

S pumps, ranges 50-70

S1, S2, S3, ST, SV

7.5 - 155 kW

安装和使用说明书



S pumps, ranges 50-70

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产品合格声明书

CN: EC 产品合格声明书

我们格兰富在我们的全权责任下声明，产品 S pumps, ranges 50-70, 7.5-155 kW，即该合格证所指之产品，符合欧共体使其成员国法律趋于一致的以下欧共理事会指令：

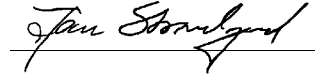
- 机械设备指令 (2006/42/EC)。
所用标准：EN 809: 1998。
- 低电压指令 (2006/95/EC)。
所用标准：EN 60204-1: 1997。
- 电磁兼容性指令 (2004/108/EC)。
- ATEX (欧洲防爆) 指令 (94/9/EC)。
仅适用于可在潜在爆炸性环境内使用的产品，Ex II 2G，配有单独的 ATEX 批准牌照和 EC 类检验证书。进一步信息见以下。

GB: EC Declaration of Conformity

We Grundfos declare under our sole responsibility that the products S pumps, ranges 50-70, 7.5-155 kW, to which this declaration relates, are in conformity with these Council directives on the approximation of the laws of the EC member states:

- Machinery Directive (2006/42/EC)
Standard used: EN 809: 1998.
- Low Voltage Directive (2006/95/EC)
Standard used: EN 60204-1: 1997.
- EMC Directive (2004/108/EC)
- ATEX Directive (94/9/EC)
Applies only to products intended for use in potentially explosive environments, Ex II 2G, and equipped with the separate ATEX approval plate and EC-type examination certificate.

Bjerringbro, 15th March 2011



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Person authorised to compile technical file and empowered to sign the EC declaration of conformity.

Notified body: Baseefa. No 1180. Staden Lane, Buxton, Derbyshire SK17 9RZ, UK.

Manufacturer: Oy GRUNDFOS Environment Finland Ab, Kaivokselantie 3-5, Vantaa, Finland.

Range	Certificate No	Standards used
50, 54, 58, 62, 66, 70	Baseefa 09ATEX0020X	EN 60079-0: 2007, EN 60079-1: 2007, EN 13463-1: 2002, EN 13463-5: 2004, EN 13463-6: 2005

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**警告**

装机前, 先仔细阅读本安装操作手册。安装和运行必须遵守当地规章制度并符合公认的良好操作习惯。

1. 本文献中所用符号

**警告**

不执行这些安全须知可能会引起人身伤害。

**警告**

如果不遵守这些操作指导会有触电危险并造成严重的人身伤害或死亡后果。

**警告**

该产品的表面十分灼热可以引起烫伤或其它人身伤害。

**警告**

使用防爆泵时必须遵守这些操作指导。使用标准泵时也建议按照这些指导进行操作。

**警告**

高声压级, 必须使用听力保护。

小心

不执行这些安全须知可能会导致故障发生或设备损坏。

注意

可以使工作简化和保证安全的注意事项或须知。

2. 概述

该手册对配备功率为 7.5 至 160 kW 电机、50-70 系列的格兰富 S 潜水式污水及废水泵的安装、操作及保养进行了说明。

本手册还对防爆泵作了特别说明。

针对安全使用 S 泵 (50-70 系列的防爆泵) 需要注意的特殊情况如下:

1. 确保湿度开关与热敏开关分别与不同的电路连接, 并且拥有单独的警报输出 (电机停止), 从而避免电机内部出现湿度或者温度过高的情况。

2. 替换螺栓的等级必须达到符合 EN/ISO 3506-1 标准的 A4-80 或 A2-80。

3. 电机的火焰通道间隙偏窄, 具体尺寸需由制造商详细说明。

注意: 在进行电机维修时应当使用原产维修件, 以确保火焰通道间隙留有足够的空间。

4. 在水泵运行期间冷却夹套内注满泵送液体。泵送液体的液位必须与电机控制回路连接的液位开关来控制。

5. 最低液位取决于安装类型, 其规格在本安装与操作指导中作出说明。

6. 确保永久安装的电缆受到恰当的机械保护, 并连接到对应的端子接线板上。



2.1 应用

50-70 系列的 S 泵适用于公共设施、私人住宅以及工业应用中的污水及废水泵送设计。

水泵具有多种安装方式, 包括潜水式、干式、卧式以及立式安装。

最大颗粒尺寸: 80-145 mm, 视具体性能范围而定。

2.1.1 潜在爆炸性环境

在潜在爆炸性环境中应使用 50-70 机型的 S 防爆泵。见章节 2.5.1 防爆证书和防爆等级。

注意

水泵的防爆等级为 Ex bc d IIB T3。水泵安装须通过地方当局批准。

2.2 运行条件

2.2.1 pH 值

所有型号水泵均适用于pH值为4至10的液体泵送作业。

2.2.2 液体温度

0 °C至 +40 °C。

2.2.3 环境温度

-20 °C至+40 °C。

2.2.4 泵送液体的密度和粘度

泵送密度和/或运动粘度高于水的液体时，请使用与其适配的高功率电机。

2.2.5 流速

建议维持一个最低流速，以免管道系统中形成沉淀。

建议流速

- 竖立管道中: 0.7 m/s
- 水平管道中: 1.0 m/s

2.2.6 泵送液体的液位

对于采用安装类型C的潜水泵，建议水泵最低停止液位应始终高于泵壳顶端。

警告



避免水泵出现干运转的情况。

泵送液体的液位必须由与电机控制回路连接的液位开关来控制。最低液位取决于安装类型，其规格在本安装与操作指南中作出说明。

安装类型	说明	附件
S	在自动耦合装置上进行潜水安装的不含冷却夹套的污水泵。	自动耦合装置
C	在自动耦合装置上进行潜水安装的配备冷却夹套的污水泵。	自动耦合装置
D	采用干式、立式安装的配备冷却夹套的污水泵。	50、54、58和62系列：立式安装的底座。 66和70系列：用于立式安装的底座。
ST	带或不带冷却夹套安装在井筒内的污水泵。	安装在井筒内的座环
H	在自动耦合装置上进行潜水安装的不含冷却夹套的污水泵。	自动耦合装置

为确保电机工作时能适当的降温，须遵守下列基本要求：

- **安装类型S**
对于S1运行(连续运行)，水泵的泵送液体必须始终淹没电机顶部。
对于S3运行(间歇运行)，水泵的泵送液体必须始终淹没电机中部。



警告

安装S类型的水泵应始终浸没在泵送的液体中，以防止发生爆炸。

- **安装类型 C**
泵壳体必须始终被泵送液体浸没。

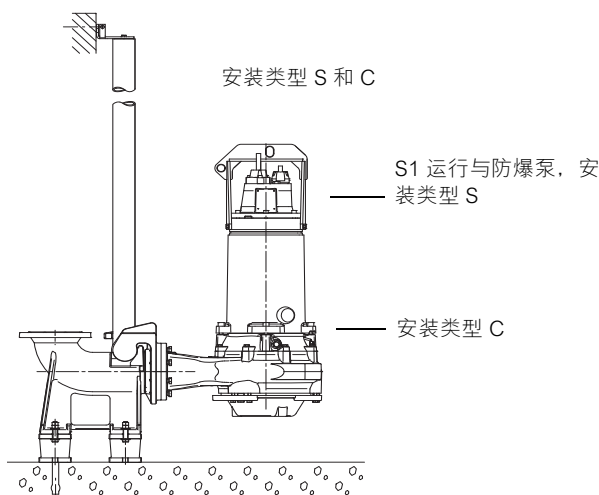


图 1 液位

- **安装类型D与H**
无特殊要求。
- **泵型ST**
液位必须在水泵进口上方不小于350 mm处。见图 9。

2.2.7 运行模式

水泵适用于长时间或间歇式运行操作；每小时最大启动次数如下表所示：

S 泵系列	每小时启动次数
50	20
54	
58	
62	15
66	
70	

2.2.8 防护等级

IEC IP68.

2.3 声压级

警告



根据不同的安装类型，水泵可承受的声压水平可高于 70 dB(A)。

在运行的水泵附近的工作人员须穿戴必要的听觉防护工具。

2.4 型号说明

本手册描述的50-70系列的S泵均在订单确认书及其他水泵附属文件中以型号代码标明。

注意：本手册所包含的个别水泵型号可能无现货供应。

代码	示例	S	1	.100	.100	.55	4	.50M	.S	.205	.G	.N	.D	.Z
泵型														
S	格兰富污水与废水泵													
ST	安装在井筒管内的多流道叶轮泵													
叶轮类型														
1	单流道													
2	双流道													
3	三流道													
V	超级涡流式													
水泵通道														
最大颗粒尺寸 [mm]														
泵出口														
水泵排水口标称直径[mm]														
输出功率P2														
型号标识上的代码编号/10 [kW]														
极数														
2	二极电机													
4	四极电机													
6	六极电机													
8	八极电机													
10	十极电机													
泵的范围/扬程形式														
50S	非常高													
50H	高													
50M	中													
50L	低													
50E	很低													
50F	非常低													
安装类型														
S	无冷却夹套的潜水安装													
C	配备冷却夹套的潜水安装													
D	干式、立式安装													
H	干式、卧式安装													
实际叶轮直径														
[mm]														
叶轮、水泵壳与电机壳的材料编码														
G	铸铁叶轮、水泵壳与电机外壳													
Q	不锈钢叶轮，DIN W.-Nr. 1.4408													
S	不锈钢叶轮与水泵壳，DIN W.-Nr. 1.4408													
R	不锈钢叶轮、水泵壳与电机外壳，DIN W.-Nr. 1.4408													
D	双相钢叶轮													
泵的类型														
N	非防爆泵													
Ex	配备防爆电机的水泵													
传感型的形式														
B	内置SM 111模块的S泵。热敏电阻传感器直接与IO111或其他热敏电阻继电器连接。													
C	未使用													
D	无内置SM 111模块的S泵													
Z	定制产品													

2.5 铭牌

所有水泵信息均在电机顶盖上的铭牌中显示。见图 2。若铭牌丢失或已损坏，可通过铭牌下方的产品序号来识别水泵。

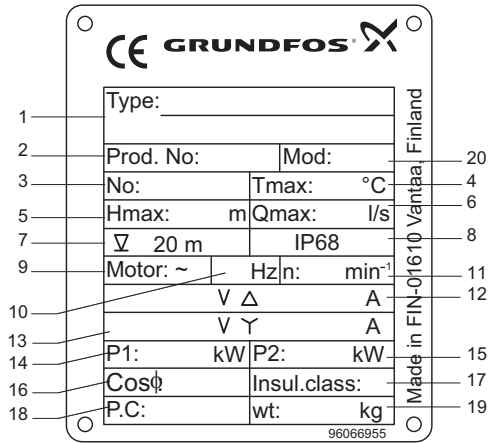


图 2 泵铭牌

位置号	说明
1	型号
2	SAP代码
3	序列号
4	最高液体温度
5	最大扬程
6	最大流量
7	最大安装深度
8	防护等级
9	相数
10	频率
11	额定转速
12	电压/电流、三角形连接
13	电压/电流、星形连接
14	功率输入
15	轴功率
16	功率因数
17	绝缘等级
18	生产代码，年份/星期
19	水泵重量
20	代码

2.5.1 防爆证书和防爆等级

直接驱动、50或60 Hz: CE 1180 II2 G Ex bc d IIB T4

变频器驱动: CE 1180 II2 G Ex bc d IIB T3

防爆泵已通过Baseefa (2001) Ltd.认证，并符合欧洲议会指令94/9/EC (防爆指令)附录II中规定的有关在易爆环境中所使用的设备的设计和结构的健康安全要求。

水泵 (防爆泵)通过认证后，在其铭牌附近的可视区域应配有认证标牌。

图 3 显示水泵的认证标牌，该系列水泵可选择配备达到T3或T4温度等级的电机。



图 3 防爆泵的认证标牌，T3和T4等级

认证标牌提供下列信息:

	欧盟防爆标志
II	设备组 (II = 非采矿类)
2	设备种类 (高防护)
G	爆炸环境类型
CE	CE 标志
1180	品质认证机构的数量
Ex	依据欧盟标准的防爆电机
b	火源控制
c	构造安全
d	电机承受的爆炸压力
IIB	气体组 (乙烯)
T3	电机表面最高温度为 200 °C
T4	电机表面最高温度为 135 °C
Gb	设备保护水平, 区域1
Baseefa	证书号
IECEx	证书号

3. 安全



警告

水泵在水池内安装，必须由经过专业培训的人员来进行。



警告

在大气环境具有爆炸性时，不允许人员进入安装区域。



警告

必须将电源开关在 0 位锁定。型号及要求如 EN 60204-1, 5.3.2 标准所规定。

为安全起见，所有在水池内开展的工作必须在一名位于泵池外的人员指导下进行。

可潜式污水泵和废水泵水池内的污水或废水可能含有毒性和/或致病性物质。因此，所有相关人员必须穿戴适当的个人防护装备及衣物，且必须在严格地有效遵守卫生法规的前提下对水泵本体及其附近进行操作。



警告

对于某些安装类型，其表面温度最高能达到 90 °C。



警告

在起吊水泵前，应确保吊耳螺栓已拧紧。必要时拧紧。起吊或运输工作中粗心大意会导致人身伤害或水泵损坏。



警告

在尝试吊起水泵前，确保起重装置（吊链等）的额定起重能力符合要求。



起重装置的额定起重能力标示于识别标签上。泵的重量在铭牌上标出。

3.1 潜水及干式立式安装的起吊点 (S/C/D)

4 在起吊水泵时，从正确的起吊点进行起吊很重要，因为这可确保水泵在起重过程中保持平衡。S 泵型号 S/C/D 配有起吊支架，以确保持水泵可被安全起吊。参见图 与下表，以找到正确的起吊点。

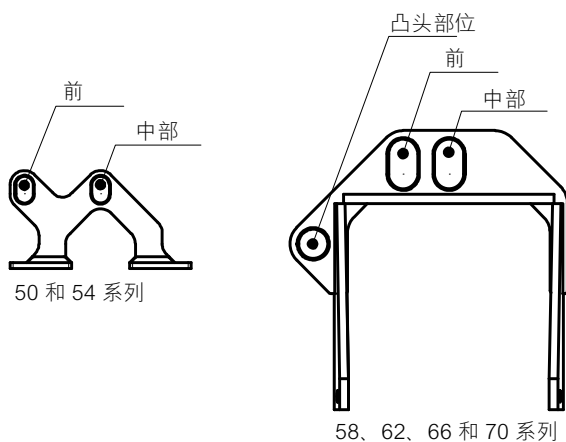


图 4 起吊点

出口法兰 型号	泵系列					
	50	54	58	62	66	70
DN80	中部	中部	-	-	-	-
DN100	中部	中部	-	-	-	-
DN125	中部	中部	中部	中部	-	-
DN200	前	前	前	中部	中部	中部
DN250	-	前	-	-	中部	中部
DN300	-	-	前	中部	中部	中部
DN500	-	-	-	-	凸头部位	前
DN600	-	-	-	-	凸头部位	前

