Pressure Booster System

KSB Delta Solo Compact

KSB Delta Solo Compact MVP

Installation/Operating Manual
Legal information/Copyright

Installation/Operating Manual KSB Delta Solo Compact

Original operating manual

All rights reserved. The contents provided herein must neither be distributed, copied, reproduced, edited or processed for any other purpose, nor otherwise transmitted, published or made available to a third party without the manufacturer’s express written consent.

Subject to technical modification without prior notice.

© KSB B.V., Alphen aan den Rijn, Nederland 02/08/2019
Contents

Glossary ......................................................................................................................................................... 5

1 General .......................................................................................................................................................... 6
   1.1 Principles .............................................................................................................................................. 6
   1.2 Software changes .................................................................................................................................. 6
   1.3 Installation of partly completed machinery ..................................................................................... 6
   1.4 Target group ......................................................................................................................................... 6
   1.5 Other applicable documents ................................................................................................................. 6
   1.6 Symbols .................................................................................................................................................. 6
   1.7 Key to safety symbols/markings ............................................................................................................ 7

2 Safety .......................................................................................................................................................... 8
   2.1 General .................................................................................................................................................. 8
   2.2 Intended use .......................................................................................................................................... 8
   2.3 Personnel qualification and personnel training ................................................................................... 8
   2.4 Consequences and risks caused by non-compliance with this manual ............................................... 9
   2.5 Safety awareness ................................................................................................................................... 9
   2.6 Safety information for the operator/user ........................................................................................... 9
   2.7 Safety information for maintenance, inspection and installation ....................................................... 9
   2.8 Unauthorised modes of operation ....................................................................................................... 10
   2.9 Electromagnetic compatibility (EMC) ............................................................................................... 10
      2.9.1 Interference emission requirements ......................................................................................... 10
      2.9.2 Line harmonics requirements ................................................................................................... 11
      2.9.3 Interference immunity requirements ......................................................................................... 11

3 Transport/Temporary Storage/Disposal .................................................................................................. 12
   3.1 Checking the condition upon delivery .............................................................................................. 12
   3.2 Transport ............................................................................................................................................. 12
   3.3 Storage/preservation ........................................................................................................................... 12
   3.4 Return to supplier ................................................................................................................................ 13
   3.5 Disposal .............................................................................................................................................. 13

4 Description ................................................................................................................................................ 14
   4.1 General description ............................................................................................................................. 14
   4.2 Designation .......................................................................................................................................... 14
   4.3 Name plate .......................................................................................................................................... 14
   4.4 Design details ....................................................................................................................................... 14
   4.5 Configuration and function ............................................................................................................... 15
   4.6 Noise characteristics .......................................................................................................................... 16
   4.7 Scope of supply ................................................................................................................................... 16
   4.8 Dimensions and weight ....................................................................................................................... 16
   4.9 Terminal wiring diagram ..................................................................................................................... 16
   4.10 Potential equalisation ....................................................................................................................... 16

5 Installation at Site ................................................................................................................................... 17
   5.1 Installation ........................................................................................................................................... 17
   5.2 Checks to be carried out prior to installation .................................................................................... 17
   5.3 Installing the pressure booster system .............................................................................................. 18
   5.4 Connecting the piping ........................................................................................................................ 18
      5.4.1 Fitting an expansion joint ........................................................................................................... 19
   5.5 Installing unpressurised inlet tanks ................................................................................................. 19
   5.6 Electrical connection ........................................................................................................................ 20
      5.6.1 Sizing the power cable .............................................................................................................. 20
      5.6.2 Connecting the external dry running protection device (optional) ....................................... 20

6 Commissioning/Start-up/Shutdown ....................................................................................................... 22
   6.1 Commissioning/Start-up ................................................................................................................... 22
6.1.1 Prerequisites for commissioning/start-up .......................................................... 22
6.1.2 Commissioning/start-up of pressure booster system ........................................ 22
6.2 Switching on the pressure booster system .............................................................. 23
6.3 Checklist for commissioning/start-up .................................................................... 23
6.4 Shutdown .................................................................................................................. 23

7 Operating the Pressure Booster System .................................................................. 25
7.1 Design of the frequency inverter ............................................................................ 25
7.2 Pressure booster systems with configured frequency inverter drives .................... 25
7.3 Programming .......................................................................................................... 25

8 Servicing/Maintenance .............................................................................................. 27
8.1 General information/Safety regulations .................................................................. 27
8.2 Servicing/Inspection .............................................................................................. 28
8.2.1 Supervision of operation ...................................................................................... 28
8.2.2 Maintenance schedule ......................................................................................... 28
8.2.3 Setting the pre-charge pressure .......................................................................... 29

9 Trouble-shooting ....................................................................................................... 30

10 Related Documents .................................................................................................. 32
10.1 General assembly drawings/exploded views with list of components .................... 32
10.1.1 KSB Delta Solo Compact MVP ......................................................................... 32

11 EU Declaration of Conformity ................................................................................ 33
12 Certificate of Decontamination ................................................................................ 34
13 Commissioning Report ............................................................................................. 35

Index ............................................................................................................................. 36
Glossary

Accumulator
Pressure losses may occur in the piping downstream of the pressure booster system as a result of losses due to leakage. The accumulator serves to compensate for pressure losses and minimises the frequency of starts of the pressure booster system.

Certificate of decontamination
A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

Dry running protection
Dry running protection devices prevent the pump from being operated without the fluid to be handled, which would result in pump damage.

IE3
Efficiency class to IEC 60034-30: 3 = Premium Efficiency (IE = International Efficiency)
1 General

1.1 Principles
This operating manual is valid for the type series and variants indicated on the front cover.
The operating manual describes the proper and safe use of this equipment in all phases of operation.
The name plate indicates the type series, the main operating data and the serial number. The serial number uniquely describes the product and is used as identification in all further business processes.
In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

1.2 Software changes
The software has been specially created for this product and thoroughly tested. Making changes or additions to the software or parts of the software is prohibited. This does not, however, apply to software updates supplied by KSB.

