KPL, KPG and KWM

15-1060 Hp, 60 Hz, ANSI

Installation and operating instructions

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GRUNDFOS

Original installation and operating instructions

CONTENTS

Read this document before installing the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Limited warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

2. General information

This booklet gives instructions for installation, operation and maintenance of Grundfos KPL, KPG and KWM pumps.

2.1 Target groups

These installation and operating instructions are intended for professional installers.

2.2 Hazard statements

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

SIGNAL WORD

Description of hazard

Consequence of ignoring the warning.

- Action to avoid the hazard.

2.3 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

Observe these instructions for explosion-proof products.

A blue or grey circle with a white graphical symbol indicates that an action must be taken.

A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

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

Tips and advice that make the work easier.

3. Receiving the product

Make sure that the pump cannot roll or fall over.

4. Installation requirements

4.1 Safety information and preparation

- Pump installation in pits must be carried out by specially trained persons.
- Work in or near pits must be carried out according to local regulations.
- For safety reasons, all work in pits must be supervised by a person outside the pit.

DANGER

Electric shock

Death or serious personal injury

- It must be possible to lock the main switch in position 0. Type and requirements as specified in National Electric Code (NEC), or NFPA 70.

CAUTION

Crushing hazard

Minor or moderate personal injury

- Wear personal protective equipment when working on the product.

CAUTION

Biological hazard

Minor or moderate personal injury

- Flush the pump thoroughly with clean water and rinse the pump parts after dismantling.
  Pits for submersible drainage and effluent pumps may contain drainage or effluent with toxic and/or contagious substances.
- Wear appropriate personal protective equipment and clothing.
- Observe the local hygiene regulations in force.

When the pump is completely submerged, it is sufficiently cooled by the surrounding liquid.

In addition to the pump, the following items are required and must be ordered separately.

- A cable suspension system for securing the cables.
- Control equipment, e. g. MP 204.
- KPL and KWM: A column pipe with a seat ring and integrated anti-rotation brackets on which the pump is standing. The seat ring can be supplied with the pump as an installation accessory.
- KPG: A gate with a flange connection that corresponds to the outlet flange of the KPG.

4.2 Lifting the product

DANGER

Crushing hazard

Death or serious personal injury

- Always check the lifting bracket or lifting eyes and the chain for corrosion or wear before lifting.
- Always lift the pump by its lifting bracket or lifting eyes or by a fork-lifttruck. See fig. 1 - 10.

DANGER

Crushing hazard

Death or serious personal injury

- Always use certified lifting equipment.
- Note that the cable suspension system is not certified lifting equipment.
- All lifting equipment must be rated for the purpose and checked for damage before lifting the pump. The lifting equipment rating must not be exceeded.
- The weight of the specific pump is stated on the nameplate.

DANGER

Electric shock

Death or serious personal injury

- Never lift the pump by the power cables.

DANGER

Crushing hazard

Death or serious personal injury

- Make sure the lifting bracket or lifting eye bolts and the strap is tightened before lifting the pump.

Carelessness during lifting or transportation may cause personal injury or damage to the pump.

If the pump is tilted more than 10 ° in any direction from its normal position (BS EN 809:1998+A1:2009), the pump may lose its stability.

Lifting points

When lifting the pump, use the right lifting points to keep the pump balanced.

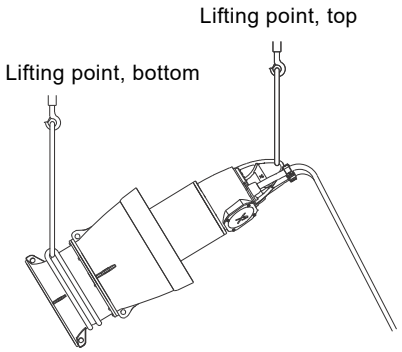

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Fig. 1 KPL and KWM: lifting points

Lifting point, top

KPL and KWM: use the lifting bracket as the top lifting point. See fig. 4.

KPG: use two top lifting points. See fig. 5.

Lifting point, centre (KPG)

When installing KPG pumps horizontally, use the lifting points on the outlet casing. See fig. 6.

Lifting point, bottom

Use the pump inlet casing as the bottom lifting point. Lift by a lifting strap or a lifting chain secured around the pump inlet. See fig. 7 and fig. 10.

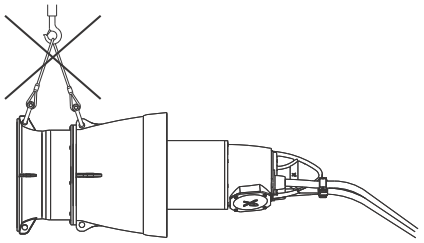

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Fig. 2 KPL and KWM: anti-rotation brackets

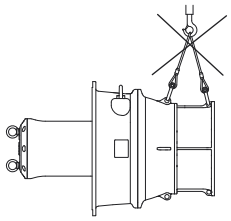

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Fig. 3 KPG: anti-rotation brackets

4.2.1 Lifting with single or double wire

Lifting with single wire

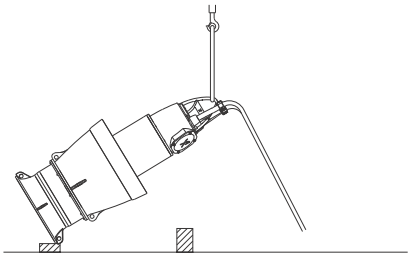

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Fig. 4 KPL and KWM: lifting with single wire

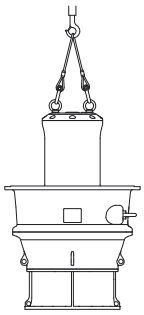

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Fig. 5 KPG: lifting with single wire (for transport)

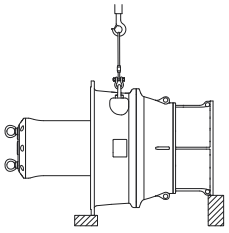

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Fig. 6 KPG: lifting with single wire connected to both lifting eyes (for installation)

During installation, the KPG motor top is inserted into the gate flange. Therefore, only the lifting method in Fig. 6 can be used for installation.

The lifting eyes in the outlet casing are close to the centre of gravity, so the pump can be lifted in horizontal position without using the lifting eyes on the motor top.

Lifting with double wire

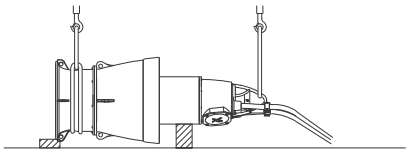

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Fig. 7 KPL and KWM: lifting with double wire, step 1

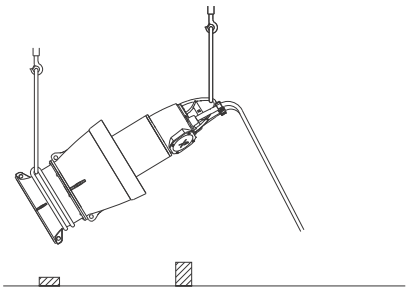

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Fig. 8 KPL and KWM: lifting with double wire, step 2

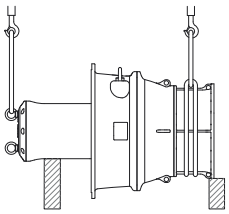

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Fig. 9 KPG: lifting with double wire, step 1

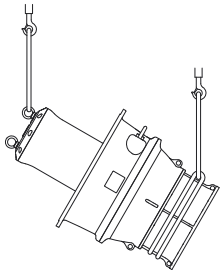

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Fig. 10 KPG: lifting with double wire, step 2

Mechanical installation of KPL and KWM

DANGER

Electric shock

Death or serious personal injury

- Before installation, switch off the power supply and lock the main switch in position 0.
- Before working on the pump, switch off any external voltage connected to the pump.

Observe all safety regulations at the installation site,

Observe the maximum cable bending radius. See *12.2.1 Bending radius of cables*.

Prior to installation, check the oil level in the oil chamber. See section *10.2.3 Checking and changing the oil*.

4.2.2 Requirement for free space below the pump

The following table indicates the column pipe diameter (∅D) and the minimum free space allowed (C) under the pump. For further information on installation, see fig. 11 and fig. 12.

KPL		KWM	
∅D [in. (mm)]	**C [in. (mm)]**	**∅D [in. (mm)]**	**C [in. (mm)]**
20 (500)	10 (250)	-	-
24 (600)	12 (300)	24H (600H)	12 (300)
		24M (600M)	12 (300)
28 (700)	14 (350)	28H (700)	14 (350)
		28M (700)	14 (350)
32 (800)	16 (400)	32H (800H)	16 (400)
		32M (800M)	16 (400)
36 (900)	18 (450)	36H (900)	18 (450)
		36M (900)	18 (450)
40 (1000)	20 (500)	40H (1000H)	20 (500)
		40M (1000M)	20 (500)
48 (1200)	24 (600)	48 (1200)	24 (600)
56 (1400)	28 (700)	56 (1400)	28 (700)
60 (1500)	30 (750)	-	-
64 (1600)	32 (800)	64 (1600)	32 (800)
72 (1800)	36 (900)	-	-

Under-floor installation

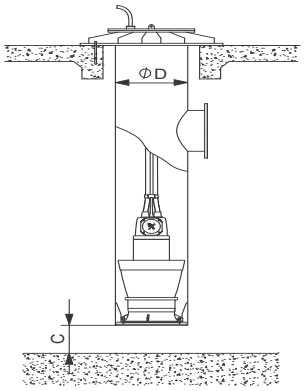

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Fig. 11 KPL: installation dimensions

