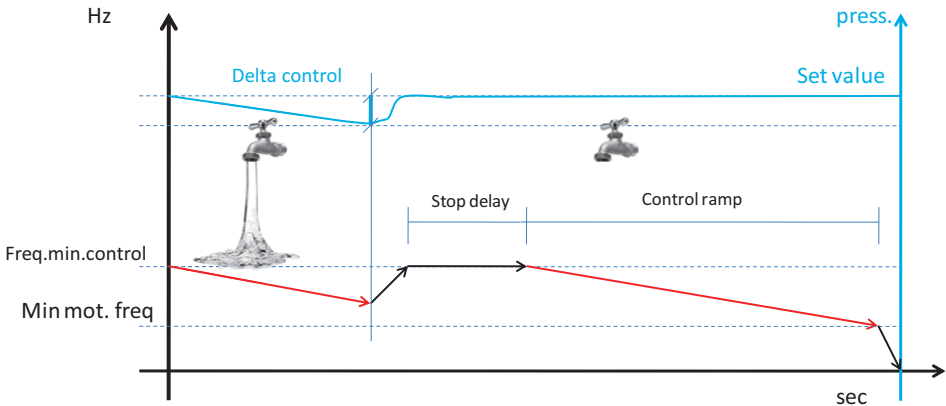
To exit the Menu level and return to initial display, press STOP button.

6.5 Control parameters

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
<div>Control mode</div> <ul style="list-style-type: none"> • Constant value • Fix speed • Const.value 2set • Fix speed 2 val. • External speed 	Constant value	<p>Mode of control:</p> <ul style="list-style-type: none"> • Constant value: VASCO changes the pump speed to keep the set value constant regardless water demand. • Fix speed: VASCO feeds the pump at set frequency, so the pump speed is kept constant. • Const. value 2 set: the two values are selected by opening or closing the digital input IN2. • Fix speed 2 val: the two values are selected by opening or closing the digital input IN2. • External speed: control motor frequency by using analogical input AN4. 					

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
Max alarm value XXX.X [bar]	10	Maximum value allowed in the system. If the readen value goes over this value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the readen value goes below the maximum value for a period of at least 5 seconds.	✓	✓	✓	✓	✓
Min alarm value XXX.X [bar]	0	Minimum value allowed in the system. If the readen value goes lower than this value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the readen value goes higher than the minimum value for a period of at least 5 seconds.	✓	✓	✓	✓	✓
Ext.set enabling ON/OFF	OFF	Enabling of set value changing by analog input AN3.	✓		✓		
Set value XXX.X [bar]	3	Set value to be kept constant.	✓				
Compensation XXX.X [bar]	0	Value compensation at the maximum frequency for each pump. Acting on the green button you can reverse the sign.	✓				
Set value 2 XXX.X [bar]	3	Set value to be kept constant.			✓		
Compensation 2 XXX.X [bar]	0	Value compensation at the maximum frequency for each pump. Acting on the green button you can reverse the sign.			✓		
Set value update XX [s]	5	Time to update set value for compensation.	✓		✓		

