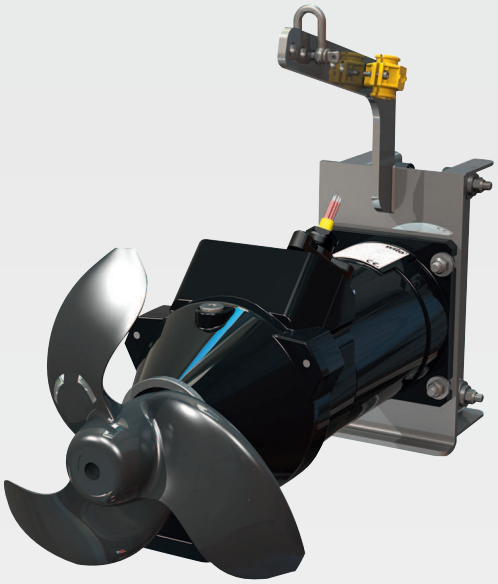
Pioneering for You

Wilo-EMU TR 14-40



zh-CHS 安装及操作说明

en Installation and operating instructions

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目录表

1 概述

1.1 关于本说明书

本安装及操作说明书是产品的固定组成部分。开始操作之前，请先阅读说明书并将其妥善保存在方便易取之处。严格遵守说明书中列出的要求和操作步骤，是按规定使用及正确操作产品的前提条件。另外注意遵守产品上标注的所有参数和标识。

原版操作说明书以德语撰写。所有其它语种的说明书均为其翻译件。

1.2 版权

1.3 保留更改权力

生产商保留对产品以及单个部件进行技术变更的权利。说明书中使用的图片可能与实际设备存在偏差，仅用于举例介绍产品。

1.4 质量保证

质保和质保时间适用现行的“通用商务条款(AGB)”。条款请见：www.wilo.com/legal

如果与该条款有所不同，必须在合同中规定，并在执行中优先对待。

质保索赔

如果符合以下几点要求，生产商有义务解决质量和设计方面的所有问题：
- 在质保期内以书面形式向生产商报告产品缺陷。
- 按规定使用产品。
- 已连接所有监控设备，且在试运行前进行过检查。

免责声明

免责声明即免除因人身伤害或物资损失所导致的任何法律责任。只要出现下面所列事项其中之一，就适用这一免责规定：
- 由于运营者或委托方提供的数据存在缺陷或者错误，导致出现配置欠缺问题
- 不遵守安装及操作说明
- 未按规定使用
- 违规存放或运输
- 错误安装或拆卸
- 保养不良
- 未经允许进行维修
- 安装基底存在缺陷
- 化学、电气或电化影响
- 磨损

2 安全

本章节主要介绍各生命阶段适用的基础提示信息。不遵守提示会导致下列危险：
- 电气、机械和细菌作用以及电磁场危害人身安全
- 有害物质泄漏会污染环境
- 物资损失
- 产品重要功能失灵

不遵守提示信息会导致丧失索赔权利。

此外也应遵守其他章节列出的各项指导说明和安全说明！

2.1 安全说明的标识

本安装及操作说明针对物资损失和人身安全问题列举了多项安全说明。其表现形式各有不同：
- 涉及到人身安全问题的安全说明以一个信号词作为开端，配套使用相应的**符号**并使用灰色作为背景色。

危险

危险类型和危险源！

危险产生的影响以及避免危险说明。

- 涉及到物资损失问题的安全说明也以一个信号词作为开端，但是**没有**符号。

小心

危险类型和危险源！

影响或信息。

信号词

- **危险！**
  如不注意，会导致死亡或重伤！
- **警告！**
  如不注意，可能导致人员受伤（重伤）！
- **小心！**
  如不遵守，可能造成物资损失，甚至导致全损。
- **提示！**
  操作产品时有用的注意事项

文本说明

✓ 前提条件

1. 操作步骤/细目列举

⇒ 提示/指导

► 结果

图标

本说明书使用下图标：


电击危险


细菌感染危险

爆炸气体导致危险


一般警告图标


切割受伤警告


高温表面警告


高压警告


悬挂物警告


个人防护装备：带头盔


个人防护装备：穿劳保鞋


个人防护装备：戴防护手套


个人防护装备：佩戴安全带


个人防护装备：戴口罩

个人防护装备：戴护目镜

禁止独自工作！必须两人在场。

实用提示

2.2 工作人员资格鉴定

工作人员必须：
- 了解当地现行的事故预防条例。
- 已阅读安装及操作说明书并且理解其中内容。

工作人员必须具备下列资质：
- 电气作业：电气作业必须由专业电工执行。
- 提升作业：提升装置必须由接受过培训的专业人员操作。根据 BGV D8 或本地法规出具证明。
- 安装/拆卸工作：必须由专业人员执行，而且要求该人员接受过相关培训，了解工作中会用到的工具以及当前建筑基底需要使用的固定材料。
- 保养工作：必须由熟悉所使用工作介质及其废弃处置的专业人员执行。此外工作人员还必须具有机械制造方面的基础知识。

“专业电工”定义

所谓“专业电工”，是指接受过相关培训，具备所需知识和经验，能够发现并且规避电力危险的人员。

2.3 电气作业

- 电气作业由专业电工负责执行。
- 在对产品开始任何作业之前，都应先将其断电并采取措施防止重新接通。
- 通电时注意遵守当地相关法规。
- 注意遵守当地供电公司的相关规定。
- 将电气连接方式等知识告知相关人员。
- 告知相关人员如何关闭产品。
- 遵守本安装及操作说明以及铭牌上给出的技术参数。
- 将产品接地。
- 遵守电气开关设备连接规定。
- 如果使用启动控制器（比如软启动或变频器等），注意遵守电磁兼容性规定。如果需要，考虑采取专业措施（比如使用屏蔽电缆和滤波器等）。
- 更换损坏的接线电缆。请咨询客户服务部。

2.4 监控装置

安装方必须准备下列监控设备：

断路器

断路器的规格和开关属性取决于所连接产品的额定电流。注意遵守当地相关法规。

电机保护开关

对于不带插头的产品，安装方应该准备一个电机保护开关！最低要求是配备一个符合本地规定，具备温度补偿、差分触发和重启锁定功能的热敏继电器/电机保护开关。针对反应灵敏的电网，安装方还应准备其他保护装置（比如超压、欠压或缺相继电器等）。

漏电断路器 *(RCD)*

遵守当地供电公司的相关规定！建议使用漏电断路器。
如果人员可能接触到产品和导电液体，需要对电路连接采取安全措施，装备一个漏电断路器 (RCD)。

2.5 在危害健康的介质内使用

如果在危害健康的介质内使用产品，可能导致细菌感染危险！拆下之后，以及再次使用之前，应该彻底清洁产品并进行消毒。运营者必须注意以下几点：
- 进行产品清洁时，提供下列防护装备供工作人员使用：
  – 封闭式护目镜
  – 氧气面罩
  – 防护手套
- 告知所有工作人员，流体会导致危险，并普及正确的流体处理方法！

2.6 运输

- 碰撞或挤压会导致人员受伤。注意穿戴以下防护装备：
  - 安全鞋
  - 安全头盔
- 遵从当地有关作业安全和事故防范措施的现行法律法规。
- 标记工作区域。
- 将擅自进入工作区域的人员清理出场。
- 遵守包装规定：
  - 抗撞击
  - 保证产品稳固。
  - 防尘、防油、防潮。
- 只使用合法且获得认证的升降装置和提升装置。
- 根据实际情况（天气、吊挂点、负载等）选择提升装置。
- 始终将提升装置固定在吊挂点上并检查是否固定。
- 使用期间必须保证升降装置稳定可靠。
- 使用升降装置时，如果有必要（比如视线受阻），应该另外安排一个人负责协调。
- 产品提起之后，远离升降装置的摆动范围。
- 切勿在悬挂物下停留。悬挂物切勿从有人员停留的工作位置上方经过。

2.7 安装/拆卸工作

- 受伤危险源：
  - 滑倒
  - 绊倒
  - 碰撞
  - 挤压
  - 坠落

  穿戴以下防护装备：
  - 安全鞋
  - 安全手套，用以预防切割伤害
  - 安全头盔
  - 防坠落安全装置
- 遵从当地有关作业安全和事故防范措施的现行法律法规。
- 标记工作区域。
- 确保工作区域内无冰。
- 确保工作区域四周未放置其他物体。
- 如果由于天气原因导致无法安全工作，则停止工作。
- 将擅自进入工作区域的人员清理出场。
- 始终安排两人执行作业。
- 如果作业高度超过 1 m (3 ft)，需要使用带防坠落安全装置的支架。
- 封锁支架四周的工作区域。
- 将产品断电并采取安全措施防止意外接通。
- 所有旋转零部件均须保持静止。
- 使用电气装置工作时，确保不存在爆炸风险。
- 只使用技术方面毫无瑕疵的升降装置。
- 产品提起之后，远离升降装置的摆动范围。
- 在密闭的室内或建筑内工作时，有毒气体或窒息气体会不断聚集。注意保证通风顺畅并按照工作规程采取防护措施（示例）：
  - 进行气体检测，防止气体汇聚。
  - 随身携带气体报警设备。
  - 其他

2.8 运行期间

- 产品工作区域不是人员停留区。在产品运行过程中，禁止任何人在工作区域内停留。
- 按照工作规程的相关通知，佩戴防护装备。
- 一旦发生故障或者出现异常，操作人员必须立即报告主管。
- 一旦出现危及人身安全的缺陷，操作人员必须立刻关闭设备：
  - 安全和监控设备故障
  - 外壳部件损坏
  - 电气装置损坏
- 螺旋桨不得碰撞任何部件和运行空间的墙壁。注意遵守规划资料中规定的产品与部件和池壁之间的间距。
- 如果水位波动剧烈，需要安装一个液位监控装置，以此保证达到要求的水覆盖深度。
- 在一般工作条件下，产品的噪声低于 85 dB(A)。但是实际发出的噪声受多种因素影响：
  - 安装深度
  - 安装方式
  - 负载情况
  - 潜水深度

2.9 保养工作

- 挤压和高温工作介质会导致人员受伤。穿戴以下防护装备：
  – 封闭式护目镜
  – 防护手套
  – 安全鞋
- 始终在运行空间以外执行保养工作。
- 只执行本安装及操作说明中列出的保养工作。
- 进行保养和维修时，只使用生产商提供的原装部件。由于使用非原装部件而造成的任何损失，生产商概不承担任何责任。
- 滴落的流体和工作介质必须立刻收集起来并按照当地现行规定进行废弃处理。

更换工作介质

如果电机内部出现损坏，可能导致密封室内**形成一定强度的压力！打开**螺旋塞时，这种压力会向外冲出。如果打开螺旋塞时不注意，它可能会高速弹出！请始终遵守以下指示，避免受伤：

- 遵守规定的工作步骤顺序。
- 缓慢转动螺旋塞，不要完全拧出。开始泄压之后（可听见空气鸣叫声或嘶嘶声），不要继续转动螺旋塞。
  警告！ 泄压时可能喷出高温工作介质，会导致烫伤！为了避免受伤，执行任何作业之前，都应先将电机冷却到环境温度！
- 待泄压完成之后，完全拧出螺旋塞。

2.10 工作介质

密封壳体灌注有白油。定期维护时需要更换工作介质，报废处理时应当遵守本地相关法规。

2.11 运营者的责任

- 为工作人员提供以其母语写成的安装及操作说明。
- 为工作人员提供必要的培训，确保其能胜任指派的工作。
- 提供必要的防护装备并保证工作人员佩戴防护装备。
- 使产品上安装的安全和提示标牌长期保持清晰可读状态。
- 使工作人员了解设备的功能原理。
- 杜绝电流导致危险。
- 标记工作区域并采取安全措施。
- 为工作人员指定工作范围，保证安全作业。
- 产品正常运行时，测量声压级。如果噪声超过 85 dB(A)，需要佩戴护耳装置并注意工作规程中的提示信息！

3 应用/使用

3.1 规定用途

搅拌器适用于在污水、废水（含/不含粪便）和污泥中进行间歇运行和连续运行：

- 用于生成水流
- 用于固体悬浮
- 用于同质化

符合规定的使用还包括遵守本手册的规定。任何超出规定范围的应用均视为不合规定。

3.2 未按规定使用

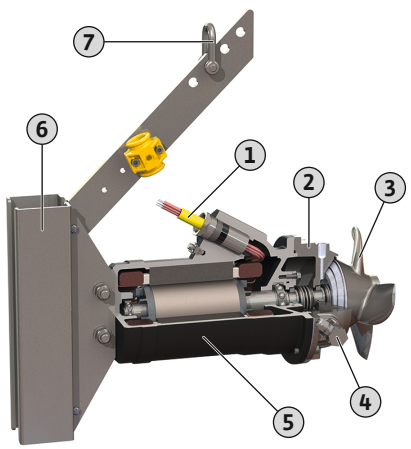
搅拌器不得用于处理下列介质：

- 饮用水
- 非牛顿型流体
- 含有石块、木头、金属等硬质成分的重度污染流体
- 纯净的易燃易爆介质

4 产品说明

4.1 结构

电动潜水搅拌器由下列部件构成：



1	连接电缆
2	密封壳体
3	螺旋桨
4	铅芯湿度电极（选配）
5	电机
6	用于下降装置的机架
7	吊挂点

Fig. 1: 电动潜水搅拌器概述

4.1.1 螺旋桨

实心材料制成的螺旋桨带后曲入流边和荣获专利的 Helix 桨毂。**注意！ 螺旋桨在运行期间不得浮出水面。遵守规定的最小水覆盖深度！**

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TRE 36...	TR 40...
额定直径，单位：mm (in)	140 (5.5)	160 (6)	210 (8)	220 (8.5)	280 (11)	360 (14)	400 (16)
叶片数量	2	2	2	3	2	3	3
材料规格							
PUR	•	•	•	–	•	•	•
EN-GJL-250 (ASTM A48 Class 35/40B)	–	–	–	o	–	–	–
1.4571 (AISI 316TI)	–	–	o	–	–	o	o
1.4408 (ASTM A 351)	–	–	–	•	–	–	–

• = 批量的，– = 不可用，o = 选装
* = PUR/GFK (PUR/GFRP) 复合材料制成的高耐磨性螺旋桨，装备经过硬化处理的前缘。

4.1.2 电机

使用三相交流电规格的表面冷却电机作为驱动。电机装备经过永久润滑且尺寸足够的免维护滚针轴承。通过周围的流体进行冷却。余热通过电机外壳直接排放到流体中。

接线电缆经过密封处理，不但防高压水，而且防流体，此外还具有纵向防水性。接线电缆端部裸露，标准长度为 10 m (33 ft)。可根据需求提供更长的电缆。

	TR...
介质温度	3 ~ 40 °C (37 ~ 104 °F)
防护等级	IP68
绝缘等级	H
极数	4，6，8
最大开关频率	15/h
最大潜水深度	20 m (66 ft)
防爆	ATEX，FM，CSA
运行模式，潜水式	S1
运行模式，非潜水式	–

	TR...
电机能效等级	-
外壳材料	EN-GJL-250 (ASTM A48 Class 35/40B)

4.1.3 密封件

电机和螺旋桨之间装有密封壳体，它在液体侧和电机侧装有密封件。

液体侧密封通过一个机械密封实现。机械密封额外配备一个密封套。密封套可以保证机械密封底座的持久性和耐腐蚀性。电机侧密封通过一个转轴密封或机械密封实现。

密封壳体灌注有白油，用于收集液体侧密封件的泄漏物。

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
密封件							
流体侧：SiC/SiC	•	•	•	•	•	•	•
电机侧：NBR（腈）	–	–	–	•	–	•	•
电机侧：SiC/SiC	•	•	•	–	•	–	–
外壳材料							
EN-GJL-250 (ASTM A48 Class 35/40B)	•	•	•	•	•	•	•

4.2 监控装置

可能的监控设备概述：

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
内部监控设备							
电机舱	o	o	o	–	o	–	–
电机舱/密封室*	–	–	–	o	–	o	o
电机绕组**	•	•	•	•	•	•	•
外部监控设备							
密封室	o	o	o	o	o	o	o

图例

– = 不存在/不可能，o = 可选，• = 批量的

* 在防爆规格产品中，监控装置不可替代！

** 标配装有一个温度限制装置。在符合 ATEX 防爆标准的产品中，装有一个温度调节和限制装置。

所有现有的监控设备必须始终处于连接状态！

电机舱监控装置

电机舱监控装置可以保护电机绕组免于短路。湿度探测通过一个电极实现。

电机舱和密封室监控装置

电机舱监控装置可以保护电机绕组免于短路。密封室监控设备记录通过液体侧机械密封渗入流体的事件。湿度探测通过电机舱和密封室内的电极实现。

注意！ 防爆规格产品不装备这种监控装置！

电机绕组监控装置

电机过热保护装置可以保护电机绕组免于过热。标配安装一个带双金属片的温度限制装置。

温度探测装置可以选装一个 PTC 传感器。此外也可将电机过热保护装置用作温度调节装置。这样就可以探测两个温度。达到低温之后，可以在电机冷却后执行一次自动重启。只有达到高温时，才必须使用重启锁定功能执行一次关机。

密封室外部监控装置

密封室可以装备一个外部铅芯湿度电极。电极记录通过液体侧机械密封渗入介质的事件。之后就可以通过水泵控制器生成报警或者关闭水泵。

4.3 运行模式

运行模式 *S1*：连续运行

搅拌器能在额定负荷下连续运行，而不会超过允许的温度。

4.4 使用变频器运行

允许使用变频器运行设备。相关要求参见附录并注意遵守！

4.5 在易爆环境中运行

符合标准	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
ATEX	o	o	o	o	o	o	o
FM	o	o	o	o	o	o	o
CSA-Ex	o	o	o	o	o	o	o

图例

– = 不存在/不可能，o = 可选，• = 批量的

在爆炸性气体中使用时，搅拌器铭牌上必须具有下列标识：
- 相应认证的防爆标识
- 防爆等级

关于防爆电缆的相关要求，参见本操作说明书的附录，并注意遵守要求！

防爆许可

搅拌器适合在潜在爆炸环境中运行：
- 设备组：II
- 类别：2，1 区和 2 区

搅拌器不得在 0 区使用！

FM 认证

搅拌器适合在潜在爆炸环境中运行：
- 防护等级：Explosionproof
- 类别：Class I，Division 1

注意：如果根据 Division 1 布线，则也允许在 Class I, Division 2 中安装。

CSA 防爆认证

搅拌器适合在潜在爆炸环境中运行：
- 防护等级：Explosion-proof
- 类别：Class 1，Division 1

4.6 铭牌

下面概要介绍铭牌上的缩写词和相关数据：

铭牌缩写词	含义
P-Typ	搅拌器型号
M-Typ	电机型号
S/N	序列号
MFY	生产日期*

铭牌缩写词	含义
n	转速
T	流体最高温度
IP	防护等级
I_N	额定电流
I_{ST}	起动电流
I_{SF}	服务因数下的额定电流
P_2	额定功率
U	测定电压
f	频率
Cos φ	电机效率
SF	服务因数
OT_S	运行模式：潜水式
OT_E	运行模式：非潜水式
AT	起动方式
m	重量

*生产日期书写格式符合 ISO 8601 标准：JJJJWww
- JJJJ = 年份
- W = 周缩写词
- ww = 日历周数据

4.7 型号代码

示例：**Wilo-EMU TR 36.95-6/16REx S17**	
TR	电动潜水搅拌器，卧式： TR = 搅拌器配备标准异步电机 TRE = 搅拌器配备能效等级 IE3/IE4 的异步电机
36	x10 = 螺旋桨直径，单位 mm
95	螺旋浆转速，单位 rpm
6	极数
16	x10 = 定子组件长度，单位 mm
R	电机规格： R = 搅拌器规格 V = 小功率搅拌器规格
Ex	具有防爆级
S17	特种螺旋桨的螺旋桨代码（不适用标准型螺旋桨）

4.8 供货范围

- 搅拌器带裸露电缆端部
- 根据客户需求提供相应长度的电缆
- 所安装的附件，例如机架、铅芯湿度电极等
- 安装及操作说明

4.9 附件

- 下降装置
- 辅助升降装置
- 池壁和池底安装固定托架
- 用于固定升降绳的系绳柱
- 定位挡块
- 附加的绳索张紧装置
- 固定件套件带地脚螺栓

5 运输和存放

5.1 交货

收到货物之后，必须立刻检查货物有无缺陷（损坏、完整性）。如有缺陷，必须标注在运单上！此外还必须在到货当天，将损坏情况告知运输公司或者生产商。如果不在当天通知，就会丧失索赔权利。

5.2 运输

警告

在悬挂物下停留！

所有人严禁在悬挂物下停留！零部件掉落会导致（严重）受伤。悬挂物切勿从有人员停留的工作位置上方经过！

警告

不佩戴防护装备会导致头部和脚部受伤！

工作时存在（严重）受伤危险。穿戴以下防护装备：

- 安全鞋
- 如果使用提升设备，还必须佩戴安全头盔！

注意

请只使用技术方面毫无瑕疵的提升设备！

请只使用技术方面毫无瑕疵的提升设备提升和降低搅拌器。确保搅拌器在升降过程中不会卡住。切勿超过提升设备允许的最大承载能力！开始使用之前，先检查提升设备的功能是否正常！

注意

在无吊挂点的情况下运输搅拌器

搅拌器安装在地面和墙壁时，不安装基座框架，也就没有吊挂点。将搅拌器放在托盘上运往安装地点。在安装地点，由一个或两个工作人员进行定位放置。注意搅拌器的重量！

- 为了避免搅拌器在运输途中受损，到达使用地之后再拆除包装。
- 发运使用过的搅拌器时，必须使用尺寸足够大而且不易撕破的塑料袋进行包装，包装时注意收口。
- 接线电缆的裸露端部必须封住，防止进水。
- 遵守所在国现行的安全法规。
- 使用合法且获得认证的升降装置和提升装置。
- 根据实际情况（天气、吊挂点、负载等）选择提升装置。
- 只将提升装置固定在吊挂点上。必须使用 U 形环进行固定。
- 使用具备足够承载能力的提升设备。
- 使用期间必须保证提升设备稳定可靠。
- 使用提升设备时，如果需要（比如视线受阻），必须安排另外一位工作人员负责协调。

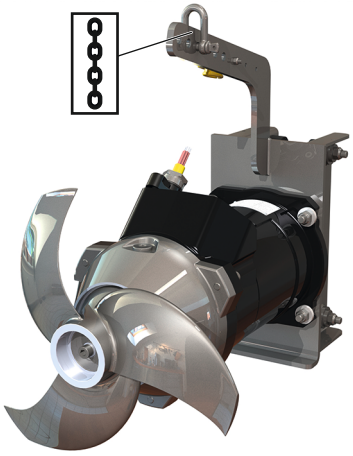


Fig. 2: 吊挂点

5.3 存放

危险

危害健康的介质会导致危险！

如果在危害健康的介质中使用搅拌器，可能有生命危险。

- 拆卸后和执行所有其他工作前，需要对搅拌器进行净化处理。
- 遵守工作规程的相关规定。运营者必须保证工作人员已经收到并阅读工作规程。

警告

螺旋桨叶片的尖锐边缘！

螺旋桨叶片可能逐渐形成尖锐边缘，导致四肢被割伤。注意佩戴防护手套，防止出现切割受伤的情况。

小心

渗入湿气导致全损

湿气渗入接线电缆会导致接线电缆和搅拌器损坏！切勿将接线电缆端部浸入液体中，储存时须将其牢牢封住。

新搅拌器到货后，可以储存一年。如果储存时间超过一年，请咨询客户服务部。

储存时注意下列事项：

- 将搅拌器水平、平稳放置在坚实的底座上，**采取安全措施防止其掉落和滑动！小心！ 切勿将搅拌器放在螺旋桨上。这会导致螺旋桨或轴损坏！如果螺旋桨直径较大，注意使用合适的基座。**
- 存储温度范围是 -15 至 +60 °C（5 至 140 °F），空气湿度最高 90 %，不冷凝。建议使用温度介于 5 至 25 °C（41 至 77 °F），相对空气湿度在 40 % 至 50 % 之间的防冻仓库。
- 切勿在执行焊接作业的室内储存搅拌器。因为焊接时形成的气体或辐射可能侵蚀弹性体零件和涂层。
- 保护接线电缆，防止其弯折和损坏。
- 保护搅拌器免受阳光直射和热侵蚀。外部热量可能导致螺旋桨和涂层受损！
- 定期（每年 2 次）转动螺旋桨。从而防止轴承无法转动，并更新机械密封的润滑膜。**警告！ 螺旋桨的锐边会导致人员受伤！**
- 弹性体零件和涂层会自然脆化。如果储存时间超过 6 个月，必须咨询客户服务部。

结束储存时段之后，必须清洁搅拌器上的灰尘和油，并检查涂层和损坏情况。如果涂层受损，须在继续使用前将其修复。

6 安装及电气连接

6.1 工作人员资格鉴定

- 电气作业：电气作业必须由专业电工执行。
- 安装/拆卸工作：必须由专业人员执行，而且要求该人员接受过相关培训，了解工作中会用到的工具以及当前建筑基底需要使用的固定材料。
- 提升作业：提升装置必须由接受过培训的专业人员操作。根据 BGV D8 或本地法规出具证明。

6.2 运营者的责任

- 遵守本地现行的同业工伤事故保险联合会的事故防范规定和安全规定。
- 遵守有关处理重物或在悬挂物之下工作的所有法律法规。
- 提供防护装备并保证工作人员佩戴防护装备。
- 标记工作区域并确保工作区域四周未放置其他物体。
- 将擅自进入工作区域的人员清理出场。
- 如果由于天气原因（比如结冰、强风天气等）导致无法安全工作，则停止工作。
- 建筑/地基必须具有足够的强度，这样才能安全可靠地固定并确保功能正常。准备建筑/地基并保证其适用性，是运营者的责任！
- 检查现有的规划资料（安装图、运行空间结构图、供给情况）是否齐全和正确。