Under-floor installation

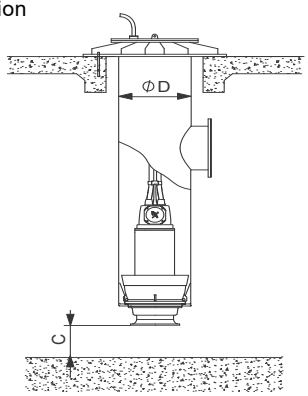

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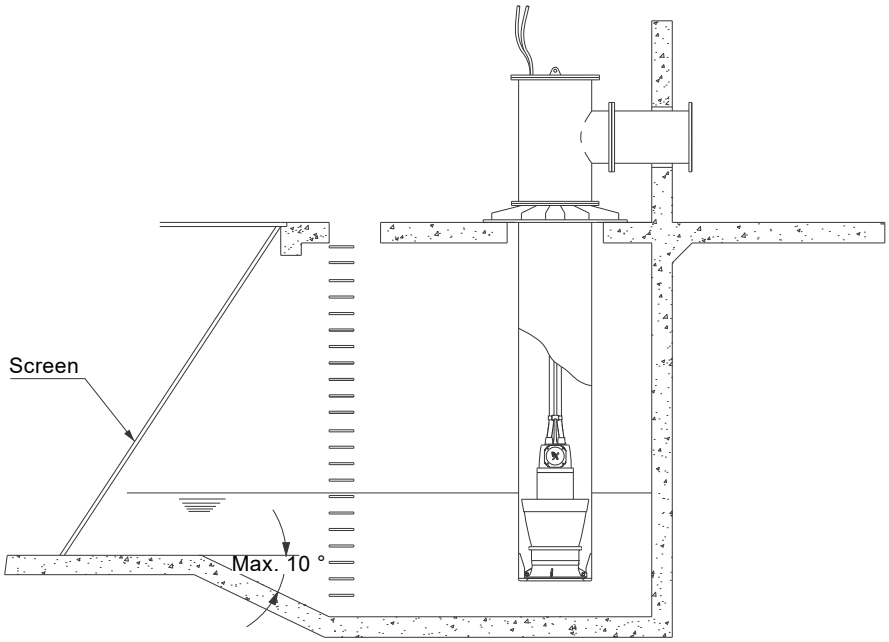
Fig. 12 KWM: installation dimensions

4.2.3 Installing the anchor bolts

As part of the construction work, the anchor bolts must be installed before the concrete is poured. If this cannot be accomplished, mark out and install the anchor bolts during the installation of the column pipe.

4.2.4 Pit construction



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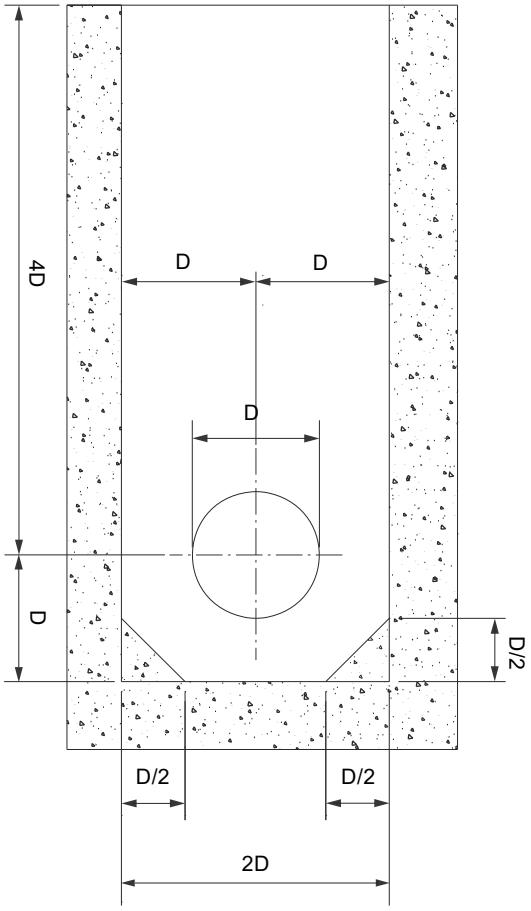

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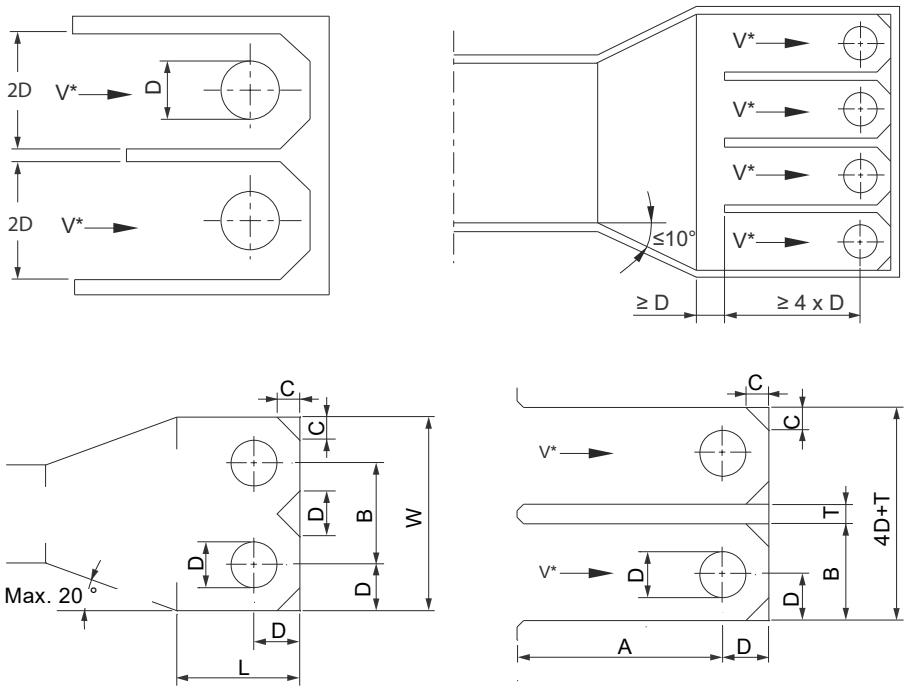
Fig. 13 Schematic view of pit design



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* Flow velocity V:
0.7 m/sec. for storm- and wastewater containing particles.
0.3 m/sec. for screened storm- and wastewater without particles.

Dimensions

D* [in. (mm)]	A [mm]	B [mm]	C [mm]	W [mm]	L [mm]	T
20 (DN 500)	79 (2000)	39 (1000)	10 (250)	79 (2000)	79 (2000)	Depending on construction, contact Grundfos
24 (DN 600)	94 (2400)	47 (1200)	12 (300)	94 (2400)	94 (2400)	
28 (DN 700)	110 (2800)	55 1400)	14 (325)	110 (2800)	110 (2800)	
32 (DN 800)	126 (3200)	63 (1600)	16 (400)	126 (3200)	126 (3200)	
36 (DN 900)	142 (3600)	71 (3800)	18 (450)	142 (3600)	142 (3600)	
40 (DN 1000)	157 (4000)	79 (2000)	20 (500)	157 (4000)	157 (4000)	
48 (DN 1200)	189 (4800)	94 (2400)	24 (600)	189 (4800)	189 (4800)	
56 (DN 1400)	220 (5600)	110 (2800)	28 (700)	220 (5600)	220 (5600)	
60 (DN 1500)	236 (6000)	118 (3000)	30 (750)	236 (6000)	236 (6000)	
64 (DN 1600)	252 (6400)	126 (3200)	32 (800)	252 (6400)	252 (6400)	
72 (DN1800)	285 (7200)	142 (3600)	35 (900)	285 (7200)	285 (7200)	

* D = pipe diameter DN

4.2.5 Installing the column pipe

1. Fit a waterproof sealing between the mounting flange and the concrete support. See fig. 14.

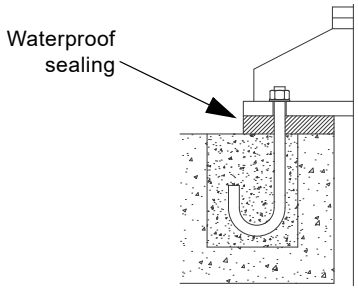


Fig. 14 Position of the waterproof sealing

2. Slowly lower the column pipe into the pit using overhead lifting equipment.
3. Make sure that the column pipe is vertical and fastened to the concrete.
4. Tighten the anchor bolt nuts to ensure that the column pipe cannot move.

4.2.6 Installing the KPL and KWM pump

Make sure that the pump is aligned with the anti-rotation brackets and cannot rotate when the impeller runs.

Wrong direction of rotation results in damage to the pump.

- Check the direction of rotation before the installation. See section *5.1.1 Checking the direction of rotation*.
- The use of a phase detection equipment, such as the MP 204, protects the pump from starting if the phase sequency is changed.

1. Make sure that the sealing O-ring is clean and located in the groove on the bottom of the inlet casing (KPL) or outlet casing (KWM). The O-ring seals between the pump and the seat ring to preventing backflow.
2. Slowly lower the pump into the column pipe using the overhead lifting equipment. If necessary, use an intermediate lifting ring.
3. Carefully guide the pump into position at the bottom of the column pipe, so the pump does not tilt in any way on the stop vanes at the bottom of the column pipe.
4. Lift the pump 1 inch (2 to 3 cm) and turn it counter-clockwise until the anti-rotation brackets touch the nearest adjacent stop vanes.

The pump is secured by its own weight against the anti-rotation brackets. No additional fastening is required.

Turbulence optimization is not possible if the pump is mounted in an oversize column pipe.

4.2.7 Installing the cable suspension system in the column pipe

If the pump is configured for side discharge, locate the cable inlet opposite the water outlet.

Disruption in the direction of water flow may cause damage to the cable.

To avoid cable damage, do not position the cable inlet in the column pipe near the water outlet.

Follow these instructions and secure the cables properly:

1. Clamp the wire rope and all cables together. Make sure there is 20 inches (0.5 m) distance between the clamps adapted to the weight of the cables. See fig. 15.Fasten the wire rope to the eye at the top of the column pipe.
2. Adjust the turnbuckle between the wire rope and the eye of the beam. Make sure there is no slack in the cable suspension, the cables are fixed to it and cannot move during operation.
3. Lead the cables through the cable bushing of the column pipe.
4. Run the cables to the external terminal box. Make sure that the cable bushing is fitted correctly and prevents water from entering.
5. Fit the top cover on the upper part of the column pipe using a waterproof gasket, then tighten the bolts. Make sure that the cover prevents water from entering.

DANGER

Crushing hazard

Death or serious personal injury

- Do not put your hands or any tools into the pump inlet or outlet after the pump has been connected to the power supply, unless the main switch has been locked in position 0.

Cable suspension system

A cable suspension system is mandatory to avoid cable damage during operation.

