

Pioneering for You

wilo

Wilo-FAG



中 安装及操作维护说明

en Installation and operating instructions

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警告

- 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、 从水泵垂直位置向下看，水泵顺时针方向旋转，严禁反转。
- 7、 使用前请仔细阅读产品使用说明书。

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，诸如如何发现潜在的危险、降低维修成本、减少维修次数，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，已阅读过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程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

威乐中国总部
威乐（中国）水泵系统有限公司
Wilo China Ltd.
厂区地址：北京市顺义区赵全营兆丰工业区兆丰二街 10 号 101300
电话：010-52347888
传真：010-52347666
E-mail: wilo.info@wilo.com.cn
Http://www.wilo.com.cn

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：危害四肢。



“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。



“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。



“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。
- 必须遵守设备使用地相关的法律法规。为确保安全，必须建立员工责任制。所有员工都有义务遵守这些规章制度。
- 工具及其他用品应摆放在显眼的位置。
- 移动式 / 运动式起重设备应保证运行时稳定可靠。
- 应采取措施禁止人员站在起吊重物的下方，而且也禁止起吊重物到有人工作的开放空间。
- 紧固装置应满足使用条件的要求，如附近的气候、吊钩和荷载要求等。如在使用后将紧固装置从设备上拆离，应做好标记后妥善保管。
- 所用的紧固装置必须是合理设计并得到正式使用许可的。
- 使用移动式起重设备提升重物时，应采取防止发生倾斜、滑移和松动等。
- 起吊重物时，如有必要（如操作员视线受阻），应有第二人协助指挥调整。
- 提升的重物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，如天气变坏须立即停止操作。

- 在封闭的场所工作时，应保证有充足的新鲜空气。保持足够的通风。
- 焊接或使用电气设备时，应确保没有爆炸危险。



以上内容必须严格遵守，否则可能导致严重的人身伤害和 / 或设备损坏。

2.4 人员资质

设备的操作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。所有的操作人员应为成年人。另外，必须保证所有的人员能够阅读并理解此手册中的内容；如有必要，可向制造商订购操作人员能够理解的语言版本。

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常运行。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，因为我们的产品采用模块化设计，型号很多，大小各异，采用这种方式也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、设备布置图和 / 或安装图。

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准确的信息。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改变。

不同的工作介质通常要求采用不同材质和形式的叶轮，订单中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，请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有害的介质中，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（例如油），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，使用时应遵循本地的相关标准。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。



只有电工才可以进行电气操作（接线、维护、维修等）。不用的电缆必须断开。禁止将电缆头浸在工作介质中。

设备接到控制柜时，尤其是当使用软启动器或变频器时，控制柜制造商的规范必须符合电磁兼容性的要求。对于动力电缆和控制电缆，可能需要特别的屏蔽措施，例如采用特殊电缆。



只有符合 GB/EU 标准的开关装置才可以被接入。请记住电磁辐射对心脏起搏器有干扰，现场的移动无线设备也可能引起故障。



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），接地连接应增加一个漏电保护装置。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。这些继电器可以从制造商或电气产品代理商处买到。



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。



如果安全装置已经损坏或工作不正常，不得启动水泵。

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（湿式安装、干式安装、便携式安装）、附件（如：导轨）的固定、管线安装、运行地点、淹没深度等。

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。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：

概述

- 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）。
- 设备按规定操作时产生的问题。
- 安全和控制装置由专业人员连接并检查时仍出现的问题。

质保期

如没有特殊规定，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品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状况。本手册中没有快速修理的内容，所有的维修工作只能由制造商及其授权的维修中心来完成。

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
- 装配/拆卸不当
- 维护不当
- 由不具备资质的人员进行维修
- 安装地点不合适或土建不合格
- 化学、电化学及电的影响
- 磨损

上述情况下，制造商将不负责承担任何人身、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会较高。

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(短时运行)：
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。虹吸运行仅用于“移动式安装”！

干转保护：
干转保护设计为当液位低于最低水位（设备的最低淹没深度）时自动停机。安装浮子开关即可实现干转保护。

液位控制：
液位控制即根据泵池的水位来控制设备的开停。安装浮子开关可实现液位控制。
无论是干式安装还是湿式安装，均应绝对避免发生干转。

按照设备安装方式（湿式/干式/移动式）和相应的工作模式（S1,S2-15,等等）的说明进行操作，如果违反可能导致设备的严重损坏。

请遵守设备技术文档中关于最小覆水深度的规定。

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的废水、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 以上的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；
- 输送介质的最大密度是 1050kg/m³；
- 输送介质的最大粘度是 1 × 10⁶ m²/s；
- 介质的 PH 值为 6~9；
- 输送介质的最高温度是 40℃；
- 悬浮的颗粒最大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)，污水进水池应设置拦污栅，滤除粗大污物。

另外，特殊的水泵型式可用于腐蚀性和磨损性的介质。关于这些产品的具体信息，请咨询制造商。

本产品用于湿式安装下运转。请注意相关的运行模式和最低淹没水位。

请注意产品不是自吸式的，即叶轮必须浸泡在介质中以便于泵送。

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。电力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：

泵和电机间的密封采用高可靠的机械密封方式。

密封腔：

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，这样可以确保对密封持久连续的润滑。

叶轮：

叶轮采用半开式叶轮或闭式叶轮，固定在电机轴上并由其驱动。

由于每个叶轮都有各自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，密封腔内置湿度电极（取决于型号）。控制柜根据传递来的信号分析判断，在设备运行不正常时，迅速关闭电源，停止电机运行，时刻保护设备的安全运行。

