

Wilo-EMU TR/TRE 216 ... 326-3



zh-CHS 安装及操作说明



en Installation and operating instructions



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1 概述

1.1 关于本说明书

本说明书是产品的固定组成部分。遵守本说明书中列出的要求和操作步骤，是正确操作和使用产品的前提条件：

- 在执行所有工作前请仔细阅读本说明书。
- 请妥善保管说明书，以备随时使用。
- 遵守所有产品相关参数。
- 注意产品上的标识。

原版操作说明书以德语撰写。其他语种的说明书均为其翻译件。

1.2 数字版说明书

本说明书的数字版本请参见以下产品页面：
<https://qr.wilo.com/737>

1.3 版权

本安装及操作说明的版权归 Wilo 所有。未经允许，禁止对其中的内容进行复制和传播，也禁止出于竞争目的而使用或者透露给他人。

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1.5 保修和免责声明

Wilo 对于如下情况，不承担任何保修义务或责任：

- 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
- 不遵守本说明书的内容
- 未按规定使用
- 不按规范存放或运输
- 错误安装或拆卸
- 缺乏维护
- 无授权维修
- 安装基础有缺陷
- 化学、电气或电化学影响
- 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：

- 人员受伤
- 环境污染
- 物资损失
- 丧失索赔权利

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防范规定。
- 工作人员已阅读安装及操作说明并且理解其中内容。
- 电气作业：受过培训的专业电工
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。
- 安装/拆卸工作：接受过培训的废水处理技术人员
固定在不同的结构体上，提升设备，污水设施的基础知识
- 保养工作：接受过培训的废水处理技术人员
使用/废弃处置用过的工作介质，机械制造基础知识（安装/拆卸）
- 提升工作：接受过提升装置操作培训的专业人员
提升设备，提升装置，吊装孔

儿童和行为能力受限的人

- 未满 16 周岁：禁止使用本产品。
- 未满 18 周岁：在（监管人员）监督下使用！
- 身体、感官或精神上能力不足的人员：禁止使用本产品！

2.3 个人防护装备

规定的防护装备是最低要求。遵守工作规程的相关要求。

防护装备：运输、安装和拆卸以及保养

- 安全鞋：防护等级 S1 (uvex 1 sport S1)
- 防护手套 (EN 388)：4X42C (uvex C500)
- 安全头盔 (EN 397)：符合标准，防止横向变形 (uvex pheos)
(如果使用提升设备)

防护装备：清洁作业

- 防护手套 (EN ISO 374-1): 4X42C + A 型 (uvex protector chemical NK2725B)
- 护目镜 (EN 166)：(uvex skyguard NT)
 - 镜框标记：W 166 34 F CE
 - 镜片标记：0-0.0* W1 FKN CE
 - * 根据 EN 170 的防护等级与此项作业无关。
- 呼吸面罩 (EN 149): 3M 6000 系列半面罩，带过滤器 6055 A2

物品建议

括号中的物品建议仅供参考。可以根据上述标记用结构相同的物品替换！

2.4 电气作业

- 电气作业由专业电工负责执行。
- 将产品断电并采取安全措施防止意外接通。
- 通电时注意遵守当地相关法规。
- 注意遵守当地能源供应公司的相关规定。
- 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。

2.5 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)

- 根据当地能源供应公司的规定安装漏电断路器 (RCD)。
- 如果人员可能接触到产品和导电液体，则安装漏电断路器 (RCD)。

2.6 危害健康的流体

污水或不流动的积水中会形成有害细菌。可能存在细菌感染危险！

- 穿戴防护装备！
- 拆下之后，应该彻底清洁产品并进行消毒！
- 告知所有工作人员，泵送流体会导致危险！

2.7 运输

- 遵从当地有关作业安全和事故防范措施的现行法律法规。
- 标记并封锁工作区域。
- 将擅自进入工作区域的人员清理出场。
- 始终将提升装置固定在吊装孔上。
- 检查提升装置是否已牢固地固定好。
- 遵守包装规定：
 - 抗撞击
 - 确保产品固定。
 - 防尘、防油、防潮。

2.8 安装/拆卸工作

- 穿戴好防坠落装备！
- 遵从当地有关作业安全和事故防范措施的现行法律法规。
- 标记并封锁工作区域。
- 确保工作区域内无冰。
- 清除工作区域内四处散放的物体。
- 将擅自进入工作区域的人员清理出场。
- 如果由于天气原因导致无法安全工作，则停止工作。
- 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。
- 密闭空间保持通风顺畅。
- 在密闭的室内或建筑内有毒气体或窒息气体会不断聚集。遵守工作规程要求的保护措施，例如随身携带气体报警设备。
- 如果存在爆炸风险，切勿进行焊接作业或使用电气装置工作。
- 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。
- 为产品消毒。

2.9 运行期间

- 标记并封锁工作区域。
- 在产品运行期间，禁止任何人在工作区域内停留。
- 通过单独的控制器的流程接通和断开产品。停电之后，产品可能会自动接通。
- 如果电机浮出水面，电机外壳温度可能超过 40 °C (104 °F)。
- 一旦发生故障或者出现异常，立即报告主管。
- 如果产品存在缺陷，立即关闭。
- 螺旋桨不得碰撞任何加装件或墙壁。注意遵守规划资料中规定的间距。
- 遵守规定的水覆盖深度。如果水位波动剧烈，需要安装一个液位监控装置。
- 声压受多种因素影响（安装、工况点等）。测量运行条件下的当前噪声级。噪声级超过 85 dB(A)，需佩戴耳罩。标记工作区域！

2.10 保养工作

- 将产品断电并采取安全措施防止意外接通。
- 为产品消毒。
- 执行保养作业的地点须整洁、干燥、光线充足。
- 只执行本安装及操作说明中列出的保养工作。
- 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。

2.11 工作介质

密封壳体灌注有白油。变速器和前室灌注有齿轮油。

- 立即收集泄漏出的物质。
- 如果发生重大泄漏，请联系客户服务部。
- 如果密封件损坏，油会流入流体中。
- 如不慎接触皮肤：用肥皂和水彻底冲洗相应皮肤部位。如果皮肤发炎，需就医。
- 如不慎接触眼睛：取下隐形眼镜。用水彻底冲洗眼睛。如果眼睛发炎，需就医。

2.12 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。
- 提供防护装备。保证工作人员穿戴防护装备。
- 使产品上安装的安全和信息标志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。
- 为设备中的危险部件装备触摸防护装置（安装方提供）。
- 标记并封锁工作区域。
- 测量噪声级。噪声级超过 85 dB(A)，需佩戴耳罩。标记工作区域！

3 运输和存放

3.1 交货

- 收到货物之后，立刻检查货物有无缺陷（有无损坏、是否完整）。
- 如有缺陷，标注在运单上！
- 在到货当天，将发现的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。

3.2 运输



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！

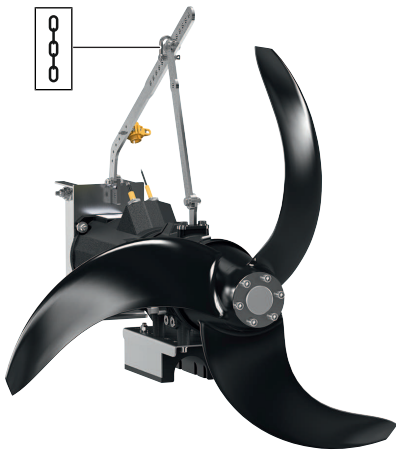


Fig. 1: 吊装孔

- 穿戴防护装备！遵守工作规程。
 - 防护手套：4X42C (uvex C500)
 - 安全鞋：防护等级 S1 (uvex 1 sport S1)
- 挂在搅拌器的吊装孔上！
- 防止接线电缆进水。
- 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。

3.3 使用提升设备

如果使用提升设备（提升装置、吊车、环链葫芦等），请注意以下几点：

- 佩戴符合 EN 397 标准的安全头盔！
- 遵守当地有关提升设备的使用规定。
- 确保正确使用提升设备是运营者的责任！
- 提升装置
 - 使用合法且获得认证的提升装置。
 - 根据吊装孔选择提升装置。
 - 按照当地法规将提升装置固定在吊装孔上。
- 提升设备
 - 使用前，检查功能是否正常！
 - 具备足够的承载能力。
 - 确保使用过程中的稳定性。
- 提升过程
 - 防止产品在升降过程中被卡住。
 - 切勿超出允许的最大承载能力！
 - 如果需要（比如视线受阻），安排另外一位工作人员负责协调。
 - 严禁人员在悬挂物下停留！
 - 悬挂物切勿从有人员停留的工作位置上方经过！

3.4 存放



危险

危害健康的流体会导致危险！

细菌感染危险！

- 搅拌器拆卸后请采取消毒处理！
- 遵守工作规程的相关规定！



警告

锋利边缘导致受伤危险！

螺旋桨叶片可能逐渐形成尖锐边缘，存在割伤危险！

- 佩戴防护手套！

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。

- 将搅拌器横着（水平）妥善放置在坚固的基底上。
- 固定搅拌器，防止翻倒和滑移！
- 切勿将搅拌器放在螺旋桨上。如果螺旋桨直径较大，须准备一个合适的基座。
小心！当心产品损坏！螺旋桨和轴可能受损！
- 搅拌器最多可存放一年。如果储存时间超过一年，请咨询客户服务部。
- 存放条件：
 - 存储温度范围：-15 °C 至 +60 °C (+5 至 +140 °F)，空气湿度最高：90 %，非冷凝。
 - 建议：5 至 25 °C (41 至 77 °F)，相对空气湿度：40 至 50 %。
 - 保护搅拌器避免阳光直射。高温会导致损坏！
- 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。注意弯曲半径！
- 定期（每年 2 次）转动螺旋桨。从而防止轴承无法转动，并更换机械密封的润滑膜。注意！佩戴防护手套！

4 应用/使用

4.1 规定用途

用于商业环境中的流体均质化以及产生流动：

- 工艺污水
- 含有粪便的污水

遵守基于运营方要求的特定设计！任何超出所述范围的用途都将被视为违规使用。

4.2 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

5 产品说明

5.1 结构

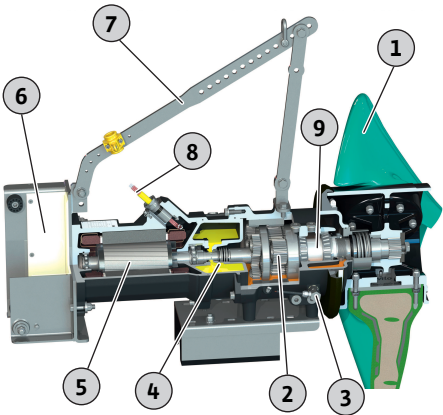


Fig. 2: 潜水搅拌器概述

电动潜水搅拌器由下列部件构成：

| | |
|---|------------|
| 1 | 螺旋桨 |
| 2 | 2 挡变速器 |
| 3 | 铅芯湿度电极（选配） |
| 4 | 密封室 |
| 5 | 电机 |
| 6 | 用于下降装置的机架 |
| 7 | 手柄 |
| 8 | 接线电缆 |
| 9 | 前室 |

5.1.1 电机

Wilo-EMU TR ...

表面冷却式三相潜水电机带有永久润滑式大尺寸滚子轴承。电机绕组配备温度监控装置。余热通过电机外壳直接排放至周围的流体中。接线电缆采用耐重型机械负荷设计，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。连接电缆标配裸露电缆端部，长度为 10 m (33 ft)。

Wilo-EMU TRE ...

表面冷却式三相潜水电机带有永久润滑式大尺寸滚子轴承。电机绕组配备温度监控装置。余热通过电机外壳直接排放至周围的流体中。接线电缆采用耐重型机械负荷设计，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。连接电缆标配裸露电缆端部，长度为 10 m (33 ft)。

潜水式电动机满足IE3/IE4电机能效等级（根据 IEC 60034-30 标准）。能效等级IE4的电机名称中包含“E4”字样。

技术数据

| | |
|-----------|-----------------------------|
| 运行模式，潜水式 | S1 |
| 运行模式，非潜水式 | - |
| 流体温度 | 3 ... 40 °C (37 ... 104 °F) |
| 最大潜水深度 | 20 m (66 ft) |
| 防护等级 | IP68 |
| 绝缘等级 | H |
| 最大开关频率 | 15 /h |

5.1.2 变速器

双级行星齿轮变速器，可更改变速比。为了吸收形成的搅拌力，避免其传递至电机轴承，因此装备了规格足够大的变速器轴承。

5.1.3 密封件

密封方式则采用 3 室系统来实现：

- 前室
- 变速器室
- 密封室

前室

大容积前室灌注有齿轮油，用于收集液体侧密封的泄漏物。流体侧密封则采用机械密封。与变速器室之间则采用一个径向轴封来密封。

变速器室

变速器室灌注有齿轮油，保证持续润滑行星齿轮和变速器轴承。与密封室之间则采用一个机械密封来密封。

密封室

大容积密封室灌注有白油，用于收集变速器室的泄漏物。与电机之间则采用一个径向轴封来密封。

5.1.4 螺旋桨

2 叶或 3 叶螺旋桨采用实心或复合材料制成，螺旋桨公称直径为 1600 mm 至 2600 mm。后曲式设计的入流边可防止出现堵塞。

| | TR/E 216 ... | TR/E 221 ... | TR/E 226-3 ... | TRE 312 ... | TR/E 316 ... | TR/E 321 ... | TR/E 326-3 ... |
|-----------------|--------------|--------------|----------------|--------------|--------------|--------------|----------------|
| 额定直径，单位：mm (in) | 1600 (63) | 2100 (83) | 2600 (102) | 1200 (47) | 1600 (63) | 2100 (83) | 2600 (102) |
| 叶片数量 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| 单个叶片 | • | • | • | • | • | • | • |
| 预装配的螺旋桨 | — | — | — | • | — | — | — |
| 现场安装螺旋桨 | • | • | • | — | • | • | • |

• = 标配，— = 不可用

5.1.5 材料

| | TR/E 216 ... | TR/E 221 ... | TR/E 226 ... | TRE 312 ... | TR/E 316 ... | TR/E 321 ... | TR/E 326-3 ... |
|------------------------------------|--------------|--------------|--------------|-------------|--------------|--------------|----------------|
| 外壳 | | | | | | | |
| EN-GJL-250 (ASTM A48 Class 35/40B) | • | • | • | • | • | • | • |
| 流体侧密封件 | | | | | | | |
| SiC/SiC | • | • | • | • | • | • | • |
| 前室/变速器室密封件 | | | | | | | |
| FPM (FKM) | • | • | • | • | • | • | • |
| 变速器室/密封室密封件 | | | | | | | |
| SiC/SiC | • | • | • | • | • | • | • |
| 密封室/电机密封件 | | | | | | | |
| FPM (FKM) | • | • | • | • | • | • | • |
| 螺旋桨轮毂 | | | | | | | |
| EN-GJL-250 (ASTM A48 Class 35/40B) | • | • | • | — | • | • | • |
| 1.4571 (AISI 316Ti) | — | — | — | • | — | — | — |

| | TR/E 216 ... | TR/E 221 ... | TR/E 226 ... | TRE 312 ... | TR/E 316 ... | TR/E 321 ... | TR/E 326-3 ... |
|--|--------------|--------------|--------------|-------------|--------------|--------------|----------------|
|--|--------------|--------------|--------------|-------------|--------------|--------------|----------------|

