



## Wilo- Sub TWS

中 安装操作维护手册

EN Installation and operating instructions

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Fig. 1

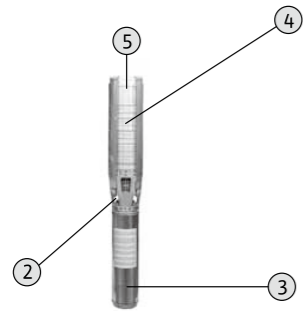


Fig. 2

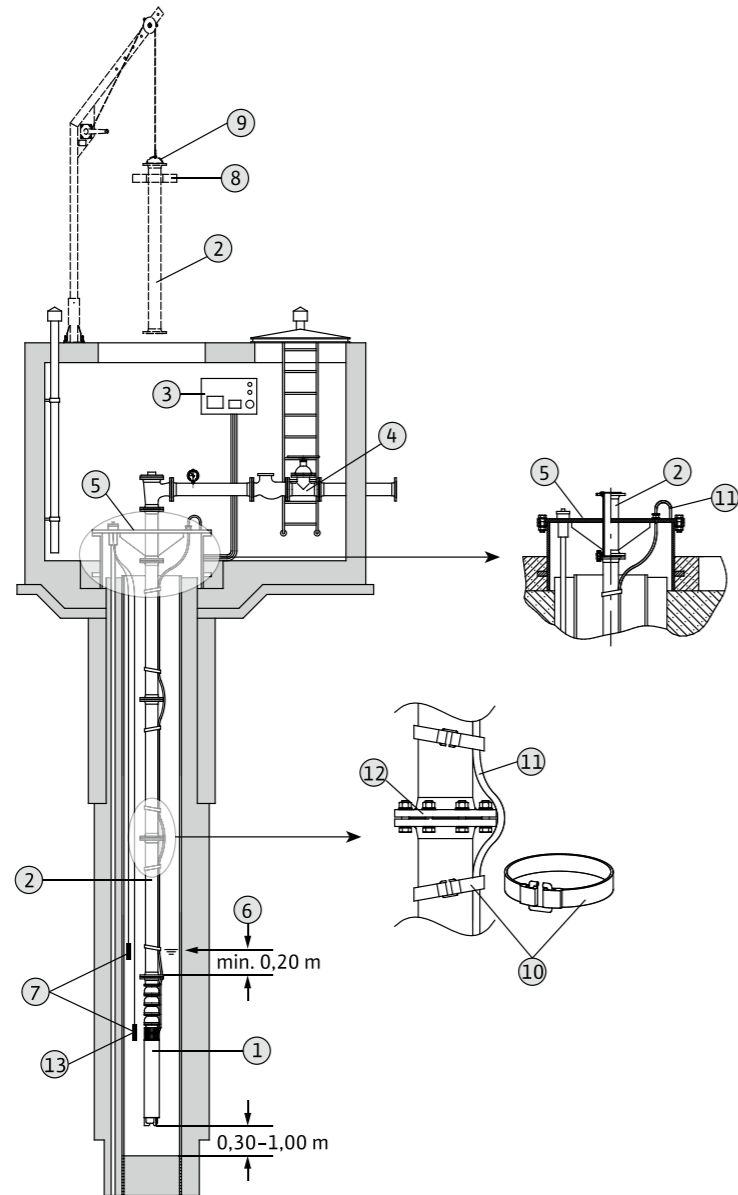
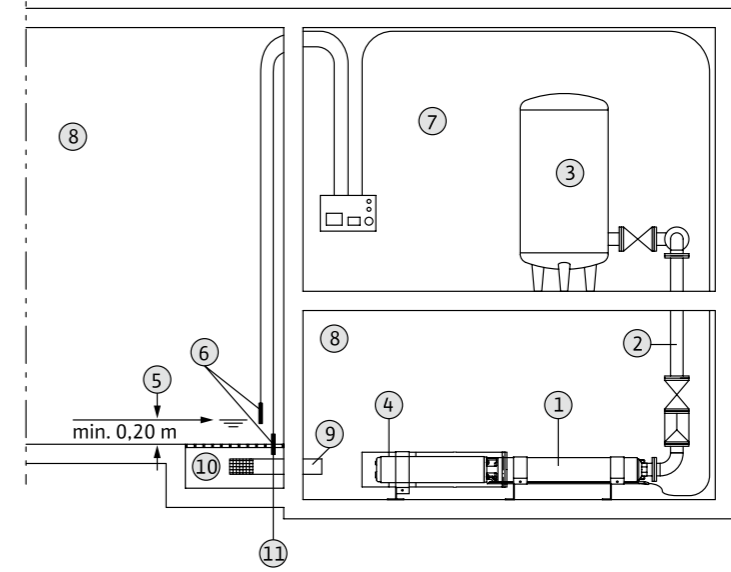


Fig. 3



## 1 前言

### 1.1 关于文档

本操作章程的最初版本为德文，其他语言版本翻译的原始德国手册。

操作手册包含 EC 符合性声明的副本。

任何未经授权或未经批准的更改在指定的建设工程将会取消这个声明。

### 1.2 手册的设计

手册分为单独的章节。每一章都有一个标题，清楚描述了该节的内容。

对所有重要部分，目录中都有一个标题。

所有重要的操作和安全指令都突出显示。详细信息可以在第二章“安全”中查到。

### 1.3 人员资格

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。

设备的操作和维修人员还必须遵守国家事故预防法规。

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。

此泵不适于身体、感官或精神能力受限以及不具备相关经验和知识的人员（包括儿童）使用，除非由负责他们安全的人员监督他们并指导他们如何使用此泵。应照看好儿童，以确保其不会玩耍泵设备。

### 1.4 缩写和术语

在操作和维护手册中使用的各种缩写和术语。

#### 1.4.1 缩写

- p.t.o = please turn over 请翻阅
- approx. = approximately 大约
- i.e. = that is 就是说
- incl. = included 包括
- min. = minimum 最小
- max. = maximum 最大
- etc. = and so on 等等
- s.a. = see also 参见
- e.g. = for example 例如

#### 1.4.2 条款

干转

该产品可以全速运行。然而当没有液体时，严禁干转。如有必要，必须安装干转保护装置！

干转保护

由浮子开关或液位传感器确保正确运转。浮子开关或液位传感器安装在管路里，在水位降至最低覆盖水位以下时会关闭泵设备。

液面控制

液位控制，可使用一个或两个浮子开关来进行干转保护，来避免泵经常在开、关之间来回切换。

### 1.5 版权

本安装和操作手册的版权归制造商所有。本安装和操作手册仅供安装、操作和维护人员使用。未经制造商的明确同意，其所包含的规定和制图禁止复制或传播（无论全部或部分），也不得用于任何具有竞争性的目的。手册中所采用的示图可能与实物有所不同，仅作为泵设备示意性图示之用。

### 1.6 变更的权利

制造商保留对设备或部件进行技术改进的权利。本安装和操作手册适用于标题页上所示的泵设备。

### 1.7 保修

本章包含了有关保修的一般信息。任何偏差均必须经过合同约定并且应予以优先考虑！

在制造商所出售的泵中若发现存在任何缺陷，只要缺陷符合以下任意一条或多条要求，制造商则有义务纠正此类缺陷：

#### 1.7.1 概述

- 缺陷由所用材料或者产品制造或设计方式导致的。
- 已在协定的保修期限内，以书面形式向制造商报告所发现的缺陷。
- 仅按照规定使用泵设备。
- 所有安全和控制装置的连接和检查工作均由具有资质的人员完成。

#### 1.7.2 保修期

如没有其他规定，保修期为调试或交货日期 1 个月之后的 12 个月。任何偏差均必须经过书面确认。以确认产品的有效保修期。

#### 1.7.3 备件、附件和改装

仅可使用制造商的原装备件用于维修、更换、加装和改装。只有这样才能保证使用寿命及安全的运行。未经授权加装和改装或者使用非原装备件可能严重损坏泵设备和 / 或伤害工作人员。

#### 1.7.4 维护

应当定期执行规定的维护和检验工作。此类作业只能由具有资质、经过培训并取得授权的人员执行！本手册未列出的维护，仅应由制造商和授权的服务中心执行。

### 1.7.5 产品损坏

必须由经过培训的人员立即消除危及安全的损坏和故障。仅当泵处于完好工况时方可操作。通常情况下，维修作业仅应由制造商或授权的服务中心执行。制造商的维修人员有权对已损坏的产品交付到工厂检查。

### 1.7.6 免责声明

若产品发生损坏情况，只要适用以下任何一项的内容，则不予保修，也不承担责任：

- 制造商认为运营商或客户所提供的信息不充分或不正确
- 未遵守本安装和操作手册中规定的安全的指示和工作指示，未遵守当地的适用法律。
- 使用不当
- 未正确的储存和运输
- 装配 / 拆卸不当
- 维护不充分
- 维修不当
- 施工现场或施工不当
- 化学、电化学和电的影响
- 磨损

也就是说，制造商的责任概不包括人身伤害、材料损坏或财务损失的所有责任。

## 2 安全

本节列出了所有通用的安全说明和技术信息。此外，所有其他章节均包含具体的安全说明和技术信息。在泵使用寿命周期的各个阶段（安装、运行、维护、运输等等）期间，必须遵守并执行所有的说明和信息。运营商应负责确保所有人员遵照上述说明和指导方针。

### 2.1 指示和安全信息

本手册以指示和安全说明的形式用以避免人身伤害和财产损失。为便于工作人员明确识别，指示和安全说明区分如下：

#### 2.1.1 指示

指示以粗体字显示，直接针对前述文字或章节。

**Example:** 例如

注意，对带有饮用水的产品，必须采取防冻措施保护！

#### 2.1.2 安全说明

安全说明采用略微缩进和粗体形式，始终以警示词开始。

指示信息只指财产损失的，灰色印刷，没有安全标志。

指示信息是指人身伤害的，黑字印刷，总是有一个安全标志。危险，禁止或指令符号作为安全符号

例如：



危险标志：一般危险



危险标志，例如，电流



禁止标志，例如，阻止进入！



指令标志，例如，穿戴防护服

所采用的安全标志符合通用的指令和规章，如 DIN 和 ANSI。

每个安全指示开头都有一个下面的提示：

- 危险
  - 可能发生严重或致命人身伤害！
- 警告
  - 可能发生严重人身伤害！
- 小心
  - 可能发生人身伤害
- 小心（未带符号的说明）
  - 可能发生实质性的财产损失。可能出现无法弥补的损害！

安全提示开始从信号词和描述风险开始，其次是风险源和潜在后果，最后建议预防。

例如：

谨防旋转部分！

旋转的转子可以粉碎和切断四肢。

关掉产品，让转子停下来。

### 2.2 一般安全

- 安装或拆除产品时，不得独自一人在室内或舱内作业。始终应有第二人在现场。
- 在泵上执行任何作业（装配、拆卸、维护、安装）之前，始终应切断其电源。应当将泵与电气系统断开并加以保护，避免被重新接通电源。所有转动部件必须停下来。
- 若出现任何故障或不正常情况，操作人员应立即通知其上级主管。
- 若发生下列存在安全风险的故障，运营商必须立即关闭设备。这是至关重要的，可能危及人员安全。其中包括：
  - 安全和 / 或监控设备的故障
  - 重要部件的损坏
  - 电气设备、电缆和绝缘材料的损坏
  - 工具和其他器具应保持在其指定之处，以确保可以随时使用。

- 在密闭室内必须提供充分的通风。
- 当焊接或使用电子设备，确保没有爆炸的危险。
- 仅使用法定与正式批准的提升装置。
- 提升装置必须予以安全存放，必须适于使用条件（气候、吊挂装置、荷载等）
- 使用移动设备进行起吊荷载时，在操作期间应当确保其保持稳定。
- 当使用移动设备进行起吊非制导的荷载时，应采取措施以避免倾斜、移位、滑动等。
- 应当采取措施，以确保不会有人在悬吊的荷载正下方。此外，还应禁止将悬吊的荷载移动通过存在人员的工作场所上方。
- 使用移动设备进行提升荷载时，如果需要，应在现场安排第二个人员进行协调工作（例如，操作者视野被阻挡）。
- 吊运待提升的荷载时，必须确保即使出现电力故障也不会导致任何人受到伤害。此外，在户外执行此类作业时，若天气状况变坏，则取消作业。

必须严格遵守上述指示。若不遵守则可能会导致人身伤害或重大财产损失。

### 2.3 使用的指令

本产品是主题

- 各种电气指令
- 各种统一标准
- 和各种国家标准。

请咨询符合欧盟声明的精确信息和指南和规范。

同时，各种国家标准也可以用作该产品的使用，安装和拆除。

### 2.4 CE 标志

可以在铭牌附件找到 CE 标志。铭牌一般粘贴在电机的外壳上。

### 2.5 电气作业

该产品以交替或三相电流运行。必须遵守当地能源供应公司（如 VDE 0100）的要求。当连接产品时，必须严格遵守“电气连接”章的内容！

如果泵已经由保护装置切断电源，在错误得以纠正之前，不得重新接通电源。



触电危险！

不正确执行电气作业可能会导致致命伤害！电气作业只能由具有资质的电工完成。

当心湿气！

渗入电缆的湿气会损坏泵和电缆。切勿将电缆末渗入湿气。未使用的电线必须绝缘！

### 2.6 电气连接

泵的操作人员必须知道电源供电之处以及如何切断供电。建议安装漏电断路器（RCD）。必须遵守国家的、当地的以及公共事业公司的法律法规。

当泵连接到电气操作面板上时，尤其是使用软启动控制或频率转换器等电子设备时，必须遵循控制开关制造商的技术规范，以符合电磁兼容性 (EMC) 的要求。可能需要为电源和控制电缆采取专门的单独屏蔽措施（例如：屏蔽电缆，滤波器等）。