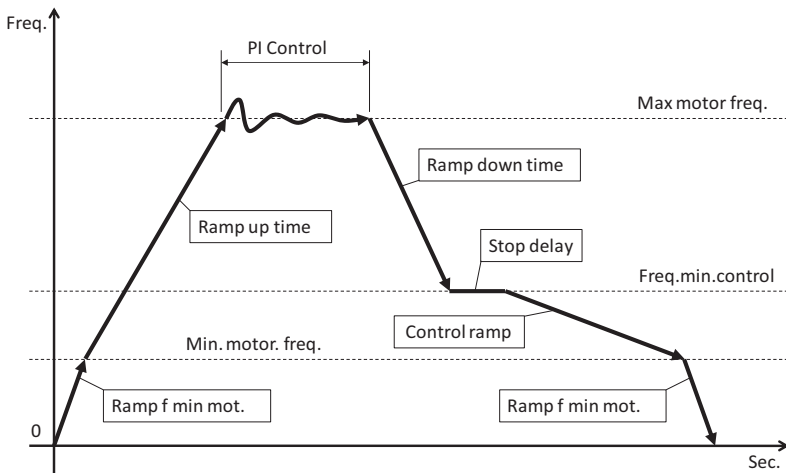
Parameter	Default	Description	Constant value	Fix speed	Const. value 2 set	Fix speed 2 val.	External speed
<p>To ensure proper operation of pressure control is recommended to place the sensor near the pump.</p> <p>To compensate the pressure loss in the pipes (proportional to flow) it is possible to vary the pressure set in a linear relation with respect to frequency.</p>  <p>It can perform the following test to verify the correct value of compensation:</p> <ol style="list-style-type: none"> 1. install a pressure gauge away from the pressure sensor 2. open completely the valve 3. check the pressure gauge <p>--> Set the value of <i>compensation</i>. equal to the difference of the values from the two gauges.</p> <p>When using a group of pumps, the pressure compensation to be applied to each pump is equal to the total pressure compensation (when all the pumps are running at full speed) divided by the number of pumps in the group.</p>							
Operating freq. XXX [Hz]	50	Frequency value to feed the pump.		✓			
Operating freq. 2 XXX [Hz]	50	Frequency value to feed the pump.				✓	
Freq.min.control XXX [Hz]	50	Minimum frequency below which the pump tries to stop.	✓		✓		✓
Stop delay XX [s]	5	Delay for which the pump tries to stop below freq.min.control.	✓		✓		✓
Control ramp XXX.X [s]	20	Ramp time from freq.min.control to min.motor freq. If, during this time, the read value goes below the (set value - delta control), VASCO powers the motor	✓		✓		✓

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
		again; otherwise, VASCO will stop the pump.					
Delta control XXX.X [bar]	0.1	Value drop below the set value required to restart the pump during control ramp.	✓		✓		
 <p>The graph illustrates the pump control logic. The vertical axis represents frequency in Hz, with markers for 'Freq.min.control' and 'Min mot. freq'. The horizontal axis represents time in seconds. A blue line represents the pressure ('press.') which has a 'Set value'. The frequency curve (red line) shows a 'Delta control' event where it drops below the set value, followed by a 'Stop delay' and then a 'Control ramp' where it increases back towards the set value. Icons of pumps are shown at different frequency levels to indicate their operating states.</p>							
Delta start XXX.X [bar]	0.5	Value drop below the set value required to start the pump from stop condition.	✓		✓		
Delta stop XXX.X [bar]	0.5	Value increase respect to set value which must be passed so that there is a forced shutdown of the pump.	✓		✓		
Ki		Kp and Ki parameters allow the dynamic control of system by VASCO; set values (Ki=50, Kp=005) are usually enough to get a valid dynamic control.	✓		✓		
Kp							
Pump DOL 1 ON/OFF	OFF	Function to activate (ON) the first auxiliary pump DOL 1 (Direct On Line pump).	✓		✓		
Pump DOL 2 ON/OFF	OFF	Function to activate (ON) the second auxiliary pump DOL 2 (Direct On Line pump).	✓		✓		
COMBO ON/OFF	OFF	Enabling or disabling COMBO operation as described in COMBO chapter.	✓		✓		

Parameter	Default	Description	Constant value	Fix speed	Const. value 2 set	Fix speed 2 val.	External speed
Address XX	00	VASCO address: • 00 master • 01 to 07 slaves	✓		✓		
Alternance ON/OFF	OFF	Function to allow alternating between the VASCOs connected in COMBO (or pumps connected in DOL) in order to allow equal use of each pump in the group; master will reorganize the starting priority of the pumps by checking the life of each of them.	✓		✓		
Alternance period XX [h]	0	Maximum difference in terms of hours between VASCOs in the group. 0 stays for 5 minutes.	✓		✓		
Start delay AUX t = XX [s]	0	Delay time with which the slaves start after the variable speed pump has reached the maximum frequency and the pressure value has fallen below set value – delta control	✓		✓		
PI control Direct/Reverse	Direct	Direct: increasing motor speed also misured value increases Reverse: increasing motor speed, misured value decreases.	✓		✓		
Periodic autorun t = XX [h]	0	Pump periodic autorun after XX hours of inactivity. Value 0 makes function disabled. <u>Warning</u> , review the advice in chapter 1.	✓	✓	✓	✓	✓
Dry run cosphi X.XX	0.65	Cosphi value below which the unit stops the motor and give “no water” alarm.	✓	✓	✓	✓	✓
Restarts delay XX [min]	10	Restart delay after a dry running alarm. At each tentative (max 5) restart delay will be doubled.	✓	✓	✓	✓	✓

6.6 Motor parameters

Parameters	Default	Description
Rated motor Volt. XXX [V]	XXX	Motor rated voltage (as shown on motor nameplate).