螺旋桨

| | | | | | | | |
|------------------|---|---|---|---|---|---|---|
| GFK-VE (GFRP-VE) | • | • | • | – | • | • | • |
| PA6G | – | – | – | • | – | – | – |

• = 标配, – = 不可用

5.2 监控装置

非防爆级潜水搅拌机可能采用的监控设备概览：

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|----------------|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| 电机舱/密封室 | o | o | o | o | o | o | o |
| 前室（外部铅芯湿度电极） | o | o | o | o | o | o | o |
| 电机绕组：温度限制装置 | • | • | • | • | • | • | • |
| 电机绕组：温度调节和限制装置 | o | o | o | o | o | o | o |

图例

– = 不可能, o = 可选, • = 标配

防爆级潜水搅拌机可能采用的监控设备概览：

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|--------------|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| 电机舱/密封室 | – | – | – | – | – | – | – |
| 前室（外部铅芯湿度电极） | o | o | o | o | o | o | o |

具有ATEX防爆认证

| | | | | | | | |
|----------------|---|---|---|---|---|---|---|
| 电机绕组：温度限制装置 | o | o | o | o | o | o | o |
| 电机绕组：温度调节和限制装置 | • | • | • | • | • | • | • |

具有FM/CSA防爆认证

| | | | | | | | |
|----------------|---|---|---|---|---|---|---|
| 电机绕组：温度限制装置 | • | • | • | • | • | • | • |
| 电机绕组：温度调节和限制装置 | o | o | o | o | o | o | o |

图例

– = 不可能, o = 可选, • = 标配

所有现有的监控设备必须始终处于连接状态！

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变速器室渗入流体事件。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

电机过热保护可以保护电机绕组免于过热。标准安装带一个双金属片的温度限制装置。如果达到反应温度，必须使用重启锁定功能执行一次关闭操作。

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。如果达到更低的反应温度，可以在电机冷却后执行一次自动重启。只有达到高反应温度时，才必须使用重启锁定功能执行一次关闭操作。

前室外部监控设备

前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。之后就可以通过设备控制器生成报警或者关闭搅拌器。

5.3 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！

5.4 在易爆环境中运行

| 符合标准 | TR 216 ... | TRE 216 ... | TR 221 ... | TRE 221 ... | TR 226-3 ... | TRE 226-3 ... | TRE 312 ... | TR 316 ... | TRE 316 ... | TR 321 ... | TRE 321 ... | TR 326-3 ... | TRE 326-3 ... |
|--------|------------|-------------|------------|-------------|--------------|---------------|-------------|------------|-------------|------------|-------------|--------------|---------------|
| ATEX | o | o | o | o | o | o | o | o | o | o | o | o | o |
| FM | o | o | o | o | o | o | o | o | o | o | o | o | o |
| CSA-Ex | o | - | o | - | o | - | - | o | - | o | - | o | - |

图例

- = 不存在/不可能, o = 可选, • = 标配

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

5.5 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* |
| n | 转速 |

| 铭牌缩写词 | 含义 |
|-----------------|------------|
| 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

5.6 型号代码

示例：**Wilo-EMU TRE 326-3.24-6/16Ex**
EMU 潜水搅拌机，卧式
TRE 产品系列：
→ TR：搅拌机装备标准异步电机
→ TRE：搅拌机装备IE3/IE4异步电机
3 叶片数量
26 x100 = 螺旋桨直径，单位 mm
3 结构模型
24 螺旋桨转速，单位 rpm
6 极数
16 x10 = 定子组件长度，单位 mm
Ex 具有防爆认证

5.7 供货范围

→ 潜水搅拌机带连接电缆
→ 螺旋桨轮毂
→ 螺旋桨叶片
→ 附件已安装完毕，具体取决于安装方式
→ 安装及操作说明

5.8 附件

→ 下降装置
→ 辅助升降装置
→ 用于固定升降绳的系绳柱
→ 附加的绳索张紧装置
→ 固定件套件带地脚螺栓

6 安装及电气连接
6.1 工作人员资格鉴定

→ 电气作业：受过培训的专业电工
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。
→ 安装/拆卸工作：接受过培训的废水处理技术专业人员
固定在不同的结构体上，提升设备，污水设施的基础知识
→ 提升工作：接受过提升装置操作培训的专业人员
提升设备，提升装置，吊装孔

6.2 运营者的责任

- 遵守本地现行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。保证工作人员穿戴防护装备。
- 标记工作区域。
- 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。
- 运行污水处理技术设备时，注意遵守当地实施的废水处理技术法规。
- 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！
- 检查现有的咨询文件（安装图、安放位置、入口条件）是否齐全和正确。

6.3 安装方式

- 灵活安装下降装置用作支架单元

6.4 安装



危险

在安装过程中，危害健康的介质会导致危险！

使安放位置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！



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！

- 作业时必须有另一名工作人员在场！

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。

- 穿戴防护装备！遵守工作规程。
 - 防护手套：4X42C (uvex C500)
 - 安全鞋：防护等级 S1 (uvex 1 sport S1)
 - 穿戴好防坠落装备！
 - 安全头盔：EN 397 符合标准，防止横向变形 (uvex pheos)
(使用提升设备的情况下)
- 准备安放位置：
 - 干净，无大颗粒固体物
 - 干燥
 - 不上冻
 - 已消毒
- 始终安排两人执行作业。
- 标记工作区域。
- 将擅自进入工作区域的人员清理出场。
- 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。
- 工作期间，有毒气体或窒息气体会不断聚集：
 - 遵守工作规程要求的保护措施（随身携带气体测量装置、气体报警设备）。
 - 确保充分的通风。
 - 如果出现有毒气体或窒息气体汇集的情况，立即离开工位！
- 放置提升设备：平坦的表面，清洁、牢固的地基。存放地点和安放位置必须易于接近。
- 将链条或钢索通过一个卸扣固定在把手/吊装孔上。只使用建筑技术允许使用的提升装置。
- 切勿在升降装置的摆动范围内停留。
- 按规定铺设所有接线电缆。接线电缆不得引发任何危险（绊倒危险，运行中损坏）。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。
- 遵守与墙壁和现有加装件之间的最小间距。

6.4.1 保养工作

如果存放时间超过 12 个月，则在开始安装之前，需要进行以下保养作业：

- 转动螺旋桨。
参见章节“转动螺旋桨 [► 30]”。
- 为密封室、变速器室和前室换油。
参见章节“换油 [► 32]”。

6.4.2 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！

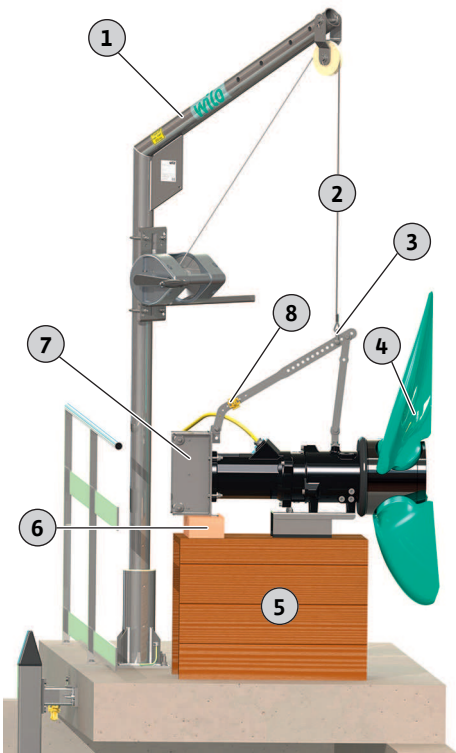


Fig. 3: 准备搅拌机

准备工作

| | |
|---|---------------|
| 1 | 升降装置 |
| 2 | 提升设备 |
| 3 | 吊挂用卸扣 |
| 4 | 螺旋桨 |
| 5 | 用于确保设备安全放置的基座 |
| 6 | 用于对齐的支撑块 |
| 7 | 机架 |
| 8 | 用于消除应力的电缆支架 |

- ✓ 搅拌机已放置并水平校准。
- ✓ 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. 使用一个卸扣，将机架吊挂在提升设备上。
- 2. 安装螺旋桨。参见单独的安装说明书“安装叶片”。
- 3. 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。
- 4. 请铺设好所有接线电缆。
- 5. 安装电缆支架，将电缆固定在水池边上。
小心！水池的水流很大时，请安装“附加的绳索张紧装置”！

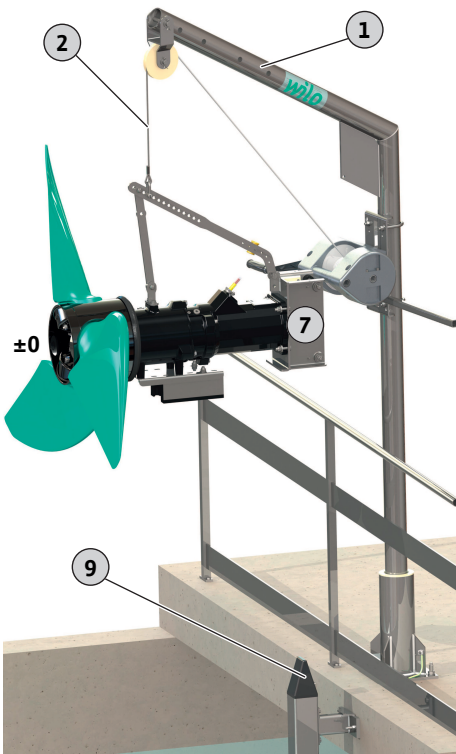


Fig. 4: 在水池上方摆动搅拌机

提升搅拌机并在水池上方摆动

| | |
|---|----------|
| 1 | 升降装置 |
| 2 | 提升设备 |
| 7 | 机架 |
| 9 | 下降装置的导流管 |

- ✓ 准备工作已完成。
- 1. 提升搅拌机，直至其可在栏杆上方安全摆动。
注意！搅拌机必须水平悬挂在升降装置上。如果搅拌机倾斜悬挂在升降装置上，则调整机架上的吊装孔。
- 2. 在水池上方摆动搅拌机。
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。

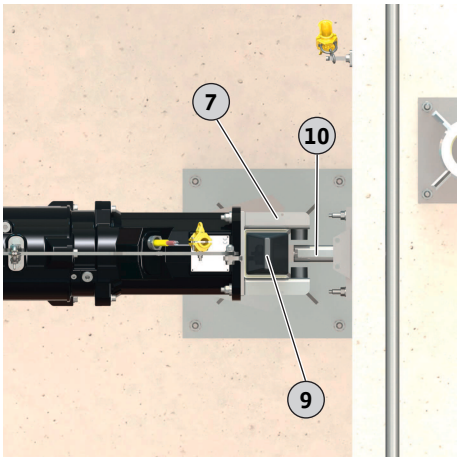


Fig. 5: 搅拌器在下降装置上

将搅拌器安装在下降装置上

| | |
|----|----------|
| 7 | 机架 |
| 9 | 下降装置的导流管 |
| 10 | 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。
- ✓ 将电缆支架固定在水池边缘。
 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！

结束安装

| | |
|----|----------|
| 1 | 升降装置 |
| 2 | 提升设备 |
| 9 | 下降装置的导流管 |
| 11 | 接线电缆 |

- ✓ 搅拌器已安装在下降装置上
 1. 缓慢降下搅拌器。
 - 降下时稍微约束住接线电缆。
 - 接线电缆不得受损。不得直接搭在水池边缘上！
注意！或者可以使用单独的尼龙绳进行张紧。附件中包含相应的张紧套件。
 2. 降下搅拌器，直至到达导流管末端。
 3. 将接线电缆与电缆支架固定在水池边缘。
- ▶ 安装过程结束。铺设接线电缆并进行电气连接。

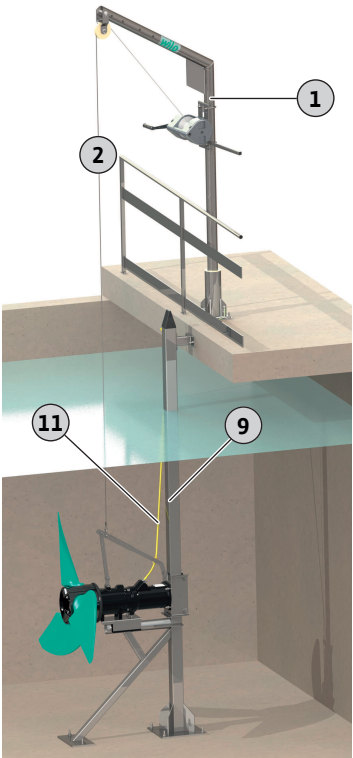


Fig. 6: 搅拌器已安放在支架上

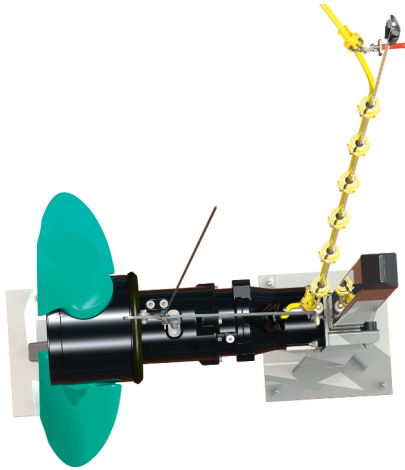


Fig. 7: 附加的绳索张紧装置

安装额外的绳索张紧装置

附加的绳索张紧装置可防止接线电缆在水池流量过大时损坏。绳索张紧装置包括一根 12 mm 的尼龙绳 (PA6) 和相应数量的电缆支架。电缆支架的数量和尺寸取决于订单。

警告！ 尼龙绳和电缆支架仅用于张紧接线电缆。严禁用于固定重物或第三方产品！

注意！ 以所提供的长度安装尼龙绳。如要缩短尼龙绳，需使用热风枪焊接两端，并用热缩管固定以防扭曲！

✓ 潜水搅拌机已完全安装好。

1. 将尼龙绳穿过基座上的吊环并打结固定。
2. 用手张紧尼龙绳（拉力约 10 ... 15 kg）。
3. 将尼龙绳牢固地固定在尺寸足够大的结构部件上（例如栏杆、上方夹持器等）。
4. 将第一个电缆支架直接固定在基座上。使用电缆支架将所有接线电缆夹紧在尼龙绳上。注意！不要绷紧接线电缆！接线电缆必须形成一个环！
5. 使用其他电缆支架将接线电缆夹紧在尼龙绳上。两个电缆支架之间的最大间距：1 m。小心！尼龙绳可延长到水中。尼龙绳拉紧时，接线电缆必须下垂约 10 cm！

移动式升降装置：安装系绳柱

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！

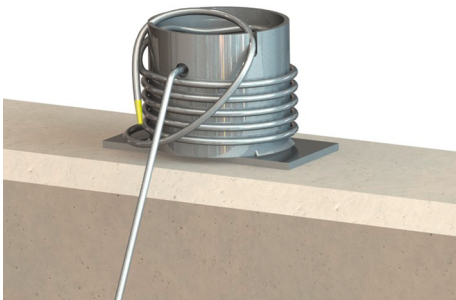


Fig. 8: 提升设备固定在系绳柱上

6.5 电气连接



危险

触电导致生命危险！

执行电气作业时不按规定操作，会发生电击致死事故！

- 由专业电工负责执行电气作业！
- 遵守当地相关法规！



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机进行电气连接。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！

- 电源连接符合铭牌上的信息。
- 三相交流电机（3~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。
- 连接所有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)