仅当控制开关符合当地标准时，方可进行连接。移动无线设备可能会造成系统故障。



当心电磁辐射！

电磁辐射对装有心脏起搏器的人员可能会造成致命危险。挂上适当的标牌，并确保所有受影响人员意识到危险性！

### 2.7 接地

我们的产品（包括保护装置和控制系统、辅助升降装置）是必须接地的。若有人员可能会接触到泵和工作液体（如在建筑工地），连接线路则必须另外装配漏电保护装置。

该泵组是潜水产品，符合标准要求的防护等级 IP68。

安装的开关设备的防护等级可以在其柜体和相应的操作手册中找到。

### 2.8 安全和监控装置

我们的产品可以配备机械（如进气过滤器）和/或电气（例如，热传感器、湿度传感器等）安全和监控装置。这些装置必须连接。

在启动前，必须连接和检查电气设备如热传感器，浮子开关等，确保其运转正常。

请注意，某些设备需要继电器正常工作，例如 PTC 热敏电阻和装 PT100 传感器。这个继电器可以从制造商或电力供应经销商处获得。

有关人员必须了解所安装的系统及其工作原理。

小心！

若监控设备已拆除或已损坏、或者不工作时，切勿运行泵设备。

### 2.9 运行期间的安全规则

运行泵时，始终应遵循工作安全、事故预防和电气设备操作方面的当地适用法律和法规。为确保安全的工作实践，运营商应明确指定员工的职责。所有人员均有责任确保遵守规章制度。

该产品具有旋转部件。在运行期间，泵中注满液体，这些液体可能会出现非常锐利的边缘。



小心旋转部分！

水力系统中的旋转部件上可能会形成锐利边缘。会导致挤压和肢体切断的事故。在执行维护或维修作业之前，应关闭泵，始终令旋转部件停止下来！

### 2.10 泵送液体

每种工作介质在成分、腐蚀性、耐磨性、干物质含量以及其他许多方面各有不同。一般情况下，我公司的泵可用于多种应用。请注意，若要求发生变化（密度、粘度或一般成分），则也影响到泵的许多参数。

在不同的工作介质条件下使用或更换泵时，应遵守以下几项要求：

- 当用于饮用水的场合时，所有与液体接触的部件都必须适用于输送饮用水要求，并满足当地法律和法规的要求。
- 已在肮脏污水中运行的泵在用于其他工作介质之前必须加以彻底清洗。

- 已在含有污水和 / 或对身体有害液体的污水中运行的泵在用于其他工作介质之前必须加以消毒。
- 必须明确泵是否完全可以用于其他工作介质。
- 如果机械密封存在故障，泵中注入的润滑剂或冷却液（如油）会污染工作介质。
- 严禁泵输送纯净的爆炸性或高度易燃性流体！



危险 - 爆炸性液体！

严禁泵送爆炸性液体（汽油、煤油等）。此泵不适于这些液体！

### 2.11 声压

根据泵的规格和容量（kW）的不同，运行期间的声压级大约介于 70 dB（A）至 110 dB（A）之间。

但是，实际声压级取决于多项因素。其中包括安装深度、配置、配件和管路的固定、工况点、潜水深度等。

我们建议，一旦泵在其工况点和所有工作条件下运行后，运营商在工作场所另外进行测量。



注意：佩戴耳塞！

依照适用法律和规章，若声压级大于 85dB（A），则应佩戴听力保护装置。运营商应负责确保遵守上述规章。

## 3 运输和储存

### 3.1 交付

交付后，立即检查装货是否齐全并且完好无损。如有任何部件受损或丢失，必须在交付当天通知运输公司或制造商。该日期之后所提出的索赔均不予认可。必须在货运文件上记录部件损坏情况。

### 3.2 运输

只可以使用适当且经过认可的固定装置、运输和提升装置。这些装置必须拥有足够的承载能力，确保泵得到安全运输。若使用链条，则必须防止滑动。

有关人员必须能够胜任相关任务，并且在工作期间必须遵守所有适用的国家安全法规。

泵由制造商或货运代理公司采用合适的包装进行交付。通常，这可以防止运输和存放期间发生损坏。若产品频繁在不同地点使用，则应将包装放置在安全之处。

谨防冰冻！

如果使用饮用水作为冷却剂 / 润滑剂，产品在运输过程中必须采取防冰冻的措施。如果不能的话，产品必须排干净！

### 3.3 存放

对新供应的泵做好准备工作，则至少可以存放一年。在临时存放前，应对泵进行彻底清洁。

存放时应考虑如下事项：

- 将泵放置在结实的表面上并防止滑动或倒落。潜水泵竖直存放。如果水平放置必须确保产品不能弯曲。
- 否则，可能出现弯曲张力过高，会损坏产品。



倒落会发生危险！

切勿将泵在未固定状态下存放。若泵倒落，可能造成伤害！

- 产品可以存放在温度低至 -15℃ 的环境中。储存室必须干燥。我们建议存放在温度在 5℃ 和 25℃ 之间的防冻室内。装满饮用水的产品可以存放在温度 3℃ 的防冻房间内长达 4 周。如需更长的时间存放，则应把产品的饮用水排空。
- 产品不能存放在焊接工作的地方。焊接产生的气体和热量会损害泵的弹性部件和涂料。
- 在存放前应封闭所有抽吸或出水口，防止污染物。
- 应防止电源电缆缠结、受损或受潮。



触电危险！

受损的电源电缆可能造成致命伤害！损坏的电缆必须由专业电工立即更换。

当心湿气！

渗入电缆的湿气会损坏泵和电缆。切勿将电缆末渗入湿气。

- 必须避免泵受到阳光直射、受热、受到尘土污染或受冻。高温和低温会对转子和涂层造成很大的伤害！
- 若泵已经存放很长一段时间，则应在试运行前清除灰尘或油积垢等杂质。应检查叶轮是否正常运转。应检查壳体涂层是否受损。

在试运行前，应检查密封室内的充注液位（如油、电机填充液，等），如果必要，予以加满！填充饮用水的产品，应完全加满。

小心损坏涂层！

损坏的涂层会导致不可挽回的损害产品（如形成铁锈）！因此，损坏的涂层必须立即修理。可由制造商进行修复工作。

只有完好无损的涂层才符合规定用途的标准！

如果遵循这些规则，你的产品可以存储的时间较长。请记住，随着时间的推移，弹性部件和涂料变得脆弱。如果产品存储时间更长超过 6 个月，我们建议检查这些零件，必要时予以更换。

如果这是这种情况，请咨询制造商。

### 3.4 退货交付

退回工厂的泵必须进行适当包装。也就是说，已经将杂质清除，并且，如果已用于危害健康的流体，则应当已进行过净化处理。装运时，部件必须采用大小合适的防撕裂塑料袋加以包装，保证其密封严实并防漏。此外，包装必须避免泵在运输过程中受损。如有任何问题，请

联系制造商！



## 4 产品描述

产品精细的制造并经过严格的质量控制。正确的安装和维护能够保证无故障的运行。

### 4.1 适当的使用和应用的领域

潜水泵适用于：

- 从井和水池提取饮用水和非饮用水
- 民用供水
- 公共供水，洒水和灌溉
- 提升泵站
- 降低地下水位
- 工业抽水
- 没有长纤维和颗粒的供水

潜水泵不能以下介质：

- 污水废水
- 污水 / 污物
- 未经处理的污水



触电危险

当该产品用于游泳池或其他可以进入的水池时，小心电流，可能有致命的危险。请注意以下内容：若池中有人，严格禁止使用该产品！

如果池是闲置的，必须按照相应的国家规定采取防护措施。

正确使用也需要注意这些说明。其他使用被认为不正确的。

#### 4.1.1 泵送饮用水

当泵用于输送饮用水时，应评估该产品是否适用于当地的法律法规的要求。

### 4.2 概述

Wilo-Sub TWS...是防水潜水泵，可以垂直和水平固定安装。

Fig. 1: 描述

1	电缆	4	水力部件
2	进水口	5	出水口
3	电机部件		

#### 4.2.1 水力

多级的轴向或半开的水力可组合的设计，泵壳、泵轴和转子部件都为不锈钢材质。泵出口为螺纹连接，并配有集成的止回阀。

该产品不能自吸，换句话说，泵必须始终淹没在介质中，并确保其最低的运行水位。

#### 4.2.2 电机

三相电机中充满了油或水-2 二醇混合物，威乐标配 MW 型电机仅能立式安装，富兰克林电机可以立式或卧式安装。电机外壳是不锈钢材质。电机符合 NEMA 标准。

电机利用介质冷却。当运转时，电机必须始终淹没在介质中。液体的最大温度和最小的流动速度不能超过其要求。

连接电缆采用防水电缆，并固定到电机上。电缆型式取决于电机型式：

- TWS- 免费的电缆
- TWS-...QC: 快速接头电缆

快速接头电缆连接及安装方便

电缆组件；自由端电缆

注意开关装置的防护等级。

#### 4.2.3 密封

电机和水力部件之间的密封是由轴封，或浮动环密封（电机功率 $\geq 2.5\text{kW}$ ）。

### 4.3 运行模式

#### 4.3.1 S1 运行模式（连续运转）

该泵可以在没有超过最大额定负载的允许的温度。

### 4.4 技术数据

一般数据

- Mains supply: see type plate 电压
- Rated motor capacity P2: see type plate 电机功率
- Max. pump head: see type plate 最高扬程
- Max. pump flow: see type plate 最大流量
- Activation type: direct 启动方式
- Liquid temperature: 1 to 40 °C 介质温度
- Protection class: IP 68 防护等级
- Isolation class: F 绝缘等级
- Speed: see type plate 转速参考样本
- Max. submersion: 70 m 最大的淹没深度
- Starts per hour: max. 20 每小时启动次数
- Max. sand content: 50 mg/m<sup>3</sup> 最大含砂量
- Min. flow at the motor: 0.1 m/s 电机最小的流速：0.1m/s
- Operating modes S1 运行模式 S1



#### 4.5 型号说明

Example: Wilo-Sub TWS 4.12-15

例如

- TWS= 不锈钢潜水泵
- 4= 适用井径，英寸
- 12= 额定流量
- 15= 叶轮级数

#### 4.6 供货范围

标准的泵

- 电缆长度为 1.5 或 2.5 米（从电机边缘起）
- 安装使用维护说明书
- 交流启动装置，电机热保护装置，转换开关和自由的电缆接头
- 自由的直流电缆接头

质量控制版本：

- 1.75m 快速电缆接头组件
- 安装维护使用说明书

#### 4.7 附件（可选的）

- 冷却夹套
- 开关设备
- 液位传感器
- 快速电缆接头
- 电机电缆装置
- 扩展的电机电缆封装设置

## 5 安装

为防止在安装过程中对产品受损或产生严重伤害，必须遵守以下几点：

- 安装作业—产品的组装和安装—仅应由专业人员执行。必须始终遵守安全说明。
- 在实施任何安装作业前，必须检查是否存在运输损坏。

#### 5.1 概述

在使用较长的排水管路（特别是在稳定爬坡或陡峭地形情况下）可能会发生压力波动。

压力波动可能会毁坏泵或系统，并且会因阀瓣撞击产生噪音污染。可以通过采用适当措施来防止压力波动（例如，带有可调式关闭时间的止回阀，或排放管线的特殊走线）。

在输送石灰水后，必须用干净的水进行冲洗，以防止结垢和后续的故障。

若正在使用液位控制，则要确保最低水位覆盖面。必须尽力避免壳体或管路系统中的气泡，并且必须采用适当的通风系统来去除这些气泡。防止泵发生霜冻。

#### 5.2 安装的类型

- 垂直固定安装，淹没
- 水平固定安装，淹没，只有与冷却夹套一起使用！

#### 5.3 操作区域

操作区必须清洁，没有粗糙固态物，干燥并且防霜冻，如有必要，应予以去污。而且它也必须适用于特定的泵。供水必须有足够大的流量，这样可以预防干运转和 / 或空气进入。

当安装在井或钻井时，确保泵不能接触井壁。因此，必须确保潜水泵的外径始终小于井筒或钻孔的内径。

在容器、井或钻井的密室中作业时，出于安全考虑，必须安排第二个人在场。若可能产生有毒或窒息性气体，则必须采取必要的防护措施。

必须确保升降装置安装方便，因为这对于泵的组装和拆卸十分必要。必须确保可以使用提升装置安全接触到运转和存放位置上的泵设备。设备必须定位在结实的支撑表面上。运输泵时，必须将承载设备固定到提供的提升吊眼上。

电源电缆的布线方式必须确保始终能够实现安全运转和无故障组装 / 拆卸。切勿使用电源电缆搬运或拖拉泵设备。使用控制开关时，必须遵守相应的防护等级。通常，控制开关需要安装在潜在爆炸性区域之外，并且安装方式必须防止进水。