4. 运输与存放

水泵包装完毕后由工厂直接送达；在安装前，应保持水泵包装完整。

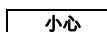
确保循环泵不会滚动或掉落。

所有起重设备均应经过标称确认是否合用，并在起吊水泵之前检查起重设备有无损坏。在任何情况下都不允许超出起重设备的额定极限。泵的重量在铭牌上标出。



警告

起吊水泵时应使用起吊架或叉车，切勿使用电机电缆或软管/水管。



小心

电气连接前，切勿移除电缆未固定的一端上的绝缘材料。无论电缆未固定的一端是否使用绝缘材料保护，端口都不应暴露在潮湿的环境中或与水接触。否则可能导致电机损坏。

如需长时间存放，水泵应采取防潮和防锈措施。

存放温度: -30 °C 至 +60 °C。



警告

若水泵安装后存放时间超过一年或水泵使用前存放时间较长，则水泵叶轮至少每月转动一次。

在一段较长时间的存放后，在泵重新工作之前必须先对其进行检查。确保叶轮转动自如。要特别注意检查轴封和电缆入口的状况。

5. 安装



警告

安装时，使用起重链条来支撑水泵或将水泵平放，以确保其保持平稳。



警告

安装开始之前，断开电源并将电源开关锁定在 0 位。在对泵开展工作之前，必须将所有连接到泵上的外部电压全部断开。

随泵一起提供的额外铭牌应被固定在安装地点处。

须遵守安装现场相应的安全规定，例如使用吹风机以保持水池空气流通。



警告

在泵与电源连接之后，不要将手或任何工具放进泵的吸入或排出口内；除非是已经通过拆去保险丝或断开电源开关的方式将泵关掉。须确保电源开关不会意外接通。

安装之前，先检查油腔中的油位。见章节 9.1 检查油位并更换机油。

TM04 7173 1710

5.1 安装类型

50-70系列的S泵可适用多种安装类型。
图表 5 至 9 显示多种水泵安装类型。

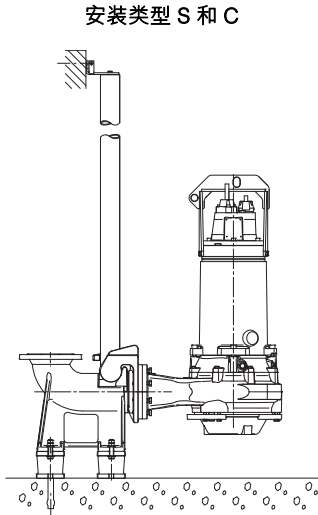


图 5 在自动耦合装置上的潜水安装

小心 在法兰与螺栓处应避免管道张力。

小心 由于水分可通过电缆渗入电机中，因此不可将电缆未固定的一端浸入水中。

水池中的固定安装

通过导轨，水泵可在水池内自由升降。选择安装类型C时，液位可低于类型S所要求的液位；见表 1。

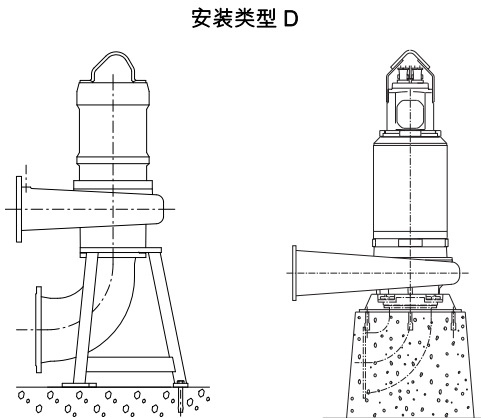


图 6 干式、立式安装，配备底座（左）与底盘（右），底盘下方为两个混凝土基座

泵房内固定安装

水泵通过法兰接头与进、排水管连接，并使用螺栓固定。配备 DN 500或DN 600法兰的水泵应安装在混凝土基座上(见上图右侧)。

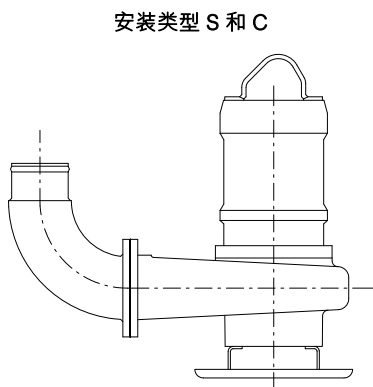


图 7 潜水式临时安装

水池内临时安装

选择安装类型C时，液位可低于类型S所要求的液位；见表1。

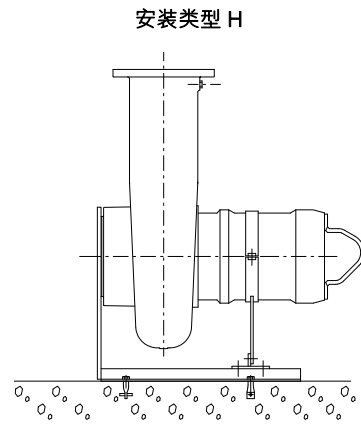


图 8 干式、卧式安装，配备基座与支架

泵房内固定安装

水泵通过法兰接头与进、排水管连接，并使用螺栓固定。

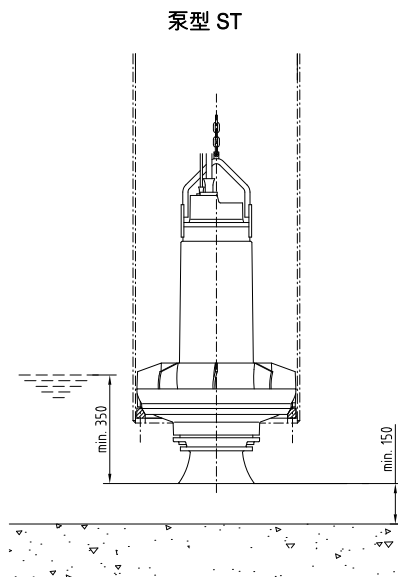


图 9 立式圆筒管安装

钢管或混凝土井筒内立式圆筒管安装。

TM02 4000 0309

TM02 4001 4601 / TM02 4023 4701

TM02 4002 4601

TM02 4003 4601

TM02 2494 4401

5.2 在自动耦合装置上的潜水安装

固定安装泵可置于固定的自动耦合装置上，作业时可完全或部分浸没在泵送液体中。

注意

确保在安装管道时不要用力过度。切不可使水泵承受来自管道的重力。我们建议使用松套法兰来缓解安装并避免法兰和螺栓处的管道张力。

注意

管道内不得使用弹性元件或弯管：勿使用此类元件进行管道系统连接。

注意

在某些水泵安装类型中，自动耦合装置的下方需放置一个底座，从而确保水泵能正确安装。在设计安装时，应考虑水泵安装是否需要使用底座。

1. 在水池的内侧钻出用于固定导轨支架的孔，用两个螺丝将导轨支架临时固定。
2. 将自动耦合装置的底座部分放置在水池底。用一根导轨来确立正确的位置。用地脚螺栓固定自动耦合底座。如果水池底不平整，那么自动耦合底座必须有支撑，以便可以将它在水平位置上固定。
3. 组装排出管路时请按照公认的程序进行并避免管路变形或承受张力。
4. 将导轨放置在自动耦合底座上，然后根据位于水池顶部的导轨支架精确调整导轨的长度。
5. 松开临时固定的导轨支架。将膨胀销钉插入导轨。将导轨支架固定在水池的里面。拧紧膨胀销钉内的螺栓。
6. 向水池中放入水泵之前先清除水池中的垃圾碎屑。
7. 在泵上安装导爪。
8. 在导轨之间滑动导爪，并通过安全固定在水泵起吊支架上的链子将水泵降低到水池内。当泵到达自动耦合装置的底座位置时会自动紧密连接。
9. 将起重链条末端挂在水池顶端的吊钩上，从而防止链条接触泵壳。
10. 将电机电缆卷在一个线盘上，以此来调整电机电缆的长度并确保该电缆在水泵工作时不会受损。在水池的顶部将该线盘固定好。确保电缆没有大幅度弯曲或穿通。
11. 如果需要的话，连接电机电缆和控制电缆。

注意

电缆的自由端不可没入水中，因为水分可以穿透电缆进入电机。

5.3 干式安装

干式安装的水泵应固定安装在泵房内。

水泵电机属密封、防水型设备，即使安装地点出现溢水情况，电机也不会因此损坏。

1. 在混凝土底板/基座上标记并钻取安装孔。
2. 将支架或基座安装在水泵下方。
3. 用地脚螺栓固定水泵。
4. 检查水泵是否竖立/水平放置。

为方便维修水泵，我们建议在水泵一侧使用隔离阀。

5. 将进、排水管以及隔离阀（如有）安装到位，并确保水泵未受到来自管道的应力。
6. 将电机电缆卷在一个线盘上，以此来调整电机电缆的长度并确保该电缆在水泵工作时不会受损。将线盘固定在一个合适的挂钩上。确保电缆没有大幅度弯曲或穿通。
7. 如果需要的话，连接电机电缆和控制电缆。

小心

水平安装水泵时，我们建议在进水管与水泵之间安装减径管。安装时，应安装偏心式的缩径管，以确保校正装置面向上方。这样便可避免进水管内聚集大量空气，并排除干扰作业的危险。见图 10。

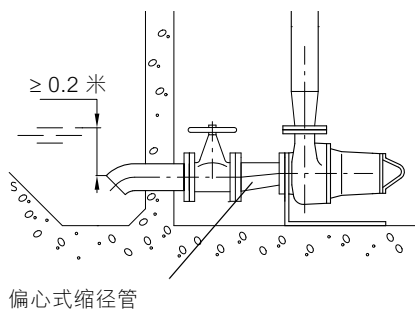


图 10 偏心缩径管

5.4 潜水式安装，便携式

1. 将环架装在水泵进水口法兰上。
2. 在出口上接一个 90° 弯头并连接排出管路(软管/硬管)。若安装软管，应确保软管不打结，且软管内径与水泵排出口相匹配。
3. 将链条在泵的提升架上栓牢，然后将泵降入水中。建议将水泵置于平整坚固的基座上。确保使用起重链起吊水泵，切勿使用电缆。
4. 将起重链条末端挂在水池顶端的吊钩上，从而防止链条接触泵壳。
5. 将电机电缆卷在一个线盘上，以此来调整电机电缆的长度并确保该电缆在水泵工作时不会受损。将线盘固定在一个合适的挂钩上。确保电缆没有大幅度弯曲或穿通。
6. 如果需要的话，连接电机电缆和控制电缆。

5.5 圆筒管内立式安装

1. 将水泵配备的环套装在钢制圆筒管的下开口上，或使用混凝土将其与水泥圆筒管浇注连接。
2. 将链条与起重支架固定并松开线盘上的电缆。
3. 将水泵放入圆筒管内。确保泵壳外凹槽内的O型密封环已安装到位。密封环上的3个导销能将水泵导入正确的位置，并能防止水泵在运作时发生翻转。
4. 将起重链条末端挂在水池顶端的吊钩上，从而防止链条接触泵壳。
5. 将电机电缆卷在一个线盘上，以此来调整电机电缆的长度并确保该电缆在水泵工作时不会受损。将线盘固定在一个合适的挂钩上。确保电缆没有大幅度弯曲或穿通。
6. 如果需要的话，连接电机电缆和控制电缆。

5.6 泵的控制装置

50-70系列的S泵可与格兰富的独立水泵液位控制器连接，该控制器为水泵配件：

- LC型控制器适用于单泵安装
- LCD型控制器适用于双泵安装。

根据用途的不同，水泵可使用相应的液位控制设备。

LC型控制器配有2个或3个液位开关：

两个用于水泵的启动和停机。第三个液位开关为选配，用于高液位报警。

LCD控制器则配备3或4个液位开关：

一个用于泵的一般停机，另两个用于泵的启动。第四个液位开关为选配，用于高液位报警。

安装液位开关时，请遵守以下几点：

1. 为防止潜水泵的气蚀和振动，停止开关必须以泵停止前液位低于泵壳的顶部的方式安装。作为水泵干式安装的基本法则，最低停机液位必须在进水管开口位置以上不小于20 cm处。见图 10。
2. 启动液位开关应照此方式安装，以便当液面达到设定水平时水泵可自动开启。但是，水泵应在液位达到水池底部进水管之前启动。
3. 若安装高液位报警开关，应确保将该开关安装在启动液位开关上方10 cm处；但是，装置应在液位达到水池进水管前发出警报。



警告

水泵控制器不得在易爆环境中安装。



警告

在易爆环境中，水泵内须注满泵送液体。必须安装一个附加液位开关，以确保在停止液位开关失效的情况下水泵仍可停止。

5.7 电流分离

高压检测双层绝缘传感器可确保用电安全。此外，IO 111内部可进行电流隔离。

5.8 IO 111

IO 111用于连接配备模拟和数字传感器的格兰富污水与废水泵和水泵控制器。最关键的传感器数据显示在前面板上。

一个IO 111模块可以连接一个水泵。

IO 111和传感器一起在泵的电机电压与所接控制器之间形成一个电流隔离。

5.8.1 绝缘电阻的测量

IO 111用于测量定子绕组与地线之间的绝缘电阻：

- 电阻高于 10 MΩ = 合格。
- 电阻位于10 MΩ 与1 MΩ 之间= 警告。
- 电阻低于1 MΩ = 报警。

5.9 热敏开关

定子绕组内部配备3个双金属片热敏开关；当出现温度过高的情况时，例如150 °C，触点将自动开启。

热敏开关的供应电压必须保持在12-230 VAC。

热敏开关应与控制电缆连接，并且必须接在独立水泵控制器的安全电路上。见章节7. 电气连接。

小心 水泵控制器的电机保护断路器须配备单独的电路，在水泵保护电路开启的情况下该电路能自动断开电源连接。



警告

安装/使用人员须安装自动断路器，当热敏开关或湿敏开关出现故障时该断路器可自动断开电源连接。

5.10 湿度开关

非防爆型水泵配备了一个湿度开关，位于电机顶盖下方的电机舱内。

防爆泵则配备了2个串联湿度开关。

50、62、66和70系列的水泵均配备2个湿度开关，一个装在电机顶盖下方的电机舱内，另一个位于电机下部。

54和58系列的水泵的湿度开关位于电机顶盖下方的电机舱内。

由于湿度开关为非反转型，使用后须进行更换。

湿度开关与热敏开关拥有各自独立的电路，并与控制电缆连接。见7. 电气连接。此外，两个开关应与独立水泵控制器的安全电路连接。

小心 水泵控制器的电机保护断路器必须包含一个可以在泵的保护回路打开时自动断开电源的回路。

5.11 热敏电阻

热阻器为可选配件。

热阻器将替代热敏开关用作电机保护装置，用于监控定子温度，并应与控制箱内的热阻继电器连接。

5.11.1 水泵安装完毕后进行检查

1. 用万用表检查电路电阻是否为 $< 150 \Omega$ (热阻器)。
2. 使用万用表检查电路与定子机壳之间的绝缘电阻是否超出量程范围(不可测量 ∞)。
3. 采用相同的方法检测供电电缆末端。