6.3 安装方式

- 池底和池壁固定式安装
- 以灵活方式安装在下降装置上

注意！ 视具体设备而定，可在 -90° 至 +90° 范围内垂直安装。这种安装方式的具体事宜，请咨询客户服务部！

6.4 安装

危险

在安装过程中，危害健康的介质会导致危险！

使安装地点在安装过程中保持干净、无菌。如果可能接触危害健康的介质，注意下面几点：

- 佩戴防护装备：
  - ⇒ 封闭式护目镜
  - ⇒ 口罩
  - ⇒ 防护手套
- 一旦有介质滴落，立刻进行收集。
- 遵守工作规程的相关规定！运营者必须保证工作人员已经收到并阅读工作规程！

危险

独自执行危险作业导致生命危险！

需要在竖井和狭窄空间内完成的工作，以及存在坠落危险的工作，这两个都是危险工种，不允许单人独自作业！为安全起见，必须有第二个人在场。

警告

不佩戴防护装备会导致头部和脚部受伤并存在坠落危险！

工作时存在（严重）受伤危险。穿戴以下防护装备：

- 安全手套，用以预防切割伤害
- 安全鞋
- 安全带
- 如果使用提升设备，还必须佩戴安全头盔！

小心

固定错误造成物资损失

固定错误可能导致搅拌器出现功能性障碍和损坏。

- 如果要固定在混凝土建筑上，需要使用地脚螺栓进行固定。遵守生产商发布的安装规定！严格遵守温度说明和硬化时间。
- 如果要固定在钢制建筑上，注意检查建筑是否足够坚固。使用具有足够强度的固定材料！
  使用合适的材料，避免出现电化腐蚀！
- 拧紧所有螺栓连接。遵守扭矩参数。

注意

请只使用技术方面毫无瑕疵的提升设备！

请只使用技术方面毫无瑕疵的提升设备提升和降低搅拌器。确保搅拌器在升降过程中不会卡住。切勿超过提升设备允许的最大承载能力！开始使用之前，先检查提升设备的功能是否正常！

- 准备运行空间/安装地点：
  - 干净，无大颗粒固体
  - 干燥
  - 不上冻
  - 经过消毒处理
- 始终安排两人执行作业。

- 避免出现身体疼痛和疲劳现象。
- 如果作业高度超过 1 m (3 ft)，需要使用带防坠落安全装置的支架。
- 封锁支架四周的工作区域。
- 在密闭室内工作时，有毒气体或窒息气体会不断聚集。注意保证通风顺畅并按照工作规程采取防护措施（示例）：
  – 进行气体检测，防止气体汇聚。
  – 随身携带气体报警设备。
  – 其他
- 如果出现有毒气体或窒息气体汇集的情况，立刻采取对策。
- 提升、降低和运输搅拌器时，使用升降装置。
- 将升降装置通过一个 U 形环固定在吊挂点上。只使用建筑技术允许使用的提升装置。
- 产品提起之后，远离升降装置的摆动范围。
- 必须能够安全安装升降装置。储存位置和安装地点必须能够通过升降装置到达。安装位置的地基必须坚实。
- 与墙壁和现有部件保持适当距离，不小于最小间距。
- 铺设的接线电缆必须能够安全运行。检查电缆横截面和电缆长度对于选择的铺设方式来说是否足够。

6.4.1 保养工作

如果储存时间超过 6 个月，则在开始安装之前，需要进行以下保养工作：

- 转动螺旋桨。
- 密封壳体换油。

6.4.1.1 转动螺旋桨

警告
螺旋桨叶片的尖锐边缘！
螺旋桨叶片可能逐渐形成尖锐边缘，导致四肢被割伤。注意佩戴防护手套，防止出现切割受伤的情况。

✓ 搅拌器未连接电网！

✓ 防护装备就位！

1. 将搅拌器水平放在固定的底座上。
   警告！ 双手可能因挤压而受伤。保证搅拌器不会掉落或滑动！
   小心！ 切勿将搅拌器放在螺旋桨上！视螺旋桨直径而定，合理使用基座。
2. 小心、缓慢抓住螺旋桨并转动。

6.4.1.2 密封壳体换油 (TR 14/16/21/28)

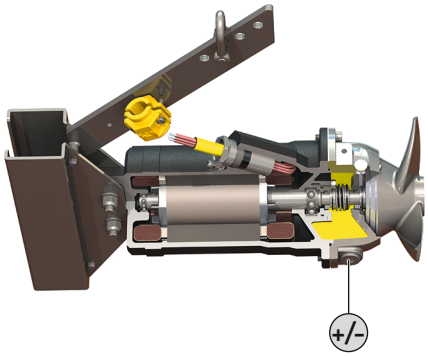


Fig. 3: 换油

+/-	密封壳体排油/注油

✓ 搅拌器未安装。

✓ 搅拌器未连接电网。

✓ 防护装备就位！

1. 将搅拌器水平放在固定的底座上。
   警告！ 双手可能因挤压而受伤。保证搅拌器不会掉落或滑动！
   小心！ 切勿将搅拌器放在螺旋桨上！视螺旋桨直径而定，合理使用基座。
2. 放置合适的容器用于收集工作介质。
3. 拧出螺旋塞 **(+/-)**。
4. 使搅拌器侧倾，排出工作介质。
5. 检查工作介质：如果工作介质内有金属屑，请联系客户服务部！
6. 按照当地法规对工作介质进行废弃处理！
7. 重新水平放置搅拌器，使开孔朝上。
8. 通过螺旋塞 **(+/-)** 的开孔注入工作介质。
   ⇒ 遵守规定的工作介质类型和数量！
9. 清洁螺旋塞 **(+/-)**，装入新密封环，重新拧入。**最大拧紧扭矩：8 Nm (5.9 ft·lb)！**
10. 重新采取防腐措施：使用 Sikaflex 等密封螺旋塞。

6.4.1.3 密封壳体换油 (TR 22/36/40)

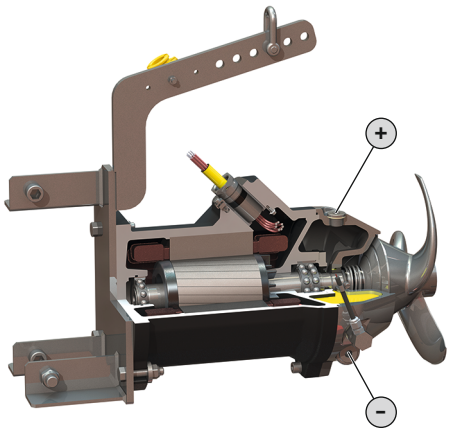


Fig. 4: 换油

+	密封壳体注油
-	密封壳体排油

✓ 搅拌器未安装。

✓ 搅拌器未连接电网。

✓ 防护装备就位！

1. 将搅拌器水平放在固定的底座上。
   警告！ 双手可能因挤压而受伤。保证搅拌器不会掉落或滑动！
   小心！ 切勿将搅拌器放在螺旋桨上！视螺旋桨直径而定，合理使用基座。
2. 放置合适的容器用于收集工作介质。
3. 拧出螺旋塞 **(+)**。
4. 拧出螺旋塞 **(–)** 并排出工作介质。
5. 检查工作介质：如果工作介质内有金属屑，请联系客户服务部！
6. 按照当地法规对工作介质进行废弃处理！
7. 清洁螺旋塞 **(–)**，装入新密封环，重新拧入。**最大拧紧扭矩：8 Nm (5.9 ft·lb)！**
8. 通过螺旋塞 **(+)** 的开孔注入工作介质。
   ⇒ 遵守规定的工作介质类型和数量！
9. 清洁螺旋塞 **(+)**，装入新密封环，重新拧入。**最大拧紧扭矩：8 Nm (5.9 ft·lb)！**
10. 重新采取防腐措施：使用 Sikaflex 等密封螺旋塞。

6.4.2 池壁安装

Fig. 5: 池壁安装

采用池壁安装方式时，直接将搅拌器安装在池壁上。在池壁上铺设接线电缆并向上引出。

✓ 已备好安装所需的运行空间/安装地点。注意遵守规划资料中规定的产品与部件和池壁之间的间距。

✓ 搅拌器未连接电网。

✓ 如果安装高度超过 1 m，需要准备带防坠落安全装置的支架。

1. 两人合作，将搅拌器在池壁上定位，并标出固定孔。
2. 将搅拌器放在工作区域以外。
3. 钻固定孔并放置地脚螺栓。**注意！ 遵守生产商发布的安装规定！**
4. 地脚螺栓完成硬化之后，两人合作，将搅拌器插在地脚螺栓上，使用固定材料进行固定。
5. 将搅拌器固定安装在池壁上。**注意！ 遵守生产商发布的安装规定！**
6. 在池壁上铺设接线电缆，注意铺设时需要轻轻拉紧。**小心！ 如果接线电缆需要经过水池边缘，注意可能发生摩擦。尖锐的水池边会导致接线电缆损坏。必要时将水池边处理成斜面！**
7. 采取防腐措施（比如使用 Sikaflex）：填充电机法兰上的长孔，直至垫圈处。

► 搅拌器安装完毕。进行电气连接。

6.4.3 地面安装

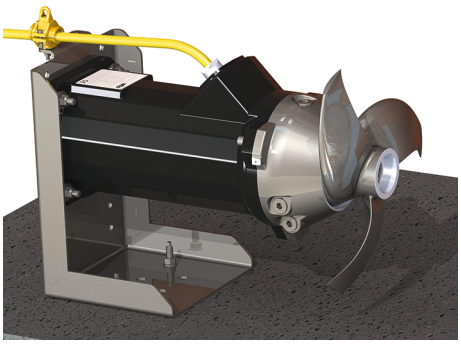


Fig. 6: 地面安装

采用池底安装方式时，将搅拌器通过托架直接安装在池底。**小心！ 如果订购了池底安装款搅拌器，设备会预装托架。如果搅拌器供货时未带托架，请联系客户服务部补订！**在池底铺设接线电缆，通过池壁引向上方。

✓ 已备好安装所需的运行空间/安装地点。注意遵守规划资料中规定的产品与部件和池壁之间的间距。

✓ 搅拌器未连接电网。

✓ 托架已安装在搅拌器上。

1. 两人合作，将搅拌器定位在池底，并标出 2 个固定孔。
2. 将搅拌器放在工作区域以外。
3. 钻固定孔并放置地脚螺栓。**注意！ 遵守生产商发布的安装规定！**

4. 地脚螺栓完成硬化之后，两人合作，将搅拌器放在地脚螺栓上，使用固定材料进行固定。
5. 将搅拌器固定安装在池底。**注意！遵守生产商发布的安装规定！**
6. 在池底和池壁铺设接线电缆，注意铺设时需要轻轻拉紧。**小心！如果接线电缆需要经过水池边缘，注意可能发生摩擦。尖锐的水池边会导致接线电缆损坏。必要时将水池边处理成斜面！**
7. 采取防腐措施（使用 Sikaflex 等）：
   - 填充托架和建筑之间的密封缝。
   - 填充托架底座上的孔。
   - 填充托架内的划痕。

► 搅拌器安装完毕。进行电气连接。

6.4.4 使用下降装置安装

通过一个下降装置，将搅拌器沉入水池中。通过下降装置的导流管，将搅拌器安全引向工况点。形成的反作用力直接通过下降装置导入建筑中。建筑的设计结构必须能够承受这一负载！

小心！使用错误的附件会造成物资损失！由于反作用力较大，因此搅拌器必须使用生产商提供的附件（下降装置和机架）运行。如果订购搅拌器时也订购了安装用的下降装置，会预安装机架。如果搅拌器供货时未带机架，请联系客户服务部补订！

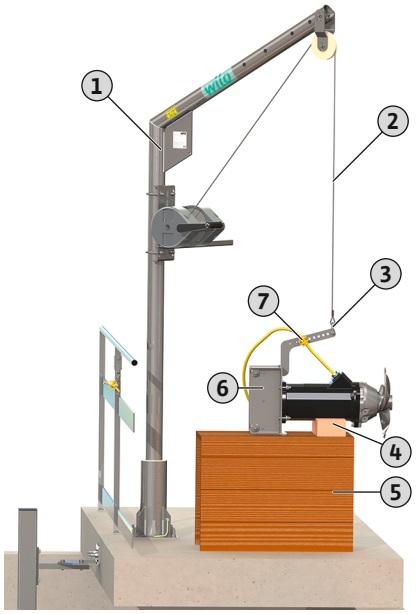


Fig. 7: 准备搅拌器

准备工作

1	升降装置
2	提升设备
3	吊挂用 U 形环
4	支脚
5	用于确保设备安全放置的基座
6	机架
7	用于消除应力的电缆支架

✓ 搅拌器已放置并水平校准。

✓ 机架已安装在搅拌器上。

✓ 下降装置已安装在水池中。

✓ 具有足够承载能力的升降装置就位。

1. 使用一个 U 形环，将机架吊挂在提升设备上。
2. 配备贯穿式塑料滚轮的规格：松开活动开口销，拆下贯穿式塑料滚轮和快速释放轴。
   注意！妥善存放部件，以备日后安装使用。
3. 铺设所有接线电缆并安装电缆支架。
   电缆支架将接线电缆固定在提升设备上，防止接线电缆失控掉入水池。

搅拌器	电缆支架间距
TR 14	550 mm (20 in)
TR 16	550 mm (20 in)
TR 21	550 mm (20 in)
TR 22	750 mm (30 in)
TR 28	550 mm (20 in)
TR 36	750 mm (30 in)
TR 40	750 mm (30 in)

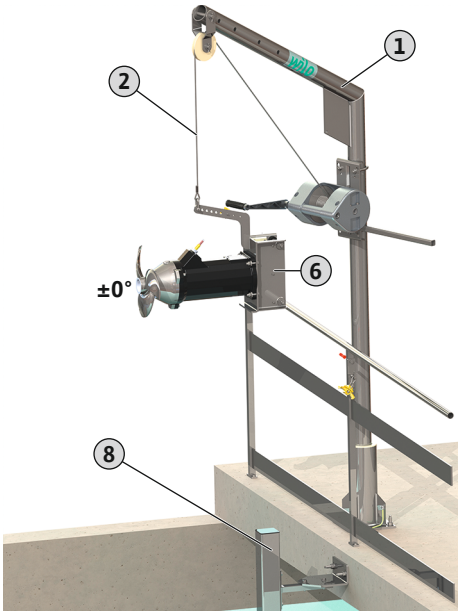


Fig. 8: 在水池上方摆动搅拌器

提升搅拌器并在水池上方摆动

1	升降装置
2	提升设备
6	机架
8	下降装置的导流管

✓ 准备工作已完成。

1. 提升搅拌器，直至其可在栏杆上方安全摆动。
   注意！ 搅拌器必须水平悬挂在升降装置上。如果搅拌器倾斜悬挂在升降装置上，则调整机架上的吊挂点。
2. 在水池上方摆动搅拌器。
   注意！ 机架必须与导流管垂直。如果机架与导流管不垂直，则调整升降装置的幅度。

将搅拌器安装在下降装置上

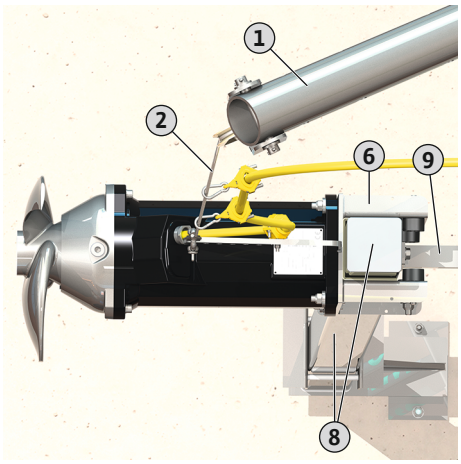


Fig. 9: 搅拌器在下降装置上

1	升降装置
2	提升设备
6	机架
8	下降装置的导流管
9	下降装置上夹持器

✓ 搅拌器水平悬挂。

✓ 机架与导流管呈垂直状态。

✓ 电缆支架安装完毕。

1. 缓慢降下搅拌器。
2. 将导流管引入机架中，不要倾斜。
   注意！ 导轮贴在导流管上。
3. 配备快速释放轴的产品款型：
   降下搅拌器，直至机架到达上夹持器的下方。安装快速释放轴和贯穿式塑料滚轮，并用活动开口销将其锁止！

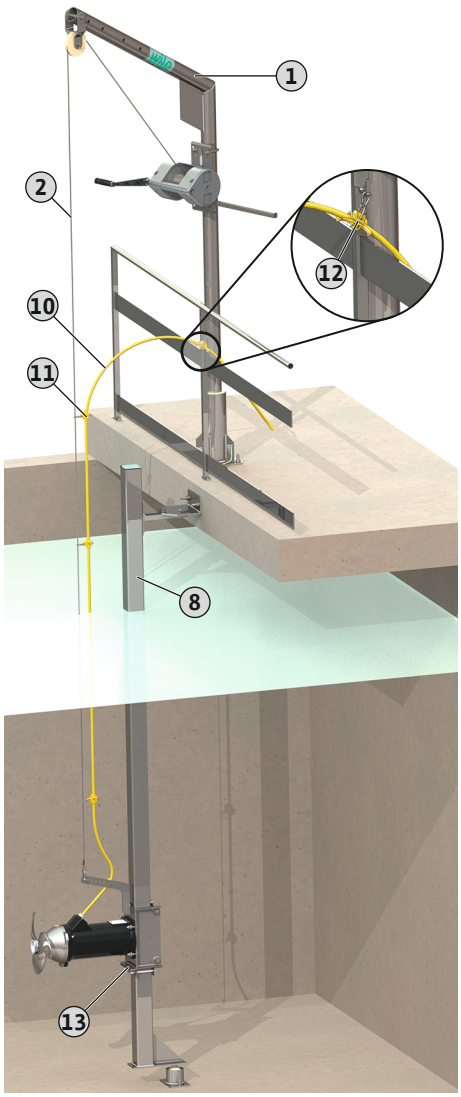


Fig. 10: 搅拌器到达固定限位器

结束安装

1	升降装置
2	提升设备
8	下降装置的导流管
10	连接电缆
11	带弹簧扣的电缆支架，通过提升设备进行电缆导向
12	带弹簧扣的电缆支架，锁紧防止坠落
13	固定限位器

✓ 搅拌器已安装在下降装置上

1. 缓慢降下搅拌器。
2. 使用电缆支架，将接线电缆挂在提升设备上。
   接线电缆通过提升设备（钢索等）实现安全引导。**小心！ 如果引导接线电缆时不使用电缆支架，必须保证接线电缆不会被拽进螺旋桨中！**
3. 降下搅拌器，直至到达导流管末端或者固定限位器。
4. 将接线电缆固定在支架或升降装置上，防止掉落！
5. 检查下降装置的摆动范围。
   检查下降装置的整个摆动范围。搅拌器不得与建筑物（部件、池壁）发生碰撞。**小心！ 如果整个摆动范围不可用，则采取机械手段对摆动范围进行限制！**
6. 调整理想角度，之后通过一颗螺栓固定下降装置，防止发生变化。

► 安装过程结束。铺设接线电缆并进行电气连接。

移动式升降装置：安装系绳柱

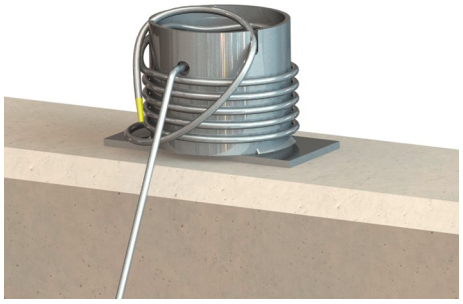


Fig. 11: 提升设备固定在系绳柱上

如果使用移动式升降装置，需要在池边装一个系绳柱：
- 从升降装置中取出提升设备（钢索等），固定在系绳柱上。
- 将接线电缆固定在池边，防止掉落。

小心！ 如果接线电缆需要经过水池边缘，注意可能发生摩擦。尖锐的水池边会导致接线电缆损坏。必要时将水池边处理成斜面！

6.5 电气连接

危险

小心触电死亡！

执行电气作业时不按规定操作，会发生电击致死事故！电气作业必须由专业电工按照当地的相关规定执行。

危险

接线错误可能发生爆炸！

- 始终在潜在爆炸环境以外对搅拌器进行电气连接。如果必须在潜在爆炸环境内接线，则在获得防爆认证的外壳（符合 DIN EN 60079-0 标准规定的防爆等级）内进行！如不遵守，爆炸会导致生命危险！
- 在标记的接地端连接电位均衡器。接地端设在接线电缆区域内。电位均衡器必须使用符合当地法规的电缆截面。
- 接线工作须由专业电工执行。
- 进行电气连接时，也应注意本操作说明附录中防爆章节的详细信息！

- 电源连接必须与铭牌上的说明一致。
- 三相交流电机电源侧馈电具备顺时针旋转磁场。
- 按照当地法规的相关要求铺设接线电缆并按照芯线布局进行连接。
- 连接监控设备并检查功能是否正常。
- 按照当地法规的相关要求进行接地。

6.5.1 电源一侧的保险丝

断路器

断路器的规格和开关属性取决于所连接产品的额定电流。注意遵守当地相关法规。

电机保护开关

对于不带插头的产品，安装方应该准备一个电机保护开关！最低要求是配备一个符合本地规定，具备温度补偿、差分触发和重启锁定功能的热敏继电器/电机保护开关。针对反应灵敏的电网，安装方还应准备其他保护装置（比如超压、欠压或缺相继电器等）。

漏电断路器 *(RCD)*

遵守当地供电公司的相关规定！建议使用漏电断路器。
如果人员可能接触到产品和导电液体，需要对电路连接采取安全措施，**装备**一个漏电断路器 (RCD)。

6.5.2 保养工作

开始安装之前，先执行下列保养工作：
- 检查电机绕组的绝缘电阻。
- 检查温度传感器的电阻。
- 检查铅芯湿度电极（选配）的电阻。

如果测得的数值与规定参数存在偏差，说明：
- 电机或接线电缆内渗入潮气。
- 监控设备损坏。

如果发生故障，请联系客户服务部。

6.5.2.1 检查电机绕组的绝缘电阻

使用绝缘测试仪（测量直流电压 = 1000 V）测量绝缘电阻。遵守下列数值：
- 预调试时：绝缘电阻不得低于 20 MΩ。
- 进行其他测量时：绝缘电阻值必须大于 2 MΩ。

6.5.2.2 检查温度传感器的电阻

使用电阻表测量温度传感器的电阻。必须遵守下列测量值：
- **双金属片**：测量值 = 0 Ohm（通过）。
- **PTC 传感器**（正温度系数电阻）：测量值取决于安装的传感器个数。PTC 传感器的冷态电阻介于 20 至 100 Ohm 之间。
  – 如果串联三个传感器，测量值介于 60 至 300 Ohm 之间。
  – 如果串联四个传感器，测量值介于 80 至 400 Ohm 之间。

6.5.2.3 检查用于进行密封室监控的外部电极的电阻

使用电阻表测量电极的电阻。测得的数值必须趋向于“无穷大”。如果数值 ≤30 kOhm，说明油中有水，换油！

6.5.3 连接三相交流电机

为三相交流电机供货时末端已露出。通过连接控制开关中的供电线接入电网。接线精确参数参见随附提供的接线图。**电气连接工作须由专业电工执行！**

注意！ 各芯线按照接线图命名。切勿切断芯线！芯线名称和接线图之间不存在其他分配关系。

直接启动时的电源连接芯线名称	
U，V，W	电源连接

直接启动时的电源连接芯线名称	
PE (gn-ye)	接地

星三角启动时的电源连接芯线名称	
U1，V1，W2	电源连接（绕组始端）
U2，V2，W2	电源连接（绕组末端）
PE (gn-ye)	接地

6.5.4 连接监控设备

监控设备连接和规格精确参数，参见随附提供的接线图。**电气连接工作须由专业电工执行！**

注意！ 各芯线按照接线图命名。切勿切断芯线！芯线名称和接线图之间不存在其他分配关系。

危险

接线错误可能发生爆炸！

如未正确连接监控设备，潜在爆炸环境内存在生命危险！接线工作须由专业电工执行。在潜在爆炸环境中使用时，适用下列原则：

- 通过一个评测继电器连接电机过热保护！
- 温度限制装置引发的关闭操作，必须通过重启锁定功能实现！只有手动操作解锁按键之后，才允许重启！
- 外部电极（比如密封室监控设备）通过一个评测继电器与本安电路连接在一起！
- 注意本操作说明附录中防爆章节的详细信息！

可能的监控设备概述：

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
内部监控设备							
电机舱	o	o	o	–	o	–	–
电机舱/密封室*	–	–	–	o	–	o	o
电机绕组**	•	•	•	•	•	•	•
外部监控设备							
密封室	o	o	o	o	o	o	o