1.3 Installation of partly completed machinery
To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance.

1.4 Target group
This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 8)

1.5 Other applicable documents

<table>
<thead>
<tr>
<th>Table 1: Overview of other applicable documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document</td>
</tr>
<tr>
<td>Sub-supplier product literature</td>
</tr>
</tbody>
</table>

1.6 Symbols

<table>
<thead>
<tr>
<th>Table 2: Symbols used in this manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
</tr>
<tr>
<td>✓</td>
</tr>
<tr>
<td>☳</td>
</tr>
<tr>
<td>⇒</td>
</tr>
<tr>
<td>⇨</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>!</td>
</tr>
</tbody>
</table>
## 1.7 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>! DANGER</td>
<td>This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>! WARNING</td>
<td>This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.</td>
</tr>
<tr>
<td>General hazard</td>
<td>In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.</td>
</tr>
<tr>
<td>Electrical hazard</td>
<td>In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.</td>
</tr>
<tr>
<td>Machine damage</td>
<td>In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.</td>
</tr>
</tbody>
</table>
2 Safety

All the information contained in this section refers to hazardous situations.
In addition to the present general safety information the action-related safety
information given in the other sections must be observed.

2.1 General
• This operating manual contains general installation, operating and maintenance
instructions that must be observed to ensure safe operation of the system and
prevent personal injury and damage to property.
• Comply with all the safety instructions given in the individual sections of this
operating manual.
• The operating manual must be read and understood by the responsible specialist
personnel/operators prior to installation and commissioning.
• The contents of this operating manual must be available to the specialist
personnel at the site at all times.
• Information and markings attached directly to the product must always be
complied with and kept in a perfectly legible condition at all times. This applies
to, for example:
  – Arrow indicating the direction of rotation
  – Markings for connections
  – Name plate
• The operator is responsible for ensuring compliance with all local regulations not
taken into account.

2.2 Intended use
• The pressure booster system must only be operated within the operating limits
described in the other applicable documents.
• Only operate pressure booster systems which are in perfect technical condition.
• Do not operate partially assembled pressure booster systems.
• The pressure booster system must only handle the fluids described in the product
literature of the respective design variant.
• Never operate the pressure booster system without the fluid to be handled.
• Observe the information on minimum flow rates specified in the product
literature (to prevent overheating, bearing damage, etc).
• Observe the maximum flow rates indicated in the data sheet or product
literature (to prevent overheating, cavitation damage, bearing damage, etc).
• Do not throttle the flow rate on the suction side of the pressure booster system
(to prevent cavitation damage).
• Consult the manufacturer about any other modes of operation not described in
the product literature.

2.3 Personnel qualification and personnel training
• All personnel involved must be fully qualified to install, operate, maintain and
inspect the product this manual refers to.
• The responsibilities, competence and supervision of all personnel involved in
transport, installation, operation, maintenance and inspection must be clearly
defined by the operator.
• Deficits in knowledge must be rectified by means of training and instruction
provided by sufficiently trained specialist personnel. If required, the operator can
commission the manufacturer/supplier to train the personnel.
• Training on the pressure booster system must always be supervised by specialist
technical personnel.
2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices
  - Hazard to the environment due to leakage of hazardous substances

2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

2.6 Safety information for the operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If shutting down the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pressure booster system are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Carry out work on the pressure booster system during standstill only.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pressure booster system out of service always adhere to the procedure described in the manual.
- Decontaminate pressure booster systems which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.
- Make sure the pressure booster system cannot be accessed by unauthorised persons (e.g. children).
- Prior to opening the device, pull the mains plug and wait for at least 10 minutes.
2.8 Unauthorised modes of operation
Always observe the limits stated in the product literature.

The warranty relating to the operating reliability and safety of the pressure booster system supplied is only valid if the equipment is used in accordance with its intended use. (☞ Section 2.2, Page 8)

2.9 Electromagnetic compatibility (EMC)

2.9.1 Interference emission requirements
The EN 61800-3 EMC product standard is relevant for electric variable speed drives/control systems. It specifies all pertinent requirements and refers to the relevant generic standards for complying with the EMC Directive.

Frequency inverters are commonly used by operators as a part of a system, plant or machine assembly. It should be noted that the operator bears all responsibility for the final EMC properties of the equipment, plant or installation.

A prerequisite or requirement for complying with the relevant standards or the limit values and inspection/test levels referenced by them is that all information and descriptions regarding EMC-compliant installation be observed and followed.

In accordance with the EMC product standard, the EMC requirements to be met depend on the purpose or intended use of the frequency inverter. Four categories are defined in the EMC product standard:

Table 4: Categories of intended use

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Limits to EN 55011</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Frequency inverters with a supply voltage under 1000 V installed in the first environment (residential and office areas).</td>
<td>Class B</td>
</tr>
<tr>
<td>C2</td>
<td>Frequency inverters with a supply voltage under 1000 V installed in the first environment (residential and office areas) that are neither ready to be plugged in/connected nor are mobile and must be installed and commissioned by specialist personnel.</td>
<td>Class A, Group 1</td>
</tr>
<tr>
<td>C3</td>
<td>Frequency inverters with a supply voltage under 1000 V installed in the second environment (industrial environments).</td>
<td>Class A, Group 2</td>
</tr>
<tr>
<td>C4</td>
<td>Frequency inverters with a supply voltage over 1000 V and a nominal current over 400 A installed in the second environment (industrial environments) or that are envisaged for use in complex systems.</td>
<td>No borderline/ boundary³¹</td>
</tr>
</tbody>
</table>

The following limit values and inspection/test levels must be complied with if the generic standard on interference emissions applies:

Table 5: Classification of installation environment

<table>
<thead>
<tr>
<th>Environment</th>
<th>Generic standard</th>
<th>Limits to EN 55011</th>
</tr>
</thead>
<tbody>
<tr>
<td>First environment (residential and office areas)</td>
<td>EN/IEC 61000-6-3 for private, business and commercial environments</td>
<td>Class B</td>
</tr>
<tr>
<td>Second environment (industrial environments)</td>
<td>EN/IEC 61000-6-4 for industrial environments</td>
<td>Class A, Group 1</td>
</tr>
</tbody>
</table>

The frequency inverter meets the following requirements:

Table 6: EMC properties of the frequency inverter

<table>
<thead>
<tr>
<th>Power [kW]</th>
<th>Cable length [m]</th>
<th>Category to EN 61800-3</th>
<th>Limits to EN 55011</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 11</td>
<td>≤ 5</td>
<td>C1</td>
<td>Class B</td>
</tr>
</tbody>
</table>

The EN 61800-3 standard requires that the following warning be provided for drive systems that do not comply with category C1 specifications:

This product can produce high-frequency interference emissions that may necessitate targeted interference suppression measures in a residential or office environment.