5.12 Pt100温度传感器

Pt100温度传感器可作为水泵配件或FPV(工厂产品型号)的可选型号之一提供。

Pt100温度传感器主要用于监测轴承温度，但也可用于监测定子温度。

注意

轴承温度监控为可选功能。50和54系列的水泵热阻器仅可监控防爆泵下轴承的温度。

传感器电阻在

- 0 °C时为100 Ω
- 在100 °C时为 138.5 Ω
- 常温下约为108 Ω 。

对温度的限制如下：

- 90 °C: 轴承温度警报。
- 130 °C: 轴承温度过高导致水泵停止运行
- 150 °C: 定子温度过高导致水泵停止运行。

常温下，热阻器的电阻约为100 Ω 。



警告

由于磨损、缺少润滑油等导致温度过高时，Pt100传感器将发出警报，并在温度达到预设值后断开电源连接。下轴承(轴端)传感器内的最高警报温度为100 °C，上轴承为120 °C(仅适用于58、62、66和70系列的水泵)。

5.12.1 水泵安装完毕后进行检查

1. 使用万能表检测传感器的常温电阻是否约为108 Ω 。
2. 使用万用表检查电路与定子机壳之间的绝缘电阻是否超出量程范围(不可测量 ∞)。
3. 采用相同的方法检测供电电缆末端。
4. 进行水泵检查时，Pt100传感器须与记录设备相连。

6. WIO 传感器 (油中含水率传感器)

6.1 WIO传感器为水泵配件



警告

润滑油不足可能导致温度过高，并对机械密封造成损坏。当出现机油质量偏低或机油耗尽时，油腔内的WIO传感器将发出警报。

WIO传感器为水泵配件，可安装至电机功率为 5.5 至160 kW的水泵上。

传感器可测量油室中的水分含量。

传感器由一块浸没在油里的平板电容组成，电容可对电子线路进行测量并向外传输4-20 mA的电流信号。

6.2 装配WIO传感器

将WIO传感器代替加油螺塞装入油箱的注入孔内。

1. 取出加油螺塞。
2. 将传感器推入注入孔中。
3. 在油箱内将传感器向推压至合理深度，直至其完全浸没在润滑油中，并避免与旋转零件发生接触。根据水泵的不同型号，传感器的插入深度也不同，如下表所示。
4. 将传感器衬套拧入加油螺塞的螺纹中。

注意

垂直安装 使用油室最下端的螺丝孔。
水平安装 始终使用检测螺丝孔。

小心

换油后，应先使用溶剂油将WIO传感器清洗干净，然后再将其装入孔中。

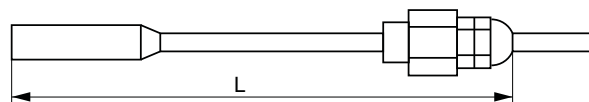


图 11 WIO传感器规格

TM03 5531 3806

S 泵系列	插入深度长 [mm]
50	80
54	90
58	100
62	100
66	100
70	100

欲知更多详情，见WIO传感器安装说明(96591899)。

6.3 电气数据，WIO传感器

输入电压:	12-24 VDC
输出电流:	3.4-22 mA
功率消耗:	0.6 W
环境温度:	0 至 70 °C

6.4 传感器信号

4-20毫安 = 油中含有0-20 % 的水分
准确度优于2 %。

22 mA = 警告:
水份含量远超测量范围。

3.5 mA = 报警:
油箱内有空气。

注意

传感器信号只有在油水混合时(当泵运转时)才有效。

7. 电气连接



警告

水泵必须与外部工频开关连接，触点间隔符合 EN 60204-1, 5.3.2标准。

必须按照地方规定执行电气连接操作。

供电电压和供电频率在循环泵的铭牌上标明。

电机终端的允许电压偏差必须在额定电压的-10 %到+10 % 范围内。

请确保电机与安装现场中电源供应之间的匹配性。

电机通过电源线和管道进行接地连接。电机顶盖配备外部接地或等电位连接导体。



警告

对于采用干式安装的防爆泵，我们同样建议使用外部接地。



警告

在水泵安装和首次启动之前，先目测电缆状况以防短路。

水泵必须连接至电机保护断路器。

最常用的启动方法是直接启动 (DOL)、星-三角启动 (Y/D) 及软启动。甚至可根据制造商要求，通过变频器来启动水泵。选择合理的启动方式是出于对水泵使用及电源情况的考虑。

采用星-三角启动方法进行启动时，确保瞬变时间最小化十分重要，因为这可避免高强度的瞬时扭矩。我们建议使用最大瞬变时间为50 ms的时间继电器或制造商所提供的其它规格继电器。

注意

直接启动与星-三角启动的布线图如图 12 与图 13所示。

P1和P2与热敏开关和湿度开关相互串联。

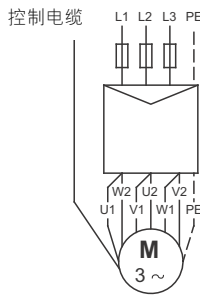


图 12 直接启动

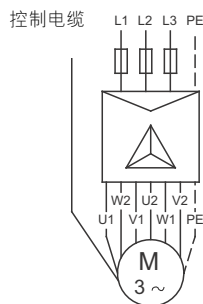


图 13 星-三角形启动

7.1 变频器操作

原则上说来，所有三相电机都可以连接到变频器上。

然而，变频器操作往往会加大电机绝缘系统的负载，而且因为峰电压导致涡电流而使得电机的噪音水平高于通常。

此外，由变频器启动的大电机还会负载轴承电流。

对于变频器操作，请遵守以下：

必须做到的要求。

应该做到的建议。

要考虑到后果。

7.1.1 要求

- 必须连接电机热敏保护。
- 峰电压和 dU/dt 必须符合下表要求。所指的值为供应到电机端子的最大值。电缆影响未被考虑在内。对于实际值以及电缆对峰电压和 dU/dt 的影响，请参见变频器的数据表。

最大重复峰电压 [V]	最大 dU/dt U _N 400 V (V/μ sec.)
850	2000

- 如果是防爆泵，检查特指泵的防爆证书是否允许使用变频器。
- 根据电机数据设置变频器的 U/f 比率。
- 必须遵守地方规章 / 标准。

7.1.2 建议

安装变频器之前，先计算好安装所允许的最低频率以防止零流量。

- 不要将电机速度降到额定速度的 30 % 以下。
- 保持流速在每秒 1 米以上。
- 每天至少一次水泵以额定速度运行以防管路系统中发生沉淀。
- 不要超出铭牌上规定的频率范围。否则电机会过载。
- 保持电机电缆越短越好。峰值电压会随电机电缆的长度增加而增加。参阅所用变频器的数据表。
- 在变频器上使用输入和输出滤波器。参阅所用变频器的数据表。
- 如果存在可以影响其他电气设备的电气噪音危险，请使用屏蔽的电机电缆。参阅所用变频器的数据表。

7.1.3 后果

在通过变频器运行水泵时，请您意识到以下可能发生的后果：

- 锁定转子的扭矩会降低。至于会降低多少则取决于变频器的类型。对于锁定转子可用扭矩的信息，请参阅相应变频器的安装与操作指导手册。
- 还可能影响到轴承和机封的工作条件。至于哪些影响则取决于应用。实际发生的影响无法估计。
- 噪音也可能增加。对于如何降低噪音的建议，请参阅相应变频器的安装与操作指导手册。

7.2 电缆数据

H07RN-F标准

S 泵系列	线缆类型 [mm ²]	外部电缆直径 [mm]		弯曲半径 [cm]
		最小	最大	
50	7 x 1.5	14.4	16.4	10
	4 x 2.5	16.7	18.7	12
	4 x 6	15.7	17.2	11
54	4 x 6	15.7	17.2	11
	4 x 10	20.9	23.4	14
58	4 x 6	15.7	17.2	11
	4 x 10	20.9	23.4	14
62	4 x 6	15.7	17.2	11
	4 x 10	20.9	23.4	14
	4 x 16	23.8	26.3	16
66	4 x 10	20.9	23.4	14
	4 x 16	23.8	26.3	16
	4 x 25	28.9	31.4	19
70	4 x 25	28.9	31.4	19
	4 x 35	32.5	34.7	22
	4 x 50	37.7	40.4	25
	4 x 70	42.7	45.4	28

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电磁兼容 (EMC)

S 泵系列	线缆类型 [mm ²]	外部电缆直径 [mm]		弯曲半径 [cm]
		最小	最大	
50	3 x 6	13.6	15.2	7.6
	3 x 6	13.6	15.2	7.6
54	3 x 10	17.8	19.8	9.9
	3 x 6	13.6	15.2	7.6
58	3 x 10	17.8	19.8	9.9
	3 x 6	13.6	15.2	7.6
62	3 x 10	17.8	19.8	9.9
	3 x 16	20.9	22.9	11.5
	3 x 10	17.8	19.8	9.9
66	3 x 16	20.9	22.9	11.5
	3 x 35	28.3	31.3	15.7
70	3 x 35	28.3	31.3	15.7
	3 x 70	38.7	41.7	20.9

控制电缆

线缆类型 [mm ²]	外部电缆直径 [mm]		弯曲半径 [cm]
	最小	最大	
7 x 1.5	14.4	16.0 - 16.4	10
10 x 1.5	0.71 (18)	0.79 (20)	4.7 (12)



警告

防爆水泵顶盖配备了外部接地端口，从而确保水泵的接地连接。电气安装须包含外部接地连接的操作。接地导体须满足现行的电气安全法规的要求。

相导体 (S) 安装的横截面 [mm ²]	接地导体的最小横截面 [mm ²]
S ? 16	S
16 < S ? 35	16
S > 35	0.5 *S, 最大 70



警告

在水泵安装和首次启动之前，先目测电缆状况以防短路。

8. 启动



警告

在手动启动或转换成自动控制之前，应确保水泵已无人员操作或无人靠近水泵。



警告

在首次启动之前或长期存放之后，应确保水泵内部已注入泵送液体。

若水泵采用干式安装，则在其运行过程中，应将冷却夹套内注满泵送液体。在首次启动前，通过除气来确保已注满液体。

请按以下步骤操作。

1. 移除保险丝或关闭主开关。
2. 检查油室内的油位。见章节 9.1 检查油位并更换机油。
3. 检查叶轮能否自由转动。
4. 如果有监控单元，检查该单元工作是否正常。
5. 若采用潜水式安装，应确保水泵已经完全浸没在液体中。
6. 若采用干式安装，应确保水箱内有适量的泵送液体。



警告

确保水泵已注满泵送液体。

采用干式安装的水泵应通过泵壳上通风孔进行通风。

7. 打开隔离阀，如果安装了的话。
8. 检查系统是否已经灌水并已除气。
9. 检查液位开关的设置。
10. 启动水泵，并检查水泵是否出现异常噪音或振动。

小心

如果此泵或其他水泵发出异常噪音或振动；或水泵出现供水故障，则立即停止此泵。在找到故障原因并排除了故障之前不要重新启动水泵。

11. 水泵启动后，应制定准确的实际工作点，为水泵检测提供参照，以检测其是否达到理想的运行状态。

注意

启动后，水泵可在短时间内不浸没在水中，以便检查其转动方向。

应根据事先制定的常规程序来运行水泵，水泵监测设备与配件(阀门等)的检查也应根据预先计划进行。未经授权的人员不得更改水泵和设备的设置。

8.1 检查旋转的方向

电机外壳上有一个箭头指明正确的转动方向。从驱动端观测时，水泵须按顺时针转动。检测水泵(脉动)启动后的转动情况。若水泵按逆时针脉动，则其转动方向正确。

同时，还可以遵照以下方式检测水泵转动方向：

1. 启动水泵，并检查液体流量或排出压力。
2. 关闭水泵，并互换电机的两个相位。
3. 重新启动水泵，检查液体流量或排出压力。
4. 停止水泵。
5. 比较第1点和第3点中读取的数据。排出较大流量液体或较高压力的那个连接即为正确的转动方向。

小心

用链条将水泵吊起后，水泵只可运行一小段时间。

9. 保养和服务

**警告**

在维修保养期间，包括运输返厂维修时，须用起重链条支撑水泵或将水泵平放以保持平稳。

**警告**

在对泵开展工作之前，请务必保证保险丝已经拆去或主电源开关已经断开。确保水泵电源不会被意外接通。所有转动部件必须停止转动。

保养与维修须由接受专业培训的人员进行。

**警告**

只有格兰富或经格兰富授权的服务站才能执行防爆泵的保养维修工作。

**警告**

切勿在易爆或多尘环境中打开水泵。

在开展保养和服务之前，确保水泵已经用清水彻底冲洗。拆卸后将泵零件用水冲洗。

正常工作条件下运行的水泵应该在每运行2000小时后或者每年至少进行一次检修。若泵送的液体中含有大量泥土或砂石，则水泵应在每运行1000小时后或每6个月进行一次检修。

应该检修以下项目：

- 功率消耗
- 油位及油况
如果是新泵或者是更换轴封后的泵，应该在运行一周时间后检查机油的油位与水份含量。如果油内的水分含量超过 20%，则说明轴封可能已损坏。见章节 9.1 检查油位并更换机油。

注意 按照当地规范来处置废弃机油。

根据水泵不同尺寸型号，油室容量也不同，从 1.9 至 12.5 升不等。参见下表。

油量

S 泵系列	安装类型	电极数量	油量 [l]
50	S	所有类型	2.6
	C-D-H	所有类型	1.9
54	S	所有类型	3.5
	C-D-H	所有类型	2.5
58	S	所有类型	4.6
	C-D-H	所有类型	3.8
62	S	所有类型	9.0
	C-D-H	所有类型	7.1
66	S	所有类型	12.5
	C-D-H	所有类型	9.2
70	S	所有类型	12.4
	C-D-H	所有类型	9.0

- 电缆引入口
确保电缆引入口具有防水性，无弯曲或挤压变形的情况出现。
- 叶轮间隙
检查叶轮间隙。见章节 9.2 检查并调整叶轮间隙。
- 水泵部件
检查泵壳等部件是否有磨损。
更换被磨损零件。
- 滚珠轴承
检查轴是否有异常噪音或沉重运转(用手来转动轴)。更换磨损的滚珠轴承。
在滚珠轴承出现磨损或电机功能恶劣的情况下，通常都需要对泵进行大修。此项操作只能由授权的维修工厂进行。