图例

– = 不存在/不可能，o = 可选，• = 批量的

* 在防爆规格产品中，监控装置不可替代！

** 标配装有一个温度限制装置。在符合 ATEX 防爆标准的产品中，装有一个温度调节和限制装置。

6.5.4.1 电机舱监控装置

通过一个评测继电器连接电极。建议使用“NIV 101/A”继电器。阈值为 30 kOhm。

芯线名称	
DK	电极接口

达到阈值之后，必须执行一次关闭操作！

6.5.4.2 电机舱/密封室监控装置

通过一个评测继电器连接电极。建议使用“NIV 101/A”继电器。阈值为 30 kOhm。

芯线名称	
DK	电极接口

达到阈值之后，必须执行一次关闭操作！

6.5.4.3 电机绕组监控装置

配备双金属片

双金属片直接接入控制开关，或者通过一个评测继电器接入控制开关。
连接值：最大 250 V(AC)，2.5 A，cos φ = 1

双金属片芯线名称	
温度限制装置	
20，21	双金属片接口
温度调节和限制装置	
21	高温接口
20	中温接口
22	低温接口

配备 *PTC* 传感器

通过一个评测继电器连接 PTC 传感器。建议使用“CM-MSS”继电器。阈值已预设。

PTC 传感器芯线名称	
温度限制装置	
10，11	PTC 传感器接口
温度调节和限制装置	
11	高温接口
10	中温接口
12	低温接口

温度调节和限制装置的触发状态

视电机过热保护的规格而定，达到阈值后必须实现下列触发状态：
- 温度限制装置（1 温度回路）：
  达到阈值之后，必须执行一次关闭操作。
- 温度调节装置和限制装置（2 温度回路）：
  达到低温阈值后，可以通过自动重启功能执行一次关闭操作。达到高温阈值后，必须通过手动重启功能执行一次关闭操作。

注意附录中防爆章节的详细信息！

6.5.4.4 密封室监控装置（外部电极）

通过一个评测继电器连接外部电极。建议使用“NIV 101/A”继电器。阈值为 30 kOhm。

达到阈值之后，必须发出警告或者执行关闭操作。

注意附录中防爆章节的详细信息！

小心
连接密封室监控设备
如果达到阈值后只发出一次警告，那么，进水可能导致搅拌器全盘受损。始终建议关闭搅拌器！

6.5.5 电机保护设置

电机保护必须根据选择的启动模式进行设置。

6.5.5.1 直接启动

满负荷运行时，将电机保护开关参数设为额定电流（参见铭牌）。部分负荷运行时，建议设置的电机保护开关参数高于工况点所测得电流 5 %。

6.5.5.2 星三角启动

电机保护的设置视安装情况而定：
- 电机保护安装在电机支线中：将电机保护设置为 0.58 x 额定电流。
- 电机保护安装在电源线中：将电机保护设置为额定电流。

星形连接的起动时间最长为 3 s。

6.5.5.3 软启动

满负荷运行时，将电机保护开关参数设为额定电流（参见铭牌）。部分负荷运行时，建议设置的电机保护开关参数高于工况点所测得电流 5 %。此外还要注意以下几点：

- 电耗必须始终低于额定电流。
- 30 s 内完成启动和关闭。
- 达到正常运行模式后桥接电子启动器（软启动），避免出现功率损耗。

6.5.6 使用变频器运行

允许使用变频器运行设备。相关要求参见附录并注意遵守！

7 试运行

警告

不佩戴防护装备会导致手脚受伤！

工作时存在（严重）受伤危险。穿戴以下防护装备：

- 安全手套，用以预防切割伤害
- 安全鞋
- 如果使用提升设备，还必须佩戴安全头盔！

7.1 工作人员资格鉴定

- 电气作业：电气作业必须由专业电工执行。
- 操作/控制：操作人员必须了解整台设备的工作原理。

7.2 运营者的责任

- 在搅拌器上或者指定位置放置安装及操作说明。
- 为工作人员提供以其母语写成的安装及操作说明。
- 保证所有工作人员均已阅读安装及操作说明书并且理解其中内容。
- 设备方面的所有安全装置和紧急停机开关都处于激活状态，并经检查确认功能正常。
- 搅拌器适合在规定的工作条件下使用。

7.3 检查旋转方向

出厂时搅拌器设为适合顺时针旋转磁场的旋转方向并且经过检查。按照“电气连接”章节的相关说明进行连接。

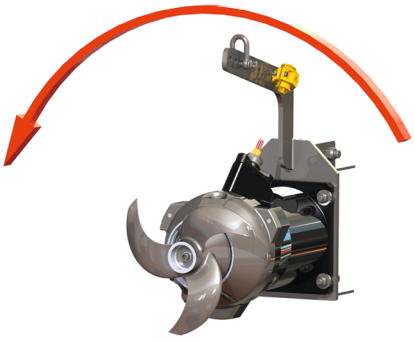


Fig. 12: 正确的旋转方向

检查旋转方向

✓ 存在具有顺时针旋转磁场的电源连接。

✓ 旋转磁场已经过专业电工的检查。

✓ 无人员在搅拌器的工作区域内停留。

✓ 搅拌器已完成固定安装。
警告！ 切勿抓握搅拌器！高起动扭矩可能导致重伤！

✓ 螺旋桨可见。

1. 接通搅拌器。**最长运行时间：15 s！**
2. 螺旋桨旋转方向：
   从前面看：螺旋桨逆时针转动（左转）。
   从后面看：螺旋桨顺时针转动（右转）。

► 旋转方向正确。

旋转方向错误

如果旋转方向错误，如下改变连接：

- 直接启动：两相互换。
- 星三角启动：互换两个绕组的连接（比如 U1/V1 和 U2/V2）。

注意！ 改变连接之后，再次检查旋转方向！

7.4 在易爆环境中运行

符合标准	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
ATEX	o	o	o	o	o	o	o
FM	o	o	o	o	o	o	o
CSA-Ex	o	o	o	o	o	o	o

图例

– = 不存在/不可能，o = 可选，• = 批量的

在爆炸性气体中使用时，搅拌器铭牌上必须具有下列标识：
- 相应认证的防爆标识
- 防爆等级

关于防爆电缆的相关要求，参见本操作说明书的附录，并注意遵守要求！

防爆许可

搅拌器适合在潜在爆炸环境中运行：
- 设备组：II
- 类别：2，1 区和 2 区

搅拌器不得在 0 区使用！

***FM* 认证**

搅拌器适合在潜在爆炸环境中运行：
- 防护等级：Explosionproof
- 类别：Class I，Division 1

注意：如果根据 Division 1 布线，则也允许在 Class I, Division 2 中安装。

***CSA* 防爆认证**

搅拌器适合在潜在爆炸环境中运行：
- 防护等级：Explosion-proof
- 类别：Class 1，Division 1

7.5 开机前：

接通前检查下列几项：
- 检查安装操作是否符合规定，是否符合本地现行的相关法规：
  – 搅拌器是否接地？
  – 有无检查接线电缆的铺设情况？
  – 电气连接是否符合规定？
  – 机械部件是否正确固定？
- 检查工作条件：
  – 有无检查流体最高/最低温度？
  – 有无检查最大潜水深度？
  – 间歇运行：是否遵守最大开关频率？
- 检查安装地点/运行空间：
  – 有无定义和监控螺旋桨上方最低水位？
  – 最低介质温度可以降至 3 °C 以下：是否安装了具有自动关闭功能的监控装置？
  – 螺旋桨转动范围内有无部件？

7.6 接通和关闭

通过一个由施工方提供的独立操作台（通/断开关，控制开关）来接通和关闭搅拌器。

在启动过程中，会有几秒钟时间超过额定电流。在达到电机运行温度以及水池中形成水流之前，电耗会稍许超过额定电流。正常运行时不得超过额定电流。小心！**如果搅拌器未启动，立即将其关闭。再次接通之前，先排除故障！**

7.7 运行过程中

警告

高温表面可能导致烫伤！

电机外壳在运行过程中温度较高，可能导致烫伤。关闭后使电机冷却到环境温度！

警告

螺旋桨叶片的尖锐边缘！

螺旋桨叶片可能逐渐形成尖锐边缘，导致四肢被割伤。注意佩戴防护手套，防止出现切割受伤的情况。

运行过程中注意遵守本地实行的相关规定：

- 劳动保护
- 事故防范
- 电气机械使用

必须严格遵守运营者规定的操作人员工作范围。所有操作人员都有义务遵守工作范围和各项规定！

- 工作电压（额定电压 +/–10 % ）
- 频率（额定频率 +/– 2 %）
- 各相位之间的电耗（最大 5 %）
- 各个相位之间的电压差（最大 1 %）
- 最大开关频率
- 螺旋桨上方的最小水覆盖深度
- 安静/无振动运行

高电耗

视流体和当前形成的水流而定，电耗可能发生小幅度波动。电耗持续处于较高水平，说明配置发生改变。配置改变的原因可能包括：

- 流体的黏度和密度发生变化，比如由于聚合物或沉淀物的添加比例改变。**小心！ 这种变化可能导致功耗剧烈升高，甚至导致过载！**
- 对流体中纤维和磨蚀性成分的机械性预清洁程度不足。
- 部件或者运行空间内的偏转导致水流不均匀。
- 水池出入口受阻、进气口状况（通风）改变或者多个搅拌器相互作用，导致产生振动。

检查设备配置并采取对策。**小心！ 电耗持续处于较高水平会导致搅拌器磨损度增大！**如需更多帮助，请联系客户服务部。

监控流体温度

流体温度不得降至 3 °C 以下。流体温度低于 3 °C 会导致流体变浓，可能导致螺旋桨碎裂。如果流体温度可能降至 3 °C 以下，需要安装一个具有预警和关闭功能的自动温度测量装置。

监控最低水覆盖深度

螺旋桨在运行过程中不得浮出水面。必须遵守规定的最低水覆盖深度！如果液位波动剧烈，需要安装液位监控装置。一旦低于最低水覆盖深度，就会关闭搅拌器。

8 停止运行/拆卸

8.1 工作人员资格鉴定

- 操作/控制：操作人员必须了解整台设备的工作原理。
- 电气作业：电气作业必须由专业电工执行。
- 安装/拆卸工作：必须由专业人员执行，而且要求该人员接受过相关培训，了解工作中会用到的工具以及当前建筑基底需要使用的固定材料。
- 提升作业：提升装置必须由接受过培训的专业人员操作。根据 BGV D8 或本地法规出具证明。

8.2 运营者的责任

- 遵守本地现行的同业工伤事故保险联合会的事故防范规定和安全规定。
- 遵守有关处理重物或在悬挂物之下工作的法律法规。
- 提供必要的防护装备并保证工作人员佩戴防护装备。
- 在封闭的空间内需提供足够的通风条件。
- 如果出现有毒气体或窒息气体汇集的情况，立刻采取对策！

8.3 停止运行

停止运行时会关闭搅拌器，但是继续保持安装状态。因此搅拌器随时处于运行准备就绪状态。

✓ 为了保护搅拌器免遭霜冻和冰冻危害，必须将搅拌器整个沉入流体中。

✓ 流体温度必须高于 +3 °C (+37 °F)。

1. 在操作台上关闭搅拌器。
2. 采取安全措施（比如锁住主开关），防止搅拌器意外重启。

► 搅拌器现已停止运行，可以开始拆卸。

如果搅拌器在停止运行后继续保持安装状态，注意下列几项要求：

- 在停止运行的整个时段内保证符合上述前提条件。如果不能保证满足前提条件，请在停止运行后将搅拌器拆除！
- 如果定期（每月一次至每季度一次）长时间停止运行，需要执行一次持续 5 分钟的功能运行。小心！ 必须在有效的工作条件下执行功能运行。不允许进行干运行！ 如不遵守，可能导致全损！

8.4 拆卸

危险

在拆卸过程中，有害健康的介质会导致危险！

拆卸过程中可能会接触到危害健康的介质。注意下列事项：

- 佩戴防护装备：
  - ⇒ 封闭式护目镜
  - ⇒ 口罩
  - ⇒ 防护手套
- 一旦有介质滴落，立刻进行收集。
- 遵守工作规程的相关规定！运营者必须保证工作人员已经收到并阅读工作规程！

危险

危害健康的介质会导致危险！

如果在危害健康的介质中使用搅拌器，可能有生命危险。

- 拆卸后和执行所有其他工作前，需要对搅拌器进行净化处理。
- 遵守工作规程的相关规定。运营者必须保证工作人员已经收到并阅读工作规程。

危险

小心触电死亡！

执行电气作业时不按规定操作，会发生电击致死事故！电气作业必须由专业电工按照当地的相关规定执行。

危险

独自执行危险作业导致生命危险！

需要在竖井和狭窄空间内完成的工作，以及存在坠落危险的工作，这两个都是危险工种，不允许单人独自作业！为安全起见，必须有第二个人在场。

警告

不佩戴防护装备会导致头部和脚部受伤并存在坠落危险！

工作时存在（严重）受伤危险。穿戴以下防护装备：

- 安全手套，用以预防切割伤害
- 安全鞋
- 安全带
- 如果使用提升设备，还必须佩戴安全头盔！

警告

高温表面可能导致烫伤！

电机外壳在运行过程中温度较高，可能导致烫伤。关闭后使电机冷却到环境温度！

注意

请只使用技术方面毫无瑕疵的提升设备！

请只使用技术方面毫无瑕疵的提升设备提升和降低搅拌器。确保搅拌器在升降过程中不会卡住。**切勿**超过提升设备允许的最大承载能力！开始使用之前，先检查提升设备的功能是否正常！

8.4.1 池底和池壁安装

✓ 搅拌器已停止运行。

✓ 运行空间已完成清空和清洁，可能已消毒。

✓ 搅拌器已完成清洁，可能已消毒。

✓ 安排两人执行作业。

1. 将搅拌器断电。
2. 拆下接线电缆并将其卷起。
3. 进入运行空间。**危险！如果运行空间无法进行清洁和消毒，请按照工作规程佩戴防护装备！**
4. 从池壁或池底拆下搅拌器。
5. 将搅拌器放在托盘上，采取安全措施防止滑落，之后将其从运行空间内提出。

► 拆卸完成。彻底清洁搅拌器并进行储存。

8.4.2 使用下降装置

✓ 搅拌器已停止运行。

✓ 已按照工作规程提供防护装备。

1. 将搅拌器断电。
2. 拆下接线电缆并将其卷起。
3. 将提升设备放入升降装置中。
4. 缓慢提升搅拌器，将其从水池取出。在提升过程中，将接线电缆从提升设备上松开并将其卷起。
   危险！搅拌器和接线电缆系直接从流体中取出。按照工作规程佩戴防护装备！
5. 摆动搅拌器并将其放在安全的底座上。

► 拆卸完成。彻底清洁搅拌器和安装位置，必要时进行消毒，之后进行储存。

8.4.3 清洁和消毒

危险

危害健康的介质会导致危险！

如果在危害健康的介质中使用过搅拌器，可能有生命危险!执行所有其他工作之前，需要对搅拌器进行净化处理！进行清洁事需要佩戴下列防护装备：

- 封闭式护目镜
- 氧气面罩
- 防护手套

⇒ 所列设备是最低要求，注意工作规程中的相关规定！运营者必须保证工作人员已经收到并阅读工作规程！

✓ 已拆下搅拌器。

✓ 接线电缆的裸露端部已经进行防水密封。

✓ 脏污的清洁用水已经按照本地实行的相关规定排入污水管道。

✓ 已准备消毒剂，供受到污染的搅拌器使用。

1. 将提升设备固定在吊挂点上。
2. 将搅拌器提升到距离池底大约 30 cm (10 in) 的位置。
3. 从上到下，向搅拌器喷射清水。**注意！ 如果搅拌器受到污染，需要使用相应的消毒剂！必须严格遵守工作规程的相关说明！**
4. 从各个方向向螺旋桨喷水。
5. 将池底的脏污残渣冲入下水道。
6. 使搅拌器干燥。

9 维护和维修

危险

危害健康的介质会导致危险！

如果在危害健康的介质中使用搅拌器，可能有生命危险。

- 拆卸后和执行所有其他工作前，需要对搅拌器进行净化处理。
- 遵守工作规程的相关规定。运营者必须保证工作人员已经收到并阅读工作规程。

注意

请只使用技术方面毫无瑕疵的提升设备！

请只使用技术方面毫无瑕疵的提升设备提升和降低搅拌器。确保搅拌器在升降过程中不会卡住。**切勿**超过提升设备允许的最大承载能力！开始使用之前，先检查提升设备的功能是否正常！

- 在照明和通风条件优良的干净环境中进行保养。将搅拌器放在稳固底座上，采取安全措施防止掉落/滑落。**注意！ 切勿将搅拌器放在螺旋桨上！**
- 只执行本安装及操作说明中列出的保养工作。
- 进行保养时穿戴以下防护装备：
  - 护目镜
  - 安全鞋
  - 安全手套

9.1 工作人员资格鉴定

- 电气作业：电气作业必须由专业电工执行。
- 保养工作：必须由熟悉所使用工作介质及其废弃处置的专业人员执行。此外工作人员还必须具有机械制造方面的基础知识。

9.2 运营者的责任

- 提供必要的防护装备并保证工作人员佩戴防护装备。
- 使用合适的容器收集工作介质并按规定进行废弃处理。
- 按规定对使用过的防护服进行废弃处理。

- 只使用生产商提供的原装部件。由于使用非原装部件而造成的任何损失，生产商概不承担任何责任。
- 一旦发生流体和工作介质泄露事故，立即收集泄漏物并按照当地现行法规进行废弃处理。
- 提供需要使用的工具。
- 使用易燃溶剂和清洁剂时，应禁止明火、明灯和吸烟。

9.3 工作介质

9.3.1 油类型

出厂时密封室内灌注了药用白油。换油时建议使用下列型号的油：

- Aral Autin PL*
- Shell ONDINA 919
- Esso MARCOL 52* 或 82*
- BP WHITEMORE WOM 14*
- Texaco Pharmaceutical 30* 或 40*

根据“USDA-H1”，标有“*”的所有油品允许食用。

9.3.2 润滑脂

使用下列润滑脂：

- Esso Unirex N3
- Tripol Molub-Alloy-Food Proof 823 FM（获得**“USDA-H1”**认证）

9.3.3 加注量

- TR 14:0.35 l (12 US.fl.oz.)
- TR 16:0.35 l (12 US.fl.oz.)
- TR 21:0.35 l (12 US.fl.oz.)
- TR 22:1.30 l (44 US.fl.oz.)
- TR 28:0.35 l (12 US.fl.oz.)
- TR 36:1.10 l (37 US.fl.oz.)
- TR 40:1.10 l (37 US.fl.oz.)

规定的加注量适用于所述安装方式。如果安装方式有异，则采用随附数据表给出的加注量。

9.4 保养间隔

为了保证设备可靠地运行，必须定期进行保养。在实际应用中，可以根据实际工作条件，确定与合同中所列间隔时间不同的保养间隔！如果在运行过程中出现剧烈振动，必须检查搅拌器和安装情况，不可拘泥于规定的保养间隔。

9.4.1 一般工作条件下的保养间隔

8000 个运行小时或者最迟 **2** 年后

- 目检接线电缆
- 目检电缆支架和绳索张力情况
- 目检搅拌器的磨损情况
- 检查监控设备的功能
- 目视检查附件
- 换油

15000 个运行小时或者最迟 **10** 年后

- 大修

9.4.2 恶劣条件下的保养间隔

在恶劣条件下，必要时必须缩短规定的保养间隔。恶劣或者繁重的生产条件是指以下情况：

- 流体中含有长纤维成分
- 流体具有强度腐蚀或磨蚀性
- 流体生成大量气体
- 在不合适的工况点运行
- 流动状态不适宜（部件或通风等因素导致）

在恶劣条件下使用搅拌器时，建议签订保养合同。相关事宜请联系客户服务部。

9.5 保养措施

警告

螺旋桨叶片的尖锐边缘！

螺旋桨叶片可能逐渐形成尖锐边缘，导致四肢被割伤。注意佩戴防护手套，防止出现切割受伤的情况。

警告

不穿戴防护装备会导致手、脚和眼睛受伤！

工作时存在（严重）受伤危险。穿戴以下防护装备：

- 安全手套，用以预防切割伤害
- 安全鞋
- 封闭式护目镜

开始采取保养措施之前，必须满足下列前提条件：

- 电机已冷却到环境温度。
- 彻底清洁搅拌器，必要时进行消毒。

9.5.1 建议的保养措施

建议定期检查电耗和所有三个相位的工作电压，以此保证产品顺畅运行。在正常运行情况下，这些数值保持恒定。受流体性质的影响，会出现轻微波动。

根据电耗情况，可以在早期发现搅拌器损坏或者功能失灵并排除故障。电压大幅度波动会加重电机绕组的负荷，可能导致故障。定期检查可以避免造成严重的间接性损失，同时降低发生全损事故的风险。建议采用远程监控方式进行定期检查。

9.5.2 目检接线电缆

检查接线电缆的以下几方面：

- 气泡
- 裂纹
- 划痕
- 摩擦情况
- 挤压情况
- 化学侵蚀致变

一旦确定接线电缆受损，立刻将搅拌器停止运行！联系客户服务部更换接线电缆。只有经过专业排除故障之后，才能重新将搅拌器投入运行！

小心！ 接线电缆损坏可能导致搅拌器进水！进水会导致搅拌器全损。

9.5.3 目检电缆支架和绳索张力情况

检查电缆支架和接线电缆张紧装置（提升设备或单独的尼龙绳），查看材料疲劳和材料损耗情况。如果发现磨损症状，立刻更换损坏的部件。

9.5.4 目检搅拌器的磨损情况

检查各部件（螺旋桨、桨毂等）的损坏和磨损情况。如果确定存在缺陷，注意下面几项：

- 如果涂层损坏，需要修复涂层。
- 如果部件发生磨损，请联系客户服务部并更换部件！

9.5.5 监控设备功能检查

检查电阻之前，必须先将搅拌器冷却至环境温度！

9.5.5.1 检查温度传感器的电阻

使用电阻表测量温度传感器的电阻。必须遵守下列测量值：

- **双金属片**：测量值 = 0 Ohm（通过）。
- **PTC 传感器**（正温度系数电阻）：测量值取决于安装的传感器个数。PTC 传感器的冷态电阻介于 20 至 100 Ohm 之间。
  – 如果串联三个传感器，测量值介于 60 至 300 Ohm 之间。
  – 如果串联四个传感器，测量值介于 80 至 400 Ohm 之间。

9.5.5.2 检查用于进行密封室监控的外部电极的电阻

使用电阻表测量电极的电阻。测得的数值必须趋向于“无穷大”。如果数值≤30 kOhm，说明油中有水，换油！

9.5.6 目视检查附件

附件必检项：

- 是否正确固定
- 功能是否正常
- 有无磨损症状，比如振动导致的裂纹

一旦确定存在缺陷，必须立刻维修或者更换附件。

9.5.7 换油

警告

工作介质承受高压！

电机内可能形成高达数巴的压力！打开螺旋塞时，这种压力会向外冲出。如果打开螺旋塞时不注意，它可能会高速弹出！请始终遵守以下指示，避免受伤：

- 遵守规定的工作步骤顺序。
- 缓慢转动螺旋塞，不要完全拧出。开始泄压之后（可听见空气鸣叫声或嘶嘶声），不要继续转动螺旋塞！
- 待泄压完成之后，完全拧出螺旋塞。
- 戴上封闭式护目镜。

警告

高温工作介质导致烫伤！

泄压时可能喷出高温工作介质，进而导致烫伤！请务必遵守以下指示，避免受伤：

- 将电机冷却到环境温度，之后打开螺旋塞。
- 佩戴封闭式护目镜或面部保护装置以及手套。

9.5.7.1 密封壳体换油 (TR 14/16/21/28)

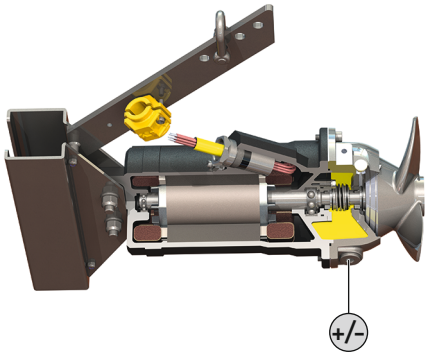


Fig. 13: 换油

+/-	密封壳体排油/注油

✓ 搅拌器未安装。

✓ 搅拌器未连接电网。

✓ 防护装备就位！

1. 将搅拌器水平放在固定的底座上。
   警告！ 双手可能因挤压而受伤。保证搅拌器不会掉落或滑动！
   小心！ 切勿将搅拌器放在螺旋桨上！视螺旋桨直径而定，合理使用基座。
2. 放置合适的容器用于收集工作介质。
3. 拧出螺旋塞 **(+/-)**。
4. 使搅拌器侧倾，排出工作介质。
5. 检查工作介质：如果工作介质内有金属屑，请联系客户服务部！
6. 按照当地法规对工作介质进行废弃处理！
7. 重新水平放置搅拌器，使开孔朝上。
8. 通过螺旋塞 **(+/-)** 的开孔注入工作介质。
   ⇒ 遵守规定的工作介质类型和数量！
9. 清洁螺旋塞 **(+/-)**，装入新密封环，重新拧入。**最大拧紧扭矩：8 Nm (5.9 ft·lb)！**
10. 重新采取防腐措施：使用 Sikaflex 等密封螺旋塞。

9.5.7.2 密封壳体换油 (TR 22/36/40)