结构构件和底座应有足够的稳定性，可使产品牢固固定。运营商或供应商负责提供底座，并且确定其具有合适的大小、稳定性和强度！

对流体吸入口使用导板和偏转板。若吸水高度接近水的表面，会有气体进入流体，而这些气体可能积聚在管道系统内。这可能导致运行工况不当，并导致整个系统停用。

#### 5.4 安装



小心坠落！

在安装泵及其附件时，有时需要直接在水池或密室边缘作业。粗心大意或穿着不当可能发生坠落。这存在致命伤害的风险！采取所有必要的安全预防措施来避免发生此类危险。

在安装产品时应注意遵守以下事项：

- 该作业必须由 ([ 专业人员 ] 进行，而电气作业则应由 ([ 电工 ] 进行。
- 在运输过程中，必须使用适当并经过认可的紧固装置，而不能使用电源电缆。紧固装置必须有可靠的固定点，必要时进行固定。
- 检查可用的文档（安装计划，作业区域设计，进水口）是否完整和正确。

为获得必要的冷却，该产品必须始终淹没在介质中。并必须保证最低水位也能淹没！

严禁干转。建议安装干转保护装置。如果液位变化很大，必须安装干转保护装置。

检查电缆长度是否足够适用于其横截面（参见目录和计划文档或咨询 Wilo 客户服务信息）。

- 在操作重型悬垂负载，或者在重型悬垂负载下方作业时，请遵守所有规章、规则 and 法律规定。
- 穿戴合适的防护服 / 设备。
- 也请遵守适用的国家事故防范条例和行业协会安全规定。
- 在安装之前，检查涂层。如有损坏，在安装之前必须进行修复。

#### 5.4.1 电机填充液

电机在出厂时内部充满了水 - 乙二醇混合液，可确保电机在 -15° C 时不会霜冻。

电机的设计是不能从外部填充液体。有制造商进行必须的填充。填充的液位在存储很长一段时间后必须检查 (>1 年)！

#### 5.4.2 快速电缆接头的安装

快速电缆接头必须在整机安装之前进行。

警告：该操作必须在干燥的地方进行，确保插头与连接套不能含有任何水分。水分会损坏电缆和产品！

- 快速接头与快速插座用于连接电缆。
- 用金属套管和螺丝把电缆连接在一起。

#### 5.4.3 立式安装

Fig. 2: 安装

1	产品	8	支架夹
2	出水管路	9	固定架
3	开关装置	10	电缆夹
4	止回阀	11	电源线
5	井口装置	12	法兰
6	最低水位	13	干转保护
7	液位传感器		

这种安装方式，把产品直接安装在出水管路上。出水管路的长度决定了安装的深度。

不能将产品安装在坑的底部，这样可能导致泥沙聚集在电机周围，使电机热量不能排放，产生过热。

此外，产品不能水平安装过滤网。沙子和其他颗粒可能通过吸入口进入，导致水力部件损坏，同时也不能满足电机的冷却。

必要时，可安装导流罩或其他的管路。

#### 法兰管路安装

使用有足够起重能力的升降装置。在井口放置有足够承受力的两块木块，用于放置支架夹。

如果井口狭窄，必须使用定心装置，以避免产品接触井壁。

1. 安全地把潜水泵垂直的下降。
2. 利用升降装置上的固定架，连接第一段带法兰的管路，并提升起来。
3. 连接法兰管路的自由端和潜水泵，在两者之间必须安装密封垫。自下而上穿入螺栓，这样可以更好的把紧螺母。同时，总是交叉拧紧螺栓，以避免密封垫压力不均。
4. 在法兰上用电缆夹夹紧电缆。如果井口狭窄，出水管路的法兰上必须有凹槽，以便电缆通过。
5. 将连接有第一根出水管的水泵提升至井口上方，降低水泵，将支撑夹夹在出水管上，注意不要太紧，另外电缆应置于支

撑夹的外面，以避免电缆受到挤压。

6. 然后将支撑夹支撑在事先放好的方木上，继续降低泵和出水管，直至出水管的上端法兰架在支撑夹上，松开起吊设备，整个泵及出水管支撑在支撑夹上。
7. 取下上端法兰上的固定架，接到下一根出水管上，提起该出水管，将其移至井口上方，将出水管的下端连接到第一根出水管上，连接时在两个法兰之间放入密封垫片。



小心严重挤压伤

移除支撑夹后，升降装置承受整个产品及管路的重量，这可能导致升降装置变形！因此，在移除支撑夹前，确保升降装置的线是拉紧的。

9. 保持起吊高度不变，取下第一根出水管上的支撑夹，用电缆夹在法兰上面和下面的位置分别固定电缆，对于直径较大相对较重的电缆，最好每隔 2-3m 设置一个电缆夹；如果有多根电缆，应分别固定。
10. 放低出水管，使其下端法兰进入井中，装上支撑夹，继续降低出水管，直至其上端法兰支撑在支撑夹上。重复以上 7-9 操作，直至水泵到达预定深度。
11. 对于最后一个法兰，取下上面的固定架，将其固定到井盖上。
12. 将井盖慢慢吊起，取下出水管上的支撑夹，将电缆从井盖上的孔中穿出，放下井盖。

#### 迅速拧紧固定螺栓。

#### 螺纹连接安装

过程几乎和法兰管路安装一样。但是，请注意：

- 1 采用螺纹连接管路。螺纹必须是拧紧的，彼此没有泄漏。螺纹之间必须使用麻绳或聚四氟乙烯进行缠绕。
- 2 螺纹连接时，必须确保管路在一直线上，螺纹完好无损坏。
- 3 注意零件的旋转方向。使用正确的旋向（右或左方向）才能保证管路不会意外松开。
- 4 螺纹管必须避免意外的松开。
- 5 在安装过程中，所需的固定支架都必须坚固的固定在管道的连接处。均匀地拧紧螺丝，止到夹紧管路（固定之间不能相互接触）。

#### 5.4.4 水平安装

Fig. 3: 安装

1	产品	7	操作区
2	出水管	8	水箱
3	压力罐	9	进水口
4	冷却夹套	10	进水口过滤器
5	最低水位	11	干转保护装置
6	液位传感器		

必须和冷却夹套一起使用时才能水平安装。当产品直接安装在水箱 / 水库 / 容器及带法兰的管路上时，必须安装冷却夹套，以防止电机过热。

连接管路的支撑是单独的，即产品不能支撑管路。

在水平安装时，管路与产品分别安装，以确保泵出口与管路一致。

在水平安装时，必须安装冷却夹套。

1. 在安装区域（容器/水库）的地基上钻孔时，注意螺栓的规格和孔的大小，以确保螺栓足够稳定。
2. 使用合适的升降装置，将产品放置到正确的位置。
3. 使用提供的紧固材料将产品固定！
4. 产品固定后，可以安装管路及法兰，确保出水口水平。
5. 出水管路与出水口连接。法兰之间必须安装密封垫。交替把紧连接螺栓，避免损坏密封。请注意，管路的安装应避免振动或张力（必要时可使用弹性软接）。
6. 在任何时候（操作、快速维修），任何人（维修人员等）都不得损坏电源电缆。电气连接必须由授权的专人人员操作。

## 5.5 干转保护

确保没有空气进入水力部件壳体。因此，泵必须始终潜入流体内，流体表面淹没壳体的顶部边缘。为最大程度增加可靠性，建议安装干转保护系统。

由浮子开关或液位传感器确保正确运转。浮子开关或液位传感器固定在轴上，在水位降至最低覆盖水位以下时会关闭泵设备。

若在充注液位出现明显偏差的情况下，仅使用一只浮子开关来执行干转保护，泵则可能会经常在开、关之间来回切换！

这会导致超过电机启动的最大次数（开关切换循环）和电机过热！

### 5.5.1 避免过多开关切换循环的纠正措施

手动复位 - 当水位降至最低覆盖水位以下时，电机会关闭，并在恢复至充分水位后重新接通电源。

单独的关闭点 - 采用第二个开关切换点（另外的浮球开关或电极）来获得充分的启动和关闭差值。这可避免不断切换开关。

该功能可由液位控制继电器执行。

## 5.6 电气连接



致命的触电危险！

不当电气连接可能导致致命的电击事故。电气连接仅应由经过当地供电商认可的专业电工依照当地适用条例进行。

- 电源连接的电压和电流必须符合铭牌上的规定。
- 根据适用标准和规定并依照导线的分配规定连接电源电缆。
- 必须连接并测试所有可用的监控设备，例如，电机温度检测，确保其工作正常。
- 对于三相交流电机，必须存在顺时针旋转磁场。
- 对泵进行正确接地。

永久性安装的泵设备必须按照当地标准进行接地。若有一根单独的接地导线，则必须使用适当的螺丝、螺母、带齿垫圈和平垫圈将其连接至标记的孔或接地线端。接地导线连接电缆的横截面必须符合当地规定。

- 必须使用电动机保护开关。我们建议使用漏电保护断路器 (RCD)

- 开关装置必须作为附件购买。

### 5.6.1 技术细节

- 启动方式: 直接启动
  - 电流 10A
  - 电缆规格 4 x 1.5
- 只有缓动式熔断器或 K 型自动断路器可以用作断路器。

### 5.6.2 交流电动机

制造商已完成交流电机的启动设置。在启动时，仅需要连接电源电缆（接线 L 和 N）。

仅应由专业电工进行电气连接。

### 5.6.3 三相电机

三相电流类型提供有自由电缆端。在开关盒终端处将其连接至电源。

仅应由专业电工进行电气连接。

连接的电源电缆分配如下：

4-wire connection cable	
Wire color	Terminal
Black	U
Brown	V
blue or gray	W
green / yellow	PE

### 5.6.4 监控装置连接

Wilo-Sub TWS 系列的交流电动机采用综合热保护装置。如果电机变得太热，保护装置会自动关闭。一旦电机冷却，保护装置会自动复位。

用户必须安装一个电机保护开关。

Wilo-Sub TWS 系列三相电动机没有综合监控设备。

用户必须安装一个电机保护开关。

## 5.7 电动机保护和启动类型

### 5.7.1 电机保护

带自由电缆端的电机其最低要求是一个带温度补偿、差值触发的热继电器 / 电机保护开关以及一个防重启装置。

若将泵连接至经常发生故障的电气系统上，则建议在客户处安装另外的防护装置（过压、欠压或断相继电器、避雷装置等等）。

还建议安装一个漏电断路器。

在连接泵设备时，必须遵守地方和国家法规。

### 5.7.2 启动类型

直接启动

满负荷运行时，电机保护应设定至铭牌上所示的额定电流。部分负荷运行时，建议将电机保护设置在工况点处所测得电流之

上的 5%。

#### 星角启动 / 软启动

- 满负荷运行时，电机保护应设定至工况处的额定电流。部分负荷运行时，建议将电机保护设置在工况点处所测得电流之上的 5%。
- 在所有的工况点必须保证所需的最小冷却流速。
- 在整个运行期间，电流消耗必须低于额定电流。
- 必须设置 0 到 30 Hz 之间启动 / 停止的升速时间最大值为 1 秒。
- 必须设置 30 Hz 和额定频率之间启动 / 停止的升速时间最大值为 3 秒。
- 启动时的电压必须至少为额定电压的 55%（推荐为 70%）。
- 为在运行期间避免功率损耗，在正常运行后，应将电子启动器（软启动）旁路。

#### 变频器运行

- 只能在 30 Hz 至 50 赫兹进行变频运行。
- 为确保轴承润滑，泵流量至少为额定流量的 10%。
- 必须设置 0 到 30 Hz 之间启动 / 停止的升速时间最大值为 2 秒。
- 考虑到电动机绕组冷却，泵停止到重新启动的时间间隔至少为 60 秒。
- 不要超额定电流运行
- 最大电压峰值
- 最大电压上升速度 500 V/μs
- 当控制电压超过 400V 时，需要额外的变压器。