冷却夹套：

功率在 30kW 及以上者，均装有强迫水循环冷却系统，即利用压力差将冷却水在夹套内循环，带走电机热量，使水泵能在水位很低的情况下也能正常运行。

污水泵结构：

≤ 4kW 水泵结构

1	进水底座	2	泵壳
3	叶轮	4	注油孔
5	机械密封	6	放水孔
7	油腔室	8	下轴承
9	定子	10	转子
11	上轴承	12	吊环
13	电缆		

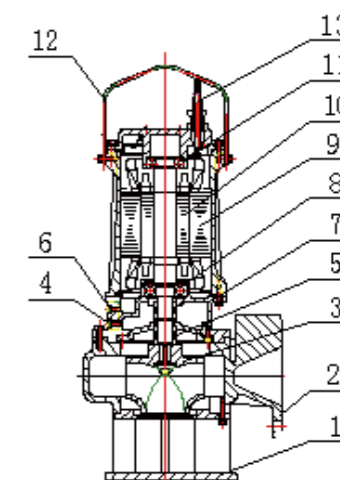


图 3 - 1 ≤ 4kW 水泵结构

5.5-22kW 水泵结构

1	进水底座	2	泵壳
3	叶轮	4	注油孔
5	机械密封	6	放水孔
7	油腔室	8	下轴承
9	定子	10	转子
11	上轴承	12	吊环
13	控制电缆	14	动力电缆

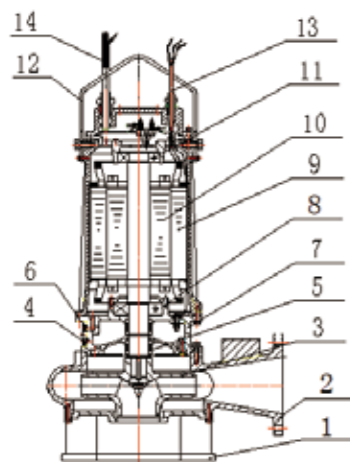
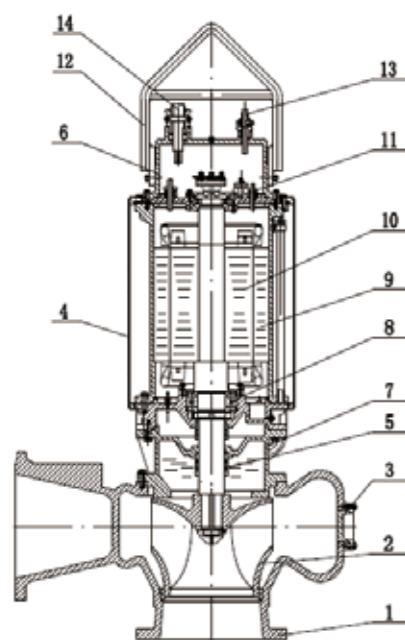


图3 - 2 5.5-22kW 水泵结构

30kW 及以上水泵结构

1	吸水口	2	叶轮
3	泵壳	4	冷却夹套
5	机械密封	6	接线盒
7	油腔室	8	下轴承
9	定子	10	转子
11	上轴承	12	吊环
13	控制电缆	14	动力电缆



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- 流道式叶轮、Z- 半开式叶轮、Cutter- 带铰刀装置)
25	最大扬程 m
100	最大流量 m ³ /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，通过外壳将热量传输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。

在此，请注意安装方式要求的不同和运行模式的不同。

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，应在货到当天通知货运公司或制造商，事后的任何索赔均视为无效。部件的损坏情况须记录在交货或货运文件上。

4.2 运输

只能采用有合适的并经过许可的紧固装置、运输方式和提升设备，这些设施应有足够的负荷能力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之后交运，以避免在运输和存放过程中损坏设备。如果经常变换货物的存放位置，应将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。运输设备时只能采用适当的起吊装置和传输设备（如输送带），如使用链条，应确保不会滑动，以防止设备损坏以及人身伤害。

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：

- 设备应置于稳定的基础之上并确保不会跌落。潜水污水泵应竖直放置。



禁止在没有任何保护的情况下放下或提起设备，应严格避免设备弯曲，否则可能导致严重的设备损坏和/或人身伤害。

- 设备可存放在最低 -15℃ 的环境里。储存室必须是干燥的，我们推荐将设备存放在 5~25℃ 的无霜冻的房间里。
- 设备不可以存放在有焊接操作的房间，因为焊接产生的气体和辐射会破坏橡胶部件和涂层。
- 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。



潮湿和霜冻可能损坏电缆。不要用力拉扯电缆，否则可能破坏电缆和电机的接线部分，而这种破坏很难及时发现。

设备如带有牵引绳，运输时可以以此牵引设备。

- 产品应避免阳光直射、受热、灰尘和霜冻。受热和霜冻可能严重损坏叶轮、转子和涂层。
- 转子或叶轮应定期转动，以防止轴承锁住，必要时更换机械轴封上的润滑油膜及轴承油脂。



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，重新启动之前应先清理灰尘和油垢等杂质，另外还应检查转子和叶轮是否运转

平稳，外壳和涂层是否有损坏等等。

启动之前，应检查油位，如有必要应及时补充。



受损的涂层应及时修补，只有完整的涂层才能符合使用标准。

如果遵守以上这些规定，设备就可以存放较长时间。请记住橡胶部件和涂层会随着时间推移自然老化，如果产品存放超过 6 个月，我们推荐务必检查这些部件以确保其功能正常，必要时应及时更换。更详细的情况请咨询制造商。

4.4 退货

退回工厂的货物应进行清洁并正确包装。

这里的“清洁”是指清除杂质，如果设备曾用于有害健康的介质还应该进行消毒。

对设备进行包装以避免运输过程中损坏设备。

如果有问题请联系制造商。



未能正确包装的退货将不在质保范围之内。

5 安装

为防止发生设备损坏和人身伤害，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。
- 遵照本手册第二章“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。
- 水泵还应注意防霜冻。

