Installation and operating instructions
1、严禁抓取电源线提升水泵。
2、水泵应有可靠的电气接地，可靠的电气接地如水管接地、金属接地或接地线。
3、检查叶轮转动方向时，双手远离叶轮。
4、水泵接通电源后，不要处理维护水泵。
5、不要拼接电源线。
6、水泉有可靠的电气接地，可靠的电气接地如水管接地、金属接地或接地线。
7、使用前请详细阅读产品使用说明书。

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1 绪言和版权

1.1 绪言
尊敬的客户
首先感谢您购买本公司的产品。在首次启动设备之前请务必仔细阅读本手册，以确保能够安全和有效地使用该设备。

本手册中含有正确使用此产品所有必须的技术资料；另外您还可以发现一些其它的有用信息，诸如如何发现设备的危险、降低维修次数、减少维修成本，以及提高产品的可靠性和使用寿命等等。

请确保此设备的操作和维护人员年满 18 周岁以上，已经阅读并充分理解本手册的内容。只有那些合格的并经过培训的人员才可以操作和维护本产品。在设备投入运行之前，务必保证遵守所有安全规定以及设备制造商的特殊要求。

本手册应置于设备工作地附近并保证设备的运行维护人员在任何时候都能很方便地拿到。

1.2 版权
本操作维护手册的版权归制造商所有，是专为操作维护人员安装、运行及维护设备而编写的；手册中所有的技术参数和图表，无论是全部还是部分，未经制造商同意，不得复制、分发，或者用于其它目的。

1.3 制造商
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1.4 变更的权利
制造商保留对整机或部件变更设计的权利。

2 概述
本手册包含操作和维护设备时必须严格遵守的基本操作规程，不仅包括本章所列出的安全指导，也包括其他章节所提到的有关内容和操作程序。操作人员必须保证严格遵守这些指导和说明。

2.1 本手册所用标识说明
“警告”标志
此标志表示: 必须严格遵守以避免人身伤害或产品损坏。

“危险”标志
此标志表示特别危险。标志上的图案表明了危险的种类，例如: 高度危险。

“禁止”标志
此标志表示绝对禁止。标志上的图案表明了禁止的内容，例如: 未经许可不得靠近。

“强制”标志
此标志表示必须执行的规定。标志上的图案表明了规定的内容，例如: 戴安全帽。

“注意”标志
此标志表示应注意相关的技术要求或提示。安全标识诸如 “危险” 、 “禁止” 、 “强制” 等和通行的标准和规程。

2.2 采用标准
我们的产品符合本地和统一标准。

2.3 安全规程
- 禁止单独一人安装 / 拆除设备。
- 进行装配、拆卸、维护和安装等工作之前必须关闭设备。设备与电源断开并确保不会被再次打开。所有转动部件应处于停止状态。
- 操作和维护人员的选用应符合规定。
- 操作人员必须清楚知道电源所在以及如何切断电源。
- 当电气和机械设备发生故障或任何不正常的情况时，操作人员应立即向上级报告。
- 当发生威胁人身安全的问题时，应立即切断电源。这些问题包括:
  - 安全和 / 或控制装置故障
  - 关键部件损坏
  - 电气设备、电缆和绝缘损坏
- 改动电气接线只能由具有资质的专业人员来完成。
- 必须遵守所有使用手册中规定的法律、法规，为确保安全，必须建立工作责任制。所有员工都有义务遵守这些规章制度。
- 工具及其他物品应存放在指定的位置。
- 移植、移动或使用设备前必须遵守安全操作守则。
- 在采取措施禁止人员在起吊重物的下方工作时，而且禁止起吊重物时有人站在重物附近。
- 操作和维护人员应遵守安全指示。如重物的重量超过电动葫芦的负载限制，必须通知操作人员。
- 当起重设备在操作时，应有第二人负责指挥。
- 使用移动式起重设备提升重物时，应采取安全的输送方式，在发生电力故障时不致发生伤亡事故。户外操作时，如天气变坏应立即停止操作。

2.4 人员资质
设备的操作和维护人员应具有从事此项工作的相应资质，例如，电气方面的工作只能由合格的电工来完成。所有的操作人员必须经过培训，必须遵循本手册及制造商的其它规定。为了保护操作人员的安全，应使用正确设计并得到正式使用许可的紧固装置。

2.5 基础
结构部件和基础应具有足够的强度，以确保设备能够安全和正确运行。设备的操作方或土建的承建方应负责根据尺寸、稳定性和强度来建造基础并保证其精度。

2.6 例图
本手册中所用的例图只是产品原图的一个模拟，因为我们产品的模块化设计，型号很多，大小各异，采用这种形式是一个较为现实的解决方案。如需了解设备的详图和说明，请参阅设备尺寸表、设备布置图及安装图。

2.7 操作程序
设备工作时，设备上转动的和活动的部件均具有潜在的危险。

不得让四肢和 / 或任何物体靠近设备的运动部件(如: 转子)！

2.8 工作介质
不同的工作介质在组成、腐蚀性、磨损性、总固体含量等方面有所不同。通常我们的设备可用于多种环境，请参考设备技术文档以及订单确认函以了解更多信息。另外请记住如果介质的密度、粘度或成分发生变化，相应的设备的一些参数也要随之变化。

不同的工作介质通常要求采用不同材质和形式的叶轮，订货时对实际情况的说明越详实，我们就能越准确地对产品作相应的调整，以满足实际的需要。一旦设备的应用环境或工作介质发生变化，应及时通知我们以便调整设备以适应新的环境。

当将设备应用到新的工作介质时，请注意如下方面:
- 在污水或废水中使用过的设备在再次使用前必须用清水或饮用水彻底清洗。
- 设备如果曾经用于对人体可能有危害的介质中，在换用于其它介质前必须消毒;而且须确认是否可以用于此介质。
- 如果设备中用到润滑油或冷却液体(如: 油)，机械轴封发生故障时，油或液体可能会泄漏到工作介质中。

2.9 电气连接与操作
设备使用交流电或工业高压电，使用时应遵循当地的有关标准。铭牌和设备的技术参数必须严格遵守。

如果保护装置自动关停设备，应将故障排除后才能重新开机。

设备只要电源才能启动。在任何情况下禁止穿越软线、软线、接线端子等。

在系统运行时，不得在电源线路上进行任何操作。

设备连接到控制柜时，尤其是当使用软启动器或变频器时，控制柜制造商的规格必须符合电磁兼容性的要求。对低压电控制和监控系统，可能需用额外的屏蔽措施，例如采用屏蔽电缆。

2.10 接地保护
设备(包括保护装置和工作位置，辅助提升装置)必须可靠接地。若人员有可能接触到设备和工作介质(如: 施工现场)，接地设计须连接一个接地保护装置。

电气类产品依据相关规范，电机防护等级为 IP68。

2.11 安全和控制装置
我们的设备可配备多种安全和控制装置，如吸入口滤网、温度传感器、密封腔泄漏控制等，这些装置禁止拆除或破坏。设备启动前必须由具有资质的专业技术人员检查温度传感器、浮子开关等装置是否正常。请记住有的装置需要相应的继电器才能实现其功能，例如正温度系数热敏电阻和PTC传感器。这些继电器可以将设备的过热信号提供给控制设备，以防止设备过热。

为安全起见，设备上的安全和控制装置未经许可不得拆除。操作人员必须具备相关的专业知识。

2.12 噪音
根据设备大小和功率的不同，噪音从 70 分贝到 110 分贝不等。

实际的噪音大小取决于如下几个因素，包括安装方式、驱动装置的类型、安装位置和风量等。

产品安装完成后，建议操作人员对设备在不同运转情况下的噪声值进行测量。根据现行的法律法规、标准和规范，如果噪音超过 85 分贝，必须佩戴耳罩 / 耳塞。操作人员必须保证遵守此项规定。
2.13 质保
本节包含有关质保的基本条款。在该合同中所规定的质保条款优先，此节内容不可取代合同中的相关条款。

下列情况下，制造商有义务和责任改正其所售出产品中所发现的任何缺陷：
- 材质的缺陷，产品设计、制造缺陷。
- 在质保期内出现的问题（用户应提供书面报告给制造商）。
- 安全和控制装置的专业人员在安装和检查时所发现的问题。

质保期
如无特殊规定，质保期为设备首次启动后 12 个月，或交货后最长 18 个月。其它有关条款应在订单确认函上以书面形式注明，所有这些条款在质保期内均为有效。

备件、外加附件和改装
只有制造商提供的原装备件备件才可用于设备的维修、更换、加装附件或改装，只有这些原装的备件才能保证较长的使用寿命和更为安全的使用。这些备件是为我们的产品特别设计的，用户自制的加装和改装部件以及其它非原装的配件均有可能引起产品的严重损坏和/或人身伤害。

维护
应由具有资格、受过培训、得到授权的人员定期进行设备维护和检修工作。维护和检修日志须及时更新，这样才可以掌握和了解维护和检修的情况。手动中没有在快速修理的内容，所有的维修工作只能由制造商及其授权的维修中心来进行。

产品损坏
危及安全的设备损坏及故障必须由授权的人员立即排除。设备应仅在正常的工作状态下运行。保修期内，设备只能由制造商或其授权的维修厂负责维修。制造商保留召回损坏设备回厂进行检修的权利。

责任免除
- 因操作人员或用户提供的信息不完全或错误导致的设计不正确
- 没有遵守相关法律和本手册之安全规定及按照相关要求及规范进行操作
- 事故和意外
- 由于不具备资质的人员进行维修
- 安装地点不适当或不合适
- 化学、电化学及其它的影响
- 污染