Figure 15 indicates a principle sketch only - the cable suspension system may be adapted to the specific pump type.

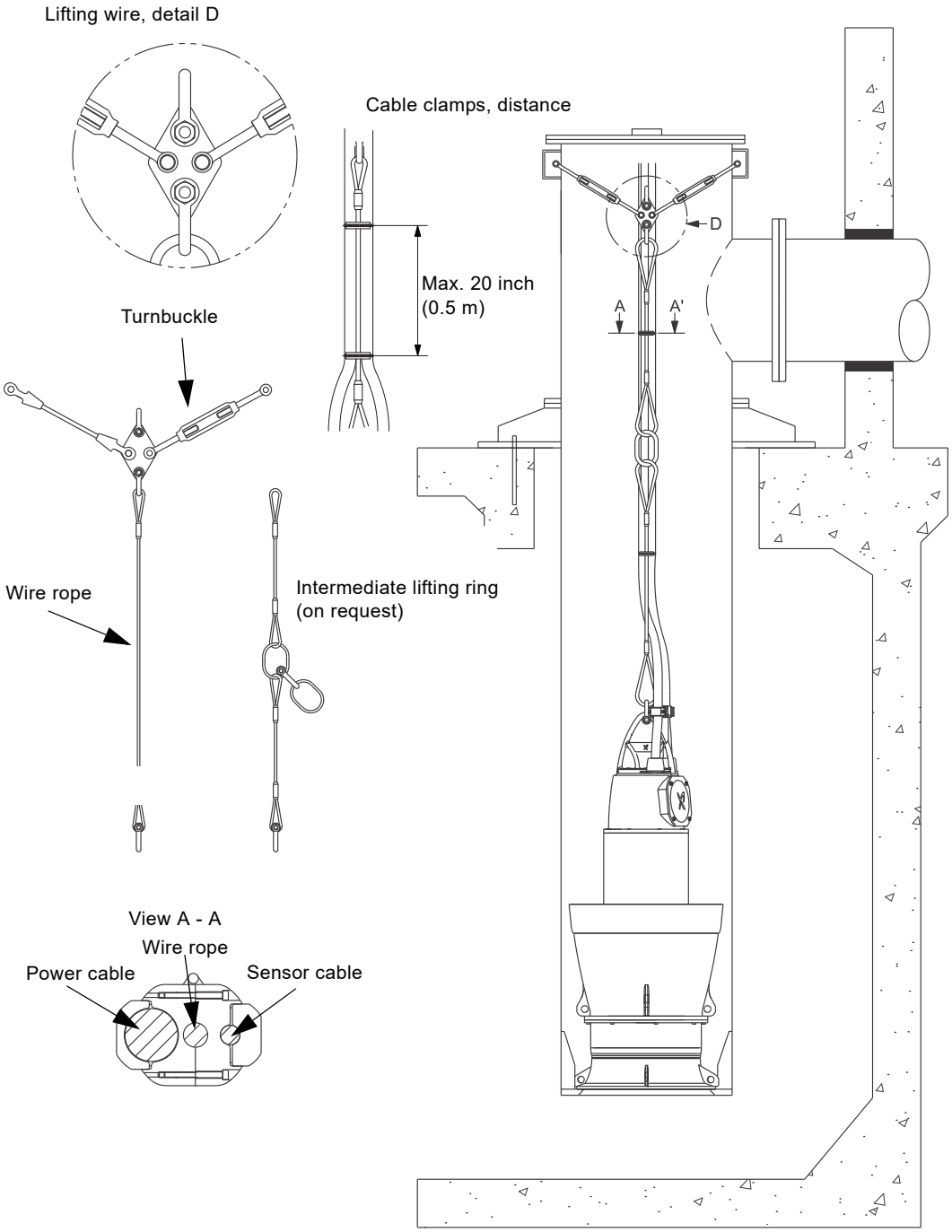


Fig. 15 Securing the cables to the lifting wire

4.3 Mechanical installation of KPG

DANGER

Electric shock

Death or serious personal injury

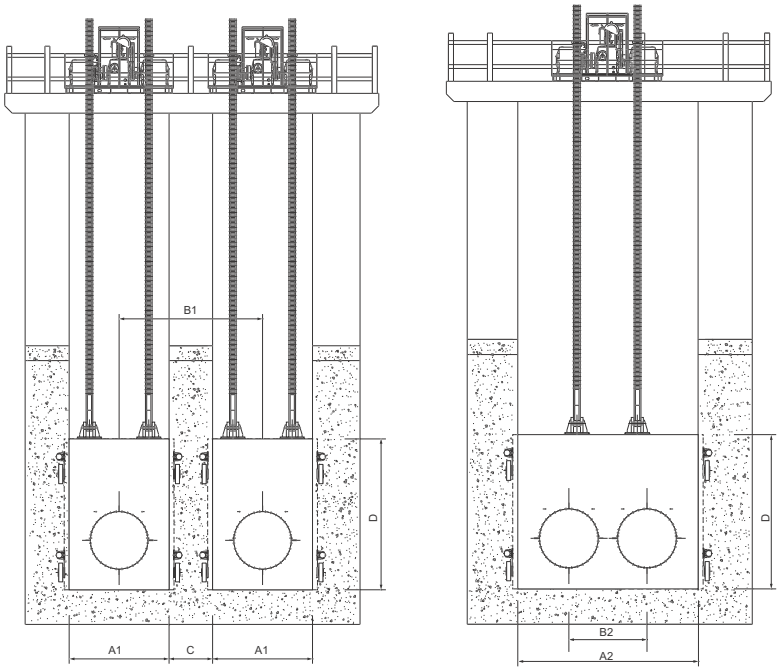
- Before installation, switch off the power supply and lock the main switch in position 0.
- Before working on the pump, switch off any external voltage connected to the pump.

Observe all safety regulations at the installation site.

Observe the maximum cable bend radius. See *12.1.4 Operating mode*.

Prior to installation, check the oil level in the oil chamber. See section *10.2.3 Checking and changing the oil*.

4.3.1 Pit construction



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Model	Outlet diameter inch [mm	1 gate + 1 pump						1 gate + 2 pumps			
		A1 inch [mm]		B1 inch [mm]		C inch [mm]		A2 inch [mm]		B2 inch [mm]	
KPG.20	20" (DN 500)	49	1250	77	1950	35	900	75	1900	35	900
KPG.24	24" (DN 600)	55	1400	83	2100	35	900	87	2200	39	1000
KPG.28	28" (DN 700)	59	1500	87	2200	35	900	94	2400	43	1100
KPG.32	32" (DN 800)	71	1800	98	2500	35	900	110	2800	51	1300
KPG.36	36" (DN 900)	75	1900	102	2600	35	900	118	3000	55	1400
KPG.40	40" (DN 1000)	83	2100	110	2800	35	900	130	3300	63	1600
KPG.48	48" (DN 1200)	102	2600	130	3300	35	900	157	4000	79	2000
KPG.56	56" (DN 1400)	118	3000	146	3700	35	900	189	4800	94	2400

4.3.2 Installing the KPG pump

- Lift the pump horizontally by the lifting eyes on the outlet casing to install it in the gate. See fig. 6.
- Use certified lifting equipment only.

Proceed as follows:

1. Make sure the cables are not damaged during the installation.
2. Make sure the lifting eye bolts are correctly installed and tightened before lifting the pump.
3. Lower the pump in front of the gate and make surethat the centre line of the pump is level with the centre line of the flange on the pump gate.
4. Make sure the rubber gasket at the gate flange is correctly positioned.
5. Position the motor on the gate flange.
6. Slide the pump onto the gate flange.
7. When the pump is in place and the holes in the pump and gate flanges are aligned, bolt the two flanges together.
8. Secure the cables to a flexible cable tray.
   – Make sure the cables can adapt to the different positions of the gate without being damaged.
   – The cables are heavy. Make sure the stress on the cables is taken by a flexible cable tray.

DANGER

Crushing hazard

Death or serious personal injury

- Do not put your hands or any tools into the pump inlet or outlet after the pump has been connected to the power supply, unless the main switch has been locked in position 0.

4.4 Electrical connection

Make sure the electrical connection complies with the local regulations.

The supply voltage and frequency are marked on the nameplate. Make sure that the motor is suitable for the power supply available at the installation site.

Connect the pump to an external main switch ensuring all-pole disconnection with a contact separation according to EN 60240-1, 5.3.2.

The pump must be connected to a motor-protective circuit breaker, such as MP 204.

A phase sequence relay is recommended,to avoid the pump to restart if the phase sequence of the power supply is changed by mistake.

Connect P1, P2 and P3 in series with the thermal protectors and moisture sensors. See section *4.4.2 Wiring diagrams*.

4.4.1 Wire colours

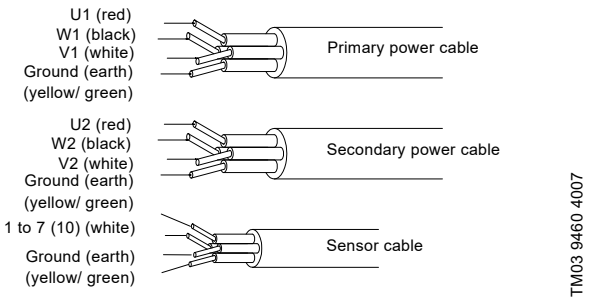

Fig. 16 Wire colours, direct-online-starting, two power cables

The use of 8-core and 11-core cables are specified according to the sensor options. See figures 1 to 4 starting on page 30.