Voltage boost XX.X [%]	0%	Voltage increase during the motor start up. Warning: An excessive value can seriously damage the motor. Contact the motor manufacturer for further information.
Rated motor Amp. XX.X [A]	XX	Rated motor current as per its nameplate indication increased by 5%.
Rated motor freq XXX [Hz]	50	Rated motor frequency as per its nameplate.
Max motor freq. XXX [Hz]	50	Maximum motor frequency. Note: by reducing the maximum motor frequency, maximum current will be reduced as well.
Min motor freq. XXX [Hz]	20	Minimum motor frequency.
Ramp up time XXX.X [sec]	4	Ramp-up time to reach the speed required to achieve the set pressure (or frequency value). Longer times delay the system reaching the preset value but better protect system components. Excessively long ramp-up times can create difficulties in VASCO setup, and can also cause false overload alarms.
Ramp down time XXX.X [sec]	4	Ramp-down time to reach zero speed. Longer times keep the system pressurized, while protecting the system components. Excessively long ramp-down times can create difficulties in VASCO setup. Excessively short ramp-down times can cause false overload alarms.
Ramp f min mot. XXX.X [sec]	1.5	Time to reach the minimum motor frequency and vice versa.
		
PWM XX.X [kHz]	8	Carrier frequency (switching frequency). It is possible to choose PWM in the range of 2.5 ,4, 6, 8, 10 kHz . Higher values give a more sinusoidal wave with fewer losses for the motor but higher losses for the inverter (increased inverter heating). If long cables are used (>20 m / >76 ft) (submersible pump) it is recommended to install an inductive filter between VASCO and the motor (available upon request) and to set the value of PWM to 2.5 kHz. This reduces the risk of voltage spikes, which can damage motor and cable insulation.

<div>V/f lin. --> quad. XXX [%]</div>	85 %	V / f characteristic with which VASCO feeds the engine. The linear characteristic corresponds to constant torque with variable speed. The quadratic characteristic is normally used with centrifugal pumps. The selection of torque characteristic should be done ensuring a smooth operation, a reduction of energy consumption and a lower level of heat and acoustic noise.
<div></div>		
<div>Rotation sense ---> / <---</div>	--->	If, during the test, the motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires at the terminals.
<div>Autorestart ON/OFF</div>	OFF	If ON is selected, after a lack of voltage, VASCO returns to its normal status; if VASCO was powering the pump before the voltage drop, it resumes powering the pump automatically. <u>Warning</u> , review the advice in chapter 1.

6.7 IN/OUT parameters

Parameter		Default	Description
Unit XXXXX		bar	Unit [bar,%,ft,in,cm,m,K,F,C,gpm,l/min,m3/h,atm,psi]
F. scale sensor XXX.X		16	Sensor full scale.
Min.value sensor XXX.X		0	Sensor minimum value.
Offset input 1 [%]		20%	Zero correction for analog input 1 (4-20 mA) (20 mA x 20% = 4 mA).