上述情况下，制造商将不负责承担任何损失、物质或经济损失。

2.14 技术状况
产品采用最先进的技术制造并符合公认的安全规范。其它信息请参考设备技术文档。

2.15 术语定义
干转：设备在没有液体的情况下全速运行。干转应绝对避免；如有必要，可安装防干转保护装置。
湿式安装：这种安装方式要求设备完全浸没在工作介质中。请注意设备的最大和最小浸没深度。
移动式安装：这种安装方式下，设备可移至任何地方使用。这种方式适合于虹吸排放基坑开挖的废水和污水。请注意设备表面的温度。
工作模式 S1（连续运行）：设备在额定功率下运行，设备表面温度保持恒定，即使超时运行温度也不会增加。设备可以在额定功率下连续运行而不会超过允许的最高温度。
工作模式 S2（正常运行）：在额定功率下的运行时间相对停机时间而言很短。最长运行时间以分钟计，如 S2 - 15，设备在额定功率下不超过最大允许温度时连续运行的时间为 15 分钟。然后设备停止运行直至设备与冷却介质的温差小于 2K。
虹吸运行：虹吸运行类似于干转，设备运行时仅有少量的液体被泵送。

3 产品说明
3.1 概述
威乐中国产品的制造非常精细并经过严格的质量控制。如果安装和维护正确，可以保证实现无故障运行。设备经过紧密封装后交货至用户。

3.2 正确使用及使用范围
我们的设备是在市政、建筑和部分工业领域中废水、污水、地表水和清水输送的理想产品。

3.3 使用条件
- 设备仅用于输送常规的未经处理的水和废水;
- 应在规定的扬程应用范围内使用（推荐按额定扬程的 -30%至 +10%）;
- 最大的潜没深度为 10 米;
- 运行过程中，电机部分露出液面不超过 1/2。30kW 以上水泵允许电机部分长时间露出水面运行，但水泵必须在最低运行水位以上工作;
- 泵的额定流量是 1050m3/h;
- 泵的额定扬程是 1 x 10^6 m2/s;
- 介质的 PH 值为 6~9;
- 介质的温度不超过 40℃;
- 悬浮的颗粒直径需在水泵可通过最大颗粒直径范围之内（可通过最大颗粒在水泵样本中有详细说明），当介质含有柔性纤维时，纤维长度最长允许 25~400mm（不同泵型有不同允许值）。

3.4 设备构造
概述
水泵包括电机、密封腔、泵壳及叶轮。这些都是按标准设计制造。

电机：电机壳采用灰铸铁。轴和紧固连接件采用不锈钢。三相异步感应电机由金属薄片和二次喷漆的线圈构成，绝缘等级为 F 级，B级温升，防护等级为 IP68。电机电缆按最大的机械负荷设计并密封，可承受介质的水压。电机电缆连接头也是同样密封。轴承是免维护的永久润滑的滚动轴承。

泵：泵壳采用灰铸铁，出口可配置耦合装置。水泵可以方便相应的管路系统对接。

密封：密封腔安装在电机与泵壳之间。由灰铸铁制成，腔内充满变压器油。这样可以确保密封泵耐久的润滑。

叶轮：叶轮采用半开式或闭式结构，固定在电机轴上并由其驱动。

冷却：由于每个叶轮都有各自的特性及不同的介质有不同的成分，我们推荐在更换叶轮时咨询一下制造商。

安全及控制设备：电机配置防过热的温度传感器，密封腔内温度检测（取决于型号）控制根据传递来的信号分析判断，如果设备运行不正常，迅速关闭电源，停止电机运行，保护设备的安全运行。

图 3 - 1 ≤ 4kW 水泵结构
1 进水底座 2 泵壳 3 叶轮 4 机械密封 5 注油孔 6 放水孔 7 油腔室 8 下轴承 9 定子 10 转子 11 上轴承 12 下轴承 13 电缆
### 图 3 - 2 5.5-22kW 水泵结构

<table>
<thead>
<tr>
<th>位置</th>
<th>图3-2的对应位置</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>进水底座</td>
</tr>
<tr>
<td>2</td>
<td>泵壳</td>
</tr>
<tr>
<td>3</td>
<td>叶轮</td>
</tr>
<tr>
<td>4</td>
<td>冷却夹套</td>
</tr>
<tr>
<td>5</td>
<td>机械密封</td>
</tr>
<tr>
<td>6</td>
<td>放水孔</td>
</tr>
<tr>
<td>7</td>
<td>油腔室</td>
</tr>
<tr>
<td>8</td>
<td>下轴承</td>
</tr>
<tr>
<td>9</td>
<td>定子</td>
</tr>
<tr>
<td>10</td>
<td>转子</td>
</tr>
<tr>
<td>11</td>
<td>上轴承</td>
</tr>
<tr>
<td>12</td>
<td>吊环</td>
</tr>
<tr>
<td>13</td>
<td>控制电缆</td>
</tr>
<tr>
<td>14</td>
<td>动力电缆</td>
</tr>
</tbody>
</table>

### 3.5 型号说明

型号代码提供了水泵的一些设计信息。

- FAG 100 C 25.100/75 Cutter
- FA 潜水污水泵产品系列
- G 用于轻污水
- 100 泵出口公称直径 mm
- C 叶轮型式  ( C - 出口型叶轮 、 Z - 半开式叶轮 、 Cutter- 带铰刀装置)
- 25 最大扬程 m
- 100 最大流量 m³/h
- 75 电机功率 kW × 10

### 3.6 冷却系统

电机是干式电机，即电机室是充满空气的，通过外壳将热量传导到介质或者周围的空气。

必须保持介质浸没泵壳部分。注意以下事项:

- 根据使用条件和介质成分的不同，泵壳可能高达 40℃，有烫伤的危险。若关闭水泵，须等泵壳的温度低于周围空气时方可摸它。

### 3.7 技术参数

产品的技术参数列在设备技术文档中，所有这些参数均应严格遵守，尤其是工作电流及电压值。

### 3.8 特别说明

- 虹吸模式:
  - 不允许用于虹吸。根据安装模式，至少要让介质浸没泵壳或电机外壳。

### 4 运输与存放

#### 4.1 交货

设备到货之后，应检查货物的损坏和缺失情况。如有部件受损或缺失，应在到货当时通知货运公司或制造商。事后有任何索赔都视为无效。部件的损坏情况应在交货或运输文件上。

#### 4.2 运输

只能使用合适的卡车进行运输。如需在运输途中更换车辆，应使用正确的工具和方法，以确保设备能够安全运输。设备应由制造商/货运公司以适当的方式包装和密封，以减少运输过程中的损坏。应确保设备在装车过程中处于适当的位置，并以适当的方式固定，以防止设备在运输过程中受到损坏。

#### 4.3 存放

新设备可以存放至少 1 年，设备临时存放之前应进行彻底清洁。

设备存放时应考虑以下几点:

- 设备应置于干燥的室内，并且要确保不会跌落。潜水排污泵应竖直放置。
- 设备的进出水口在存放前应密封以防杂质进入。
- 电缆应避免缠绕、破损或受潮。
- 设备如带有牵引绳，运输时可以以此牵引设备。
- 设备应避免阳光直晒、受潮、灰尘和霜冻。受热和霜冻可能严重损坏叶轮、转子和涂层。
- 设备运转时，转子和叶轮上较尖锐的边可能会伤及身体，因此应穿戴必要的防护服/装备。
- 设备在存放较长时间之后，重新启动之前应清理灰尘和油垢等杂质。另外还应用检查转子和叶轮是否运转灵活，外壳和涂层是否有损坏等。

启动之前，应检查油位，如有必要应及时补充。

#### 4.4 退货

退回工厂的货物应进行清洁并正确包装。退货的清洁是至关重要的。如果设备用于有害于健康的介质则应在空气循环下进行消毒。设备的包装存放在妥善的地方，只有具备资格的人员才可以承担运输任务，并应严格执行相关安全规定。

#### 4.5 运输

#### 5 安装

为保证安装安全和人身安全，安装过程中必须遵守以下几点:

- 设备的安装 — 包括设备的装配和安装应由具备资格的人员完成，并应严格执行相关安全规定。
- 在安装之前，应检查设备是否有在运输过程中造成的损坏。
- 在安装之后，应检查设备是否在运输过程中造成的损坏。
- 请按本手册第二章“概述”之规定。

### 5.1 概述

- 提升设备时请用把手，绝不可拉扯电力电缆。使用吊链进行装配时，必须使用卸扣去勾提升孔或把手。
- 用清水将含石灰、粘土、胶结物的杂质冲洗出水泵，这是为了防止结垢和潜在的危害或者对产品的破坏。
- 若是使用水位控制，则应先确认最小的覆盖深度已达到，覆盖深度请参见水泵技术文档。
- 泵壳和管路系统内避免存气，并设置相应放气装置。
- 水泵还应避免阴露。

### 5.2 安装方式

水泵的安装方式为：耦合式湿式安装和便携式湿式安装。请咨询制造商。
5.3 工作场所要求（深池或竖井）
概述：
安装水泵的工作区必须平整。安装和移动水泵前，需确保提升机构没有问题。使用提升机构可以使得运行和储存变得更加安全。水泵必须安装在牢固的基础上。必须时刻以安全操作和正确的装配/拆卸方法来布置电力电缆。必须在最低的水位以上运行。禁止水泵干转。因此，我们在有多种水位变化时安装一个水位控制器或者干转保护系统。

这些是最低要求。工作寿命的长短和是否安全运转取决于安装是否牢固。制造商为每一种安装方式准备了设计方案。必须遵守这些说明。

为达到每一种安装方式的冷却效果，必须严格遵照设备规定的专门的操作模式和最小的浸没深度要求。根据使用条件和介质成分的不同，泵壳可能高达40℃，有灼伤的危险。若关闭水泵，须等泵壳的温度低于周围空气时方可摸它。

湿式安装：
湿式安装必须配置耦合装置或便携弯头。出口侧的管路系统与其相连。连接管必须是自固定的，即其不由耦合装置或水泵支撑。工作区必须平整以便于安装水泵。维护和维修时，水泵必须搬离工作区。若空气进入介质是很危险的，当水进入进水口时，会引起大量的湍流，此时必须安装一个导流装置。