#### 产品插头 / 开关设备

将插头插入电源插座，依靠附件的控制系统来开关的开 / 关或产品的启 / 停。

作为产品的附件，开关设备及电缆可以订购。如果这样，也需遵守开关设备的操作。

插头和开关设备不是防水的。需注意防护等级。在安装该设备时，必须考虑其防水的措施。

## 6 启动

在“启动”一章中包含了对操作人员启动和安全操作该产品的所有重要指示以下约束和监控必须遵守：

- 安装类型
- 工作模式
- 最低液位 / 最大淹没深度

若泵在较长一段使其没有运行，也应检查这些条件并纠正发现的任何缺陷！

始终将本手册妥善存放在泵设备旁边，或专门指定之处，使得所有操作人员可以随时获取。

为防止在泵试运行时代设备损坏或人员严重伤害，必须遵守如下几点：

- 泵必须由专业人员进行试运行。必须始终遵守安全说明。

- 所有操作该产品的人都必须收到，阅读和理解该操作和维护手册。

- 必须连接所有安全装置和紧急断电装置，然后进行检查，确保其正常运行。

- 必须由专业人员进行电气和机械调整。

- 泵适于在规定的操作条件下使用。

- 泵的工作区域不是休闲场所，需要清空人员！启动或运行时，工作区不得有人。

- 在密室中作业时，出于安全考虑，必须安排第二个人在场。如果可能存在有毒气体危险，则必须确保充分通风。

### 6.1 电气系统

按照“安装”章节所述并且遵照 VDE 指南和适用的国家规范来连接泵并安装电源电缆。

必须对泵进行适当保护和接地。

注意旋转方向！若旋转方向不对，则泵不能按说明运行，并且可能受损。

确保已连接并检测所有监控装置。



触电危险！

若处理不当，电流可能造成致命伤亡！所有带自由电缆端（即，没有插头）的泵必须由专业电工进行连接。

### 6.2 检查旋转方向

在工厂对泵设备进行检查和调整，确保旋转方向正确。必须根据接线标识进行连接。

淹没之前，必须检查泵，确保其旋转方向是正确的。

必须在常规操作条件下进行试运行！严格禁止在泵未完全淹没时，启动泵！

#### 6.2.1 检查旋转方向

必须由本地电工使用旋转磁场测试仪来检查旋转方向。必须存在顺时针旋转磁场，才表示旋转方向正确。

如果是逆时针旋转磁场，则不得运行泵设备。

#### 6.2.2 旋转的方向不正确

当使用 Wilo 开关设备

Wilo 设计的开关设备能够正确的连接产品。如果旋转方向不对，调换电源线的两相。

客户提供的开关设备：

如果旋转方向不对，对于直接启动方式，电源两相必须调换。对星 - 三角启动方式，必须调换两个绕组的电源线，如 U1V1 和 U2V2。

### 6.3 调整液位控制设备

请参阅安装和操作手册要求的控制液位进行正确的调整设备。

请遵守产品的最低水位的要求！



## 6.4 启动

泵的工作区域不是休闲场所，需要清空人员！启动或运行时，工作区不得有人。

在首次运行前，必须按照“安装”章进行安装，并依据“维护”一章要求进行绝缘电阻检查。

当使用交换设备和 / 或插头，必须相遵守防护等级的要求。

### 6.4.1 启动之前

启动潜水泵之前，以下几点必须检查：

- 电缆 -- 没有缠绕，稍微张紧合适。
- 检查泵的液体的温度和浸没深度——参阅技术数据。
- 设备安装牢固——方能保证运转时无振动
- 附件 -- 基座、冷却夹套等必须稳固
- 泵坑的吸水室和管道应清洁干净
- 按照设备布置和装配要求进行安装
- 进行绝缘检查。详细信息，请参见“维护”一章。
- 水力部件必须完全淹没，即应该完全充满液体，无空气进入。可以使用带有放气孔的设备，或者，如果可以的话，在出水口上增加放气螺钉。
- 在调试阶段，应调节阀门开启一半，这样可以排气。
- 你可以使用电动的截止阀来防止水的冲击。可以打开进行节流或阀门关闭的位置。
- 然而，长时间不运转 (> 5 分钟)，阀门关闭或几乎关闭，不能开启运转机器。
- 检查所有的液位控制和干转保护系统。

### 6.4.2 启动后

在启动过程中，电流可以短暂超过额定电流。一旦启动完成，不能再超过额定电流。

如果电机在接通后，不能立即开启。必须尽快切断电源。再次启动前，必须遵守“技术数据”中的技术说明。如果有故障，应切断电源，再没有修复完之前，不得重新启动。

## 6.5 运行期间的安全规则

运行泵时，始终应遵循工作安全、事故预防和电气设备操作方面的当地适用法律和法规。为确保安全的工作实践，运营商应明确指定员工的职责。所有人员均有责任确保遵守规章制度。

产品拥有旋转部件。在运行期间，这些部件会转动来泵送流体。泵送的流体内的某些物质可能会在旋转部件上形成锐利边缘。



注意旋转部件！

旋转部件可能会碾压或切断四肢。切勿在运行过程中接触水力部件或旋转部件。在维护或维修工作前，应先关闭水泵，让旋转部件停下来！

应定期检查如下事项：

- 工作电压 ( 允差为额定电压的 + / - 5%)
- 频率 ( 允差为额定频率的 + / - 2%)
- 电流消耗 ( 相位之间的允差为最大值的 5%)
- 各个相位之间的电压差 ( 最大 1%)
- 单位小时启动和停机次数 ( 请参阅技术数据 )
- 对于入口防止空气，如有必要，应安装一个偏转板
- 最低潜水深度，液位控制装置，干转保护
- 平稳、低振动运行
- 进口和出口压力管内的截止阀必须开启

## 7 关闭 / 处理

在水池和 / 或罐槽内执行作业时，必须始终遵守相应的本地保护措施。出于安全考虑，必须安排第二个人在场。

只有技术完善的提升装置以及经过正规认证的承载设备方可用于起降泵设备。



由于故障导致的致命伤亡风险！

承载和提升装置必须处于完好技术状况。仅应在已检查提升装置并且确定处于其完好工作状态后，方可开始作业。若未经检查，可能导致致命伤亡事故。

### 7.1 临时关闭

对于这类停用，泵仍然保持安装并且供电尚未切断。对于暂时拆除，泵必须保持完全潜水状态，防止霜冻。确保流体和工作区的温度不低于 +3°C。

这会确保泵始终处于待运行状态。对于长时间的停用，应定期（按每月到每季度）进行 5 分钟的功能测试。

小心！

仅应在正确的运行和使用条件下进行功能运转。绝不允许机器干运行！这可能导致不可修复的损坏！

### 7.2 因维护或存放而关闭

电工必须关闭系统电源，切断泵电源连接，并防止未经许可再次接通电源。带插头的泵必须拔掉插头（请勿拉电缆！）然后即可开始拆卸、维护和存放。



当心有毒物质！

应在执行任何其他作业前，对泵送有害健康的流体的泵进行净化处理！否则，存在致命伤害的风险！进行这项作业时穿戴必要的防护服！



当心烫伤！

壳体组件温度可能上升到 40° C 以上。存在烫伤风险！关闭后，令泵冷却到环境温度。

### 7.2.1 拆除

当立式安装时，拆除必须同安装的方式一样：

- 拆除井口装置。
- 拆除出水管路，其拆出过程与安装过程相反。

当计划拆除工作时，需考虑升降装置能够承受住管路，产品（包括供电电缆）的重量，水必须排空。

当水平安装时，水箱 / 容器必须完全清空。将产品从管路上拆除并移走。

### 7.2.2 返回交付 / 存储

为了防止运输中部件损坏，零部件必须包装和密封。

在这方面，也请参考“运输和存储”章。

## 7.3 再启动

再启动之前，必须清洁产品上的灰尘和油污。然后按“维护”章节的要求进行。

上述工作完成后，产品安装必须按照“安装”章节要求进行。电气连接必须有电工进行操作。

启动时，必须按照“启动”章节要求进行。

在确保产品完好无损和准备就绪后，才能重新启动。

## 7.4 处理

### 7.4.1 润滑剂

油和润滑油必须在适当的容器收集和妥善处置，按照欧共体 75/439 / EEC 指令以及符合 5 a 和 5 b 部分的规定，德国的或适用的当地法律。

依据德国 1999 年水危害条例 (VwVwS)，混合物的水和乙二醇被归类为一类污染水。必须依据 DIN52 900( 关于丙二醇, 丙二醇 ) 或必须遵守适用的地方性法规的要求进行处理。

### 7.4.2 防护服

清洁和维护作业后，应根据适用的地方法律处置所穿戴的防护服。

### 7.4.3 产品

正确处置该产品，避免污染环境或危害人身健康。

- 利用公有或私有废物处置公司的服务，或向其咨询产品及其部件的处置方法。
- 有关正确处置的更多信息，可以向市政主管机构、废物处置管理机构，或购买产品的供应商处索取。

## 8 维护

在进行维护或维修作业前，请按照“拆除 / 处置”章节所述关闭并拆卸泵设备。

在完成维护或维修作业后，应根据“安装”章节安装和连接泵设备。应按照“试运行”章节所述打开泵设备。

所有维护和维修作业必须由 Wilo 客户服务中心、授权的维修服务中心，或经过培训的专业人员在安全的工作场所谨慎实施。

本手册未列出的维护或维修工作，只能由制造商或授权的服务中心进行。



触电危险！

在电气装置上执行作业时，存在致命电击事故的风险。对于所有维护或维修作业，必须切断泵的电源并防止未经许可再次接通电源。仅应由专业电工修理损坏的电源电缆。

请注意以下信息：

- 应向维修人员提供本手册，并且必须遵守其说明。仅可以执行本说明书所列出的维护和维修作业。
- 所有维护、检查和清洁作业必须由经过培训的专业人员在安全的工作场所谨慎实施。必须穿戴适当的防护服。应将其从电源线路上断开并保护，避免其不会被无意中接通电源。
- 在盆地和 / 或容器内执行作业时，必须始终遵守相应的本地保护措施。出于安全考量，必须安排第二个人在场。
- 只有技术完善的提升装置以及经过正规认证的承载设备方可用于起降泵设备。
  - 确保提升装置的所有固定装置、绳索和安全装置状况良好。仅应在已检查提升装置并且确定处于其完好工作状态后，方可开始作业。若未经检查，可能导致致命伤亡事故。
- 泵设备和系统上的电气作业只能由电工完成。必须更换故障保险丝。切勿尝试将其修复！仅可以使用规定电流和指定类型的保险丝。
- 使用易燃溶液和清洁剂时，禁止用火、明灯或吸烟。
- 必须对泵送有害健康的液体或与这些液体进行接触的泵进行净化处理。应确保不会产生或出现危险气体。若发生与危险液体或气体相关的受伤事故，必须按照工作场所的告示实施抢救措施，并且应立即通知医生。
- 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、油脂等应收集在适当的容器中并根据相关要求进行处理。进行维护、检查和清洁工作时应穿戴必要的防护服。
  - 也遵守当地的法律法规！
- 仅可以使用制造商明确推荐的润滑油。不得混合油和润滑油。
- 仅使用制造商生产的正品部件。

### 8.1 润滑剂

该电机填充了可能进行生物降解的水 - 乙二醇的混合液。制造商必须检查该混合液的填充液位。

## 8.2 维修周期

所需的维修周期的概述：

### 8.2.1 在初次启动之前或长时间存储之后

- 绝缘电阻检查
- 安全和控制设备检查

## 8.3 维修作业

### 8.3.1 绝缘电阻检查

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 = 1000 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 20 兆欧，
- 以后每次的测量值应大于 2 兆欧。

如果绝缘阻值太低：电缆和 / 或电机可能已受潮。以上情况下，不要连接设备，请联系制造商。

## 8.4 安全和监控装置功能测试

监控装置包括电机内的温度传感器、密封室监控器、过载继电器、过压继电器等。

过载继电器、过电压继电器和其他跳闸装置在进行测试时通常可以通过手动触发。

# 9 故障排除和可能的解决方案

为防止在修理泵故障时发生设备损坏或人员严重受伤，必须遵守如下几点：

- 仅当专业人员在场时才尝试修理故障。也就是说，各项作业必须由经过培训的专业人员进行。例如，电气作业必须由专业电工负责。
- 断开电源并将泵锁定，避免泵意外重启。采取适当的安全预防措施。
- 始终安排第二个人在场，确保紧急状况下关闭泵设备。
- 固定旋转部件，避免受伤。
- 如果对泵进行未经批准的改动，运营商应自行承担风险，制造商不承担任何担保义务。

### 9.0.1 故障：装置不启动

电力供应中断，电缆或电机绕组内短路或接地故障。

- 如有必要，由专业人员检查并更换电机和电线
- 保险丝、电机保护开关和 / 或监控装置跳闸
- 必要时，请专业人员检查连接并进行纠正。
- 根据技术规范安装或调整电机保护开关和保险丝，重置监控设备。
- 检查叶轮是否运转平稳。必要时，清洁或松开叶轮。

### 9.0.2 故障：装置启动，但电机保护开关在试运行不久后触发

1. 电机保护开关上的热敏触发装置不正确 / 设置不正确
  - 请专业人员将触发装置的设置与技术规范比对，并进行必要的纠正
2. 由于大压降而增加功耗
  - 请电工检查各相位上的电压，必要时重新布线
3. 两相运行
  - 必要时，请专业人员检查连接并进行纠正
4. 三个相位上的电压差过高
  - 必要时，请专业人员检查连接和开关系统并进行纠正。
5. 旋转方向不正确
  - 调换供电电源线的 2 个相位
6. 粘结材料、堵塞和 / 或固体物质阻碍叶轮，电流消耗增加
  - 关闭泵并锁定，避免再次通电，松开叶轮或清洁进水口
7. 液体太粘稠
  - 联系制造商

### 9.0.3 故障：装置运行，但不出水

1. 没有液体
  - 打开容器入口或阀门
2. 入口堵塞
  - 清洁供应管线、闸阀、进水管件、进水口或吸滤器
3. 叶轮堵塞或阻塞
  - 关闭泵并锁定，避免再次通电，然后松开叶轮
4. 软管或管路存在缺陷
  - 更换有缺陷的部件
5. 断续运行（周期）
  - 检查控制系统

### 9.0.4 故障：装置运行，但不在规定的运行参数范围内

1. 入口堵塞
  - 清洁供应管线、闸阀、进水管件、进水口或吸滤器
2. 出口压力管中的闸阀关闭
  - 完全开启闸阀，并监控
3. 叶轮堵塞或阻塞
  - 关闭泵并锁定，避免再次通电，然后松开叶轮
4. 旋转方向不正确