**警告**

滚珠轴承至少在每运转 25,000 小时后更换一次。

小心

定期清洁水泵外部，从而保持其良好的导热性能。

9.1 检查油位并更换机油

小心

机油应每四年更换一次，以防止发生氧化。

**警告**

润滑油不足可能导致温度过高，并对机械密封造成损坏。当出现机油质量偏低或机油耗尽时，油腔内的WIO传感器将发出警报。

油箱内有A、B两个螺丝，主要用于放油、加油以及油位控制。

在配备功率范围为22-50kW的8极或10极电机的水泵与电机功率大于50kW的水泵中，机油可在水泵垂直竖立时进行更换。螺丝B用于显示油腔内的油位情况。见图 14。

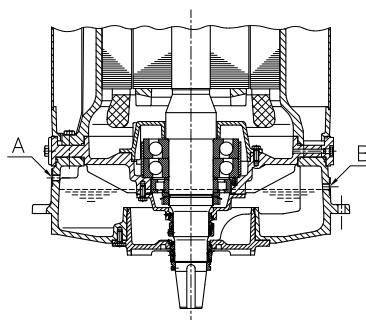


图 14 油位，立式安装

卧式安装的水泵（安装类型H）均配备第三个螺丝即螺丝C，用于放油操作。

在卧式安装的水泵（安装类型H）上，螺丝的安装位置如图所示15。

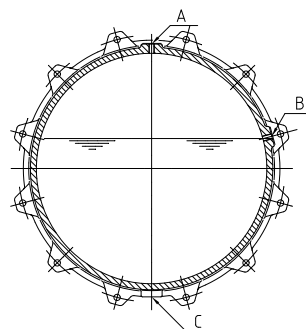


图 15 油位，卧式安装

请按以下步骤操作。

1. 放置水泵时，螺丝A应指向朝上。

**警告**

在松开油腔的螺丝A时，请注意油腔内可能会有压力累积。在压力完全释放之前请勿拆开螺丝。

2. 在水泵下方放置一个干净的容器，用于收集油腔内排出的机油。松开指向侧面的螺丝B并检查油位。通过排出油量的多少判断下端机械轴封是否有漏油的情况；漏油可能属于正常现象。
3. 翻转水泵或移除螺丝C，并将机油从油腔内排至容器中。将部分机油样品倒入玻璃容器中并检测机油情况。若机油内无杂质便可重新使用。若机油乳化，则应立即更换并处置。

注意

按照地方规范来处置废弃的机油。

油位较低可能说明上端机械轴封出现故障。请联系授权的维修工厂，以便对水泵进行进一步检修与修理（如有必要）。

4. 通过顶部孔A将机油注入油腔；当油位达到孔B时，停止加油。更换密封圈后插入螺丝，并将其拧紧。

**警告**

使用粘度等级SAE 10 W 30 或 ONDINA 917。

9.2 检查并调整叶轮间隙



警告

每次维修时，应对叶轮间隙进行检查，以防止液压零件出现表面过热的情况。

所有S1、S2与S3系列水泵的轴向叶轮间隙为 0.7 ± 0.2 mm。若间隙为 1.2 mm 或者更宽，则应将其调整至 0.7 ± 0.2 mm。

注意

SV系列水泵的叶轮间隙无法调整。

安装类型为S和C的叶轮间隙可从水泵进水口直接查看。



警告

查看前，确保电机电源已切断且主开关锁定在位置0上。

安装版本为D和H的叶轮间隙可通过安装于台上并与管道系统连接的泵进行查看和调整。叶轮间隙的查看和调整说明见 9.2.2 安装类型D和H，50-54系列和章节 9.2.3 安装类型D和H，58-70系列。

9.2.1 安装类型S和C，全部量程

1. 拧松定位螺丝，方法为每个拧转整两圈。
2. 关闭叶轮间隙，方法为沿对角线轻轻拧紧固定螺丝，直至叶轮碰到水泵外壳。



警告

在拧紧固定螺丝时力度不要太大，因为可能对轴承造成损害。移动距离通常为1到3mm。

3. 拧松固定螺丝，在固定螺丝头下方留出一个0.7 mm的空隙。见图 16。
4. 拧紧定位螺丝。
5. 沿对角线拧紧固定螺丝。

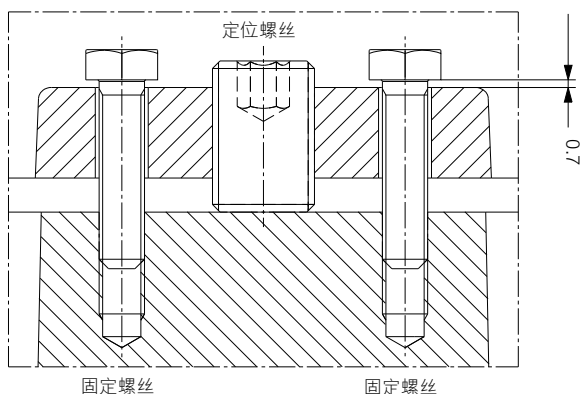


图 16 叶轮间隙调整设置

9.2.2 安装类型D和H，50-54系列

1. 拧松定位螺丝，方法为每个拧转整两圈。
2. 关闭叶轮间隙，方法为沿对角线轻轻拧紧固定螺丝，直至叶轮碰到水泵外壳。



警告

在拧紧固定螺丝时力度不要太大，因为可能对轴承造成损害。移动距离通常为1到3mm。

3. 拧松固定螺丝，在固定螺丝头下方留出一个0.7 mm的空隙，见图16。
4. 拧紧定位螺丝
5. 沿对角线拧紧固定螺丝。

9.2.3 安装类型D和H，58-70系列

通过以下步骤调整叶轮和水泵外壳的间隙：

1. 拧松6个固定螺丝，并通过拧紧3个定位螺丝消除叶轮间隙。沿对角线拧紧螺丝，使吸入盖均匀移动。



警告

在拧紧固定螺丝时力度不要太大，因为可能对轴承造成损害。移动距离通常为1到3 mm。

2. 使用测隙规或测径器测量吸入盖和水泵外壳间定位螺丝旁3个点间的距离“L”，并将数据记录下来。
3. 拧松定位螺丝并将吸入盖抽回0.5到0.9 mm。使用6个固定螺丝（将每个M12固定螺丝拧转约270°），并以距离“L”作为参考。见图 17。
4. 拧紧所有定位螺丝并检查3个参考点间的距离“L”是否稳定在新的数值。

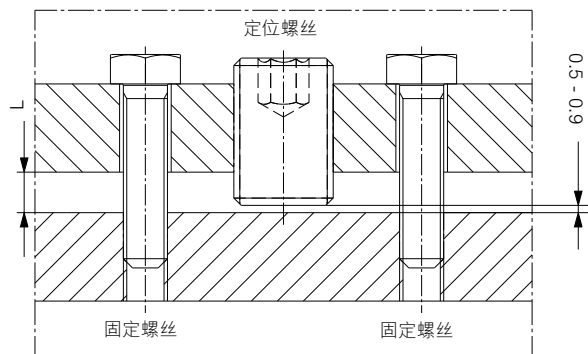


图 17 叶轮间隙调整

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9.3 防爆型S泵，50-70系列

防爆泵在检修与维修后将标有维修铭牌，用于显示以下信息：

- 修理符号R
- 维修工厂的名称与注册商标
- 工厂修理参考编号
- 检修或修理日期。

若需要继续维修，则应为水泵替换最新的维修铭牌并将之前的维修信息记录保存。

维修工厂应将所有的检修与修理记录归类保存，包括所有以前检修、修理以及更改信息。工厂的维修信息记录副本应由物主或运营商归类保存，并与出现故障的防爆泵的型号合格证原件放在一起。

9.3.1 电机电缆

只能使用制造商认证的电缆，其直径、引线数量、导体横截面与外壳材质应与电缆入口匹配。

9.3.2 电缆入口

只能使用与电缆直径相匹配的EExd电缆入口零件。电缆尺寸标志在接口或电缆入口处显示。

将电缆入口固定在电机顶盖上，并将固定螺钉拧紧，直至电缆入口完全平贴在顶盖上为止。

9.3.3 零件

若电机顶盖和电缆入口出现破损，应及时更换，并确保新零件为制造商认证的产品。电机部件不得采用机械加工、重新敲打、焊接等方法进行修理。

9.4 受污染的泵



警告

若水泵用于泵送会对人体产生危害的有毒液体，则必须将其归类为受污染水泵。

若要求格兰富进行维修水泵，必须在将水泵返回维修之前，向格兰富提供泵送液体的具体信息。否则的话，格兰富有权拒绝对该泵进行维修。

因退泵可能产生的费用由客户承担。

无论如何，如果该泵泵送过对健康有害的或有毒的液体，那么任何服务申请(不管由谁来承担)都必须包含泵送液体的详细资料。

10. 故障查找



警告

在尝试故障排除工作之前，确保险丝已经拆去或主电源开关已经切断。须确保电源开关不会意外接通。所有转动部件必须停止转动。

阅读并遵守 3. 安全章节的安全说明。

故障	原因	纠正方法
1. 水泵无法启动或停止，具体原因不详。	a) 电源无电。	恢复电源连接。手动启动水泵并检查接触器工作情况。
2. 水泵无法启动或停止。控制器的控制面板显示电机保护断路器或保护装置已断开。	a) 缺失相位。	恢复所有相位。
	b) 水泵暂时超载。	若该故障无法自动消除，则寻找故障原因并将其解决。
	c) 叶轮被杂物堵塞。	清理叶轮。
	d) 电机保护断路器设置错误。	根据电机的额定电流来设置电机保护断路器。
	e) 热敏开关跳闸。电机冷却不足。	重新冷却电机。
	f) 电机湿敏开关跳闸。	联系授权维修工厂。
	g) 电机电缆故障。	联系授权维修工厂。
	h) 电压不稳。	重置正确的电压。允差为- 10 %/+ 10 %。
3. 水泵能运转，但无法达到额定电流。	a) 转向错误。	互换电机的两个相位。
	b) 叶轮松动或磨损。	拧紧或替换叶轮。
	c) 水泵或管道系统被杂质堵塞。	将杂物清理干净。
	d) 水泵扬程过高。	测量压差，将数值与水泵性能曲线比对。将排水管的杂物排除。
	e) 阀门关闭或堵塞。止回阀非工作状态。	清理或更换阀门。
	f) 水泵或进水管内有空气。	排空水泵和吸入管。提高水池内的停止液位。
	g) 泵送液体密度太高。	稀释液体。
	h) 水泵未与自动耦合器连接到位。	将水箱内液体排空。将水泵提起，与自动耦合器重新连接。
	i) 管道系统出现泄漏。	修理管道系统。
	j) 误将水泵水池冲水系统启动。	检查水泵功能并进行相应维修。
4. 水泵能启动，但立即停止。	a) 水泵堵塞后导致电机保护断路器跳闸。	清洗水泵。
	b) 电机过热导致热敏开关跳闸。	让水泵冷却。清洗水泵。
	c) 液位开关无法设置调整或出现故障。	清洗或设置液位开关，必要时将其更换。
5. 水泵出现振动或噪音过大。	a) 杂质导致水泵局部堵塞。	清洗水泵。
	b) 转向错误。	互换电机的两个相位。
	c) 水泵运行与规定的工作范围不符。	重新设置正确的运行条件。
	d) 水泵出现故障。	修理水泵或联系授权维修工厂（若有必要）。
	e) 水泵未与自动耦合器连接到位。	将水池内液体排空。将水泵提起，与自动耦合器重新连接。
	f) 水泵汽蚀。	清理进水管。
	g) 基座、自动耦合器、环架或导轨安装不到位。	正确安装零件。
6. 机油水分过多或被乳化。	a) 下端机械密封渗漏。	联系授权维修工厂。
7. 低油位。	a) 上端机械密封渗漏。	联系授权维修工厂。

11. 回收处理

必须以环境友好的方式对本产品或产品的部件进行回收处理。

1. 使用公立或私立废品回收服务设施。
2. 如果以上无法做到，与附近的格兰富公司或服务站联系。

内容可有变动。

Original installation and operating instructions.

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**Warning**

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document**Warning**

If these safety instructions are not observed, it may result in personal injury.

**Warning**

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.

**Warning**

The surface of the product may be so hot that it may cause burns or personal injury.

**Warning**

These instructions must be observed for explosion-proof pumps. It is advisable also to follow these instructions for standard pumps.

**Warning**

The sound pressure level is so high that hearing protection must be used.

Caution

If these safety instructions are not observed, it may result in malfunction or damage to the equipment.

Note

Notes or instructions that make the job easier and ensure safe operation.

2. General description

This booklet includes instructions for installation, operation and maintenance of Grundfos submersible sewage and wastewater S pumps, range 50-70, fitted with motors of 7.5 to 160 kW.

The booklet also includes specific instructions for the explosion-proof pumps.

Special conditions for safe use of S pumps, range 50-70 Ex:

1. Make sure the moisture switches and thermal switches are connected in two separate circuits and have separate alarm outputs (motor stop) in case of high humidity or high temperature in the motor.
2. Bolts used for replacement must be class A4-80 or A2-80 according to EN/ISO 3506-1.
3. The flame path gaps of the motor are specified by the manufacturer and are narrower than standard.
Note: In case of repairs always use original service parts from the manufacturer as this ensures correct dimensions of flame path gaps.
4. During operation the cooling jacket, when fitted, must be filled with pumped liquid. The level of pumped liquid must be controlled by level switches connected to the motor control circuit.
5. The minimum level depends on the installation type and is specified in these installation and operating instructions.
6. Make sure the permanently attached cable is suitably mechanically protected and terminated in a suitable terminal board.

**2.1 Applications**

S pumps, range 50-70 are designed for the pumping of sewage and wastewater in a wide range of municipal, private and industrial applications.

Depending on the installation type, the pumps can be used for submerged or dry, horizontal or vertical installation.

Maximum solids size: 80-145 mm depending on range.

2.1.1 Potentially explosive environments

Use the explosion-proof S pumps, range 50-70, in potentially explosive environments. See section 2.5.1 *Ex certification and classification*.

Note

The explosion classification of the pump is Ex bc dIIB T3. The installation must be approved by the local authorities in each individual case.

2.2 Operating conditions

2.2.1 pH value

All pumps can be used for pumping liquids with a pH value between 4 and 10.

2.2.2 Liquid temperature

0 °C to +40 °C.

2.2.3 Ambient temperature

-20 °C to +40 °C.

2.2.4 Density and viscosity of pumped liquid

When pumping liquids with a density and/or a kinematic viscosity higher than that of water, use motors with correspondingly higher outputs.