5.4 附件安装规定
提升装置（足够的提升和负载能力）
提升装置的负载能力必须比水泵、附件和电缆的总重大。也就是说，可以在不妨碍人身安全的前提下升降水泵。提升装置的转动范围内不应有物品或障碍。

耦合装置（依装配方式而定）
水泵耦合装置与出水管路系统连接。
泵座（依装配方式而定）
便携式安装需要泵座。泵座安装在一个固定的基础上以便于和泵进水口配合并保证了水泵处于安全的位置。

固定用品和工具
确认你拥有必需的工具（如扳手）及其他的用品（如膨胀螺栓和锚栓）。固定用品必须足够可靠以确保安全装配。

5.5 安装
安装水泵时应考虑以下几点：
- 必须由有资格的人员安装。电气部分必须由有资格的电气技术人员完成；
- 水泵的安装工作和辅助装置就在池边完成，要避免掉进池里；
- 确保所有的安全要求都满足以确保不发生意外。
- 在悬挂的负载下要遵守所有的关于安装的说明、规章和法规；
- 固定装置必须得到正式批准；
- 要遵守所有的安全措施。工作安全规程，和本手册提到的规则；
- 要注意穿戴合适的保护服/装备；
- 如存在有毒或令人窒息的气体时，应记录下必要的数据；
- 安装前应对检查泵的泵壳。若有损伤，才必须修补，完整无缺的涂层才能达到真正防腐的作用。
- 在操作前必须检查泵的泵壳。若有损伤，才必须修补。完整无缺的涂层才能达到真正防腐的作用。

移动式安装时，泵壳可能高达40℃，有灼伤的危险。若关闭水泵，须等泵壳的温度低于周围空气时方可摸它。

5.6 干转保护
水泵应至少浸没到泵壳的顶端，务必确认没有空气浸入泵腔。为获得最大的可靠性，我们建议安装干转保护系统。这需要使用浮子开关，浮子开关安装在水泵内。当水位低于最低的覆盖水位要求时浮子开关会发出信号，若水位频繁变动时最好使用水位控制系统。

5.7 水位控制
每套控制系统包含一个或两个浮球开关。用于在两个不同的水位下自动关闭水泵。
一个浮球开关的用法：
- 若使用一个浮球开关，则应将其固定在最高和最低的水位的中间。请确保在最高水位时水池不会溢出。固定浮球开关的位置要足够长，才能达到这个目的。
- 若使用两个浮球开关，则两个浮球开关分别标上“上”和“下”，其上浮球开关对应最高水位，下浮球开关对应最低水位。确保在最高水位时水池不会溢出。运行时水泵的进水口必须浸没在介质中。

5.8 移动
当移动水泵时，务必先要切断电源。使用耦合装置安装时，用提升链或提升绳通过提升装置将水泵提出水池。无需专门将水泵排空。需确保动力电缆没有受到损坏。

6 启动
本章包含所有有关操作人员启动和运行设备的重要指导。以下提到技术要求的必须遵守、检查：
- 安装方式（湿式）
- 工作模式（S1）
- 最低覆盖水位
- 操作和维护手册应置于设备工作地附近或者放置在特定的地方，以保证设备的操作维护人员在任何时候都能查到设备的技术文档。若水位频繁变动时最好使用水位控制系统。

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6.1 准备工作
设备采用最新技术和制造，正常条件下可以长期稳定运行。当然前提是必须遵守所有的规章和要求。运输过程中机械轴封油的微量渗漏是无关紧要的，但必须在浸入介质之前排除。

6.2 电气系统
铺设和选择电缆时，应遵守相关的地区和国家法规，连接电机时也是如此。电机应由电机保护启动器进行保护，连接电机需注意转动方向，如果转向不正确，设备将不能按要求运行，有些情况下甚至可能损坏设备。根据设备技术参数检查运行电压，并确保各相电流一致。

确认所有的温度传感器和监测设备（如密封腔监测）已经接上，并检测功能。如果温度传感器和监测设备未接好，设备将不能正常运行。

6.3 旋转方向
注水前要检查永久固定的水泵的旋转方向。使用耦合装置的水泵须在放进介质前检查其旋转方向。

转向的检查：
- 将连接好的水泵置于地上并稍微倾斜。
- 启动-产生轻微的启动压力（不超过30秒）。从上面看，从泵进口方向看应该是逆时针旋转。
- 泵体上标有旋转方向。当水泵运转时不要将手伸进进口或出口，叶轮可能会伤到你。

请注意以下方面：
- 直流-没有燃烧，无异味（材料通用）
- 检查内部的绝缘和浸没深度是否正确。
- 检查出水口和出水管的接头系统，打开所有的隔板
- 泵壳必须浸没，也就是应完全浸没在介质中。泵壳应不带有任何气体，使用合适的排气设备排气。如需在，泵壳应采用排气按钮。
- 检查所有的附件，管路系统与耦合装置应相匹配。
- 泵座固定在固定的基础之上。

启动前必须检测绝缘性能和填充物是否满足要求，参见第7章。
6.4 电机保护及重启方式

电机保护:
带温度补偿器的热继电器是最低的配置要求。若机器与经常发生故障的电气系统相连，我们推荐安装额外的保护装置（过压，欠压或断相继电器和避雷保护）。连接机器时，必须遵守当地和国家规范。

必须使用合适的漏电保护开关。

开关 / 继电器启动方式:

手动启动
将开关接到插座并摁下继电器的开关。

自动启动
此启动方式下，通过浮子开关控制机器。

单浮球设计:
机器由一个浮球开关控制。若浮球处于浸没状态，则接通机器；若浮球露出水面，则关闭机器。

双浮球设计:
机器由两个一样的浮球控制（水位控制）。两个浮球一上一下布置，以满足在最高水位（两个浮球均处于浸没状态）时机器运行，最低水位（两个浮球均露出水面）时关闭机器。

启动方式:

直接启动
满负荷时，电机的保护电流等于额定电流。部分负荷时，我们推荐保护电流高于工作点电流 5%。

星三角启动
电机的三角形回路内保护电流为额定电流的 0.58 倍。星三角的最大启动时间为 3 秒。

启动变压器 / 软启动
满负荷时，电机的保护电流等于额定电流。部分负荷时，我们推荐保护电流高于工作点电流 5%。下降电压（约 70%）下的最大启动时间为 3 秒。

监控保护:

过热保护: 功率≤ 4KW 的水泵自带双金属温度传感器；功率≥ 5.5kW 的水泵标配热敏电阻 PTC。

泄露保护: 功率≥ 5.5kW 的水泵均在电机腔和油室配备泄露传感器；功率≥ 30kW 的水泵除以上保护外还有接线腔泄露传感器。

接线方式:

5.5 kW ≤电机功率≤ 22kW 的水泵，除电源电缆外，还有一根三芯（K1、K2 和 K3）的信号电缆，与综合保护器相接。正温度系数的热敏电阻 PTC 元件与芯线 K1、K2 相接，油腔测温电阻与芯线 K1、K3 相接。电机腔测温电阻与芯线 K1 相接，线控信号电缆与芯线 K2、K3 相接。电机腔采电采信号通过综合保护器对电机实施温度和泄露保护。

功率≥ 30kW 的水泵，可以应用户要求在电机腔内设电加热装置，其两端分别与信号电缆芯线 K5 和 K6 相接停机即接通加热，以避免停机后绕组结露，确保绕组绝缘性能和电机使用寿命。

功率≥ 22kW 的 FAG 水泵可采用 Y—△、自耦降压或无触点起动（即软启动方式）等方式启动运行。

6.5 启动后

启动过程中，电流会短暂超过额定电流。当启动过程结束时，运行电流就不再高于额定电流。

必须监控以下各项：
- 工作电压（容许与额定电压有 +/-5% 的偏差）
- 频率（容许与额定频率有 +/-2% 的偏差）
- 电流（容许相间电流最大偏差 5%）
- 相间的电压差（最大 1%）
- 每小时的启动次数（潜水电泵“开”“停”不应过于频繁，从关闭到重新启动间隔不少于 5 分钟，以防电动机内温升过高，或输水管内发生水锤现象）
- 最小的浸没水位，水位控制系统，干转保护
- 平稳转动
- 泄漏检查，若需要请参见第 7 和第 9 章的有关步骤
- 耦合装置泄露检查，检验水泵在 0.7 倍额定流量，且水位淹没至电机 1/2 处时，水泵出口不应有明显泄露
- 机械轴封会有一段磨合期，这时会有微小的泄漏。磨合期可以维持大于 1 ~ 3 个月。在此期间需换几次油。

如在此阶段后泄漏持续的话请及时联系制造商。

极限情况下的运行：

极限情况下，容许的最大电压偏差为额定电压 +/-10%，容许的最大频率偏差为额定频率的 +3% ~ –5%。相间的最大容许电压差为 1%。建议不要让机器持续在极限情况下运行。

7 维护

设备和整个系统必须定期进行检查和维护。维护的间隔由制造商和用户根据使用条件确定。如设备用于腐蚀性和 / 或磨损性介质，应咨询制造商，检查和维护的间隔应缩短。

请注意以下几点：
- 本操作维护手册应置于操作维护人员易于找到的位置，操作人员应按照本手册的指导进行操作，并只可以执行本手册中所列出的维护和维修操作。
- 设备和系统的检查、清洁和维护工作必须由经过培训的专业人员在安全的工作场所以程序进行。
- 检查和更换保护器的触点时，必须将电源切断，以避免损坏保护器。同时，还应检查内部热敏电阻的状况，以确保其正常工作。
- 电机功率≥ 30kW 的水泵，可采用 Y—△、自耦降压或无触点起动（即软启动方式）等方式启动运行。

7.1 大修

通常每年或由于工作过载而进行一次大修（正常使用寿命前），若使用在有害水气和腐蚀性介质中，则应每半年或一年大修一次。当然，所有其他的维护工作也应按制造商的指示进行。