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。

安装时请阅读目录里的相关资料。



请垂直安装本产品。若想水平或倾斜安装本产品，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。装配和移动水泵前，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，我们推荐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之相连。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)

最大负载能力必须比水泵、附件和电缆的总重大。也就是可以在不妨碍不危及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与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、法规和法规；
- 固定装置必须得到正式批准；
- 要遵守所有的安全措施，工会安全规程，和本手册提到的规定；
- 要注意穿戴合适的防护服/装备；
- 若存在有毒或令人窒息的气体时，应记录下必要的数据；
- 安装前应检查水泵的涂层。若有损坏，则必须修补。完整无缺的涂层才能达到真正防腐的作用。

带耦合装置的湿式安装

这种安装方式需要安装现场事先装好耦合装置。出口侧的管路系统与耦合装置相连。水泵由耦合装置的导杆放下并与管路系统相连。水泵必须在最低水位以上运行。

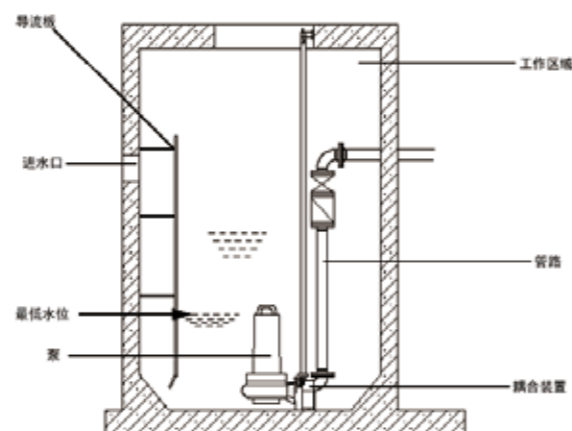


如电机没有完全浸没在介质中，设备只可进行间歇式运行 (S2-...)。

若使用此安装方式，水泵可在工作区随时进行安装和拆卸工作，如维护和维修。

- 在工作区安装耦合装置。
- 准备安装水泵。
- 检查耦合装置是否牢固、正常。
- 慢慢地将水泵由导杆放下，同时稍稍拉紧动力电缆。
- 当水泵与耦合装置相连时请确认动力电缆足够安全，防止跌落和/或受损。
- 新安装时，将工作区注满介质并把出口管排空。
- 需专业人士将水泵连上电源，并遵循第 6 章的规定 (如检查旋转方向等) 进行操作。

图 5-1: 湿式安装示例



仅可使用制造商生产的耦合装置，相关的安装信息请见本手册附录。



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。为获得最佳的可靠性，我们建议安装干转保护系统。这需要使用浮子开关。浮子开关固定在水池内，当水位低于最低的覆盖水位要求时关闭水泵。

请务必遵守有关最小覆盖水位的信息。可在设备技术文档找到此信息。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。固定浮球开关时要确保电缆足够长。这取决于这两个开关点。

两个浮球开关的用法：

使用两个浮球开关时，这两个浮球开关分别标上“上”和“下”。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溢出。

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。



泵送对人身构成威胁的液体的设备必须消毒。

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，以保证设备的运行维护人员在任何时候都能很方便地拿到。

启动设备时，为避免设备损坏和人身伤害，必须遵守以下几点：

设备应由合格的操作人员启动，并且任何时候均应遵守安全要求。

- 操作此设备的每个人都应收到、阅读过并充分理解本手册的内容，并通过在操作人员名单上签字进行确认。
- 启动之前应检查所有的安全装置和急停装置。
- 电气和机械设置只能由专业人员完成。
- 设备只能在本手册规定的工作条件下使用。

6.1 准备工作

设备采用最新技术设计和制造，正常条件下可以长期稳定运行，当然前提条件是必须遵守所有的指导和要求。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揩掉。

请检查以下方面：

- 电缆 -- 没有缠绕，张紧度合适 (稍微张紧)
- 检查介质的温度和浸没深度
- 若在出水口使用软管，应在使用前用清水将软管冲洗干净以防止渣滓堵塞。
- 湿式安装时的泵池必须清洗。
- 清洗出水口和进水口侧的管路系统，打开所有的滑板
- 泵壳必须淹没，也就是说应完全浸没在介质中，泵壳里没有空气。使用适合的排气设备排气，如需要，在卸气口使用排气螺丝。
- 检查所有的附件，管路系统与耦合装置应相互匹配。
- 检查水位控制和干转保护系统。



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。

6.2 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。



电缆头的连接必须由有资格的电气技术员来完成。

6.3 旋转方向

注水前要检查永久固定的水泵的转向。使用耦合装置的水泵须在放进介质前检查其转向。

转向的检查：

- 将连接好的水泵置于地上并稍稍倾斜。
- 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。

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措施（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，在最低水位（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，配以稳定可靠的电子电路直接测量绕组温度保护电机。同时还采用传感技术对油腔进行泄漏检测，测头与芯线 K3 相接，当油腔泄漏达到一定量时，切断电源，保护电机。

功率 ≥ 30kW 的水泵，正温度系数的热敏电阻 PTC 元件与芯线 K1、K2 相接，油腔测漏电极与芯线 K3 相接，电机腔测漏电极与芯线 K4 相接，接线盒腔测漏电极与芯线 K7 相接。即五芯 K1、K2、K3、K4 和 K7 信号电缆采集信号通过综合保护器对电机实施温度、泄漏等保护。

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。

电机功率 ≥ 22kW 的 FAG 水泵可采用 Y—Δ、自耦降压或无触点启动（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%，容许的最大的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。维护的时间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，检查和维护的时间间隔应缩短。