- 根据当地能源供应公司的规定安装漏电断路器 (RCD)。
- 如果人员可能接触到产品和导电液体，则安装漏电断路器 (RCD)。

6.5.2 维护工作

- 检查电机绕组的绝缘电阻。
- 检查温度传感器的电阻器。

6.5.2.1 检查电机绕组的绝缘电阻

- ✓ 1000 V 绝缘测量装置
- 1. 检查绝缘电阻。
 - ⇒ 预调试测量值：≥20 MΩ。
 - ⇒ 间隔测量测量值：≥2 MΩ。
- 绝缘电阻检查完毕。如果测得的数值与规定参数存在偏差，请咨询客户服务部。

6.5.2.2 检查温度传感器的电阻

- ✓ 有电阻表可用。
- 1. 测量电阻器。
 - ⇒ 双金属片测量值：0 欧姆（连续）。
 - ⇒ 3x PTC传感器测量值：介于 60 和 300 Ohm 之间。
 - ⇒ 4x PTC传感器测量值：介于 80 和 400 Ohm 之间。
- 电阻器检查完毕。如果测得的数值与规定参数存在偏差，请咨询客户服务部。

6.5.3 三相交流电机接口

- 接线电缆带裸露的端部。
- 随附的接线图含有连接电缆的相关详情：
 - 电缆规格
 - 芯线标识
- 将接线电缆连接到现场控制器上。

电源连接采用直接启动接线法时的芯线标识

| | |
|------------|------|
| U, V, W | 电源连接 |
| PE (gn-ye) | 接地 |

电源连接采用星三角接线法时的芯线标识

| | |
|------------|------------|
| U1, V1, W1 | 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

- 接线的详细信息请参见随附的接线图。
- 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，潜在爆炸环境中存在生命危险！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！

非防爆级潜水搅拌机可能采用的监控设备概览：

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|----------------|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| 电机舱/密封室 | o | o | o | o | o | o | o |
| 前室（外部铅芯湿度电极） | o | o | o | o | o | o | o |
| 电机绕组：温度限制装置 | • | • | • | • | • | • | • |
| 电机绕组：温度调节和限制装置 | o | o | o | o | o | o | o |

图例

- = 不可能，o = 可选，• = 标配

6.5.4.1 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！

6.5.4.2 电机绕组监控装置

配备双金属片

双金属片直接接入开关设备，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。

| 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 | |

| PTC 传感器芯线名称 | |
|-------------|------|
| 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

对于带双金属或 PTC 传感器的电机过热保护装置，由安装的传感器确定反应温度。视电机过热保护规格而定，达到反应温度后必须实现下列触发状态：

- 温度限制装置（1 温度回路）：
达到反应温度之后，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）：
达到低温反应温度后，可以通过自动重启功能执行一次关闭操作。达到高温反应温度后，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！

6.5.4.3 前室监控装置（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！

6.5.5 电机保护设置

6.5.5.1 直接启动

- 满负荷
按照铭牌上的参数将电机保护设置为额定电流。
- 部分负荷
将电机保护设为超过工况点所测电流 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。
- 星形接线法中的最长启动时间：3 s

6.5.5.3 软启动

- 满负荷
按照铭牌上的参数将电机保护设置为额定电流。
- 部分负荷
将电机保护设为超过工况点所测电流 5 %。

请注意以下几点：

- 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。变频器的相关要求请查阅并遵守附录中的内容！此外还要注意以下几点：

- 变频器的运行参数必须与设备参数相匹配。
- 请注意观察净化流程。可能存在淤塞或沉积物。
- 加大推力可导致附件承受更高的负载。

注意！运营者有责任遵守净化流程！

7 试运行



注意

断电后自动接通

通过单独的控制器根据流程接通和断开产品。在停电之后，可自动接通产品。

7.1 工作人员资格鉴定

- 操作/控制：操作人员接受了整个系统功能原理的指导

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。

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。

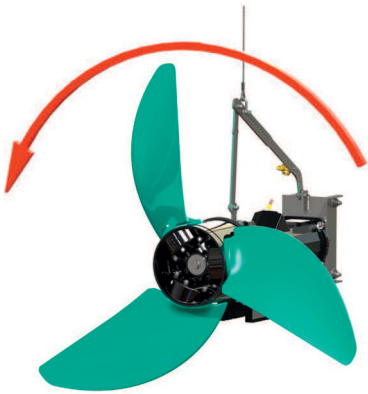


Fig. 9: TR/E 216 至 326-3 正确的旋转方向



注意！TRE 312 型搅拌器反向旋转方向！从正面观察，搅拌器顺时针旋转；从背面观察，搅拌器逆时针旋转。

Fig. 10: TRE 312 的正确旋转方向

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 216 ... | TRE 216 ... | TR 221 ... | TRE 221 ... | TR 226-3 ... | TRE 226-3 ... | TRE 312 ... | TR 316 ... | TRE 316 ... | TR 321 ... | TRE 321 ... | TR 326-3 ... | TRE 326-3 ... |
|------|------------|-------------|------------|-------------|--------------|---------------|-------------|------------|-------------|------------|-------------|--------------|---------------|
| ATEX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| 符合标准 | TR 216 ... | TRE 216 ... | TR 221 ... | TRE 221 ... | TR 226-3 ... | TRE 226-3 ... | TRE 312 ... | TR 316 ... | TRE 316 ... | TR 321 ... | TRE 321 ... | TR 326-3 ... | TRE 326-3 ... |
|--------|------------|-------------|------------|-------------|--------------|---------------|-------------|------------|-------------|------------|-------------|--------------|---------------|
| FM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CSA-Ex | 0 | - | 0 | - | 0 | - | - | 0 | - | 0 | - | 0 | - |

图例

- = 不存在/不可能, 0 = 可选, • = 标配

在爆炸性气体中使用, 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, 请检查以下几项:

- 电气连接是否符合规定?
- 接线电缆的铺设是否牢固?
- 浮子开关能否任意活动?
- 附件是否已正确固定?
- 是否遵守了流体温度?
- 是否遵守了潜水深度?
- 间歇运行: 是否遵守了最大开关频率?
- 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。

- 搅拌器启动时, 会短暂超过额定电流。
- 启动阶段, 至水池中形成水流后, 电耗会稍许超过额定电流。
- 运行过程中不得超过额定电流。

小心! 物资损失! 如果搅拌器无法启动, 请立即关闭搅拌器。电机损坏! 再次接通之前, 先排除故障。

7.7 运行过程中



警告

转动的螺旋桨有致伤危险！

禁止任何人在搅拌器工作区域内停留。有受伤的危险！

- 标记并封锁工作区域。
- 工作区域无人停留时才允许接通搅拌器。
- 如果有人进入工作区域，则立即关闭搅拌器。

定期检查以下几项：

- 搅拌器无沉积物和结垢现象。
- 确保接线电缆完好无损。
- 确保最低水浸。
- 安静、无振动运行。
- 未超出最大开关频率。
- 电源连接公差：
 - 工作电压：+/- 10 %
 - 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 %

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：操作人员接受了整个系统功能原理的指导
- 电气作业：受过培训的专业电工
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。
- 安装/拆卸工作：接受过培训的废水处理技术专业人员
固定在不同的结构体上，提升设备，污水设施的基础知识
- 提升工作：接受过提升装置操作培训的专业人员
提升设备，提升装置，吊装孔

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

搅拌器关闭，但是继续保持组装状态。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、冰冻和日光直射的危害，必须将搅拌器整个沉入流体中。

✓ 最低流体温度：+3 °C (+37 °F)。

1. 关闭搅拌器。
 2. 为操作台采取安全措施（比如锁住主开关），防止意外重启。
- ▶ 搅拌器现已停止运行，可以拆卸。

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。如果前提条件无法得到保障，请拆卸搅拌器！
- 如果定期长时间停止运行，需要执行一次功能运行：
 - 时间段：每月至每季度
 - 运行时间：5 分钟
 - 必须在有效的工作条件下执行功能运行！

8.4 拆卸



危险

危害健康的流体会导致危险！

细菌感染危险！

- 搅拌器拆卸后请采取消毒处理！
- 遵守工作规程的相关规定！



危险

触电导致生命危险！

执行电气作业时不按规定操作，会发生电击致死事故！

- 由专业电工负责执行电气作业！
- 遵守当地相关法规！



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！

- 作业时必须有另一名工作人员在场！



警告

高温表面可能导致烫伤！

电机在运行过程中可能带有高温。可能导致烫伤。

- 关闭后使电机冷却到环境温度！

工作时需要穿戴以下防护装备：

- 安全鞋：防护等级 S1 (uvex 1 sport S1)
- 防护手套：4X42C (uvex C500)
- 穿戴好防坠落装备！
- 安全头盔：EN 397 符合标准，防止横向变形 (uvex pheos)
(使用提升设备的情况下)

如果在工作时会接触到危害健康的流体，还应穿戴以下防护装备：

- 护目镜：uvex skyguard NT
 - 镜框标记：W 166 34 F CE
 - 镜片标记：0-0.0* W1 FKN CE
- 呼吸保护面罩：3M 6000 系列半面罩，带过滤器 6055 A2

规定的防护装备是最低要求。遵守工作规程的相关要求！

*根据 EN 170 的防护等级与此项作业无关。

8.4.1 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。

8.4.2 清洁和消毒

- 穿戴防护装备！遵守工作规程。
- 安全鞋：防护等级 S1 (uvex 1 sport S1)
 - 呼吸保护面罩：3M 6000 系列半面罩，带过滤器 6055 A2
 - 防护手套：4X42C + A 型 (uvex protector chemical NK2725B)
 - 护目镜：uvex skyguard NT
- 使用消毒剂：
- 严格按照生产商说明使用！
 - 根据生产商说明穿戴防护装备！
- 根据当地法规废弃处理冲洗水，例如引入污水管道！
- ✓ 已拆下搅拌器。
1. 采用防水的方式包装好裸露的电缆末端！
 2. 将提升设备固定在吊装孔上。
 3. 将搅拌器提升到距离池底大约 30 cm (10 in) 的位置。
 4. 从上到下，向搅拌器喷射清水。
 5. 从各个方向向螺旋桨喷水。
 6. 搅拌器消毒。
 7. 废弃处理底部的脏污残渣，例如冲入通道。
 8. 使搅拌器干燥。

9 维护和维修

9.1 工作人员资格鉴定

- 电气作业：受过培训的专业电工
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。
- 保养工作：接受过培训的废水处理技术专业人员
使用/废弃处置用过的工作介质，机械制造基础知识（安装/拆卸）

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。
- 须在设备的检修表中记录保养工作。

9.3 工作介质

9.3.1 油类型

白油

- ExxonMobile: Marcol 52
- ExxonMobile: Marcol 82
- Total: Finavestan A 80 B (经过NSF-H1认证)

CLP 齿轮油 (ISO VG 220)

- Aral: Degol BG 220
- BP: Energol Gr-XP 220
- Shell: Omala S2 GX 220
- Tripol: FoodProof 1810/220 (获得USDA-H1许可)

9.3.2 润滑脂

- Esso: Unirex N3
- Tripol: Molub-Alloy-Food Proof 823 FM (获得USDA-H1许可)

9.3.3 加注量

- 前室 : 1.00 l (34 US.fl.oz.)
- 变速器室 : 0.60 l (20 US.fl.oz.)
- 密封室 : 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

- 定期执行保养作业。
- 根据实际环境条件按合同调整保养间隔。联系客户服务部。
- 如果在运行过程中出现剧烈振动, 检查安装情况。

9.4.1 一般工作条件下的保养间隔

- 8000 个运行小时数或者 2 年后**
- 目检接线电缆
 - 目检电缆支架和绳索张力情况
 - 对搅拌器执行目检
 - 目检附件
 - 检查监控设备的功能
 - 换油

- 80000 个运行小时数或者 10 年后**
- 大修

9.4.2 恶劣条件下的保养间隔

在以下操作条件下, 请咨询客户服务缩短规定的保养间隔:

- 流体中含有长纤维成分
- 强腐蚀性或磨蚀性流体
- 介质能生成大量气体
- 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)

在恶劣条件下使用水泵时, 建议签订保养合同。

9.5 保养措施



警告

锋利边缘导致受伤危险!

螺旋桨叶片可能逐渐形成尖锐边缘, 存在割伤危险!

- 佩戴防护手套!

开始采取保养措施之前, 满足下列前提条件:

- 穿戴防护装备! 遵守工作规程。
 - 安全鞋: 防护等级 S1 (uvex 1 sport S1)
 - 防护手套: 4X42C (uvex C500)
 - 护目镜: uvex skyguard NT
 有关镜框和镜片的详细标记请参见“个人防护装备 [► 8]”一章。
- 搅拌器已彻底清洁并消毒。
- 电机已冷却到环境温度。
- 工作位置:
 - 洁净、照明和通风良好。
 - 工作台面坚固稳定。
 - 有保护装置, 防止摔倒和滑倒。

小心! 切勿将搅拌器放在螺旋桨上! 准备一个合适的基座。

注意! 只执行本安装及操作说明中列出的保养作业。

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 转动螺旋桨

- ✓ 防护装备就位!

✓ 将搅拌器断电！

1. 将搅拌器水平放在固定工作台面上。

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. 固定搅拌器，防止翻倒或滑移！

3. 小心抓住螺旋桨并转动。

9.5.3 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

如果接线电缆损坏：

- 立即停止运行搅拌器！
- 联系客户服务部更换接线电缆！

小心！物资损失！水会通过损坏的接线电缆进入电机。电机进水会导致搅拌器彻底损毁。

9.5.4 目检电缆支架和绳索张力情况

检查电缆支架和电缆张紧装置的材料疲劳和损耗情况。

- 如果发现磨损或损坏迹象，则立即更换部件。

9.5.5 对搅拌器执行目检

检查壳体和螺旋桨的损坏和磨损情况。如果确定存在缺陷，注意下面几项：

- 修补损坏的涂层。请在客户服务部订购维修套件。
- 如果部件发生磨损，请咨询客户服务部！

9.5.6 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！

9.5.6.1 检查温度传感器的电阻

✓ 有电阻表可用。

1. 测量电阻器。

⇒ 双金属片测量值：0 欧姆（连续）。

⇒ 3x PTC传感器测量值：介于 60 和 300 Ohm 之间。

⇒ 4x PTC传感器测量值：介于 80 和 400 Ohm 之间。

► 电阻器检查完毕。如果测得的数值与规定参数存在偏差，请咨询客户服务部。

9.5.6.2 检查前室监控装置外部电极的电阻

✓ 有电阻表可用。

1. 测量电阻器。

⇒ 测量值“无限(∞)”：监控设备正常。

⇒ 测量值 ≤ 30 kOhm：油中有水。执行换油！

► 电阻器检查完毕。如果换油后测得的数值出现偏差，请咨询客户服务部。

9.5.7 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。

9.5.8 换油

**警告****工作介质承受压力！**

电机内部会形成高压！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！
- 可能会喷射出高温工作介质！
 - ⇒ 穿戴防护装备！
 - ⇒ 执行任何作业之前，应先将电机冷却到环境温度！
 - ⇒ 遵守规定的工作步骤顺序！
 - ⇒ 缓慢旋出螺旋塞。
 - ⇒ 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，才能完全拧出螺旋塞。