³¹ An EMC plan must be devised.
2.9.2 Line harmonics requirements
The product is a device for professional applications as defined by EN 61000-3-2. The following generic standards apply when establishing a connection to the public power grid:

- EN 61000-3-2 for symmetric, three-phase devices (professional devices with a total power of up to 1 kW)
- EN 61000-3-12 for devices with a phase current of between 16 A and 75 A and professional devices from 1 kW up to a phase current of 16 A.

2.9.3 Interference immunity requirements
In general, the interference immunity requirements for a frequency inverter hinge on the specific environment in which the inverter is installed.

The requirements for industrial environments are therefore higher than those for residential and office environments. The frequency inverter is designed such that the immunity requirements for industrial environments and, thus, the lower-level requirements for residential and office environments, are met and fulfilled.

The following relevant generic standards are used for the interference immunity test:

- EN 61000-4-2: Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
- EN 61000-4-3: Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
- EN 61000-4-4: Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
- EN 61000-4-5: Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
- EN 61000-4-6: Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery
1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Transport

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
</table>

**Pressure booster system tipping over**
Danger to life from falling pressure booster system!

- Never suspend the pressure booster system by its power cable.
- Do not lift the pressure booster system by its manifold.
- Observe the applicable local accident prevention regulations.
- Observe the information on weights, centre of gravity and fastening points.
- Use suitable and permitted transport equipment, e.g. crane, forklift or pallet jack.

- Transport equipment / lifting equipment suitable for the corresponding weight has been selected and is on hand.
1. Remove the packaging. Remove the caps from the connection openings.
2. Check for any in-transit damage.
3. Transport the pressure booster system to the place of installation.
4. Detach the pressure booster system from the pallet using a suitable tool.
5. Attach the pressure booster system to the lifting equipment as illustrated.
6. Lift it off the wooden skids. Dispose of the wooden skids.
7. Carefully place down the pressure booster system at the site of installation.

3.3 Storage/preservation

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
</table>

**Damage during storage due to frost, moisture, dirt, UV radiation or vermin**
Corrosion/contamination of pressure booster system!

- Store the pressure booster system in a frost-proof room. Do not store outdoors.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
</table>

**Wet, contaminated or damaged openings and connections**
Leakage or damage of the pressure booster system!

- Only open the openings of the pressure booster system at the time of installation.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
</table>

Rotate the shaft by hand every three months, e.g. via the motor fan.

If commissioning is to take place some time after delivery, the following measures are recommended when storing the pressure booster system:
Store the pressure booster system in a dry, protected room where the atmospheric humidity is as constant as possible.

Table 7: Ambient conditions for storage

<table>
<thead>
<tr>
<th>Ambient condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity</td>
<td>50 % maximum</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 °C to +40 °C</td>
</tr>
</tbody>
</table>

- Frost-free
- Well-ventilated

3.4 Return to supplier

1. Drain the pressure booster system as per operating instructions.
2. Always flush and clean the pressure booster system, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pressure booster system has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pressure booster system must also be neutralised and treated with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pressure booster system. (⇒ Section 12, Page 34)
   Always indicate any safety and decontamination measures taken.

**NOTE**

If required, a blank certificate of decontamination can be downloaded from the following web site: [www.ksb.com/certificate_of_decontamination](http://www.ksb.com/certificate_of_decontamination)

3.5 Disposal

**WARNING**

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- Collect and properly dispose of flushing fluid and any fluid residues.
- Wear safety clothing and a protective mask if required.
- Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Dismantle the pressure booster system. Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
   - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.
4 Description

4.1 General description
- Pressure booster system

4.2 Designation

Example: KSB Delta Solo Compact 1/0606 MVP

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSB Delta Solo Compact</td>
<td>Type series</td>
</tr>
<tr>
<td>1</td>
<td>Number of pumps</td>
</tr>
<tr>
<td>06</td>
<td>Pump size</td>
</tr>
<tr>
<td>06</td>
<td>Number of pump stages</td>
</tr>
<tr>
<td>MVP</td>
<td>Design</td>
</tr>
<tr>
<td>MVP</td>
<td>MVP Variable speed pressure booster system</td>
</tr>
</tbody>
</table>

4.3 Name plate

Fig. 1: Name plate (example) KSB Delta Compact

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type series</td>
</tr>
<tr>
<td>2</td>
<td>Design</td>
</tr>
<tr>
<td>3</td>
<td>Number of pumps</td>
</tr>
<tr>
<td>4</td>
<td>Size</td>
</tr>
<tr>
<td>5</td>
<td>Number of pump stages</td>
</tr>
<tr>
<td>6</td>
<td>Serial number</td>
</tr>
<tr>
<td>7</td>
<td>Month of production/ year of production, consecutive number</td>
</tr>
<tr>
<td>8</td>
<td>Dry running protection</td>
</tr>
<tr>
<td>9</td>
<td>Power supply voltage</td>
</tr>
<tr>
<td>10</td>
<td>Power supply frequency</td>
</tr>
<tr>
<td>11</td>
<td>Maximum current input</td>
</tr>
<tr>
<td>12</td>
<td>Max. operating pressure</td>
</tr>
<tr>
<td>13</td>
<td>Enclosure</td>
</tr>
<tr>
<td>14</td>
<td>Order number</td>
</tr>
</tbody>
</table>

4.4 Design details

Design
- Fully automatic pressure booster package system
- 1 horizontal centrifugal pump with frequency inverter
- Baseplate-mounted
- Membrane-type accumulator (direct-flow) to DIN 4807-5 on the discharge side, approved for drinking water, with shut-off element and drain valve.
4 Description

- 1.5 m power cable with shockproof plug
- Check valve
- Pressure gauge

Installation
- Stationary dry installation

Drive
- Three-phase motor
- To IEC 60034-7
- Efficiency class IE3 to IEC 60034-30 (for three-phase motors ≥ 0.75 kW)
- Frequency 50 Hz/60 Hz (pump frequency = 50 Hz)
- Enclosure IP55

Automation
- Frequency inverter for speed control, IP55, for pressure-controlled starting and stopping
- Function/fault indicated
- Setting the pressure via buttons or via bluetooth using an app
- Dry running protection
- Three LEDs signalling the operating status
- Colour LED indicating readiness for operation (green)
- Colour LED indicating a fault (amber)
- Colour LED indicating lack of water (red)
- 2 volt-free contacts on terminals are provided for reporting warnings and alerts.