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，并且只可以执行本手册中所列出的维修和维护操作。



- 设备和系统的维护、检查和清洁工作只能由经过培训的专业人员在安全的工作场所谨慎地进行。



- 超过 50 公斤的物体，只能通过得到正式使用许可并处于最佳工作状态的提升装置来放下和提升。



确认所有的固定装置、绳索和手绞车的安装装置都处于最佳工作状态。只有当辅助升降装置经检查并处于最佳工作状态时方可工作。若没有经过检查，随时可能对人体造成危害。



- 机器和系统的电气方面的工作必须由电气技术人员进行操作。

- 进行快速修理、检查和清洁设备时，必须切断电源，并确保不会发生因意外将电源接通的情况。



- 有缺陷的保险丝必须换掉，保险丝决不能修理之后再使用，只能使用符合规定电流和指定型号的保险丝。



- 进行维护、检查和清洁工作时应穿戴必要的防护服 / 装备。另外，在水池、深井和 / 或容器内工作时，应采取适当的保护措施。



- 使用易燃的溶剂和清洗剂时，禁止生火、明火照明和吸烟。

- 用于有害健康的介质中的设备维护之前应进行消毒，确保没有有害气体产生和存在。

如果有害液体或气体发生伤害事故，应按照工作间的提示进行急救并立即向医生求救。



- 工作间的整齐和整洁可以保障设备的安全和无故障运行。维护工作完成后，所有清洁用品和用具应进行清理之后存放在适当的地方。

- 更换下来的润滑剂（如油、油脂）和燃料应收集在适当的容器中并根据相关要求进行处理。



- 只能使用制造商特别建议的润滑剂。油和润滑剂不可混合。



- 只能使用制造商提供的原装部件。

- 准备所有必要的工具和用品。



为检查机器的旋转方向，可以干转但不能超过 10 秒钟。对机器进行试运转或功能检测必须在正常的工作条件下进行。

7.1 大修

通常每三年要对机器进行一次大修（正常使用情况下）。

若使用在高磨损和高腐蚀性介质中，则应每一年半就大修一次。

只能由制造商或得到授权的服务机构进行大修。除了一般的维护工作外，大修期间的轴承、轴封、O 型圈、电机和动力电缆均应检查并置于规程要求的地方。

7.2 润滑剂

- 只能用同一个制造商核准的润滑剂来装满或替代。
- 若之前使用过别的润滑剂，则必须先清洗干净然后才换上。

7.3 维护周期

初次启动前或长期储存后使用：

- 检查动力电缆的绝缘电阻。
- 油位检查 - 必须使得油充满密封腔。

每月：

- 监测电流和电压
- 检查正温度系数热敏电阻和密封腔监控系统等的开关组件。

每六个月：

- 检查动力电缆的绝缘电阻。
- 目测检查动力电缆的外观
- 目测检查电缆夹和支撑
- 目测检查辅助设施如悬挂装置和提升装置

每年：

- 检查所有安装和控制装置的功能
- 检查油，若有必要则更换油
- 检查涂层，若需要则修补

7.4 维护内容

检查电流和电压值

所有三相电源都要周期性地监控电流和电压。在正常操作情况下，这些值是恒定的。介质成分的变化会引起轻微的变化。电流的变化可以更早地反映并纠正对叶轮、齿轮或电机的错误操作。更多更广泛的危害可以得到最大的保护并且减小了突发事件的发生率。

检查热敏电阻、密封腔电极等转换设备的使用状态

检查转换设备处于无故障状态。损坏的设备必须马上替换，因为这些设备已无法保证机器和操作人员的安全操作。

动力电缆的绝缘电阻

检查动力电缆的绝缘电阻时，一定要切断电源，然后可以采用欧姆表来测量电阻（测量电压 = 500 V）。阻值不可超过下列数值：

设备首次运行时绝缘电阻不能低于 100 兆欧，以后每次的测量值冷态应不低于 5 兆欧，热态应不低于 0.5 兆欧。如果绝缘阻值太低：电缆和 / 或电机可能已受潮。如果绝缘阻值太高：电缆或电机接线有问题。出现以上情况，不要连接设备，请联系制造商。

动力电缆的目测检查

检查动力电缆是否有气泡、裂痕、刮痕、擦伤或变形等。如果发现损坏，应立即更换。只有当发现的问题解决之后，设备方可再次使用。

目测检查电缆挂钩（竖钩）和钢丝

设备用于水池或水坑时，电缆挂钩（竖钩）和钢索受到更大的磨损。为了保护电缆挂钩（竖钩）和钢丝免于磨损以及防止电缆在工作区域随意漂动，定期检查是必要的。若有迹象表明电缆挂钩（竖钩）和钢丝有破损，应立即更换。

附件的目测检查

检查底座和升降装置等附件是否安装稳妥，松动和/或有故障的附件应立即进行修理或更换。

安全和控制装置的功能检查

监控装置是指诸如电机中的温度传感器、电机保护继电器、过压保护继电器等。电机保护继电器、过压保护继电器和其它的跳闸元件通常可以通过手动触发来检测。检验密封腔监视器或温度传感器时，设备应冷却至环境温度，控制柜里的监控装置供电电缆必须断开，然后用欧姆表进行检测。

关于油室密封检查

检查芯线 K3 对机壳绝缘电阻需大于 200K Ω，否则拧出密封室侧壁上油孔密封螺栓，使油孔朝下倒出机油观察机油和水的混和情况，若油中有少量的水，则更换润滑油；若油中有大量的水则应更换机械密封，橡胶垫和骨架油封及润滑油。当停止使用、进行保养时，应切断电源，用万用表测量 K3 线与机壳间的电阻值，若低于 100K Ω，请更换清洁润滑油。