4.4.2 Wiring diagrams

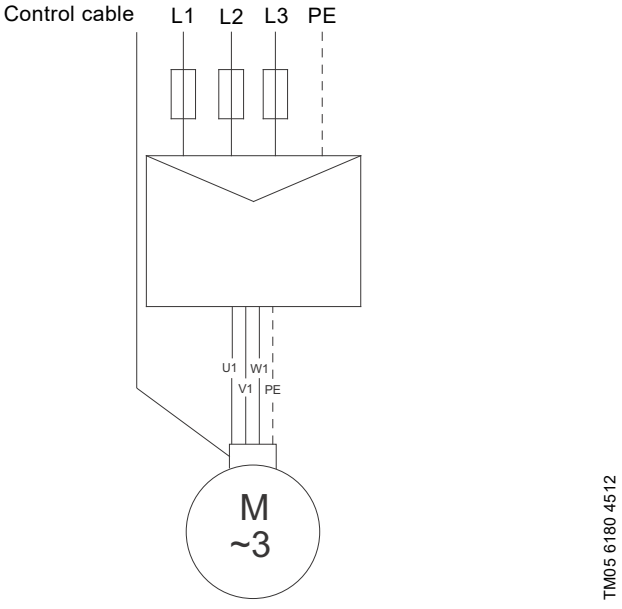

Fig. 17 Direct-online-starting, one power cable

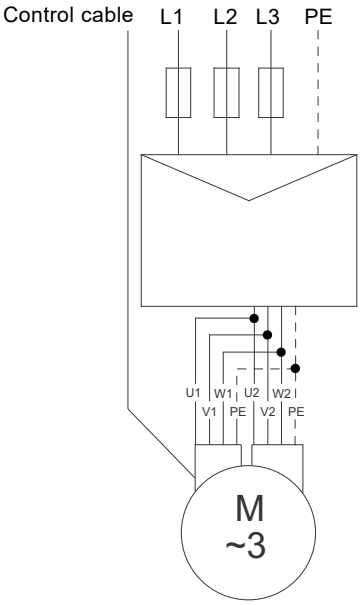

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Fig. 18 Direct-online-starting, two power cables

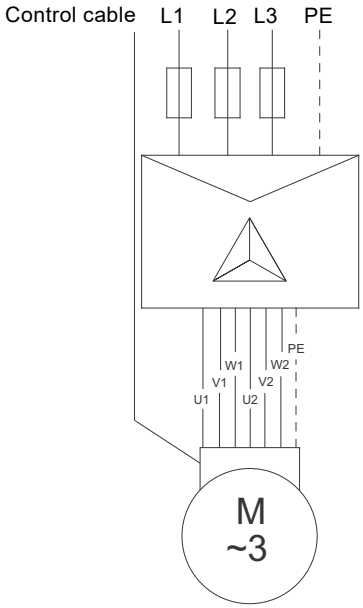

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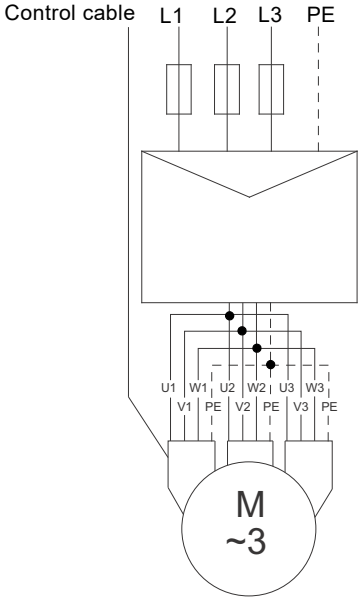
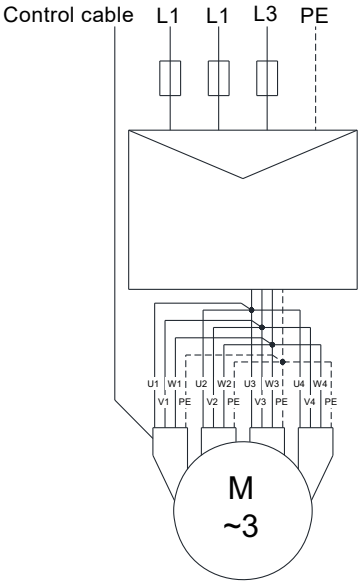
Fig. 20 Star-delta starting, one power cable



TM05 6182 4512

Fig. 19 Direct-online-starting, three power cables



TM06 9878 3517

Fig. 21 Star-delta starting, four power cables

The ground (earth) lead is a green cable marked yellow/green and labelled "PE".

4.5 Frequency converter operation

All KPL, KPG and KWM pumps can be connected to a frequency converter if an output filter is installed between the converter and the motor. In case a filter is not installed, please contact Grundfos.

Pumps can be connected ideally to a Grundfos CUE, - or a soft starter, depending on choice.

When pumps are connected to a frequency converter pay attention to the motor insulation system.

The minimum frequency depends on the type of application and the design of the discharge piping. Always consider the following when determining the minimum frequency:

- mass of the water above the propeller
- the force required to keep valves open
- the velocity reaction forces.

These factors vary from case to case. The minimum frequency has to produce the necessary torque and force from the impeller and propeller to overcome the above mentioned factors.

In environments with high content of sand, for example water treatment plants, a self-cleaning velocity of at least 1 m/s must be ensured in the column's largest diameter.

Ramp down over 30 seconds is recommended to the

minimum frequency of positive flow.

The thermal protection of the motor must be connected.

The 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

Set the frequency converter U/f ratio according to the motor data.

Local regulations and standards must becomplied with.

4.5.1 CUE or VFD

The optional CUE or VFD, which is either a Grundfos variable-frequency converter or a general variable frequency converter, offers better pump protection and a more steady flow through the pipe system.

In addition, Grundfos CUE and VFD offer these features:

- anti-blocking
- automatic energy optimization
- specific-energy test
- output frequency
- monitoring of:
  - •voltage*
  - •current*
  - •phase sequence*
  - •power*
  - •energy*
  - •torque*
- reverse start

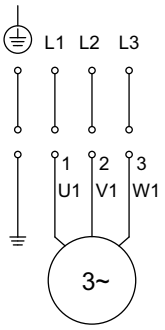
Note: Reverse start results in damage to the pump and column pipe.

- run flushing
- stop flushing
- PID control.

* These functions are only available with Grundfos CUE.

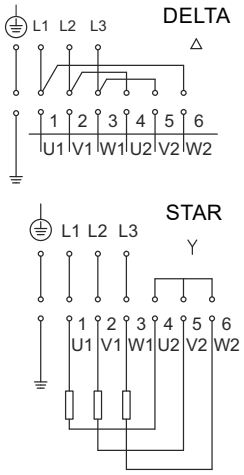
5. Starting up the product

The pump can be started by either direct-on-line starting, star-delta starting, soft starter or frequency converter. For the wiring of the start-stop circuit, see fig. 22 or 23.



TM05 9167 4113

Fig. 22 Direct-on-line starting



TM05 9168 4113

Fig. 23 Star-delta starting

5.1 Preparations for starting up

DANGER

Rotating elements

Death or serious personal injury

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

- Turn the propeller or impeller by hand to make sure the propeller or impeller can rotate freely. See fig. 25.
- Make sure that the supply voltage and frequency correspond to the values stated on the nameplate. If not, do not start the pump.
- Make sure that the outer cable sheath is intact, so water cannot penetrate to the terminal box. If the original power cables are refitted, cut off a short piece to ensure that the cable entry sealing sleeve does not clamp around the cable.
- Make sure that the cable entry bushing and the washers correspond to the outside diameter of the power cables. When preparing the power cable conductors for connection to the pump and the terminal box, ensure that the ground (earth) conductor is at least 2.2 inches (50 mm) longer than the other conductors. This is substantialin case a cable is pulled out unintentionally, so the ground (earth) conductor connection is the last to be disconnected.
- Check the direction of the rotation. See section *5.1.1 Checking the direction of rotation*.

5.1.1 Checking the direction of rotation

Check the direction of rotation before the startup.

DANGER

Electric shock

Death or serious personal injury

- In case the pump is running with wrong direction of rotation, do not touch the pump or the cables.

KPL and KWM: Wrong direction of rotation leads to damage to the pump and the column pipe.

Always check the direction of rotation before the pipe is filled with liquid.

Method 1 - Free-standing pump

DANGER

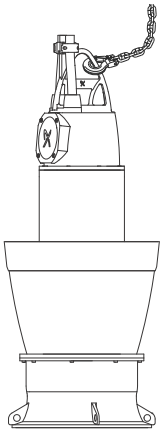
Crushing hazard

Death or serious personal injury

- Never stand under or next to the pump when it is hanging from a crane.

Proceed as follows:

1. Place the pump on a plain surface.
2. Secure the pump by using the lifting chain and a crane to preventit from tilting. The pump must rest on the ground without any load on the crane. See fig. 24.



TM06 9724 3017

Fig. 24 Pump secured with a crane

3. Start the pump and let it run for a few seconds.
4. Observe the jerk of the pump. If the pump jerks counterclockwise, the direction of rotation is correct. See fig. 25.

The jerk of large pumps can be powerful.

If the direction of rotation is wrong, interchange two phases in the power cable.

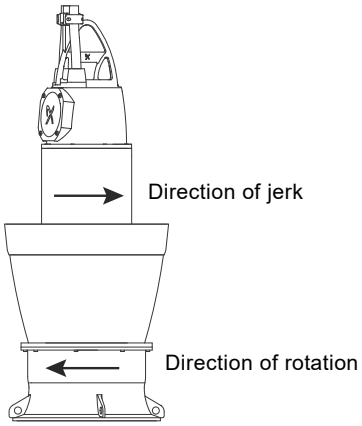
Method 2 - Pump installed in a column pipe

- Make sure the column pipe is not filled with water.
- Make sure the pump is installed correctly. See section *4.2.6 Installing the KPL and KWM pump*.

Proceed as follows:

1. Check the electrical connections with a phase detector to make sure the connections are correct.
2. Start the pump and let it run for a few seconds.
3. Observe the jerk of the pump. If the pump jerks counterclockwise, the direction of rotation is correct. See fig. 25.

If the direction of rotation is wrong, interchange two phases in the power cable.



TM03 9466 3612

Fig. 25 Direction of jerk and rotation

5.2 Startup

DANGER

Automatic startup

Death or serious personal injury

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

Do not start the pump before checking the direction of rotation.

Always operate the pump in accordance with established routines with scheduled checks. Ensure that the pump and equipment settings cannot be changed by unauthorized persons.

Proceed as follows:

1. Lock the main switch in position 0.
2. Check the oil level in the oil chamber.
3. Make sure that the monitoring units are operating appropriately.
4. Make sure that the pump is submerged in the liquid.
5. Open the isolating valves, if fitted.
6. Check the setting of the level switches.
7. Unlock the main switch, start the pump and check the pump operation for abnormal noise or vibrations.