7.2 润滑剂

- 只能使用和制造商建议的润滑油或等同替代品。
- 若之前使用过的润滑油，则必须先清洗干净后才能更换。

7.3 维护期

初次启动前或长期闲置后使用时；
- 检查动力电缆的绝缘情况。
- 每个月：
  - 检查动力电缆的绝缘情况。
  - 检查漏电保护开关的漏电情况，绝缘值应符合规定要求。
- 每年：
  - 检查动力电缆的绝缘情况。
  - 检查系统内接线及连接是否牢固。
  - 检查电缆的绝缘情况，若发现电缆绝缘损坏，应立即更换。
  - 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。

7.4 维护内容

检查电缆和接线端子：
- 所有三相电缆都应该使用耐高温型电缆，以确保在正常操作情况下，这些电缆不会发生热变性。
- 能够承受现有的工作温度。
- 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。
- 检查电缆的绝缘情况，若发现电缆绝缘损坏，应立即更换。
- 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。

7.5 维护周期

初次启动前或长期闲置后使用时：
- 检查动力电缆的绝缘情况。
- 每个月：
  - 检查动力电缆的绝缘情况。
  - 检查系统内接线及连接是否牢固。
  - 检查电缆的绝缘情况，若发现电缆绝缘损坏，应立即更换。
  - 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。
- 每年：
  - 检查动力电缆的绝缘情况。
  - 检查系统内接线及连接是否牢固。
  - 检查电缆的绝缘情况，若发现电缆绝缘损坏，应立即更换。
  - 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。
- 每两年：
  - 检查动力电缆的绝缘情况。
  - 检查系统内接线及连接是否牢固。
  - 检查电缆的绝缘情况，若发现电缆绝缘损坏，应立即更换。
  - 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。

7.6 小修

检查电缆和接线端子：
- 所有三相电缆都应该使用耐高温型电缆，以确保在正常操作情况下，这些电缆不会发生热变性。
- 能够承受现有的工作温度。
- 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。
- 检查电缆的绝缘情况，若发现电缆绝缘损坏，应立即更换。
- 检查电缆的接线端子是否牢固，若发现松动，应及时紧固。

7.7 大修

通常每年或由于工作过载而进行一次大修（正常使用寿命前），若使用在有害水气和腐蚀性介质中，则应每半年或一年大修一次。当然，所有其他的维护工作也应按制造商的指示进行。
出现较大偏差时，请联系制造商。检查安全和控制装置以及升降装置时，请参考其相关的操作手册。
故障 5：水泵运转不平稳，噪声大

<table>
<thead>
<tr>
<th>原因</th>
<th>处理方法</th>
</tr>
</thead>
<tbody>
<tr>
<td>设备在允许范围之外运行</td>
<td>检查设备运行参数，必要时进行修正和调整运行状况</td>
</tr>
<tr>
<td>设备内有水、泥或杂物沉积</td>
<td>清理积水和沉积物</td>
</tr>
<tr>
<td>转子偏心</td>
<td>关闭设备并更换其避免再次打开，清洁叶轮</td>
</tr>
<tr>
<td>运行过程中空气吸入量超标</td>
<td>联系制造商</td>
</tr>
<tr>
<td>噪音大</td>
<td>检查电机接线</td>
</tr>
<tr>
<td>转向不正确</td>
<td>更换磨损的部件</td>
</tr>
<tr>
<td>轴承故障</td>
<td>联系制造商</td>
</tr>
<tr>
<td>设备安装不正确</td>
<td>检查安装，如有必要可使用橡胶垫片</td>
</tr>
<tr>
<td>表 9-5 水泵运转不平稳，噪声大</td>
<td></td>
</tr>
</tbody>
</table>

故障 6：机械轴封处泄漏，密封腔监控装置报警并关停设备

<table>
<thead>
<tr>
<th>原因</th>
<th>处理方法</th>
</tr>
</thead>
<tbody>
<tr>
<td>机械轴封处密封损坏</td>
<td>更换机械轴封</td>
</tr>
<tr>
<td>密封腔电缆损坏</td>
<td>更换密封腔传感器</td>
</tr>
<tr>
<td>机械轴封损坏</td>
<td>联系制造商，更换机械轴封</td>
</tr>
<tr>
<td>表 9-6 机械轴封处泄漏、密封腔监控装置报警并关停设备</td>
<td></td>
</tr>
</tbody>
</table>

9.2 故障的进一步解决方案

如果上表中所列的故障无法修复，请联系我们的客户服务部门。

- 通过电话或书面形式提供帮助
- 提供现场服务
- 在工厂内检查和修理设备

请注意有的服务会收取一定的费用，我们的客户服务部会告知您相关的详情。
1 Introduction

1.1 Preface

Dear Customer,

Thank you for choosing one of our company’s products. Read this operating and maintenance manual carefully before you first use it. This is the only way to ensure that the product is safely and economically used. The documentation contains all the necessary specifications for the product, allowing you to use it properly. In addition, you will also find information on how to recognize potential dangers, reduce repair costs and downtime, and increase the reliability and working life of the product.

All personnel who work on or with the product must be qualified for such work. The entire personnel must be of age. It must be ensured that personnel have read and understood the instructions in this operating and maintenance handbook. All safety requirements and specific manufacturer’s requirements must be fulfilled before the product is put into operation.

This manual must also be accessible to personnel at all times and also be made available where the product is used.

1.2 Copyright

This operation and maintenance manual has been copyrighted by the manufacturer. The operation and maintenance handbook is intended for the use by assembly, operating and maintenance personnel. It contains technical specifications and diagrams which may not be reproduced or distributed, either completely or in part, or used for any other purpose without the expressed consent of the manufacturer.

1.3 Manufacturer’s address

Wilo China Ltd.
Tel: 010-5234 7888
Fax: 010-5234 7666
Internet: www.wilo.com.cn
E-mail: info@wilo.com.cn

1.4 Rights of alteration

The manufacturer reserves the right to make technical alterations to systems or components.

2 Safety

This chapter lists all the generally applicable safety instructions and technical information. Furthermore, every other chapter contains specific safety instructions and technical information. All instructions and information must be observed and followed during the various phases of the product’s lifecycle (installation, operation, maintenance transport etc.). The operator is responsible for ensuring that personnel follow these instructions and guidelines.

2.1 Instructions and safety information

This manual uses instructions and safety information for preventing injury and damage to property. To make this clear for the personnel, the instructions and safety information are distinguished as follows: Information referring to personal injury is printed in black and always accompanied by a danger symbol. Danger, prohibition or instruction symbols are used as safety symbols. The safety symbols conform to the generally valid guidelines and regulations, for example DIN and ANSI.

Each safety instruction begins with one of the following signal words:

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger</td>
<td>Serious or fatal injuries can occur.</td>
</tr>
<tr>
<td>Warning</td>
<td>Serious injuries can occur.</td>
</tr>
<tr>
<td>Caution</td>
<td>Injuries can occur.</td>
</tr>
<tr>
<td>Caution</td>
<td>Serious damage to property can occur, including irreparable damage.</td>
</tr>
</tbody>
</table>

Safety instructions begin with a signal word and description of the hazard, followed by the hazard source and potential consequences, and end with information on preventing it. Example:

**Beware of rotating parts!**

The moving rotor can crush and sever limbs. Switch off the machine and let the rotor come to a rest.

2.2 Directives used

Our products are subject to local and harmonized standards.

2.3 General safety

- Never work alone when installing or removing the product.
- The machine must always be switched off before any work is performed on it (assembly, dismantling, maintenance, installation). The product must be disconnected from the electrical system and secured against being switched on again. All rotating parts must be at a standstill.
- The operator should inform his/her superior immediately should any defects or irregularities occur.
- It is of vital importance that the system is shut down immediately by the operator if any problems arise which may endanger safety of personnel. Problems of this kind include:
  - Failure of the safety and/or control devices
  - Damage to critical parts
  - Damage to electrical installations, cables and insulation
  - Tools and other objects should be kept in a place reserved for them so that they can be found quickly.
  - Sufficient ventilation must be provided in enclosed rooms.
  - When welding or working with electronic devices, ensure that there is no danger of explosion.
  - Only use fastening devices which are legally defined as such and officially approved.
  - The fastening devices should be suitable for the conditions of use (weather, hooking system, load, etc.). If these are separated from the machine after use, they should be expressly marked as fastening devices. Otherwise they should be carefully stored.
  - Mobile working apparatus for lifting loads should be used in a manner that ensures the stability of the working apparatus during operation.
  - When using mobile working apparatus for lifting non-guided loads, measures should be taken to avoid tipping and sliding etc.
  - Measures should be taken that no person is ever directly beneath a suspended load. Furthermore, it is also prohibited to move suspended loads over workplaces where people are present.
  - If mobile working equipment is used for lifting loads, a second person should be present to coordinate the procedure if needed (for example if the operator’s field of vision is blocked).
  - The load to be lifted must be transported in such a manner that nobody can be injured in the case of a power cut. Additionally, when working outdoors, such procedures must be interrupted immediately if weather conditions worsen.

**These instructions must be strictly observed. Non-observance can result in injury or serious damage to property.**

2.4 Personnel qualification

All personnel who work on or with the product must be qualified for such work; electrical work, for example may only be carried out by a qualified electrician. The entire personnel must be of age.

Operating and maintenance staff must also work according to local accident prevention regulations. It must be ensured that personnel have read and understood the instructions in this operating and maintenance handbook; if necessary this manual must be ordered from the manufacturer in the required language.

2.5 Foundations

The structural components and foundations must be of sufficient stability to ensure safe and functional operation. The operator or the supplier is responsible for the provision of the foundations and their accuracy in terms of dimensions, stability and strength.

2.6 Illustrations

The illustrations used are of dummies and original drawings of the products. This is the only realistic solution for our wide range of products and the differing sizes enabled by the module system.

More exact drawings and specifications can be found on the dimension sheet, the planning information and/or the installation plan.

2.7 Operating procedure

Certain parts such as the rotor and propeller rotate during operation in order to pump the fluid. Certain materials can cause very sharp edges on these parts.