Parameter	Default	Description
Offset input 2 [%]	20%	Zero correction for analog input 2 (4-20 mA) (20 mA x 20% = 4 mA).
Offset input 3 [%]	0%	Zero correction for analog input 3 (0-10V) (10V x 00% = 0 V).
Offset input 4 [%]	0%	Zero correction for analog input 4 (0-10V) (10V x 00% = 0 V).
AN1,AN2 function XXXXXX	Independent	Function logic for analog input AN1,AN2 (independent, lower value, higher value, difference 1-2).
Digital input 1 N.O. / N.C.	N.O.	By selecting N.O. (normally open) VASCO runs the motor if the digital input 1 is open; motor will be stopped if the digital input 1 is closed. By selecting N.C. (normally closed) VASCO runs the motor if the digital input 1 is closed; motor will be stopped if the digital input 1 is opened.
Digital input 2 N.O. / N.C.	N.O.	By selecting N.O. (normally open) VASCO runs the motor if the digital input 2 is open; motor will be stopped if the digital input 2 is closed. By selecting N.C. (normally closed) VASCO runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.
Digital input 3 N.O. / N.C.	N.O.	By selecting N.O. (normally open) VASCO runs the motor if the digital input 3 is open; motor will be stopped if the digital input 3 is closed. By selecting N.C. (normally closed) VASCO runs the motor if the digital input 3 is closed; motor will be stopped if the digital input 3 is opened.
Digital input 4 N.O. / N.C.	N.O.	By selecting N.O. (normally open) VASCO runs the motor if the digital input 4 is open; motor will be stopped if the digital input 4 is closed. By selecting N.C. (normally closed) VASCO runs the motor if the digital input 4 is closed; motor will be stopped if the digital input 4 is opened.
Dig.In.2/3 delay [s]	3	Digital input IN2 & IN3 delay. Digital input IN1 has 1 second fix delay.


6.8 Connectivity parameters

Parameters	Default	Description
MODBUS address XXX	1	MODBUS address from 1 to 247
MODBUS baudrate XXXXX [bps]	9600	MODBUS baudrate from 1200 bps to 57600 bps
MODBUS data format XXXXX	RTU N81	MODBUS data format: RTU N81, RTU N82, RTU E81, ETU O81

7. Protections and alarms

Anytime a protection occurs a blinking message is displayed together with an audible alarm; on STATUS in the initial view, the protection is displayed; by pressing the STOP button. Only from this position (STATUS) in the initial view is it possible to try to reset the alarm; if VASCO does not reset the alarm it is displayed again together an audible sound.

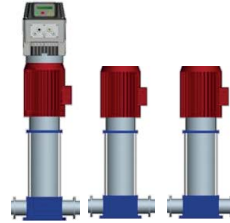
ALARM MESSAGE	ALARM DESCRIPTION	POSSIBLE SOLUTIONS
OVERCURRENT MOT.	<p>Motor overload: input current of the motor is higher than the rated motor current setting parameter.</p> <p>Motor voltage drop caused by the inverter causes the motor input current to be higher than rated. Contact motor manufacturer to check if motor is capable of accepting this current.</p>	<ul style="list-style-type: none"> Make sure that the motor current setting parameter is higher than rated. Check other possible causes of over current
UNDER VOLTAGE	Supply voltage too low	Check possible causes of undervoltage
OVER VOLTAGE	Supply voltage too high	Check possible causes of overvoltage
OVER TEMP. INV.	Inverter over temperature	<ul style="list-style-type: none"> Make sure than ambient temperature is less than 40 °C (104 °F). Check if auxiliary cooling fan is working properly and if mounting space is adequate for proper cooling. Reduce the PWM value (<i>Advance Parameter Menu</i>)
NO LOAD	No load	<ul style="list-style-type: none"> Check if load is properly connected to the VASCO terminals
NO WATER (DRY RUN COSPHI)	Motor cosphi is lower than the set value of dry running cosphi	<ul style="list-style-type: none"> Check if the pump is primed Check the set value of dry running cosphi. Dry running cosphi is approximately 60% of the rated cosphi (at rated frequency) listed on the motor plate. <p>If pump's cosphi is lower than the set dry-running cosphi for at least 2 seconds, VASCO stops the pump. VASCO tries to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped.</p> <p>WARNING: if dry running protection occurs, VASCO will try to start the pump automatically. Be sure to cut power supply to VASCO before performing any maintenance.</p>
SENSOR FAULT	Sensor error	<ul style="list-style-type: none"> Check the transducer Check the wiring of transducer
MAX. VALUE ALARM	Measured value has reached the maximum value accepted by the system.	<ul style="list-style-type: none"> Check possible causes of reaching max value Check the max alarm value setting