When started, the pump jerks counterclockwise.

In case of abnormal noise or vibrations, stop the pump immediately. Do not restart the pump until the cause of the fault is identified and eliminated.

8. After startup, establish the actual pump duty point.

6. Handling and storing the product

6.1 Handling the product

- Make sure that the lifting equipment is appropriate. See section *4.2 Lifting the product*.
- Always lift the pump by its lifting bracket/eye or by a forklift truck, if the pump is fixed on a pallet.
- Observe the maximum cable bending radius. See *12.2.1 Bending radius of cables*.

6.2 Storing the product

Leave the cable end protectors and sensor cables on the power until making the electrical connection.

The free cable ends must never be exposed to moisture or water.

For periods of storage, the pump must be protected against moisture and heat. After a period of storage, inspect the pump before putting it back into operation. See also section *12.1.8 Storage temperature*.

6.2.1 Storing in the pit (dry or wet)

The pump is frost-proof as long as it is operating or submerged in the liquid. If the pit has been pumped dry, and the pump has been exposed to the atmosphere, allow the pump to stand submerged in the liquid for a short period before starting it up. This eliminates the possibility of a frozen propeller or impeller. Never use an open flame to thaw out the pump.

If the pump is submerged in liquid, operate it for 30 seconds every month.

6.2.2 Storing in dry conditions

If the pump is stored dry, rotate the propeller or impeller by hand at least bi-monthy to prevent the shaft seals from seizing up.

If the propeller or impeller cannot be turned by hand, contact an authorized service workshop.

During storage, pay attention to the condition of the shaft seals and the cable entries. Clean the pump at regular intervals and spray it with corrosion-inhibiting oil. Always store the pump protected and do not exposeit to direct sunlight.

7. Product introduction

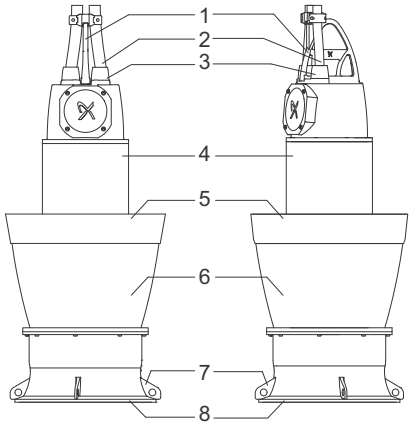
7.1 Applications

The pumps are designed for pumping storm- and wastewater in a wide range of municipal and industrial applications:

- flood and stormwater control
- drainage and irrigation
- raw-water intake
- transfer of liquids in large-scale municipal sewage treatment plants
- circulation of large quantities of water in water theme parks, etc.
- circulation of water in fish farms
- water level control in coastal and low-lying areas
- filling and emptying water from dry docks and harbour.

7.2 General description

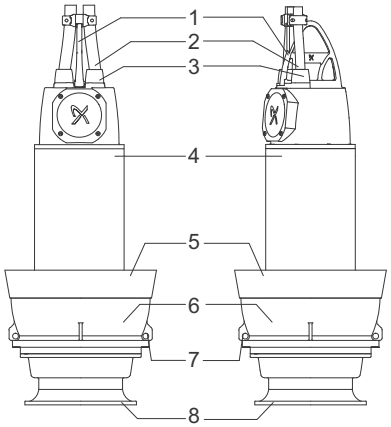
KPL pumps are submersible axial-flow propeller pumps.



TM05 5309 3812

Fig. 26 KPL pump

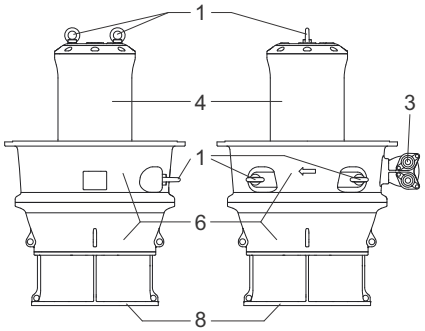
KWM pumps are submersible mixed-flow pumps.



TM05 5620 3912

Fig. 27 KWM pump

KPG pumps are gate pumps for submersible installation.



TM07 4689 2219

Fig. 28 KPG pump

Pos.	Description
1	KPL, KWM: Lifting bracket KPG: Lifting eyes
2	Power supply cables
3	Cable entries
4	Submersible motor
5	Turbulence optimizer (outlet sealing parts)
6	Outlet casing
7	Anti-rotation bracket
8	Inlet casing

8. Identification

8.1 Type key

Fix the extra nameplate supplied with the pump at the installation site or keep it in the cover of this booklet.
Example of KPL: KPL. 56.175.16.T.60.9.E.46

Example of KPG: KPG.5 6.175.16.T.60.9.E.46

Example of KWM: KWM. 56.600.12.T.60.865.M.46

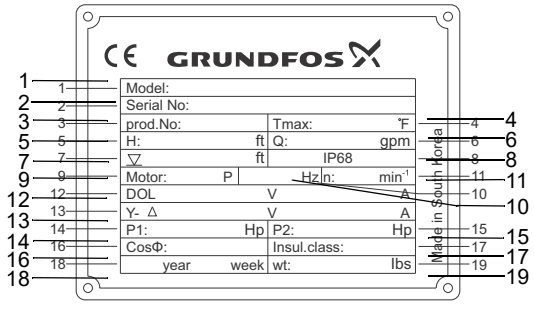
Code	Description	Explanation
KPL	Submersible axial-flow pump	Pump type
KWM	Submersible mixed-flow pump	
KPG	Submersible axial-flow gate pump	
56	56"= 56 inches	Column pipe diameter [in]
175	Output power P2 175 = 175 Hp	Power [Hp]
600	600	
16	16-pole	Number of poles
12	12-pole	
T	Three-phase motor	Number of phases
60	60 Hz	Frequency
9	9	KPL, KPG propeller number
865	Impeller number	KWM: impeller number
M	KWM - Medium head	Pump range and pressure
E	KPL and KPG- Extra-low head	
46	460 V	Voltage
Z	Custom-built variant	

* Special variant, contact Grundfos.

Note: Not all variants are available for all pump types / sizes.

8.2 Nameplate

Fit the extra nameplate supplied with the pump at the installation site.



TM05 7248 1613

Fig. 29 Nameplate

Pos.	Description
1	Type designation
2	Serial number
3	Product number
4	Maximum ambient temperature
5*	Duty-point head
	Best-efficiency-point head
	Maximum head
6*	Duty-point flow rate
	Best-efficiency-point flow rate
	Maximum flow rate
7	Maximum installation depth
8	Enclosure class according to IEC 60529
9	Number of poles
10	Frequency
11	Rated speed
12	Voltage and current, delta connections
13	Voltage and current, star connection
14	Input power
15	Shaft power
16	Power factor
17	Insulation class
18	Production code, year and week
19	Pump weight

* The values shown for duty-point head and duty-point flow rate are standard. Other values are available on request.

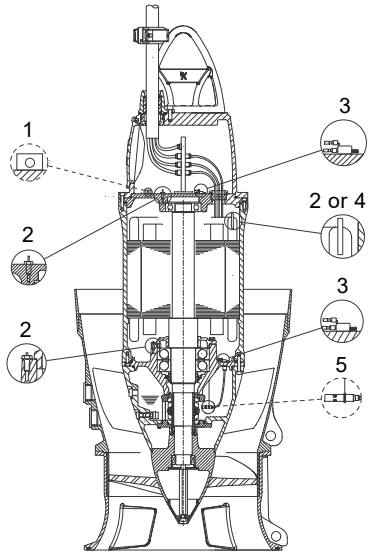
9. Protection and control functions

9.1 Sensors

The table shows the difference between standard product and factory product variant (FPV) and the number of sensors. FPV sensors can be chosen individually.

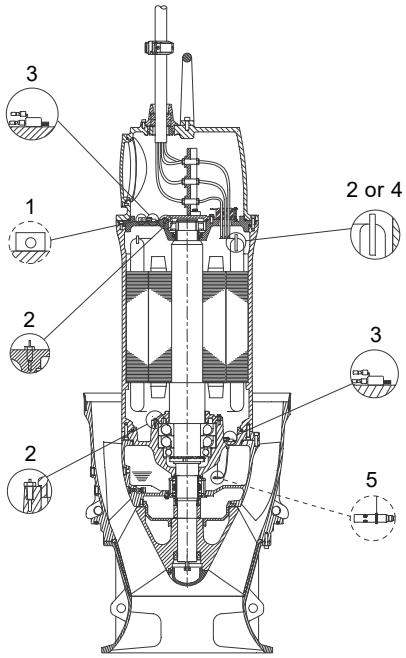
Sensor	Type	Number of sensors	
		Standard	FPV
Stator thermal protection	Bi-metal	3	3
Stator thermal protection	Pt100	1	3*
Terminal box moisture sensor	Switch	1	1
Motor housing moisture sensor	Switch	1	1
Bearing thermal protection (lower)	Pt100	1	1
Bearing thermal protection (upper)	Pt100	1	1
Water-in-oil sensor (WIO)	Analog		1
Vibration sensor	Analog		1

* Three Pt100 sensors are installed in the pump at the factory, but only one sensor is connected as standard. All 3 stator thermal sensors cannot be connected, if the bearing sensors are also connected.