关于电机密封检查

检查芯线 K3、K4 绝缘电阻值，需大于 200K Ω，否则应拧出气孔密封螺栓，使气孔朝下，如电机腔内无任何液体流出，则说明水泵密封工作正常，如流出微量的油则应经常检查，如流出大量的水油混合物，则应拆开水泵检查密封件更换所有失效的机械密封、O 型密封圈、骨架油封等密封件。当电机腔内渗漏进水，控制柜的指示灯报警，并自动停机。切断电源后，用万用表检查芯线 K4 与机壳间电阻值低于 5K Ω，则确认为电机腔内进水，应将气孔打开让水流尽，当电机内仅有少量水时把电加热器芯线 K5、K6 接通电源，以驱散潮气，数小时后检查绝缘电阻值，如绝缘良好可安装运行。

对于大功率水泵，可以从控制电缆 K7、K4、K3 与机壳之间的电阻值分别反映接线盒电机腔与油腔的密封情况，电阻大于 200K Ω密封很好，100~200K Ω应加强检查，电阻低于 100K Ω应检修（用万用表测，切不可用摇表），经保养的水泵重新安装运行前，应将水泵在干燥的陆地上通电空转以达到驱潮的目的，通电观察水泵运行状态，应无异常振动、噪声、电流平衡电流值约为额定电流的 35—45%，小功率泵不大于 50%，运转 0.5~1 小时，停机后立即检查电机热态绝缘电阻，待冷却后，再检查冷态绝缘电阻，合格后按要求装配，密封好投入安装使用。保养时电机腔进水受潮严重的，还应将电机定子拆下，在烘房中烘干并检查绕组绝缘、绕组耐压、匝间绝缘等性能合格后再装配、密封投入使用。

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。

7.5 维修

进行维修时，要时刻谨记下面的几点：
- 螺纹固定件如弹性垫环或自锁螺纹固定件也应更换。
- 在维修过程中杜绝使用蛮力。



运行过程中，叶片会产生非常锐利的飞边。因此维修时必须极度小心。最好穿上必要的防护服/装备。

当没有装上叶轮开动机器时，对密机械轴封会造成损坏或破坏。严禁没装叶轮就启动机器。

更换机械密封

更换密机械密封需要关于这些精密部件的足够的专业知识。除此之外，更换这些部件之前，必须有拆卸机器的足够的经验。为此，在更换机械密封之前必须联系厂家。只有这样，更换过程的必要步骤才会得到更充分的阐述和验证。

8 停机

8.1 短时停机

设备短时停用时，机器保持原来的安装状态且接线不与电源断开。短时停机期间，设备应保护机器以免受到霜冻和冰冻，并确保设备的工作地（例如：深井）不会完全被冰覆盖。如此，可以保证设备可以随时启动。设备长期停用时，需定期（每月一次至每季度一次）开机运转 5 分钟。



在功能测试运转之前，仔细阅读关于安装方式和工作模式的注意事项。

8.2 长期停用/存放



移动机器时，小心外壳的高温。外壳的温度可能高达 40℃。须等泵壳的温度低于周围空气时方可摸它。

关闭系统，断开电源，拆出设备，贮存于仓库中。注意以下关于存放的事项：

- 清洁机器
- 将设备存放在一个清洁干燥的地方，防止设备受到霜冻。
- 将设备竖直放在坚固的基础上并防止其倾倒。
- 将机器吸水口和出水口用合适的材料（如薄箔）封上。
- 将电缆接头支撑在接头套里以免发生永久变形。
- 防止电缆头受潮。
- 保护设备避免阳光直晒，以防止橡胶部件、叶轮和外壳涂层变脆。
- 如将设备存放在修理车间，必须注意：电焊时产生的辐射和体会破坏密封的橡胶部件。

- 为了更长时间储存，需定期（至少半年一次）用手转动叶轮以免轴承产生压痕和转子生锈。

8.3 存放较长时间之后重新启用

设备重启前应清除灰尘和油污，之后进行必要的保养和快速检修（有关细节，请参阅第 7 章）。检查叶轮是否运转顺畅。完成上述工作之后，就可以开始安装设备（请参阅第 5 章）并由专业人员接上电源。关于启动机器，请参阅第 6 章的内容。当设备状况良好并做好一切准备工作之后方可启动设备。

9 故障检修

检修设备时，为避免设备损坏或人身伤害，必须遵守以下几点：

- 只能由具有相应资质的人员来检修。
- 首先要切断电源，并采取适当措施确保不会发生因意外导致电源接通的情况。
- 必须有第二个人在场以确保设备电源是安全断开的。
- 移动设备部件时应确保安全。
- 请参阅第 2 章的“安全总则”。



独自一人操作是很危险的，由此导致的问题不在质保之列。

9.1 常见故障及解决办法

故障 1：电机不启动

原因	处理方法
电力供应中断 – 短路、电缆或电机绕组接地	由电气技术人员检查电机和电缆，若需要就更换
保险丝，电机保护开关和/或控制装置动作	由专业人员检查连接处，若需要就修理 请电气技术人员比较触发器设置与技术说明书，若需要就调整 检查叶轮是否转动平稳，若需要就清理
密封腔控制（可选件）动作切断电源（与操作有关）	参见“故障：机械轴封泄漏，密封腔控制报警并关停设备”

表 9-1 电机不启动

故障 2：电机启动，但启动不久保护开关就动作

原因	处理方法
电机保护开关的温度触发器没有正确设置	请电气技术人员比较触发器设置与技术说明书，若需要就调整
电压大幅下降导致功率消耗增加	由电工检查相间电压，如有必要，重新接线
缺相	由专业人员检查接线，如有问题，进行修理
三相之间的电压相差较大	由专业人员检查接线和配电系统，如有必要，进行修理
转向不正确	调换电源的其中两相接线
叶轮被粘性物体、大块物体和/或硬物堵塞，导致电流消耗增大	关闭水泵并保护其避免被再次打开，清洁叶轮或进水口
泵送的液体过于浓稠	咨询制造商