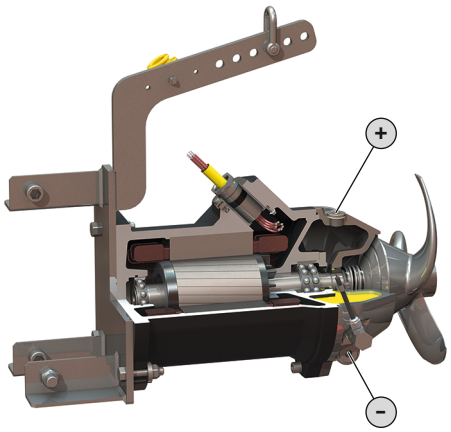


Fig. 14: 换油

+	密封壳体注油
-	密封壳体排油

✓ 搅拌器未安装。

✓ 搅拌器未连接电网。

✓ 防护装备就位！

1. 将搅拌器水平放在固定的底座上。
   警告！ 双手可能因挤压而受伤。保证搅拌器不会掉落或滑动！
   小心！ 切勿将搅拌器放在螺旋桨上！视螺旋桨直径而定，合理使用基座。
2. 放置合适的容器用于收集工作介质。
3. 拧出螺旋塞 **(+)**。
4. 拧出螺旋塞 **(–)** 并排出工作介质。
5. 检查工作介质：如果工作介质内有金属屑，请联系客户服务部！
6. 按照当地法规对工作介质进行废弃处理！
7. 清洁螺旋塞 **(–)**，装入新密封环，重新拧入。**最大拧紧扭矩：8 Nm (5.9 ft·lb)！**
8. 通过螺旋塞 **(+)** 的开孔注入工作介质。
   ⇒ 遵守规定的工作介质类型和数量！
9. 清洁螺旋塞 **(+)**，装入新密封环，重新拧入。**最大拧紧扭矩：8 Nm (5.9 ft·lb)！**
10. 重新采取防腐措施：使用 Sikaflex 等密封螺旋塞。

9.5.8 大修

大修时检查下列部件的磨损和损坏情况：
- 马达轴承
- 变速器轴承和行星齿轮级
- 螺旋桨
- 轴封
- O 形圈
- 连接电缆
- 加装附件

使用原装件更换损坏的部件，如此可保证正常运行。大修由生产商或者授权的维修厂执行。

9.6 维修工作

警告

螺旋桨叶片的尖锐边缘！

螺旋桨叶片可能逐渐形成尖锐边缘，导致四肢被割伤。注意佩戴防护手套，防止出现切割受伤的情况。

警告

不穿戴防护装备会导致手、脚和眼睛受伤！

工作时存在（严重）受伤危险。穿戴以下防护装备：
- 安全手套，用以预防切割伤害
- 安全鞋
- 封闭式护目镜

开始维修前，必须满足下列前提条件：
- 搅拌器已冷却至环境温度。
- 搅拌器已断电并采取安全措施防止意外重启。
- 彻底清洁搅拌器，必要时进行消毒。

维修工作一般原则：
- 如有流体和工作介质低落，立刻进行收集！
- 必须更换 O 形圈、密封垫和螺钉锁紧装置！
- 注意附录给出的拧紧扭矩！

- 实施这些工作时，严禁使用蛮力！

9.6.1 螺钉锁紧装置使用提示

螺栓可以配备一个螺钉锁紧装置。出厂时有两种螺栓锁紧方式：
- 液体螺栓防松
- 机械螺栓防松

必须更换螺钉锁紧装置！

液体螺栓防松

使用中等强度的螺丝防松胶（比如 Loctite 243）实现液体螺栓锁紧。施加力度较大时，这种锁紧方式就会失效。如果螺栓锁紧松不开，必须将连接处加热到大约 300 °C (572 °F)。拆卸后彻底清洁部件。

机械螺栓防松

机械螺钉锁紧装置由两个 Nord-Lock 楔形锁紧垫圈构成。螺栓连接的这种锁紧方式通过夹紧力实现。

9.6.2 允许执行哪些维修工作

- 更换螺旋桨
- 更换液体侧机械密封。
- 更换机架。
- 更换池底安装用托架。

9.6.3 更换螺旋桨

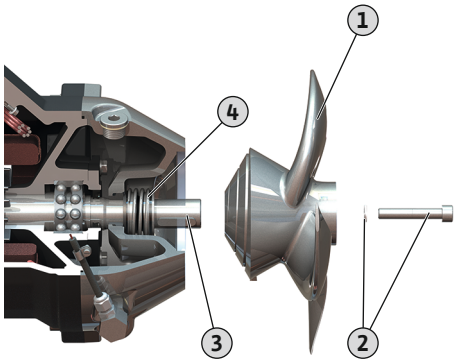


Fig. 15: 更换螺旋桨

1	螺旋桨
2	螺旋桨固定装置：内六角螺栓和垫圈
3	轴
4	机械密封

✓ 搅拌器已放置并固定在坚实底座上。

✓ 工具已就位。

1. 拧松螺旋桨固定装置并将其拧下。**注意！ 使用合适的辅助工具锁止螺旋桨。**
2. 小心地将螺旋桨从轴上拔下来。**小心！ 这时机械密封已经不再处于固定状态。搅拌器必须与螺旋桨一起运行！如果搅拌器不带螺旋桨运行，会导致机械密封损毁。一旦机械密封损坏，密封室内的油会流出。**
3. 清洁轴并涂抹新的润滑脂。
4. 小心推入新螺旋桨，直至止挡处。
5. 将螺丝防松胶涂抹在内六角螺栓上，套上垫圈，拧入轴中。
6. 拧紧螺旋桨固定装置。最大拧紧扭矩：见附录。
7. 用手转动螺旋桨，检查灵活度。

► 螺旋桨更换完毕。检查密封壳体内的油量，必要时补注。

9.6.4 更换液体侧机械密封

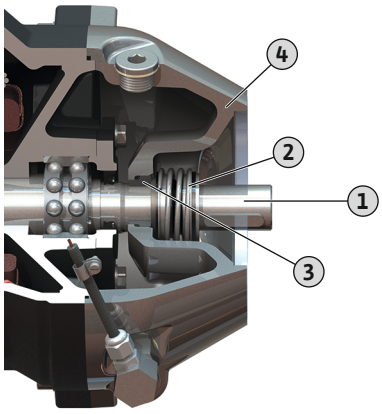


Fig. 16: 更换机械密封

1	轴
2	机械密封：弹簧
3	机械密封：对环
4	密封壳体

✓ 搅拌器已放置并固定在坚实底座上。

✓ 工具已就位。

✓ 已排出密封壳体内的油。

✓ 已拆下螺旋桨。

1. 从轴上取下平键。
2. 从轴上拔下机械密封的弹簧和垫圈。
3. 从壳体底座中压出机械密封的对环并将其从轴上拔下。
4. 清洁轴并检查磨损和腐蚀情况。**警告！ 如果轴损坏，请联系客户服务部！**
5. 使用去除张力后的水或洗涤剂润滑轴。**小心！ 严禁使用油或油脂作为润滑剂！**

6. 借助安装工具，将机械密封的新对环压入壳体底座中。小心！ 压入对环时注意不要倾斜。如果压入时对环倾斜，对环会碎裂。之后就无法继续使用机械密封！
7. 将机械密封的新弹簧和垫圈套在轴上。
8. 清洁平键并将其放入轴的凹槽内。
9. 安装螺旋桨。

► 机械密封更换完毕。向密封壳体内注油。

9.6.5 更换机架

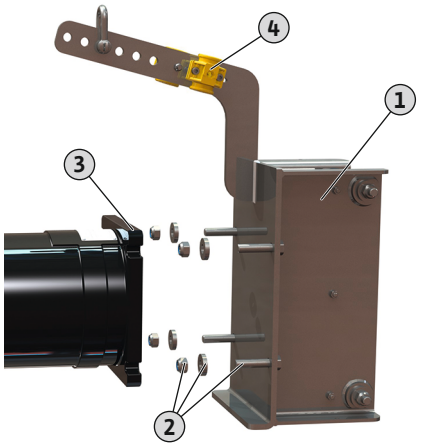


Fig. 17: 更换机架

1	机架
2	4 种固定材料：六角螺栓、垫圈、六角螺母
3	电机法兰
4	用于消除应力的电缆支架

✓ 搅拌器已放置并固定在坚实底座上。

✓ 电机已支起，可以顺利更换机架。

✓ 工具已就位。

1. 打开电缆支架，取出接线电缆。
2. 松开并旋出六角螺母。
3. 从六角螺栓上拔下垫圈。
4. 从电机法兰上拔下机架。
5. 清洁电机法兰上的污垢，比如沉积物、老密封材料等。
6. 从机架中拔出六角螺栓并插入新机架。
7. 将螺丝防松胶涂在六角螺栓上。
8. 将新机架套在电机法兰上。
9. 将垫圈套在六角螺栓上。
10. 拧紧六角螺母。最大拧紧扭矩：见附录。
11. 将接线电缆放在电缆支架中，闭合电缆支架。小心！ 不要拧紧电缆支架！
12. 校准接线电缆：接线电缆形成一个小弧度，不拉紧。
13. 紧紧闭合电缆支架。
14. 采取防腐措施（比如使用 Sikaflex）：
    - 填充电机法兰与机架之间的密封缝。
    - 填充电机法兰上的长孔，直至垫圈处。

► 机架更换完毕。

9.6.6 更换池底安装用托架

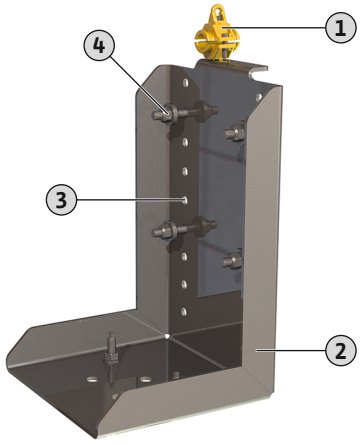


Fig. 18: 池底安装用托架

1	用于消除应力的电缆支架
2	托架
3	高度光栅
4	4 种固定材料：六角螺栓、垫圈、六角螺母

✓ 搅拌器已放在坚实底座上。

✓ 安排两人执行作业！

✓ 工具已就位。

1. 打开电缆支架，取出接线电缆。
2. 松开并旋出六角螺母。
3. 从六角螺栓上拔下垫圈。
4. 2.工作人员：从托架上取下搅拌器并拿在手中。
5. 取出六角螺栓。
6. 将六角螺栓插入新托架。
   注意！ 注意高度光栅！螺旋桨不得与地面发生碰撞！
7. 2.工作人员：将搅拌器插在六角螺栓上。
8. 将垫圈套在六角螺栓上。

9. 拧紧六角螺母。最大拧紧扭矩：见附录。
10. 将接线电缆放在电缆支架中，闭合电缆支架。小心！不要拧紧电缆支架！
11. 校准接线电缆：接线电缆形成一个小弧度，不拉紧。
12. 紧紧闭合电缆支架。

► 托架更换完毕。

10 故障、原因和排除方法

危险

危害健康的介质会导致危险！

如果搅拌器装在危害健康的介质中，可能有生命危险!工作时需要穿戴以下防护装备：

- 封闭式护目镜
- 氧气面罩
- 防护手套

⇒ 所列设备是最低要求，注意工作规程中的相关规定！运营者必须保证工作人员已经收到并阅读工作规程！

危险

小心触电死亡！

执行电气作业时不按规定操作，会发生电击致死事故！电气作业必须由专业电工按照当地的相关规定执行。

危险

独自执行危险作业导致生命危险！

需要在竖井和狭窄空间内完成的工作，以及存在坠落危险的工作，这两个都是危险工种，不允许单人独自作业！为安全起见，必须有第二个人在场。

警告

禁止工作人员在搅拌器工作区域内停留！

搅拌器运行时会吸拉工作人员，导致（严重）受伤！因此禁止人员在其工作区域内停留。如果有人进入搅拌器的工作区域，使搅拌器停止运行并采取安全措施防止意外重启！

警告

螺旋桨叶片的尖锐边缘！

螺旋桨叶片可能逐渐形成尖锐边缘，导致四肢被割伤。注意佩戴防护手套，防止出现切割受伤的情况。

故障：搅拌器不启动

1. 电源连接中断或者导线/电机绕组发生短路/对地短路。
   ⇒ 安排专业电工检查接线和电机，必要时进行更换。
2. 电机保护开关或监控设备的断路器脱扣。
   ⇒ 安排专业人员检查接线和监控设备，必要时进行改动。
   ⇒ 安排专业电工按照技术规定安装电机保护开关和断路器并进行设置，重置监控设备。
   ⇒ 检查螺旋桨的灵活性，必要时清洁螺旋桨和机械密封。
3. 密封室监控设备（选配）电路断路（取决于接线）。
   ⇒ 参见“故障：机械密封泄漏，前室/密封室监控设备报告故障并关闭搅拌器”

故障：搅拌器启动后，很快就触发电机保护

1. 电机保护开关设置错误。
   ⇒ 安排专业电工检查触发器设置并进行修正。
2. 高电压降导致高电耗。
   ⇒ 安排专业电工检查各相位的电压值。联系电网运营商。
3. 接线只有两相。
   ⇒ 安排专业电工检查接线并进行修正。
4. 相位之间电压差异大。
   ⇒ 安排专业电工检查各相位的电压值。联系电网运营商。
5. 旋转方向错误。
   ⇒ 安排专业电工修正接线。
6. 堵塞导致高电耗。
   ⇒ 清洁螺旋桨和机械密封。
   ⇒ 检查预清洁装置。
7. 流体密度过高。
   ⇒ 检查设备布局。
   ⇒ 联系客户服务部。

故障：搅拌器运行，但是达不到设备参数

1. 螺旋桨堵塞。
   ⇒ 清洁螺旋桨。
   ⇒ 检查预清洁装置。
2. 旋转方向错误。
   ⇒ 安排专业电工修正接线。
3. 螺旋桨有磨损迹象。
   ⇒ 检查螺旋桨，必要时更换。
4. 接线只有两相。
   ⇒ 安排专业电工检查接线并进行修正。

故障：搅拌器运行不安静，噪声大

1. 不允许的工况点。
   ⇒ 检查流体的密度和黏度。
   ⇒ 检查设备布局，咨询客户服务部。
2. 螺旋桨堵塞。
   ⇒ 清洁螺旋桨和机械密封。
   ⇒ 检查预清洁装置。
3. 接线只有两相。
   ⇒ 安排专业电工检查接线并进行修正。
4. 旋转方向错误。
   ⇒ 安排专业电工修正接线。
5. 螺旋桨有磨损迹象。
   ⇒ 检查螺旋桨，必要时更换。
6. 电机轴承磨损。
   ⇒ 联系客户服务部；搅拌器返厂维修。

其他故障排除方法

如果所述方法于故障排除无益，请联系客户服务部。客户服务部门可如下提供帮助：

- 通过电话或邮件提供帮助。
- 提供现场支持。
- 返厂检查和维修。

如果向客户服务部门提出支援请求，可能会产生费用！具体金额请咨询客户服务部。

11 备件

请在客户服务部订购备件。为了减少询问，同时避免出现订购错误，请提供序列号或商品号。**保留技术变更权利！**

12 废弃处置

12.1 油和润滑剂

工作介质必须被收集到一个适当的容器中，并根据当地现行的指令废弃处置。

12.2 防护服

穿过的防护服必须根据当地现行的指令废弃处置。

12.3 收集用过的电气和电子产品的相关信息

按规定废弃处置和正确回收这些产品，能避免环境污染、保护人类的健康。

注意

禁止作为生活垃圾废弃处置！

在欧盟地区，该标志张贴在产品、包装或随附的资料中。它的意思是，相关的电气和电子产品不得作为生活垃圾废弃处置。

在按规定处理、回收和废弃处置相关旧产品时，要注意以下几点：

- 这些产品只能交给专门为此设立且获得认证的垃圾处理场。
- 注意当地现行的规定！

有关按规定废弃处置的信息，请咨询当地社区、最近的垃圾处理场或您购买产品的经销商。关于回收的详细信息请参见 www.wilo-recycling.com。

13 附件

13.1 拧紧扭矩

A2/A4 不锈钢螺栓			
螺纹	拧紧扭矩		
	Nm	**kp m**	**ft·lb**
M5	5.5	0.56	4
M6	7.5	0.76	5.5
M8	18.5	1.89	13.5
M10	37	3.77	27.5
M12	57	5.81	42
M16	135	13.77	100
M20	230	23.45	170
M24	285	29.06	210
M27	415	42.31	306
M30	565	57.61	417

如果使用 Nord-Lock 螺钉锁紧装置，将拧紧扭矩提高 10 % ！

13.2 使用变频器运行

电机可与变频器串联（遵守 IEC 60034-17 标准）运行。如果额定电压超过 415 V/50 Hz 或 480 V/60 Hz，必须咨询客户服务部。由于高次谐波会导致电机额外升温，因此电机的额定功率必须高出搅拌器的功率需求 10 % 左右。如果变频器配备无高次谐波的输出端，可能可将功率储备降低 10 %。使用输出端滤波器可以减弱高次谐波。变频器必须与滤波器相互匹配。

根据电机额定电流对变频器进行配置。务必注意：尤其处于低转速范围的情况下，搅拌器工作时应该保持不晃动、不振动。否则机械密封会丧失密封性并损坏。搅拌器在整个调节范围内工作时，不得出现振动、共振和摆动力矩现象，噪音也不能过度，这一点很重要。电源受谐波影响，导致发动机噪音音量提升，属于正常现象。

为变频器设置参数时，注意遵守潜水电机和风扇二次特征曲线（U/f 特征曲线）的设置！U/f 特征曲线确保在频率低于额定频率（50 Hz 或 60 Hz）时，输出端电压能

够满足搅拌器的功率需求。新型变频器具有能源自动优化功能 – 这种自动机制的目标是达到相同的效果。进行变频器设置时，请注意变频器的安装及操作说明。

如果电机与变频器配套运行，视型号和安装条件而定，电机监控可能受到干扰。采取下列措施，可以降低或避免干扰：
- 遵守 IEC 60034-25 标准规定的电压峰值极限值和上升速度极限值。可能必须安装输出端滤波器。
- 改变变频器的脉冲频率。
- 如果内部密封室监控设备发生故障，使用外部双杆湿度电极。

下列结构性措施也可以减少或者避免干扰：
- 干线和控制线具有单独的电源线（视电机规格而定）。
- 布线时，在干线和控制电缆之间留出足够的间距。
- 使用已屏蔽的电源线。

汇总
- 连续运行，直至达到额定频率（50 Hz 或 60 Hz）。
- 注意与电磁兼容性规定有关的附加措施（选择变频器、使用滤波器等）。
- 不得超出电机的额定电流与额定转速。
- 必须能够连接电机自带的温度监控装置（双金属或 PTC 传感器）。

13.3 防爆认证

本章节详细介绍在爆炸性环境中运行搅拌器的相关信息。所有工作人员都必须阅读本章节内容。**本章节仅适用于获得防爆认证的搅拌器！**

13.3.1 获得防爆认证的搅拌器标识

在爆炸性气体中使用时，搅拌器铭牌上必须具有下列标识：
- 相应认证的防爆标识
- 防爆等级
- 认证编号（取决于认证机构）
  如果认证机构要求，会在产品铭牌上刻印认证编号。

13.3.2 防护等级

电机的结构规格符合下列防护等级：
- 防火外壳 (ATEX)
- Explosionproof (FM)
- Flameproof enclosures (CSA-EX)

为了限制表面温度，电机至少装有一个温度限制装置（单电路温度监控装置）。此外还能进行温度调节（双电路温度监控）。

13.3.3 规定用途

防爆许可

搅拌器适合在潜在爆炸环境中运行：
- 设备组：II
- 类别：2，1 区和 2 区
  搅拌器不得在 0 区使用！

FM **认证**

搅拌器适合在潜在爆炸环境中运行：
- 防护等级：Explosionproof
- 类别：Class I，Division 1
  注意：如果根据 Division 1 布线，则也允许在 Class I, Division 2 中安装。

CSA **防爆认证**

搅拌器适合在潜在爆炸环境中运行：
- 防护等级：Explosion-proof
- 类别：Class 1，Division 1

13.3.4 电气连接

危险

小心触电死亡！

执行电气作业时不按规定操作，会发生电击致死事故！电气作业必须由专业电工按照当地的相关规定执行。

- 始终在潜在爆炸环境以外对搅拌器进行电气连接。如果必须在潜在爆炸环境内接线，则在获得防爆认证的外壳（符合 DIN EN 60079-0 标准规定的防爆等级）内进行！如不遵守，爆炸会导致生命危险！接线工作须由专业电工执行。
- 所有位于“防火花区域”以外的监控设备，必须连接一个本安电路（比如 Ex-i 继电器 XR-4...）。
- 电压公差最大不得超过 ±10 %。

可能的监控设备概述：

型号	TR 14	TR 16	TR 21	TR 22	TR 28	TR 36	TR 40
电机舱	o	o	o	–	o	–	–
电机绕组：温度限制装置	•	•	•	o	•	o	o
电机绕组：温度调节和限制装置	o	o	o	•	o	•	•
密封室（外部铅芯湿度电极）	o	o	o	o	o	o	o

图例

– = 不存在/不可能，o = 可选，• = 批量的

13.3.4.1 电机绕组监控装置

危险

电机过热导致爆炸风险！

如果温度限制装置接线错误，可能由于电机过热而引起爆炸！温度限制装置必须连接一个手动重启锁定装置。也就是说，“解锁按钮”必须手动操作！

视电机过热保护规格而定，达到阈值后必须实现下列触发状态：

- 温度限制装置（1 温度回路）：
  达到阈值之后，必须**使用重启锁定功能**执行一次关闭操作。
- 温度调节装置和限制装置（2 温度回路）：
  达到低温阈值后，可以通过自动重启功能执行一次关闭操作。达到高温阈值后，必须**通过重启锁定功能**执行一次关闭操作。

小心！过热会导致电机损坏！自动重启时，注意遵守规定的最大开关频率和开关间歇时间！

连接电机过热保护

- 通过一个评测继电器连接双金属片。建议使用“CM-MSS”继电器。已预设阈值。
  连接值：最大 250 V(AC)，2.5 A，cos φ = 1
- 通过一个评测继电器连接 PTC 传感器。建议使用“CM-MSS”继电器。已预设阈值。

13.3.4.2 密封室监控装置（外部电极）

- 通过一个获得防爆认证的评测继电器连接外部铅芯湿度电极！建议使用“XR-4...”继电器。
  阈值为 30 kΩ。
- 连接必须通过本安电路实现！

13.3.4.3 在变频器上运行

- 变频器型号：脉冲宽度调制
- 连续运行：30 Hz 至额定频率（50 Hz 或 60 Hz）。
- 最小开关频率：4 kHz
- 接线端子板最大电压峰值：1350 V
- 变频器输出电流：最高为额定电流的 1.5 倍
- 最长过载时间：60 s
- 扭矩波动：二次特征曲线
  可根据需求提供转速/扭矩特征曲线！
- 注意与电磁兼容性规定有关的附加措施（选择变频器、滤波器等）。
- 切勿超过电机的额定电流与额定转速。
- 必须能够连接电机自带的温度监控装置（双金属或 PTC 传感器）。
- 如果耐温等级标记为 T4/T3，则适用 T3 级别。

13.3.5 试运行

危险

使用未获得认证的搅拌器可能引发爆炸风险！

爆炸导致生命危险！潜在爆炸环境内只能使用铭牌上标有防爆字样的搅拌器。

- 潜在爆炸环境由运营者负责划分。
- 潜在爆炸环境内只允许使用获得防爆认证的搅拌器。
- 获得防爆认证的搅拌器须在铭牌上标注说明。
- 切勿超过**最高流体温度**！
- 根据 DIN EN 50495 标准，类别 2 需要装备一台 SIL 1 级安全装置，而且硬件必须达到零容错标准。

13.3.6 维护和维修

- 按规定进行保养。
- 只执行本安装及操作说明中列出的保养工作。
- 在防火花缝开展维修作业时，**只能**按照生产商提供的设计参数执行作业。不允许按照 DIN EN 60079-1 标准表 1 和表 2 的数值进行维修。
- 请只使用生产商指定的螺旋塞，最低要求是强度等级达到 600 N/mm² (38.85 long tons-force/inch²)。

13.3.6.1 修复壳体涂层

涂层厚度较大时，漆层可能产生静电。**危险！有爆炸危险！静电在爆炸性环境中释放会导致爆炸！**

修复壳体涂层时，厚度不可超过 2 mm (0.08 in)！

13.3.6.2 更换接线电缆

严禁更换接线电缆！

13.3.6.3 更换机械密封

严禁更换电机侧密封件！

Table of contents

1 General information

1.1 About these instructions

These installation and operating instructions are an integral part of the product. Read these instructions before commencing work and keep them in an accessible place at all times. Strict adherence to these instructions is a precondition for the intended use and correct operation of the product. All information and markings on the product must be observed.

The language of the original operating instructions is German. All other languages of these instructions are translations of the original operating instructions.

1.2 Copyright

1.3 Subject to change

The manufacturer reserves the right to make technical modifications to the device or individual components. The illustrations used may differ from the original and are intended as an example representation of the device.

1.4 Warranty

The specifications in the current "General Terms and Conditions" apply to the warranty and the warranty period. These can be found at www.wilo.com/legal

Any deviations must be contractually agreed and shall then be given priority.

Claim to warranty

If the following points are complied with, the manufacturer is obligated to rectify every qualitative or constructive flaw:
- The defects are reported in writing to the manufacturer within the warranty period.
- Application according to intended use.
- All monitoring devices are connected and tested before commissioning.

Exclusion from liability

Exclusion from liability excludes all liability for personal injury, material damage or financial losses. This exclusion ensues as soon as one of the following applies:
- Inadequate configuration due to inadequate or incorrect instructions by the operator or the client
- Non-compliance with installation and operating instructions
- Improper use
- Incorrect storage or transport
- Incorrect installation or dismantling
- Insufficient maintenance
- Unauthorised repairs
- Inadequate construction site
- Chemical, electrical or electro-chemical influences
- Wear

2 Safety

This chapter contains basic information for the individual phases of the life cycle. Failure to observe this information carries the following risks:
- Injury to persons from electrical, mechanical and bacteriological factors as well as electromagnetic fields
- Environmental damage from discharge of hazardous substances
- Property damage
- Failure of important functions of the product

Failure to observe the information contained herein will result in the loss of claims for damages.