**Beware of rotating parts!** The moving parts can crush and sever limbs. Never reach into the pump unit or the moving parts during operation. Switch off the machine and let the moving parts come to a rest before maintenance or repair work.

2.8 Pumped fluids

Each pumped fluid differs in regard to composition, corrosiveness, abrasiveness, TS content and many other aspects. Generally, our products can be used for many applications. For more precise details, see the machine data sheet and the order confirmation. It should be remembered that if the density, viscosity-lit or the general composition change, this can also alter many parameters of the product.

Different materials and impeller shapes are required for different pumped fluids. The more exact your specifications on your order, the more exactly we can modify our product to meet your requirements. If the area of application and/or the pumped fluid change, please inform us of this so that we can adapt the product to the new circumstances.

When switching the product into another pumped fluid, observe the following points:

- Products which have been operated in sewage or waste water must be thoroughly cleaned with pure water or drinking water before use.
- Products which have pumped fluids which are hazardous to health must always be decontaminated before changing to a new fluid. Also clarify whether the product may be used in a different pumped fluid.
- With products which have been operated with a lubricant or cooling fluid (such as oil), this can escape into the pumped fluid if the mechanical shaft seal is defective.
2.9 Electrical work & Electrical connection

Our electrical products are operated with alternating or industrial high-voltage current. The “Electrical connection” data sheet must be observed when connecting the product. The technical specifications must be strictly adhered to.

If the machine has been switched off by a protective device, it must not be switched on again until the error has been corrected.

Beware of damp
Moisture penetrating cables can damage them and render them useless. Never immerse cable ends in the pumped fluid or other liquids. Any unused wires must be disconnected.

When the machine is connected to the electrical control panel, especially when electronic devices such as soft startup control or frequency drives are used, the relay manufacturer’s specifications must be followed in order to conform to EMC. Special separate shielding measures e.g. special cables may be necessary for the power supply and control cables.

The connections may only be made if the relays meet the harmonized GB/EU standards. Mobile radio equipment may cause malfunctions.

2.10 Ground connection

Our products (machine including protective devices and operating position, auxiliary hoisting gear) must always be grounded. If there is a possibility that people can come into contact with the machine and the pumped liquid (e.g. at construction sites), the grounded connection must be additionally equipped with a fault current protection device.

The electrical products conform to motor protection class IP 68 in accordance with the valid norms.

2.11 Safety and control devices

Our products are equipped with various safety and control devices. These include, for example suction strainers, thermo sensors, sealed room monitor etc. These devices must never be dismantled or disabled. Equipment such as thermo sensors, float switches, etc. must be checked by an electrician for proper functioning before start-up. Please remember that certain equipment requires a relay to function properly, e.g. posistor and PTC sensor. This relay can be obtained from the manufacturer or a specialist electronics dealer.

Staff must be informed of the installations used and how they work.

Never operate the machine if the safety and monitoring devices have been removed or disabled, or if they do not work.

2.12 Sound pressure

Depending on the size and capacity (kW), the products produce a sound pressure of approximately 70 dB (A) and 110 dB (A).

The actual sound pressure, however, depends on several factors. These include, for example, the installation type (wet, dry, transportable), fastening of accessories (e.g. suspension unit) and pipeline, oper-at-ing site, immersion depth, etc.

Once the product has been installed, we recommend that the operator make additional measurements under all operating conditions.

In accordance with the laws in effect, guidelines, standards and regulations, ear protection must be worn if the sound pressure is greater than 85 dB (A). The operator is responsible for ensuring that this is observed!

2.13 Warranty

This chapter contains the general information on the warranty. Contractual agreements have the highest priority and are not superseded by the information in this chapter. The manufacturer is obliged to accept any defects found in the products it sells, provided that the following requirements have been fulfilled:

General information
- The defects are caused by the materials used or the way the product was manufactured or designed.
- The defects were reported in writing to the manufacturer within the agreed warranty period.
- The product was used only as prescribed.
- All safety and control devices were connected and inspected by authorized personnel.

Warranty period
If no other provisions have been made, the warranty period applies to the first 12 months after initial start-up or to a max. of 18 months after the delivery date. Other agreements must be made in writing in the order confirmation. They will remain valid at least until the agreed warranty period of the product has expired.

Spare parts, add-ons and conversions

Only original spare parts as supplied by the manufacturer may be used for repairs, replacements, add-ons and conversions. Only these parts guarantee a long working life and the highest level of safety. These parts have been specially designed for our products. Self-made add-ons or conversions or the use of non-original spare parts can seriously damage the product and/or injure personnel.

Maintenance

The prescribed maintenance and inspection work should be carried out regularly. This work may only be carried out by qualified, trained and authorized personnel. The maintenance and inspection log supplied must be properly updated. This enables you to monitor the status of inspections and maintenance work. Quick repairs not listed in this operation and maintenance manual and all types of repair work may only be performed by the manufacturer and its authorized service centers.

Damage to the product

Damage as well as malfunctions that endanger safety must be eliminated immediately by authorized personnel. The product should only be operated if it is in proper working order. During the agreed warranty period, the product may only be repaired by the manufacturer or an authorized service workshop! The manufacturer reserves the right to recall the damaged product to the factory for inspection!

Exclusion from liability

No liability will be assumed for product damage if one or more of the following points apply:
- Incorrect design on our part due to faulty and/or incorrect information provided by the operator or customer
- Non-compliance with the safety instructions, the regulations and the requirements set forth by law and this operating and maintenance manual
- Incorrect storage and transport
- Improper assembly/dismantling
- Improper maintenance
- Unqualified repairs
- Faulty construction site and/or construction work
- Chemical, electrochemical and electrical influences
- Wear

This means the manufacturer’s liability excludes all liability for personal, material or financial injury.

2.14 Technical condition

Our products are manufactured by the most advanced technology and meet the technical safety standards of the State. See technical Documentation for additional information.

2.15 Technical terms

Dry run

The product is running at full speed; however, there is no liquid to be pumped. A dry run is to be strictly avoided. If necessary, a safety device must be installed.

“wet” installation type

This installation type requires the product to be immersed in the pumped fluid. It is completely surrounded by the pumped fluid. Please observe the values for the maximum submersion depth and the minimum water coverage.

“transportable” installation type

With this installation type, the product is equipped with a pedestal. It can be installed and operated at any location. Please observe the values for the maximum submersion depth and the minimum water coverage, and remember that the surfaces of the product become very hot.

“Siphoning operation”

At the rated load, a constant temperature is reached that does not increase even in prolonged operation. The operating equipment can operate uninterruptedly at the rated load without exceeding the maximum permissible temperature.

“S2” operating mode (short-term operation)

The period of service at the rated load is short in comparison to the subsequent pause. The maximum operating period is indicated in minutes, for example, S2-15. The operating equipment can operate during this time uninterruptedly at the rated load without exceeding the maximum permissible temperature. The pauses must continue until the machine temperature no longer exceeds that of the coolant by more than 2K.

“Siphoning operation”

Siphoning operation is similar to dry running. The product operates at fullspeed, but only small amounts of liquid are pumped. Siphoning operation is only possible with certain types.

Dry-run protection

The dry-run protection is designed to automatically shut down the product if the water level falls below the minimum water coverage value of the product. This is made possible by installing a float switch.

Level control

The level control is designed to switch the product on or off depending on the filling level. This is made possible by installing a float switch.

Use in siphoning mode is not permitted. According to the type of installation, the machine must be submerged in pumped liquid at least up to the top edge of the pump or motor housing.

3 Product description

3.1 Overview

The machine is manufactured with great care and is subject to constant quality controls. Trouble-free operation is guaranteed if it is installed and maintained correctly.

3.2 Proper use and fields of application

Submersible motor pumps are used in pumping sewage water, washer water, surface water and clear water in municipal application, building services and part of industrial usage. The dirty waste water may also contain solid particles depending on the model of the machine. Motors are installed wet.

3.3 Conditions of use

- The machine can be used to pump slightly dirty water.
- The machine must be used in proper range of head (~30% to +10% of rated head). The maximum submersion is 10m. Depending on the installation types, the machine must be submerged in pumped liquid at least 12/ up to the top edge of motor. 30Kw and up can run with the motor exposing above water, but the minimum water coverage is required.
- Pumped liquid has a permitted maximum density of 1050 kg/m³ and a maximum viscosity of approx. 3x10⁶ m²/s.
- Pumped liquid’s PH value is 6-9.
- Maximum liquid temperature is 40 °C.
- Maximum diameter of solid particles contained in the pumped liquid must be less than the maximum diameter that can flow through the pump. (Maximum diameter can be found in the catalogue). When there are flexible fibers contained in the pumped liquid, the maximum length of them is 25-400 mm (depending on the model of the machine). Trash rack is also required to filter out larger solids.
- Special models are also available for use with abrasive and corrosive liquids. For information on these models, please consult the manufacturer. The exact details about your machine version can be found in the technical data.

3.4 Construction

The machine consists of the motor and the pump housing as well as the impeller which belongs to it. These are assembled in a modular design.

Motor

The shaft and screw connections are made of stainless steel. The three-phase asynchronous motor consists of a stator in the "H" insulation class as well as the motor shaft with rotor package. Degree of protection is IP68. The power supply cable is designed for the maximum mechanical load and is sealed against water pressure from the pumped liquid. The motor cable lead connections are sealed from the pumped liquid as well. The bearings used are permanently lubricated maintenance-free antifriction bearings.

Pump

The pump housing is manufactured from gray cast iron, and, depending on the model, is supplied with different connections. This means that the machine can be connected with the respective pipeline system.

Sealing

The sealing between pump and motor is carried out by two separate mechanical shaft seals in tandem arrangement. The sliding and counter-rings of the mechanical shaft seals used are made from silicon carbide.

Sealing housing

The sealing housing is located between the motor and pump housing and is made of gray cast iron. The sealing chamber is filled with transformer oil, this means a long-lasting lubrication of the sealing is guaranteed.