表 9-2 电机启动，但启动不久保护开关就动作

故障 3：水泵运行，但不出水

原因	处理方法
无泵送液体	打开进水阀门或闸板阀
吸水口堵塞	清理吸水口、闸板阀或吸水口滤网
叶轮堵塞或受阻	关闭设备并保护其避免被再次打开，清理叶轮
管路或软管损坏	更换损坏的管道
不连续运行	检查控制柜

表 9-3 水泵运行，但不出水

故障 4：水泵运行，但不稳定

原因	处理方法
吸水口堵塞	清理吸水口、闸板阀或吸水口滤网
出水管上的闸板阀没有打开	完全打开阀门
叶轮堵塞或受阻	关闭设备并保护其避免被再次打开，清理叶轮
转向不正确	调换电源接线
系统中有空气	检查管道系统，如有必要进行排气
压力过大	检查出水管上的阀门，如有必要完全打开。更换不同的叶轮或咨询制造商
部件磨损	更换磨损部件
管路或软管损坏	更换损坏的管道
泵送液体中所含气体超出允许值	咨询制造商
缺相	由专业人员检查接线，如有问题，进行修理
设备运行时水位降低过大	检查系统处理水量，检查液位控制装置的设置及功能

表 9-4 水泵运行，但不稳定

故障 5：水泵运转不平稳，噪音大

原因	处理方法
设备在允许范围之外运行	检查设备运行参数，必要时进行修正和调整运行工况
吸水口、滤网或叶轮堵塞	清理吸水口、滤网和叶轮
叶轮受阻	关闭设备并保护其避免被再次打开，清理叶轮
泵送液体中所含气体超出允许值	咨询制造商
缺相	由专业人员检查接线，如有问题，进行修正
转向不正确	调换电源接线
部件磨损	更换磨损的部件
轴承故障	联系制造商
设备安装之后产生机械应力	检查安装，如有必要可使用橡胶垫片

表 9-5 水泵运转不平稳，噪音大

故障 6：机械轴封处泄漏，密封腔监控装置报警并关停设备

原因	处理方法
新机械轴封运行时泄漏量增加	换油
密封腔电缆损坏	更换密封腔传感器
机械轴封损坏	联系制造商，更换机械轴封

表 9-6 机械轴封处泄漏，密封腔监控装置报警并关停设备

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。他们可以在如下方面提供帮助：

- 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

请注意有的服务要收取一定的费用，我们的客户服务部会告知您相关的详情。

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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: wilo.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:

Signal word	Meaning
Danger	Serious or fatal injuries can occur.
Warning	Serious injuries can occur.
Caution	Injuries can occur.
Caution (Instruction without symbol)	Serious damage to property can occur, including irreparable damage.

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 electric 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 modular 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 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 damaged, 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, operating 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 correct 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 maximum 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 and 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.

"S1" operating mode (continuous 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 full speed, 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, wastewater, 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 1/2 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 1050kg/m³ and a maximum viscosity of approx.1x10⁶ 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 25-400mm (depending on the model of the machine), Trash rack is also required to Filter out larger solid. 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.



Depending on the model, the machine can be operated in different installation types. Please also note the appropriate information on operating mode and minimum water coverage.



Please also note that this machine is not self-suctioning, which means that the impeller must always be surrounded by fluid in order to pump.

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 "F" 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.

Impeller

The impeller is enclosed or semi-open type. The impeller is fastened directly to the motor shaft and driven by it.

Safety and monitoring devices

The motor is equipped with temperature sensors. These are to protect the motor from overheating.

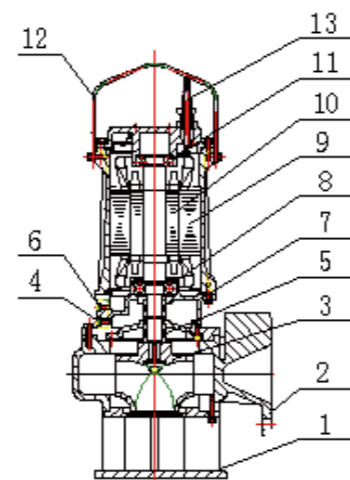
In addition, the machine is equipped with an electrode for motor chamber and terminal chamber monitoring and can additionally be equipped with a sealed chamber electrode (depending on the model). Depending on the connection, a warning signal can be displayed and/or the machine switched off if water enters the motor chamber, terminal chamber or the sealing housing.

Cooling jacket

Pumps with 30kW and up is equipped with a cooling jacket. The pressure difference let the pumped liquid run in the cooling jacket to take heat away.

Pump structure(≤ 4kW)

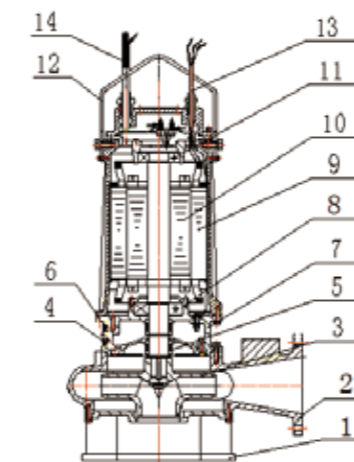
1	Suction base	2	Pump casing
3	Impeller	4	Oil filler hole
5	Mechanical seal	6	Outlet hole
7	Sealing housing	8	Lower bearing
9	Stator	10	Rotator
11	Upper bearing	12	Lifting handle
13	Cable		



3 - 1 Pump structure(≤ 4kW)

Pump structure(5.5-22kW)