MIN. VALUE ALARM	Measured value has reached the lowest value accepted by the system.	<ul style="list-style-type: none"> Check possible causes reaching min value (i.e. broken pipe, open pressure relief valve, etc.) Check the min alarm value setting.
IGBT TRIP ALARM	The current drawn by the load exceeds the capacity of VASCO. VASCO is still able to continue to power the load for 10 minutes with an output current of 101% of nominal and for 1 minute with an output current of 110% of nominal	<ul style="list-style-type: none"> Increase the ramp-up time Make sure that the load current is at least 10% below the VASCO nominal current Check the voltage drop along the supply cable to the motor
NO COMMUNICATION	Communication between Master and slave(s) has been interrupted	<ul style="list-style-type: none"> Check the wiring connections Make sure the Master is not in the Menu level; if so, exit from the level. In the STATUS of the slave (where the alarm is displayed) try to reset the alarm by pushing STOP button.
ADDRESS ERROR	Same address as other VASCOs in the group	<ul style="list-style-type: none"> The address of each VASCO needs to be different
KEYBOARD FAULT	A Button on the keyboard has been pressed for more than 150 seconds	<ul style="list-style-type: none"> Make sure buttons are not depressed Call service assistance
ACTIVE DIG.IN.X	Digital input X opened /closed	<ul style="list-style-type: none"> Check the input digital configuration (IN/OUT Parameters menu)
ALARM SLAVE XX	slave XX error detected by master	<ul style="list-style-type: none"> check the status of the slave
	<p>If pumps cosphi is lower than the dry-running cosphi for at least 2 seconds, VASCO will stop the pump. VASCO will try to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped.</p> <p>ATTENTION: if dry-running protection occurs, VASCO will try to start the pump automatically. Be sure to cut power supply before attempting maintenance</p> <p>VASCO will stop the pump if the input motor current is higher than the set motor current for an extended time. By pressing the START button it is possible to run the pump again.</p> <p>VASCO will stop the pump if the input voltage is higher than the set voltage for an extended time. By pressing the START button it is possible to run the pump again. VASCO will stop the pump if the input voltage is lower than the set voltage for an extended time. By pressing the START button it is possible to run the pump again.</p>	

8. Auxiliary pumps during constant pressure control

When the water needs vary considerably, it is advisable to share the water request between several pumps ensuring better efficiency and reliability.

A first method consists of a single pump driven directly by VASCO and another 1 or 2 pumps directly connected to the mains DOL (Direct On Line); DOL pumps are controlled by VASCO and connected to the mains through 1 or 2 contactors.



In this method, DOL pumps are not started and stopped smoothly with the corresponding increase in energy consumption and mechanical wear (startup current). Also note that DOL pumps are not protected by VASCO.

A second method of sharing water demand (named COMBO mode) consists of using additional pumps in parallel (up to 8), with each one driven by a VASCO.



In this method, energy consumption and reliability of the pumping system is maximized: VASCO monitors and protects each pump. It is possible to assemble a booster system composed of pumps connected in COMBO mode and another 1 or 2 DOL pumps to cover additional water demand (managed only by master).



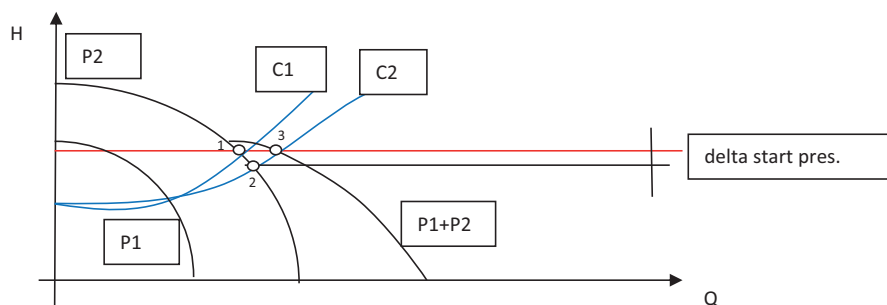
8.1 DOL pumps

Each DOL pump is switched on by a contactor controlled by the digital output DOL1 and DOL2 present in the VASCO.