3.6 Cooling

The motor is a dry runner. This means that the motor chamber is filled with air. The heat escapes through the housing parts. Heat is transferred through them to the pumped fluid and/or the ambient air. Note the following information:

BEWARE of burns!

The housing components can heat up to well above 40 °C. There is a risk of burns! After switching it off, let the pump cool down to ambient temperature.

3.7 Technical data

Technical parameters are listed in the technical documents. All technical parameters should be strictly observed, especially the operating current and voltage.

3.8 Special Explanation

Use in siphoning mode is not permitted. According to the type of installation, the machine must be submerged in pumped liquid at least up to the top edge of the pump or motor housing.

4 Transport and storage

4.1 Delivery

On arrival, the delivered items must be inspected for damage and a check made that all parts are present. If any parts are damaged or missing, the transport company or the manufacturer must be informed on the day of delivery. Any claim made at a later date will be deemed invalid. Damage to parts must be noted on the delivery or freight documentation.

4.2 Transport

Only the appropriate and approved fastening devices, transportation means and lifting equipment may be used. These must have sufficient load bearing capacity to ensure that the product can be transported safely. If chains are used they must be secured against slipping. The staff must be qualified for the tasks and must follow all applicable national safety regulations during the work.
4.3 Storage

Newly supplied products are prepared so that they can be stored for at least 1 year. The product should be cleaned thoroughly before interim storage. The following should be taken into consideration for storage:

- Place the product on a firm surface and secure it against falling over. Submersible motor pumps should be stored vertically.

Danger from falling over

Never put down the product unsecured. If the product falls over, injury can occur.

- Our products can be stored at temperatures down to -15°C. The store room must be dry. We recommend a frost-protected room with a temperature of between 5°C and 25°C for storage.

- The product may not be stored in rooms where welding work is conducted as the resulting gases and radiation can damage the elastomer parts and coatings.

- Any suction or pressure connections on products should be closed tightly before storage to prevent impurities.

- The power supply cables should be protected against kinking, damage and moisture.

Beware of electrical current

Damaged power supply cables can cause fatal injury! Defective cables must be replaced by a qualified electrician immediately.

- The machine must be protected from direct sunlight, heat, dust, and frost. Heat and frost can cause considerable damage to propellers, rotors and coatings.

- The rotors or propellers must be turned at regular intervals. This prevents the bearing from locking and the film of lubricant on the mechanical shaft seal is renewed. This also prevents rust film deposits.

- Any impurities have been removed and decontaminated if it has been used with materials which are hazardous to health. The impurities must be removed and decontaminated if it has been used with materials which are hazardous to health.

- Place the product on a firm surface and secure it against falling over. Submersible motor pumps should be stored vertically.

4.4 Returning to the supplier

Protection against damage occurring during transport and storage. The packaging must protect the product against damage. If you should have any questions please contact the manufacturer.

- If the product has been stored for a long period it must be cleaned and correctly packaged. In this context, clean means that impurities have been removed and decontaminated if it has been used with materials which are hazardous to health. The packaging must protect the product against damage. If you should have any questions please contact the manufacturer.

- Any suction or pressure connections on products should be closed tightly before storage to prevent impurities.

- The power supply cables should be protected against kinking, damage and moisture.

Beware of electrical current

Damaged power supply cables can cause fatal injury! Defective cables must be replaced by a qualified electrician immediately.

- The machine must be protected from direct sunlight, heat, dust, and frost. Heat and frost can cause considerable damage to propellers, rotors and coatings.

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- Place the product on a firm surface and secure it against falling over. Submersible motor pumps should be stored vertically.

4.5 Installation

In order to prevent damage to the machine or serious injury during installation the following points must be observed:

- Installation work – assembly and installation of the machine – may only be carried out by qualified persons. The safety instructions must be followed at all times. – The machine must be inspected for transport damage before any installation work is carried out.

5.1 General information

After pumping water containing lime, clay or cement, flush out the machine with clean water in order to prevent encrustation and to prevent later break-downs.

5.1.1 Cleaning

Clean the machine with clean water in order to prevent encrustation and to prevent later break-downs.

5.2 Installation types

Possible types of vertical installation for the machine:

- Wet installation with a suspension unit.
- Portable wet installation.

5.3 The operating area

The operating area must be laid out for each machine. You must ensure that lifting gear can be fitted without any trouble, since this is required for assembly and removal of the machine. It must be possible to safely reach the machine in its operating and storage locations using the hoisting gear.

5.4 Assembly accessories

Swiveling hoisting gear

The maximum bearing capacity must be greater than the weight of the machine, add-ons units and cable. It is essential that the machine can be lifted and lowered without hindrance or endangering personnel. There should be no objects or obstacles in the working zone of the hoisting gear.

Suspension unit (according to the mounting type)

The suspension unit connects to the discharge pipe.

Pump base (according to the mounting type)

The portable pump need a pump base. The pump base is installed on a pump foundation to keep pump safe.

Fixing materials and tools

Make sure you have the required tools (such as wrenches) and other material (such as plugs and anchor bolts). The fastening materials should be sufficiently stable to ensure safe assembly.

5.5 Installation

The following information should be taken into consideration when installing the machine:

- The machine must be located on a firm foundation. Electric power cables must be laid out in such a way that safe operation and non-problematic assembly/dismantling are possible at all times.
- The structural components and foundations must be of sufficient stability to ensure safe and functional operation. The operator or the supplier is responsible for the provision of the foundations and their accuracy in terms of dimensions, stability and strength. Never let the machine run dry. Therefore, we recommend installing a level control unit or a dry-run protection system where there are great variations in the level.
- Use guide and deflector plates for the pumped fluid intake. If the water jet reaches the surface of the water or the machine, air will be introduced into the pumped liquid. This will lead to unfavorable current and pumping conditions. As a result, the machine does not run smoothly and is subjected to higher wear and tear.

5.6 Commissioning

The machine must be completely submerged in pumped liquid up to the minimum water coverage.

- Install the suspension unit in the operating area (Only use a suspension unit produced by the manufacturer. Information about installation is located in the appendix of this operating manual).
- Prepare the machine for operation on a suspension unit.
- Check that the suspension unit is firmly fixed and functions properly.
- Have an expert connect the machine to the power supply and check the direction of rotation in accordance with chapter 6.
- Lower the machine slowly onto the guide pipes in the operating area. Hold the electric power cables slightly taut when lowering. When the machine is connected to the suspension unit, make sure that the electric power cables are secured adequately against falling and/or damage.
- For new installation: Flush the operating area and bleed the discharge pipe.
- Start the machine in accordance with chapter 6.
5.6 Dry-run protection
The machine must always be submerged up to the top edge of the pump housing. Make sure that no air enters the pump housing.
For optimum reliability, we recommend installing a dry-run protection system. Correct running is ensured by float switches or electrodes. The float switch / electrode is fastened in the pit and switches off the machine when the water level falls below the minimum coverage level.
For dry installations, the float switch must be fitted at an appropriate height in the collector tank.
Please observe the information about the minimum water coverage. If dry-run protection is not only put into effect on one float or electrode when filling levels deviate strongly, then the machine may turn on and off constantly!
This can result in the maximum number of motor start-ups being exceeded.

5.7 Water level control

Manual reset
The motor is switched off when the water level falls below the minimum coverage level and switched back on when a sufficient water level is reached.
Separate reactivation point
Using a second switching point (additional float or electrode), a sufficient difference is obtained between the activation and deactivation points. This prevents constant switching. This function can be put into effect with a level control relay.

5.8 Removal
When removing the machine, make sure that it is first disconnected from the mains.
On portable installations, the machine can be lifted out of the pit after it has been disconnected from the mains and the discharge pipe has been emptied. You may have to disconnect the pit after it has been disconnected from the mains and the discharge pipe has been emptied. You may have to disconnect the pit after it has been disconnected from the mains and the discharge pipe has been emptied.
On portable installations, the machine can be lifted out of the pit after it has been disconnected from the mains and the discharge pipe has been emptied.

6.1 Preparatory measures
The machine has been designed and constructed using the very latest technology. Under normal working conditions it will operate reliably and for long periods. The one condition for this is that all instructions and advice are observed.
Minor oil leakage in the mechanical shaft seal on delivery is no cause for concern. However, it must be removed prior to submersion in the pumped liquid.
Please check the following:
- Cable guidance – no loops, slightly taut
- Check the temperature and submersion depth of the pumped liquid – see machine data sheet
- If a hose is used on the discharge side, it should be flushed out with clean water before use to prevent any sediment causing blockages.
- The pump sump must be cleaned for wet installation
- Clean the discharge and intake side pipe system and open all sliders
- The pump housing must be flooded, i.e. it should be completely full of fluid with no air in it at all. Bleeding can take place using a suitable bleeding device in the system, or, if available, with bleeders screws on the discharge port.

6.2 Electrical system
Observe the relevant local and national regulations when laying out and selecting the electric lines as well as when connecting the motor. The motor must be protected by a motor protection switch.
Have the motor connected in accordance with the "Electrical connection data sheet.
Protection available through the control panel.
6.3 Direction of rotation
The machine must be connected in accordance with the data sheet "Electrical connection plan". Rotation direction is controlled by a rotating field tester. This tester is switched on when the pump is connected and displays the rotation direction of the rotating field. There must be a clockwise rotating field for the machine to run correctly.
If a counter-clockwise rotating field is displayed, two phases must be swapped.

6.4 Motor protection and activation types
Motor protection
The minimum requirement is a thermal relay / motor protection switch with temperature compensation, differential triggering and an anti-activation device in accordance with the appropriate national regulations. If the machines are connected to electrical systems in which faults frequently occur, we recommend installing additional protective devices (overvoltage, undervoltage or phase failure relays, lightning protection). Local and national regulations must be adhered to when connecting the machine.
Activation types with plugs / relays
Units with relays
Connect the plug to the socket provided and press the On/Off switch on the relay.
Activation types for cables
Units with relays
Please observe the relay manual.