2.2.5 Flow velocity

It is advisable to keep a minimum flow velocity to avoid sedimentations in the piping system.

Recommended velocities

In vertical pipes: 0.7 m/s

In horizontal pipes: 1.0 m/s

2.2.6 Level of pumped liquid

For a submerged pump, installation type C, the lowest stop level must always be above the pump housing.



Warning

Dry-running is not allowed.

The level of pumped liquid must be controlled by level switches connected to the motor control circuit. The minimum level depends on the installation type and is specified in these installation and operating instructions.

Installation type	Description	Accessories
S	Sewage pump without cooling jacket for submerged installation on auto coupling.	Auto coupling
C	Sewage pump with cooling jacket for submerged installation on auto coupling.	Auto coupling
D	Sewage pump with cooling jacket for dry vertical installation.	Range 50, 54, 58 and 62: Base stand for vertical installation. Range 66 and 70: Base plate for vertical installation.
ST	Sewage pump with or without cooling jacket for vertical installation in column pipe.	Seat ring for vertical installation in column pipe.
H	Sewage pump with cooling jacket for dry horizontal installation.	Base stand for horizontal installation

To ensure adequate cooling of the motor during operation, the following minimum requirements must be met:

• Installation type S

For S1 operation (continuous operation), the pump must always be covered by the pumped liquid to the top of the motor.

For S3 operation (intermittent operation), the pump must always be covered by the pumped liquid to the middle of the motor.



Warning

Installation type S pumps must always be fully submerged in the pumped liquid to be Ex protected.

• Installation type C

The pump housing must always be covered by the pumped liquid.

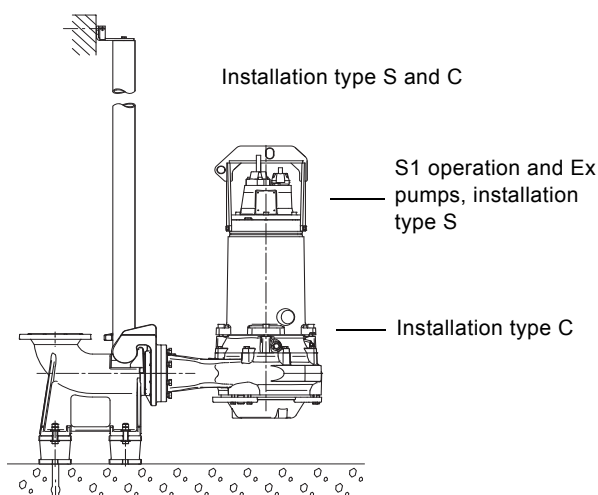


Fig. 1 Liquid level

• Installation type D and H

No special requirements.

• Pump type ST

The liquid level must be at least 350 mm above the pump inlet. See fig. 9.

2.2.7 Operating mode

The pumps are designed for continuous operation or for intermittent operation with the maximum number of starts per hour stated in the table below:

S pump, range	Starts per hour
50	20
54	
58	
62	15
66	
70	

2.2.8 Enclosure class

IEC IP68.

2.3 Sound pressure level



Warning

Depending on the installation type the sound pressure level of the pump can be higher than 70 dB(A).

When working nearby such an installation in operation, hearing protection must be used.

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2.4 Type key

All S pumps, range 50-70, described in this booklet are identified by the type code stated in the confirmation of order and other documentation supplied with the pump.

Please note that the pump type described in this booklet is not necessarily available in all variants.

Code Example	S	1	.100	.100	.55	4	.50M	.S	.205	.G	.N	.D	.Z
Pump type													
S	Grundfos sewage and wastewater pump												
ST	Multi-channel impeller pump installed in column pipe												
Impeller type													
1	Single-channel												
2	Two-channel												
3	Three-channel												
V	SuperVortex												
Pump passage													
Maximum solids size [mm]													
Pump discharge													
Nominal diameter of pump discharge port [mm]													
Output power P2													
Code number from type designation/10 [kW]													
Number of poles													
2	2-pole motor												
4	4-pole motor												
6	6-pole motor												
8	8-pole motor												
10	10-pole motor												
Pump range/pressure version													
50S	Super high												
50H	High												
50M	Middle												
50L	Low												
50E	Extra low												
50F	Super low												
Installation type													
S	Submersible installation without cooling jacket												
C	Submersible installation with cooling jacket												
D	Dry, vertical installation												
H	Dry, horizontal installation												
Actual impeller diameter													
[mm]													
Material code for impeller, pump- and motor housing													
G	Cast iron impeller, pump housing and motor housing												
Q	Stainless steel impeller, DIN W.-Nr. 1.4408												
S	Stainless steel impeller and pump housing, DIN W.-Nr. 1.4408												
R	Stainless steel impeller, pump housing and motor housing, DIN W.-Nr. 1.4408												
D	Duplex steel impeller												
Pump version													
N	Non-ex pump												
Ex	Pump with explosion-proof motor												
Sensor version													
B	S pump with built-in SM 111 module. PTC sensors are connected directly to IO 111 or other PTC relay.												
C	Not in use												
D	S pump without built-in SM 111 module												
Z	Custom-built products												

2.5 Nameplate

All pumps can be identified by means of the nameplate on the motor top cover. See fig. 2. If the nameplate is missing or damaged, the pump can be identified by the serial number stamped under the nameplate.

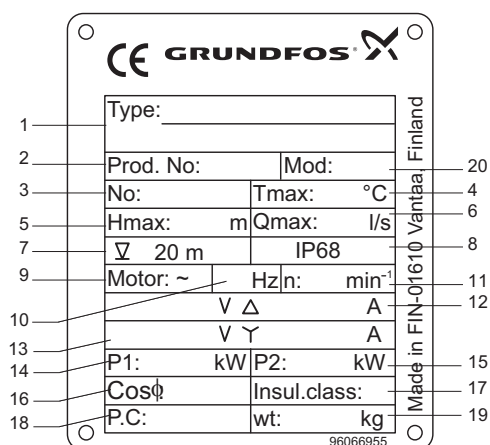


Fig. 2 Pump nameplate

Pos.	Description
1	Type designation
2	SAP code
3	Serial number
4	Maximum liquid temperature
5	Maximum head
6	Maximum flow
7	Maximum installation depth
8	Enclosure class
9	Number of phases
10	Frequency
11	Rated speed
12	Voltage/current, delta connection
13	Voltage/current, star connection
14	Power input
15	Shaft power
16	Power factor
17	Insulation class
18	Production code, year/week
19	Weight of the pump
20	Model

2.5.1 Ex certification and classification

Direct drive, 50 or 60 Hz: CE 1180 II2 G Ex bc d IIB T4
 Frequency converter drive: CE 1180 II2 G Ex bc d IIB T3
 Explosion-proof pumps have been approved by Baseefa (2001) Ltd. in conformity with the essential health and safety requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Council Directive 94/9/EC (ATEX).

The certified pumps (Ex pumps) are supplied with an approval plate fixed in the visible place close to the nameplate.

Fig. 3 shows the approval plates for the pumps equipped optionally with the motors classified to T3 or T4 temperature class.



Fig. 3 Approval plates of explosion-proof pumps, T3 and T4 classification

The approval plate gives the following details:

	EU ex-symbol
II	Equipment group (II = non-mining)
2	Equipment category (high protection)
G	Type of explosive atmosphere
CE	CE mark
1180	Number of quality assurance notified body
Ex	Motor explosion-proof according to European standard
b	Control of ignition sources
c	Constructional safety
d	Motor withstands explosion pressure
IIB	Gas group (ethylene)
T3	Maximum surface temperature of the motor is 200 °C
T4	Maximum surface temperature of the motor is 135 °C
Gb	Equipment protection level, zone 1
Baseefa	Certificate number
IECEx	Certificate number

3. Safety



Warning
Pump installation in tanks must be carried out by specially trained persons.



Warning
Persons must not enter the installation area when the atmosphere is explosive.



Warning
It must be possible to lock the mains switch in position 0. Type and requirements as specified in EN 60204-1, 5.3.2.

For safety reasons, all work in tanks must be supervised by a person outside the pump tank.

Tanks for submersible sewage and wastewater pumps contain sewage and wastewater with toxic and/or disease-causing substances. Therefore, all persons involved must wear appropriate personal protective equipment and clothing and all work on and near the pump must be carried out under strict observance of the hygiene regulations in force.



Warning
For some installation types, the surface temperature may be up to 90 °C.



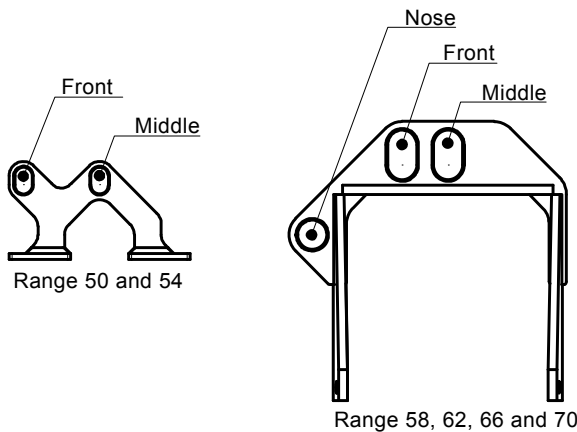
Warning
Make sure that the lifting eye bolts are tightened before attempting to lift the pump. Tighten if necessary. Carelessness during lifting or transportation may cause injury to personnel or damage to the pump.



Warning
Make sure the rated lifting capacity of the lifting equipment (lifting chain etc.) is adequate before attempting to lift the pump.
The rated lifting capacity of the lifting equipment is marked in the identification label. The weight of the pump is marked in the pump nameplate.

3.1 Lifting points for submerged and dry vertical installation (S/C/D)

When lifting the pump, it is important to use the right lifting point to keep the pump balanced. S pumps model S/C/D are equipped with a bracket with lifting points ensuring that the pump can be lifted in a safe manner. See fig. 4 and table below to find the correct lifting point.



TM04 7173 1710

Fig. 4 Lifting points

Discharge flange size	Pump range					
	50	54	58	62	66	70
DN80	Middle	Middle	-	-	-	-
DN100	Middle	Middle	-	-	-	-
DN125	Middle	Middle	Middle	Middle	-	-
DN200	Front	Front	Front	Middle	Middle	Middle
DN250	-	Front	-	-	Middle	Middle
DN300	-	-	Front	Middle	Middle	Middle
DN500	-	-	-	-	Nose	Front
DN600	-	-	-	-	Nose	Front

4. Transportation and storage

The pump is supplied from the factory in proper packing in which it should remain until it is to be installed.

Make sure that the pump cannot roll or fall over.

All lifting equipment must be rated for the purpose and checked for damage before any attempt to lift the pump. The lifting equipment rating must under no circumstances be exceeded. The pump weight is stated on the pump nameplate.



Warning
Always lift the pump by its lifting bracket or by means of a fork-lift truck, never by means of the motor cable or the hose/pipe.

Do not remove the insulation from the free end of the supply cable until the electrical connection is to be made. Whether insulated or not, the free cable end must never be exposed to moisture or water. Non-compliance with this may cause damage to the motor.

Caution

For long periods of storage, the pump must be protected against moisture and heat.

Storage temperature: -30 °C to +60 °C.



Warning
If the pump is stored for more than one year or it will be a long time before it is put into operation after the installation, the impeller must be turned at least once a month.

After a long period of storage, the pump should be inspected before it is put into operation. Make sure that the impeller can rotate freely. Pay special attention to the condition of the shaft seals and the cable entry.

5. Installation



Warning

During installation, always support the pump by means of lifting chains or place it in horizontal position to secure stability.



Warning

Before beginning the installation, switch off the power supply and lock the mains switch in position 0.

Any external voltage connected to the pump must be switched off before working on the pump.

The extra nameplate supplied with the pump should be fixed at the installation site.

All safety regulations must be observed at the installation site, for instance the use of blowers for fresh-air supply to the tank.

Warning

Do not put your hands or any tool into the pump suction or discharge port after the pump has been connected to the power supply, unless the pump has been switched off by removing the fuses or switching off the mains switch. Make sure that the power supply cannot be accidentally switched on.



Prior to installation, check the oil level in the oil chamber. See section 9.1 Oil check and oil change.

5.1 Installation type

S pumps, range 50-70 are designed for various installation types. Figures 5 to 9 show the possible installation types.

Installation type S and C

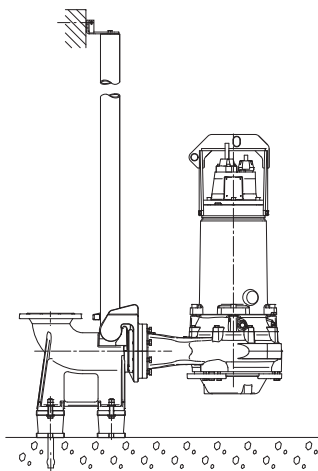


Fig. 5 Submerged installation on auto coupling

Caution Avoid pipe tension at flanges and bolts.

Caution The free end of the cable must not be submerged as water may penetrate through the cable into the motor.

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Permanent installation in tank

The pump can easily be pulled out and lowered into the tank by means of the guide rails. The liquid level can be set lower for type C than for type S. See fig. 1.

Installation type D

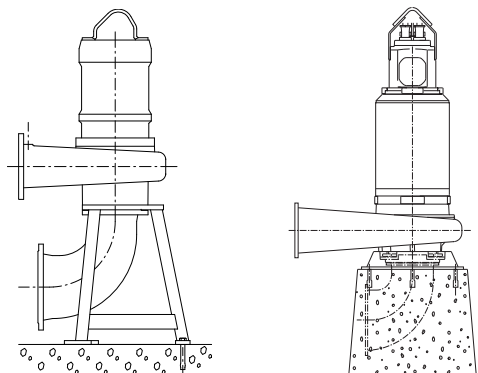


Fig. 6 Dry, vertical installation with base stand (left) and base plate on two concrete pedestals (right)

TM02 4001 4601 / TM02 4023 4701

Permanent installation in a pump room

The pump is bolted to the suction and discharge pipes by means of flange connections. Pumps with DN 500 or DN 600 flange are to be installed on a concrete foundation (see the above figure to the right).

Installation type S and C

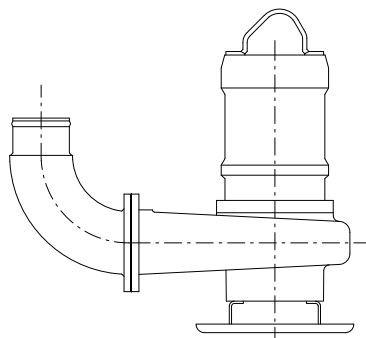


Fig. 7 Submerged, temporary installation

TM02 4002 4601

Temporary installation in a tank

The liquid level can be set lower for type C than for type S. See fig. 1.