4.5 Configuration and function

![Configuration Diagram]

Fig. 2: Configuration

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Swing check valves</td>
</tr>
<tr>
<td>2</td>
<td>Frequency inverter</td>
</tr>
<tr>
<td>3</td>
<td>Baseplate</td>
</tr>
<tr>
<td>4</td>
<td>Membrane-type accumulator</td>
</tr>
</tbody>
</table>
The fully automatic pressure booster system pumps the fluid to the consumer installations in the set pressure range using one non-self-priming horizontal high-pressure pump (7).

The fully automatic pressure booster system pumps the fluid to the consumer installations in the set pressure range using one or two non-self-priming horizontal high-pressure pumps (7).

The pump is controlled and monitored by motor-mounted frequency inverters. The standard setting is for the pressure booster system to start automatically as a function of pressure; the actual pressure is measured by an analog pressure measuring device (pressure transmitter).

The use of this variable speed pump significantly reduces wear as well as the frequency of pump starts in parallel operation.

If a duty pump fails, a fault is output, which can be reported via volt-free contacts (e.g. to the control station).

If the demand drops towards 0, the pressure booster system slowly runs down to the stop point and stops.

The pressure booster system is designed with dry running protection.

If the pump has not been in operation for 24 hours, a test run is initiated.

In manual mode, a minimum flow is required to protect the pump against overheating.

For the noise characteristics refer to the operating manual of the pump (set).

The following items are included in the scope of supply:

**Pressure booster system**
- 1 horizontal centrifugal pump with frequency inverter
- Check valve
- Discharge-side, direct-flow membrane-type accumulator
- Integrated dry running protection

**Control unit**
- Single-phase frequency inverter, motor-mounted

For dimensions and weights please refer to the type series booklet of the pump (set).

For the terminal assignment refer to the circuit diagram.

The power cable has an earthed plug for potential equalisation.
5 Installation at Site

5.1 Installation

**WARNING**

Installation on mounting surfaces which are unsecured and cannot support the load
Personal injury and damage to property!
- Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class X0 to EN 206-1.
- The mounting surface must have set and must be completely horizontal and even.
- Observe the weights indicated.

**NOTE**

Do not install pressure booster systems next to sleeping or living quarters.

**NOTE**

The anti-vibration mounts provide adequate insulation against solid-borne noise.

Before beginning with the installation check the following:
- All structural work required has been checked and prepared in accordance with the dimensions in the outline drawing.
- The pressure booster system can be operated on the power supply network in accordance with the data on the name plate.
- The place of installation is frost-free.
- The place of installation can be locked.
- The place of installation is well-ventilated.
- A suitably dimensioned drain connection (e.g. leading to a sewer) is available.
- If expansion joints are used, take note of its creep resistance. Expansion joints must be easily replaceable.

The pressure booster system is designed for a maximum ambient temperature of 0 °C to +40 °C at a relative humidity of 50 %.

5.2 Checks to be carried out prior to installation

Place of installation

**WARNING**

Installation on mounting surface which is unsecured and cannot support the load
Personal injury and damage to property!
- Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1.
- The mounting surface must be set, flat, and level.
- Observe the weights indicated.

2) KSB Delta Primo VC: +30 °C
5 Installation at Site

### NOTE

The anti-vibration mounts of the pressure booster system provide adequate insulation against solid-borne noise. Thanks to level-adjustable feet (KSB accessory) the pressure booster system can also be installed in a horizontal position on uneven floors.

1. All structural work required has been checked and prepared in accordance with the dimensions in the outline drawing.

#### 5.3 Installing the pressure booster system

#### WARNING

**Top-heavy pressure booster system**

Risk of personal injury by pressure booster system tipping over!

- Pressure booster systems awaiting final installation must be secured against tipping over.
- Firmly anchor the pressure booster system.

Remove all packaging before installing the pressure booster system. Connect the pressure booster system's inlet line and discharge line to the corresponding site distribution lines.

#### NOTE

To prevent the transmission of piping forces and solid-borne noise, installing expansion joints with length-limiters is recommended.

Allow sufficient space for maintenance and repair work.

- All structural work required has been checked.
- The dimensions of the concrete foundation are correct, and the concrete has set firmly.

1. Mark out the anchoring holes on the floor as shown in the outline drawing.
2. Drill the holes (max. diameter: 12 mm).
3. Insert plug fixings of appropriate size.
4. Place the pressure booster system in its correct installation position.
5. Use suitable bolts to firmly anchor the pressure booster system.

#### 5.4 Connecting the piping

#### CAUTION

**Air pockets in suction line**

Pressure booster system cannot prime!

- Lay the pipe with a continuously rising slope.
5.4.1 Fitting an expansion joint

**DANGER**
Sparks and radiant heat
Fire hazard!
▷ Take suitable precautions to protect the expansion joint if any welding work is carried out nearby.

**CAUTION**
Wet, contaminated or damaged openings and connections
Damage to the pressure booster system!
▷ Do not open the pressure booster system openings until just prior to installation.

✓ The expansion joint has a length limiter with solid-borne sound insulation so as to be able to absorb reaction forces.
1. Install the expansion joint in the piping free of twist or distortion. Never use the expansion joint to compensate for misalignment or mismatch of the piping.
2. Tighten the bolts evenly and crosswise during assembly. The ends of the bolts must not protrude from the flange.
3. Do not apply paint to the expansion joint. Protect it from any contact with oil.
4. The position of the expansion joint within the pressure booster system must allow easy access and inspection and it must, therefore, not be insulated along with the piping.
5. Expansion joints are subject to wear.

5.5 Installing unpressurised inlet tanks

Installation and location of an unpressurised inlet tank together with the pressure booster system are governed by the same rules applicable to the pressure booster system.

Install the closed tank (under atmospheric pressure) available from us as an accessory as described in the installation instructions supplied with the tank.
CAUTION
Contamination in the pressure booster system
Damage to the pumps!
- Clean the tank before filling it.

The tank must be connected mechanically and electrically to the pressure booster system prior to commissioning of the system.

5.6 Electrical connection

WARNING
Incorrect connection to the mains
Damage to the mains network, short circuit!
- Observe the technical specifications of the local energy supply companies.

Connection to power supply is effected by means of a 230 V plug in accordance with VDE 0100.
Site-supplied fusing: 16 A (max).