Activation types for cables with free ends (without plugs)
Direct activation
Motor protection should be set to the rated current when fully loaded. At partial load, we recommend that motor protection is set 5% above the measured current at the operating point.
Star–delta activation
If the motor protection is installed in the line:
Set the motor protection to 0.58 x the rated current. The maximum start-up time in star–delta mode is 3 seconds.
If the motor protection is not installed in the line:
Set the motor protection to the rated current when fully loaded.
Starting transformer/soft start
Motor protection should be set to the rated current when fully loaded. At partial load, we recommend that motor protection is set 5% above the measured current at the operating point.
The minimum start-up time at reduced voltage (approx. 70%) is 3 seconds.

Monitoring equipment
Overheating protection: Up and equal to 40kW power of the pump with double metal temperature sensor. Power > 5.5kW pumps with thermostat PTC.
Leakage protection: For pumps power between 5.5kW to 22kW, there are equipped with leakage sensors in the motor housing and oil chamber, to detect if any leakage in the motor. The sensor in the oil chamber could detect if any oil leakage into the oil chamber to further prevent the motor damaged from more water leakage. The alarm will shut off the motor to avoid the damage of motor.
For power > 30kW pumps, there are also equipped with leakage sensor in the terminal compartment. This signals if there is any leakage in the terminal compartments.
Depending on the customer’s requirement, power > 30kW pumps can equipped with an anti-condensation heater.
There are protection function like lack–phase protection, overload protection, low-voltage protection, and short-circuit protection available through the control panel.

Monitoring device connections
Power between 5.5kW to 22kW pumps have 3 wires control cable (K1/K2/K3) connecting with electric protector. Thermal monitoring of the motor is performed by PT1 sensors. K1 and K2 wires are connected with PTC sensors to monitor motor overheat. K3 wire is connected with the internal electrode to monitor the motor and sealing chamber leakage.
The motor rated power > 30kW has a 7 wires control cable (K1/ K2/K3/K4/K5/K6/K7) connecting with electric protector. K1 and K2 wires are connected with PTC sensors to monitor motor overheat. K3 wire is connected with the internal electrode to monitor the motor compartment leakage. K4 wire is connected with the internal electrode to monitor the sealing chamber leakage. K7 wire is connected with the internal electrode to monitor the terminal compartment leakage. K5 and K6 wires are connected with the anti-condensation heater (Depending on the customer’s requirement).
6.5 Starting

The rated current is briefly exceeded during the start-up procedure. Once this process has ended, the operating current should no longer exceed the rated current. If the motor does not start immediately after the machine is switched on, it must be switched off immediately. The start pauses specified in the technical data must be adhered to before starting up again. If the fault recurs, the machine must be switched off again immediately. The machine may only be started again once the fault has been rectified.

The following items should be monitored:

- Operating voltage (permisible deviation +/-5% of the rated voltage)
- Frequency (permisible deviation +/-2% of the rated frequency)
- Current consumption (permisible deviation between phases is a maximum of 5%)
- Voltage difference between the individual phases (max. 1%)
- Starts and stops per hour (see technical data)
- Air entry in the inflow, a deflector plate should be fitted if necessary
- Minimum water immersion level, level control unit, dry-run protection
- Smooth running
- Check for leaks, if need be, follow the necessary steps as set out in “Maintenance”
- Check for suspension device leakage. There is no obvious leakage from the fitting surface between the pump flange and coupling base when the water level is submerged to 1/2 of the motor at 0.7 rated flow.

As mechanical shaft seals have a certain running-in phase, it is possible that minor leaks may occur. This running-in phase lasts approx. 1 - 3 months. Change the oil several times during this phase. Please consult the manufacturer if leakage continues after this running-in phase has ended.

Operation in the limit range

The maximum limit range deviation for operational data is +/-10% of the rated voltage and +3% to -5% of the rated frequency. The permissible voltage difference between the individual phases is a maximum of 1%. Continuous operation in the limit range is not recommended.

7 Maintenance

The machine and the entire system must be inspected and maintained at regular intervals. The time limit for maintenance is set by the manufacturer and applies to the general conditions of use. The manufacturer should be consulted if the system is to be used with corrosive and/or abrasive pumped liquids, as the time limit between inspections may need to be reduced.

Note the following information:

- The operating and maintenance manual must be available to the maintenance personnel and its instructions followed. Only the repair and maintenance measures listed here may be performed.
- All maintenance, inspection and cleaning work on the machine and the system may only be carried out by trained specialists exercising extreme care in a safe workplace. Proper protective clothing is to be worn. The machine must be disconnected from the electricity supply before any work is carried out. There must be no way that it can be inadvertently switched on.
- Above a weight of 50kg, only hoisting gear which has been officially approved and which is in a technically perfect condition should be used for lowering and raising the machine.
- Make sure that all fastening devices, ropes and safety devices of the hand winch are in a technically perfect condition. Work may only commence if the auxiliary hoisting gear has been checked and found to be in perfect working order. If it is not inspected, danger to personnel may result.
- Electrical work on the machine and system must be carried out by an electrician. For machines approved for work in areas subject to explosion danger, please refer to the “Explosion protection in accordance with the ... regulation” chapter. Defective fuses must be replaced. Under no circumstances are they to be repaired. Only fuses at the specified current and of the prescribed type may be used.
- When working with inflammable solvents and cleaning agents, fires, unheeded lighting and smoking are prohibited.
- Machines which circulate fluids hazardous to health, or which come into contact with them, must be decontaminated. It must be ensured that no dangerous gases can form or are present.
- If injuries involving hazardous pumping liquids or gases occur, first-aid measures must be performed in accordance with the notices in the workplace and a doctor should be called immediately.
- Ensure that all necessary tools and materials are available.
- Tidiness and cleanliness guarantee safe and problem-free operation of the machine. After working on the machine all cleaning materials and tools should be removed from it. All materials and tools should be stored in an appropriate place.
- Operating supplies such as oils and lubricants must be collected in appropriate vessels and properly disposed of. Appropriate protective clothing is to be worn for cleaning and maintenance jobs. Only lubricants expressly recommended by the manufacturer may be used. Oils and lubricants should not be mixed. Only use genuine parts made by the manufacturer.
- A trial run or functional test of the machine must be performed as instructed in the general operating conditions.

7.1 General overhaul

During this the bearings, shaft seals, O-rings and power supply cables are inspected and replaced as required in addition to normal maintenance work. This work may only be conducted by the manufacturer or an authorized service workshop.

7.2 Lubricants

- The machine lubricants may only be topped up or replaced with lubricants from the same manufacturer.
- Machines which have previously been operated using other lubricants must first be thoroughly cleaned before they can be operated.

7.3 Maintenance intervals

Before initial start-up or after a longer period of storage:
- Checking the insulation resistance
- Fill level check in sealing room/chamber – lubricant must reach up to the lower edge of the filling opening
- Monthly
- Monitoring the current consumption and voltage
- Checking the used relays for resistors, sealing room monitor, etc.
- Every six months
- Visual inspection of the power supply cable
- Visual inspection of the cable holder and the cable braiding
- Visual inspection of accessories, e.g. the suspension device and hoisting gears
- Yearly
- Changing the lubricant in the housing room/chamber
- Emptying the leakage chamber (not present in all models)
- Functional inspection of all safety and control devices
- Coating check and touch-up as required

7.4 Maintenance tasks

Monitoring the current consumption and voltage

The current consumption and voltage is to be monitored periodically during all 3 phases. This remains constant during normal operation. Slight fluctuations are a result of the composition of the pumped fluid. The current consumption can assist in early detection and correction of damage and/or faulty operation in the impeller/proper bearings and/or the motor. More extensive resulting damage can thus be largely prevented and the risk of a total failure can be reduced.

Checking the used relays for resistors, sealing room monitor, etc.

Check the relays used are functioning fault-free. Defective devices must be immediately replaced, because these cannot ensure safe operation of the machine. The test procedure details should be followed closely (in the operating instructions for each relay).

Checking the insulation resistance

To check the insulation resistance, the power supply cable must be disconnected. The resistance can then be measured with an insulation tester (measuring voltage = 500V DC). The following values may not be exceeded:

The insulation resistance may not be below 100mega-ohms during initial operation. For all further measurements the value of cold insulation resistance must be greater than 5mega-ohms and the value of hot insulation resistance must be greater than 0.5mega-ohms insulation resistance too low: Moisture may have penetrated the cable and/or the motor. Do not connect the machine, consult manufacturer.

Visual inspection of the power supply cable

The power supply line must be examined for bubbles, cracks, scratches, chafed areas and/or crushed sections. If damage is found, the power cable must be exchanged immediately.

The cables may only be changed by the manufacturer or an authorized/certified service workshop. The machine may not be used again until the damage has been adequately rectified.

Visual examination of the cable holders (carabiners) and the cable braiding

When the machine is used in basins or pits, the lifting cables/cable holders (carabiners) and the cable braiding are subject to constant wear. Regular inspections are necessary in order to prevent the lifting cables/cable holders (carabiners) and cable braiding from wearing out and to prevent the electricity cable from being damaged.

The lifting cables/cable holders (carabiners) and the cable braiding are to be immediately replaced if any signs of wear appear.

Visual inspection of accessories

Inspect accessories such as suspension units and hoisting gear to check whether they are secured in a stable manner. Loose and/or defective accessories should be repaired immediately or replaced.

Functional inspection of safety and control devices

Motor temperature monitor

PTC sensors must be connected via an evaluation relay in the switchgear. The max. motor temperature is 135 °C. This equals to a threshold of 750 Ohm. When the threshold is reached, the unit must switch off. For this reason, no warranty claims can be accepted for any damage to the winding resulting from unsuitable motor monitoring.

Monitoring the sealing chamber

The sealing chamber is monitored by an internal pencil electrode. This must be connected via an evaluation relay. The recommended threshold is 100 kOhm. When the threshold is reached, a warning must be given or the unit switched off.