VASCO relays driving the DOL pumps are relays with no voltage contacts. Max voltage to the contacts is 250 V, max current 5 A.

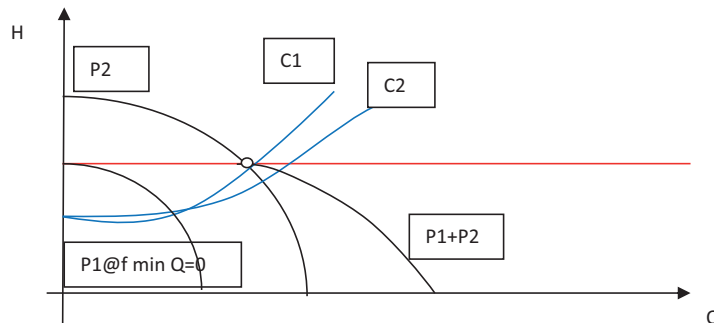
Two pumps are connected in parallel, with one pump (pump 1, P1) run by the inverter, while the second pump (pump 2, P2) is directly connected to the main power ("Direct On Line" connection). Start/Run of the second pump is controlled by the relay DOL1 (allowing a third pump to be controlled by the relay DOL2).



If pump 1 (P1) is already running to maintain the desired set pressure (red line), an additional water request changes the system curve from C1 to C2; since pump 1 (P1) is running at maximum speed, it is not possible to maintain the set pressure by increasing the speed, so the system pressure will drop till reaching the new working point 2.

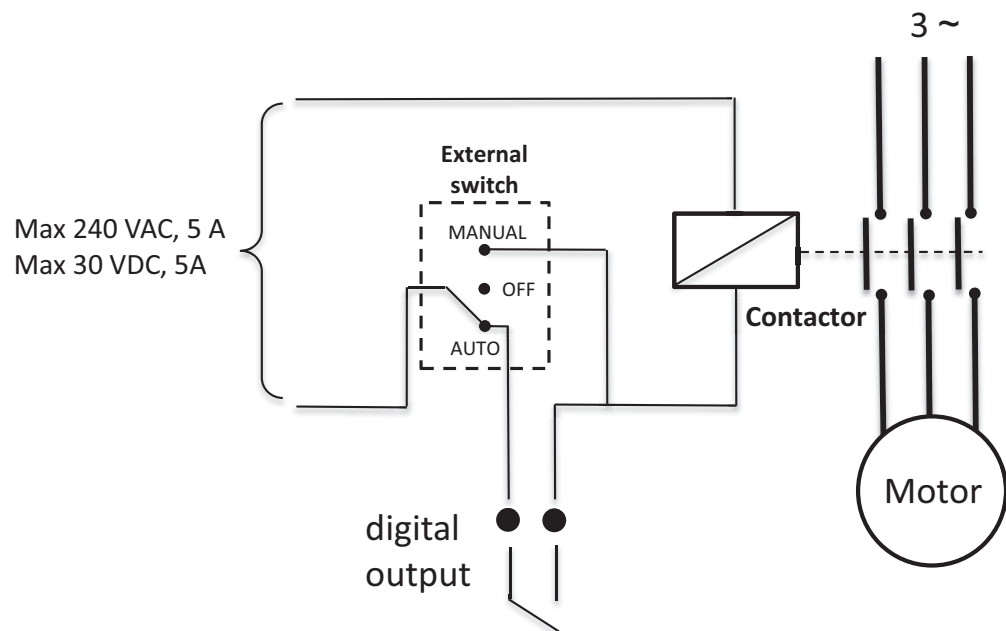
If pressure at the point 2 is (set value – delta control), VASCO will run the DOL by relay DOL1. The DOL pump will run at its nominal speed while the pump 1 will drop its speed equal to the P1 pattern to maintain set pressure.

If water demands decreases, returning to the system curve C1, pump 1 will reduce the pump speed to maintain constant pressure in the system. When pump 1 reaches a frequency equivalent to the minimum frequency, while still maintaining set pressure, the DOL pump will be switched off and pump 1 will increase the speed to maintain the p_{set} in the system.