9.5.8.1 为密封室、变速器室和前室换油

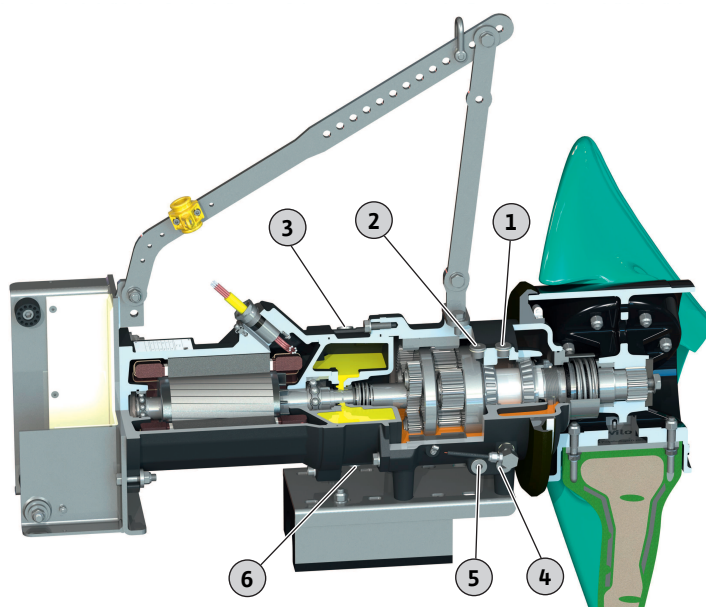


Fig. 11: 换油

| | |
|---|---------|
| 1 | 前室注入孔 |
| 2 | 变速器室注入孔 |
| 3 | 密封室注入孔 |
| 4 | 前室排放孔 |
| 5 | 变速器室排放孔 |
| 6 | 密封室排放孔 |

- ✓ 防护装备就位！
- ✓ 搅拌器已拆卸、清洁完毕，并完成消毒处理。
- 1. 将搅拌器水平放在固定工作台面上。
小心！当心产品损坏！切勿将搅拌器放在螺旋桨上！始终将搅拌器放在基座上。
- 2. 固定搅拌器，防止翻倒和滑移！
- 3. 放置合适的容器用于收集工作介质。
- 4. 拧开加注口的螺旋塞：
 - ⇒ 1 = 前室
 - ⇒ 2 = 变速器室
 - ⇒ 3 = 密封室
- 5. 将排放口的螺旋塞拧开，排放工作介质：
 - 注意！将前室、变速器室和密封室冲洗干净，实现彻底的清空。

- ⇒ 4 = 前室
- ⇒ 5 = 变速器室
- ⇒ 6 = 密封室

6. 检查工作介质：

- ⇒ 工作介质清澈：工作介质可重复使用。
- ⇒ 工作介质脏污（黑色）：注入新的工作介质。
- ⇒ 工作介质呈乳白色/浑浊：油中有水。机械密封造成的少量泄漏属于正常现象。如果油与水的比例小于 2:1，那么可能损坏机械密封。进行换油并在 4 周后再次检查。如果再次有水进入油中，则通知客户服务部！
- ⇒ 工作介质中有金属屑：通知客户服务部！

7. 清洁排放孔的螺旋塞，装入新密封环，重新拧入螺旋塞。最大拧紧扭矩：8 Nm (5.9 ft·lb)！

8. 通过注入孔填注工作介质。

- ⇒ 遵守规定的工作介质类型和数量！

9. 清洁注入孔的螺旋塞，装入新密封环，重新拧入螺旋塞。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。

9.5.9 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

锋利边缘导致受伤危险！

螺旋桨叶片可能逐渐形成尖锐边缘，存在割伤危险！

- 佩戴防护手套！

开始维修前，必须满足下列前提条件：

- 穿戴防护装备！遵守工作规程。
 - 安全鞋：防护等级 S1 (uvex 1 sport S1)
 - 防护手套：4X42C (uvex C500)
 - 护目镜：uvex skyguard NT
 有关镜框和镜片的详细标记请参见“个人防护装备 [► 8]”一章。
- 搅拌器已彻底清洁并消毒。
- 电机已冷却到环境温度。
- 工作位置：
 - 洁净、照明和通风良好。
 - 工作台面坚固稳定。
 - 有保护装置，防止摔倒和滑倒。

小心！切勿将搅拌器放在螺旋桨上！准备一个合适的基座。

注意！只执行本安装及操作说明书中列出的维修工作。

维修工作的原则：

- 如有流体和工作介质滴落，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！
- 严格禁止使用蛮力！

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。
- 更换固定夹。
- 更换基座。

9.6.3 更换螺旋桨

有关更换螺旋桨叶片的所有信息请参见单独的说明书“安装叶片”。

9.6.4 更换液体侧机械密封

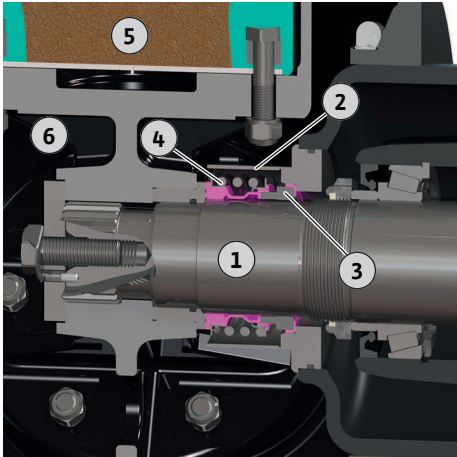


Fig. 12: 更换液体侧机械密封

| | |
|---|----------|
| 1 | 轴 |
| 2 | 密封套 |
| 3 | 机械密封：静止环 |
| 4 | 机械密封：弹簧 |
| 5 | 螺旋桨叶片 |
| 6 | 毂 |

- ✓ 搅拌器已放置并固定在坚实底座上。
- ✓ 工具已就位。
- ✓ 已排出前室的油。
- ✓ 已拆卸螺旋桨（带毂的叶片）。
- 1. 从轴上拔下机械密封的弹簧。
- 2. 使用橡胶锤，小心地拆下密封套。
- 3. 从壳体底座中压出机械密封的静止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，将机械密封的新静止环压入壳体底座中。小心！压入静止环时注意不要倾斜。如果压入时静止环倾斜，静止环会碎裂。之后就无法继续使用机械密封！
- 7. 安装密封套：在密封套配合面上涂抹 Loctite 262 或 2701。使用橡胶锤，将密封套压在底座上。
- 8. 将机械密封的新弹簧套在轴上。
- 9. 安装螺旋桨。
- 机械密封更换完毕。为前室注油。

9.6.5 更换固定夹

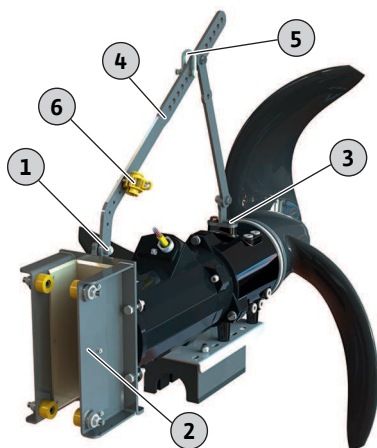


Fig. 13: 更换手柄

| | |
|---|----------------------------|
| 1 | 1x 机架固定材料：六角头螺钉，2 个垫圈，六角螺母 |
| 2 | 机架 |
| 3 | 2x 搅拌器固定材料：六角头螺钉，垫圈 |
| 4 | 手柄 |
| 5 | 卸扣 |
| 6 | 电缆支架固定件：垫圈，六角螺母 |

✓ 搅拌器已放置并固定在坚实底座上。

✓ 工具已就位。

1. 拆卸电缆支架：

- 松开并拧下六角螺母。
- 从六角头螺钉上拔下垫圈。

2. 松开机架上的固定夹固定件：

- 松开并拧下六角螺母。
- 从六角头螺钉上拔下垫圈。
- 拧下六角头螺钉。

3. 松开搅拌器上的固定夹固定件：松开并拧下六角头螺钉。

4. 取下固定夹。

5. 放置新固定夹并用固定件固定在机架上：

- 将垫圈套在六角头螺钉上。
- 插入六角头螺钉，使其穿过机架和固定夹。
- 套入垫圈并转动六角螺母。

注意！只稍微拧紧固定件！固定固定夹！

6. 将固定夹固定在搅拌器上：

- 将垫圈套入六角螺栓。
- 为六角头螺钉涂抹螺丝防松胶。
- 拧入并拧紧六角头螺钉。最大拧紧扭矩：见附录。

7. 比较新固定夹两个支撑条的钻孔布置型式和老固定夹的钻孔布置型式。必要时调整新固定夹的钻孔布置型式。

8. 将固定夹固定在机架上：

- 拧松六角螺母。
- 为六角头螺钉涂抹螺丝防松胶。
- 拧紧六角螺母。最大拧紧扭矩：见附录。

9. 安装电缆支架：

- 将电缆支架插入固定夹。注意！电缆必须形成一个小弧度。铺设电缆时切勿绷紧！
- 将垫圈套入六角头螺钉。
- 转动并拧紧六角螺母。最大拧紧扭矩：见附录。

10. 检查卸扣的位置！

将提升设备挂到卸扣上。搅拌器在提升时必须保持水平。如果搅拌器倾斜，则调整卸扣。

► 固定夹更换完毕。

9.6.6 更换机架

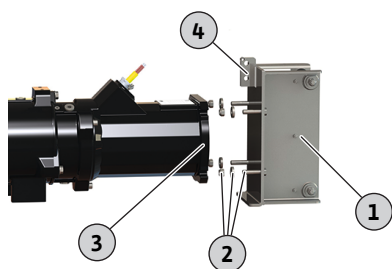


Fig. 14: 更换机架

| | |
|---|------------------------|
| 1 | 机架 |
| 2 | 4x 机架固定材料：六角螺栓、垫圈、六角螺母 |
| 3 | 电机法兰 |
| 4 | 固定夹固定件：六角螺栓，2 个垫圈，六角螺母 |

✓ 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. 松开固定夹的固定件并拧出六角螺栓。

2. 松开机架固定件的六角螺母并将其拧下。

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. 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。
 12. 重新将固定夹固定在机架上：
 - 将垫圈套在六角螺栓上。
 - 插入六角螺栓，使其穿过机架和固定夹。
 - 将垫圈套在六角螺栓上。
 - 在六角螺栓上涂抹螺丝防松胶。
 - 转动六角螺母并将其拧紧。最大拧紧扭矩：见附录。
- 机架更换完毕。

10 故障、原因和排除方法



警告

转动的螺旋桨有致伤危险！

禁止任何人在搅拌机工作区域内停留。有受伤的危险！

- 标记并封锁工作区域。
- 工作区域无人停留时才允许接通搅拌机。
- 如果有人进入工作区域，则立即关闭搅拌机。

故障：搅拌机不启动

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机”

故障：搅拌机启动后，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。一旦有介质滴落，立刻进行收集！

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 关于收集损耗的电气产品和电子产品的的相关信息

按规定废弃处置和正确回收这些产品，能避免环境污染、保护人身健康。



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访问www.wilo-recycling.com。

保留技术变更权利！

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 在变频器上运行

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，请咨询客户服务部。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。变频器和滤波器须相互匹配！

根据电机额定电流对变频器进行配置。请注意，搅拌器在整个调节范围内工作时不得出现抖动和振动（无振动、共振和摆动力矩现象）。否则机械密封会丧失密封性并损坏。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，注意遵守潜水式电动机的二次特征曲线（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。

如果电机与变频器同时运行，电机监测可能受到干扰。下列措施可降低或避免干扰：

- 遵守 IEC 60034-25 标准规定的过电压极值和上升速度极值。必要时安装输出滤波器。
- 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。

下列结构性措施可减少或者避免干扰：

- 干线和控制电缆具有单独的接线电缆（视电机结构尺寸而定）。
- 布线时，在干线和控制电缆之间留出足够的间距。
- 使用已屏蔽的接线电缆。

汇总

- 连续运行时的最低/最高频率：
 - 异步电动机：30 Hz 至额定频率（50 Hz 或 60 Hz）
 - 永磁电机：30 Hz 至型号铭牌上指定的最高频率
 注意！如果频率增大，请联系客户服务部！
- 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。
- 连接双金属或 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

触电导致生命危险！

执行电气作业时不按规定操作，会发生电击致死事故！

- 由专业电工负责执行电气作业！
- 遵守当地相关法规！

- 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 $\pm 10\%$ 。

防爆级潜水搅拌器可能采用的监控设备概览：

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|---------------------|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| 电机舱/密封室 | - | - | - | - | - | - | - |
| 前室（外部铅芯湿度电极） | o | o | o | o | o | o | o |
| 具有ATEX防爆认证 | | | | | | | |
| 电机绕组：温度限制装置 | o | o | o | o | o | o | o |
| 电机绕组：温度调节和限制装置 | • | • | • | • | • | • | • |
| 具有FM/CSA防爆认证 | | | | | | | |
| 电机绕组：温度限制装置 | • | • | • | • | • | • | • |
| 电机绕组：温度调节和限制装置 | o | o | o | o | o | o | o |

图例

- = 不可能, o = 可选, • = 标配

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！

对于电机过热保护，由安装的传感器确定反应温度。视电机过热保护规格而定，达到反应温度后必须实现下列触发状态：

- 温度限制装置（1 温度回路）：
达到反应温度之后，必须通过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）：
达到低温反应温度后，可以通过自动重启功能执行一次关闭操作。达到高温反应温度后，必须通过重启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暂停时间！

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。
连接值：最大 250 V(AC)，2.5 A， $\cos \varphi = 1$
- 通过一个评测继电器连接PTC传感器。建议使用“CM-MSS”继电器。
- 如果使用变频器，将温度传感器与Safe Torque Off (STO)相连。这样可在硬件方面保证关闭。

13.3.4.2 前室监控装置（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
- 连续运行时的最低/最高频率：
 - 异步电动机：30 Hz 至额定频率（50 Hz 或 60 Hz）
 - 永磁电机：30 Hz 至型号铭牌上指定的最高频率
 注意！最高频率可能低于 50 Hz！
- 最小开关频率：4 kHz
- 接线端子板最大过电压：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
- 扭矩应用：二次水泵特征曲线或者自动能量优化程序（比如VVC+）
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设备（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钉，最低要求是强度等级达到 600 N/mm² (38.85 长吨-力/英寸²)。

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！

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1 General information

1.1 About these instructions

These instructions form part of the product. Compliance with the instructions is essential for correct handling and use:

- Read the instructions carefully before all activities.
- Keep the instructions in an accessible place at all times.
- Observe all product specifications.
- Observe the markings on the product.

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

1.2 Digital instructions

The digital version of the instructions is available on the following product page:
<https://qr.wilo.com/737>

1.3 Copyright

These installation and operating instructions have been copyrighted by Wilo. Content of any kind must not be reproduced, distributed or used by unauthorised persons for purposes of competition and shared with others.

1.4 Subject to change

Wilo shall reserve the right to change the listed data without notice and shall not be liable for technical inaccuracies and/or omissions. The illustrations used may differ from the original and are intended as an example representation of the device.