Installation type H

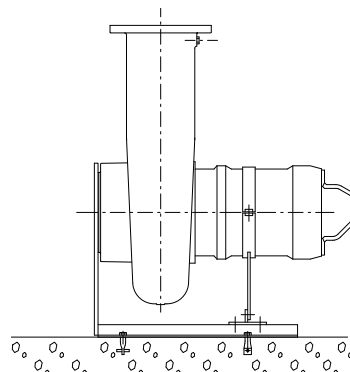


Fig. 8 Dry horizontal installation with base stand and bracket

TM02 4003 4601

Permanent installation in a pump room

The pump is bolted to the suction and discharge pipes by means of flange connections.

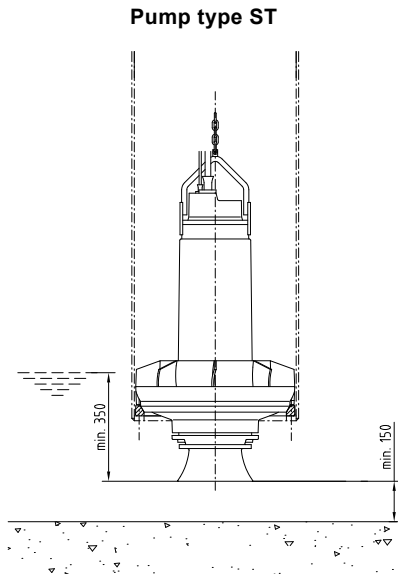


Fig. 9 Vertical column pipe installation

Vertical column pipe installation in steel pipe or concrete shaft.

5.2 Submerged installation on auto coupling

Pumps for permanent installation can be installed on a stationary auto coupling and operated completely or partially submerged in the pumped liquid.

Make sure that the pipework is installed without the use of undue force. No loads from the pipework weight must be carried by the pump. We recommend the use of loose flanges to ease the installation and to avoid pipe tension at flanges and bolts.

Note

Do not use elastic elements or bellows in the pipework; these elements should never be used as a means to align the pipework.

Note

In some installations, a plinth is required beneath the auto coupling to ensure correct installation of the pump. This should be considered during the design of the installation.

Note

1. Drill mounting holes for the guide rail bracket on the inside of the tank and fasten the guide rail bracket provisionally with two screws.
2. Place the auto-coupling base unit on the bottom of the tank. Use a plumb line to establish the correct positioning. Fasten the auto coupling with expansion bolts. If the bottom of the tank is uneven, the auto-coupling base unit must be supported so that it is level when being fastened.
3. Assemble the discharge pipe in accordance with the generally accepted procedures and without exposing the pipe to distortion or tension.
4. Place the guide rails on the auto-coupling base unit and adjust the length of the rails accurately to the guide rail bracket at the top of the tank.
5. Unscrew the provisionally fastened guide rail bracket. Insert the expansion dowels into the guide rails. Fasten the guide rail bracket on the inside of the tank. Tighten the bolts in the expansion dowels.
6. Clean out debris from the tank before lowering the pump into the tank.
7. Fit the guide claw to the pump.

8. Slide the guide claw of the pump between the guide rails and lower the pump into the tank by means of a chain secured to the lifting bracket of the pump. When the pump reaches the auto-coupling base unit, the pump will automatically connect tightly.
9. Hang up the end of the chain on a suitable hook at the top of the tank and in such a way that the chain cannot come into contact with the pump housing.
10. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook at the top of the tank. Make sure that the cables are not sharply bent or pinched.
11. Connect the motor cable and the control cable, if any.

Note

The free end of the cable must not be submerged, as water may penetrate through the cable into the motor.

5.3 Dry installation

Pumps in dry installation are installed permanently in a pump room.

The pump motor is enclosed and watertight and will not be damaged if the installation site is flooded with water.

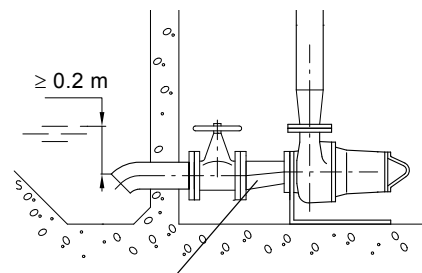
1. Mark and drill mounting holes in the concrete floor/concrete foundation.
2. Fit the bracket or base stand to the pump.
3. Fasten the pump with expansion bolts.
4. Check that the pump is vertical/horizontal.

In order to facilitate service on the pump, we recommend to use isolating valves on either side of the pump.

5. Fit the suction and discharge pipes and isolating valves, if used, and ensure that the pump is not stressed by the pipework.
6. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
7. Connect the motor cable and the control cable, if any.

We recommend to use a reducer between the suction pipe and the pump in horizontal installations. The reducer must be of the eccentric type and must be installed so that the straight edge is pointing upwards. In this way, the accumulation of air in the suction pipe is avoided and the risk of disturbance of operation is eliminated. See fig. 10.

Caution



Reducer of the eccentric type

Fig. 10 Eccentric reducer

5.4 Submerged installation, portable

1. Fit the ring stand to the pump suction flange.
2. Fit a 90 ° elbow to the pump discharge port and connect the discharge pipe/hose.
If a hose is used, make sure that the hose does not buckle and that the inside diameter matches that of the discharge port.
3. Lower the pump into the liquid by means of a chain secured to the lifting bracket of the pump. It is recommended to place the pump on a plane, solid foundation. Make sure that the pump is hanging from the chain and not the cable.
4. Hang up the end of the chain on a suitable hook at the top of the tank and in such a way that the chain cannot come into contact with the pump housing.
5. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
6. Connect the motor cable and the control cable, if any.

5.5 Vertical installation in column pipe

1. Weld the ring supplied with the pump onto the lower opening of the steel column pipe or concrete it into place at the lower opening of the concrete column pipe.
2. Fasten a chain to the lifting bracket and uncoil the supply cable.
3. Lower the pump into place in the column pipe. Make sure that the O-ring seal is positioned correctly in the groove on the outside of the pump housing. Three guide pins on the ring will guide the pump into the right position and prevent it from turning in the seat when running.
4. Hang up the end of the chain on a suitable hook at the top of the tank and in such a way that the chain cannot come into contact with the pump housing.
5. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
6. Connect the motor cable and the control cable, if any.

5.6 Pump controller

S pumps, range 50-70 can be connected to a separate Grundfos pump controller for level control, which is available as an accessory:

- type LC for one-pump installations
- type LCD for two-pump installations.

Depending on application, different types of level control equipment can be used.

The LC controller is fitted with two or three level switches: Two for start and stop of pump. The third level switch, which is optional, is for high-level alarm.

The LCD controller is fitted with three or four level switches: One for common stop and two for start of the pumps. The fourth level switch, which is optional, is for high-level alarm.

When installing the level switches, the following points should be observed:

1. To prevent air intake and vibrations in submerged pumps, the stop level switch must be fitted in such a way that the pump is stopped before the liquid level is lowered below the top of the pump housing.
As a principal rule for pumps in dry installation, the lowest stop level must be at least 20 cm above the opening of the suction pipe. See fig. 10.
2. The start level switch should be installed in such a way that the pump is started at the required level; however, the pump must always be started before the liquid level reaches the bottom inlet pipe to the tank.
3. The high-level alarm switch, if installed, should always be installed about 10 cm above the start level switch; however, alarm must always be given before the liquid level reaches the inlet pipe to the tank.



Warning

The pump controller must not be installed in potentially explosive atmospheres.



Warning

Pumps installed in potentially explosive atmosphere must always be filled with the pumped liquid.

An additional level switch must be installed to ensure that the pump is stopped in case the stop level switch is not operating.

5.7 Galvanic separation

Double-insulated sensors for all measurements of high voltages ensure the electrical safety. Furthermore, there is a galvanic separation inside the IO 111.

5.8 IO 111

The IO 111 forms interface between a Grundfos sewage and wastewater pump with analogue and digital sensors and the pump controller. The most important sensor data are indicated on the front panel.

One pump can be connected to an IO 111 module.

Together with the sensors, the IO 111 forms a galvanic separation between the motor voltage in the pump and the controller connected.

5.8.1 Measurement of insulation resistance

The IO 111 measures the insulation resistance between a stator winding and earth:

- Resistance above 10 MΩ = ok.
- Resistance between 10 MΩ and 1 MΩ = warning.
- Resistance below 1 MΩ = alarm.

5.9 Thermal switches

Three bimetallic thermal switches are built into the stator windings, and a contact will open in case of overtemperature, i.e. 150 °C.

The supply voltage to the thermal switches must be 12-230 VAC.

The thermal switches are connected to the control cable, and must be connected to the safety circuit of the separate pump controller. See section 7. *Electrical connection*.

The motor protective circuit breaker of the pump controller must include a circuit which automatically disconnects the power supply in case the protective circuit for the pump is opened.

Caution



Warning

The installer/user must install an automatic circuit breaker which disconnects the power supply in case the thermal switches or the moisture switches are not operating.

5.10 Moisture switches

Non-explosion-proof pumps have one moisture switch, which is fitted in the chamber below the motor top cover.

Explosion-proof pumps have two moisture switches connected in series.

Ranges 50-58 and 66-70 explosion-proof pumps have two moisture switches, one below the motor top cover and one in the stator housing in the bottom of the motor.

Range 62 has both moisture switches placed below the motor top cover.

Moisture switches and thermal switches are motor protection devices which protect the motor from damage due to moisture or overheating. The moisture switches are non-reversing and must be replaced after use.

The moisture switches and thermal switches are connected in two separate circuits and to the control cable. See 7. *Electrical connection*. They are also to be connected to the safety circuit of the separate pump controller.

The motor-protective circuit breaker of the pump controller must include a circuit which automatically disconnects the power supply in case the protective circuit for the pump is opened.

Caution

5.11 Thermistors

Thermistors are available as an option.

The thermistors can be used as motor protection devices to monitor stator temperature instead of thermal switches and must be connected to the thermistor relay in the control cabinet.

5.11.1 Checking after installation of pump

- Using a multimeter, check whether the circuit resistance is $< 150 \Omega$ /thermistor.
- Using a multimeter, check whether the insulation between circuit and stator housing is outside the scale (not measurable ∞).
- Carry out similar measurements at the end of the supply cable.

5.12 Pt100 temperature sensor

The Pt100 temperature sensor is available as an accessory or as an FPV (Factory Product Variant) option.

The Pt100 sensor is primarily used for the monitoring of bearing temperature, but it can also be used in the stator.

The bearing temperature monitoring is only available as an option. For range 50 and 54 it is only available for monitoring the lower bearing temperature in explosion-proof pumps.

Note

The sensor resistance is

- 100 Ω at 0 °C
- 138.5 Ω at 100 °C
- approx. 108 Ω at room temperature.

The following temperature limits are used:

- 90 °C: alarm for bearing temperature
- 130 °C: pump stop caused by high bearing temperature
- 150 °C: pump stop caused by high stator temperature.

At room temperature, the thermistor resistance is approx. 100 Ω .

Warning

In case of overheating caused by wear, lack of lubricant etc., the Pt100 sensor trips an alarm and disconnects the power supply at a preset temperature. Max. acceptable alarm temperature in bearing sensors is 100 °C for the lower bearing (shaft end) and 120 °C for the upper bearing (range 58, 62, 66 and 70 only).



5.12.1 Checking after installation of pump

- Using a multimeter, check whether the resistance at room temperature is approx. 108 Ω .
- Using a multimeter, check whether the insulation between circuit and stator housing is outside the scale (not measurable ∞).
- Carry out similar measurements at the end of the supply cable.
- During pump check, the Pt100 sensor must be connected to a recording device.

6. Water-in-oil (WIO) sensor

6.1 WIO as accessory

Warning



Lack of the lubricant may cause overheating and damage of the mechanical seals. The WIO sensor in the oil chamber trips the alarm if the oil quality is poor or there is no oil in the oil chamber.

The WIO sensor is available as an accessory for pumps with motor sizes of 5.5 to 160 kW.

The sensor measures the water content in the oil chamber.

The sensor consists of a plate capacitor which is immersed in the oil and measures the electronic circuit, emitting a 4-20 mA proportional current signal.

6.2 Fitting the WIO sensor

The WIO sensor is to be fitted in the filling hole of the oil chamber instead of the oil screw.

- Remove the oil screw.
- Push the sensor into the oil filling hole.
- Push the sensor to a suitable depth in the oil chamber without letting it touch the rotating parts, but so deep that the sensor is completely covered by the oil. Recommended insertion depths for different pump types appear from the table below.
- Screw the sensor bush into the thread for the oil screw.

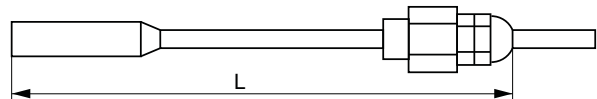
Vertical installation: Always use the lowest oil screw hole.

Note

Horizontal installation: Always use the inspection screw hole.

Caution

Before refitting the WIO sensor after oil change, clean it with white spirit.



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Fig. 11 Dimensions of WIO sensor

S pumps, range	Insertion depths L [mm]
50	80
54	90
58	100
62	100
66	100
70	100

For more detailed information, see installation instruction for the WIO sensor (96591899).

6.3 Electrical data, WIO sensor

Input voltage:	12-24 VDC
Output current:	3.4-22 mA
Power consumption:	0.6 W
Ambient temperature:	0 to 70 °C

6.4 Sensor signals

4-20 mA	= 0-20 % water in the oil Accuracy better than 2 %.
22 mA	= Warning: Water content far outside measuring range.
3.5 mA	= Alarm: Air in the oil chamber.

Note *The sensor signal is only valid when oil and water is mixed (when the pump is running).*

7. Electrical connection



Warning

The pump must be connected to an external mains switch with a contact separation according to EN 60204-1, 5.3.2.

The electrical connection must be carried out in accordance with local regulations.

The supply voltage and frequency are marked on the pump nameplate.

The voltage tolerance at the motor terminals must be within -10 %/+ 10 % of the rated voltage.

Make sure that the motor is suitable for the power supply available at the installation site.

The motor is effectively earthed via the power cable and pipework. The motor top cover is equipped with connections for external earthing or an equipotential bonding conductor.



Warning

For Ex models in dry installation (version D), we recommend also to connect an external earthing.



Warning

Before installation and the first start-up of the pump, check the condition of the cable visually to avoid short circuits.

The pump must be connected to a motor protective circuit breaker.

The most commonly used start-up methods are direct-on-line starting (DOL), star-delta starting (Y/D) and soft start. The pump can even be started via a frequency converter according to the frequency converter manufacturer's specifications. The selection of suitable starting method depends on several considerations on usage and mains supply conditions.

When using star-delta starting, it is important to keep switching transient time to a minimum to avoid high transient torques. We recommend to use a time relay with a switching time of maximum 50 ms or according to the starter manufacturer's specifications.