NOTE
In individual cases, an earth leakage circuit breaker may trip when the pressure booster system is first commissioned. This may be caused by total discharge of the intermediate circuit.

5.6.1 Sizing the power cable
The cross-section of the power cable must be sized for the total rated power requirement.

5.6.2 Connecting the external dry running protection device (optional)
- An M12 plug is included in the scope of supply (the pressure booster system has a connection for an external, operator-supplied dry running protection device.)

NOTE
Pressure booster system does not start up
If the pressure booster system is equipped with a connection for an external dry running protection device, an external, operator-supplied dry running protection device must be connected. When the external dry running protection device (e.g. float switch) is not connected, the pressure booster system will not start.

1. Connect the cores of the external dry running protection device at pin 2 and pin 4 of the M12 plug. The contact must be a normally closed contact.

Fig. 4: Connecting the external dry running protection equipment
### Table 9: Pin assignment of the M12 plug

<table>
<thead>
<tr>
<th>Item</th>
<th>Status</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Normally closed contact</td>
<td>Connected to DI2</td>
</tr>
<tr>
<td>3</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Normally closed contact</td>
<td>Connected to GND</td>
</tr>
</tbody>
</table>
6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up
Before commissioning/start-up of the pressure booster system make sure that the following requirements are met:

▪ The pressure booster system has been properly connected to the electric power supply and is equipped with all protection devices.
▪ All relevant VDE standards and/or regulations applicable in the country of use are complied with.

NOTE
The competent authorities must be informed in due time prior to commissioning/test running the system.

6.1.2 Commissioning/start-up of pressure booster system

CAUTION
Foreign matter in the piping
Damage to the pump set / pressure booster system!

▷ Before commissioning/starting up or functional check running the pressure booster system, make sure that there is no foreign matter in the pressure booster system or piping.

NOTE
Commissioning of the pressure booster system - even test running - shall only be carried out in full compliance with all pertinent VDE (German Association of Electrical Engineers) regulations.

NOTE
In individual cases, an earth leakage circuit breaker may trip when the pressure booster system is first commissioned. This is caused by total discharge of the intermediate circuit.

✓ The pipe unions between the pump and the piping have been re-tightened.
✓ The cooling air inlet and outlet openings on the motor are unobstructed.
✓ All shut-off valves of the pressure booster system are open.
✓ The pre-charge pressure of the membrane-type accumulator has been checked. (⇒ Section 8.2.3, Page 29)

1. Open or loosen the vent plugs on the pump (refer to the pump’s installation/operating manual).
2. Slowly open the inlet-side shut-off element and prime the pressure booster system until the fluid to be handled escapes through all vent holes.
3. Insert and slightly tighten the pump vent plugs.
4. Plug in the mains plug or set the master switch to I.
5. Close the discharge-side shut-off element slowly and check whether the pressure booster system stops.
6. Run the pump again, with the discharge-side shut-off element open, and loosen the vent plug to let any remaining air escape.
7. Then re-tighten the vent plug firmly.
8. Verify that the pump is running smoothly.
9. Close the discharge-side shut-off element in order to verify whether the pump reaches its maximum shut-off head.
10. Make sure that the dry running protection device is working properly.

**NOTE**
Minor leakage of the mechanical seals during commissioning is normal and will cease after a short period of operation.

### 6.2 Switching on the pressure booster system
Plug in the mains plug or set the master switch to I to energise the pump. Readiness for operation is signalled by a permanently lit red LED and a flashing green LED.

### 6.3 Checklist for commissioning/start-up

**Table 10:** Checklist

<table>
<thead>
<tr>
<th>Actions</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Read the operating manual.</td>
<td></td>
</tr>
<tr>
<td>2. Compare the power supply data against the name plate data.</td>
<td></td>
</tr>
<tr>
<td>3. Check the earthing system (taking measurements).</td>
<td></td>
</tr>
<tr>
<td>4. Check the mechanical connection to the water mains.</td>
<td></td>
</tr>
<tr>
<td>Re-tighten the flange bolting and pipe unions.</td>
<td></td>
</tr>
<tr>
<td>5. Prime and vent the pressure booster system from the inlet side.</td>
<td></td>
</tr>
<tr>
<td>6. Check inlet pressure.</td>
<td></td>
</tr>
<tr>
<td>7. Check the start-up pressure, re-adjust if necessary.</td>
<td></td>
</tr>
<tr>
<td>8. Test the proper function of the lack-of-water and dry running protection equipment.</td>
<td></td>
</tr>
<tr>
<td>9. Vent the pump for a second time after it has been running for 5 to 10 minutes.</td>
<td></td>
</tr>
<tr>
<td>10. Check the pre-charge pressure.</td>
<td></td>
</tr>
<tr>
<td>11. Record all system conditions that do not correspond to our specifications or to the purchase order in the commissioning report (i.e. inlet pressure + max. pressure of pressure booster system higher than 16 bar).</td>
<td></td>
</tr>
<tr>
<td>12. Complete the commissioning report together with the operator/user and instruct the operator/user as to the function of the unit.</td>
<td></td>
</tr>
</tbody>
</table>

### 6.4 Shutdown

**NOTE**
As long as the pressure booster system is out of operation, water is supplied directly at \( p_m \) through the pressure booster system.
The pressure booster system remains installed

✓ Sufficient fluid handled is supplied for the operation check run of the pressure booster system.

1. Pull the mains plug or set the master switch to 0.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage at the pressure booster system</strong></td>
</tr>
<tr>
<td>Danger to life!</td>
</tr>
</tbody>
</table>

▷ Prior to opening the device, wait at least 10 minutes for any residual voltage to dissipate.

2. Start up the pressure booster system regularly between once a month and once every three months for approximately five minutes during prolonged shutdown periods. This will prevent the formation of deposits within the pump and the pump intake area.

The pressure booster system is removed from the pipe and stored

✓ The pressure booster system has been properly drained.

1. Spray-coat the inside wall of the pump casings, and in particular the impeller clearance areas, with a preservative.

2. Spray the preservative through the suction and discharge nozzles. It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).

3. Oil or grease all exposed machined parts and surfaces of the pressure booster system to protect them against corrosion.
CAUTION

Incorrect operation
Water supply is not assured!
▷ Make sure to comply with all local regulations, particularly the EC Machinery Directive and the EC Directive on Low-Voltage Equipment.