The instructions and safety instructions in the other chapters must also be observed!

2.1 Identification of safety instructions

These installation and operating instructions set out safety instructions for preventing personal injury and damage to property. These safety instructions are shown differently:
- Safety instructions relating to personal injury start with a signal word, are **preceded by a corresponding symbol** and are shaded in grey.

DANGER

Type and source of the danger!

Consequences of the danger and instructions for avoidance.

- Safety instructions relating to property damage start with a signal word and are displayed **without** a symbol.

CAUTION

Type and source of the danger!

Consequences or information.

Signal words

- **DANGER!**
  Failure to observe the safety instructions will result in serious injuries or death!
- **WARNING!**
  Failure to follow the instructions can lead to (serious) injuries!
- **CAUTION!**
  Failure to follow the instructions can lead to property damage and a possible total loss.
- **NOTICE!**
  Useful information on handling the product

Markups

✓ Prerequisite

1. Work step/list

   ⇒ Notice/instructions

► Result

Symbols

These instructions use the following symbols:


Danger of electric voltage


Danger of bacterial infection

Danger – explosive atmosphere


General warning symbol


Warning of cutting injuries


Warning of hot surfaces


Warning of high pressure


Warning of suspended loads


Personal protective equipment: wear a safety helmet


Personal protective equipment: wear foot protection


Personal protective equipment: wear hand protection


Personal protective equipment: wear safety harness


Personal protective equipment: wear mouth protection


Personal protective equipment: wear safety goggles


Working alone is prohibited! A second person must be present.


Useful information

2.2 Personnel qualifications

Personnel must:
- Be instructed about locally applicable regulations governing accident prevention.
- Have read and understood the installation and operating instructions.

Personnel must have the following qualifications.
- Electrical work: A qualified electrician must carry out the electrical work.
- Lifting work: A specialist suitably trained in the operation of lifting devices must carry out lifting work. Evidence must be presented in accordance with BGV D8 or applicable local regulations.
- Installation/dismantling: The technician must be trained in the use of the necessary tools and fixation materials for the relevant construction site.
- Maintenance tasks: The technician must be familiar with the use of operating fluids and their disposal. In addition, the technician must have basic knowledge of mechanical engineering.

Definition of "qualified electrician"

A qualified electrician is a person with appropriate technical education, knowledge and experience who can identify **and** prevent electrical hazards.

2.3 Electrical work

- Electrical work must be carried out by a qualified electrician.
- Before commencing work, disconnect the product from the mains and safeguard it from being switched on again.
- Observe applicable local regulations when connecting to the mains power supply.
- Adhere to the requirements of the local energy supply company.
- Train personnel in connecting electrics.
- Instruct personnel in options for switching off the device.
- Comply with the technical specifications contained in these installation and operating instructions and on the rating plate.
- Earth the device.
- Observe regulations for connection to the electrical switching system.
- Comply with the specifications on electro-magnetic compatibility when using electronic start-up controllers (e.g. soft starter or frequency converter). If required, take into account special measures (e.g. shielded cables, filters etc.).
- Replace defective connection cables. Contact customer service.

2.4 Monitoring devices

The following monitoring devices must be provided on-site:

Circuit breaker

The size and switching characteristics of the circuit breakers must conform to the rated current of the connected product. Observe local regulations.

Motor protection switch

Make provision for an on-site motor protection switch for devices without a plug! The minimum requirement is a thermal relay/motor protection switch with temperature compensation, differential triggering and anti-reactivation device in accordance with the local regulations. In case of sensitive mains, make provision for the installation on-site of other protective equipment (e.g. overvoltage, undervoltage or phase failure relay, etc.).

Residual-current device (RCD)

Comply with the regulations of the local energy supply company! The use of a residual-current device is recommended.
If persons come into contact with the device and conductive fluids, secure the connection **with** a residual-current device (RCD).

2.5 Use in fluids hazardous to health

There is a danger of bacterial infection when using the device in fluids hazardous to health! Thoroughly clean and disinfect the device after dismantling and prior to further use. The operator must ensure the following:

- The following protective equipment is provided and worn when cleaning the device:
  - Closed safety goggles
  - Breathing mask
  - Protective gloves
- All persons are informed about the fluid, the associated danger and its correct handling!

2.6 Transport

- Risk of injury from impact or crushing. Wear the following protective equipment:
  - Safety shoes
  - Safety helmet
- Locally applicable laws and regulations for work safety and accident prevention must be complied with.
- Demarcate the working area.
- Unauthorised persons must be kept away from the working area.
- Observe packaging regulations:
  - Impact-resistant
  - Ensure the product is properly fixed in place.
  - Protect it against dust, oil and moisture.
- Only use legally prescribed and approved lifting and hoisting gear.
- Select the lifting gear based on the prevailing conditions (weather, attachment point, load, etc.).
- Always attach the lifting gear to the attachment points and ensure they are securely attached.
- The stability of the hoisting gear must be ensured during operation.
- When using hoisting gear, a second person must be present to coordinate the procedure if required (e.g. if the operator's field of vision is blocked).
- Keep away from the hoisting gear's swivel range when hoisting the product.
- Persons are not permitted to stand beneath suspended loads. Do **not** carry suspended loads over workplaces where people are present.

2.7 Installing/dismantling

- Risk of injury from:
  - Slipping
  - Tripping
  - Impact
  - Crushing
  - Falling

  Wear the following protective equipment:
  - Safety shoes
  - Safety gloves for protection against cuts
  - Safety helmet
  - Safety harness
- Comply with laws and regulations on work safety and accident prevention in force at the site of installation.
- Demarcate the working area.
- Keep the working area free of ice.
- Keep the working area free of any objects lying around.
- If the weather conditions mean it is no longer possible to work safely, stop work.
- Keep unauthorised persons away from the working area.
- Work must always be carried out by two persons.

- When working at a height of more than 1 m (3 ft) above the ground, use scaffolding with a safety harness.
- Cordon off the working area around the scaffolding.
- Disconnect the device from the mains and secure it against being switched on again without authorisation.
- All rotating parts must be at a standstill.
- Make sure that there is no risk of explosion when carrying out any work with electrical devices.
- Only use properly functioning hoisting gear.
- Keep away from the hoisting gear's swivel range when hoisting the product.
- Toxic or asphyxiating gases may build up when working in closed rooms or buildings. Ensure there is sufficient ventilation and observe protective measures according to work regulations (examples):
  – Measure the gas concentration before entering.
  – Carry a gas detector with you.
  – etc.

2.8 During operation

- The work area in which the device is used is not a recreational area. No persons are allowed in the work area during operation.
- Wear protective equipment in accordance with the notice of the work regulations.
- The operator must immediately report any faults or irregularities to their line manager.
- If hazardous defects occur, the operator must immediately deactivate the device:
  – Malfunction of safety and monitoring devices
  – Damage to housing parts
  – Damage to electrical equipment
- The propeller must not bump into fixtures or walls in the operating space. Observe defined clearances to fixtures and basin walls in accordance with consulting documents.
- If the water level significantly fluctuates, ensure the required water immersion using level monitoring.
- Under normal operating conditions, the sound pressure level of the device is below 85 dB(A). However, the actual sound pressure level depends on several factors:
  – Installation depth
  – Installation type
  – Utilisation
  – Immersion depth

2.9 Maintenance tasks

- Risk of injury through crushing and hot operating fluid. Wear the following protective equipment:
  – Closed safety goggles
  – Protective gloves
  – Safety shoes
- Always carry out maintenance tasks outside the operating space.
- Only carry out maintenance tasks mentioned in these installation and operating instructions.
- Use only original parts from the manufacturer for maintenance and repairs. Use of parts other than the original parts releases the manufacturer from any liability.
- Collect any drips of fluid and operating fluid immediately and dispose of them according to locally applicable guidelines.

Changing operating fluid

In the event of a motor defect, pressure of **several bar can build up** in the sealing chamber! This pressure is released when the screw plugs are **opened**. If screw plugs are opened without due caution, they can be ejected at high speed! To avoid injuries, observe the following instructions:

- Adhere to the prescribed sequence of work steps.
- Unscrew the screw plugs slowly, but never unscrew them completely. As soon as pressure is released (audible whistling or hissing of air), stop turning the screw plug any further.
  WARNING! Hot operating fluids can also spray out when pressure is released. This can result in scalding! To avoid injuries, allow the motor to cool down to the ambient temperature before carrying out any work!
- When the pressure has been completely released, fully unscrew the screw plug.

2.10 Operating fluid

The seal housing is filled with white oil. Replace the operating fluid during regular maintenance work and dispose of it according to the local guidelines.

2.11 Operator responsibilities

- Provide installation and operating instructions in a language which the personnel can understand.
- Make sure that the personnel is relevantly trained for the specified work.
- Provide the necessary protective equipment and make sure that personnel wear it.
- Safety and information signs mounted on the device must always be legible.
- Train the personnel on how the system operates.
- Eliminate risk from electrical current.
- Demarcate and cordon off the working area.
- To ensure safe working practice, define personnel responsibilities.
- Carry out sound pressure measurement when the product is in normal operation. If the measured sound pressure is more than 85 dB(A), wear hearing protection and include such instruction in the work regulations!

3 Application/use

3.1 Intended use

The mixers are suitable for both intermittent and continuous duty in drainage and sewage (with and without faeces) as well as in sludge:

- for flow generation
- for suspension of solid matter
- for homogenisation

Intended use also includes compliance with this manual. Any use other than the intended use is regarded as improper use.

3.2 Improper use

The mixers must not be used in:

- Drinking water
- Non-Newtonian fluids
- Severely contaminated fluids containing hard components such as stone, wood, metals, etc.
- Highly flammable and explosive fluids in pure form

4 Product description

4.1 Construction

The submersible mixer consists of the following main components:

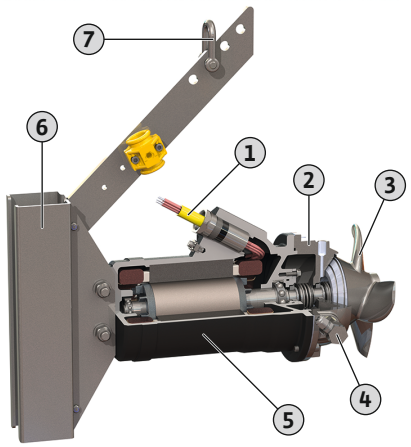


Fig. 1: Overview of the submersible mixer

1	Connection cable
2	Seal housing
3	Propeller
4	Pencil electrode (optional)
5	Motor
6	Frame for lowering device
7	Attachment point

4.1.1 Propeller

Propeller made of solid material with backward-curved incoming flow edge and patented helical hub. **NOTICE! The propeller must not emerge during operation. Observe specified minimum water immersion!**

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TRE 36...	TR 40...
Nominal diameter in mm (in)	140 (5.5)	160 (6)	210 (8)	220 (8.5)	280 (11)	360 (14)	400 (16)
Number of blades	2	2	2	3	2	3	3
Material version							
PUR	•	•	•	–	•	•	•
EN-GJL-250 (ASTM A48 Class 35/40B)	–	–	–	o	–	–	–
1.4571 (AISI 316TI)	–	–	o	–	–	o	o
1.4408 (ASTM A 351)	–	–	–	•	–	–	–

• = standard, – = not available, o = optional
* = high wear-resistant propeller made of composite PUR/GFK (PUR/GFRP) material featuring reinforced leading edge.

4.1.2 Motor

The system is driven by a surface-cooled motor in three-phase current version. The motor is fitted with maintenance-free, permanently lubricated and appropriately dimensioned roller bearings. The motor is cooled by the fluid around it. Waste heat is transferred directly to the fluid via the motor housing.

The connection cable is sealed water pressure-tight against the fluid and is sealed longitudinally watertight. The connection cable has bare cable ends and the standard length is 10 m (33 ft). Longer cables are available on request.

	TR...
Fluid temperature	3...40 °C (37...104 °F)
Protection class	IP68
Insulation class	H
Number of poles	4, 6, 8
Max. switching frequency	15/h
Max. immersion depth	20 m (66 ft)
Explosion protection	ATEX, FM, CSA
Operating mode, immersed	S1
Operating mode, non-immersed	-
Motor efficiency class	-
Housing material	EN-GJL-250 (ASTM A48 Class 35/40B)

4.1.3 Seal

Between the motor and propeller, there is the seal housing with the seal on the fluid and on the motor side.

The seal on the fluid side is provided by a mechanical seal. The mechanical seal is fitted with an additional packing sleeve. The packing sleeve ensures a durable and corrosion-resistant fit for the mechanical seal. The seal on the motor side involves either a rotary shaft seal or a mechanical seal.

The seal housing is filled with white oil and absorbs leakage from the seal on the fluid side.

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
Seal							
Fluid side: SiC/SiC	•	•	•	•	•	•	•
On the motor side: NBR (nitrile)	–	–	–	•	–	•	•
On the motor side: SiC/SiC	•	•	•	–	•	–	–
Housing material							
EN-GJL-250 (ASTM A48 Class 35/40B)	•	•	•	•	•	•	•

4.2 Monitoring devices

Overview of possible monitoring devices:

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
Internal monitoring devices							
Motor compartment	o	o	o	–	o	–	–
Motor compartment/sealing chamber*	–	–	–	o	–	o	o
Motor winding**	•	•	•	•	•	•	•
External monitoring devices							
Sealing chamber	o	o	o	o	o	o	o

Legend

– = not available/possible, o = optional, • = standard

* In the Ex version, this monitoring is omitted and not substituted!

** A temperature limiter is fitted as standard. The Ex version as per ATEX also features an installed temperature controller and limiter.

All the monitoring devices fitted must always be connected!

Monitoring of motor compartment

The motor compartment monitoring protects the motor winding from short-circuits. The moisture is measured by an electrode.

Monitoring the motor compartment and sealing chamber

The motor compartment monitoring protects the motor winding from short-circuits. Sealing chamber control detects fluid ingress through the mechanical seal on the fluid side. In each case, the humidity is recorded by an electrode in the motor compartment and sealing chamber.

NOTICE! The Ex version does not feature this monitoring unit!

Monitoring of motor winding

The thermal motor monitoring protects the motor winding from overheating. Temperature limiting with bimetallic strip is fitted as standard.

As an option, the temperature can also be measured with a PTC sensor. The thermal motor monitoring can also be designed as temperature control. This allows the measurement of two temperatures. When the low temperature is reached, an automatic reactivation can be initiated after cooling the motor. When the high temperature is reached, the unit must deactivate with reactivation lock.

External monitoring of the sealing chamber

The sealing chamber can be equipped with an external pencil electrode. The electrode registers fluid ingress through the mechanical seal on the fluid side. An alarm or deactivation of the pump can therefore take place by pump control.

4.3 Operating modes

Operating mode S1: Continuous duty

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

4.4 Operation with frequency converter

Operation on the frequency converter is permitted. Refer to the appendix for the relevant requirements!

4.5 Operation in an explosive atmosphere

Approval according to	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
ATEX	o	o	o	o	o	o	o
FM	o	o	o	o	o	o	o
CSA-Ex	o	o	o	o	o	o	o

Legend

– = not available/possible, o = optional, • = standard

For use in explosive atmospheres, the mixer must be marked as follows on the rating plate:
- "Ex" symbol of the corresponding approval
- Ex classification

For the relevant requirements, refer to the explosion protection chapter in the appendix of these installation and operating instructions!

ATEX approval

The mixers are suitable for operation in potentially explosive atmospheres:
- Device group: II
- Category: 2, zone 1 and zone 2

Mixers must not be used in zone 0!

FM approval

The mixers are suitable for operation in potentially explosive atmospheres:
- Protection class: Explosionproof
- Category: Class I, Division 1

Notice: If the cabling is carried out according to Division 1, installation in Class I, Division 2 is also permitted.

CSA Ex rating

The mixers are suitable for operation in potentially explosive atmospheres:
- Protection class: Explosion-proof
- Category: Class 1Division 1

4.6 Rating plate

The following is an overview of the abbreviations and associated data on the rating plate:

Rating plate designation	Value
P-Typ	Mixer type
M-Typ	Motor type
S/N	Serial number
MFY	Date of manufacture*

Rating plate designation	Value
n	Speed
T	Max. fluid temperature
IP	Protection class
I_N	Rated current
I_{ST}	Starting current
I_{SF}	Rated current at service factor
P_2	Rated power
U	Rated voltage
f	Frequency
Cos φ	Motor efficiency
SF	Service factor
OT_S	Operating mode: immersed
OT_E	Operating mode: non-immersed
AT	Starting mode
m	Weight

*The date of manufacture is stated in accordance with ISO 8601: JJJJWww
- JJJJ = year
- W = abbreviation for week
- ww = calendar week

4.7 Type key

Example: Wilo-EMU TR 36.95-6/16REx S17	
TR	Submersible mixer, horizontal: TR = mixer with standard asynchronous motor TRE = mixer with asynchronous motors of motor efficiency class IE3/IE4
36	x10 = nominal propeller diameter in mm
95	Rated propeller speed in rpm
6	Number of poles
16	x10 = stator pack length in mm
R	Motor version: R = mixer version V = mixer version with reduced power
Ex	Ex-rated
S17	Propeller code for special propeller (omitted for standard propeller)

4.8 Scope of delivery

- Mixer with bare cable end
- Cable length as per customer request
- Mounted accessories, e.g. frame, pencil electrode, etc.
- Installation and operating instructions

4.9 Accessories

- Lowering device
- Auxiliary lifting device
- Mounting bracket for wall and floor fixation
- Cable bollard to secure the hoist cable
- Terminal stop
- Additional rope anchoring
- Fixation sets with anchor bolts

5 Transportation and storage

5.1 Delivery

After receiving the shipment, this must be checked immediately for defects (damage, completeness). Defects must be noted on the freight documentation! Furthermore, defects must be notified to the transport company or the manufacturer immediately on the day of receipt of shipment. Subsequently notified defects can no longer be asserted.

5.2 Transport

WARNING

Standing under suspended loads!

Never allow anyone to stand under suspended loads! Danger of (serious) injuries caused by falling parts. Loads may not be carried over work places where people are present!

WARNING

Head and foot injuries due to a lack of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety shoes
- Safety helmet must be worn if lifting equipment are used!

NOTICE

Use only properly functioning lifting equipment!

Use only properly functioning lifting equipment to lift and lower the mixer. Ensure that the mixer does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

NOTICE

Transporting mixers without attachment points

Mixers for ground and wall fixation have no in-built frame and therefore no attachment point. Transport the mixer on the pallet to the installation site. Have one or two persons position the mixer at the installation site. Bear in mind the weight of the mixer!

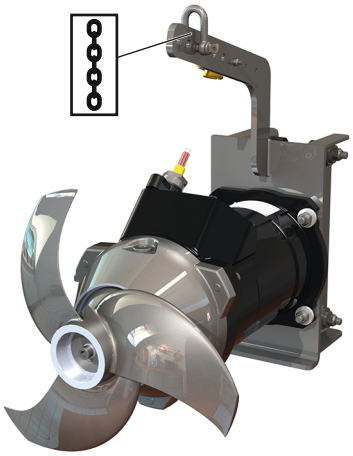


Fig. 2: Attachment point

- Only remove the outer packaging at the site of use to ensure that the mixer is not damaged during transport.
- Use tear-proof plastic sacks of sufficient size to package used mixers for transport in a leak-proof manner.
- Seal the open end of the connection cable against water ingress.
- Adhere to the applicable national safety regulations.
- Use legally specified and approved lifting gear.
- Select the lifting gear based on the existing conditions (weather, attachment point, load, etc.).
- Only attach the lifting gear to the attachment point. Fix with a shackle.
- Use lifting equipment with sufficient bearing capacity.
- The stability of the lifting equipment must be ensured during operation.
- When using lifting equipment, a second person must be present to coordinate the procedure if required (e.g. if the operator's field of vision is blocked).

5.3 Storage

DANGER

Danger from fluids hazardous to health!

Risk of fatal injury if the mixer is used in fluids hazardous to health.

- Decontaminate the mixer after dismantling and before carrying out any other work.
- Observe the specifications provided by work regulations. The operator must make sure that personnel have received and read work regulations.

WARNING

The propeller blade has sharp edges!

Sharp edges can form on the propeller blades. There is a risk of limbs being severed. Wear safety gloves to protect against cuts.

CAUTION

Total damage from to moisture ingress

Moisture ingress in the connection cable damages the connection cable and the mixer! Never immerse the end of the connection cable in a fluid and firmly seal it during storage.

Newly supplied mixers can be stored for one year. Contact customer service before storing the mixer for more than one year.

The following must be observed as regards storage:

- Place the mixer (horizontally) on a solid surface **and secure it against slipping and falling over!**
  CAUTION! Do not set the mixer down on the propeller. Doing so will damage the propeller or the shaft! In the case of larger propeller diameters, ensure an appropriate platform is provided.
- The max. storage temperature is -15 °C to +60 °C (5 °F to 140 °F) at a max. relative humidity of 90 %, non-condensing. Frost-proof storage at a temperature of 5 °C to 25 °C (41 °F to 77 °F) with relative humidity of 40 % to 50 % is recommended.
- Do not store the mixer in rooms in which welding work is carried out. The resulting gases or radiation can corrode the elastomer parts and coatings.
- Protect the connection cable against kinking and damage.
- Protect the mixer from direct sunlight and heat. Extreme heat can cause damage to the propeller and the coating!
- Turn the propeller at regular intervals (twice a year). This prevents locking of the bearings and renews the lubrication film of the mechanical seal. **WARNING! There is a risk of injury from sharp edges on the propeller!**
- Elastomer parts and the coating are subject to natural brittleness. Contact customer service if the mixer has to be stored for more than 6 months.

After storage, remove any dust and oil from the mixer and check the coating for damage. Repair damaged coatings before further use.

6 Installation and electrical connection

6.1 Personnel qualifications

- Electrical work: A qualified electrician must carry out the electrical work.
- Installation/dismantling: The technician must be trained in the use of the necessary tools and fixation materials for the relevant construction site.
- Lifting work: A specialist suitably trained in the operation of lifting devices must carry out lifting work. Evidence must be presented in accordance with BGV D8 or applicable local regulations.

6.2 Operator responsibilities

- Observe the locally applicable accident prevention and safety regulations of trade associations.
- Observe all regulations for working with heavy loads and under suspended loads.
- Provide protective equipment and ensure that the protective equipment is worn by personnel.

- Demarcate the working area and keep it free from any objects lying around.
- Unauthorised persons must be kept away from the working area.
- If the weather conditions (e.g. ice formation, strong wind) mean it is no longer possible to work safely, stop work.
- Structural components and foundations must be of sufficient stability in order to allow the device to be fixed in a secure and functional manner. The operator is responsible for the provision and suitability of the building/foundation!
- Check that the available consulting documents (installation plans, design of the operating space, inflow conditions) are complete and correct.

6.3 Installation types

- Stationary ground and wall fixation
- Flexible installation with lowering device

NOTICE! Vertical installation between -90° and +90° may be possible depending on the system. For such installations, contact customer service!

6.4 Installation

DANGER

Danger due to fluids hazardous to health during installation!

Ensure that the installation site is clean and disinfected during installation. If contact with fluids that are hazardous to health is possible, observe the following points:

- Wear protective equipment:
  - ⇒ Closed safety goggles
  - ⇒ Mouth protection
  - ⇒ Protective gloves
- Immediately wipe up drips.
- Observe the specifications provided by work regulations! The operator must make sure that personnel have received and read work regulations!

DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously! A second person must be present for safety reasons.

WARNING

A lack of protective equipment may result in hand and foot injuries or the risk of falling!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Safety harness
- Safety helmet must be worn if lifting equipment is used!

CAUTION

Material damage due to incorrect fixation

Defective fixation may limit the functionality of the mixer or damage it.

- If the mixer is fixed to a concrete structure, use anchor bolts for fixation. Follow the manufacturer's installation instructions! Temperature specifications and hardening periods must be strictly observed.
- If the mixer is fixed to a steel structure, ensure that the structure is sufficiently strong. Use fixation materials with sufficient strength!
  Use suitable materials to avoid electrochemical corrosion!
- Tighten all screwed connections. Observe torque specifications.

NOTICE

Use only properly functioning lifting equipment!

Use only properly functioning lifting equipment to lift and lower the mixer. Ensure that the mixer does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

- Prepare the operating space/installation site:
  – Clean, free of coarse solids
  – Dry
  – Frost-free
  – Decontaminated
- Work must always be carried out by two persons.
- Avoid any painful or tiring body postures.
- When working at a height of more than 1 m (3 ft) above the ground, use scaffolding with a safety harness.
- Cordon off the working area around the scaffolding.
- Toxic or asphyxiating gases may build up when working in closed rooms. Ensure there is sufficient ventilation and observe protective measures according to work regulations (examples):
  – Measure the gas concentration before entering.
  – Carry a gas detector with you.
  – etc.
- Take immediate countermeasures if there is a build-up of toxic or asphyxiating gases.
- Use hoisting gear to lift, lower and transport the mixer.
- Attach the hoisting gear to the attachment point using a shackle. Only use lifting gear which has been technically approved.
- Keep away from the hoisting gear's swivel range when hoisting the product.
- Only use hoisting gear if it can be safely attached. The storage place and the installation site must be accessible with the hoisting gear. The set-down location must have a firm surface.
- Observe minimum clearances with respect to walls and any fixtures.
- The laid connection cable must allow safe operation. Check whether the cable cross-section and the cable length are sufficient for the selected installation type.

6.4.1 Maintenance tasks

After a storage period of more than 6 months, carry out the following maintenance tasks before installation:

- Rotate propeller.
- Seal housing oil change.