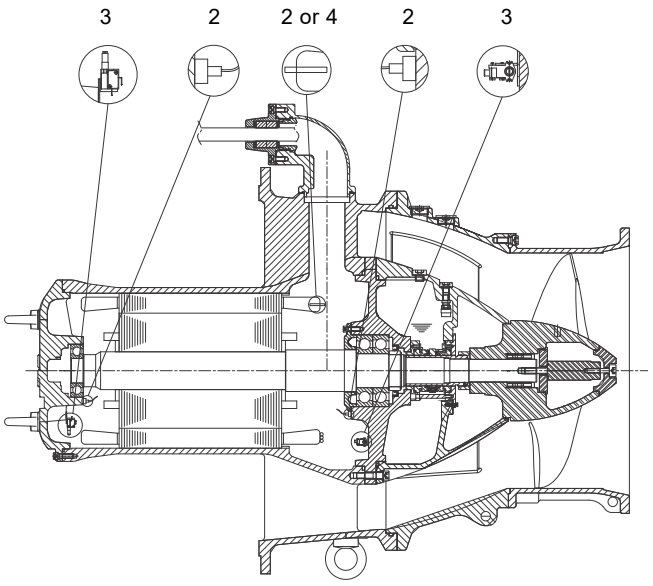
TM05 9557 4013

Fig. 30 KPL: switches and sensors



TM05 9558 4013

Fig. 31 KWM: switches and sensors



TM07 4690 2619

Fig. 32 KPG: switches and sensors

Key for figures 30, 31 and 32:

Pos.	Description
1	Vibration sensor
2	Thermal sensor
3	Moisture switch
4	Thermal switch
5	Water-in-oil sensor (WIO)

9.1.1 Thermal switches

- Standard pumps incorporate three bimetallic thermal switches built into the stator windings. The thermal switches protect the motor against overheating.
- When the maximum winding temperature is reached, the switch opens the circuit and stops the motor.
- When the windings are cooled down, the switch closes the circuit and the motor can be restarted. Manual restarting is necessary.

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

The thermal switches are connected in series in a separate circuit in the power or control cables. See section *4.4 Electrical connection*.

The thermal switches must be connected to the motor-protective safety circuit in the control cabinet.

Technical data for the thermal switches:

- two conductors
- operating voltage: 12-250 VAC
- maximum switching current: 2.5 A at cos φ = 1.

9.1.2 Pt100 sensor

The sensor is connected in a separate circuit to the power or control cables. See section *4.4 Electrical connection*.

The sensor must be connected to a Pt100 relay in the control cabinet, preferably to a Grundfos SM 113 or IO 113.

The resistance of the sensor varies with the temperature. The table below indicates approximate values.

[Ω]	[°F (°C)]
100	32 (0)
138.5	212 (100)
107.8	68 (20)

Do not use a megohmmeter to test this alarm due to the low resistance of the sensor circuits.

9.1.3 Moisture switches

The pumps have two moisture switches:

- one in the terminal box
- one in the lower part of the stator housing.

Moisture switches protect the motor from damage due to moisture.

The moisture switches are non-reversing and must be replaced after being activated.

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

The moisture switches are connected to a separate circuit through the control cable. See section *4.4 Electrical connection*.

The moisture switches must also be connected to the safety circuit of the separate pump controller.

Technical data of moisture switches:

- two conductors
- operating voltage: 12-250 VAC
- maximum switching current: 2.5 A at cos φ = 1.

9.1.4 Thermal bearing protection

Standard pumps incorporate one Pt100 sensor for analog measurement of the temperature of the lower bearing and one Pt100 sensor for the upper bearing.

The sensors are connected in separate circuits to the power or control cables. See section *4.4 Electrical connection*.

The sensors must be connected to a Pt100 relay in the control cabinet, preferably to a Grundfos SM 113 or IO 113.

The resistance of the sensors varies with the temperature. The table below indicates approximate values.

[Ω]	[°F (°C)]
100	32 (0)
138.5	212 (100)
107.8	68 (20)

The following temperature limits are predefined:

- 194 °F (90 °C): alarm for bearing temperature
- 266 °F (130 °C): pump stop caused by high bearing temperature.

After installation, check the following:

1. Make sure that the resistance at 68 °F (20 °C) is approximately 107.8 Ω.
2. Carry out similar measurements at COM1, B/S-L and B/S-H of SM 113 and the power cables. See section *4.4.2 Wiring diagrams*.
   - If SM 113 is installed inside the pump the measurement must be carried out from SM 113 wirings in the junction box. See fig. 3 in the appendix.
   - If SM 113 is installed outside the pump the measurement must be carried outfrom SM 113 wirings or end of the control cables. See fig. 1 in the appendix.

Connect the Pt100 sensor to a recording device during pump check.

Do not use a megohmmeter to test this alarm due to the low resistance of the sensor circuits.

9.1.5 Water-in-oil sensor (WIO) (only KPL and KWM)

The WIO sensor measures the water content in the oil chamber and converts the value into an analog current signal. The two sensor wires are used for supply power and transmit the signal to the measuring device or controller. The sensor measures the water content from 0 to 20 %. It also sends a signal if the water content is outside the normal range (warning), or if the oil level is low (alarm). The sensor is fitted in a stainless steel tube for mechanical protection.

The WIO sensor must be used together with Grundfos IO 113 or SM 113.

Together with IO 113, the WIO sensor filters the signal and provides an easy readout of the actual value. Furthermore, it is possible to set a user-defined warning limit and calibrate IO 113 and the sensor to the motor oil.

Do not use Shell Ondina 420X motor oil, if a WIO sensor is in use.

Lack of oil may cause overheating and damage to the mechanical shaft seals. The WIO sensor trips the alarm, if the quality or quantity of oil is inappropriate in the oil chamber.

The WIO sensor works in the following way:

Sensor signals

4-20 mA	=	0-20 % water in the oil Accuracy is better than 2 %
22 mA	=	Warning: The water content is above 20 %
3.5 mA	=	Alarm: There is air in the oil chamber

Technical data

Input voltage	12-24 VDC
Output current	3.4 - 22 mA
Power input	0.6 W
Ambient temperature	32 to 158 °F (0 to 70 °C)

9.1.6 Pump vibration sensor (PVS 3) (only KPL and KWM)

The PVS 3 sensor is a three-plane vibration sensor that monitors the vibration levelto protect the pump and the pipe system against damage. A change in the vibration level indicates an abnormal situation,which may be caused by a clogged impeller, worn bearings or a closed outlet valve. In this case, always inspect the service and carry out the neccessary eliminations to avoid damage to the pump or the pipe system.

9.2 Pump control

KPL, KPG and KWM pumps can be controlled by:

- Grundfos Dedicated Controls (DC) for one to six pumps
- IO 113
- SM 113
- MP 204.
  Note: The controllers are available as accessories.

9.2.1 Dedicated Controls (DC)

Grundfos DC is a control system designed for installation in either commercial buildings or network pumping stations with up to six pumps. Drundfos DC system provides advanced control and data communication.

The DC system consists of the following components:

- CU 361 control unit
- IO 351B module (general I/O module)
- IO 113 protection module (optional).

The DC system starts and stops the pumps by:

- float switches
- analog pressure sensors
- ultrasonic sensors.

Furthermore, it is possible to control the water level by combining float switches with an analog pressure sensor. Two additional safety float switches can be installed in the DC system for high-level and dry-running alarm.

9.2.2 IO 113

IO 113 forms the interface between a Grundfos storm- or wastewater pump with analog and digital sensors and the pump controller. The most important sensor data are indicated on the front panel. For further information, see the installation and operating instructions for IO 113 on www.grundfos.com.

One pump can be connected to an IO 113.

With the sensors, IO 113 forms a galvanic separation between the motor voltage in the pump and the controller connected.

IO 113 with SM 113 enables the following functions:

- Pump protection against overtemperature
- Sensor monitoring for analog measurement of:
  - motor temperature
  - pump vibrations
  - leakage (WIO)
  - stator insulation resistance
  - bearing temperature
  - digital measurement of moisture in motor
- Stop the pump in case of alarm
- Remote monitoring of the pump by RS485 communication (Modbus or GENIbus).

Measurement of insulation resistance

IO 113 measures the insulation resistance between a stator winding and ground (earth):

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

9.2.3 SM 113

SM 113 is used for collecting and transferring sensor data. SM 113 works together with IO 113 through power line communication using the Grundfos GENIbus protocol.

SM 113 can be placed either inside the pump terminal box (allowing fewer sensor wires out of the pump) or in the control cabinet next to the pump installation. For electrical connection, see fig. 1 - 4 in the appendix. SM 113 collects data from the following devices:

- 3 current sensors, 4-20 mA
- 3 Pt100 thermal sensors
- 1 PTC thermal sensor
- 1 digital input.

9.2.4 MP 204

The motor protector MP 204 is an electronic control unit designed for monitoring and protecting motors, pumps, machines, cables and cable joints.

The MP 204 monitors the following:

- System insulation resistance to ground (earth) before start
- Motor temperature (if the motor is fitted with an operational temperature sensor, such as a Pt100/Pt1000 or a PTC sensor.)
- Current consumption and unbalance
- Supply voltage
- Phase sequence
- Missing phase
- Power factor (cos phi)
- Harmonic distortion
- Starting capacitor (single-phase operation only)
- Run capacitor (single-phase operation only).

The MP 204 protects against:

- Overload
- Dry running in pumping systems
- Incipient motor defect
- Too high motor temperature
- Power supply failure

As a standard, the MP 204 incorporates:

- Display for reading values, such as current, voltage, temperature, cos phi, warning and trip codes
- Relay output for external fault indication
- GENIbus connection
- Pt100/Pt1000 sensor input
- PTC/thermal switch input

10. Servicing and maintaining the product

10.1 Safety instructions and requirements

DANGER

Electric shock

Death or serious personal injury

- Before working on the pump, make sure that the main switch has been locked in position 0.

WARNING

Crushing hazard

Death or serious personal injury

- Make sure that all rotating parts are stopped moving.

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

10.2 Maintenance

The pump must be subjected to a major overhaul in a service workshop every third year. This requires special tools and must be carried out by an authorized service workshop.

Inspect pumps running normal operation twice a year.

Check the following:

- Visual check
  See section *10.2.1 Visual checks*.
- Propeller or impeller clearance
  See section *10.2.2 Inspecting and adjusting the propeller or impeller clearance*.
- Oil level and oil condition
  See section *10.2.3 Checking and changing the oil*.

Inspect the oil

  – for pumps in intermittent operation, once a year

  – for pumps in permanent operation, every six months.

- Stator housing
  See section *10.2.4 Checking the stator housing*.
- Cable entry
  Make sure that the cable entry is waterproof, the cables are not sharply bent or pinched and the cable sheaths have no visual defects.
  See section *10.2.5 Checking the cable entry*.
- Insulation resistance
  See section *10.2.6 Checking the insulation resistance*.

- Pipes
  Make sure that the pipes, valves and other peripheral equipment are intact.

Faults must be repaired and notified to the supervisor.

- Pump parts
  Check the pump parts, such as the inlet and outlet casing, for possible wear. Replace defective parts.
- Ball bearings
  Check the shaft for noisy or heavy operation by turning 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 authorized service workshop.