1.5 Exclusion from warranty and liability

Wilo shall specifically not assume any warranty or liability in the following cases:

- Inadequate configuration due to inadequate or incorrect instructions by the operator or the client
- Non-compliance with these instructions
- Improper use
- Incorrect storage or transport
- Incorrect installation or dismantling
- Insufficient maintenance
- Unauthorised repairs
- Inadequate construction site
- Chemical, electrical or electrochemical influences
- Wear

2 Safety

This section contains basic information about the individual stages in the life cycle of the pump. Failure to observe this information leads to:

- Danger to persons
- Danger to the environment
- Property damage
- Loss of claims for damages

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 have been instructed on locally applicable regulations governing accident prevention.
- Personnel have read and understood the installation and operating instructions.
- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Installation/dismantling work: trained sewage technology professional
Fixation to different construction parts, lifting equipment, wastewater facility basics
- Maintenance work: trained sewage technology professional
Application/disposal of operating fluids used, basic engineering knowledge (installation/dismantling)
- Lifting work: trained specialist for the operation of lifting devices
Lifting equipment, lifting gear, attachment points

Children and persons with limited abilities

- Persons under the age of 16: Use of this product is prohibited.
- Persons under the age of 18: Supervise them during use of the product (supervisor)!
- Persons with limited physical, sensory or mental capacities: Use of this product is prohibited!

2.3 Personal protective equipment

The protective equipment specified is the minimum requirement. Observe the requirements of the work regulations.

Protective equipment: Transport, installation, removal and maintenance

- Safety shoes: Protection class S1 (uvex 1 sport S1)
- Protective gloves (EN 388): 4X42C (uvex C500)
- Safety helmet (EN 397): Conforms to standards, protection against lateral deformation (uvex pheos)
(If lifting equipment is used)

Protective equipment: Cleaning work

- Protective gloves (EN ISO 374-1): 4X42C + Type A (uvex protector chemical NK2725B)
- Safety goggles (EN 166): (uvex skyguard NT)
 - Labelling frame: W 166 34 F CE
 - Labelling disc: 0-0.0* W1 FKN CE
 - * Protection level according to EN 170 not relevant for this work.
- Breathing protection mask (EN 149): Half mask 3M series 6000 with filter 6055 A2

Article recommendations

The articles mentioned in brackets are recommendations. The articles can be replaced with an identical article according to the mentioned labellings!

2.4 Electrical work

- Electrical work must be carried out by a qualified electrician.
- Disconnect device from the mains and secure it against being switched on again without authorisation.
- Observe applicable local regulations when connecting to the mains power supply.
- Comply with the requirements of the local energy supply company.
- Train personnel on how to make electrical connections.
- Train personnel on the options for switching off the device.
- Observe the technical information in these installation and operating instructions as well as on the rating plate.
- Earth the device.
- Observe provisions 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 special measures into account (e.g. shielded cables, filters, etc.).
- Replace defective connection cables. Contact customer service.

2.5 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)

- Install a residual-current device (RCD) in accordance with the regulations of the local energy supply company.
- If people can come into contact with the device and conductive fluids, install a residual-current device (RCD).

2.6 Fluids hazardous to health

Hazardous germs form in sewage or in stagnant water. There is a danger of bacterial infections!

- Wear protective equipment!
- Clean and disinfect the product thoroughly after removal!
- Inform all persons about the pumped fluid and the danger it poses!

2.7 Transport

- Locally applicable laws and regulations on work safety and accident prevention must be complied with.
- Demarcate and cordon off the working area.
- Keep unauthorised persons away from the working area.
- Always attach the lifting gear to the attachment points.
- Ensure that the lifting gear is securely attached.
- Observe packaging instructions:
 - Impact-resistant
 - Ensure that the product is properly fixed in place.
 - Protect it against dust, oil and moisture.

2.8 Installing/dismantling

- Wear a safety harness.
- Locally applicable laws and regulations on work safety and accident prevention must be complied with.
- Demarcate and cordon off the working area.
- Keep working area free from ice.
- Remove objects lying around from the work area.
- Keep unauthorised persons away from the working area.
- If the weather conditions mean it is no longer possible to work safely, stop work.
- 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.
- Ensure enclosed spaces have sufficient ventilation.
- Toxic or asphyxiating gases may build up in enclosed spaces or buildings. Observe protective measures in accordance with work regulations, e.g. carry a gas detector with you.
- If there is a risk of explosion, do not carry out welding work or work with electrical devices.
- Disconnect device from the mains and secure it against being switched on again without authorisation.
- All rotating parts must stop.
- Disinfect product.

2.9 During operation

- Demarcate and cordon off the working area.
- No persons are allowed in the working area during operation.
- Depending on the process, the product is activated and deactivated using separate controls. The product may automatically be activated following power cuts.
- If the motor emerges, the motor housing can heat up to above 40 °C (104 °F).
- Superior must be informed immediately of any faults or irregularities.
- The product must be switched off immediately if faults occur.
- Propeller must not crash into fixtures or walls. Observe defined clearances in accordance with consulting documents.
- Observe required water immersion. If water level varies significantly, use level monitoring.
- Sound-pressure level depends on several factors (installation, duty point, etc.). Measure the current noise level under operating conditions. Wear hearing protection at noise levels of 85 dB(A) and over. Demarcate the working area!

2.10 Maintenance tasks

- Disconnect device from the mains and secure it against being switched on again without authorisation.
- Disinfect product.
- Carry out maintenance work in a clean, dry and well-lit place.
- Only carry out maintenance tasks described in these installation and operating instructions.
- Only original parts of the manufacturer may be used. The use of any non-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.

2.11 Operating fluid

The seal housing is filled with white oil. The gear and the pre-chamber are filled with gear oil.

- Absorb leakages immediately.
- If major leakages occur, contact customer service.
- If the seal is defective, the oil enters the pumped fluid.
- **Skin contact:** Rinse skin areas thoroughly with soap and water. If skin irritation occurs, consult a doctor.
- **Contact with eyes:** Remove the contact lenses. Rinse eye thoroughly with water. If eye irritation occurs, consult a doctor.

2.12 Operator responsibilities

- Provide installation and operating instructions in a language which the personnel can understand.
- Make sure that the personnel have received the required training for the specified work.
- Provide protective equipment. Ensure that the protective equipment is worn by personnel.
- Ensure that safety and information signs mounted on the device are always legible.
- Train the personnel on how the system operates.
- Fit dangerous components within the system with an on-site guard.
- Demarcate and cordon off the working area.
- Measure the noise level. At noise levels of 85 dB(A) and over, wear hearing protection. Demarcate the working area!

3 Transportation and storage

3.1 Delivery

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

3.2 Transport



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. 1: Attachment point

- Wear protective equipment! Observe the work regulations.
 - Protective gloves: 4X42C (uvex C500)
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
- Attach the mixer to the attachment point.
- Protect the connection cable against water ingress.
- 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.

3.3 Use of lifting equipment

If lifting equipment (lifting device, crane, chain hoist ...) is used, observe the following points:

- Wear a safety helmet according to EN 397!
- Comply with local regulations on the use of lifting equipment.
- The technically correct use of the lifting equipment is the operator's responsibility!
- **Lifting gear**
 - Use legally specified and approved lifting gear.
 - Select lifting gear based on the attachment point.
 - Attach lifting gear to the attachment point according to local regulations.
- **Lifting equipment**
 - Check its functions properly before use!
 - Sufficient bearing capacity.
 - Ensure stability during use.
- **Lifting operation**
 - Do not jam the product when lifting and lowering it.
 - Do not exceed the max. permissible bearing capacity!
 - If necessary (e.g. blocked view), assign a second person to coordinate.
 - No one should stand under suspended loads!
 - Do not move loads over workplaces where persons are present!

3.4 Storage



DANGER

Danger due to fluids which are hazardous to health!

Danger of bacterial infection!

- Disinfect the mixer after removal.
- Observe the specifications of the work regulations.



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the propeller blades. There is a danger of cuts and similar injuries!

- Wear protective gloves!

CAUTION

Total damage from 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.

- Securely position the mixer horizontally on a firm bearing surface.
- Secure the mixer against falling over and slipping.
- Do not set the mixer down on the propeller. In the case of larger propeller diameters, ensure an appropriate platform is provided.
- CAUTION! Material damage! Propeller and shaft can be damaged.**
- Store the mixer for a maximum of one year. Contact customer service before storing the device for more than one year.
- Storage conditions:
 - Maximum: -15 to +60 °C (5 to 140 °F), max. humidity: 90 %, non-condensing.
 - Recommended: 5 to 25 °C (41 to 77 °F), relative humidity: 40 to 50 %.
 - Protect the mixer from direct exposure to sunlight. Extreme heat can cause damage!
- 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. Maintain a constant bend radius!
- Turn the propeller at regular intervals (twice a year). This prevents the bearings from jamming and renews the lubrication film on the mechanical seal. **NOTICE! Wear protective gloves!**

4 Application/use

4.1 Intended use

For homogenisation and flow generation in commercial areas of:

- Process sewage
- Sewage containing faeces

Comply with the specific dimensioning based on the operator requirements. Any other use deviating from this is regarded as non-compliant with the intended use.

4.2 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

5 Product description

5.1 Construction

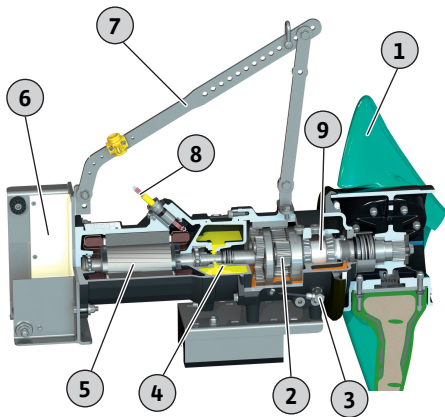


Fig. 2: Overview of the submersible mixer

The submersible mixer consists of the following main components:

| | |
|---|-----------------------------|
| 1 | Propeller |
| 2 | Gear, 2-stage |
| 3 | Pencil electrode (optional) |
| 4 | Sealing chamber |
| 5 | Motor |
| 6 | Frame for lowering device |
| 7 | Handle grip |
| 8 | Connection cable |
| 9 | Pre-chamber |

5.1.1 Motor

Wilo-EMU TR ...

Surface-cooled submersible motor in three-phase current design with permanently lubricated and large-size rolling bearings. The motor winding is equipped with temperature monitoring. The motor heat is given off directly to the surrounding fluid via the motor housing. The connection cable is designed for heavy mechanical loads, sealed water pressure-tight against the fluid and is sealed longitudinally watertight. The connection cable has bare cable ends and is 10 m (33 ft) long as standard.

Wilo-EMU TRE ...

Surface-cooled submersible motor in three-phase current design with permanently lubricated and large-size rolling bearings. The motor winding is equipped with temperature monitoring. The motor heat is given off directly to the surrounding fluid via the motor housing. The connection cable is designed for heavy mechanical loads, sealed water pressure-tight against the fluid and is sealed longitudinally watertight. The connection cable has bare cable ends and is 10 m (33 ft) long as standard.

The submersible motor meets the IE3/IE4 motor efficiency class (according to IEC 60034-30). Motors of the motor efficiency class “IE4” have been specified as “E4” in the motor designation.

Technical data

| | |
|------------------------------|-----------------------------|
| Operating mode, immersed | S1 |
| Operating mode, non-immersed | - |
| Fluid temperature | 3 ... 40 °C (37 ... 104 °F) |

| | |
|--------------------------|--------------|
| Max. immersion depth | 20 m (66 ft) |
| Protection class | IP68 |
| Insulation class | H |
| Max. switching frequency | 15/h |

5.1.2 Gear

Two-stage planetary gear with exchangeable transmission. Gear bearings have been dimensioned large to absorb resulting stirring forces and not transfer these to the motor bearing.

5.1.3 Seal

The system is sealed by a 3-chamber system:

- Pre-chamber
- Gear chamber
- Sealing chamber

Pre-chamber

The high-volume pre-chamber has been filled with gear oil to absorb any leakage at the seal on the fluid side. A mechanical seal is used as the seal on the fluid side. A rotary shaft seal seals towards the gear chamber.

Gear chamber

The gear chamber has been filled with gear oil to guarantee continuous lubrication of the planetary gear and the gear bearings. A mechanical seal seals towards the sealing chamber.

Sealing chamber

The high-volume sealing chamber is filled with white oil and absorbs any leakage from the gear chamber. A rotary shaft seal seals towards the motor.

5.1.4 Propeller

2- or 3-bladed propeller made of solid or composite material with a nominal propeller diameter of 1600 mm to 2600 mm. Clogging-free propeller geometry design made possible by backward-curved incoming flow edge.

| | TR/E 216 ... | TR/E 221 ... | TR/E 226-3 ... | TRE 312 ... | TR/E 316 ... | TR/E 321 ... | TR/E 326-3 ... |
|--------------------------------|--------------|--------------|----------------|--------------|--------------|--------------|----------------|
| Nominal diameter in mm (in) | 1600 (63) | 2100 (83) | 2600 (102) | 1200 (47) | 1600 (63) | 2100 (83) | 2600 (102) |
| Number of blades | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| Individual blades | • | • | • | • | • | • | • |
| Propeller pre-assembled | – | – | – | • | – | – | – |
| On-site propeller installation | • | • | • | – | • | • | • |

• = standard, – = not available

5.1.5 Materials

| | TR/E 216 ... | TR/E 221 ... | TR/E 226 ... | TRE 312 ... | TR/E 316 ... | TR/E 321 ... | TR/E 326-3 ... |
|------------------------------------|--------------|--------------|--------------|-------------|--------------|--------------|----------------|
| Housing | | | | | | | |
| EN-GJL-250 (ASTM A48 Class 35/40B) | • | • | • | • | • | • | • |
| Seal, on the fluid side | | | | | | | |

| | TR/E 216 ... | TR/E 221 ... | TR/E 226 ... | TRE 312 ... | TR/E 316 ... | TR/E 321 ... | TR/E 326-3 ... |
|------------------------------------|--------------|--------------|--------------|-------------|--------------|--------------|----------------|
| SiC/SiC | • | • | • | • | • | • | • |
| Seal, pre-/gear chamber | | | | | | | |
| FPM (FKM) | • | • | • | • | • | • | • |
| Seal, gear/sealing chamber | | | | | | | |
| SiC/SiC | • | • | • | • | • | • | • |
| Seal, sealing chamber/motor | | | | | | | |
| FPM (FKM) | • | • | • | • | • | • | • |
| Propeller hub | | | | | | | |
| EN-GJL-250 (ASTM A48 Class 35/40B) | • | • | • | – | • | • | • |
| 1.4571 (AISI 316Ti) | – | – | – | • | – | – | – |
| Propeller | | | | | | | |
| GFK-VE (GFRP-VE) | • | • | • | – | • | • | • |
| PA6G | – | – | – | • | – | – | – |

• = standard, – = not available

5.2 Monitoring devices

Overview of possible monitoring devices for submersible mixers **without Ex rating**:

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|---|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| Motor compartment/sealing chamber | o | o | o | o | o | o | o |
| Pre-chamber (external pencil electrode) | o | o | o | o | o | o | o |
| Motor winding: Temperature limiter | • | • | • | • | • | • | • |
| Motor winding: Temperature controller and limiter | o | o | o | o | o | o | o |

Key

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

Overview of possible monitoring devices for submersible mixers **with Ex rating**:

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|---|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| Motor compartment/sealing chamber | – | – | – | – | – | – | – |
| Pre-chamber (external pencil electrode) | o | o | o | o | o | o | o |

With ATEX approval

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Motor winding: Temperature limiter | o | o | o | o | o | o | o |
| Motor winding: Temperature controller and limiter | • | • | • | • | • | • | • |

With FM-/CSA-Ex rating

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|---|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| Motor winding: Temperature limiter | • | • | • | • | • | • | • |
| Motor winding: Temperature controller and limiter | o | o | o | o | o | o | o |

Key

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

All the monitoring devices fitted must always be connected!