6.4.1.1 Rotating the propeller

WARNING

The propeller blade has sharp edges!

Sharp edges can form on the propeller blades. There is a risk of limbs being severed. Wear safety gloves to protect against cuts.

✓ The mixer is **not** connected to the mains!

✓ Protective equipment must be put on!

1. Place the mixer horizontally on a firm surface.
   WARNING! Risk of hands being crushed. Ensure that the mixer cannot fall over or slip away!
   CAUTION! Do not set the mixer down on the propeller! Use an appropriate platform for the propeller diameter.
2. Grip the propeller slowly and carefully and rotate the propeller.

6.4.1.2 Oil change in seal housing (TR 14/16/21/28)

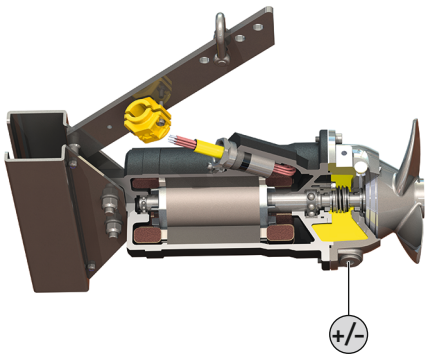


Fig. 3: Oil change

+/-	Drain/fill seal housing oil

✓ Mixer is **not** installed.

✓ Mixer is **not** connected to the mains.

✓ Protective equipment must be put on!

1. Place the mixer horizontally on a firm surface.
   WARNING! Risk of hands being crushed. Ensure that the mixer cannot fall over or slip away!
   CAUTION! Do not set the mixer down on the propeller! Use an appropriate platform for the propeller diameter.
2. Position a suitable tank to collect the operating fluid.
3. Unscrew the screw plug **(+/-)**.
4. Tip the mixer and allow the operating fluid to drain out.
5. Check the operating fluid: Notify customer service if the operating fluid contains metal swarf!
6. Dispose of operating fluid in accordance with local regulations!
7. Return the mixer to a horizontal position so that the opening points upwards.
8. Pour the new operating fluid in through the hole for the screw plug **(+/-)**.
   ⇒ Comply with the specifications for the operating fluid type and quantity!
9. Clean the screw plug **(+/-)**, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
10. Restore corrosion protection: Seal screw plug, e.g. with Sikaflex.

6.4.1.3 Oil change in seal housing (TR 22/36/40)

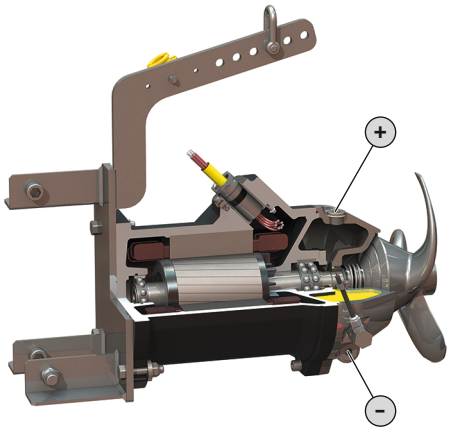


Fig. 4: Oil change

+	Fill oil in the seal housing
-	Drain oil in the seal housing

✓ Mixer is **not** installed.

✓ Mixer is **not** connected to the mains.

✓ Protective equipment must be put on!

1. Place the mixer horizontally on a firm surface.
   WARNING! Risk of hands being crushed. Ensure that the mixer cannot fall over or slip away!
   CAUTION! Do not set the mixer down on the propeller! Use an appropriate platform for the propeller diameter.
2. Position a suitable tank to collect the operating fluid.
3. Unscrew the screw plug **(+)**.
4. Unscrew screw plug **(-)** and drain the operating fluid.
5. Check the operating fluid: Notify customer service if the operating fluid contains metal swarf!
6. Dispose of operating fluid in accordance with local regulations!
7. Clean the screw plug **(-)**, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
8. Pour new operating fluid in through the hole for the screw plug **(+)**.
   ⇒ Comply with the specifications for the operating fluid type and quantity!

9. Clean the screw plug **(+)**, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
10. Restore corrosion protection: Seal screw plug, e.g. with Sikaflex.

6.4.2 Wall fixation

Fig. 5: Wall fixation

In the case of wall fixation, the mixer is mounted directly on the basin wall. Lay the connection cable against the basin wall and lead it upwards.

✓ Operating space/installation location is prepared for the installation. Defined clearances to fixtures and basin walls are kept in accordance with the consulting documents.

✓ Mixer is not connected to the mains.

✓ For installation at heights over 1 m, use scaffolding with a safety harness.

1. Have 2 persons position the mixer against the basin wall and mark the fixation holes.
2. Set the mixer down outside of the working area.
3. Drill fixation holes and insert anchor bolts. **NOTICE! Follow the manufacturer's installation instructions!**
4. Once the anchor bolts have hardened in place, have 2 persons place the mixer on the anchor bolts and fix in place with fixation material.
5. Fix the mixer firmly against the basin wall. **NOTICE! Follow the manufacturer's installation instructions!**
6. Lay the connection cable against the basin wall so that it is slightly taut. **CAUTION! If the connection cable leads over the edge of the basin, beware of potential abrasion. Sharp edges may damage the connection cable. Bevel the basin edge if necessary!**
7. Apply corrosion protection (e.g. Sikaflex): Fill the slotted holes on the motor flange up to the washer.

► Mixer is installed. Make the electrical connection.

6.4.3 Ground installation

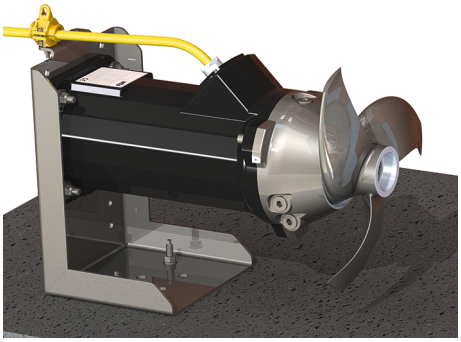


Fig. 6: Ground installation

In the case of ground installation, the mixer is fixed directly to the floor of the basin using a mounting bracket. **CAUTION! If the mixer is ordered for ground installation, the mounting bracket comes pre-assembled. If the mixer is delivered without a mounting bracket, order the appropriate mounting bracket from customer service!** Lay the connection cable along the basin floor and upwards up the basin wall.

✓ Operating space/installation location is prepared for the installation. Defined clearances to fixtures and basin walls are kept in accordance with the consulting documents.

✓ Mixer is not connected to the mains.

✓ Mounting bracket mounted on the mixer.

1. Have 2 persons position the mixer on the basin floor and mark 2 fixation holes.
2. Set the mixer down outside of the working area.
3. Drill fixation holes and insert anchor bolts. **NOTICE! Follow the manufacturer's installation instructions!**
4. Once the anchor bolts have hardened in place, have 2 persons position the mixer on the anchor bolts and fix in place with fixation material.
5. Mount the mixer firmly against the basin floor. **NOTICE! Follow the manufacturer's installation instructions!**
6. Lay the connection cable against the basin floor and the basin wall so that it is slightly taut. **CAUTION! If the connection cable leads over the edge of the basin, beware of potential abrasion. Sharp edges may damage the connection cable. Bevel the basin edge if necessary!**
7. Apply corrosion protection (e.g. Sikaflex):
   - Sealing joint between mounting bracket and structure.
   - Fill holes in the baseplate of the mounting bracket.
   - Fill scratches in the mounting bracket.

► Mixer is installed. Make the electrical connection.

6.4.4 Installation with lowering device

The mixer is lowered into the basin using a lowering device. The lowering device's guide pipe safely guides the mixer to the duty point. The resultant reaction forces are transferred directly into the foundation via the lowering device. The foundation **must** be designed to bear this load!

CAUTION! Material damage due to incorrect accessories! Due to the high reaction forces, the mixer may only be operated with the manufacturer's accessories (lowering device and frame). If the mixer is ordered together with a lowering device for installation, the frame comes pre-assembled. If the mixer is delivered without a frame, order the appropriate frame from customer service!

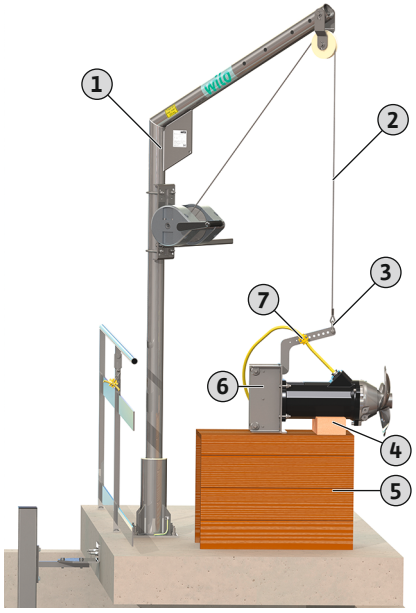


Fig. 7: Prepare the mixer

Preparatory works

1	Hoisting gear
2	Lifting equipment
3	Shackle for attachment
4	Support
5	Platform for secure set-down
6	Frame
7	Cable brackets for strain relief

✓ Mixer set down and horizontal.

✓ Frame mounted on the mixer.

✓ Lowering device mounted in basin.

✓ Hoisting gear with sufficient bearing capacity provided.

1. Attach lifting equipment to frame with a shackle.
2. Version with plastic rollers: Loosen linchpins and dismantle plastic rollers and quick-release axles.
   NOTICE! Prepare components for further installation.
3. Lay all connection cables and mount cable brackets.
   The cable brackets fix the connection cable to the lifting equipment and prevent uncontrolled floating of the connection cable in the basin.

Mixer	Cable bracket clearance
TR 14	550 mm (20 in)
TR 16	550 mm (20 in)
TR 21	550 mm (20 in)
TR 22	750 mm (30 in)
TR 28	550 mm (20 in)
TR 36	750 mm (30 in)
TR 40	750 mm (30 in)

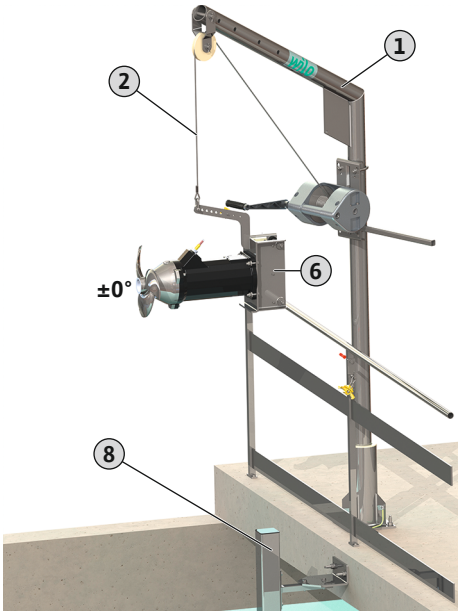


Fig. 8: Swivel the mixer over the basin

Lift the mixer and swivel it over the basin

1	Hoisting gear
2	Lifting equipment
6	Frame
8	Guide pipe for lowering device

✓ Preparatory tasks completed.

1. Lift mixer so that it can be swivelled safely over the railings.
   NOTICE! The mixer must hang horizontal on the hoisting gear. If the mixer hangs at an angle to the hoisting gear, adjust the attachment point on the frame.
2. Swivel the mixer over the basin.
   NOTICE! The frame must be perpendicular to the guide pipe. If the frame is not perpendicular to the guide pipe, adjust the reach of the hoisting gear.

Mounting the mixer on the lowering device

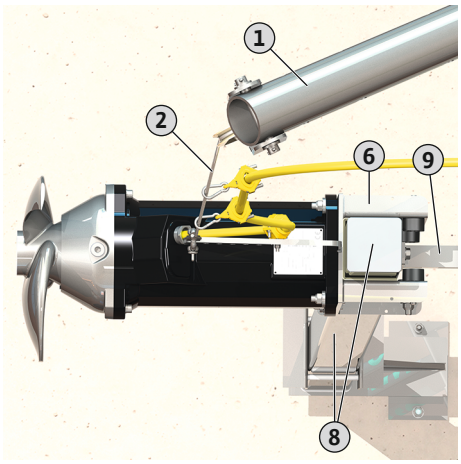


Fig. 9: Mixer on the lowering device

1	Hoisting gear
2	Lifting equipment
6	Frame
8	Guide pipe for lowering device
9	Upper holder of the lowering device

✓ Mixer hangs horizontally.

✓ Frame perpendicular to the guide pipe.

✓ Cable bracket is installed.

1. Slowly lower the mixer.
2. Insert the guide pipe in the frame without tilting.
   NOTICE! The guide rollers are in contact with the guide pipe.
3. Version with quick-release axles:
   Lower the mixer until the frame is below the upper holder. Install the quick-release axles and plastic rollers and secure them with linchpins!

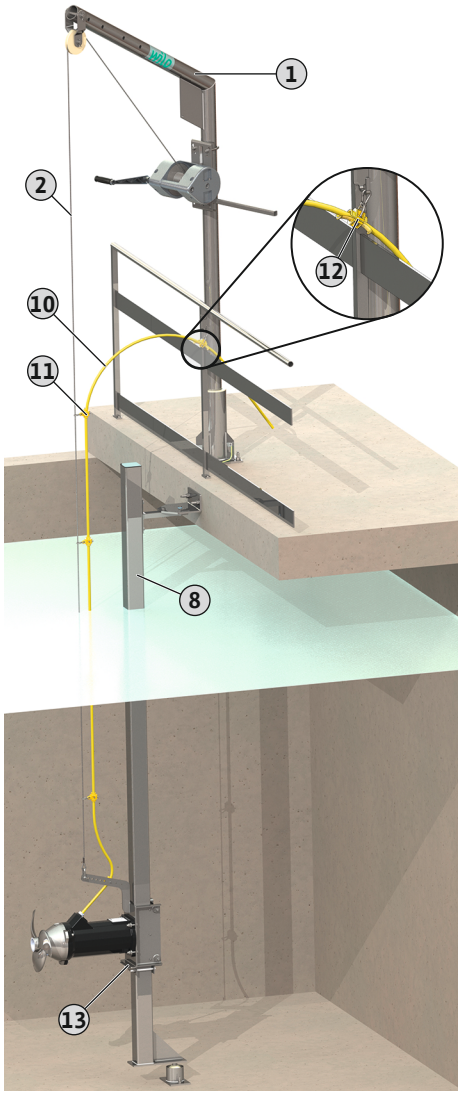


Fig. 10: Mixer set down on the fixed limit stop

Completing installation

1	Hoisting gear
2	Lifting equipment
8	Guide pipe for lowering device
10	Connection cable
11	Cable bracket with snap hook, cable routing via lifting equipment
12	Cable bracket with snap hook, safeguard against falling
13	Fixed limit stop

✓ Mixer mounted on the lowering device

1. Slowly lower the mixer.
2. Hang the connection cable on the lifting equipment using the cable brackets. The connection cable is routed safely using the lifting equipment (e.g. wire rope). **CAUTION! If no cable brackets are used to route the connection cable, ensure that the connection cable is not pulled into the propeller!**
3. Lower the mixer to the end of the guide pipe or until it reaches the fixed limit stop.
4. Secure the connection cable to the railing or hoisting gear to prevent it from falling!
5. Check the swivel range of the lowering device. Check the entire swivel range of the lowering device. The mixer must not bump into any structures (fixtures, basin wall). **CAUTION! If the full swivel range cannot be used, mechanically limit the swivel range!**
6. Set the desired angle and install a screw to secure the lowering device against further adjustments.

► Installation is complete. Lay the connection cable and make the electrical connection.

Mobile hoisting gear: Installing a cable bollard

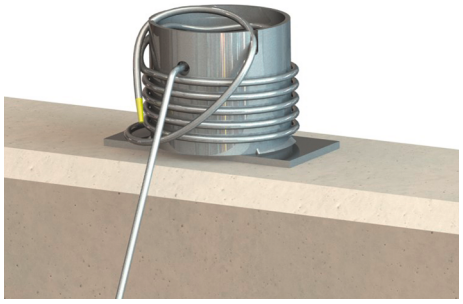


Fig. 11: Lifting equipment secured to a cable bollard

If a mobile hoisting gear is used, install a cable bollard at the edge of the basin:
- Remove lifting equipment (e.g. wire rope) from the hoisting gear and secure to the cable bollard.
- Secure the connection cable edge of the basin to prevent it from falling.

CAUTION! If the connection cable leads over the edge of the basin, beware of potential abrasion. Sharp edges may damage the connection cable. Bevel the basin edge if necessary!

6.5 Electrical connection

DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.

DANGER

Risk of explosion due to incorrect connection!

- Always connect the mixer to an electrical outlet outside the explosive area. If the connection must be made within the explosive area, then the connection must be carried out in an Ex-rated housing (ignition protection class DIN EN 60079-0)! Non-compliance will lead to a risk of fatal injury from explosion!
- Connect the equipotential bonding conductor to the earth terminal indicated. The earth terminal is installed in the area of the connection cable. A cable cross-section in accordance with the locally applicable regulations must be used for the equipotential bonding conductor.
- The connection must always be carried out by a qualified electrician.
- For the electrical connection, also note the additional information in the chapter on potentially explosive areas found in the appendix of these installation and operating instructions!

- The mains connection must match the specifications on the rating plate.
- Power supply on mains side for three-phase current motors with clockwise rotating field.
- Lay the connection cable in accordance with the locally applicable regulations and connect it according to the wire assignment.
- Connect the monitoring devices and check their function.
- Earth the device properly in accordance with applicable local regulations.

6.5.1 Fuse on mains side

Circuit breaker

The size and switching characteristics of the circuit breakers must conform to the rated current of the connected product. Observe local regulations.

Motor protection switch

Make provision for an on-site motor protection switch for devices without a plug! The minimum requirement is a thermal relay/motor protection switch with temperature compensation, differential triggering and anti-reactivation device in accordance with the local regulations. In case of sensitive mains, make provision for the installation on-site of other protective equipment (e.g. overvoltage, undervoltage or phase failure relay, etc.).

Residual-current device (RCD)

Comply with the regulations of the local energy supply company! The use of a residual-current device is recommended.
If persons come into contact with the device and conductive fluids, secure the connection **with** a residual-current device (RCD).

6.5.2 Maintenance tasks

Carry out the following maintenance tasks prior to installation:
- Check the insulation resistance of the motor winding.
- Test the resistance of the temperature sensor.
- Test the resistance of the pencil electrode (optionally available).

If the measured values differ from the specifications:
- Moisture may have penetrated into the motor or the connection cable.
- The monitoring device may be defective.

Contact customer service in the event of a fault.

6.5.2.1 Checking the insulation resistance of the motor winding

Use an insulation tester to measure the insulation resistance (measuring voltage = 1000 V). Observe the following values:
- At the time of initial commissioning: Insulation resistance may not be less than 20 MΩ.
- For further measurements: Value must be greater than 2 MΩ.

6.5.2.2 Test the resistor of the temperature sensor

Measure the resistor of the temperature sensors with an ohmmeter. The following measured values must be complied with:
- **Bimetallic strip**: Measured value = 0 Ohm (passage).
- **PTC sensor** (PTC thermistor): Measured value depends on the number of sensors installed. At PTC sensor has a cold resistance of between 20 and 100 Ohm.

– With **three** sensors in series, the measured value is between 60 und 300 Ohm.
– With **four** sensors in series, the measured value is between 80 und 400 Ohm.

6.5.2.3 Testing the resistor of the external electrode for sealing chamber control

Measure the resistor of the electrode with an ohmmeter. The measured value must approach “infinity”. For values ≤ 30 kOhm, if there is water in the oil – change the oil!

6.5.3 Three-phase motor connection

The three-phase current version is supplied with bare cable ends. Connection to the mains is established by connecting the power supply cables in the switchgear. Refer to the attached connection diagram for more precise details regarding the connection. **Electrical connection must always be carried out by a qualified electrician!**

NOTICE! The individual wires are designated according to the connection diagram. Do not cut the wires! There is no additional assignment between the wiring diagram and connection diagram.

Wiring diagram of the power connections for direct activation	
U, V, W	Mains connection
PE (green-yellow)	Earth

Wiring diagram of the power connections for star-delta starting	
U1, V1, W2	Mains connection (start of winding)
U2, V2, W2	Mains connection (end of winding)
PE (green-yellow)	Earth

6.5.4 Monitoring equipment connection

Refer to the enclosed connection diagram for details regarding the connection and installation of the monitoring devices. **Electrical connection must always be carried out by a qualified electrician!**

NOTICE! The individual wires are designated according to the connection diagram. Do not cut the wires! There is no additional assignment between the wiring diagram and connection diagram.

DANGER

Risk of explosion due to incorrect connection!

If the monitoring devices are not connected correctly, there is a risk of fatal injury due to explosion in potentially explosive areas! Connection must always be carried out by a qualified electrician. If used in potentially explosive areas:

- Connect the thermal motor monitoring via an evaluation relay!
- Deactivation by the temperature limiter must be conducted with reactivation lock! It must only be possible to restart the unit when the unlock key has been actuated by hand!
- Connect the external electrode (e.g. sealing chamber control) via an evaluation relay with an intrinsically safe circuit!
- Note the additional information in the chapter on potentially explosive areas found in the appendix of these installation and operating instructions!

Overview of possible monitoring devices:

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
Internal monitoring devices							
Motor compartment	o	o	o	–	o	–	–
Motor compartment/sealing chamber*	–	–	–	o	–	o	o

	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
Motor winding**	•	•	•	•	•	•	•
External monitoring devices							
Sealing chamber	o	o	o	o	o	o	o

Legend

– = not available/possible, o = optional, • = standard

* In the Ex version, this monitoring is omitted and not substituted!

** A temperature limiter is fitted as standard. The Ex version as per ATEX also features an installed temperature controller and limiter.

6.5.4.1 Monitoring of motor compartment

Connect the electrodes via an evaluation relay. Relay “NIV 101/A” is recommended for this. The threshold is 30 kOhm.

Wiring diagram	
DK	Electrode connection

The system must be deactivated when the threshold is reached!

6.5.4.2 Motor compartment/sealing chamber monitoring

Connect the electrodes via an evaluation relay. Relay “NIV 101/A” is recommended for this. The threshold is 30 kOhm.

Wiring diagram	
DK	Electrode connection

The system must be deactivated when the threshold is reached!

6.5.4.3 Monitoring of motor winding

With bimetallic strips

Directly connect bimetallic strips to the switchgear or via an evaluation relay. Connection values: max. 250 V (AC), 2.5 A, cos φ = 1

Wiring diagram for bimetallic strip	
Temperature limiter	
20, 21	Bimetallic strip connection
Temperature controller and limiter	
21	High temperature connection
20	Centre terminal
22	Low temperature connection

With PTC sensor

Connect the PTC sensor via an evaluation relay. Relay “CM-MSS” is recommended for this. The threshold has been preset.

PTC sensor wiring diagram	
Temperature limiter	
10, 11	PTC sensor connection
Temperature controller and limiter	
11	High temperature connection
10	Centre terminal
12	Low temperature connection

Triggering status for temperature controller and limiter

Depending on the version of the thermal motor monitoring, the following triggering status must occur when the threshold value is reached:

- Temperature limiter (1 temperature circuit):
  The system must be deactivated when the threshold is reached.
- Temperature controller and limiter (2 temperature circuits):
  When the threshold for the low temperature is reached, the motor can deactivate with automatic reactivation. When the threshold for the high temperature limit is reached, the motor must deactivate with manual reactivation.

Note the additional information in the section on potentially explosive areas in the appendix!

6.5.4.4 Sealing chamber monitoring (external electrode)

Connect the external electrode via an evaluation relay. Relay “NIV 101/A” is recommended for this. The threshold is 30 kOhm.

Once the threshold is reached, a warning must be output or the unit must be switched off.

Note the additional information in the section on potentially explosive areas in the appendix!

CAUTION

Connection of the sealing chamber control

If, on reaching the threshold, there is only a warning, the mixer may be irreparably damaged by the water ingress. Deactivation of the mixer is always recommended!

6.5.5 Motor protection adjustment

Motor protection must be set depending on the selected activation type.

6.5.5.1 Direct activation

At full load, set the motor protection switch to the rated current (see rating plate). At partial load, it is recommended to set the motor protection switch 5 % above the current measured at the duty point.

6.5.5.2 Star-delta activation

The motor protection setting depends on the installation:

- Motor protection installed in the motor line: Set the motor protection to 0.58 x the rated current.
- Motor protection installed in the mains supply cable: Set the motor protection to the rated current.

The maximum start-up time in star connection is 3 seconds.

6.5.5.3 Soft starter

At full load, set the motor protection switch to the rated current (see rating plate). At partial load, it is recommended to set the motor protection switch 5 % above the current measured at the duty point. The following points must also be observed:

- Power consumption must always be below the rated current.
- Complete starting and stopping within 30 s.
- To avoid power dissipation, bypass the electronic starter (soft start) once normal operation is reached.

6.5.6 Operation with frequency converter

Operation on the frequency converter is permitted. Refer to the appendix for the relevant requirements!

7 Commissioning

WARNING

Hand and foot injuries due to lack of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Safety helmet must be worn if lifting equipment are used!

7.1 Personnel qualifications

- Electrical work: A qualified electrician must carry out the electrical work.
- Operation/control: Operating personnel must be instructed in the functioning of the complete system.

7.2 Operator responsibilities

- Provide installation and operating instructions by the mixer or at a place specially reserved for it.
- Make the installation and operating instructions available in a language the personnel can understand.
- Make sure that the installation and operating instructions are read and understood by all personnel.
- All safety devices and emergency cut-outs on the system-side must be active and checked to ensure that they work properly.
- The mixer is suitable for use under the specified operating conditions.