Monitoring the Motor/terminal compartment

The Motor/terminal compartment is monitored by an internal pencil electrode. This must be connected via an evaluation relay. The recommended threshold is 100 kOhm. When the threshold is reached, a warning must be given or the unit switched off.
7.5 Repairs

When carrying out repair work, the following information should always be noted:
- Round sealing rings as well as existing seals should always be replaced.
- Screw fixings such as spring washers or the self-locking Nord-Lock screw fixing should always be replaced.
- If no self-locking Nord-Lock screw fixing is used as a locking screw or it is not possible to use these, then no dacromet-coated screw should be used. In this case, screws made from the material A2 or A4 must be used. The correct torques must be observed.
- Never use brute force during this work.

Changing sealing parts

Changing sealing parts on the liquid side such as the block seal cartridge and the mechanical seal shaft requires a certain amount of specialist knowledge about these sensitive components. Changing sealing parts on the liquid side such as the block seal cartridge and the mechanical seal shaft requires a certain amount of specialist knowledge about these sensitive components.

Changing the lubricant

The drained lubricant must be checked for dirt and water content. If the lubricant is very dirty and contains more than 1/3 water, it must be changed again after four weeks. If there is again water in the lubricant then, it seems likely that a seal is defective. If the lubricant is very dirty and contains more than 1/3 water, it must be changed again after four weeks.

7.6 Temporary shutdown

In order to prevent damage or serious injury while rectifying machine faults, the following points must be observed:
- Only attempt to rectify a fault if you have qualified staff. This means each job must be carried out by trained specialist staff, for example electrical work must be performed by a trained electrician.
- Always secure the machine against an accidental restart by disconnecting it from the electric system. Take appropriate safety precautions.
- Always have a second person make sure the machine is switched off in an emergency.
- Secure moving parts to prevent injury.
- Independent work on the machine is at one’s own risk and releases the manufacturer from any warranty obligation.

8 Shutdown

8.1 Temporary shutdown

For this type of shutdown, the machine remains installed and is not cut off from the electricity supply. For temporary shutdown, the machine must remain completely submerged so that it is protected from frost and ice. Make sure the operating room and the pumped fluid cannot be covered by ice. This ensures that the machine is always ready for operation. During longer shutdown periods, carry out a regular (monthly to quarterly) function run for a period of 5 minutes.

8.2 Final shutdown / storage

Beware of hot parts!

When removing the machine, be careful of the temperature of the housing and the connected piping. These can heat up to well above 40°C. Let the machine cool down to ambient temperature before you touch it.

9 Troubleshooting

In order to prevent damage or serious injury while rectifying machine faults, the following points must be observed:
- In case of larger deviations, please consult the manufacturer. Please consult the appropriate operating manual for details on inspecting the safety and monitoring devices on the auxiliary lifting gear.

Changing the lubricant

The drained lubricant must be checked for dirt and water content. If the lubricant is very dirty and contains more than 1/3 water, it must be changed again after four weeks. If there is again water in the lubricant then, it seems likely that a seal is defective. If the lubricant is very dirty and contains more than 1/3 water, it must be changed again after four weeks. If there is again water in the lubricant then, it seems likely that a seal is defective.

Changing sealing parts

Changing sealing parts on the liquid side such as the block seal cartridge and the mechanical seal shaft requires a certain amount of specialist knowledge about these sensitive components. If a sealing room or leakage monitoring system is being used, the display will light up again within four weeks of changing the lubricant if a seal is defective.

Faults - The machine starts, but the motor protection switch triggers shortly after start-up

Fault 1: The machine will not start

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity supply interrupted – short circuit or earth connection in the cable or motor windings</td>
<td>Have the motor and wires checked by a specialist and replaced if necessary</td>
</tr>
<tr>
<td>Fuses, the motor protection switch and/or monitoring devices are triggered</td>
<td>Have a specialist inspect the connection and correct them as necessary</td>
</tr>
<tr>
<td>Machine must be dismantled</td>
<td>Have the motor protection switch adjusted according to the technical specifications, and reset monitoring equipment</td>
</tr>
</tbody>
</table>

Fault 2: The motor starts, but the motor protection switch is incorrectly set

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The thermal trigger on the motor protection switch is incorrectly set</td>
<td>Have a specialist compare the setting of the trigger with the technical specifications and adjust it if necessary</td>
</tr>
<tr>
<td>Increased power consumption due to major voltage drop</td>
<td>Have an electrician check the voltage on each phase and rewire if necessary</td>
</tr>
<tr>
<td>Two-phase operation</td>
<td>Have a specialist inspect the connection and correct it as necessary</td>
</tr>
<tr>
<td>Excessive voltage differences on the three phases</td>
<td>Have a specialist inspect the connection and the switching system and correct it as necessary</td>
</tr>
<tr>
<td>Incorrect direction of rotation</td>
<td>Swap the 2 phases from the mains supply</td>
</tr>
<tr>
<td>Impeller/propeller impeded by adhesive material, blockages and/or solid matter, increased current consumption</td>
<td>Switch off the machine, secure it against being switched on again and free the impeller/propeller</td>
</tr>
<tr>
<td>The pumped fluid is too dense</td>
<td>Contact the manufacturer</td>
</tr>
</tbody>
</table>

Fault 3: Machine runs but does not pump

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pumped fluid</td>
<td>Open the container intake or sliders</td>
</tr>
<tr>
<td>Intake blocked</td>
<td>Clean the intake, slider, suction port or intake strainer</td>
</tr>
<tr>
<td>Impeller/propeller blocked or obstructed</td>
<td>Switch off the machine, secure it against being switched on again and free the impeller/propeller</td>
</tr>
<tr>
<td>Defective hose or piping</td>
<td>Replace defective parts</td>
</tr>
<tr>
<td>Intermittent operation</td>
<td>Check the control panel</td>
</tr>
</tbody>
</table>

Fault 4: The machine runs, but the stated operating levels are not reached

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake blocked</td>
<td>Clean the intake, slider, suction port or intake strainer</td>
</tr>
<tr>
<td>Slide in the discharge line closed</td>
<td>Fully open the slide</td>
</tr>
<tr>
<td>Impeller/propeller blocked or obstructed</td>
<td>Switch off the machine, secure it against being switched on again and free the impeller/propeller</td>
</tr>
<tr>
<td>Incorrect direction of rotation</td>
<td>Replace 2 phases on the mains supply</td>
</tr>
<tr>
<td>Air in the system</td>
<td>Check the pipes, pressure relief and/or pump unit, and bleed if necessary</td>
</tr>
<tr>
<td>Machine pumping against excessive pressure</td>
<td>Have a specialist inspect the connection and the switching system and correct it as necessary</td>
</tr>
<tr>
<td>Signs of wear</td>
<td>Replace worn parts</td>
</tr>
<tr>
<td>Defective hose or piping</td>
<td>Replace defective parts</td>
</tr>
<tr>
<td>Inadmissible levels of gas in the pumped liquid</td>
<td>Contact the factory</td>
</tr>
<tr>
<td>Two-phase operation</td>
<td>Have a specialist inspect the connection and correct it as necessary</td>
</tr>
<tr>
<td>Excessive decrease in the water table during operation</td>
<td>Check the supply and capacity of the system, and inspect the level control settings and function</td>
</tr>
</tbody>
</table>

Fault 5: The system stops without reason

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pumped fluid</td>
<td>Check the pipes, pressure relief and/or pump unit, and bleed if necessary</td>
</tr>
<tr>
<td>Intake blocked</td>
<td>Clean the intake, slider, suction port or intake strainer</td>
</tr>
<tr>
<td>Impeller/propeller blocked or obstructed</td>
<td>Switch off the machine, secure it against being switched on again and free the impeller/propeller</td>
</tr>
<tr>
<td>Defective hose or piping</td>
<td>Replace defective parts</td>
</tr>
<tr>
<td>Intermittent operation</td>
<td>Check the control panel</td>
</tr>
</tbody>
</table>
Fault 5: The machine does not run smoothly and is noisy

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine is running in an disallowed operation range</td>
<td>Check the operational data of the machine and correct if necessary and/or adjust the operating conditions</td>
</tr>
<tr>
<td>The suction port, strainer and/or impeller/propeller is blocked</td>
<td>Clean the suction port, strainer and/or impeller/propeller</td>
</tr>
<tr>
<td>The impeller is impeded</td>
<td>Switch off the machine, secure it against being switched on again and free the impeller</td>
</tr>
<tr>
<td>Inadmissible levels of gas in the pumped liquid</td>
<td>Contact the factory</td>
</tr>
<tr>
<td>Two-phase operation</td>
<td>Have a specialist inspect the connection and correct it as necessary</td>
</tr>
<tr>
<td>Incorrect direction of rotation</td>
<td>Replace 2 phases on the mains supply</td>
</tr>
<tr>
<td>Signs of wear</td>
<td>Replace worn parts</td>
</tr>
<tr>
<td>Defective motor bearing</td>
<td>Contact the factory</td>
</tr>
<tr>
<td>The machine is installed with mechanical strain</td>
<td>Check the installation, use rubber spacers if necessary</td>
</tr>
</tbody>
</table>

Fault 6: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches the machine off

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensation build-up due to lengthy storage and/or temperature fluctuation</td>
<td>Operate the machine briefly (max. 5 min.) without sealing chamber monitoring</td>
</tr>
<tr>
<td>Increased leakage when running in new mechanical shaft seals</td>
<td>Change the oil</td>
</tr>
<tr>
<td>Defective sealing chamber cables</td>
<td>Replace the moisture sensors</td>
</tr>
<tr>
<td>Mechanical shaft seal is defective</td>
<td>Replace the mechanical shaft seal after contacting the factory</td>
</tr>
</tbody>
</table>

Further steps for troubleshooting

If the items listed here do not help you rectify the fault, contact our customer service. They can help you as follows:
- Telephone or written help from customer service
- On-site support from customer service
- Checking and repairing the machine at the factory

Note that you may be charged for some services provided by our customer support.

Customer service will provide you with details on this.