Note *When using star-delta starting, it is important to keep switching transient time to a minimum to avoid high transient torques. We recommend to use a time relay with a switching time of maximum 50 ms or according to the starter manufacturer's specifications.*

The wiring diagrams for direct-on-line starting and star-delta starting are shown in fig. 12 and fig. 13, respectively. L1 and L2 are connected in series with the thermal switches and the moisture switches.

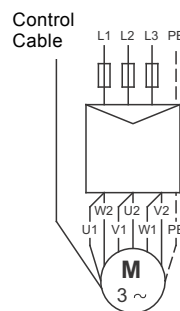


Fig. 12 Direct-on-line starting

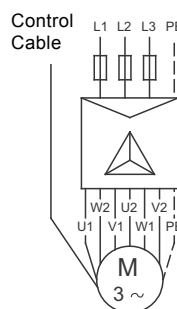


Fig. 13 Star-delta starting

7.1 Frequency converter operation

In principle, all three-phase motors can be connected to a frequency converter.

However, frequency converter operation will often expose the motor insulation system to a heavier load and cause the motor to be more noisy than usual due to eddy currents caused by voltage peaks.

In addition, large motors driven via a frequency converter will be loaded by bearing currents.

For frequency converter operation, please observe the following information:

- Requirements must be fulfilled.
- Recommendations ought to be fulfilled.
- Consequences should be considered.

7.1.1 Requirements

- The thermal protection of the motor must be connected.
- Peak voltage and dU/dt must be in accordance with the table below. The values stated are maximum values supplied to the motor terminals. The cable influence has not been taken into account. See the frequency converter data sheet regarding the actual values and the cable influence on the peak voltage and dU/dt.

Maximum repetitive peak voltage [V]	Maximum dU/dt U _N 400 V [V/μ sec.]
850	2000

- If the pump is an Ex-approved pump, check if the Ex certificate of the specific pump allows the use of a frequency converter.
- Set the frequency converter U/f ratio according to the motor data.
- Local regulations/standards must be fulfilled.

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7.1.2 Recommendations

Before installing a frequency converter, calculate the lowest allowable frequency in the installation in order to avoid zero flow.

- Do not reduce the motor speed to less than 30 % of rated speed.
- Keep the flow velocity above 1 m/sec.
- Let the pump run at rated speed at least once a day in order to prevent sedimentation in the piping system.
- Do not exceed the frequency indicated on the nameplate. In this case there is risk of motor overload.
- Keep the motor cable as short as possible. The peak voltage will increase with the length of the motor cable. See data sheet for the frequency converter used.
- Use input and output filters on the frequency converter. See data sheet for the frequency converter used.
- Use screened motor cable if there is a risk that electrical noise can disturb other electrical equipment. See data sheet for the frequency converter used.

7.1.3 Consequences

When operating the pump via a frequency converter, please be aware of these possible consequences:

- The locked-rotor torque will be lower. How much lower will depend on the frequency converter type. See the installation and operating instructions for the frequency converter used for information on the locked-rotor torque available.
- The working condition of bearings and shaft seal may be affected. The possible effect will depend on the application. The actual effect cannot be predicted.
- The acoustic noise level may increase. See the installation and operating instructions for the frequency converter used for advice as to how to reduce the acoustic noise.

7.2 Cable data

Standard H07RN-F

S pump, range	Cable type [mm ²]	Outer cable diameter [mm]		Bending radius [cm]
		min.	max.	
50	7 x 1.5	14.4	16.4	10
	4 x 2.5	16.7	18.7	12
	4 x 6	15.7	17.2	11
54	4 x 6	15.7	17.2	11
	4 x 10	20.9	23.4	14
58	4 x 6	15.7	17.2	11
	4 x 10	20.9	23.4	14
62	4 x 6	15.7	17.2	11
	4 x 10	20.9	23.4	14
	4 x 16	23.8	26.3	16
66	4 x 10	20.9	23.4	14
	4 x 16	23.8	26.3	16
	4 x 25	28.9	31.4	19
70	4 x 25	28.9	31.4	19
	4 x 35	32.5	34.7	22
	4 x 50	37.7	40.4	25
	4 x 70	42.7	45.4	28

EMC

S pump, range	Cable type [mm ²]	Outer cable diameter [mm]		Bending radius [cm]
		min.	max.	
50	3 x 6	13.6	15.2	7.6
54	3 x 6	13.6	15.2	7.6
	3 x 10	17.8	19.8	9.9
58	3 x 6	13.6	15.2	7.6
	3 x 10	17.8	19.8	9.9
62	3 x 6	13.6	15.2	7.6
	3 x 10	17.8	19.8	9.9
	3 x 16	20.9	22.9	11.5
66	3 x 10	17.8	19.8	9.9
	3 x 16	20.9	22.9	11.5
	3 x 35	28.3	31.3	15.7
70	3 x 35	28.3	31.3	15.7
	3 x 70	38.7	41.7	20.9

Control cables

Cable type [mm ²]	Outer cable diameter [mm]		Bending radius [cm]
	min.	max.	
7 x 1.5	14.4	16.0 - 16.4	10
10 x 1.5	0.71 (18)	0.79 (20)	4.7 (12)

Warning



The top cover of explosion-proof pumps is provided with an external earth terminal to ensure the connection to earth. The electrical installation must include an external connection from this terminal to earth. The earth conductor must fulfill all electrical safety regulations in force.

Cross section of phase conductor (S) of the installation [mm ²]	Minimum cross section of earth conductor [mm ²]
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	$0.5 * S$, max. 70



Warning

Before installation and the first start-up of the pump, check the condition of the cable visually to avoid short circuits.

8. Start-up



Warning

Before manual starting or changeover to automatic control, make sure that no persons are working on or near the pump.



Warning

Before the first start-up and after a long standstill period, make sure that the pump has been filled with pumped liquid.

In dry installed versions the cooling jacket must always be filled with pumped liquid when operating. Ensure this by venting before the first start-up.

Proceed as follows:

1. Remove the fuses or switch off the mains switch.
2. Check the oil level in the oil chamber.
See section 9.1 *Oil check and oil change*.
3. Check whether the impeller can rotate freely.
4. Check whether the monitoring units, if used, are operating satisfactorily.
5. For pumps in submerged installation, make sure that the pump is submerged in the liquid.
6. For pumps in dry installation, make sure that there is liquid in the tank from which the supply of liquid comes.



Warning

Make sure that the pump has been filled with pumped liquid.

Pumps in dry installation must be vented via the vent hole in the pump housing.

7. Open the isolating valves, if fitted.
8. Check whether the system has been filled with liquid and vented.
9. Check the setting of the level switches.
10. Start the pump and check the pump operation for abnormal noise or vibrations.

In case of abnormal noise or vibrations from the pump or other pump or liquid supply failures, stop the pump immediately. Do not attempt to restart the pump until the cause of the fault has been found and the fault corrected.

Caution

11. After start-up, the actual pump duty point must be established as accurately as possible so that it can be checked whether the operating conditions are as desired.

Note

The pump may only be started for a very short period without being submerged for checking of direction of rotation.

The operation of the pump should always take place in accordance with established routines with scheduled checks of pump monitoring equipment and accessories (valves, etc.). Make sure that the pump and equipment settings cannot be changed by unauthorised persons.

8.1 Checking the direction of rotation

An arrow cast in the pump housing indicates the correct direction of rotation. The pump must rotate clockwise when seen from the drive end. Observe the movement of the pump (jerk) when started. If the pump jerks counter-clockwise, the direction of rotation is correct.

As an alternative, the direction of rotation can be checked as follows:

1. Start the pump and check the quantity of liquid or the discharge pressure.
2. Stop the pump and interchange two of the phases to the motor.
3. Restart the pump and check the quantity of liquid or the discharge pressure.
4. Stop the pump.
5. Compare the results taken under points 1 and 3.
The connection which gives the larger quantity of liquid or the higher pressure is the correct direction of rotation.

Caution

The pump must only run for a short period when suspended from a chain.

9. Maintenance and service



Warning

During maintenance and service, including transportation to service workshop, always support the pump by means of lifting chains or place it in horizontal position to secure stability.



Warning

Before starting work on the pump, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on. All rotating parts must have stopped moving.

Maintenance and service must be carried out by specially trained persons.



Warning

The maintenance and service work on explosion-proof pumps must be carried out by Grundfos or a service workshop authorised by Grundfos.



Warning

Do not open the pump if the ambient atmosphere is explosive or dusty.

Before carrying out maintenance and service, make sure that the pump has been thoroughly flushed with clean water. Rinse the pump parts in water after dismantling.

Pumps running normal operation should be inspected every 2000 operating hours or at least once a year. If the pumped liquid is very muddy or sandy, the pump should be inspected every 1000 operating hours or every six months.

The following points should be checked:

- **Power consumption**
- **Oil level and oil condition**

When the pump is new or after replacement of the shaft seals, check the oil level and water content after one week of operation. If there is more than 20 % of water in the oil, the shaft seal may be defective. See section 9.1 Oil check and oil change.

Note

Dispose of the oil in accordance with local regulations.

The oil chamber contains 1.9 to 12.5 litres of oil depending on pump size. See table below.

Quantity of oil

S pump, range	Installation type	No of poles	Quantity of oil [l]
50	S	All	2.6
	C-D-H	All	1.9
54	S	All	3.5
	C-D-H	All	2.5
58	S	All	4.6
	C-D-H	All	3.8
62	S	All	9.0
	C-D-H	All	7.1
66	S	All	12.5
	C-D-H	All	9.2
70	S	All	12.4
	C-D-H	All	9.0

- **Cable entry**
Make sure that the cable entry is waterproof and that the cables are not sharply bent or pinched.
- **Impeller clearance**
Check the impeller clearance. See section 9.2 Inspection and adjustment of impeller clearance.
- **Pump parts**
Check the pump housing, etc. for possible wear. Replace defective parts.
- **Ball bearings**
Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace defective ball bearings.
A general overhaul of the pump is usually required in case of defective ball bearings or poor motor function. This work must be carried out by an authorised service workshop.



Warning

The ball bearings must be replaced at least every 25,000 operating hours.

Caution

Clean the outside of the pump at regular intervals in order to retain the heat conductivity.

9.1 Oil check and oil change

Caution

Change the oil every four years to prevent oxidation.



Warning

Lack of the lubricant may cause overheating and damage of the mechanical seals. The WIO sensor in the oil chamber trips the alarm if the oil quality is poor or there is no oil in the oil chamber.

The oil chamber has two screws, A and B, for oil drainage, oil filling and level control.

In pumps with 8- or 10-pole motors of 22-50 kW and pumps with motors larger than 50 kW, the oil can be changed while the pump is standing upright. The screw B is used for the indication of the oil level in the oil chamber. See fig. 14.

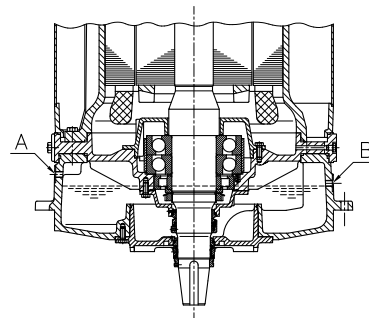


Fig. 14 Oil level, vertical installation

Horizontally installed pumps (installation type H) have a third screw, C, for oil drainage.

On horizontally installed pumps (installation type H), the oil screws are always positioned as shown in fig. 15.

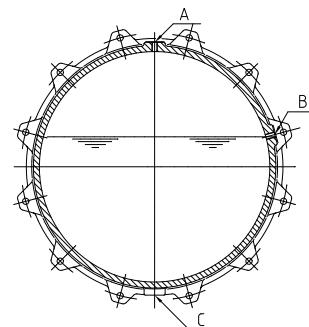


Fig. 15 Oil level, horizontal installation

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Proceed as follows:

1. Place the pump in such a position that the screw A is pointing upwards.



Warning

When slackening the screw A of the oil chamber, note that pressure may have built up in the chamber. Do not remove the screw until the pressure has been fully relieved.

2. Place a clean container under the pump to collect all the drained-off oil. Slacken the screw B pointing to the side and observe the oil level. The drained-off quantity of oil indicates whether the lower mechanical shaft seal is leaking, which may be normal.
3. Turn the pump or remove the screw C and allow all the oil to drain from the chamber into the container. Pour an oil sample into a glass container and observe the condition of the oil. Clear oil can be reused. Emulsified oil must be changed and disposed of.

Note

Used oil must be disposed of in accordance with local regulations.

Low oil level may indicate that the upper mechanical shaft seal is defective. Contact an authorised service workshop for further overhaul of the pump and repair, if required.

4. Fill the oil chamber with oil through the top hole A until the oil level reaches the hole B. Replace the O-rings with new rings, insert the screws and tighten securely.



Warning

Use viscosity grade SAE 10 W 30 or ONDINA 917.

9.2 Inspection and adjustment of impeller clearance



Warning

Check impeller clearance every time service is carried out to prevent hot surfaces in the hydraulic parts.

All S1, S2 and S3 pumps have an axial impeller clearance of 0.7 ± 0.2 mm.

If the clearance is 1.2 mm or more, adjust it to 0.7 ± 0.2 mm.

Note

It is not possible to adjust the impeller clearance of SV pumps.

The impeller clearance of installation types S and C can be inspected directly through the pump inlet.



Warning

Before inspection, make sure that the motor is switched off and that the mains switch is locked in position 0.

Installation versions D and H can be inspected and adjusted with the pump installed on the base stand and connected to the pipework. Inspect and adjust the impeller clearance as described in sections 9.2.2 *Installation types D and H, range 50-54* and 9.2.3 *Installation types D and H, range 58-70*.

9.2.1 Installation types S and C, all ranges

1. Slacken the set screws by two full turns each.
2. Close the impeller clearance by lightly tightening the fastening screws diagonally until the impeller touches the pump housing.



Warning

Do not use too much force when tightening the fastening screws as this may damage the bearings. The movement is usual 1 to 3 mm.

3. Slacken the fastening screws to make an 0.7 mm gap under the heads of the fastening screws. See fig. 16.
4. Tighten the set screws tightly.
5. Tighten the fastening screws diagonally.

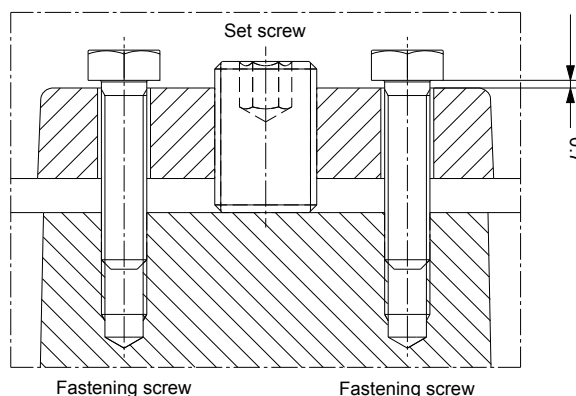


Fig. 16 Impeller clearance adjustment

9.2.2 Installation types D and H, range 50-54

1. Slacken the set screws by two full turns each.
2. Close the impeller clearance by lightly tightening the fastening screws diagonally until the impeller touches the pump housing.