Monitoring the motor compartment and sealing chamber

The motor compartment monitoring protects the motor winding from short-circuits. Sealing chamber control detects fluid ingress from the gear chamber. 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!

Motor winding monitoring

Thermal motor monitoring protects the motor winding from overheating. A temperature limiter with a bimetallic strip is fitted as standard. Once the activation temperature has been reached, deactivation with reactivation lock must take place.

Optionally, the temperature can also be measured using a PTC sensor. Thermal motor monitoring can also be designed as temperature control. This allows two temperatures to be measured. Once the low activation temperature has been reached, an automatic reactivation can be initiated after the motor has cooled down. The unit is forced to deactivate with reactivation lock once the high activation temperature has been reached.

External monitoring of the pre-chamber

The pre-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 mixer can therefore occur via the system controller.

5.3 Operation with frequency converter

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

5.4 Operation in an explosive atmosphere

| Approval according to | TR 216 ... | TRE 216 ... | TR 221 ... | TRE 221 ... | TR 226-3 ... | TRE 226-3 ... | TRE 312 ... | TR 316 ... | TRE 316 ... | TR 321 ... | TRE 321 ... | TR 326-3 ... | TRE 326-3 ... |
|-----------------------|------------|-------------|------------|-------------|--------------|---------------|-------------|------------|-------------|------------|-------------|--------------|---------------|
| ATEX | o | o | o | o | o | o | o | o | o | o | o | o | o |
| FM | o | o | o | o | o | o | o | o | o | o | o | o | o |
| CSA-Ex | 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 1 Division 1

5.5 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* |
| 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

5.6 Type key

Example: **Wilo-EMU TRE 326-3.24-6/16Ex**

EMU Submersible mixer, horizontal

TRE Series:

- TR: Mixer with standard asynchronous motor
- TRE: Mixer with IE3/IE4 asynchronous motor

3 Number of blades

26 x100 = nominal propeller diameter in mm

3 Model

- 24** Rated propeller speed in rpm
- 6** Number of poles
- 16** x10 = stator pack length in mm
- Ex** Ex-rated

5.7 Scope of delivery

- Submersible mixer with connection cable
- Propeller hub
- Propeller blade
- Accessories attached, depending on the installation type
- Installation and operating instructions

5.8 Accessories

- Lowering device
- Auxiliary lifting device
- Cable bollard to secure the hoist cable
- Additional rope anchoring
- Fixation sets with anchor bolts

6 Installation and electrical connection

6.1 Personnel qualifications

- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Installation/dismantling work: trained sewage technology professional
Fixation to different construction parts, lifting equipment, wastewater facility basics
- Lifting work: trained specialist for the operation of lifting devices
Lifting equipment, lifting gear, attachment points

6.2 Operator responsibilities

- Observe locally applicable accident prevention and safety regulations.
- Observe all regulations for working with heavy loads and under suspended loads.
- Provide protective equipment. Ensure that the protective equipment is worn by personnel.
- Demarcate the working area.
- Keep unauthorised persons 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.
- Observe local sewage technology regulations for the operation of sewage systems.
- 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 structural component/foundation!
- Check that the available consulting documents (installation plans, installation location, inflow conditions) are complete and accurate.

6.3 Installation types

- Flexible installation with lowering device as stand unit

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:
 - ⇒ sealed safety goggles
 - ⇒ mouth protection
 - ⇒ protective gloves
- Wipe up drips immediately.
- Observe the specifications of the 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!

- Only carry out work with another person!

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.

- Wear protective equipment! Observe the work regulations.
 - Protective gloves: 4X42C (uvex C500)
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Wear a safety harness.
 - Safety helmet: EN 397 Conforms to standards, protection against lateral deformation (uvex pheos)
(When using lifting equipment)
- Prepare the installation site:
 - Clean, free of coarse solids
 - Dry
 - Frost-free
 - Disinfected
- Work must always be carried out by two persons.
- Demarcate the working area.
- Keep unauthorised persons away from the working area.
- From a working height of more than 1 m (3 ft) above the ground, use scaffolding with a safety harness.
- Toxic or asphyxiating gases may build up during work:
 - Observe protective measures in accordance with work regulations (gas measurement, carry a gas detector with you).
 - Ensure adequate ventilation.
 - If toxic or asphyxiating gases accumulate, leave the workplace immediately!
- Install lifting equipment: even surface, clean, firm base. Warehouse and installation location must be easily accessible.
- Attach chain or wire rope to handle/attachment point with a shackle. Only use lifting gear that has been technically approved.
- Do not stay within the swivel range of the hoisting gear.
- All connection cables must be laid properly. The connection cables must not pose any risk (i.e. tripping, damage during operation). Check whether the cable cross-section and the cable length are sufficient for the selected installation type.
- Observe minimum clearances to walls and any fixtures.

6.4.1 Maintenance tasks

After a storage period of more than 12 months, carry out the following maintenance tasks before installation:

- Rotate propeller.
See section "Rotating the propeller [► 71]".
- Oil change in sealing, gear and pre-chamber.
See section "Oil change [► 72]".

6.4.2 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 for installation with a lowering device, the frame comes pre-assembled. If the mixer is delivered without a frame, order the appropriate frame from customer service!

Preparatory tasks

| | |
|---|----------------------------------|
| 1 | Hoisting gear |
| 2 | Lifting equipment |
| 3 | Shackle for attachment |
| 4 | Propeller |
| 5 | Platform for secure set-down |
| 6 | Supporting block for alignment |
| 7 | Frame |
| 8 | 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 is available.
1. Attach lifting equipment to frame with a shackle.
 2. Mount the propeller. See separate installation instructions "Blade installation".
 3. Version with plastic rollers: Loosen linchpins and dismantle plastic rollers and quick-release axles.

NOTICE! Prepare components for further installation.

4. Lay all connection cables.
5. Mount the cable bracket for the cable anchoring on the edge of the basin.

CAUTION! In case of powerful flows in the basin, install the "additional rope anchoring"!

Lift the mixer and swivel it over the basin

| | |
|---|--------------------------------|
| 1 | Hoisting gear |
| 2 | Lifting equipment |
| 7 | Frame |
| 9 | 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 be suspended horizontally with the hoisting gear. If the mixer hangs at an angle to the hoisting gear, adjust the attachment point on the frame.
 2. Pivot 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.

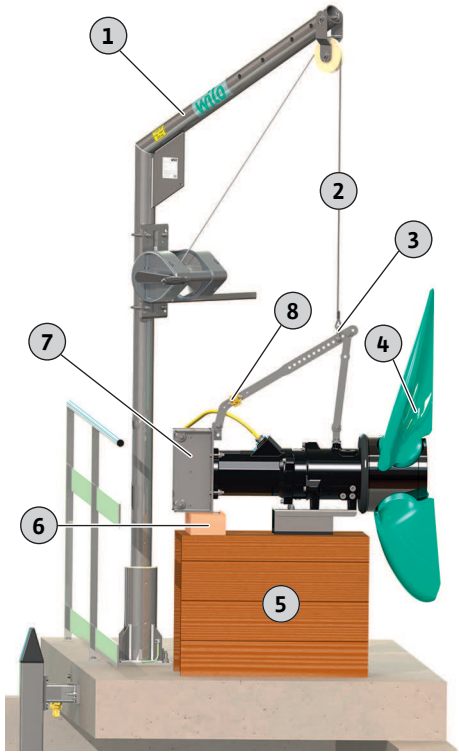


Fig. 3: Prepare the mixer

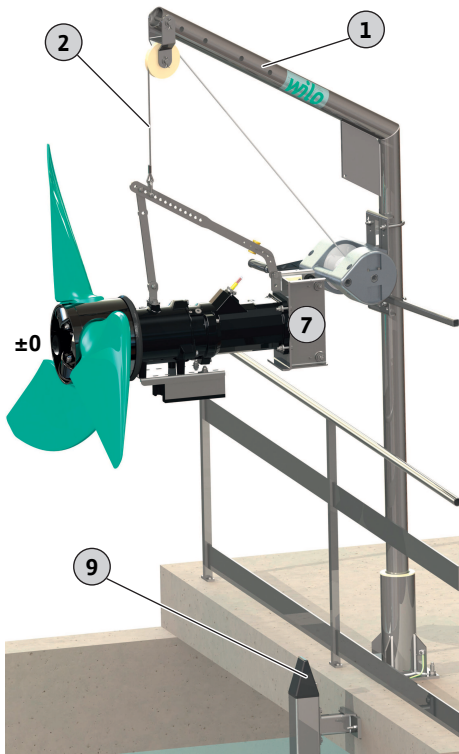


Fig. 4: Swivel the mixer over the basin

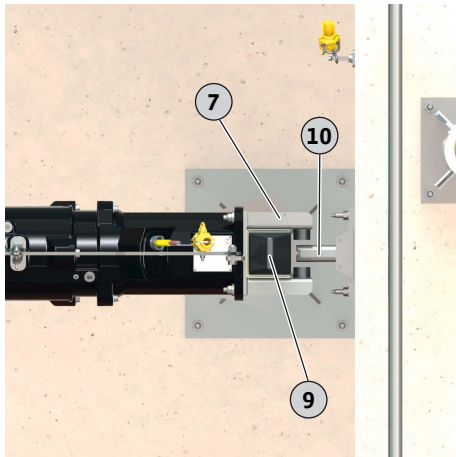


Fig. 5: Mixer on the lowering device

Mounting the mixer on the lowering device

| | |
|----|-------------------------------------|
| 7 | Frame |
| 9 | Guide pipe for lowering device |
| 10 | Upper holder of the lowering device |

- ✓ Mixer hangs horizontally.
 - ✓ Frame perpendicular to the guide pipe.
 - ✓ Cable bracket mounted on the edge of the basin.
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 mixer until the frame is below the upper holder. Install the quick-release axles and plastic rollers and secure them with linchpins!

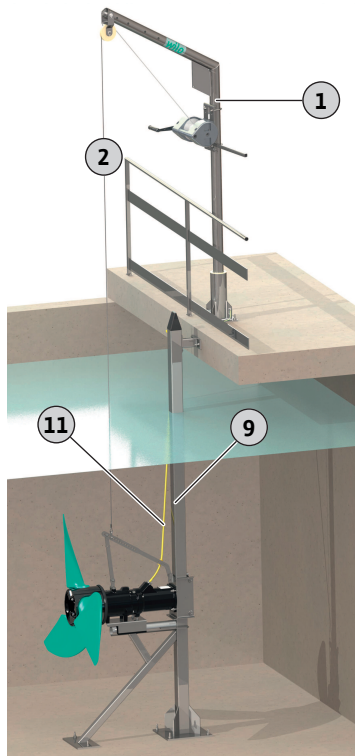


Fig. 6: Mixer set down on the stand unit

Completing installation

| | |
|----|--------------------------------|
| 1 | Hoisting gear |
| 2 | Lifting equipment |
| 9 | Guide pipe for lowering device |
| 11 | Connection cable |

- ✓ Mixer mounted on the lowering device
1. Slowly lower the mixer.
 - Hold the connection cable slightly taut when lowering it.
 - Do not damage the connection cable. Do not lead it directly over the edge of the basin!**NOTICE! Alternatively, anchoring can be done via a separate nylon rope. An anchoring set is included in the accessories for this purpose.**
 2. Lower the mixer to the end of the guide pipe.
 3. Anchor the connection cable with the cable bracket on the edge of the basin.
- Installation is complete. Lay the connection cable and make the electrical connection.

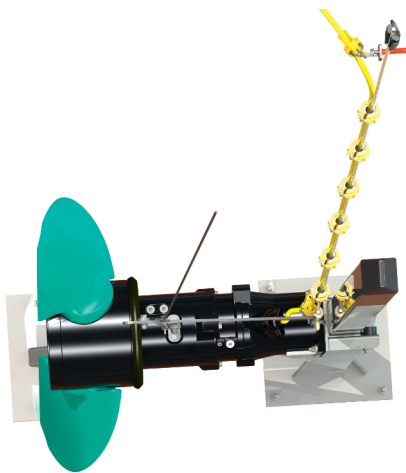


Fig. 7: Additional rope anchoring

Install additional rope anchoring

The additional rope anchoring protects the connection cable against damage in case of powerful flows in the basin. The rope anchoring consists of a 12 mm nylon rope (PA6) and a corresponding number of cable brackets. The quantity and size of the cable brackets depends on the order.

WARNING! Use the nylon rope and cable brackets only for anchoring the connection cable. They must never be used to secure heavy loads and/or third-party products!

NOTICE! Install the nylon rope in the length delivered. If the nylon rope is shortened, fuse the ends with a heat gun and secure against unravelling with heat-shrink tubing!

- ✓ The submersible mixer is completely installed.
- 1. Guide the nylon rope through a free eyelet on the frame and knot it securely.
- 2. Tension the nylon rope hand-tight (tensile force approx. 10...15 kg).
- 3. Securely attach the nylon rope to adequately dimensioned parts of the construction (e.g. railings, top holder etc.).
- 4. Attach the first cable bracket directly to the frame. Attach all the connection cables to the nylon rope using this bracket. **NOTICE! Do not tauten the connection cables! The connection cables must form a loop!**
- 5. Use the additional cable brackets to attach the connection cables to the nylon rope. Max. distance between the cable brackets: 1 m. **CAUTION! The nylon rope may stretch in the water. When the nylon rope is taut, the connection cables must sag approximately 10 cm!**

Mobile hoisting gear: Installing 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!

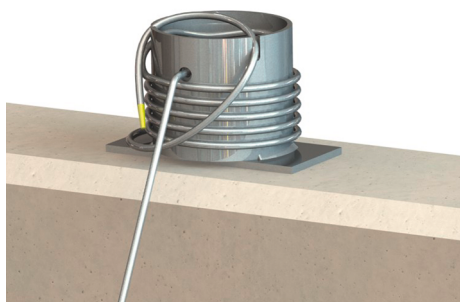


Fig. 8: Lifting equipment secured to a cable bollard

6.5 Electrical connection



DANGER

Risk of fatal injury due to electrical current!

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!
- Observe local 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!

- Mains connection corresponds to the information on the rating plate.
- Power supply on mains side with clockwise rotating field for three-phase AC motors (3~ motor).
- Route the connection cables according to the local regulations and connect them according to the wire assignment.
- Connect **all** of the monitoring devices and check their function.
- Secure the earthing in accordance with the 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)

- Install a residual-current device (RCD) in accordance with the regulations of the local energy supply company.
- If people can come into contact with the device and conductive fluids, install a residual-current device (RCD).

6.5.2 Maintenance tasks**6.5.2.1 Checking the insulation resistance of the motor winding**

- Check the insulation resistance of the motor winding.
- Check the resistance of the temperature sensors.

✓ Insulation tester 1000 V

1. Check the insulation resistance.

⇒ Measured value at initial commissioning: $\geq 20 \text{ M}\Omega$.

⇒ Measured value at interval measurement: $\geq 2 \text{ M}\Omega$.

► Insulation resistance checked. If the measured values deviate from the specifications, consult the customer service.

6.5.2.2 Test the resistor of the temperature sensor

✓ Ohmmeter available.

1. Measure the resistance.

⇒ Measured value **Bimetallic strip**: 0 ohms (passage).

⇒ Measured value **3x PTC sensor**: between 60 and 300 ohm.