- 调换供电电源线的 2 个相位

#### 5. 系统内有空气

- 检查管路、压力护罩和 / 或水力部件，必要时进行排空

#### 6. 泵在泵送时受到过大压力

- 检查出口压力管的闸阀。如有必要，完全开启，使用不同的叶轮，或联系制造商

#### 7. 磨损迹象

- 更换磨损部件
- 检查液体中的含固量

#### 8. 软管或管路存在缺陷

- 更换有缺陷的部件

#### 9. 液体内含气量超标

- 联系制造商

#### 10. 两相运行

- 必要时，请专业人员检查连接并进行纠正

#### 11. 运行时潜水面过度下降

- 检查系统的供应和能力，检查液位控制设置和功能

### 9.0.5 故障：装置运行不平稳，有噪音

#### 1. 泵在不允许的范围内运行

- 检查泵的运行数据，如有必要，进行纠正，或调整运行条件

#### 2. 进水口、滤网和 / 或叶轮堵塞

- 清洁进水口、滤网和 / 或叶轮

#### 3. 叶轮阻塞

- 关闭泵并锁定，避免再次通电，然后松开叶轮。

#### 4. 液体内含气量超标

- 联系制造商

#### 5. 两相运行

- 必要时，请专业人员检查连接并进行纠正

#### 6. 旋转方向不正确

- 调换供电电源线的 2 个相位

#### 7. 磨损迹象

- 更换磨损部件

#### 8. 电机轴承存在缺陷

- 联系制造商

#### 9. 泵在机械应力下安装

- 检查安装，如有必要，使用伸缩接头

### 9.0.6 进一步的故障排除措施

如果上述各项措施未能纠正故障，则联系我们的客户服务中心。可以向你提供如下帮助：

- 客户服务的电话或书面支持
- 客户服务的现场支持
- 在工厂对泵进行检查或维修

请注意，我们客户服务部门所提供的某些服务可能需要收费。更多详情，请联系客户服务中心。

### 10 备件

必须从制造商的客户服务中心处订购备件。为了避免查询和订购错误，每次订购时应提交铭牌上的所有数据。

Fig. 1

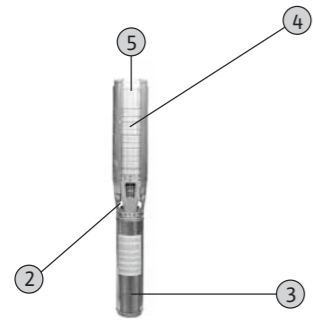


Fig. 2

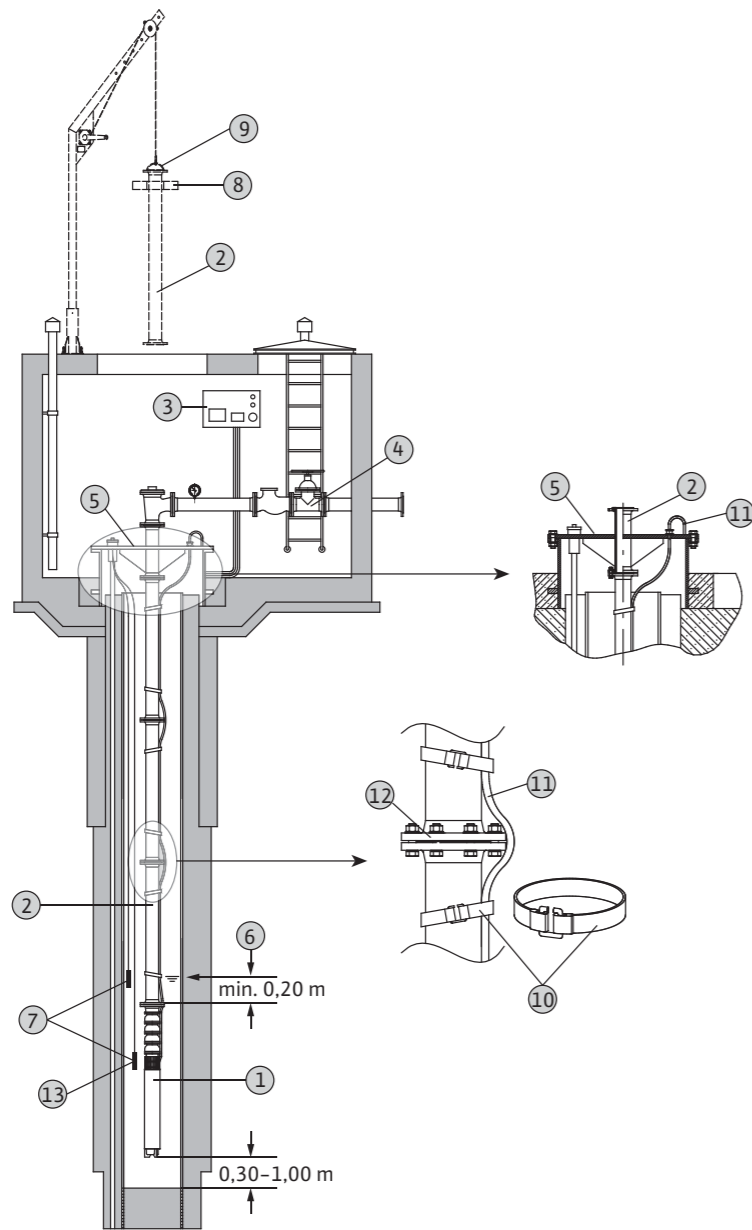
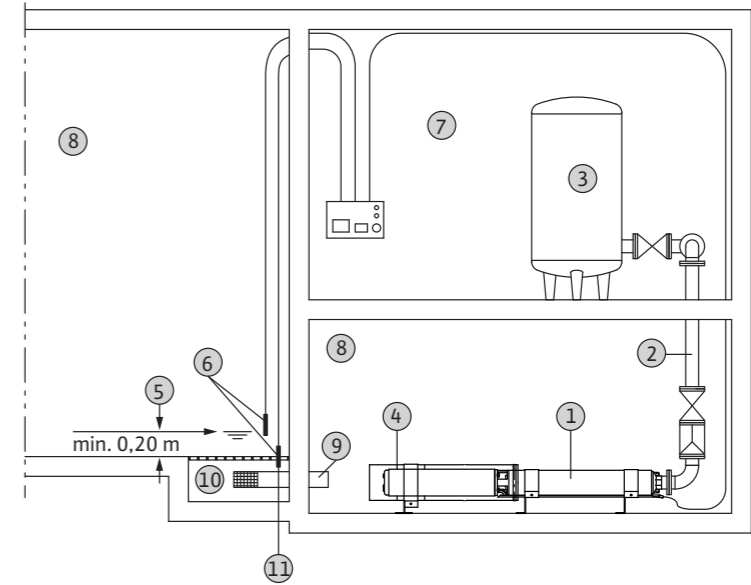


Fig. 3



## 1 Introduction

### 1.1 About this document

The language of the original operating manual is German. All other language versions are translations of the original German manual.

The operating manual contains a copy of the EC Declaration of Conformity.

Any unauthorized or unapproved changes made to the constructions specified therein will nullify this declaration.

### 1.2 Layout of the manual

The manual is divided into individual chapters. Each chapter has a heading which clearly describes the content of that chapter.

The table of contents also serves as a brief reference, since all the important sections have their own headers.

All the important operating and safety instructions are highlighted. For detailed information on the structure of these texts, see "Safety" in Chapter 2.

### 1.3 Personnel qualifications

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. All personnel must be of legal age.

Operating and maintenance personnel must also observe national accident prevention regulations.

It must be ensured that personnel has 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.

This product is not intended to be used by persons (including children) with limited physical, sensory or mental abilities or without experience and/or without knowledge, unless they are supervised by a person responsible for their safety and receive instructions from this person as to how the product is to be used.

Children must be supervised in order to ensure that they do not play with the product.

### 1.4 Abbreviations and technical terms

Various abbreviations and technical terms are used in this operating and maintenance manual.

#### 1.4.1 Abbreviations

- p.t.o = please turn over
- approx. = approximately
- i.e. = that is
- incl. = included
- min. = minimum
- max. = maximum
- etc. = and so on
- s.a. = see also
- e.g. = for example

### 1.4.2 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!

#### 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 or level sensor, for example.

#### Level control

The level control is designed to switch the product on or off at various filling levels. This is made possible by installing either one or two float switches.

### 1.5 Copyright

This operation and maintenance manual has been copyrighted by the manufacturer. The operation and maintenance handbook is intended for 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.

### 1.6 Rights of alteration

The manufacturer reserves the right to make technical alterations to systems or components. This operating and maintenance manual refers to the product indicated on the title page.

### 1.7 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:

#### 1.7.1 General

- 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 qualified personnel.

#### 1.7.2 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. period of 18 months after the delivery date. Other agreements must be made in writing in the order confirmation. These will remain valid at least until the agreed warranty period of the product has expired.

### 1.7.3 Spare parts, add-ons and modifications

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

### 1.7.4 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. Repairs not listed in this operation and maintenance manual and all types of repair work may only be performed by the manufacturer and authorized service centers.

### 1.7.5 Damage to the product

Damage as well as malfunctions that endanger safety must be eliminated immediately by trained 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 have the damaged product delivered by the operator to the factory for inspection!

### 1.7.6 Exclusion from liability

No liability will be assumed for product damage if one or more of the following points applies:

- A construction by the manufacturer based on faulty and/or incorrect information provided by the operator or customer
- Non-compliance with the safety instructions, the regulations and requirements in terms of German law and/or the applicable local laws, as well as this operating and maintenance manual
- Improper use
- Incorrect storage and transport
- Improper assembly/dismantling
- Insufficient 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 Safety

This chapter lists all the generally applicable safety instructions and technical information. Furthermore, each remaining 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 life cycle (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 uniquely identify these for personnel, the instructions and safety information are differentiated as follows:

### 2.1.1 Instructions

An instruction is displayed in "bold". Instructions contain text that refers to the previous text or particular sections of chapters, or highlights short instructions.

Example:

**Note that products stored with drinking water must be protected from frost!**

### 2.1.2 Safety information

Safety information is slightly indented and displayed in "bold". It always commences with a signal word.

Information that only refers to material damage is printed in gray, without safety symbols.

Information that refers to personal injury is printed in black and is always accompanied by a safety symbol. Danger, prohibition or instruction symbols are used as safety symbols.

Example:



Danger symbol: General hazard



Danger symbol, for example, electrical current



Prohibition symbol, for example, Keep out!



Instruction symbol, for example, wear protective clothing

The safety symbols used conform to the generally valid directives and regulations, such as DIN and ANSI.

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

- **Danger**  
This can result in serious or fatal injuries!
- **Warning**  
Serious injuries can occur!
- **Caution**  
Injuries can occur!
- **Caution** (Instruction without symbol)  
Substantial material damage can occur. Irreparable damage is possible!

Safety instructions begin with a signal word and description of the hazard, followed by the hazard source and potential consequences, and end with advice on prevention.

Example:

**Beware of rotating parts!**  
**The rotating rotor can crush and sever limbs.**  
**Switch off the product and let the rotor come to a stop.**

## 2.2 General safety

- When installing or removing the product, never work alone in rooms and shafts. A second person must always be present.
- The product 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 have come to a stop.
- The operator should inform his/her superior immediately should any defects or irregularities occur.
- It is of vital importance that the system be 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 important 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 kept safely and must be suitable for the conditions of use (weather, hooking system, load, etc).
- Mobile working apparatus for lifting loads should be used in a manner that ensures their support stability during operation.
- When using mobile working apparatus for lifting non-guided loads, preventive measures should be taken to avoid tipping and sliding etc.
- Measures should be taken to ensure 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 a mobile working apparatus is used for lifting loads, a second person should be present to coordinate the procedure, if required (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 outage. 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 substantial material damage.**

## 2.3 Directives used

- This product is subject
- various EC directives
  - various harmonized standards
  - and various national standards.

Please consult the EU Declaration of Conformity for the precise information and the guidelines and norms in effect.

Also, various national standards are also used as a basis for using, assembling and dismantling the product. These include the German accident prevention regulations, VDE regulations, German Equipment Safety Law etc.

## 2.4 CE marking

The CE marking is found either on the type plate or near the type plate. The type plate is attached to the motor casing or to the frame.

## 2.5 Electrical work

Our electrical products are operated with alternating or three-phase current. The local regulations (e.g. VDE 0100) must be observed. The chapter entitled "Electrical connection" must be observed when connecting the product. The technical specifications must be strictly adhered to!

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



**Beware of electrical current!**  
**Incorrectly performed electrical work can result in fatal injury! This work may only be carried out by a qualified electrician.**

**Beware of moisture!**  
**Moisture penetrating the cable damages both the product and cable. Never immerse cable ends in the pumped liquid or other liquids. Unused wires must be insulated!**

## 2.6 Electrical connection

The operator is required to know where the machine is supplied with current and how to cut off the supply. The installation of an earth leakage circuit breaker (RCD) is recommended.

The governing national directives, standards and regulations as well as the requirements of the local public utility company must be observed.

When the product is connected to the electrical control panel, particularly when electronic devices such as soft startup control or frequency drives are used, the relay manufacturer's specifications must be followed to comply with the electromagnetic compatibility (EMC) requirements. Special separate shielding measures (e.g. shielded cables, filters, etc.) may be necessary for the power supply and control cables.

**The connections may only be made if the relays meet the harmonized EU standards. Mobile radio**

**equipment may cause malfunctions in the system.**



**Beware of electromagnetic radiation!**  
**Electromagnetic radiation can pose a fatal risk for people with pacemakers. Put up appropriate signs and make sure anyone affected is aware of the danger!**

## 2.7 Ground connection

Our products (unit including protective devices and control station, auxiliary hoisting gear) must always be grounded. If there is a possibility that people can come into contact with the product and the pumped liquid (e.g. at construction sites), the connection must be additionally equipped with an earth leakage protection device.

**The pump units are submersible and conform to protection class IP 68 in terms of the applicable standards.**

**The protection class of the installed switching devices can be found on the device housing and corresponding operation manual.**

## 2.8 Safety and monitoring devices

Our products can be equipped with mechanical (e.g. intake strainer) and/or electrical (e.g., thermo sensors, moisture sensors, etc.) safety and monitoring devices. These devices must be attached or connected.

Electrical devices such as thermo sensors, float switches, etc. must be connected and checked by an electrician for proper functioning before start-up.