If two pumps are connected in parallel, the first driven by VASCO and the second with a DOL connection, it is necessary to make sure that the value "delta control" will be sufficiently high to ensure the first pump, once the DOL pump is switched on, will reach a frequency higher than its minimum frequency value.

By proper setting of the minimum frequency, excessive pump ON/OFF cycling is avoided, thus preventing damage to the DOL pump.



8.2 COMBO function

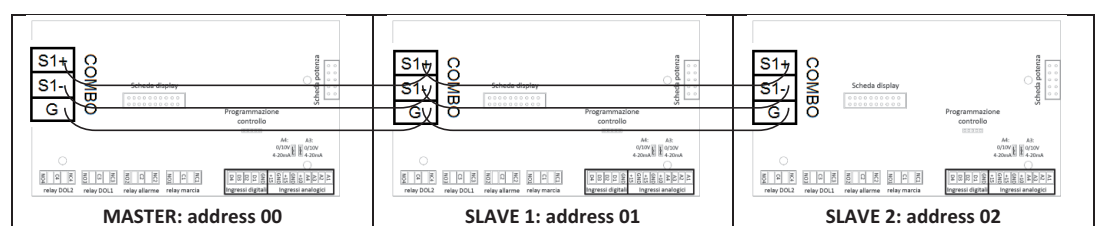
In the “Control parameters” menu it is possible to enable the COMBO function that allows serial communication between up to 8 VASCOs, each one connected to a pump. The operating principle (switch on/off) of pumps is similar to as stated in chapter 8.1.

To achieve the COMBO function in a system consisting of several interconnected VASCOs, use a pressure sensor connected to each VASCO. The value of the *set pressure* is communicated to the slaves via the serial port.

As a further help, you can connect another two DOL pumps to the VASCO Master to cover additional water demand; they will be operated only when all the COMBO pumps are already in operation.

RS485 serial connection

VASCO’s communication is made through a private protocol using the RS485 port. Each VASCO must be connected to each other by using a tripolar cable (0,5 mm²) wired on S+,S-,G pins on control board.



Master setup

1. Supply power to the VASCO master.
2. If not yet completed, perform the initial configuration as described on chapter 6.2
3. Initial view is shown:

Inv: ON/OFF Mot: ON/OFF

p_mis=XX.X [bar]

4. Scroll until:

Menù

ENT to access

5. Press ENT

MENU'

Control. param.

6. Press ENT

7. Insert password (default 001).

8. Scroll until:

Combo

ON/OFF

9. Set ON

10. Set:

Address XX	00	VASCO's address in parallel operation. • 00 : VASCO master
Alternance ON/OFF	OFF	Function to allow alternating between the VASCOs connected in parallel in order to allow equal use of each pump in the group; in this way Master will reorganize the starting priority of the pumps by checking the life of each of them.
Start delay AUX t = XX [s]	0	Delay time with which the slaves start after the variable speed pump has reached the maximum frequency and the pressure value has fallen below set value – delta control

11. Press STOP (red button)

12. Press STOP again

Slave setup

Follow Master setup until point 11.

In case of failure of master in a Combo system, will be replaced by slave. As a consequence, all parameters must be setup independently on each inverter, master mode.

1. Set:

<div>Address</div> <div>XX</div>	VASCO's address in parallel operation. <ul style="list-style-type: none"> 01 --> 07: VASCO slaves
----------------------------------	---

2. Press STOP (red button).
3. In the *Motor parameters* verify that *Autorestart* is set *ON*.
4. Press STOP (red button).
5. Press STOP again.

Whenever the user accesses the Menu screen of the VASCO master, the communication between VASCOs is automatically interrupted.

In case of alarm or failure of a pump in a Combo system, this pump's operation will be replaced (temporary or permanently) by another pump.

In case of failure of master in a Combo system, it will be replaced by the next slave after about 1 minute. In order to enable master replacement Autorestart must be set ON in each slaves.