⇒ Measured value **4x PTC sensor**: between 80 and 400 ohm.

- Resistance checked. If the measured value deviates from the specification, consult the customer service.

6.5.3 Connection of the three-phase AC motor

- Connection cable with bare cable ends.
- The supplied connection diagram contains detailed information about the connection cable:
 - Cable version
 - Wiring diagram
- Connect the connection cable to the on-site control.

Wiring diagram of the direct starting power connection

| | |
|------------|------------------|
| U, V, W | Mains connection |
| PE (gn-ye) | Earth |

Wiring diagram of the power connection for star-delta starting

| | |
|------------|-------------------------------------|
| U1, V1, W1 | Mains connection (start of winding) |
| U2, V2, W2 | Mains connection (end of winding) |
| PE (gn-ye) | Earth |

6.5.4 Monitoring equipment connection

- Refer to the attached connection diagram for more precise details regarding the version.
- 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 for submersible mixers **without Ex rating**:

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|---|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| Motor compartment/sealing chamber | o | o | o | o | o | o | o |
| Pre-chamber (external pencil electrode) | o | o | o | o | o | o | o |
| Motor winding: Temperature limiter | • | • | • | • | • | • | • |
| Motor winding: Temperature controller and limiter | o | o | o | o | o | o | o |

Key

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

6.5.4.1 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!**6.5.4.2 Monitoring of motor winding****With bimetallic strips**

Connect the bimetallic strips directly to the switchgear or via an evaluation relay.
 Connection values: max. 250 V (AC), 2.5 A, $\cos \varphi = 1$

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. "CM-MSS" relay is recommended for this purpose.

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

Trigger status for temperature controller and limiter

The installed sensor specifies the trigger temperature as part of thermal motor monitoring using bimetallic or PTC sensors. Depending on the thermal motor monitoring version, the following triggering status must occur when the trigger temperature is reached:

- Temperature limiter (1 temperature circuit):
The unit must be deactivated once the trigger temperature has been reached.
- Temperature controller and limiter (2 temperature circuits):
Once the trigger temperature for the low temperature is reached, the motor can deactivate with automatic reactivation. Upon reaching the trigger temperature for the high temperature limit, the motor must deactivate with manual reactivation.

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

6.5.4.3 Pre-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!

6.5.5 Motor protection adjustment**6.5.5.1 Direct activation**

- **Full load**
Set the motor protection to the rated current according to the rating plate.
- **Partial load operation**
Set the motor protection to 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 in the motor line: Set the motor protection to 0.58 x rated current.
 - Motor protection installed in the mains supply cable: Set the motor protection to the rated current.
- The maximum start-up time in the star connection: 3 s

6.5.5.3 Soft starter

- **Full load**
Set the motor protection to the rated current according to the rating plate.
- **Partial load operation**
Set the motor protection to 5 % above the current measured at the duty point.

Please observe the following points:

- Current 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 corresponding requirements for the frequency converter and observe its contents! The following points must also be observed:

- Adjust the operating parameters of the frequency converter to the system parameters.
- Observe the treatment process. Silting or deposits may occur.
- Increased thrust can lead to higher loads on the attachment parts.

NOTICE! The operator is responsible for compliance with the treatment process!

7 Commissioning



NOTICE

Automatic activation after power cut

Depending on the process, the product is switched on and off using separate controls. The product may automatically switch on following power cuts.

7.1 Personnel qualifications

- Operation/control: Operating personnel, 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".

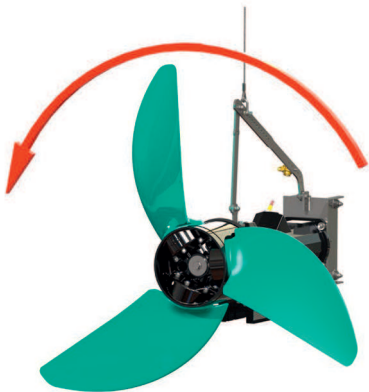


Fig. 9: Correct direction of rotation TR/E 216 to 326-3

Direction of rotation check

- ✓ 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 hold the mixer in your hands! The high starting torque can lead to serious injuries!
- ✓ Propeller is visible.
 1. Activate the mixer. **Max. operation duration: 15 s!**
 2. Propeller direction of rotation:
View from front: The propeller rotates anti-clockwise (to the left).
View from rear: The propeller rotates clockwise (to the right).
- Direction of rotation correct.



Fig. 10: Correct direction of rotation TRE 312

NOTICE! Reverse direction of rotation for mixer type TRE 312! The mixer rotates clockwise when viewed from the front and anti-clockwise from the rear.

Incorrect direction of rotation

- If the direction of rotation is incorrect, 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 216 ... | TRE 216 ... | TR 221 ... | TRE 221 ... | TR 226-3 ... | TRE 226-3 ... | TRE 312 ... | TR 316 ... | TRE 316 ... | TR 321 ... | TRE 321 ... | TR 326-3 ... | TRE 326-3 ... |
|-----------------------|------------|-------------|------------|-------------|--------------|---------------|-------------|------------|-------------|------------|-------------|--------------|---------------|
| ATEX | o | o | o | o | o | o | o | o | o | o | o | o | o |
| FM | o | o | o | o | o | o | o | o | o | o | o | o | o |
| CSA-Ex | 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 1 Division 1

7.5 Before switching on

Check the following prior to activation:

- Has the electrical connection been carried out in accordance with regulations?
- Has the connection cable been routed safely?
- Can the float switch move freely?
- Accessories attached correctly?
- Temperature of the pumped fluid observed?
- Immersion depth observed?
- Intermittent operation: Is the max. switching frequency complied with?
- 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.

- When the mixer starts, the rated current is exceeded for a short time.
- Current consumption continues to be slightly above the rated current during the start-up phase, until the flow in the basin increases.
- During operation, do not exceed the rated current any more.

CAUTION! Material damage! If the mixer does not start up, switch it off immediately. Motor failure! Remove the fault first before reactivation.

7.7 During operation



WARNING

Risk of injury from rotating propeller!

No persons are allowed to be present in the working area of the mixer. There is a risk of injury!

- Demarcate and cordon off the working area.
- If there are no persons in the working area, activate the mixer.
- If persons enter the working area, switch off the mixer immediately.

Please regularly check the following points:

- Mixer free from deposits and encrustations.
- Connection cable is not damaged.
- Minimum water submersion ensured.
- Quiet and low-vibration running.
- Max. switching frequency not exceeded.
- Mains connection tolerances:
 - Operating voltage: $\pm 10\%$
 - Frequency: $\pm 2\%$
 - Current consumption between the individual phases: max. 5 %
 - Voltage difference between the individual phases: max. 1 %

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, instructed in the functioning of the complete system
- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Installation/dismantling work: trained sewage technology professional
Fixation to different construction parts, lifting equipment, wastewater facility basics
- Lifting work: trained specialist for the operation of lifting devices
Lifting equipment, lifting gear, attachment points

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 but remains installed. This ensures that the mixer is always ready for operation.

- ✓ To protect the mixer from frost, ice and direct sunlight, immerse the mixer completely in the fluid.
- ✓ Minimum fluid temperature: +3 °C (+37 °F).

1. Switch off the mixer.
 2. Secure the operating point against being switched on again by unauthorised persons (e.g. lock main switch).
- The mixer has been decommissioned and can be dismantled.

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

- Ensure that the aforementioned requirements are maintained for the complete period of shutdown. If these requirements cannot be guaranteed, remove the mixer.
- For an extended period of shutdown, carry out a function test at regular intervals:
 - Period: monthly to quarterly
 - Running time: 5 minutes
 - Only run a function test in valid operating conditions!

8.4 Removal



DANGER

Danger due to fluids which are hazardous to health!

Danger of bacterial infection!

- Disinfect the mixer after removal.
- Observe the specifications of the work regulations.



DANGER

Risk of fatal injury due to electrical current!

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!
- Observe local 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!

- Only carry out work with another person!



WARNING

Risk of burns from hot surfaces!

The motor can get hot during operation. It may cause burns.

- Allow the motor to cool down to ambient temperature after switching it off.

Wear the following protective equipment while performing the work:

- Safety shoes: Protection class S1 (uvex 1 sport S1)
- Protective gloves: 4X42C (uvex C500)
- Wear a safety harness.
- Safety helmet: EN 397 Conforms to standards, protection against lateral deformation (uvex pheos)
(When using lifting equipment)

If contact with hazardous fluid occurs during work, wear the following additional protective equipment:

- Safety goggles: uvex skyguard NT
 - Labelling frame: W 166 34 F CE
 - Labelling disc: 0-0.0* W1 FKN CE
- Breathing protection: Half mask 3M series 6000 with filter 6055 A2

The protective equipment specified is the minimum requirement. Observe the specifications of the work regulations!

* Protection level according to EN 170 not relevant for this work.

8.4.1 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.

8.4.2 Clean and disinfect

- Wear protective equipment! Observe the work regulations.
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Breathing protection: Half mask 3M series 6000 with filter 6055 A2
 - Protective gloves: 4X42C + Type A (uvex protector chemical NK2725B)
 - Safety goggles: uvex skyguard NT
- Use of disinfectants:
 - Use strictly according to the manufacturer's instructions!
 - Wear protective equipment according to the manufacturer's instructions!
- Dispose of rinsing water in accordance with the local regulations, e.g. feed it into the sewer!
- ✓ Mixer removed.
 1. Ensure that the bare cable ends are packed in a watertight manner!
 2. Attach the lifting equipment to the attachment point.
 3. Lift the mixer approximately 30 cm (10 in) above the ground.
 4. Spray the mixer with clear water from top to bottom.
 5. Spray the propeller from all sides.
 6. Disinfect the mixer.
 7. Dispose of dirt residue on the ground, e.g. flush it into the sewer.
 8. Allow the mixer to dry.

9 Maintenance and repair

9.1 Personnel qualifications

- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Maintenance work: trained sewage technology professional
Application/disposal of operating fluids used, basic engineering knowledge (installation/dismantling)

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. The use of any non-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, fire, naked flames and smoking are prohibited.
- Document maintenance tasks in the system's inspection list.

9.3 Operating fluid

9.3.1 Oil types

White oil

- ExxonMobile: Marcol 52
- ExxonMobile: Marcol 82
- Total: Finavestan A 80 B (NSF-H1 certified)

CLP gear oil (ISO VG 220)

- Aral: Degol BG 220
- BP: Energol Gr-XP 220
- Shell: Omala S2 GX 220
- Tripol: FoodProof 1810/220 (USDA-H1 approved)

9.3.2 Grease

- Esso: Unirex N3
- Tripol: Molub-Alloy-Food Proof 823 FM (USDA-H1 approved)

9.3.3 Filling quantities

- Pre-chamber: 1.00 l (34 US.fl.oz.)
- Gear chamber: 0.60 l (20 US.fl.oz.)
- Sealing chamber: 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

- Regularly carry out maintenance tasks.
- Contractually adjust maintenance intervals depending on the actual environmental conditions. Contact customer service.
- If strong vibrations occur during operation, check the installation.

9.4.1 Maintenance intervals for normal conditions

8000 operating hours or after 2 years

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

80000 operating hours or after 10 years

- Complete overhaul

9.4.2 Maintenance intervals for harsh conditions

Under the following operating conditions, shorten the specified maintenance intervals in consultation with the customer service:

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

If there are harsh operating conditions, it is recommended to conclude a maintenance contract.

9.5 Maintenance measures



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the propeller blades. There is a danger of cuts and similar injuries!

- Wear protective gloves!

Before starting maintenance work, meet the following requirements:

- Wear protective equipment! Observe the work regulations.
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Protective gloves: 4X42C (uvex C500)
 - Safety goggles: uvex skyguard NT
- For detailed marking of frame and disc, see the section on “Personal protective equipment [► 46]”.
- The mixer has been thoroughly cleaned and disinfected.
- Motor must have cooled down to the ambient temperature.
- Workplace:
 - Clean, good lighting and ventilation.
 - Firm and stable work surface.
 - Secured against falling over and slipping.

CAUTION! Do not set the mixer down on the propeller! Provide an appropriate platform.

NOTICE! Only perform the maintenance work described in these installation and operating instructions.

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 Rotating the propeller

- ✓ Protective equipment used!
- ✓ Mixer disconnected from mains.
- 1. Place mixer on a firm work surface in a horizontal position.

CAUTION! Do not place the mixer on the propeller! Use an appropriate platform for the propeller diameter.

- 2. Secure the mixer against falling over or slipping!
- 3. Grip the propeller carefully and rotate the propeller.

9.5.3 Visual inspection of the connection cable

Check connection cable for:

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

If the connection cable is damaged:

- Decommission the mixer immediately!
- Have the connection cable replaced by the customer service!

CAUTION! Material damage! Damaged connection cables cause water to enter the motor. Water in the motor leads to total damage of the mixer.

9.5.4 Visual inspection of cable brackets and cable tensioning

- Check cable brackets and anchoring for material fatigue and shrinkage.
- Replace worn or defective components immediately.

9.5.5 Visual inspection of the mixer

- Check the housing and propeller for damage and wear. If there are defects, observe the following:
- Repair damaged coating. Order repair kits from the customer service.
- If components have worn, contact customer service!

9.5.6 Function test of the monitoring device

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

9.5.6.1 Test the resistor of the temperature sensor

✓ Ohmmeter available.

1. Measure the resistance.

⇒ Measured value **Bimetallic strip**: 0 ohms (passage).

⇒ Measured value **3x PTC sensor**: between 60 and 300 ohm.

⇒ Measured value **4x PTC sensor**: between 80 and 400 ohm.

► Resistance checked. If the measured value deviates from the specification, consult the customer service.

9.5.6.2 Check the resistance of the external electrode for pre-chamber monitoring

✓ Ohmmeter available.

1. Measure the resistance.

⇒ Measured values "infinite (∞)": Monitoring device OK.

⇒ Measured value ≤ 30 kOhm: Water in oil. Change oil.

► Resistance checked. If the measured value still deviates after the oil change, consult customer service.

9.5.7 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.

9.5.8 Oil change



WARNING

Operating fluid under pressure!

High pressure can build up in the motor! 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!
- Hot operating fluid may spray out!
 - ⇒ Wear protective equipment!
 - ⇒ Allow the motor to cool down to ambient temperature before carrying out any work!
 - ⇒ Adhere to the prescribed sequence of work steps!
 - ⇒ Unscrew the screw plugs slowly.
 - ⇒ As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further!
 - ⇒ Only when the pressure has been completely released, fully unscrew the screw plug.

9.5.8.1 Oil change: sealing, gear and pre-chamber

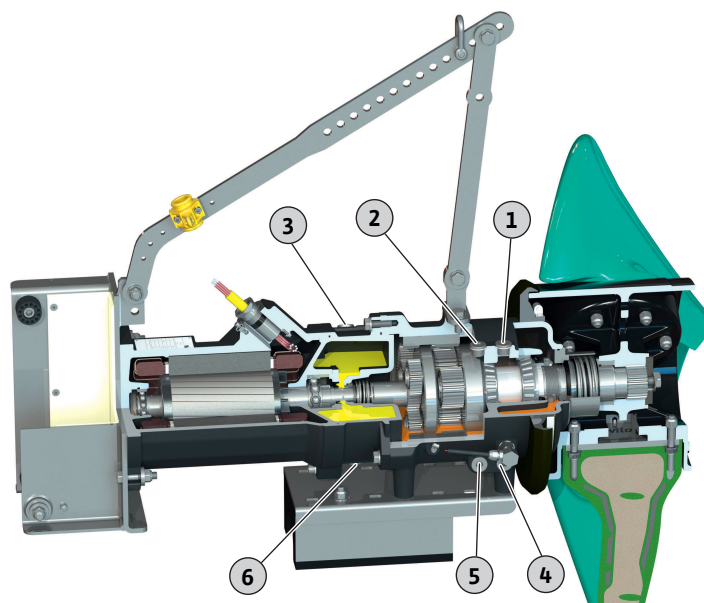


Fig. 11: Oil change

| | |
|---|-----------------------------|
| 1 | Pre-chamber filler hole |
| 2 | Gear chamber filler hole |
| 3 | Sealing chamber filler hole |
| 4 | Pre-chamber drain hole |
| 5 | Gear chamber drain hole |
| 6 | Sealing chamber drain hole |

✓ Protective equipment used!