Please note that certain devices require a relay to function properly, e.g. PTC thermistor and PT100 sensor. This relay can be obtained from the manufacturer or an electrical supply dealer.

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

**Caution!**

**Never operate the product if the safety and monitoring devices have been removed or damaged, or if they do not work.**

## 2.9 Safety rules during operation

When operating the product, always follow the locally applicable laws and regulations for work safety, accident prevention and handling electrical machinery. To help to ensure safe working practice, the responsibilities of employees should be clearly set out by the owner. All personnel are responsible for ensuring that regulations are observed.

The product has moving parts. During operation, these parts turn to pump the fluid. Certain materials in the

pumped fluid can cause very sharp edges to form on the moving parts.



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

## 2.10 Pumped liquids

Each pumped liquid differs in respect of composition, corrosiveness, abrasiveness, dry matter content and in many other aspects. Generally, our products can be used for many applications. Please note that if requirements change (density, viscosity or general composition), this can also affect many parameters of the product.

When using or replacing the product in a different pumped liquid, observe the following points:

- When used in drinking water applications, all the parts that come into contact with the fluid must be suitable for use with drinking water. This must be checked according to local laws and regulations.
- Products that have been operated in dirty waste water must be cleaned thoroughly before being used for other pumped liquids.
- Products that have been operated in sewage water and/or fluids that are hazardous to health must be decontaminated before being used with other pumped liquids.

**It must be clarified, whether the product can be used at all with another pumped liquid.**

- If a product is operated with a lubricant or cooling fluid (such as oil), the pumped liquid can be contaminated by these substances if the mechanical shaft seal is defective.
- It is strictly prohibited to pump explosive or highly flammable liquids in pure form!



**Danger – explosive liquids!**  
**It is strictly prohibited to pump explosive liquids (gasoline, kerosene, etc.). The products are not designed for these liquids!**

## 2.11 Sound pressure

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

The actual sound pressure, however, depends on several factors. These include, for example, the installation depth, configuration, fastening of accessories and pipeline, operating point, immersion depth, etc.

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

**Caution: Wear ear protectors!**

**In terms of the applicable laws and regulations, ear protection must be worn if the sound pressure is greater than 85 dB (A)! The operator is responsible for ensuring compliance with these regulations!**





### 3 Transport and storage

#### 3.1 Delivery

Upon receipt of the delivery, it is immediately checked for damage and completeness. If any parts are damaged or missing, the transport company or the manufacturer must be informed on the day of delivery. Claims made after this date cannot be recognized. Damage to parts must be noted on the delivery or freight documentation.

#### 3.2 Transport

Only the appropriate and approved fastening devices, transportation means and lifting gear 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 personnel must be qualified for the tasks and must follow all national safety regulations in effect 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 for reuse if the product is frequently used at different locations.

##### Beware of frost!

If drinking water is used as a coolant/lubricant, the product must be protected against frost during transport. If this is not possible, the product must be drained and dried out!

#### 3.3 Storage

Newly supplied products are prepared so that they can be stored for at least 1 year. The product should be cleaned thoroughly before it is put into temporary storage!

The following should be taken into consideration for storage:

- Place the product on a firm surface and secure it against slipping and falling over. Submersible motor pumps can be stored vertically and horizontally. Ensure that they cannot bend if stored horizontally. **Otherwise, excessive bending tension may arise, which can damage the product.**

- The product may not be stored in rooms where welding work is conducted as the resulting gases and radiated heat can damage the elastomer parts and coatings.
- Any suction or discharge ports should be closed tightly before storage to prevent impurities.
- The current 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.**

##### Beware of moisture!

**Moisture penetrating the cable damages both the product and cable. Therefore, never immerse cable ends in the pumped liquid or other liquids.**

- The machine must be protected from direct sunlight, heat, dust, and frost. Heat and frost can cause considerable damage to rotors and coatings!
- 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 should be checked for smooth operation. The housing coatings should be checked for damage.

**Before start-up, the filling levels (oil, motor filling, etc) should be checked and topped up, if necessary. Products filled with drinking water should be completely filled before start-up!**

##### Beware of damaged coatings!

**Damaged coatings can lead to irreparable damage to the unit (e.g. rust formation)! Therefore, damaged coatings must be repaired immediately. Repair sets are available from the manufacturer.**

**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 over time. If the product is to be stored for longer than 6 months, we recommend checking these parts and replacing them as necessary. If this is the case, please consult the manufacturer.

#### 3.4 Returning to the product

Products that are returned to the factory must be properly packaged. In this context, properly means that impurities have been removed from the product and that it has been decontaminated, if it was used with fluids that are hazardous to health. The packaging must protect the product from damage during transportation. If you have any questions please contact the manufacturer!



**Danger from falling over!**  
**Never set 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 for storage with a temperature between 5 °C and 25 °C.

**Products that are filled with drinking water can be stored in frost-free rooms at temperatures up to 3 °C for up to 4 weeks. If longer storage is intended, the products should be emptied and dried out beforehand.**

### 4 Product description

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

#### 4.1 Proper use and fields of application

The submersible motor pumps are suitable for:

- Potable and non-potable water supplies from drilled holes and cisterns
- Domestic water supplies
- Communal water supplies, sprinkler and flood irrigation
- Booster stations
- Lowering the water table
- Pumping water for industrial uses
- Pumping water without long-fibered and abrasive components

The submersible motor pumps **must not be used** for pumping the following:

- Waste water
- Sewage/feces
- Raw sewage

##### Beware of electrical current

**When using the product in swimming pools or other accessible pools, there is a risk of fatal injury due to electrical current. Note the following information:**

**Use is strictly forbidden if any persons are in the pool!**

**If the pool is unoccupied, protective measures must be taken according to DIN VDE 0100-702.46 (or the appropriate national regulations).**



Proper use also includes observation of these instructions. Any other use is regarded as improper.

##### 4.1.1 Pumping of drinking water

When using to pump drinking water, the locally applicable guidelines/laws/regulations should be reviewed as to whether the product is suitable for this purpose.

#### 4.2 Construction

The Wilo-Sub TWS... is a water-proof submersible motor pump which can be operated vertically and horizontally in a stationary position.

Fig. 1: Description

1	Cable	4	Hydraulic housing
2	Intake port	5	Discharge port
3	Motor housing		

##### 4.2.1 Hydraulics

Multistage hydraulics with radial or semi-radial rotors in a sectional design. The hydraulic housing, the pump shafts and the rotors are made of stainless steel. The discharge side connection is designed as a vertical

threaded flange with inner thread and integrated back-flow preventer.

**The product is not self-priming, in other words, the pump medium must flow with primary pressure or taper automatically and a minimum level of submergence must always be ensured.**

#### 4.2.2 Motor

AC or three-phase motors filled with a water-glycol mixture are used for direct start-up. The motor housing is made of stainless steel. The motors have a 4" Nema connector.

The motor is cooled by the pumped medium. The motor must therefore always be submerged when operated. The thresholds for max. liquid temperature and minimum flow speed may not be exceeded.

The connection cable is longitudinally water-proof and fixedly connected to the motor. The version will depend on the particular type:

- TWS- ...: with free cable ends
- TWS-... QC: Connection cable with QuickConnect linkage for fast and easy installation of QuickConnect cable assembly kits; cables with free ends

**Note the IP protection class of the switching device.**

#### 4.2.3 Sealing

The seal between motor and hydraulics is made by a rotary shaft seal, or a floating ring seal (for motors of 2.5 kW or greater).

#### 4.3 Operating modes

##### 4.3.1 Operating mode "S1" (continuous operation)

The pump can operate continuously at the rated load without exceeding the maximum permissible temperature.

#### 4.4 Technical data

##### General data

- Mains supply: see type plate
- Rated motor capacity  $P_2$ : see type plate
- Max. pump head: see type plate
- Max. pump flow: see type plate
- Activation type: direct
- Liquid temperature: 1 to 40 °C
- Protection class: IP 68
- Isolation class: F
- Speed: see type plate
- Max. submersion: 70 m
- Starts per hour: max. 20
- Max. sand content: 50 mg/m<sup>3</sup>
- Min. flow at the motor: 0.1 m/s
- Operating modes S1

hydraulic housing or pipeline system must be avoided at all costs and must be removed using a suitable ventilation system. Protect the product from frost.

#### 4.5 Type code

**Example: Wilo-Sub TWS 4.12-15**

- **TWS**= submersible pump made of stainless steel
- **4** = diameter of the hydraulics in inches
- **12** = nominal flow volume in m<sup>3</sup>/h
- **15** = number of stages of the hydraulic system

#### 4.6 Scope of delivery

Standard pump:

- Unit with 1.5 or 2.5 m cable (from motor upper edge)
- Installation and operation manual
- AC version with start-up device, thermic motor protection device, on/off switches and free cable ends
- DC version with free cable ends

QC version:

- Unit with 1.75 m QuickConnect cable with free cable ends
- Installation and operation manual

#### 4.7 Accessories (optionally available)

- Cooling jacket
- Switching devices
- Level sensors
- QuickConnect cable sets
- Motor cable kits
- Encapsulating set for motor cable extension

### 5 Installation

In order to prevent damage to the product 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 carrying out any installation work.

#### 5.1 General

In cases where pumping is made through longer discharge pipes (especially on long ascents), attention is drawn to pressure surges.

Pressure surges can lead to destruction of the unit/system and noisy operation resulting from valve knocking. This can be avoided by taking appropriate measures (e.g. non-return valves with adjustable closure time or laying the discharge pipe in a special way).

After pumping water containing lime, flush out the product with clean water in order to prevent encrustation and subsequent breakdowns.

If you are using level control, make sure that the minimum water coverage is present. Air pockets in the

#### 5.2 Types of installation

- Vertical stationary installation, submerged
- Horizontal stationary installation, submerged – only to be used together with a cooling jacket!

#### 5.3 The operating area

The operating area must be clean, free of coarse solids, dry, frost-free and, if necessary, decontaminated. It must also be suitable for the respective product. The water supply must be sufficient for the maximum flow rate on the unit so that dry running and/or air entry is prevented.

When installed in wells or bore holes, ensure that the unit does not come into contact with the walls. Therefore, ensure that the outer diameter of the submersible motor pump is always smaller than the inner diameter of the well or bore hole.

When working in containers, wells or bore holes, a second person must always be present for safety reasons. If there is danger of poisonous or asphyxiating gases forming, the necessary countermeasures must be taken!

It must be ensured that hoisting gear can be fitted without any trouble, since this is required for assembly and removal of the product. It must be possible to reach the product safely in its operating and storage locations using the hoisting gear. The machine must be positioned on a firm foundation. For transporting the product, the load-carrying equipment must be secured to the appropriate fastening points.

Electric power cables must be laid out in such a way that safe operation and trouble-free assembly/dismantling are possible at all times. The product must never be carried or dragged by the power supply cable. When using switching devices, the corresponding protection class must be observed. Switching devices must always be mounted in such a way that they are protected from flooding.

The structural components and foundations must be of sufficient stability in order to allow the product to be anchored securely and functionally. The operator or the supplier is responsible for the provision of the foundations and their suitability in terms of dimensions, stability and strength!

Use guide and deflector plates for the pumped liquid intake. If the water jet reaches the surface of the water, air will be introduced into the pumped liquid. This will lead to unfavorable current and pumping conditions for the unit. As a result of cavitation, the product does not run smoothly and is subjected to increased wear.

#### 5.4 Installation



##### Danger of falling!

**When installing the product and its accessories, work is sometimes performed directly at the edge of the well or basin. Carelessness and/or wearing inappropriate clothing could result in a fall. There is a risk of fatal injury! Take all necessary safety precautions to prevent this.**

The following information must be observed when installing the product:

- This work must be carried out by a qualified person and electrical work must be carried out by an electrician.
- Suitable fastening devices must always be used when transporting the unit, never the power supply cable. The fastening device must always be secured to the fastening points, using shackles when necessary. Fastening devices must be technically approved.
- Check that the available planning documentation (installation plans, layout of the operating area, intake ratios) is complete and correct.

**Products of this type must always be submerged during operation to attain the necessary cooling. Always make sure that the minimum water coverage is guaranteed!**

**Never let the machine run dry. We recommend that dry-run protection be installed. If fluid levels deviate dramatically, a dry-run protection must be installed.**

**Check whether the cross section of the cable used is sufficient for the required cable length (see the catalog and planning documents or consult Wilo customer service for more information).**

- Please observe all regulations, rules and legal requirements for working with and underneath heavy suspended loads.
- Wear appropriate protective clothing/equipment.
- Please also observe the applicable national accident prevention regulations and trade association safety provisions.
- The coating is to be examined before installation. If defects are found, these must be rectified before installation.

##### 5.4.1 Motor filling fluid

The motor is already filled with a water/glycol mixture at the factory. This ensures that the product is protected from frost up to -15 °C.

The motor is designed to that it cannot be filled from the outside. Filling of the motor must be carried out by the manufacturer. The filling level must be checked after a long period in storage (> 1 year)!

##### 5.4.2 Installing the Quick-Connect cable

On QC versions, the QC cable must be connected before installing the unit in the operating area. **Caution: This work must be carried out in a dry place. Ensure that both the plug and connection socket do not contain any moisture. Moisture penetration will destroy the cable and may damage the unit!**

- Insert the Quick-Connect plug into the Quick-Connect socket on the connection cable of the unit.
- Pull the metal sleeve over the connection and screw both cable ends together.