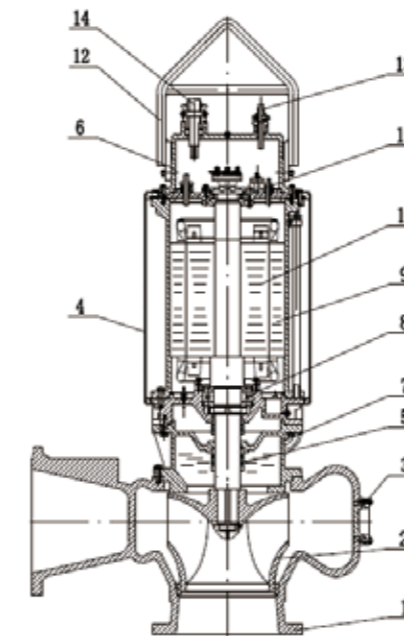
1	Suction base	2	Pump casing
3	Impeller	4	Oil filler hole
5	Mechanical seal	6	Outlet hole
7	Sealing housing	8	Lower bearing
9	Stator	10	Rotator
11	Upper bearing	12	Lifting handle
13	Control cable	14	Power cable



3 - 2 Pump structure(5.5-22kW)

Pump structure(≥ 30kW)

1	Suction bell	2	Impeller
3	Pump casing	4	Cooling jacket
5	Mechanical seal	6	terminal box
7	Sealing housing	8	Lower bearing
9	Stator	10	Rotator
11	Upper bearing	12	Lifting handle
13	Control cable	14	Power cable



3 - 3 Pump structure(≥ 30kW)

3.5 Type designation

The type code provides information about the design of the machine.

FAG 100 C 25.100/75 Cutter	
FA	Wilo sewage pump
G	For grey water
100	Nominal diameter in DN
C	Impeller type (C-Enclosed-channel impeller, Z-Semi-open impeller, Cutter-With cutting device)
25	Maximum head (m)
100	Maximum flow (m ³ /h)
75	Motor rated power (kW × 10)

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.

The product is delivered by the manufacturer/shipping agency in suitable packaging. This normally precludes the possibility of damage occurring during transport and storage. The packaging should be stored in a safe place if the location used is changed frequently.

4.3 Storage

Newly supplied products are prepared 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 the gear pinions (if present on the product) from becoming fixed as they turn and also renews the lubricating film on the gear pinions (preventing rust film deposits).



Beware of sharp edges

Sharp edges can form on rotors and propellers. There is a risk of injuries. Wear protective gloves.

- If the product has been stored for a long period of time it should be cleaned of impurities such as dust and oil deposits before start-up. Rotors and propellers should be checked for smooth running, housing coating and damage.

Before start-up, the filling levels (oil, motor filling etc.) of the individual products should be checked and topped up if required. Products filled with white oil should be completely

filled before start-up. Please refer to the machine data sheet for specifications on filling.



Damaged coatings should be repaired immediately. Only a coating that is completely intact fulfills the criteria for intended usage.

If these rules are observed, your product can be stored for a longer period. Please remember that elastomer parts and coatings become brittle naturally. If the product is to be stored for longer than 6 months, we recommend checking these parts and replacing them as necessary. Please consult the manufacturer.

4.4 Returning to the supplier

Products which are delivered to the plant must be clean 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.

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.

If you are using level control, make sure that the minimum water coverage is present. Air pockets may not be allowed to enter the pump housing or the pipeline system, and they must be removed with a suitable ventilation system and/or a small inclination of the machine (with a portable installation). Protect the machine from frost.

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.

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.

5.4 Assembly accessories

Swiveling hoisting gear

The maximum bearing capacity must be greater than the weight of the machine, add-on 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 swiveling range 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 firm 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:

- This work may only be carried out by qualified personnel. Electrical work may only be carried out by qualified electricians.
- Lift the machine by the handle or lifting eyelets, never by the power supply cable. When assembling with chains, they must be connected with a shackle to the lifting eyelets or the carrying handle. Fastening devices must have official approval.
- Please observe all guidelines, rules and legal requirements for working with and underneath heavy suspended loads.
- Wear the appropriate protective clothing/equipment.
- If there is danger that poisonous or asphyxiating gases may collect, then the necessary counter-measures should be taken.

- Please also observe all accident prevention guidelines, trade association safety guidelines and the advice contained in this operating and maintenance manual.

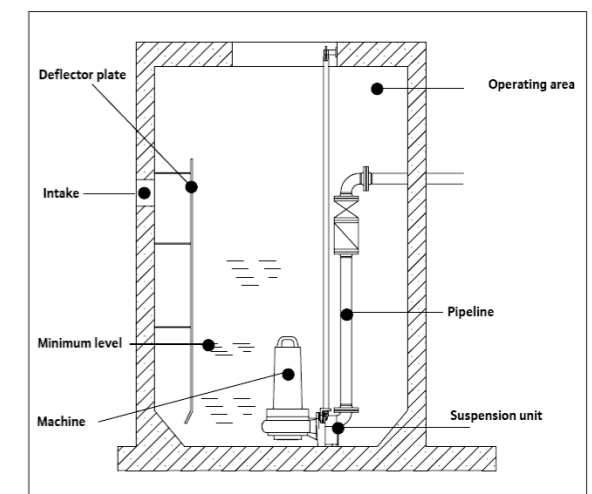
- The coating of the machine is to be examined before installation. If defects are found, these must be eliminated. An intact coating is necessary for the best possible protection from corrosion.

Wet installation with a suspension unit

A suspension unit must be installed for wet installation. This must be ordered separately from the manufacturer. The pipeline system on the discharge side is connected to this. The connected pipeline must be self-supporting, i.e. it should not be supported by the suspension unit. The operating area must be laid out so that the suspension unit can be installed and operated without difficulty. For maintenance and/or repair work, the machine must be taken out of the operating area. The suspension unit makes this possible at any time.

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: Flood the operating area and bleed the discharge pipe.
- Start the machine in accordance with chapter 6.



5-1: Example of wet installation

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 only put into effect with 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 hose first. Here too, you should use appropriate lifting gear if the pit is deep, or the machines are heavy.