Inspect the pump after one week of operation,if the pump is new or the shaft seals have been replaced.

Regular inspection and preventive maintenance ensure reliable operation.

10.2.1 Visual checks

Visual inspection includes the following:

- Search for cracks or other external damage.
- Check the lifting bracket or eyes and the lifting chain for wear and corrosion.
- Inspect the power cables for cracks or lacerations in the sheath, for kinks or for other damage.
- Check that the cables are firmly connected to the motor top cover.
- Check that no visible screws have self-loosened and tighten if necessary.

10.2.2 Inspecting and adjusting the propeller or impeller clearance

When the clearance between the propeller or impeller blade and the wear ring exceeds 0.078 inches (2 mm), replace the wear ring.

For further information, contact Grundfos or the nearest authorized service workshop.

KPL and KWM: replacing the wear ring

1. Remove the screws and lift the pump off the inlet casing.
2. Replace the wear ring.
3. Assemble the pump in reverse order.

10.2.3 Checking and changing the oil

Check the oil level after one month of operation if the pump is new or the shaft seals have been replaced. The oil must be changed if it contains water.

If the pump is fitted with a WIO sensor, the manual check of the oil level is not needed.

CAUTION

Pressurised system

Minor or moderate personal injury

- The oil chamber may be under pressure. Loosen the screws carefully and do not remove them until the pressure has been completely relieved.

Pump out all the used oil. After refilling, tighten the oil plug to torque 59 ft-lb (80 Nm).

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

An oil change kit (98887554) is available to ease the oil change.

See separate instructions for the oil change kit on Grundfos Product Center.

10.2.4 Checking the stator housing

If there is water in the stator housing, the cause may be as follows:

- An O-ring is damaged.
- The cable entry is leaking.

If there is oil in the stator housing, the cause may be as follows:

- The inner seal is damaged.
- An O-ring is damaged.

10.2.5 Checking the cable entry

- Check that the cable clamps are tight.
- Check that the cable entry is tight.
- Cut off a piece of the cable so the rubber bush closes around a new position on the cable. Always use new rubber bushings when reassembling the cable inlet.
- Check that the rubber bushings and the washers fit to the outside diameter of the cables.
- Make sure there is no slack in the cable suspension, the cables are fixed to the cable suspensionand cannot move during operation.

In case the outer sheath is damaged, replace the cable.

10.2.6 Checking the insulation resistance

IO 113 measures the insulation resistance between a stator winding and ground (earth).

- The resistance is above 10 MΩ: OK.
- The resistance is 1 to 10 MΩ: warning.
- The resistance is below 1 MΩ: alarm.

Use an insulation resistance tester set to 1000 VDC. Check the phase-to-phase and phase-to-earth resistance. The test result must be over 100 MΩ.

10.3 Spare parts

Always replace damaged motor parts with new and approved ones. Motor parts must not be reconditioned by machining, re-tappingor welding.

For further information about service and spare parts,visit www.grundfos.com.

10.4 Contaminated pumps

CAUTION

Biological hazard

Minor or moderate personal injury

- Flush the pump thoroughly with clean water and rinse the pump parts after dismantling.

The pump is classified as contaminated if it has been used for a toxic or contagious liquid.

Before returning the product for service, contact Grundfos with details about the pumped liquid. Otherwise, Grundfos can deny to service the product.

11. Fault finding

Before diagnosing any fault, read and observe the safety instructions in section *10.1 Safety instructions and requirements*.

DANGER

Electric shock

Death or serious personal injury

- Before working on the product, make sure that the power supply has been switched off and it cannot be switched on unintentionally.

Fault	Cause	Remedy
1. The pump does not start.	a) A fault signal is indicated.	• If the bearing temperature is high, take the pump to the workshop for repair. • If the stator temperature is high, make sure that the water can move around the stator housing without any obstacles and the propeller or impeller rotates easily. • If there is a fault in the thermal protectors, contact an authorized electrician. Check that the overload protection is reset.
	b) The pump cannot be started manually.	Check the control voltage, and if the control fuses are intact. • Make sure all connections and fits are correct. • Check if the relay and contactor coils are functioning correctly.
	c) A fault signal is indicated on the control panel.	• Measure if the supply voltage is correct on all phases. • Check the main power switch and the fuses. Replace the fuses if necessary. • Check if the overload protection reset. • Check the power cable for damages.
2. The pump starts, but the motor protection stops it after a few seconds.	a) The motor protection is set too low.	• Check the motor data on the nameplate. • Adjust the settings of the motor protection.
	b) It is difficult to rotate the propeller or impeller by hand.	• Clean the propeller or impeller of fibres and rags. • Clean out the pit.
	c) The voltage is not the same on all three phases.	Contact an authorized electrician.
	d) The phase currents are unbalanced or too high.	Contact an authorized electrician.
	e) The insulation between the phases and between phases and ground (earth) in the stator is defective.	Use an insulation resistance tester set to 1000 VDC and check that the insulation between phases and between phases and ground (earth) complies with the correct levels for the motor type. If necessary, contact an authorized electrician.
	f) The density of the pumped liquid is too high. Maximum density is 68.8 lbs/ft^3 (1000 kg/m^3).	Dilute the liquid.
	g) The motor protection devices are defective.	Replace the defective motor protection devices.
3. The pump does not stop.	a) The pump is not able to empty the pit to the stop level.	Check that the pipe connection is in order. • Check if the propeller or impeller clogged or jammed. • Check if the valves are open.
	b) The level sensor is defective.	• Clean the stop sensor. • Check the contactor. If the contactor is defective, replace it. • Replace the defective components.
	c) The stop level is set too low.	Increase the stop level.
4. The pump starts, stops and starts in rapid sequence.	a) The pump starts due to backflow which fills the pit to the start level again.	Check if the distance between the start and stop levels is enough. • Check if all the valves are functioning correctly.
	b) The control voltage is lower than the rated control voltage.	Check the contactor. If the contactor is defective, replace it. • Check that the voltage in the starting circuit is sufficient in relation to the rated voltage, when the pump starts (check the voltage drop).

12. Technical data

12.1 Operating conditions

12.1.1 pH value

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

12.1.2 Liquid temperature

The allowed temperature is 32-104 °F (0 to +40 °C).

12.1.3 Density and viscosity of the pumped liquid

Maximum density:68.8 lbs/ft^3 (1000 kg/m^3).

Maximum kinematic viscosity: 1cSt 1 mm^2/s (1 cSt).

When pumping liquids with a density or kinematic viscosity higher than that of water (the values stated above), use a motor with a correspondingly higher output.

12.1.4 Operating mode

The pumps are designed for continuous and intermittent operation. The maximum number of starts allowed are shown in this table:

Motor power [Hp]	Maximum number of starts per hour*
≤ 20	15
> 20 - ≤ 300	10
> 300	10 (soft starter)

* Maximum 5000 starts per year

In order to avoid overloading the windings, seals and bearings, the above numbers of starts must not be exceeded.

12.1.5 Enclosure class

IEC IP68.

12.1.6 Sound pressure level

CAUTION

Sound pressure level

Minor or moderate personal injury

- Use hearing protection when working nearby an installation.
  Depending on the installation type, the sound pressure level of the pump can be higher than 70 dB (A).

12.1.7 Turbulence optimizer (only with KPL and KWM)

Turbulence optimization is only possible if the pump is mounted in the column pipe size that the pump is intended for.

12.1.8 Storage temperature

Storage temperature: -13 to +131 °F (-25 to +55 °C).
Maximum 158 °F (70 °C) for short periods not exceeding 24 hours (EN 60204-1, 4.5).

12.2 Dimensions and weights

For pump dimensions and weights, see data booklet on www.grundfos.com.

12.2.1 Bending radius of cables

The bending radius of the cables is 15 times the outer cable diameter.

Cable type	Square [inch² (mm²)]	Cable diameter [inch (mm)]	Bending radius [inch (mm)]
PNCT 6x6+1x4+6x1.5	0.0093 (6)	0.94 (24)	14.17 (360)
PNCT 6x10+1x6+6x1.5	0.0155 (10)	1.34 (34)	20.08 (510)
PNCT 6x16+1x10+6x1.5	0.0248 (16)	1.34 (34)	20.08 (510)
PNCT 6x25+1x16+6x1.5	0.03875 (25)	1.65 (42)	24.80 (630)
PNCT(R) x35+1x25+6x1.5	0.05425 (35)	1.77 (45)	26.57 (675)
PNCT(R) 4x70	0.1085 (70)	1.97(50)	29.53 (750)
PNCT(R) 4x95	0.1473 (95)	2.20 (56)	33.07 (840)
PNCT(R) 4x120	0.186 (120)	2.56(65)	38.39 (975)
PNCT(R) 4x150	0.2325 (150)	2.72 (69)	40.75 (1035)
PNCT(R) 4x185	0.2868 (185)	2.76 (70)	41.34 (1050)
Sensor cable	-	0.91 (23)	13.58 (345)

12.3 Water level requirements

The minimum requirement for free space and a guideline for the minimum water level are shown in the tables below. The figures show installation examples.

All values in the table below are minimum values. Depending on the specific pump type and operating range, the specific level for "S" and "M.W.L" must be selected using the NPSH curve for the specific pump and the max. and min. operating range for the application. The specific min. water level must be calculated based on min. and max. operating range for the specific pump.

The site conditions influence the M.W.L.

- Perfect site conditions might allow a lower M.W.L. This has to be verified by CFD simulation.
- Unfavourable site conditions might require a higher M.W.L.