9. Trouble-shooting chart

LCD does not switch on after powering the VASCO	<ul style="list-style-type: none"> • Check the connecting flat cable between the LCD board (attached to the cover) and the control board • Check the fuses • Check that the power cables are properly connected.
Power line of VASCO is interrupted by the differential protection contactor	<ul style="list-style-type: none"> • Check the leakage current to ground of EMC filter • Following a rapid off/on the power supply, the differential contactor can interrupt the power. After turning off the VASCO it is recommended to wait at least 1 minute before restarting.
When performing sensor test operation, SENSOR OFF alarm occurs	<ul style="list-style-type: none"> • Check that the sensor cable is properly connected to the sensor device and to the VASCO. • Make sure that the sensor and its cable are not damaged. • Check that the operating range of sensor is of 4 -20 mA type and the value of 15 V is within the voltage feed range of the sensor.
Frequency and pressure oscillation on constant pressure control mode	<ul style="list-style-type: none"> • Check if the water tank and its air pressure are correctly set. It may be necessary to increase the tank volume or reduce the pre-charge pressure. • Check the ki & kp parameters (Control parameters menu). At first, it is suggestable to increase the Ki value. If it not enough reduce of one unit the Kp value.
DOL pump stops and starts continuously	<ul style="list-style-type: none"> • Increase <i>delta control</i>. • Check to see if the water tank and it's air pressure are correctly set. It may be necessary to increase the tank volume or reduce the pre-charge pressure.
Measured pressure drops too much before VASCO starts the pump.	<ul style="list-style-type: none"> • Decrease the delta start value (Control Parameters menu) . • Check to see if the water tank and it's air pressure are correctly set. It may be necessary to increase the tank volume or reduce the pre-charge pressure. • Modify the value of ki & kp parameters (Control Parameters menu). At first, it is suggestable to reduce the Ki value. If it is not enough increase of one unit the Kp value.

10. Technical Assistance

For more technical information contact the authorized reseller providing the following information. The solution to the problem will be found faster and easier if full information is provided.

Model/Serial Code	LCD version (shown when VASCO is power supplied) LCD = _._		INV version (shown when VASCO is power supplied) INV = _._	
Line Voltage: ____ [V]	Line Frequency: <input type="checkbox"/> 50 Hz <input type="checkbox"/> 60 Hz			
description of problem:				
installation type: <input type="checkbox"/> wall mounted <input type="checkbox"/> on motor fan cover				
motor type: <input type="checkbox"/> single phase <input type="checkbox"/> three phase <input type="checkbox"/> submersible <input type="checkbox"/> surface				
if submersible: cable lenght [m]: ____			if submersible: cable section [mm ²]: ____	
P2 motor [kW]: ____	rated motor Volt [V]: ____	rated motor Amp [A]: ____	rated motor Hz: ____	
if single phase: capacitor ____ [UF]	if singlephase: starting Amp I st = ____ [A]	pump performances Q = ____ [l/min] H = ____ [m]		
tank volume: ____ [liters]		precharge pressure: ____ [bar]		
number of DOL pumps: ____		number of COMBO pumps: ____		
medium ambient temperature: ____ [°C]		pressure sensor 4 mA = ____ [bar] 20 mA = ____ [bar]		
digital inputs used:		digital ouputs used:		
electric and hydraulic scheme of the system (more detailed as possible)				
set parameters: please fill the instal. param. and adv. param columns in the software scheme.				

DECLARATION OF CONFORMITY

In according with:

Machine Directive 2006/42/EC

EMC Directive 2004/108/CE

Low Voltage Directive 2006/95/CE

R&TTE Directive 1999/05/EU

VASCO is an electronic device to be connected to other electrical equipment with which it is to form individual units. It must, therefore, that the putting into service of this unit (with all its subsidiary equipments) to be performed by qualified personnel.

The product conforms to the following regulations:

EN 55011 Class A

EN 61000

EN 60146

EN 50178

EN 60204-1

Ing. Marco Nassuato

Operation Manager



NOTE

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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Nastec srl, Via della Tecnica, 8, 36024, Mossano, Vicenza, Italy, Tel. +39 0444 886289, Fax +39 0444 776099, www.nastec.eu,
info@nastec.eu



Dutypoint Limited
Shepherd Road
Gloucester
GL2 5EL
United Kingdom

T: +44(0)1452 300592
W: www.dutypoint.com