On wet installations with suspension units, the machine is raised out of the pit using the chain or lifting cable with the help of a hoisting gear. This does not have to be emptied especially for this purpose. Make sure the power supply cable does not become damaged.



Beware of poisonous substances!

Machines which pump fluids hazardous to health present a fatal

risk. These machines must be decontaminated before any other

work is carried out. Wear the necessary protective clothing/

equipment when doing so.

6 Start up

The "Startup" chapter contains all the important instructions for the operating personnel for starting up and operating the machine safely.

The following specifications must be adhered to and checked:

- Type of installation
- Operating mode
- Minimum water coverage / max. submersion

If the machine has not been operated for some time, check these specifications again and rectify any faults you find.

The operation and maintenance handbook must always be kept either by the machine or in a place specially reserved for it where it is accessible for operating personnel at all times.

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

The machine may only be started up by qualified personnel. The safety advice must be followed at all times.

- Every person working on the machine must have received, read and understood this operating and maintenance manual. This must also be confirmed with a signature in the machine operator list.
- Activate all safety devices and emergency stop elements before startup.
- Electrical and mechanical settings may only be made by specialists.
- This machine may only be used under the working conditions specified in this handbook.

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 bleeder screws on the discharge port.

- Check that all accessories, the pipe system and suspension unit are properly fitted

- Check all level control and dry-run protection systems

An insulation test and filling level check must be carried out prior to start-up, as described in chapter 7.

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. Pay attention to the direction of rotation. If the direction of rotation is incorrect, the machine will not perform as specified, and under certain circumstances, can become damaged. In accordance with the machine data sheet, check the operating voltage and make certain that the current consumption remains uniform during all phases.

Make sure that all temperature sensors and monitoring devices, such as the sealing chamber monitor, are connected and that their function is tested.

Electrical current can cause fatal injuries if not handled correctly!

All machines with free cable ends (i.e. without plugs) must be connected by a qualified electrician.

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-reativation 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 plugs

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 maximum start-up time at reduced voltage (approx. 70%) is 3 seconds.

Monitoring equipment

Overheating protection: Up and equal to 4kW power of the pump with double metal temperature sensor, Power \geq 5.5kW pumps with thermistor 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 protect the motor damaged from more water leakage. The alarm will shut off the motor to avoid the damage of motor.

For power \geq 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 \geq 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 a 3 wires control cable (K1/K2/K3) connecting with electric protector. Thermal monitoring of the motor is performed by PTC 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 \geq 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 After 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 (permissible deviation +/-5% of the rated voltage)
- Frequency (permissible deviation +/-2% of the rated frequency)
- Current consumption (permissible 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 infeed, 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, unshielded 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 oil 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 posistors, sealing room monitor, etc.

Every six months

- Visual inspection of the power supply cable
- Visual inspection of the cable holder and the cable bracing
- Visual inspection of accessories, e.g. the suspension device and hoisting gears

Yearly

- Changing the lubricant in the sealing 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/propeller, 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 posistors, 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 bracing

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

The lifting cables/cable holders (carabiners) and the cable bracing 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.

In the 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. In this case, please consult the manufacturer. 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.

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. In addition to this, in order to carry out the work, much of the machine must be dismantled.

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 components. These can heat up to well above 40° C. Let the machine cool down to ambient temperature before you touch it.

Switch off the system, disconnect the machine from the electricity supply and dismantle and store it. Note the following information concerning storage:

- Clean the machine.
- Store it in a clean, dry place, protect the machine against frost.
- Place it down vertically onto a firm foundation and secure it against falling.
- Seal the intake and discharge ports of pumps with suitable material (such as foil).
- Support the electric connecting lead on the cable lead-in to help avoid a permanent deformation.
- Protect the ends of the electric power cable from moisture.
- Protect the machine from direct sunshine as a preventive measure against brittleness in elastomer parts and the propeller and casing coating.
- When storing the machine in a garage please remember: Radiation and gases which occur during electric welding destroy the elastomers of the seals.
- During lengthy periods of storage, regularly (for example every six months) turn the impeller or propeller by hand. This prevents indentations in the bearings and stops the rotor from rusting up.

8.3 Restarting after an extended period of storage

Before restarting the machine, clean it of dust and oil deposits. Then carry out the necessary maintenance actions (see "Maintenance"). Check that the mechanical shaft seal is in good order and working properly.

Once this work has been completed, the machine can be installed (see "Installation") and connected to the electricity supply by a specialist. See "Startup" a for instructions on restarting.

Only restart the machine if it is in perfect condition and ready for operation

9 Troubleshooting

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.

Fault1: The machine will not start

Cause	Remedy
Electricity supply interrupted – short circuit or earth connection in the cable or motor windings	Have the motor and wires checked by a specialist and replaced if necessary
Fuses, the motor protection switch and/or monitoring devices are triggered	Have a specialist inspect the connection and correct them as necessary Have the motor protection switch adjusted according to the technical specifications, and reset monitoring equipment Check that the impeller/propeller runs smoothly. Clean it or free it as necessary
The moisture sensors (option) has interrupted the power circuit (operator-related)	See fault: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches the machine off

Fault2: The motor starts, but the motor protection switch triggers shortly after start-up

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

Fault3: Machine runs but does not pump

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

Fault4: The machine runs, but not at the stated operating levels

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

Fault5: The machine does not run smoothly and is noisy

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

Fault6: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches the machine off

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

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.

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Pioneering for You

Wilo China Ltd.

No. 10 Zhaofeng 2nd Street, Zhaofeng Industrial
Zone (Airport Industrial Zone C)

Zhaoquanying, Shunyi District

101300 Beijing

China

T +86 10 52347888

F +86 10 52347666

wilo.info@wilo.com.cn

www.wilo.com.cn