7.3 Direction of rotation monitoring

The mixer is checked at the factory and set to the correct direction of rotation for a clockwise rotating field. Connection is made in accordance with the specifications in chapter “Electrical connection”.

Direction of rotation check

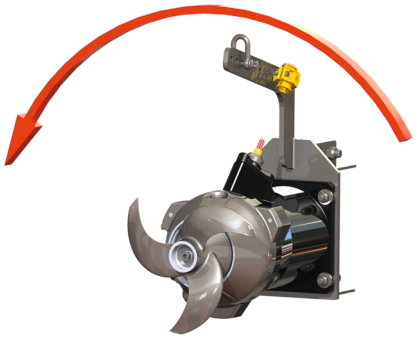


Fig. 12: Correct direction of rotation

✓ Mains connection with clockwise rotating field present.

✓ Rotating field inspected by a qualified electrician.

✓ No persons are allowed in the working area of the mixer.

✓ Mixer securely installed.
WARNING! Do not touch mixer with hands! The high starting torque can lead to serious injuries!

✓ Propeller is visible.

1. Switch on the mixer. **Max. operation duration: 15 s!**
2. Direction of propeller rotation:
   View from front: The propeller rotates anti-clockwise (to the left).
   View from behind: The propeller rotates clockwise (to the right).

► Direction of rotation correct.

Incorrect direction of rotation

If the direction of rotation is false, change the connection as follows:
- Direct starting: swap two phases.
- Star-delta starting: swap connections of two windings (e.g. U1/V1 and U2/V2).

NOTICE! After changing this connection, check the direction of rotation again!

7.4 Operation in an explosive atmosphere

Approval according to	TR 14...	TR 16...	TR 21...	TR 22...	TR 28...	TR 36...	TR 40...
ATEX	o	o	o	o	o	o	o
FM	o	o	o	o	o	o	o
CSA-Ex	o	o	o	o	o	o	o

Legend

– = not available/possible, o = optional, • = standard

For use in explosive atmospheres, the mixer must be marked as follows on the rating plate:
- “Ex” symbol of the corresponding approval
- Ex classification

For the relevant requirements, refer to the explosion protection chapter in the appendix of these installation and operating instructions!

ATEX approval

The mixers are suitable for operation in potentially explosive atmospheres:
- Device group: II
- Category: 2, zone 1 and zone 2

Mixers must not be used in zone 0!

FM approval

The mixers are suitable for operation in potentially explosive atmospheres:
- Protection class: Explosionproof
- Category: Class I, Division 1

Notice: If the cabling is carried out according to Division 1, installation in Class I, Division 2 is also permitted.

CSA Ex rating

The mixers are suitable for operation in potentially explosive atmospheres:
- Protection class: Explosion-proof
- Category: Class 1Division 1

7.5 Before switching on

Before activating the mixer, check the following points:
- Check whether the device has been installed properly and in accordance with the locally applicable regulations:
  - Has the mixer been earthed?
  - Has the connection cable route been checked?
  - Has electrical connection been made in accordance with regulations?
  - Are mechanical components attached correctly?
- Check the operating conditions:
  - Min./max. fluid temperature checked?
  - Max. immersion depth checked?
  - Intermittent operation: Max. switching frequency complied with?
- Check installation location/operating space:
  - Has the minimum water level above the propeller been defined and monitored?
  - Min. fluid temperature can drop below 3 °C: Monitoring device with automatic deactivation installed?
  - No installations within the direct rotary range of the propeller?

7.6 Switch on and off

The mixer must switch on and off using a separate operating point (on/off switch, switchgear) set by the customer.

During the start process, the rated current is exceeded for several seconds. Current consumption continues to be slightly above the rated current until the operating temperature of the motor is reached and the flow in the basin increases. During regular operation, the rated current should no longer be exceeded. **CAUTION! If the mixer does not start up, switch off immediately. Remove the fault before reactivating!**

7.7 During operation

WARNING

Risk of burns from hot surfaces!

Motor housing can become hot during operation. It may cause burns. Allow the motor to cool down at ambient temperature after switching it off!

WARNING

The propeller blade has sharp edges!

Sharp edges can form on the propeller blades. There is a risk of limbs being severed. Wear safety gloves to protect against cuts.

During operation, observe the locally applicable regulations on the following topics:
- Work safety
- Accident prevention
- Handling electrical machines

Personnel responsibilities specified by the operator must be strictly adhered to. All personnel are responsible for ensuring that responsibilities and regulations are adhered to!

- Operating voltage (+/-10 % of the rated voltage)
- Frequency (+/-2 % of the rated frequency)
- Current consumption between individual phases (max. 5 %)
- Voltage difference between the individual phases (max. 1 %)
- Max. switching frequency
- Minimum immersion of the propeller
- Quiet/low-vibration running

Increased current consumption

Depending on the fluid and the flow, the current consumption may vary slightly. If current consumption is elevated for a longer period, this indicates a change in configuration. The cause for a change in conditions could be:

- A change in the viscosity and density of the fluid, e.g. caused by modified addition of polymers or precipitating agents. **CAUTION! This modification may cause a severely increasing power consumption and even overload the system!**
- Insufficient mechanical pre-cleaning, e.g. fibrous and abrasive content.
- Non-homogeneous flow conditions due to fixtures or deflections in the operating space.
- Vibrations due to blockage of the basin inlet/outlet and draining, modified air intake (aeration) or the combined effect of several mixers.

Check system configuration and take counter-measures. **CAUTION! Permanently increased current consumption causes increased wear on the mixer!** Contact customer service for further assistance.

Monitoring fluid temperature

The fluid temperature must not drop below 3 °C. A fluid temperature below 3 °C results in thickening of the fluid, which can result in fractures in the propeller. If the fluid temperature may fall below 3 °C, install an automatic temperature measurement device with advance warning and deactivation functions.

Monitoring minimum immersion

The propeller must not emerge from the fluid during operation. Minimum immersion specifications must be observed! If fluid levels fluctuate significantly, install a level monitoring device. If the fluid level drops below the minimum immersion level, switch off the mixer.

8 Shut-down/dismantling

8.1 Personnel qualifications

- Operation/control: Operating personnel must be instructed in the functioning of the complete system.
- Electrical work: A qualified electrician must carry out the electrical work.
- Installation/dismantling: The technician must be trained in the use of the necessary tools and fixation materials for the relevant construction site.
- Lifting work: A specialist suitably trained in the operation of lifting devices must carry out lifting work. Evidence must be presented in accordance with BGV D8 or applicable local regulations.

8.2 Operator responsibilities

- Locally applicable accident prevention and safety regulations of trade associations.
- Observe regulations for working with heavy loads and under suspended loads.
- Provide the necessary protective equipment and make sure that the personnel wears it.
- Provide adequate aeration in closed rooms.
- Take immediate countermeasures if there is a build-up of toxic or suffocating gases!

8.3 Shut-down

The mixer is deactivated during decommissioning, but remains installed. This ensures that the mixer is always ready for operation.

✓ To protect the mixer from frost and ice, always immerse the mixer completely in the fluid.

✓ The fluid temperature must always be above +3 °C (+37 °F).

1. Switch off the mixer at the operating point.
2. Secure the operating point against being switched on again by unauthorised persons (e.g. lock main switch).

► The mixer is decommissioned and can now be dismantled.

If the mixer remains installed after decommissioning, observe the following:

- Ensure that the aforementioned requirements are maintained for the complete period of decommissioning. If these requirements cannot be guaranteed, dismantle the mixer after decommissioning!
- For an extended period of decommissioning, carry out a 5-minute function test at regular intervals (monthly to quarterly). **CAUTION! A function test should only be carried out under the applicable operating conditions. Never run the machine dry! Non-compliance can lead to irreparable damage!**

8.4 Removal

DANGER

Danger due to fluids hazardous to health during removal!

During removal, contact with fluids that are hazardous to health may occur. Observe the following points:

- Wear protective equipment:
  - ⇒ Closed safety goggles
  - ⇒ Mouth protection
  - ⇒ Protective gloves
- Immediately wipe up drips.
- Observe the specifications in the work regulations! The operator must make sure that the personnel have received and read the work regulations!

DANGER

Danger from fluids hazardous to health!

Risk of fatal injury if the mixer is used in fluids hazardous to health.

- Decontaminate the mixer after dismantling and before carrying out any other work.
- Observe the specifications provided by work regulations. The operator must make sure that personnel have received and read work regulations.

DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.

DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously! A second person must be present for safety reasons.

WARNING

A lack of protective equipment may result in hand and foot injuries or the risk of falling!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Safety harness
- Safety helmet must be worn if lifting equipment is used!

WARNING

Risk of burns from hot surfaces!

Motor housing can become hot during operation. It may cause burns. Allow the motor to cool down at ambient temperature after switching it off!

NOTICE

Use only properly functioning lifting equipment!

Use only properly functioning lifting equipment to lift and lower the mixer. Ensure that the mixer does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

8.4.1 Ground and wall fixation

✓ Mixer decommissioned.

✓ Operating space emptied, cleaned and, if required, disinfected.

✓ Mixer cleaned and, if required, disinfected.

✓ Ensure work is carried out by two persons.

1. Disconnect mixer from the mains.
2. Disconnect and wind up the connection cable.
3. Enter the operating space. **DANGER! If the operating space cannot be cleaned and disinfected, wear protective equipment according to work regulations!**
4. Uninstall mixer from the basin wall or the basin floor.
5. Set the mixer down on a pallet, secure it against slipping and lift it out of the operating space.

► Removal is complete. Clean and disinfect the mixer thoroughly.

8.4.2 Using a lowering device

✓ Mixer decommissioned.

✓ Protective equipment put on according to work regulations.

1. Disconnect mixer from the mains.
2. Disconnect and wind up the connection cable.
3. Insert lifting equipment in hoisting gear.
4. Slowly lift mixer and remove it from the basin. During the lifting procedure, detach the connection cable from the lifting equipment and wind it up.
   DANGER! Mixer and connection cable come directly out of the fluid. Wear protective equipment according to work regulations!
5. Swivel mixer and set it down on a firm surface.

► Removal is complete. Clean mixer and set-down location thoroughly, disinfect if required and store away.

8.4.3 Clean and disinfect

DANGER

Danger from fluids hazardous to health!

Risk of fatal injury if the mixer was used in fluids hazardous to health! Decontaminate the mixer before carrying out any further work! Wear the following protective equipment while performing cleaning tasks:

- Closed safety goggles
- Breathing mask
- Protective gloves

⇒ The equipment listed here is the minimum requirement; observe the specifications of work regulations! The operator must make sure that personnel have received and read work regulations!

✓ Mixer has been dismantled.

✓ Apply a watertight seal to the open end of the connection cable.

✓ Contaminated cleaning water is disposed of in the sewer in accordance with local regulations.

✓ A disinfectant is available for contaminated mixers.

1. Attach the lifting equipment to the attachment point.
2. Lift the mixer approximately 30 cm (10 in) above the ground.
3. Spray the mixer with clear water from top to bottom. **NOTICE! Use an appropriate disinfectant for contaminated mixers! Follow the specifications of work regulations!**
4. Spray the propeller from all sides.
5. Flush dirt residues from the floor into the drain.
6. Allow the mixer to dry.

9 Maintenance and repair

DANGER

Danger from fluids hazardous to health!

Risk of fatal injury if the mixer is used in fluids hazardous to health.

- Decontaminate the mixer after dismantling and before carrying out any other work.
- Observe the specifications provided by work regulations. The operator must make sure that personnel have received and read work regulations.

NOTICE

Use only properly functioning lifting equipment!

Use only properly functioning lifting equipment to lift and lower the mixer. Ensure that the mixer does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

- Carry out maintenance tasks in a clean location with good lighting and ventilation. Set the mixer down horizontally on a firm surface and secure it against tipping over / slipping away. **NOTICE! Do not set the mixer down on the propeller!**
- Only carry out maintenance tasks mentioned in these installation and operating instructions.
- Wear the following protective equipment while performing maintenance tasks:
  - Safety goggles
  - Safety shoes
  - Safety gloves

9.1 Personnel qualifications

- Electrical work: A qualified electrician must carry out the electrical work.
- Maintenance tasks: The technician must be familiar with the use of operating fluids and their disposal. In addition, the technician must have basic knowledge of mechanical engineering.

9.2 Operator responsibilities

- Provide the necessary protective equipment and make sure that the personnel wears it.
- Collect operating fluids in suitable tanks and dispose of properly.
- Dispose of protective clothing used in accordance with regulations.
- Use only original parts of the manufacturer. Use of parts other than the original parts releases the manufacturer from any liability.
- Collect any leakage of fluid and operating fluid immediately and dispose of it according to the locally applicable guidelines.
- Provide the tools required.
- If flammable solvents and cleaning agents are used, open flames, naked lights and smoking are prohibited.

9.3 Operating fluid

9.3.1 Oil types

Medicinal white oil is filled into the sealing chamber ex-factory. The following oil types are recommended when changing the oil:

- Aral Autin PL*
- Shell ONDINA 919
- Esso MARCOL 52* or 82*
- BP WHITEMORE WOM 14*
- Texaco Pharmaceutical 30* or 40*

All oil types marked with "*" are approved for use with foods in accordance with "USDA-H1".

9.3.2 Grease

Use the following greases:

- Esso Unirex N3
- Tripol Molub-Alloy-Food Proof 823 FM (with **"USDA-H1" approval**)

9.3.3 Filling quantities

- TR 14: 0.35 l (12 US.fl.oz.)
- TR 16: 0.35 l (12 US.fl.oz.)
- TR 21: 0.35 l (12 US.fl.oz.)
- TR 22: 1.30 l (44 US.fl.oz.)
- TR 28: 0.35 l (12 US.fl.oz.)
- TR 36: 1.10 l (37 US.fl.oz.)
- TR 40: 1.10 l (37 US.fl.oz.)

Stated filling quantities apply for described installation types. Refer to the enclosed data sheet for the filling quantities required for deviating installation types.

9.4 Maintenance intervals

To ensure reliable operation, maintenance tasks must be carried out regularly. Depending on the real ambient temperatures, maintenance intervals different to those mentioned in the contract can be established! If strong vibrations occur during operation, the mixer and the installation must be checked regardless of the established maintenance intervals.

9.4.1 Maintenance intervals for normal conditions

8000 operating hours or after 2 years at most

- Visual inspection of the connection cable
- Visual inspection of cable brackets and cable tensioning
- Visual inspection for wear of the mixer
- Function test of monitoring devices
- Visual inspection of accessories
- Oil change

15000 operating hours or after 10 years at the latest

- General overhaul

9.4.2 Maintenance intervals for harsh conditions

Under harsh operating conditions, the specified maintenance intervals must be shortened as required. Harsh operating conditions include:

- Fluids with long-fibre components
- Strongly corrosive or abrasive fluids
- Highly gaseous fluids
- Operation at an unfavourable duty point
- Unfavourable flow conditions (e.g. due to fixtures or aeration)

When using the mixer under harsh conditions, it is recommended that a maintenance contract be entered into. Contact customer service.

9.5 Maintenance measures

WARNING

The propeller blade has sharp edges!

Sharp edges can form on the propeller blades. There is a risk of limbs being severed. Wear safety gloves to protect against cuts.

WARNING

Hand, foot or eye injuries due to the absence of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Closed safety goggles

The following preconditions must be fulfilled prior to the start of maintenance measures:

- Motor must have cooled down to the ambient temperature.
- Mixer must be thoroughly cleaned and disinfected (if required).

9.5.1 Recommended maintenance measures

Regular inspection of current consumption and the operating voltage in all three phases is recommended for smooth operation. In normal operation, these values remain constant. Slight fluctuations depend on the characteristics of the fluid.

Current consumption can provide an early indication of damage to or malfunctions in the mixer, which can then be rectified. Larger voltage fluctuations strain the motor winding and can cause breakdown. Regular inspections can therefore largely prevent major secondary damage and reduce the risk of total breakdown. In this regard, it is recommended to use remote monitoring for regular inspections.

9.5.2 Visual inspection of the connection cable

Check connection cable for:

- Bubbles
- Cracks
- Scratches
- Abrasion
- Pinch points
- Changes caused by chemical corrosion

If damage to the connection cable is identified, decommission the mixer immediately! Have the connection cable replaced by Wilo customer service. Only start the mixer up again once the damage has been properly remedied!

CAUTION! Water can enter into the mixer if the connection cable is damaged! Water ingress leads to the mixer being written off.

9.5.3 Visual inspection of cable brackets and cable tensioning

Check cable brackets and anchoring of the connection cable (lifting equipment or separate nylon rope) for material fatigue or shrinkage. If there are signs of wear, replace the faulty components immediately.

9.5.4 Visual inspection for wear of the mixer

Inspect individual components (propeller, hub, etc.) for damage and wear. If there are defects, observe the following:

- If the coating is damaged, restore it.
- If components have worn, contact customer service and replace the components in question!

9.5.5 Function test of the monitoring device

The mixer must be cooled down to ambient temperature to test resistances!

9.5.5.1 Test the resistor of the temperature sensor

Measure the resistor of the temperature sensors with an ohmmeter. The following measured values must be complied with:

- **Bimetallic strip**: Measured value = 0 Ohm (passage).
- **PTC sensor** (PTC thermistor): Measured value depends on the number of sensors installed. At PTC sensor has a cold resistance of between 20 and 100 Ohm.
  - With **three** sensors in series, the measured value is between 60 und 300 Ohm.
  - With **four** sensors in series, the measured value is between 80 und 400 Ohm.

9.5.5.2 Testing the resistor of the external electrode for sealing chamber control

Measure the resistor of the electrode with an ohmmeter. The measured value must approach “infinity”. For values ≤ 30 kOhm, if there is water in the oil – change the oil!

9.5.6 Visual inspection of accessories

Accessories must be checked for:

- Correct fixation

- Smooth function
- Signs of wear, e.g. cracks caused by frequencies

Any defects detected must be repaired immediately or the accessories must be replaced.

9.5.7 Oil change

WARNING

Operating fluid under high pressure!

A pressure of **several bar can build up** in the motor! This pressure escapes when the screw plugs are **opened**. If screw plugs are opened without due caution, they can be ejected at high speed! To avoid injuries, observe the following instructions:

- Adhere to the prescribed sequence of work steps.
- Unscrew the screw plugs slowly, but never unscrew them completely. As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further!
- When the pressure has completely dissipated, fully unscrew the screw plugs.
- Wear closed safety goggles.

WARNING

Scalding from hot operating fluids!

Hot operating fluids can also spray out when pressure is released. This can result in scalding! To avoid injuries, the following instructions must be observed:

- Allow the motor to cool down to the ambient temperature before opening the screw plugs.
- Wear closed safety goggles or face protection and gloves.

9.5.7.1 Oil change in seal housing (TR 14/16/21/28)

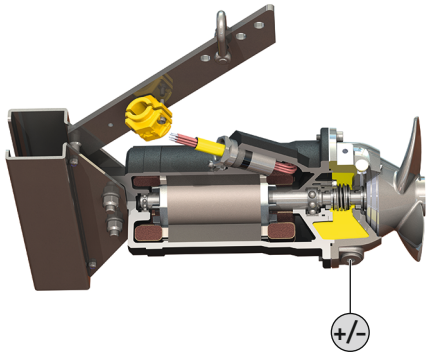


Fig. 13: Oil change

+/-	Drain/fill seal housing oil

✓ Mixer is **not** installed.

✓ Mixer is **not** connected to the mains.

✓ Protective equipment must be put on!

1. Place the mixer horizontally on a firm surface.
   WARNING! Risk of hands being crushed. Ensure that the mixer cannot fall over or slip away!
   CAUTION! Do not set the mixer down on the propeller! Use an appropriate platform for the propeller diameter.
2. Position a suitable tank to collect the operating fluid.
3. Unscrew the screw plug **(+/-)**.
4. Tip the mixer and allow the operating fluid to drain out.
5. Check the operating fluid: Notify customer service if the operating fluid contains metal swarf!
6. Dispose of operating fluid in accordance with local regulations!
7. Return the mixer to a horizontal position so that the opening points upwards.
8. Pour the new operating fluid in through the hole for the screw plug **(+/-)**.
   ⇒ Comply with the specifications for the operating fluid type and quantity!
9. Clean the screw plug **(+/-)**, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
10. Restore corrosion protection: Seal screw plug, e.g. with Sikaflex.

9.5.7.2 Oil change in seal housing (TR 22/36/40)

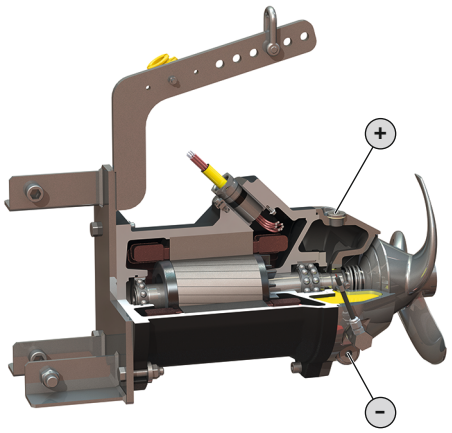


Fig. 14: Oil change

+	Fill oil in the seal housing
-	Drain oil in the seal housing

✓ Mixer is **not** installed.

✓ Mixer is **not** connected to the mains.

✓ Protective equipment must be put on!

1. Place the mixer horizontally on a firm surface.
   WARNING! Risk of hands being crushed. Ensure that the mixer cannot fall over or slip away!
   CAUTION! Do not set the mixer down on the propeller! Use an appropriate platform for the propeller diameter.
2. Position a suitable tank to collect the operating fluid.
3. Unscrew the screw plug **(+)**.
4. Unscrew screw plug **(–)** and drain the operating fluid.
5. Check the operating fluid: Notify customer service if the operating fluid contains metal swarf!
6. Dispose of operating fluid in accordance with local regulations!
7. Clean the screw plug **(–)**, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
8. Pour new operating fluid in through the hole for the screw plug **(+)**.
   ⇒ Comply with the specifications for the operating fluid type and quantity!
9. Clean the screw plug **(+)**, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
10. Restore corrosion protection: Seal screw plug, e.g. with Sikaflex.

9.5.8 General overhaul

The following components are checked for wear and damage as part of general maintenance:

- Motor bearings
- Gear bearing and planetary gear speed
- Propeller
- Shaft sealings
- O-rings
- Connection cable
- Fitted accessories

Damaged components are replaced with original parts. This will ensure correct operation. The general overhaul is performed by the manufacturer or an authorised service centre.

9.6 Repairs

WARNING

The propeller blade has sharp edges!

Sharp edges can form on the propeller blades. There is a risk of limbs being severed. Wear safety gloves to protect against cuts.

WARNING

Hand, foot or eye injuries due to the absence of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Closed safety goggles

The following preconditions must be met prior to starting repair work:
- Mixer cooled to ambient temperature.
- Mixer is switched voltage-free and safeguarded against being inadvertently activated.
- Mixer must be thoroughly cleaned and disinfected (if required).

For repair work the following generally applies:
- Immediately collect dripping fluid and operating fluids!
- Always replace O-rings, gaskets and screw locking devices!
- Observe the tightening torques in the appendix!
- Never use force when carrying out this work!

9.6.1 Instructions on using screw locking devices

A screw locking device can be used on the screws. Screw locking is done at the factory using two different methods:
- Thread-locking fluid
- Mechanical screw locking device

Always re-apply the screw locking device!

Thread-locking fluid

Medium-strength thread-locking fluid (e.g. Loctite 243) is used for the liquid screw locking compound. This threadlocker can be loosened with increased force. If the thread-locking fluid cannot be loosened, then the compound must be heated to approx. 300 °C (572 °F). Clean the components thoroughly after dismantling.

Mechanical screw locking device

The mechanical screw locking device consists of two Nord-Lock wedge lock washers. The screw connection is secured by a clamping force.

9.6.2 Which repair work may be carried out

- Propeller replacement
- Replacement of mechanical seal on the fluid side.
- Replacement of the frame.
- Replacement of the mounting bracket for ground installation.

9.6.3 Propeller replacement

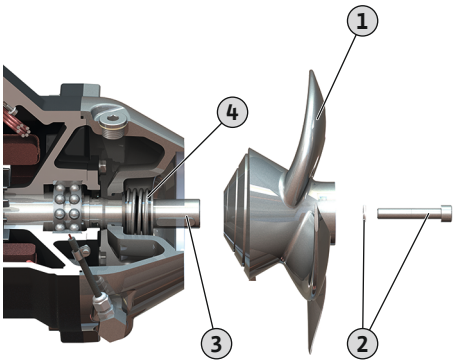


Fig. 15: Propeller replacement

1	Propeller
2	Propeller attachment: Interior hexagonal head screw and washer
3	Shaft
4	Mechanical seal

✓ Mixer set down on a firm surface and secured.

✓ Tools are ready for use.

1. Loosen and unscrew the propeller attachment. **NOTICE! Fix the propeller in place with suitable equipment.**
2. Carefully remove the propeller from the shaft. **CAUTION! The mechanical seal is now no longer secured. Only operate the mixer with the propeller! If the mixer is operated without the propeller, the mechanical seal will be destroyed. If the mechanical seal is faulty, oil escapes from the sealing chamber.**
3. Clean the shaft and apply new lubricating grease.
4. Carefully slide the propeller back on as far as it will go.
5. Coat the interior hexagonal head screw with the thread-locking fluid, insert the washer and screw it into the shaft.
6. Tighten the propeller attachment. Max. tightening torque: see appendix.
7. Turn the propeller by hand and check that it rotates easily.

► Propeller is changed. Check the oil in the seal housing and fill up if required.