Warning

Do not use too much force when tightening the fastening screws as this may damage the bearings. The movement is usual 1 to 3 mm.

3. Slacken the fastening screws to make an 0.7 mm gap under the heads of the fastening screws. See fig. 16.
4. Tighten the set screws tightly.
5. Tighten the fastening screws diagonally.

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9.2.3 Installation types D and H, range 58-70

Adjust the clearance between the impeller and the pump housing by following these steps:

1. Slacken the six fastening screws and close the impeller clearance by tightening the three set screws. Tighten the screws diagonally to move the suction cover evenly.



Warning

Do not use too much force when tightening the fastening screws as this may damage the bearings. The movement is usual 1 to 3 mm.

2. Measure the distance "L" between suction cover and pump housing at three points next to the set screws, using feeler gauges or callipers, and make a note of the distance.
3. Slacken the set screws and draw back the suction cover by between 0.5 and 0.9 mm using the six fastening screws (approx. one 270 ° turn of an M12 fastening screw) and the distance "L" as reference. See fig. 17.
4. Tighten all set screws and check that the distance "L" at the three reference points is stable at the new value.

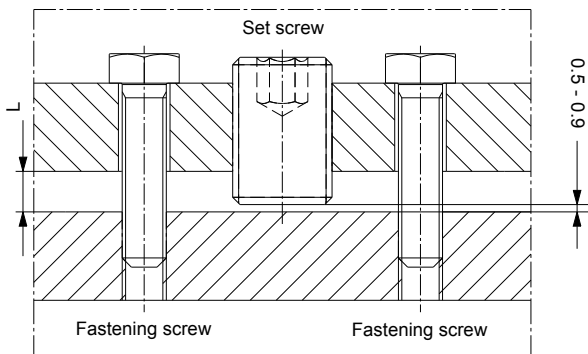


Fig. 17 Impeller clearance adjustment

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9.3 Explosion-proof S pumps, range 50-70

Overhauled and repaired explosion-proof motors are marked with a repair plate giving the following information:

- the repair symbol R
- name or registered trade mark of the repairing workshop
- workshop reference number relating to the repair
- date of overhaul or repair.

In the event of subsequent repairs, the existing plate should be replaced by a new updated plate and earlier markings are recorded.

The repairing workshop must keep records of performed overhauls and repairs together with records of all previous overhauls, repairs and possible modifications. Copies of the repairing workshop's detailed records should be filed by the owner or operator together with the original type certificate of the explosion-proof motor in question.

9.3.1 Motor cable

Use only cables which are approved by the manufacturer and suitable for the cable entry as to diameter, number of leads, conductor cross section and sheath material.

9.3.2 Cable entry

Use only EExd cable entry parts corresponding to the cable diameter. The corresponding cable dimension marking is stamped on the inlet or the cable entry.

Secure the cable entry to the motor top cover by tightening the screws evenly one by one until the cable entry is lying flat against the top cover.

9.3.3 Spare parts

Damaged motor parts, such as top cover and cable entry, should always be replaced by new and approved parts. Motor parts must not be reconditioned by machining, re-tapping, welding, etc.

9.4 Contaminated pumps



Warning

If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated.

If Grundfos is requested to service the pump, Grundfos must be contacted with details about the pumped liquid, etc. *before* the pump is returned for service. Otherwise Grundfos can refuse to accept the pump for service.

Possible costs of returning the pump are to be paid by the customer.

However, any application for service (no matter to whom it may be made) must include details about the pumped liquid if the pump has been used for liquids which are injurious to health or toxic.

10. Fault finding



Warning

Before attempting to diagnose any fault, make sure that the fuses have been removed or the mains switch has been switched off. Make sure that the power supply cannot be accidentally switched on. All rotating parts must have stopped moving.

Read and observe the safety instructions in section 3. Safety.

Fault	Cause	Remedy
1. Pump does not start or stops without visible cause.	a) No power supply.	Reestablish power supply. Start the pump manually and check contactor operation.
2. Pump does not start or stops. The control panel of the controller indicates that the motor protective circuit breaker or protection equipment has tripped out.	a) Missing phase.	Reestablish all phases.
	b) Pump momentarily overloaded.	If the fault does not disappear automatically, find the cause and remedy the fault.
	c) Impeller clogged by impurities.	Clean impeller as required.
	d) Motor protective circuit breaker not set correctly.	Set the motor protective circuit breaker as required according to rated current.
	e) Thermal switches tripped out. Insufficient motor cooling.	Reestablish motor cooling.
	f) Moisture switch in motor tripped out.	Contact an authorised service workshop.
	g) Motor cable defective.	Contact an authorised service workshop.
	h) Fluctuating voltage.	Reestablish correct voltage supply. Permissible deviation is - 10 %/+ 10 %.
3. Pump runs but does not deliver the rated flow.	a) Wrong direction of rotation.	Interchange two phases to the motor.
	b) Impeller loose or worn.	Tighten or replace the impeller.
	c) Pump or pipework blocked by impurities.	Clean as required.
	d) Pump head too high.	Measure the differential pressure and compare the value with the pump curve. Remove the blockage in the discharge pipe.
	e) Valves closed or blocked. Non-return valve not operating.	Clean or replace valves as required.
	f) Air in pump or suction pipe.	Vent the pump and suction pipe. Increase the stop level in the tank.
	g) Pumped liquid too dense.	Dilute the liquid.
	h) Pump not properly connected to auto coupling.	Pump down the liquid level in tank. Lift out the pump and relocate the pump on the auto coupling.
	i) Leakage in pipework.	Repair the pipework.
	j) Pump tank flushing system inadvertently activated.	Check function and repair as required.
4. Pump starts, but stops immediately.	a) Clogged pump causes motor-protective circuit breaker to trip out.	Clean the pump.
	b) Overheated motor causes thermal switches to trip out.	Allow pump to cool. Clean the pump.
	c) Level switch out of adjustment or defective.	Clean or set level switch or replace as required.
5. Pump vibrating or emitting excessive noise.	a) Pump partly choked by impurities.	Clean the pump.
	b) Wrong direction of rotation.	Interchange two phases to the motor.
	c) Pump operates outside specified operating range.	Reestablish proper operating conditions.
	d) Pump defective.	Repair the pump or contact an authorised workshop, if necessary.
	e) Pump not properly connected to auto coupling.	Pump down the liquid level in tank. Lift out the pump and relocate the pump on the auto coupling.
	f) Pump cavitates.	Clean the suction pipe.
	g) Base stand, auto coupling, ring stand or guide rails not installed correctly.	Install the components correctly.
6. Oil watery or emulsified.	a) Lower mechanical seal leaking.	Contact an authorised service workshop.
7. Low oil level.	a) Upper mechanical seal leaking.	Contact an authorised service workshop.

11. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.

1. 接线图

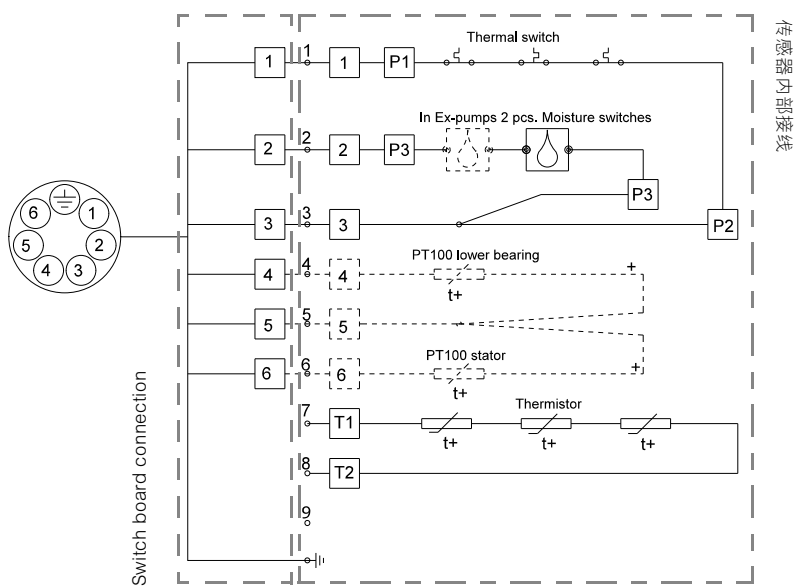


图 18 7线传感器的接线图

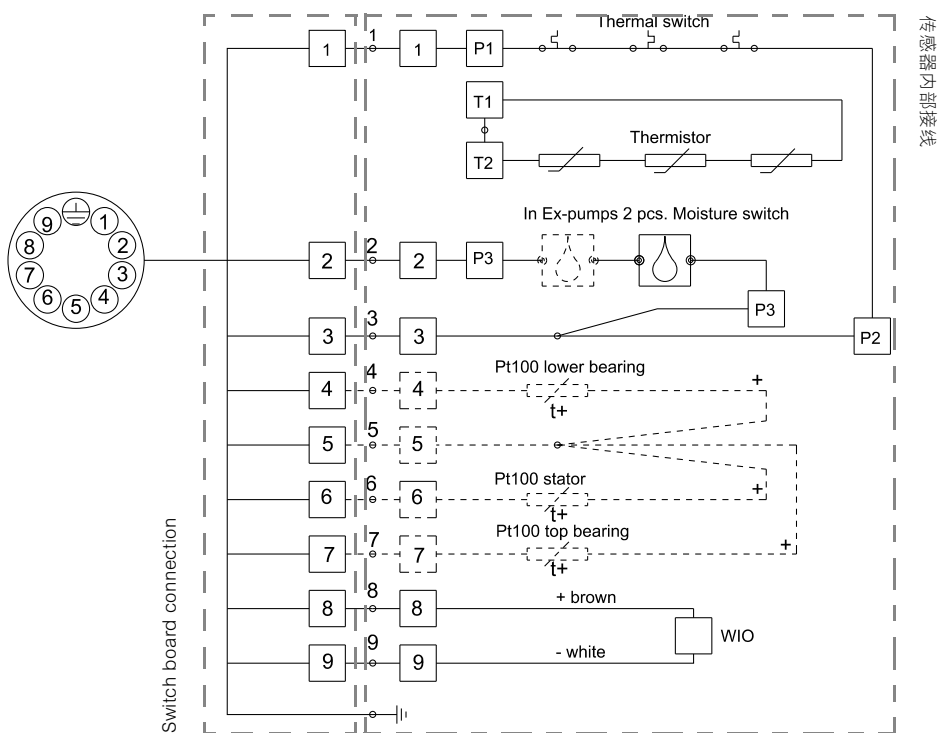


图 19 10线传感器的接线图

TM05 1641 3311

TM05 1624 3311

1. Wiring diagrams

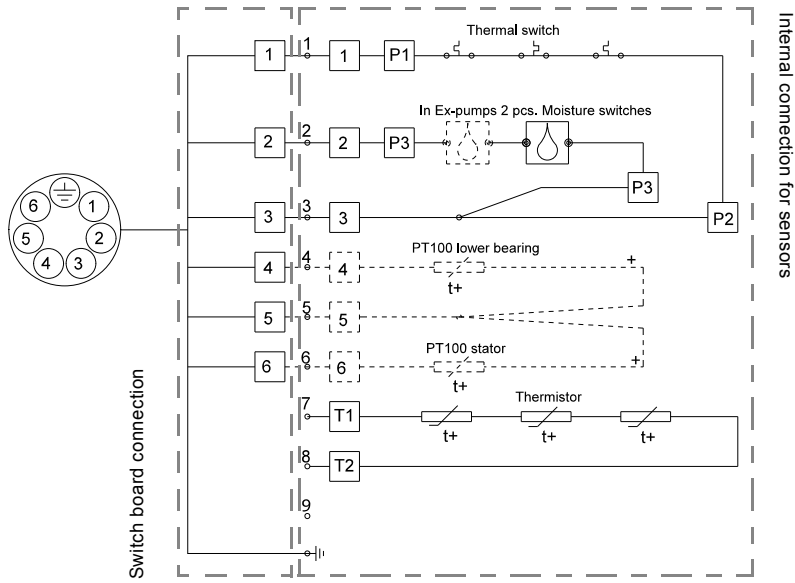


Fig. 20 Wiring diagram for sensor cable 7-lead wires

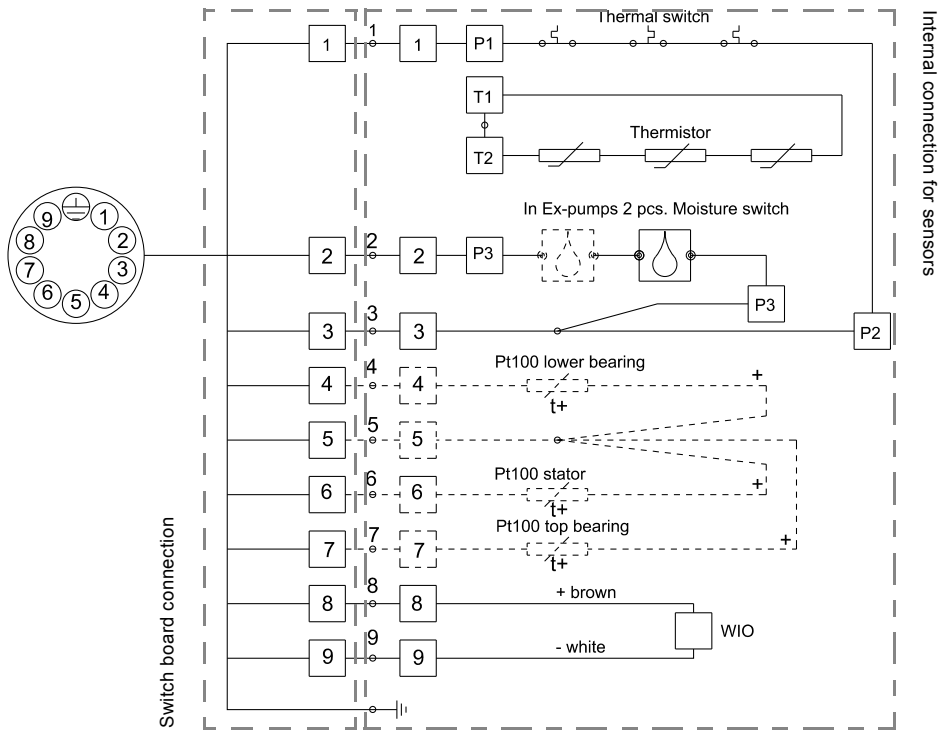


Fig. 21 Wiring diagram for sensor cable 10-lead wires

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Revised 11.11.2011

97905042 1211

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