7.1 Design of the frequency inverter
The frequency inverter is motor-mounted and self-cooling. Its display and control panel feature the following:

1  Red LED indicating stand-by
   The red stand-by LED is lit when the motor is energised.

2  Green LED indicating the operating status
   The green operating status LED flashes at different frequencies. The closer the measured pressure to the set pressure, the higher the flashing frequency.

3  Yellow alarm LED

4  The start/stop button serves to start up the pump.

5  Green SET LED
   The green SET LED starts flashing when the pressure booster system is ready for constant-pressure mode.

6  +/- buttons for setting the pressure
   +/- buttons for adjusting the motor speed in manual mode

7.2 Pressure booster systems with configured frequency inverter drives
Drives supplied as part of the pressure booster system are already configured for operation.
The information on default settings is provided for information only; it is only required if the drive needs replacing.

Table 11: Nastec Mida VFD technical data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MIDA 203</td>
<td>1~230 +/-15 %</td>
<td>3~230</td>
<td>5</td>
<td>3</td>
<td>0,55</td>
</tr>
<tr>
<td>MIDA 205</td>
<td>1~230 +/-15 %</td>
<td>3~230</td>
<td>8</td>
<td>5</td>
<td>1,1</td>
</tr>
<tr>
<td>MIDA 207</td>
<td>1~230 +/-15 %</td>
<td>3~230</td>
<td>11</td>
<td>7,5</td>
<td>2,0</td>
</tr>
</tbody>
</table>

7.3 Programming
The red stand-by LED (1) lights up when the pressure booster system is energised.
The green SET LED (5) starts flashing to indicate that the system is ready for operation.

Press the Start/Stop button to start the pump. The green operating status LED (2) starts flashing at different frequencies. The closer the measured pressure to the set pressure, the higher the flashing frequency.

When the set value is reached, the green operating status LED (2) is lit continuously.

To stop the pump press the Start/Stop button (4). The green operating status LED (2) extinguishes.

**Adjusting the pressure**

A pressure gauge is fitted in the discharge line. Slightly opening one of the consumer installations facilitates pressure adjustment.

**Adjusting the pressure**

- Start up the pump (press the Start/Stop button).
- If the Set LED (5) flashes, press the Plus button or Minus button until the Set LED lights up continuously.
- Set the pressure by pressing the Plus button or Minus button as required.
### 8 Servicing/Maintenance

#### 8.1 General information/Safety regulations

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
<th>Unintentional start-up of pressure booster system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>Danger to life!</td>
</tr>
<tr>
<td></td>
<td>- De-energise the pressure booster system for any repair work or servicing work.</td>
</tr>
<tr>
<td></td>
<td>- Ensure that the pressure booster system cannot be re-energised unintentionally.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
<th>Voltage at the pressure booster system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>Danger to life!</td>
</tr>
<tr>
<td></td>
<td>- Prior to opening the device, wait at least 10 minutes for any residual voltage to dissipate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
<th>Improper lifting/moving of heavy assemblies or components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td>Personal injury and damage to property!</td>
</tr>
<tr>
<td></td>
<td>- Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
<th>Unintentional start-up of pressure booster system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td>Risk of injury by moving parts!</td>
</tr>
<tr>
<td></td>
<td>- Make sure the pressure booster system has been de-energised before commencing work on the pressure booster system.</td>
</tr>
<tr>
<td></td>
<td>- Make sure that the pressure booster system cannot be started up unintentionally.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
<th>Unqualified personnel performing work on the pressure booster system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td>Risk of personal injury!</td>
</tr>
<tr>
<td></td>
<td>- Always have repair and maintenance work performed by specially trained, qualified personnel.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
<th>Incorrectly serviced pressure booster system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAUTION</strong></td>
<td>Function of pressure booster system not guaranteed!</td>
</tr>
<tr>
<td></td>
<td>- Regularly service the pressure booster system.</td>
</tr>
<tr>
<td></td>
<td>- Prepare a maintenance schedule for the pressure booster system, with special emphasis on lubricants, shaft seals and pump couplings.</td>
</tr>
</tbody>
</table>
The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

- Observe the safety instructions and information.
- For any work on the pump (set) observe the operating manual of the pump (set).
- In the event of damage you can always contact KSB Service.
- A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation with a minimum of maintenance expenditure and work.
- Never use force when dismantling and reassembling the equipment.

### 8.2 Servicing/Inspection

#### 8.2.1 Supervision of operation

**CAUTION**

Increased wear due to dry running
Damage to the pump set!

- Never operate the pump set without liquid fill.
- Never close the shut-off element in the suction line and/or supply line during pump operation.

**CAUTION**

Impermissibly high temperature of fluid handled
Damage to the pump!

- Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- Observe the temperature limits in the data sheet and in the section on operating limits.

While the pump is in operation, observe and check the following:

- If activated, check the functional check run.
- Measure the actual start-up pressure and stop pressure of the pump sets with a pressure gauge. Compare the values with the specifications on the name plate.
- Compare the pre-charge pressure of the accumulator with the recommended data. (⇨ Section 8.2.3, Page 29)
- Check the rolling element bearings for running noises. Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the functions of auxiliary connections, if any.

#### 8.2.2 Maintenance schedule

**Table 12: Overview of maintenance work**

<table>
<thead>
<tr>
<th>Maintenance interval</th>
<th>Servicing/maintenance work</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least once a year</td>
<td>Check the pump and drive for smooth running and the mechanical seal for integrity. Check the shut-off elements, drain valves and check valves for proper functioning and tightness. If fitted, clean the strainer in the pressure reducer. If fitted, check the expansion joints for any wear. Verify the pre-charge pressure. Check the accumulator for integrity. (⇨ Section 8.2.3, Page 29)</td>
</tr>
</tbody>
</table>
### Servicing/Maintenance

<table>
<thead>
<tr>
<th>Maintenance interval</th>
<th>Servicing/maintenance work</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least once a year</td>
<td>Check the automatic switching functionality.</td>
</tr>
<tr>
<td></td>
<td>Check the cut-in levels and cut-out levels.</td>
</tr>
<tr>
<td></td>
<td>Check the inflow, inlet pressure, lack-of-water monitoring, flow monitoring and pressure reducer.</td>
</tr>
<tr>
<td></td>
<td>Check the inlet tank and the float valve (if applicable). Check the overflow for integrity and cleanliness.</td>
</tr>
</tbody>
</table>

### 8.2.3 Setting the pre-charge pressure

**WARNING**

Wrong gas
Danger of poisoning!
▷ Use only nitrogen to charge the accumulator.