##### 5.4.3 Vertical installation

Fig. 2: Installation

1	Unit	8	Support clamp
2	Rising pipe	9	Mounting bracket
3	Switching device	10	Cable clamp
4	Check valve	11	Power supply line
5	Well head	12	Flange
6	Minimum water level	13	Dry-run protection
7	Level sensors		

With this type of installation, the product is installed directly on the rising pipe. The installation depth is determined according to the length of the rising pipe.

Do not place the product on the bottom of the pit, as this can lead to tension and mud accumulation in the motor. If the motor becomes blocked with mud, the heat discharge can no longer be ensured and the motor may overheat.

Additionally, the product should not be installed level with the filter pipe. Sand and other solids may be pumped through the suction flow, meaning the motor cooling can no longer be guaranteed. This would lead to increased wear on the hydraulics. To prevent this, a water guide shroud should be used when necessary, or the product should be installed next to blind pipes.

##### Installation with flanged pipes

Use hoisting gear with sufficient lifting capacity. Place two pieces of square timber across the well. The support clamp will later be placed on them, so they should have sufficient bearing capacity. If the well opening is narrow, a centering apparatus must be used, since the product may not touch the sides of the well.

- 1 Place the submersible motor pump vertically and secure it from falling over or slipping.
- 2 Attach the mounting brackets to the flange of the rising pipe, hang them on to the lifting gear and lift out the first pipe.
- 3 Fasten the free end of the rising pipe to the discharge port of the submersible motor pump. A seal must be placed between the connections. Always insert the bolts from below, so that the nuts can be screwed on from above. Also, always tighten the bolts in a cross pattern to avoid pressure on the seal from one side.
- 4 Fasten the cable with a cable clip slightly above the flange. If the drilled hole is narrow, the flanges of the rising pipes must be have notches for the cables to pass through.
- 5 Lift up the unit with the pipe, move it over the well and lower it until the support clamp on the rising pipe can be loosely connected. When doing this, make sure that the cable remains outside the support clamp, so that it does not get squeezed.
- 6 Then let the support clamp rest on the pieces of square timber that you put in beforehand. The system can

now be lowered further until the upper pipe flange rests on the attached support clamp.

- Remove the mounting bracket from the flange and attach it to the next pipe. Lift up the rising pipe, move it over the well and flange-bolt the free end to the rising pipe. Place another seal between the connections.

#### Beware of serious crush injuries!

**After the support clamp is removed, the hoisting gear bears the entire weight of the system and the pipe sags. This can lead to serious crush injuries! Before removing the support clamp, ensure that the holding cable in the hoisting gear is taut!**



- Remove the support clamp, then fasten the cable slightly above and below the flange with a cable clip. For heavy, large-diameter cables, it is advisable to attach a cable clip every 2 to 3 meters. If several cables are used, each must be fastened separately.
- Lower the rising pipe so that the flange is in the well, put the support clamp back on and lower the rising pipe until the next flange touches the support clamp. Repeat steps 7 to 9 until the rising pipe reaches the required depth.
- On the last flange, remove the mounting bracket and attach the well cover.
- Attach the lifting gear to the well cover and raise it slightly. Remove the support clamp, feed the cable out through the well cover and lower the cover on to the well.
- Bolt the well cover fast.

#### Installation with threaded connections

The procedure is almost the same as for installation with flanged pipes. However, please note the following:

- The pipes are joined by means of threaded connections. The threaded pipes must be screwed tight to each other without leaks. This means the pipe ends must be wound with oakum or Teflon tape.
- When screwing the pipes together, make sure that they are in line, so that the thread is not damaged.
- Note the direction of rotation on the unit. Use a pipe with the correct thread (right or left-handed) so that the pipe cannot become unscrewed by accident.
- The threaded pipe must be secured against accidental loosening.
- The support clamp required during installation must always be **firmly** mounted directly below the pipe connection bell. Tighten the screws evenly until the clamp is firmly touching the pipeline (the arms of the support clamp may not touch each other).

#### 5.4.4 Horizontal installation

Fig. 3: Installation

1	Unit	7	Operating area
2	Discharge pipe	8	Water tank
3	Pressure vessel	9	Intake
4	Cooling jacket	10	Intake filter
5	Minimum water level	11	Dry-run protection
6	Level sensors		

This installation type is only permitted when used together with a cooling jacket. The unit is installed directly in the water tank/reservoir/container and flanged onto the discharge pipe. The cooling jacket supports must be mounted at the distances specified to prevent the unit from distorting.

**The connected pipeline must be self-supporting, i.e. it may not be supported by the product.**

When installed horizontally, the pipe and unit are mounted separately. Make sure that the discharge port of the unit and the pipeline are level.

**On this type of installation, the product must be installed with a cooling jacket.**

- Drill the fastening holes for the supports on the floor of the operating area (container/reservoir). You will find specifications for the anchor bolts, distances between holes and their sizes in the corresponding instructions. Make certain that the screws and plugs are sufficiently stable.
- Fasten the supports to the floor and bring the product into the correct position using a suitable hoisting gear.
- Fasten the product to the supports using the supplied fastening materials. Ensure that the type plate points upwards!
- Once the unit is firmly mounted, you can install the piping system or flange-connect a piping system which is already in place. Ensure that the discharge ports are level.
- Connect the discharge pipe to the discharge port. A seal must be placed between the flanges of the pipeline and the unit. Tighten the fastening bolts in a cross pattern to avoid damaging the seal. Please note that the pipe system is mounted so that there is no vibration or tension (use elastic connection pieces, when necessary).
- Lay the cables in such a manner that no-one (maintenance personnel etc.) will be endangered by them at any time (operation, quick repairs). Do not damage the power supply lines. The electrical connection must be carried out by an authorized technician.

#### 5.5 Dry-run protection

Make sure that no air enters the hydraulic housing. The product must therefore always be submerged in the pumped liquid up to the top edge of 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 or electrode is fixed in the shaft and switches off the machine when the water level falls below the minimum coverage level. If the dry-run protection is put into effect with only one float or electrode whilst the filling levels fluctuate strongly, there is a danger that the unit will turn on and off constantly!

**This can result in the maximum number of motor start-ups (switching cycles) being exceeded and the motor overheating.**

#### 5.5.1 Corrective measures for avoiding excessive switching cycles

**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** – A second switching point (additional float or electrode) is used to obtain a sufficient difference between the activation and deactivation points. This prevents constant switching. This function can be put into effect with a level control relay.

#### 5.6 Electrical connection



##### Risk of fatal injury due to electrical current!

**There is a risk of fatal electric shocks caused by improper electrical connections. Electrical connections may only be carried out by a qualified electrician who is approved by the local power supplier, in accordance with locally applicable regulations.**

- Mains current and voltage must correspond to the details on the type plate.
- Connect the power supply cable in accordance with the applicable standards and regulations and according to the wire assignment.
- Any available monitoring equipment, e.g. for the motor temperature, must be connected and tested to ensure that it is working properly.
- For three-phase current motors, a clockwise rotating field must be available.
- Ground the product properly. Products that are permanently installed must be grounded in compliance with nationally applicable standards. If a separate grounding conductor is available, it must be connected to the marked hole or grounding terminal using a suitable screw, nut, toothed washer and flat washer. The cross section of the cable for the grounding conductor connection must correspond to the local regulations.
- A motor protection switch must be used.** We recommend using an earth leakage circuit breaker (RCD)
- Switching devices are to be purchased as accessories.

#### 5.6.1 Technical details

- Activation type: Direct
- Power supply fuse: 10 A
- Cable cross section 4 x 1.5

Only slow-blow fuses or K characteristic automatic cut-outs may be used for pre-fusing.

#### 5.6.2 AC motor

The AC version is delivered with a factory-installed start-up device. For connection to the mains, the power supply cable is connected to the start-up device (terminals L and N).

**Electrical connections may only be made by a qualified electrician!**

#### 5.6.3 Three-phase current motor

The three-phase current version is supplied with free cable ends. The connection to the mains is made at the switch box terminals.

**Electrical connections may only be made by a qualified electrician!**

The wires of the connection cable are assigned as follows:

4-wire connection cable	
Wire color	Terminal
black	U
brown	V
blue or gray	W
green/yellow	PE

#### 5.6.4 Monitoring device connections

The Wilo-Sub TWS series with AC motor has an integrated thermic motor protection device. If the motor becomes too hot, the unit is automatically shut down. Once the motor has cooled down, the unit automatically switches back on.

**The customer must install a motor protection switch.**

The Wilo-Sub TWS series with three-phase motor has no integrated monitoring devices.

**The customer must install a motor protection switch.**

#### 5.7 Motor protection and activation types

##### 5.7.1 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 VDE 0660 or the appropriate national regulations.

If the product is connected to electrical systems in which faults frequently occur, we recommend installing additional protective devices at the customer (overvoltage, undervoltage or phase failure relays, lightning protection etc.). We also recommend installing an earth leakage circuit breaker.

Local and national regulations must be adhered to when connecting the product.

##### 5.7.2 Activation types

###### Direct activation

At full load, the motor protection should be set to the rated current at the operating point (see type plate). At partial load, we recommend that the motor protection be set 5% above the current measured at the operating point.

###### Starting transformer/soft start

- At full load, the motor protection should be set to the rated current at the operating point. At partial load, we



- recommend that the motor protection be set 5% above the current measured at the operating point.
- The minimum required cooling flow speed must be guaranteed at all operating points.
  - The current consumption must be less than the rated current during the entire operation period.
  - The ramp time for start/stop processes between 0 and 30 Hz must be set to max. 1 second.
  - The ramp time between 30 Hz and the rated frequency must be set to max. 3 seconds.
  - The voltage at the start must measure at least 55% of the rated motor voltage (recommended: 70%).
  - To avoid power losses during operation, bypass the electronic starter (soft start) after normal operation has been established.

#### Operation with frequency transformers

- Continuous operation can only be guaranteed between 30 Hz and 50 Hz.
- To ensure the bearings remain lubricated, a pump output of 10% of the rated pump output must be maintained!
- The ramp time for start/stop processes between 0 and 30 Hz must be set to max. 2 seconds.
- A period of at least 60 seconds is recommended between a pump stop and restart to allow the motor winding to cool down.
- Never exceed the rated current on the motor.
- Maximum voltage peak: 1000 V
- Maximum voltage rise speed: 500 V/μs
- Additional filters are required when the required control voltage exceeds 400 V.

#### Products with plugs/switching devices

Insert the plug into the plug socket and press the on/off switch or let the product switch on/off automatically by means of the attached level control system.

Switching devices can be ordered as accessories for products with free cable ends. In this case, also observe the instructions enclosed with the switching device. **Plugs and switching devices are not flood-proof. Note the IP protection class. Always install switching devices in such a way that they are protected from flooding.**

## 6 Startup

The “Start-up” chapter contains all the important instructions for the operating personnel for starting up and operating the product safely.

The following constraints must be adhered to and monitored:

- Type of installation
  - Operating mode
  - Minimum water coverage / max. submersion
- If the machine has not been operated for an extended period, these constraints must also be checked and any discovered faults rectified.**

This manual must always be kept either by the product or in a place specially reserved for it, where it is accessible for the entire operating personnel at all times.

In order to prevent damage or serious injury when starting up the product, the following points must always be observed:

- The product may only be started up by qualified, trained persons. The safety advice must be followed at all times.
- All persons working on or with the product must have received, read and understood this operating and maintenance manual.
- All safety devices and emergency cut-outs are connected and have been checked to ensure that they work properly.
- Electrical and mechanical settings must be made by specialist staff.
- The product is suitable for use under the specified operating conditions.
- The work area of the product is not a recreational area and is to be kept free of people! No persons are allowed in the work area during switching on and/or during operation.
- A second person must be present when working in shafts. Adequate ventilation must be ensured if there is danger of poisonous gases forming.

### 6.1 Electrical system

The product is connected and the power supply cables installed in terms of the “Installation” chapter as well as the VDE guidelines and the applicable national regulations.

The product is protected and grounded properly.

Pay attention to the direction of rotation. If the direction of rotation is incorrect, the unit will not perform as specified and can sustain damage.

All monitoring devices are connected and have been checked to ensure that they work properly.

#### Beware of electrical current!

**Electrical current can cause fatal injuries if not handled correctly! All products with free cable ends (i.e. without plugs) must be connected by a qualified electrician.**



### 6.2 Check the direction of rotation

The product is checked and adjusted in the factory to ensure that the direction of rotation is incorrect. The connection must be made according to the wiring code information.

Before submerging, the product must be checked to ensure that the rotation direction is correct.

**A test run should only be performed under general operating conditions. Switching on a unit that has not been submerged is strictly forbidden!**

#### 6.2.1 Checking the rotation direction

The rotation direction must be checked with a rotating field tester by a local electrician. For the correct rotation direction, a clockwise rotating field must be available.

**The product is not approved for operation with a counter-clockwise rotating field.**

### 6.2.2 If the direction of rotation is not correct

#### When using Wilo switching devices

Wilo switching devices are designed so that the connected products are driven in the right direction. If the rotation direction is wrong, 2 phases/leads of the mains supply to the switching device must be replaced.

#### With switching devices provided by the customer:

If the rotation direction is wrong, with direct start motors, 2 phases must be swapped. In the case of star-delta start-up motors, the connections of two windings must be swapped e.g. U1 with V1 and U2 with V2.

### 6.3 Adjusting the level-control device

For correct adjustment, please see the installation and operation manual for the level control device.

**Please observe the information on the minimum water coverage of the product!**

### 6.4 Startup

**The work area of the unit is not a recreational area and is to be kept free of persons! No persons are allowed in the work area during switching on and/or during operation.**

Before switching on for the first time, the installation must be checked as described in the “Installation” chapter and an isolation check must be carried out according to the “Maintenance” chapter.