9.6.4 Replacing the mechanical seal on the fluid side

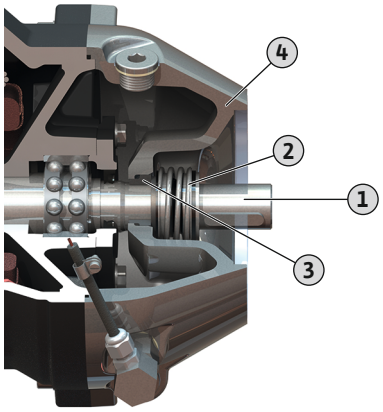


Fig. 16: Replacing mechanical seals

1	Shaft
2	Mechanical seal: Spring
3	Mechanical seal: Stationary ring
4	Seal housing

✓ Mixer set down on a firm surface and secured.

✓ Tools are ready for use.

✓ Oil drained from seal housing.

✓ Propeller removed.

1. Remove key from the shaft.
2. Remove the spring of the mechanical seal with support washer from the shaft.
3. Push the stationary ring of the mechanical seal out of its seating and remove from the shaft.
4. Clean the shaft and check for wear and corrosion. **WARNING! Contact customer service if the shaft has been damaged!**
5. Lubricate the shaft using wetted water or detergent. **CAUTION! Do not use oil or grease as lubricants!**
6. Press in a new stationary ring for the mechanical seal into the housing using an assembly unit. **CAUTION! Do not tilt the stationary ring when pushing it in. If the stationary ring is tilted or installed at an angle when it is pushed in, the stationary ring will fracture. The mechanical seal can then no longer be used!**
7. Insert new spring of the mechanical seal with support washer onto the shaft.
8. Clean the key and lay it in the groove of the shaft.
9. Mount the propeller.

► Mechanical seal is replaced. Fill oil in the seal housing.

9.6.5 Replacing the frame

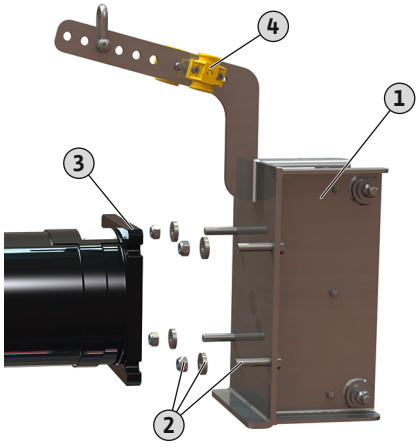


Fig. 17: Replacing the frame

1	Frame
2	4x fixation material: Hexagon head screw, washer, hexagon nut
3	Motor flange
4	Cable brackets for strain relief

✓ Mixer set down on a firm surface and secured.

✓ Motor supported in such a way that the frame can easily be changed.

✓ Tools are ready for use.

1. Open the cable brackets and take out the connection cable.
2. Undo and remove hexagon nuts.
3. Remove washers from the hexagon head screws.
4. Remove the frame from the motor flange.
5. Clean dirt from the motor flange, e.g. deposits, old sealing material.
6. Remove hexagon head screws from the frame and insert them in the new frame.
7. Coat the hexagon head screws with thread-locking fluid.
8. Place the new frame on the motor flange.
9. Place washers on the hexagon head screws.
10. Attach and firmly tighten hexagon nuts. Max. tightening torque: see appendix.
11. Lay connection cable in the cable bracket and close the cable bracket. **CAUTION! Do not tighten the cable bracket yet!**
12. Align the connection cable: The connection cable should be slightly bent, it should not be taut.
13. Close the cable brackets tightly.

14. Apply corrosion protection (e.g. Sikaflex):
    - Sealing joint between motor flange and frame.
    - Fill slots on the motor flange up to the washer.

► Frame is changed.

9.6.6 Replacing the mounting bracket for ground installation

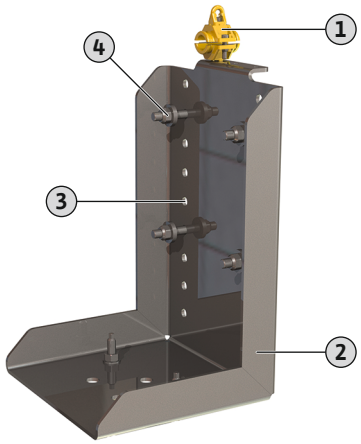


Fig. 18: Mounting bracket for ground installation

1	Cable brackets for strain relief
2	Mounting bracket
3	Height grid
4	4x fixation material: Hexagon head screw, washer, hexagon nut

✓ Mixer set down on a firm surface.

✓ Have work carried out by two persons!

✓ Tools are ready for use.

1. Open the cable brackets and take out the connection cable.
2. Undo and remove hexagon nuts.
3. Remove washers from the hexagon head screws.
4. Second person: Remove mixer from the mounting bracket and hold the mixer.
5. Remove hexagon head screws.
6. Insert hexagon head screws in the new mounting bracket.
   NOTICE! Observe the height grid! The propeller must not come into contact with the floor!
7. Second person: Place the mixer on the hexagon head screws.
8. Place washers on the hexagon head screws.
9. Attach and firmly tighten hexagon nuts. Max. tightening torque: see appendix.
10. Lay connection cable in the cable bracket and close the cable bracket. **CAUTION! Do not tighten the cable bracket yet!**
11. Align the connection cable: The connection cable should be slightly bent, it should not be taut.
12. Close the cable brackets tightly.

► Mounting bracket is changed.

10 Faults, causes and remedies

DANGER

Danger from fluids hazardous to health!

Risk of fatal injury in the case of mixers working in fluids hazardous to health! Wear the following protective equipment while performing the work:

- Closed safety goggles
- Breathing mask
- Protective gloves

⇒ The equipment listed here is the minimum requirement; observe the specifications of work regulations! The operator must make sure that personnel have received and read work regulations!

DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.

DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously! A second person must be present for safety reasons.

WARNING

No persons may remain in the working area of the mixer!

Persons can suffer (serious) injury while the mixer is in operation! No persons may therefore be present inside the working area. If persons should enter the mixer's working area, deactivate the mixer and safeguard it against being switched on again by unauthorised persons!

WARNING

The propeller blade has sharp edges!

Sharp edges can form on the propeller blades. There is a risk of limbs being severed. Wear safety gloves to protect against cuts.

Fault: The mixer does not start up

1. Mains connection interrupted or short-circuit/earth fault in the cable or motor winding.
   ⇒ Have the connection and motor checked by a qualified electrician and replace if necessary.
2. Tripping of fuses, of the motor protection switch or the monitoring device.
   ⇒ Have the connection and the monitoring device checked by a qualified electrician and change it if necessary.
   ⇒ Have the motor protection switches and fuses installed and adjusted according to technical specifications by a qualified electrician and reset the monitoring devices.
   ⇒ Check that the propeller rotates easily, and clean the propeller and mechanical seal if necessary.
3. The sealing chamber control (optional) has broken the electric circuit (connection-related).
   ⇒ See "Fault: Mechanical seal leakage, pre-chamber/sealing chamber control reports a fault and switches the mixer off"

Fault: Mixer starts up, motor protection trips after short period

1. Motor protection switch set incorrectly.
   ⇒ Have the setting of the trigger checked and corrected by a qualified electrician.
2. Increased current consumption due to major voltage drop.
   ⇒ Have the voltage of individual phases checked by a qualified electrician. Contact the power grid operator.
3. The connection only has two phases.
   ⇒ Have the connection checked and corrected by a qualified electrician.
4. Voltage differences between the phases are too great.
   ⇒ Have the voltage of individual phases checked by a qualified electrician. Contact the power grid operator.
5. Incorrect direction of rotation.
   ⇒ Have the connection corrected by a qualified electrician.
6. Increased current consumption due to clogging.
   ⇒ Clean propeller and mechanical seal.
   ⇒ Check the pre-treatment.

7. The density of the fluid is too high.
   ⇒ Check unit design.
   ⇒ Contact customer service.

Fault: Mixer runs, but system parameters are not reached

1. Propeller clogged.
   ⇒ Clean propeller.
   ⇒ Check the pre-treatment.
2. Incorrect direction of rotation.
   ⇒ Have the connection corrected by a qualified electrician.
3. Signs of wear on propeller.
   ⇒ Inspect propeller and replace if necessary.
4. The connection only has two phases.
   ⇒ Have the connection checked and corrected by a qualified electrician.

Fault: Mixer does not run smoothly and is noisy

1. Improper duty point.
   ⇒ Check fluid density and viscosity.
   ⇒ Inspect system configuration, and contact customer service.
2. Propeller clogged.
   ⇒ Clean propeller and mechanical seal.
   ⇒ Check the pre-treatment.
3. The connection only has two phases.
   ⇒ Have the connection checked and corrected by a qualified electrician.
4. Incorrect direction of rotation.
   ⇒ Have the connection corrected by a qualified electrician.
5. Signs of wear on propeller.
   ⇒ Inspect propeller and replace if necessary.
6. Motor bearings have worn.
   ⇒ Inform customer service; send the mixer back to the factory for reconditioning.

Further steps for troubleshooting

If the points listed here do not rectify the fault, contact customer service. Customer service can assist in the following ways:
- Telephone or written support.
- On-site support.
- Inspection and repair at the factory.

Costs may be incurred if you request customer services! Please contact customer services for more information.

11 Spare parts

Spare parts are ordered via customer service. To avoid return queries and incorrect orders, the serial or article number must always be supplied. **Subject to change without prior notice!**

12 Disposal

12.1 Oils and lubricants

Operating fluid must be collected in suitable tanks and disposed of in accordance with the locally applicable guidelines.

12.2 Protective clothing

Used protective clothing must be disposed of in accordance with the locally applicable guidelines.

12.3 Information on the collection of used electrical and electronic products

Proper disposal and appropriate recycling of this product prevents damage to the environment and danger to your personal health.

NOTICE

Disposal in domestic waste is forbidden!

In the European Union, this symbol can appear on the product, the packaging or the accompanying documentation. It means that the electrical and electronic products in question must not be disposed of along with domestic waste.

To ensure proper handling, recycling and disposal of the used products in question, please note the following points:

- Only hand over these products at designated, certified collecting points.
- Observe the locally applicable regulations!

Please consult your local municipality, the nearest waste disposal site, or the dealer who sold the product to you for information on proper disposal. Further recycling information can be found at www.wilo-recycling.com.

13 Appendix

13.1 Tightening torques

Rust-free screws A2/A4			
Threaded	Tightening torque		
	Nm	kp m	ft·lb
M5	5.5	0.56	4
M6	7.5	0.76	5.5
M8	18.5	1.89	13.5
M10	37	3.77	27.5
M12	57	5.81	42
M16	135	13.77	100
M20	230	23.45	170
M24	285	29.06	210
M27	415	42.31	306
M30	565	57.61	417

If a Nord-Lock screw locking device is used, increase the tightening torque by 10 %!

13.2 Operation with frequency converter

The motor in series design (confirming to IEC 60034-17) can be operated with a frequency converter. Contact customer service if the rated voltage is over 415 V/50 Hz or 480 V/60 Hz. Because of the additional heating caused by harmonics, the rated power of the motor must be around 10 % more than the power requirement of the mixer. For frequency converters with a low-harmonic output, it may be possible to reduce the 10 % power reserve. Harmonic waves are reduced by means of output filters. The frequency converter and filter must be compatible.

The configuration of the frequency converter depends on the rated motor current. Care must be taken to ensure that the mixer operates without jerking or vibrating, especially in the lower speed range. Otherwise, the mechanical seals can leak or be damaged. It is important that the mixer operates across the entire control range without vibrations, resonance, oscillation or excessive noise. Increased motor noise caused by the harmonics of the power supply is normal.

During parameterisation of the frequency converter, observe the setting of the quadratic curve (U/f curve) for submersible motor and fans! The U/f curve ensures that the output voltage at frequencies less than the rated frequency (50 Hz or 60 Hz) is adjusted to the power requirement of the mixer. Newer frequency converters feature an automatic power optimisation function – this automation achieves the same effect. For the frequency converter setting, refer to its installation and operating instructions.

Faults with the motor monitoring may occur on motors operated with a frequency converter depending on the type used and the installation conditions. The following measures can help to reduce or avoid these faults:
- Keeping within the limit values stated in IEC 60034-25 for overvoltages and rise speed. Output filters may need to be installed.
- Vary the pulse frequency of the frequency converter.
- In the event of a fault on the internal sealing chamber control, use the external double-rod electrode.

The following construction measures can also help to reduce or prevent faults:
- Separate power supply cables for the main and control cable (depending on the motor size).
- When laying, ensure there is adequate clearance between the main and control cable.
- Using shielded power supply cables.

Summary
- Continuous duty up to rated frequency (50 Hz or 60 Hz).
- Observe additional measures with regard to EMC regulations (choice of frequency converter, using filters, etc.).
- Never exceed the rated current or rated speed of the motor.
- It must be possible to connect the motor's own temperature monitoring (bimetallic strip or PTC sensor).

13.3 Ex rating

This section contains further information on the operation of the mixer in an explosive atmosphere. All personnel must read this section. **This section applies only to Ex-rated mixers!**

13.3.1 Identification of Ex-rated mixers

For use in explosive atmospheres, the mixer must be marked as follows on the rating plate:
- "Ex" symbol of the corresponding approval
- Ex classification
- Certification number (depending on the approval)
  The certification number, if required by the approval, is printed on the rating plate.

13.3.2 Protection class

The motor's design version corresponds to the following protection classes:
- Flameproof enclosure (ATEX)
- Explosionproof (FM)
- Flameproof enclosures (CSA-EX)

In order to limit the surface temperature, the motor must be equipped with at least one temperature limiter (1-circuit temperature monitoring). It may also be equipped with a temperature controller (2-circuit temperature monitoring).

13.3.3 Intended use

ATEX approval

The mixers are suitable for operation in potentially explosive atmospheres:
- Device group: II
- Category: 2, zone 1 and zone 2
  Mixers must not be used in zone 0!

FM approval

The mixers are suitable for operation in potentially explosive atmospheres:
- Protection class: Explosionproof
- Category: Class I, Division 1
  Notice: If the cabling is carried out according to Division 1, installation in Class I, Division 2 is also permitted.

CSA Ex rating

The mixers are suitable for operation in potentially explosive atmospheres:
- Protection class: Explosion-proof
- Category: Class 1Division 1

13.3.4 Electrical connection

DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.

- Always connect the mixer to an electrical outlet outside the explosive area. If the connection has to be made within the explosive area, then the connection must be carried out in an Ex-rated housing (ignition protection class according to DIN EN 60079-0)! Non-compliance will lead to a risk of fatal injury from explosion! The connection must always be carried out by a qualified electrician.
- All monitoring devices outside the "spark-proof areas" must be connected via an intrinsically safe circuit (e.g. Ex-i relay XR-4...).
- The voltage tolerance may not be higher than max. ±10 %.

Overview of possible monitoring devices:

Type	TR 14	TR 16	TR 21	TR 22	TR 28	TR 36	TR 40
Motor compartment	o	o	o	–	o	–	–
Motor winding: Temperature limiter	•	•	•	o	•	o	o
Motor winding: Temperature controller and limiter	o	o	o	•	o	•	•
Sealing chamber (external pencil electrode)	o	o	o	o	o	o	o

Legend

– = not available/possible, o = optional, • = standard

13.3.4.1 Monitoring of motor winding

DANGER

Risk of explosion due to overheating of the motor!

If the temperature limiter is connected incorrectly, there is a risk of explosion due to overheating of the motor! Always connect the temperature limiter to a manual reactivation lock. This means that a "release button" must be manually activated!

Depending on the version of the thermal motor monitoring, the following triggering status must occur when the threshold value is reached:

- Temperature limiter (1 temperature circuit):
  When the threshold is reached, deactivation **with reactivation lock** must take place!
- Temperature controller and limiter (2 temperature circuits):
  When the threshold for the low temperature is reached, the motor can deactivate with automatic reactivation. When the threshold for the high temperature is reached, the motor must deactivate **with reactivation lock**!

  CAUTION! Motor damage due to overheating! In the event of automatic reactivation, comply with the specifications for the maximum switching frequency and switching break!

Connection of the thermal motor monitoring

- Connect the bimetallic strip via an evaluation relay. Relay "CM-MSS" is recommended for this. The threshold is preset.
  Connection values: max. 250 V(AC), 2.5 A, cos φ = 1
- Connect the PTC sensor via an evaluation relay. Relay "CM-MSS" is recommended for this. The threshold is preset.

13.3.4.2 Sealing chamber monitoring (external electrode)

- Connect the external pencil electrode via an Ex-rated evaluation relay! Relay "XR-4..." is recommended for this.
  The threshold is 30 kOhm.
- The connection must be made using an intrinsically safe circuit!

13.3.4.3 Frequency converter operation

- Type of converter: Pulse-width modulation
- Continuous duty: 30 Hz up to rated frequency (50 Hz or 60 Hz).
- Min. switching frequency: 4 kHz
- Max. overvoltages on the terminal board: 1350 V
- Output current on the frequency converter: max. 1.5 times rated current
- Max. overload time: 60 s
- Torque applications: quadratic curve
  Speed/torque curves required are available on request!
- Observe additional measures with regard to EMC regulations (choice of frequency converter, filters, etc.).
- Never exceed the rated current or rated speed of the motor.
- It must be possible to connect the motor's own temperature monitoring (bimetallic strip or PTC sensor).
- If the temperature class is marked as T4/T3, temperature class T3 applies.

13.3.5 Commissioning

DANGER

Risk of explosion when using non-Ex-rated mixers!

Risk of fatal injury due to explosion! Only use mixers which have Ex labelling on the rating plate within potentially explosive areas.

- The operator is responsible for defining the potentially explosive area.
- Only Ex-rated mixers may be used within potentially explosive areas.
- Mixers with an Ex rating must be labelled as such on the rating plate.
- Do not exceed the **max. fluid temperature**!
- According to DIN EN 50495, a safety device with SIL level 1 and hardware fault tolerance 0 must be provided for category 2.

13.3.6 Maintenance and repair

- Carry out maintenance tasks according to the regulations.
- Only carry out maintenance tasks mentioned in these installation and operating instructions.
- The spark-proof gaps may **only** be repaired according to the manufacturer's design specifications. It is **not** permitted to carry out repairs according to the values in tables 1 and 2 of DIN EN 60079-1.
- Only use screw plugs as stipulated by the manufacturer, that at least correspond to a strength class of 600 N/mm² (38.85 long tons-force/inch²).

13.3.6.1 Repair of housing coating

The paint layer can become electrostatically charged in case of thicker coats.**DANGER! Risk of explosion! In explosive atmospheres, a discharge can cause an explosion!**

If the housing coating has to be repaired, the maximum coat thickness is 2 mm (0.08 in)!

13.3.6.2 Replacing the connection cable

Changing the connection cable is strictly prohibited!

13.3.6.3 Changing the mechanical seal

Changing the seal on the motor side is strictly prohibited!

Wilo – International (Subsidiaries)

Argentina
WILO SALMSON
Argentina S.A.
C1295ABI Ciudad
Autónoma de Buenos Aires
T +54 11 4361 5929
matias.monea@wilo.com.ar

Australia
WILO Australia Pty Limited
Murrarrie, Queensland, 4172
T +61 7 3907 6900
chris.dayton@wilo.com.au

Austria
WILO Pumpen Österreich GmbH
2351 Wiener Neudorf
T +43 507 507-0
office@wilo.at

Azerbaijan
WILO Caspian LLC
1065 Baku
T +994 12 5962372
info@wilo.az

Belarus
WILO Bel IOOO
220035 Minsk
T +375 17 3963446
wilo@wilo.by

Belgium
WILO NV/SA
1083 Ganshoren
T +32 2 4823333
info@wilo.be

Bulgaria
WILO Bulgaria EOOD
1125 Sofia
T +359 2 9701970
info@wilo.bg

Brazil
WILO Comercio e
Importacao Ltda
Jundiaí – São Paulo – Brasil
13.213-105
T +55 11 2923 9456
wilo@wilo-brasil.com.br

Canada
WILO Canada Inc.
Calgary, Alberta T2A 5L7
T +1 403 2769456
info@wilo-canada.com

China
WILO China Ltd.
101300 Beijing
T +86 10 58041888
wilobj@wilo.com.cn

Croatia
WILO Hrvatska d.o.o.
10430 Samobor
T +38 51 3430914
wilo-hrvatska@wilo.hr

Cuba
WILO SE
Oficina Comercial
Edificio Simona Apto 105
Siboney. La Habana. Cuba
T +53 5 2795135
T +53 7 272 2330
raul.rodriguez@wilo-cuba.com

Czech Republic
WILO CS, s.r.o.
25101 Cestlice
T +420 234 098711
info@wilo.cz

Denmark
WILO Nordic
Drejergangen 9
DK-2690 Karlslunde
T +45 70 253 312
wilo@wilo.dk

Estonia
WILO Eesti OÜ
12618 Tallinn
T +372 6 509780
info@wilo.ee

Finland
WILO Nordic
Tillinmäentie 1 A
FIN-02330 Espoo
T +358 207 401 540
wilo@wilo.fi

France
Wilo Salmson France S.A.S.
53005 Laval Cedex
T +33 2435 95400
info@wilo.fr

United Kingdom
WILO (U.K.) Ltd.
Burton Upon Trent
DE14 2WJ
T +44 1283 523000
sales@wilo.co.uk

Greece
WILO Hellas SA
4569 Anixi (Attika)
T +302 10 6248300
wilo.info@wilo.gr

Hungary
WILO Magyarország Kft
2045 Törökbálint
(Budapest)
T +36 23 889500
wilo@wilo.hu

India
Wilo Mather and Platt Pumps
Private Limited
Pune 411019
T +91 20 27442100
services@matherplatt.com

Indonesia
PT. WILO Pumps Indonesia
Jakarta Timur, 13950
T +62 21 7247676
citrawilo@cbn.net.id

Ireland
WILO Ireland
Limerick
T +353 61 227566
sales@wilo.ie

Italy
WILO Italia s.r.l.
Via Novegro, 1/A20090
Segrate MI
T +39 25538351
wilo.italia@wilo.it

Kazakhstan
WILO Central Asia
050002 Almaty
T +7 727 312 40 10
info@wilo.kz

Korea
WILO Pumps Ltd.
20 Gangseo, Busan
T +82 51 950 8000
wilo@wilo.co.kr

Latvia
WILO Baltic SIA
1019 Riga
T +371 6714-5229
info@wilo.lv

Lebanon
WILO LEBANON SARL
Jdeideh 1202 2030
Lebanon
T +961 1 888910
info@wilo.com.lb

Lithuania
WILO Lietuva UAB
03202 Vilnius
T +370 5 2136495
mail@wilo.lt

Morocco
WILO Maroc SARL
20250 Casablanca
T +212 (0) 5 22 66 09 24
contact@wilo.ma

The Netherlands
WILO Nederland B.V.
1551 NA Westzaan
T +31 88 9456 000
info@wilo.nl

Norway
WILO Nordic
Alf Bjerckes vei 20
NO-0582 Oslo
T +47 22 80 45 70
wilo@wilo.no

Poland
WILO Polska Sp. z.o.o.
5-506 Lesznowola
T +48 22 7026161
wilo@wilo.pl

Portugal
Bombas Wilo-Salmson
Sistemas Hidraulicos Lda.
4475-330 Maia
T +351 22 2080350
bombas@wilo.pt

Romania
WILO Romania s.r.l.
077040 Com. Chiajna
Jud. Ilfov
T +40 21 3170164
wilo@wilo.ro

Russia
WILO Rus ooo
123592Moscow
T +7 496 514 6110
wilo@wilo.ru

Saudi Arabia
WILO Middle East KSA
Riyadh 11465
T +966 1 4624430
wshoula@wataniaind.com

Serbia and Montenegro
WILO Beograd d.o.o.
11000 Beograd
T +381 11 2851278
office@wilo.rs

Slovakia
WILO CS s.r.o., org. Zložka
83106 Bratislava
T +421 2 33014511
info@wilo.sk

Slovenia
WILO Adriatic d.o.o.
1000 Ljubljana
T +386 1 5838130
wilo.adriatic@wilo.si

South Africa
Wilo Pumps SA Pty LTD
Sandton
T +27 11 6082780
gavin.bruggen wilo.co.za

Spain
WILO Ibérica S.A.
28806 Alcalá de Henares
(Madrid)
T +34 91 8797100
wilo.iberica@wilo.es

Sweden
WILO NORDIC
Isbjörnsvägen 6
SE-352 45 Växjö
T +46 470 72 76 00
wilo@wilo.se

Switzerland
Wilo Schweiz AG
4310 Rheinfelden
T +41 61 836 80 20
info@wilo.ch

Taiwan
WILO Taiwan CO., Ltd.
24159 New Taipei City
T +886 2 2999 8676
nelson.wu@wilo.com.tw

Turkey
WILO Pompa Sistemleri
San. ve Tic. A.Ş.
34956 İstanbul
T +90 216 2509400
wilo@wilo.com.tr

Ukraine
WILO Ukraine t.o.w.
08130 Kiew
T +38 044 3937384
wilo@wilo.ua

United Arab Emirates
WILO Middle East FZE
Jebel Ali Free zone – South
PO Box 262720 Dubai
T +971 4 880 91 77
info@wilo.ae

USA
WILO USA LLC
Rosemont, IL 60018
T +1 866 945 6872
info@wilo-usa.com

Vietnam
WILO Vietnam Co Ltd.
Ho Chi Minh City, Vietnam
T +84 8 38109975
nkminh@wilo.vn

wilo

Pioneering for You

WILO SE
Nortkirchenstr. 100
44263 Dortmund
Germany
T +49 (0)231 4102-0
T +49 (0)231 4102-7363
wilo@wilo.com
www.wilo.com