**CAUTION**

Pre-charge pressure too high
Damage to the accumulator!
▷ Observe the manufacturer’s product literature (see name plate or operating manual of the accumulator).

The accumulator’s pre-charge pressure \( p \) must be lower than the set start-up pressure \( p_E \) of the pressure booster system.

The best storage volumes are achieved with the following settings (mean value):

- Value 0.9 at start-up pressure > 3 bar
- Value 0.8 at start-up pressure < 3 bar

**Example 1**

\[ p_E = 5 \text{ bar} \]

\[ 5 \text{ bar} \times 0.9 = 4.5 \text{ bar} \]

With a start-up pressure of 5 bar the pre-charge pressure of the accumulator must be 4.5 bar.

**Example 2**

\[ p_E = 2 \text{ bar} \]

\[ 2 \text{ bar} \times 0.8 = 1.6 \text{ bar} \]

With a start-up pressure of 2 bar the pre-charge pressure of the accumulator must be 1.6 bar.

**Checking the pre-charge pressure**

1. Close the shut-off elements fitted underneath the membrane-type accumulator.
2. Drain the membrane-type accumulator via the drain valve.
3. Remove and store the protective cap of the membrane-type accumulator valve.
4. Check the pre-charge pressure using suitable equipment (e.g. tyre pressure gauge).
5. Fit the protective cap of the membrane-type accumulator valve.

**Filling the membrane-type accumulator**

1. Remove and store the protective cap of the membrane-type accumulator valve.
2. Add nitrogen through the valve.
3. Fit the protective cap of the membrane-type accumulator valve.
9 Trouble-shooting

NOTE
Before performing any work on the pump’s internal parts during the warranty period please always consult the manufacturer. Our after-sales service will be at your disposal. Non-compliance will lead to forfeiture of any and all rights to claims for damages.

Table 13: Pump faults

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage along the shaft</td>
<td>Worn shaft seal</td>
<td>Replace the shaft seal.</td>
<td>Check the pump for impurities.</td>
</tr>
<tr>
<td></td>
<td>Pump has been operated without water.</td>
<td>Replace the shaft seal.</td>
<td></td>
</tr>
<tr>
<td>Pump does not run smoothly (noise and vibrations).</td>
<td>No water in the pump</td>
<td>Prime and vent the pump.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No water supply</td>
<td>Re-establish water supply.</td>
<td>Check supply lines for clogging.</td>
</tr>
<tr>
<td></td>
<td>Bearings of pump and/or motor defective</td>
<td>Have bearings replaced by certified company.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydraulic pump components defective</td>
<td>Replace hydraulic pump components.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrong direction of rotation of the pump</td>
<td>Interchange two phases of the power supply between frequency inverter and motor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Caution: Prior to opening the device, wait at least 10 minutes for any residual voltage to dissipate.</td>
<td></td>
</tr>
<tr>
<td>System/pump does not start.</td>
<td>No voltage at the terminals</td>
<td>Check power supply.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry running protection has tripped.</td>
<td>Re-establish water supply. Reset system.</td>
<td>Check that the supply tank is filled with water and that the supply line to the pressure booster system is not clogged.</td>
</tr>
<tr>
<td></td>
<td>Wrong setting of pressure setpoint</td>
<td>Adjust pressure setpoint.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drive fault</td>
<td>Reset drive and note down error code.</td>
<td></td>
</tr>
<tr>
<td>Insufficient flow rate and/or pressure of the system/pump</td>
<td>Air inside the pump</td>
<td>Vent the pump.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrong direction of rotation of the pump</td>
<td>Interchange two phases of the power supply between frequency inverter and motor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Caution: Prior to opening the device, wait at least 10 minutes for any residual voltage to dissipate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flow rate of water meter in suction line too low</td>
<td>Increase flow rate of water meter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>System-side filter clogged</td>
<td>Clean filter or check filter for obstruction. If required, replace filter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shut-off valve in outlet and/or inlet closed</td>
<td>Open both shut-off valves.</td>
<td></td>
</tr>
</tbody>
</table>

KSB Delta Solo Compact
<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumps start and stop too frequently.</td>
<td>Accumulator leakage or wrong pressure setting</td>
<td></td>
<td>Have system checked by the manufacturer.</td>
</tr>
<tr>
<td>Pump 1 not running, pump 2 running.</td>
<td>Pump 1 has been stopped, and pump 2 has assumed the master function.</td>
<td>Disconnect the system from the power supply. Then re-connect it.</td>
<td></td>
</tr>
</tbody>
</table>

The yellow alarm LED indicates different alarm messages by flashing at different frequencies followed by a 3-second pause.

**Table 14: Error codes of the frequency inverter**

<table>
<thead>
<tr>
<th>Flashing frequency</th>
<th>Description</th>
<th>System re-start</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x</td>
<td>Lack of water. Automatic re-start after 5-10-20-40-80 minutes.</td>
<td>De-energise the system (pull the mains plug or set the master switch to 0). Only after the system has been de-energised can it be re-started.</td>
</tr>
<tr>
<td>2x</td>
<td>The maximum motor current is higher than the set limit.</td>
<td></td>
</tr>
<tr>
<td>3x</td>
<td>Sensor alarm (sensor not connected or incorrectly connected, or output current below 2 mA)</td>
<td></td>
</tr>
<tr>
<td>4x</td>
<td>Overheating alarm (temperature at NTC thermistor exceeds 70 °C)</td>
<td></td>
</tr>
<tr>
<td>5x</td>
<td>Frequency inverter alarm (current too high)</td>
<td>De-energise the system (pull the mains plug or set the master switch to 0). Only after the system has been de-energised can it be re-started.</td>
</tr>
<tr>
<td>6x</td>
<td>Communication error between master and slaves (check the DIP switch position).</td>
<td>Caution: After switching off the frequency inverter, wait 10 minutes until dangerous voltages have discharged.</td>
</tr>
<tr>
<td>7x</td>
<td>The alarm value for the maximum pressure has been reached.</td>
<td></td>
</tr>
<tr>
<td>8x</td>
<td>The alarm value for minimum pressure has been reached.</td>
<td></td>
</tr>
<tr>
<td>Rapid flashing without any pauses</td>
<td>The digital inputs have been disconnected.</td>
<td></td>
</tr>
</tbody>
</table>
10 Related Documents

10.1 General assembly drawings/exploded views with list of components

10.1.1 KSB Delta Solo Compact MVP

Fig. 6: KSB Delta Solo Compact MVP

Table 15: List of components

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>79-2</td>
<td>Measuring transducer</td>
<td>691</td>
<td>Pressure gauge</td>
</tr>
<tr>
<td>591</td>
<td>Accumulator</td>
<td>742.01/02</td>
<td>Lift check valve</td>
</tr>
<tr>
<td>595</td>
<td>Anti-vibration pad</td>
<td>743.90</td>
<td>Ball valve</td>
</tr>
<tr>
<td>655</td>
<td>Pump</td>
<td>838</td>
<td>Pressure switch(^3)</td>
</tr>
</tbody>
</table>

The individual parts of the pump set are shown in the product literature of the pump set.