✓ Mixer removed, cleaned and disinfected.

1. Place mixer on a firm work surface in a horizontal position.

CAUTION! Material damage! Do not set the mixer down on the propeller! Always place the mixer on a platform.

2. Secure the mixer against falling over and slipping.

3. Position a suitable tank to collect the operating fluid.

4. Remove the screw plug from the filler hole:

⇒ 1 = pre-chamber

⇒ 2 = gear chamber

⇒ 3 = sealing chamber

5. Unscrew the screw plug of the drain hole and drain the operating fluid:

NOTICE! Flush the pre-, gear and sealing chamber to drain it completely.

⇒ 4 = pre-chamber

⇒ 5 = gear chamber

⇒ 6 = sealing chamber

6. Check the operating fluid:

⇒ Operating fluid clear: Operating fluid can be reused.

⇒ Operating fluid contaminated (black): fill with new operating fluid.

⇒ Operating fluid milky/cloudy: Water in oil. Minor leakage through the mechanical seal is normal. If the ratio of oil to water is less than 2:1, the mechanical seal may be damaged. Change the oil and check again four weeks later. If water is again present in the oil during the second check, contact customer service!

⇒ Metal chips in the operating fluid: Contact the customer service!

7. Clean the drain hole screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

8. Pour the operating fluid through the filler hole.

⇒ Comply with the specifications for the operating fluid type and quantity!

9. Clean the filler hole 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.

9.5.9 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

Risk of injury from sharp edges!

Sharp edges can form on the propeller blades. There is a danger of cuts and similar injuries!

- Wear protective gloves!

The following preconditions must be met prior to starting repair work:

- Wear protective equipment! Observe the work regulations.
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Protective gloves: 4X42C (uvex C500)
 - Safety goggles: uvex skyguard NT

For detailed marking of frame and disc, see the section on “Personal protective equipment [► 46]”.

- The mixer has been thoroughly cleaned and disinfected.
- Motor must have cooled down to the ambient temperature.
- Workplace:
 - Clean, good lighting and ventilation.
 - Firm and stable work surface.
 - Secured against falling over and slipping.

CAUTION! Do not set the mixer down on the propeller! Provide an appropriate platform.

NOTICE! Only carry out the repair work described in these installation and operating instructions.

For repair work, the following applies:

- Wipe up spillage quantities of fluid and operating fluid immediately!
- Always replace O-rings, gaskets and screw locking devices!
- Observe the tightening torques in the appendix!
- The use of force is strictly prohibited!

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

- Replacement of the propeller
- Replacement of mechanical seal on the fluid side.
- Replace the handle grip.
- Replacement of the frame.

9.6.3 Propeller replacement

For all information on propeller blade replacement, please see the separate instructions for “Blade installation”.

9.6.4 Replacing the mechanical seal on the fluid side

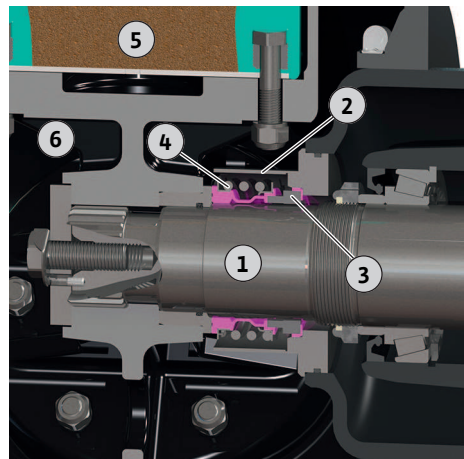


Fig. 12: Change of the mechanical seal on the fluid side

| | |
|---|----------------------------------|
| 1 | Shaft |
| 2 | Packing sleeve |
| 3 | Mechanical seal: Stationary ring |
| 4 | Mechanical seal: Spring |
| 5 | Propeller blade |
| 6 | Hub |

- ✓ Mixer set down on a firm surface and secured.
 - ✓ Tools are ready for use.
 - ✓ Oil drained from the pre-chamber.
 - ✓ Propeller (blade with hub) dismantled.
1. Remove the mechanical seal spring from the shaft.
 2. Carefully remove the packing sleeve using a rubber mallet.
 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. Installing the packing sleeve: Coat the packing sleeve mating surface using Loctite 262 or 2701. Press on the packing sleeve in position using a rubber mallet.
 8. Install a new mechanical seal spring on the shaft.
 9. Mount the propeller.
- Mechanical seal is replaced. Top up oil in the pre-chamber.

9.6.5 Replacing the handle grip

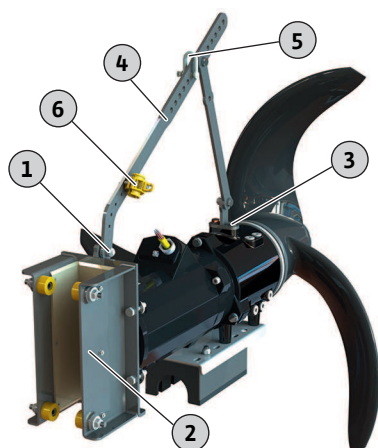


Fig. 13: Replacing the handle grip

| | |
|---|---|
| 1 | 1x Frame fixation material: Hexagon head screw, 2x washers, hexagon nut |
| 2 | Frame |
| 3 | 2x mixer fixation material: Hexagon head screw, washer |
| 4 | Handle grip |
| 5 | Shackle |
| 6 | Cable bracket fixation: Washer, hexagon nut |

✓ Mixer set down on a firm surface and secured.

✓ Tools are ready for use.

1. Disassembling cable brackets:

- Undo and unscrew the hexagon nut.
- Pull off the washer from the hexagon head screw.

2. Undoing the handle grip fixation on the frame:

- Undo and unscrew the hexagon nut.
- Pull off the washer from the hexagon head screw.
- Pull out the hexagon head screw.

3. Undoing the handle grip handle fixation on the mixer: Undo and unscrew the hexagon head screws.

4. Remove the handle grip.

5. Place a new handle grip and secure it to the frame using the fixation:

- Position the washer on the hexagon head screw.
- Insert the hexagon head screw through the frame and handle grip.
- Position the washer and screw on the hexagon nut.

NOTICE! Only slightly tighten the fixation! Do not fully tighten the handle grip!

6. Securing the handle grip on the mixer:

- Position the washer on the hexagon head screw.
- Coat the hexagon head screw with thread-locking fluid.
- Screw in the hexagon head screw and fully tighten it. Max. tightening torque: see appendix.

7. Compare the drilling pattern of both handle grip struts with the drilling pattern of the old handle grip. If necessary, adapt the drilling pattern of the new handle grip.

8. Securing the handle grip on the frame:

- Undo the hexagon nut.
- Coat the hexagon head screw with thread-locking fluid.
- Fully tighten the hexagon nut. Max. tightening torque: see appendix.

9. Installing cable brackets:

- Insert cable bracket into handle grip. **NOTICE! The cable must be routed in a small arc. Do not route the cable under tension!**
- Position the washers on the hexagon head screws.
- Screw on and fully tighten the hexagon nut. Max. tightening torque: see appendix.

10. Check the shackle position!

Attach the lifting equipment to shackles. The mixer must remain horizontal during lifting. Move shackles if the mixer tilts.

► Handle grip changed.

9.6.6 Replacing the frame

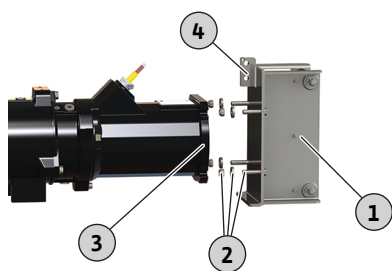


Fig. 14: Replacing the frame

| | |
|---|---|
| 1 | Frame |
| 2 | 4x frame fixation material: Hexagon head screw, washer, hexagon nut |
| 3 | Motor flange |
| 4 | Handle grip fixation: Hexagon head screw, 2x washers, hexagon nut |

- ✓ 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. Undo the handle grip fixation and pull out the hexagon head screw.
 2. Undo and unscrew the hexagon nut for frame attachment.
 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. Apply corrosion protection (e.g. Sikaflex):
 - Sealing joint between motor flange and frame.
 - Fill slots on the motor flange up to the washer.
 12. Reattaching the handle grip to the frame:
 - Position the washer on the hexagon head screw.
 - Insert the hexagon head screw through the frame and handle grip.
 - Position the washer on the hexagon head screw.
 - Coat the hexagon head screw with thread-locking fluid.
 - Screw on and fully tighten the hex nut. Max. tightening torque: see appendix.
- Frame is changed.

10 Faults, causes and remedies



WARNING

Risk of injury from rotating propeller!

No persons are allowed to be present in the working area of the mixer. There is a risk of injury!

- Demarcate and cordon off the working area.
- If there are no persons in the working area, activate the mixer.
- If persons enter the working area, switch off the mixer immediately.

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. Wipe up drips immediately!

12.2 Protective clothing

Used protective clothing must be disposed off 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 putting your personal health at risk.



NOTICE

Disposal in domestic waste is prohibited!

In the European Union this symbol may be included 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.

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

- Hand over these products at designated, certified collection points only.
- 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. See www.wilo-recycling.com for more information about recycling.

Subject to change without prior notice!

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 |

| Rust-free screws A2/A4 | | | |
|------------------------|-------------------|-------|-------|
| Threaded | Tightening torque | | |
| | Nm | kp m | ft·lb |
| 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 Frequency converter operation

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 above 415 V/50 Hz or 480 V/60 Hz. Because of the additional heating caused by harmonics, the rated power of the motor should be around 10 % more than the power requirement of the mixer. For frequency converters with a low-harmonic output, it is possible to reduce the 10 % power reserve. Harmonic waves are reduced by means of output filters. Synchronise the frequency converter and the filter with each other!

The configuration of the frequency converter depends on the rated motor current. Make sure that the mixer operates across the entire control range without jerking or vibrating (without vibrations, resonance, oscillation). Otherwise, the mechanical seals may leak or be damaged. 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 characteristic curve (U/f characteristic curve) for submersible motors! The U/f characteristic 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. More recent 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.

Motor monitoring faults may occur if the motor is operated with a frequency converter. The following measures can reduce or avoid these faults:

- Keeping within the limit values stated in IEC 60034-25 for overvoltage and rise speed. If necessary, install output filters.
- Vary the pulse frequency of the frequency converter.
- In the event of a fault in the internal sealing chamber monitoring, use the external double-rod electrode.

The following construction measures can help to reduce or prevent faults:

- Separate connection cables for the main and control cable (depending on the motor size).
- Keep an adequate distance between main and control cable during routing.
- Use shielded connection cables.

Summary

- Min./max. frequency during continuous duty:
 - Asynchronous motors: 30 Hz up to rated frequency (50 Hz or 60 Hz)
 - Permanent magnet motors: 30 Hz up to the stated maximum frequency as per rating plate
- NOTICE! Higher frequencies are possible following consultation with customer service!**
- Observe additional measures with regard to EMC regulations (choice of frequency converter, using filters, etc.).
- Do not exceed the rated current or rated speed of the motor.
- Connection for 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 1 Division 1

13.3.4 Electrical connection



DANGER

Risk of fatal injury due to electrical current!

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!
- Observe local 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 for submersible mixers **with Ex rating**:

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|-----------------------------------|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| Motor compartment/sealing chamber | – | – | – | – | – | – | – |

| | TR/TRE 216 ... | TR/TRE 221 ... | TR/TRE 226-3 ... | TRE 312 ... | TR/TRE 316 ... | TR/TRE 321 ... | TR/TRE 326-3 ... |
|---|----------------|----------------|------------------|-------------|----------------|----------------|------------------|
| Pre-chamber (external pencil electrode) | o | o | o | o | o | o | o |
| With ATEX approval | | | | | | | |
| Motor winding: Temperature limiter | o | o | o | o | o | o | o |
| Motor winding: Temperature controller and limiter | • | • | • | • | • | • | • |
| With FM-/CSA-Ex rating | | | | | | | |
| Motor winding: Temperature limiter | • | • | • | • | • | • | • |
| Motor winding: Temperature controller and limiter | o | o | o | o | o | o | o |

Key

– = not 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 re-activation lock. This means that a "release button" must be manually activated!

The installed sensor specifies the trigger temperature as part of thermal motor monitoring. Depending on the thermal motor monitoring version, the following triggering status must occur when the trigger temperature is reached:

→ Temperature limiter (1 temperature circuit):

The unit must be deactivated **with anti-reactivation lock** once the trigger temperature has been reached!

→ Temperature controller and limiter (2 temperature circuits):

Once the trigger temperature for the low temperature is reached, the motor can deactivate with automatic reactivation. Upon reaching the trigger temperature for the high temperature limit, the motor must deactivate with manual **anti-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 using an evaluation relay. "CM-MSS" relay is recommended for this purpose.

Connection values: max. 250 V(AC), 2.5 A, $\cos \varphi = 1$

→ Connect the PTC sensor via an evaluation relay. "CM-MSS" relay is recommended for this purpose.

→ If a frequency converter is used, connect the temperature sensor at the Safe Torque Off (STO). Deactivation on hardware side is thus ensured.

13.3.4.2 Pre-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

- Converter type: Pulse-width modulation
- Min./max. frequency during continuous duty:
 - Asynchronous motors: 30 Hz up to rated frequency (50 Hz or 60 Hz)
 - Permanent magnet motors: 30 Hz up to the stated maximum frequency as per rating plate
- NOTICE! The maximum frequency may be below 50 Hz!**
- Min. switching frequency: 4 kHz
- Max. overvoltage at the terminal board: 1350 V
- Output current at the frequency converter: max. 1.5 times rated current
- Max. overload time: 60 s
- Torque applications: quadratic pump curve or automatic energy optimisation procedure (e.g. VVC+)
Required speed/torque curves are available on request!
- Observe additional measures with regard to EMC regulations (choice of frequency converter, filters, etc.).
- Do not 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 described in these installation and operating instructions.
- The spark-proof gaps must **only** be repaired according to the manufacturer's design specifications. Carrying out repairs according to the values in tables 1 and 2 of DIN EN 60079-1 is **not** permitted.
- Only use screws as stipulated by the manufacturer, which at a minimum 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!



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2. **Background** (10 minutes)

3. **Methodology** (10 minutes)

4. **Results** (10 minutes)

5. **Conclusion** (10 minutes)

6. **References** (10 minutes)

7. **Appendix** (10 minutes)

8. **Summary** (10 minutes)

9. **Q&A** (10 minutes)

10. **Final Remarks** (10 minutes)

11. **Thank You** (10 minutes)

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