When using switching devices and/or plugs, the corresponding IP protection classes must be observed.

#### 6.4.1 Before switching on

The following points must be checked before switching on the submersible motor pump:

- Cable guidance – no loops, slightly taut.
- Check the temperature of the pumped liquid and the submersion depth – see technical data.
- The product machine is fixed securely – vibration-free operation must be assured.
- The accessories – pedestal, cooling jacket etc. are securely fixed.
- The suction chamber of the pump sump and the pipelines must be completely free of dirt.
- Flush out the pipeline and the product before connecting them to the supply network.
- Carry out an insulation check. For details on this, see the “Maintenance” chapter.
- The hydraulic housing must be flooded, i.e. it should be completely full of fluid, with no air in it at all. Bleeding can be carried out using a suitable bleeding device in the system, or, if available, with bleeder screws on the discharge port.
- The sliders on the pressure side should be half opened during commissioning so that the pipeline can be bled.
- You can use an electrically actuated check valve to reduce or prevent water impact. The unit can be switched on in a throttled or closed slider position. **However, do not operate for long periods (> 5 minutes) with the slider closed or nearly closed, and do not run the machine dry.**

- Check all level control and dry-run protection systems.

### 6.4.2 After starting up

The rated current is briefly exceeded during the start-up procedure. Once the start-up procedure has completed, the operating current may no longer exceed the rated current.

If the motor does not start immediately after the unit is switched on, it must be switched off without delay. The start pauses specified in the “Technical data” chapter must be adhered to before starting up again. If the fault recurs, the unit must be switched off again immediately. The unit may only be restarted, once the fault has been rectified.

### 6.5 Safety rules during operation

When operating the product, always follow the locally applicable laws and regulations for work safety, accident prevention and handling electrical machinery. To help to ensure safe working practice, the responsibilities of employees should be clearly set out by the owner. All personnel are responsible for ensuring that regulations are observed.

The product has moving parts. During operation, these parts turn to pump the fluid. Certain materials in the pumped fluid can cause very sharp edges to form on the moving parts.

#### Beware of rotating parts!

**The rotating parts can crush and sever limbs. Never reach into the hydraulics or the moving parts during operation. Switch off the product and let the moving parts come to a stop before maintenance or repair work!**



The following must be checked at regular intervals:

- 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 intake, a guide plate or deflector plate should be fitted if necessary
- Minimum water immersion level, level control unit, dry-run protection
- Smooth, low vibration running
- Shut-off valves in the intake and discharge pipes must be open.

## 7 Shut-down/disposal

All work must be carried out with the greatest care.

Proper protective clothing must be worn.

When carrying out work in basins and/or containers, the respective local protection measures must be observed in all cases. A second person must be present for safety reasons.

Only hoisting gear that is in a technically perfect condition and load-carrying equipment that has been officially approved may be used for lowering and raising the product.

**Risk of fatal injury due to malfunctions!**

**Load-carrying equipment and hoisting gear must be in a perfect technical condition. Work may only commence if the hoisting gear has been checked and found to be in perfect working order. If it is not inspected, danger to personnel may result!**



### 7.1 Temporary shutdown

For this type of shutdown, the product remains installed and is not cut off from the electricity supply. For temporary shutdown, the product must remain completely submerged so that it is protected from frost and ice. Ensure that the temperature of the pumped liquid and in the operating area does not fall below +3 °C.

This ensures that the product will be ready for operation at all times. During longer shutdown periods, carry out a regular (monthly to quarterly) function run for a period of 5 minutes.

**Caution!**

**Only carry out a function run under the proper operating and usage conditions. Never run the machine dry! This can result in irreparable damage!**

### 7.2 Final shutdown for maintenance work or storage

The system must be switched off and the product must be disconnected from the mains by an electrician and secured against being switched on again without permission. Units with plugs must be unplugged (do not pull the cable). Work on removing the product, maintenance and storage can then commence.

**Beware of poisonous substances!**

**Products that pump fluids which are hazardous to health must always be decontaminated before undertaking any other work! There is otherwise a risk of fatal injury! Wear the necessary protective clothing for this work!**



**Beware of burns!**

**The housing parts can heat up to well above 104 °F (40 °C). There is a danger of burns! After switching off, let the product cool down to ambient temperature.**



#### 7.2.1 Removal

When installed vertically, the removal must be made in the same way as the installation:

- Remove the well head.
- Remove the rising pipe and unit in reverse order to the installation sequence.

**When planning the appropriate dimensions and selecting the lifting gear, consider that the complete weight of the pipes, unit (including power**

**supply cable) and water column must all be lifted during removal!**

When installed horizontally, the water tank/container must be completely emptied. The product can then be disconnected from the discharge pipe and removed.

#### 7.2.2 Return delivery/storage

For shipping, the parts must be packed and sealed in sufficiently large, non-tearing plastic sacks to prevent leakages. Shipping must be carried out by carriers who have been briefed accordingly.

**In this regard, please also refer to the chapter "Transport and storage".**

### 7.3 Starting up again

Clean the product of dust and oil deposits before starting up again. Then carry out all the maintenance tasks as described in the chapter entitled "Maintenance".

Once this work has been completed, the product can be installed and connected to the electricity supply by an electrician. This work must be carried out in accordance with the "Installation" chapter.

The product must be switched on as described in the "Start-up" chapter.

**The product may only be restarted if it is in perfect condition and ready for operation.**

### 7.4 Disposal

#### 7.4.1 Lubricants

Oils and lubricants must be collected in appropriate containers and properly disposed of in terms of EC Directive 75/439/EEC as well as in compliance with the provisions of sections 5a and 5b of the German Waste Act or the applicable local laws.

Mixtures of water and glycol are classified as a class 1 water hazard in terms of the German Water Hazard Regulations (VwVwS) of 1999. The requirements of DIN 52 900 (in respect of propanediol and propylene glycol) or the applicable local regulations must be observed in the disposal.

#### 7.4.2 Protective clothing

Protective clothing worn for cleaning and maintenance work is to be disposed of in accordance with the German Waste Code TA 524 02 and EC Directive 91/689/EEC.

#### 7.4.3 Product

Proper disposal of this product avoids damage to the environment and risks to personal health.

- Make use of the services or the advice of public or private waste disposal companies for the disposal of the product as well as parts thereof.
- More information about proper disposal can be obtained from the urban administration, the waste disposal authorities or from the supplier from whom the product was purchased.

## 8 Maintenance

Before performing maintenance or repair work, switch off and dismantle the product as described in the chapter entitled "Final shutdown/disposal".

After completing maintenance or repair work, the product must be installed and connected according to the "Installation" chapter. The product must be switched on as described in the "Start-up" chapter

Maintenance or repair work must be carried out by an authorized service center, Wilo customer service or a qualified specialist.

**Maintenance or repair work and/or structural changes that are not listed in this operating and maintenance manual may only be carried out by the manufacturer or by authorized service centers.**



**Risk of fatal injury due to electrical current!**

**There is a risk of fatal electric shocks when performing work on electrical devices. With all maintenance or repair work, the unit must be disconnected from the mains and secured against being switched on again without permission. Damage to the power supply cable may only be rectified by a qualified electrician.**

Note the following information:

- This manual must be available to the maintenance personnel and its instructions must be 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 electrical system and secured against being switched on again. It must be prevented from being switched on inadvertently.
- When carrying out work in basins and/or containers, the respective local protection measures must be observed in all cases. A second person must be present for safety reasons.
- Only hoisting gear that is in a technically perfect condition and load-carrying equipment that has been officially approved may be used for lowering and raising the product.  
**Make sure that all fastening devices, ropes and safety devices of the hoisting gear are in a technically perfect condition. Work may only commence if the hoisting gear is in perfect working order. If it is not inspected, fatal injuries may result.**
- Electrical work on the product and system must be carried out by an electrician. 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 flammable solvents and cleaning agents, fires, unshielded lighting and smoking are prohibited.
- Products that circulate fluids hazardous to health, or that come into contact with these fluids, 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 must be called immediately.**

- Ensure that all necessary tools and materials are available. Tidiness and cleanliness guarantee safe and trouble-free operation of the product. After working on the unit, all cleaning materials and tools should be removed from it. All materials and tools should be stored in an appropriate place.
- Lubricants, such as oil and grease, must be collected in suitable vessels and disposed of properly

. Appropriate protective clothing is to be worn for cleaning and maintenance jobs.

**Also observe the local laws and regulations!**

- 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.

### 8.1 Lubricants

The motor is filled with a water-glycol mixture, which is biodegradable. Inspection of the mixture and filling level must be performed by the manufacturer.

### 8.2 Maintenance intervals

Overview of the maintenance intervals needed:

#### 8.2.1 Before initial start-up or after a longer period of storage

- Check the insulation resistance
- Functional inspection of safety and control devices

### 8.3 Maintenance tasks

#### 8.3.1 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 = 1,000 V). The following values may not be exceeded:

- For the initial start-up: Minimum insulation resistance 20 MΩ.
- For further measurements: Value must be greater than 2 MΩ.

**If the insulation resistance is too low, moisture may have penetrated the cable and/or the motor. Do not connect the machine, consult manufacturer!**

### 8.4 Functional inspection of safety and monitoring devices

Monitoring devices include temperature sensors in the motor, sealed volume monitors, motor protection relays, overvoltage relays, etc.

Motor protection relays, overvoltage relays and other tripping devices can generally be triggered manually for test purposes.

## 9 Troubleshooting and possible solutions

In order to prevent damage or injury while rectifying product faults, the following points must be observed in all cases:

- Only attempt to rectify a fault if you have qualified staff. This means that each job must be carried out by trained specialist staff. For example, electrical work must be performed by a trained electrician.
- Always secure the product against an accidental restart by disconnecting it from the mains. Take appropriate safety precautions.
- Always have a second person on hand to ensure that the product has been switched off for safety.
- Secure moving parts to prevent injury.
- Unsanctioned changes to the product are made at the operator's own risk and release the manufacturer from any warranty obligations.

### 9.0.1 Fault: The unit will not start

- 1 Electricity supply interrupted, short circuit or earth fault in the cable or motor windings
  - Have the motor and wires checked by a specialist and replaced if necessary.
- 2 Fuses, the motor protection switch and/or monitoring devices are triggered
  - Have a specialist inspect the connections and correct them as necessary.
  - Have the motor protection switches and fuses installed or adjusted according to the technical specifications, and reset monitoring equipment.
  - Check that the impeller runs smoothly. Clean or free it as necessary.

### 9.0.2 Fault: The unit starts, but the motor protection switch triggers shortly after start-up

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

### 9.0.3 Fault: Unit runs but does not pump

- 1 No pumped liquid
  - Open the container intake or sliders
- 2 Intake blocked
  - Clean the intake, slider, intake port or intake strainer
- 3 Impeller blocked or obstructed
  - Switch off the unit, secure it against being switched on again and free the impeller
- 4 Defective hose or pipeline
  - Replace defective parts
- 5 Intermittent operation (cycles)
  - Check the control panel

### 9.0.4 Fault: The unit runs, but not at the stated operating levels

- 1 Intake blocked
  - Clean the intake, slider, intake port or intake strainer
- 2 Slider in the discharge pipe closed
  - Open the slider and constantly monitor the power consumption
- 3 Impeller blocked or obstructed
  - Switch off the unit, secure it against being switched on again and free the impeller
- 4 Incorrect direction of rotation
  - Replace two phases on the mains supply
- 5 Air in the system
  - Check the pipelines, pressure shroud and/or hydraulics, and bleed if necessary
- 6 Unit is pumping against excessive pressure
  - Check the slider in the discharge pipe and open it completely if necessary, use a different impeller or contact the factory
- 7 Signs of wear
  - Replace worn parts
  - Check for solids in the pumped liquid
- 8 Defective hose or pipeline
  - Replace defective parts
- 9 Inadmissible levels of gas in the pumped liquid
  - Contact the factory
- 10 Two-phase operation
  - Have a specialist inspect the connection and correct it as necessary
- 11 Excessive decrease in the water table during operation
  - Check the supply and capacity of the system, and inspect the level control settings and functionality

### 9.0.5 Fault: The unit does not run smoothly and is noisy

- 1 Unit is running in an inadmissible operation range
  - Check the operational data of the unit and correct if necessary and/or adjust the operating conditions
- 2 The intake port, strainer and/or impeller is blocked
  - Clean the intake port, strainer and/or impeller
- 3 The impeller is impeded
  - Switch off the unit, secure it against being switched on again and free the impeller
- 4 Inadmissible levels of gas in the pumped liquid
  - Contact the factory
- 5 Two-phase operation
  - Have a specialist inspect the connection and correct it as necessary
- 6 Incorrect direction of rotation
  - Replace two phases on the mains supply
- 7 Signs of wear
  - Replace worn parts
- 8 Defective motor bearing

- Contact the factory
- 9 The unit is installed under mechanical strain
    - Check the installation, use rubber spacers if necessary

### 9.0.6 Further steps for troubleshooting

If the points listed here do not rectify the fault, contact our customer service. They can help you as follows:

- Telephone or written support from customer service
- On-site support from customer service
- Inspection or repair of the unit at the factory

Please note that you may be charged for some services provided by our customer support. For more details, please contact customer service.

## 10 Spare parts

Spare parts can be ordered from the manufacturer's customer service. To avoid queries and incorrect orders, the serial and/or article number must always be supplied.

**Technical changes reserved!**



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