\(^3\) Optional
11 EU Declaration of Conformity

Manufacturer: KSB B.V.
Kalkovenweg 13
2401 LJ Alphen aan den Rijn (The Netherlands)

The manufacturer herewith declares that the product:

KSB Delta Solo Compact (MVP)

**Serial number:** 06/2018 0000000-0001 - 52/2020 9999999-9999

- is in conformity with the provisions of the following Directives as amended from time to time:
  - Pump set: 2006/42/EC Machinery Directive
  - Electrical components: 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
  - 2014/30/EU: Electromagnetic Compatibility (EMC)

The manufacturer also declares that
- the following harmonised international standards have been applied:
  - ISO 12100
  - EN 809
  - EN 60204-1
  - EN 806-2

Person authorised to compile the technical file:

Menno Schaap
Manager Competence Centre Products
KSB B.V.
(Subsidiary D.P. Industries B.V.)
Kalkovenweg 13
2401 LJ Alphen aan den Rijn (The Netherlands)

The EU Declaration of Conformity was issued in/on:

Alphen aan den Rijn, 04.07.2019

[Signature]

Menno Schaap
Manager Competence Centre Products
KSB B.V.
Kalkovenweg 13
2401 LJ Alphen aan den Rijn

4) Where applicable
12 Certificate of Decontamination

Type: .................................................................
Order number/Order item number*: .................................................................
Delivery date: .................................................................
Applications: .................................................................
Fluid handled*: .................................................................

Please tick where applicable:

- ☐ Corrosive
- ☐ Oxidising
- ☐ Flammable
- ☐ Explosive
- ☐ Hazardous to health

- ☐ Seriously hazardous to health
- ☐ Toxic
- ☐ Radioactive
- ☐ Bio-hazardous
- ☐ Safe

Reason for return*: .................................................................
Comments: .................................................................

The product/accessories have been carefully drained, cleaned and decontaminated inside and outside prior to dispatch/placing at your disposal.

We herewith declare that this product is free from hazardous chemicals, biological and radioactive substances.

For mag-drive pumps, the inner rotor unit (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) has been removed from the pump and cleaned. In cases of containment shroud leakage, the outer rotor, bearing bracket lantern, leakage barrier and bearing bracket or intermediate piece have also been cleaned.

For canned motor pumps, the rotor and plain bearing have been removed from the pump for cleaning. In cases of leakage at the stator can, the stator space has been examined for fluid leakage; if fluid handled has penetrated the stator space, it has been removed.

- ☐ No special safety precautions are required for further handling.
- ☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

............................................................................................................................
............................................................................................................................

We confirm that the above data and information are correct and complete and that dispatch is effected in accordance with the relevant legal provisions.

............................................................................................................................
............................................................................................................................
............................................................................................................................
Place, date and signature Address Company stamp

5) Required fields
13 Commissioning Report

The pressure booster system specified below has been commissioned today by the undersigned, authorised KSB Service who created this report.

Pressure booster system details
Type series ........................................................................................................................................
Size ........................................................................................................................................
Serial number ........................................................................................................................................
Order No. ........................................................................................................................................

Purchaser/place of installation
Purchaser
Name ........................................................................................................................................
Address ........................................................................................................................................

Place of installation

Operating data For further data refer to the wiring diagram.
Start-up pressure \( p_E \) [bar] ......................................................................................................................
Inlet pressure monitoring \( p_{\text{inl}} \cdot x \) (setting of inlet pressure switch) .................................................................................................................................
Stop pressure \( p_A \) [bar] ......................................................................................................................
Inlet pressure \( p_{\text{inl}} \) [bar] ......................................................................................................................
Pre-charge pressure of accumulator \( p_{\text{pre-charge}} \) [bar] .................................................................................................................................

The operator or operator's representative herewith confirms to have received instructions on how to operate and service the pressure booster system. The relevant circuit diagrams and operating instructions have been handed over.

Non-conformities found during commissioning
Non-conformity
1 ........................................................................................................................................

Deadline for remedial action

Name of KSB representative

Name of purchaser or representative

Place

Date

KSB Delta Solo Compact
## Index

<table>
<thead>
<tr>
<th>Letter</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Automation</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>Certificate of Decontamination</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Commissioning/Start-up</td>
<td>22</td>
</tr>
<tr>
<td>D</td>
<td>Design</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Designation</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Disposal</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Drive</td>
<td>15</td>
</tr>
<tr>
<td>E</td>
<td>EMC Directive</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Event of damage</td>
<td>6</td>
</tr>
<tr>
<td>I</td>
<td>Installation</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Installation at site</td>
<td>17, 18</td>
</tr>
<tr>
<td></td>
<td>Intended use</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Interference emissions</td>
<td>10</td>
</tr>
<tr>
<td>K</td>
<td>Key to safety symbols/markings</td>
<td>7</td>
</tr>
<tr>
<td>M</td>
<td>Maintenance work</td>
<td>28</td>
</tr>
<tr>
<td>O</td>
<td>Operating limits</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Other applicable documents</td>
<td>6</td>
</tr>
<tr>
<td>P</td>
<td>Partly completed machinery</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Personnel</td>
<td>8</td>
</tr>
<tr>
<td>Q</td>
<td>Qualification</td>
<td>8</td>
</tr>
<tr>
<td>R</td>
<td>Return to supplier</td>
<td>13</td>
</tr>
<tr>
<td>S</td>
<td>Safety</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Safety awareness</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Scope of supply</td>
<td>16</td>
</tr>
<tr>
<td>W</td>
<td>Warnings</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Warranty claims</td>
<td>6</td>
</tr>
</tbody>
</table>