12.3.1 Water level requirements, KPL

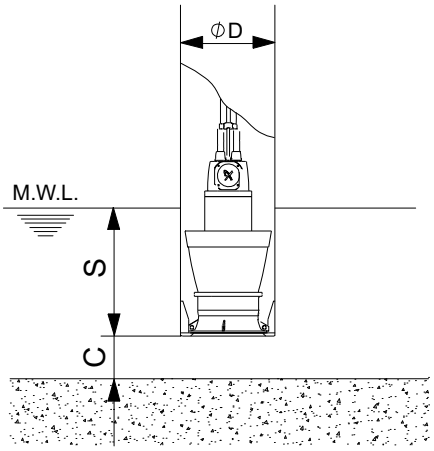


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Fig. 33 Installation example of KPL

Requirements for installation

ØD [in. (mm)]	C [in. (mm)]	S [in. (mm)]	Min. water level [in. (mm)]
20 (508)	10 (254)	30-47 (750-1200)	39-57 (1000-1450)
24 (610)	12 (305)	43-55 (1100-1400)	55-67 (1400-1700)
28 (712)	14 (356)	51-69 (1300-1750)	65-83 (1650-2100)
32 (813)	16 (407)	55-83 (1400-2100)	71-98 (1800-2500)
36 (915)	18 (458)	59-100 (1500-2550)	77-118 (1950-3000)
40 (1016)	20 (508)	65-110 (1650-2800)	85-130 (2150-3300)
48 (1220)	24 (610)	79-134 (2000-3400)	102-157 (2600-4000)
56 (1423)	28 (712)	91-150 (2300-3800)	118-177 (3000-4500)
60 (1524)	30 (762)	96-159 (2450-4050)	126-189 (3200-4800)
64 (1626)	31 (788)	118-165 (3000-4200)	150-197 (3800-5000)
72 (1829)	35 (889)	157-181 (4000-4600)	193-217 (4900-5500)

* M.W.L. = minimum water level,

12.3.2 Water level requirements, KPG

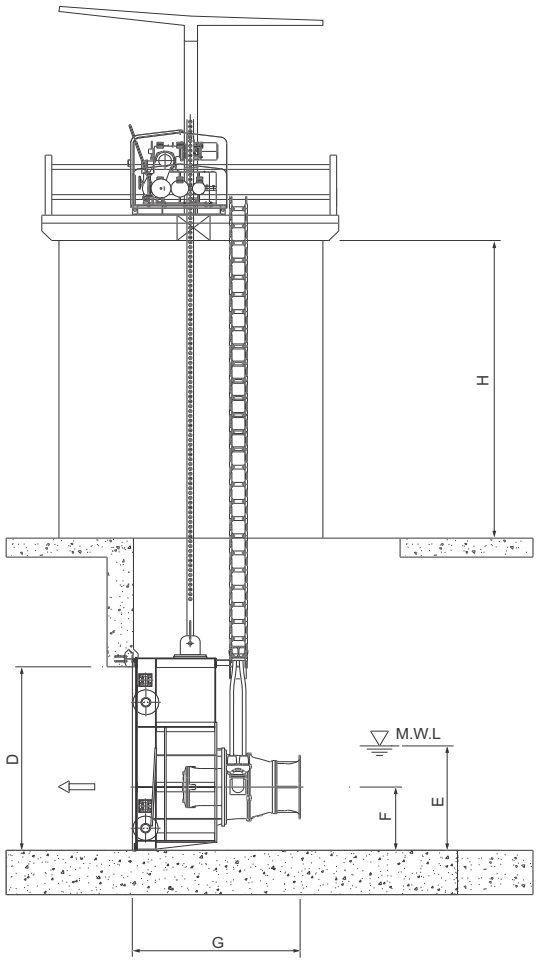

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Fig. 34 Installation example of KPG

Requirements for installation

Model	Outlet diameter	D	E	F	G	H
KPG.500	DN 500	1450	900	500	1250	3700
KPG.600	DN 600	1700	1050	600	1500	4200
KPG.700	DN 700	1700	1250	700	1500	4500
KPG.800	DN 800	1950	1400	800	1750	4500
KPG.900	DN 900	2200	1600	850	2000	5200
KPG.1000	DN 1000	2200	1750	900	2000	5200
KPG.1200	DN 1200	2450	2000	1100	2250	5700
KPG.1400	DN 1400	2450	2250	1300	2250	5700

* M.W.L. = minimum water level, see also the note in Section *12.3*.

12.3.3 Water level requirements, KWM

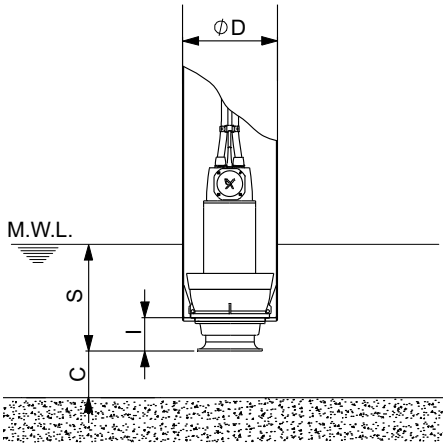

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Fig. 35 Installation example of KWM

Requirements for installation

ØD [in. (mm)]	C [in. (mm)]	I [in. (mm)]	S [in. (mm)]	M.W.L.* [in. (mm)]
24M	12 (305)	11.0 (280)	43-55 (1100-1400)	55-67 (1400-1700)
24H	12 (305)	10.6 (270)	43-55 (1100-1400)	55-67 (1400-1700)
28 (712)	14 (356)	15.7 (400)	51-69 (1300-1750)	65-83 (1650-2100)
32M	16 (483)	17.3 (440)	55-83(1400-2100)	71-98 (1800-2500)
32H	16 (407)	16.7 (425)	55-83 (1400-2100)	71-98 (1800-2500)
36 (915)	18 (458)	22.6 (575)	59-100 (1500-2550)	77-118 (1950-3000)
40M	20 (508)	25.6 (650)	65-110 (1650-2800)	85-130 (2150-3300)
40H	20 (508)	22.6 (575)	65-110 (1650-2800)	85-130 (2150-3300)
48 (1220)	24 (610)	29.1 (740)	79-134 (2000-3400)	102-157 (2600-4000)
56 (1423)	28 (712)	32.9 (835)	91-150 (2300-3800)	118-177 (3000-4500)
64 (1626)	31 (788)	37.0 (940)	118-165 (3000-4200)	150-197 (3800-5000)

* M.W.L. = minimum water level, see also the note in Section *12.3*.

13. Disposing of the product

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.

The crossed-out wheelie bin symbol on a product means that it must be disposed of separately from household waste. When a product marked with this symbol reaches its end of life, take it to a collection point designated by the local waste disposal authorities. The separate collection and recycling of such products will help protect the environment and human health.

See also end-of-life information on www.grundfos.com/products/product-sustainability/product-recycling.

1. Wiring diagrams

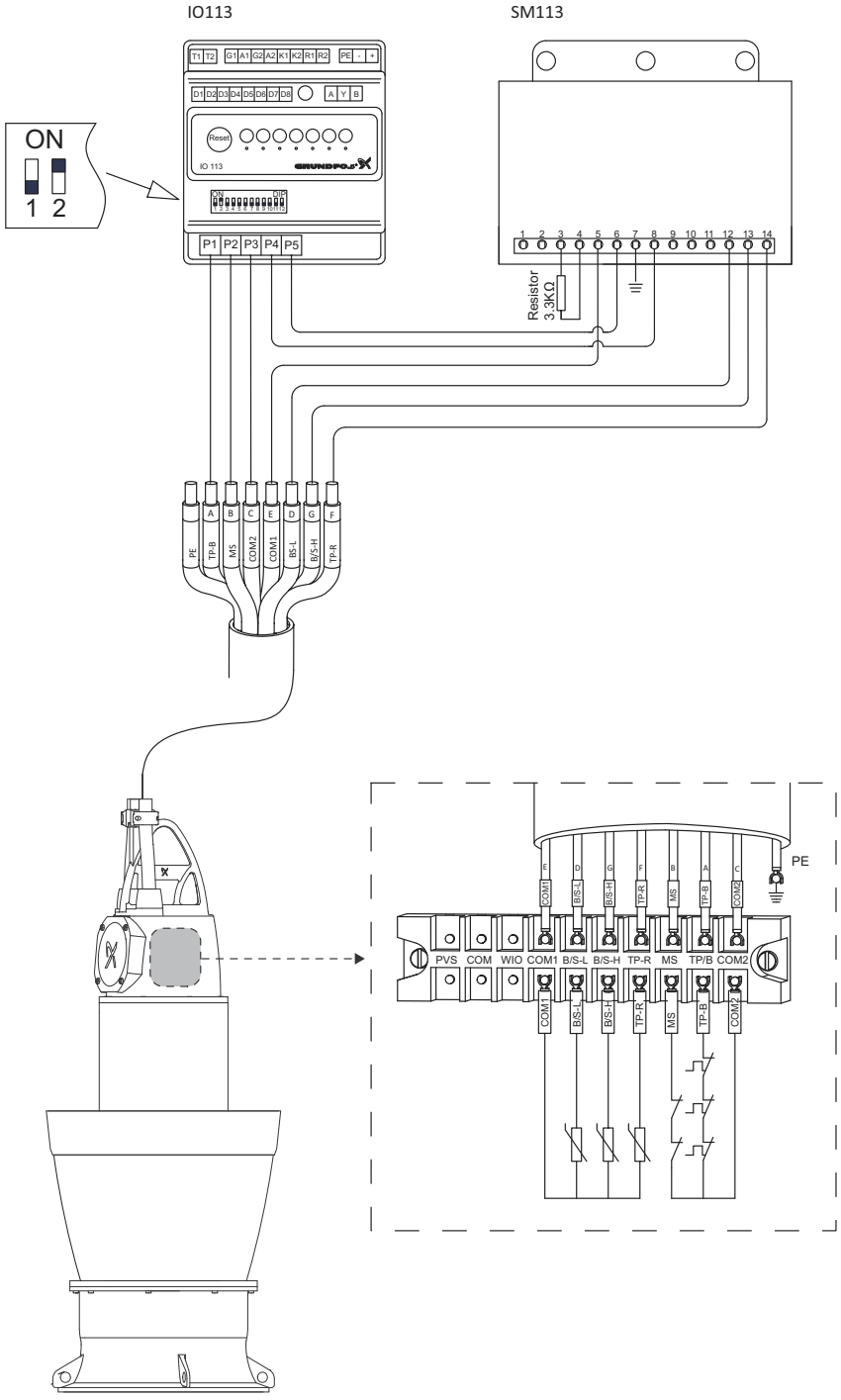

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Fig. 1 Standard wiring diagram of IO 113 and SM 113 in a control cabinet outside the pump

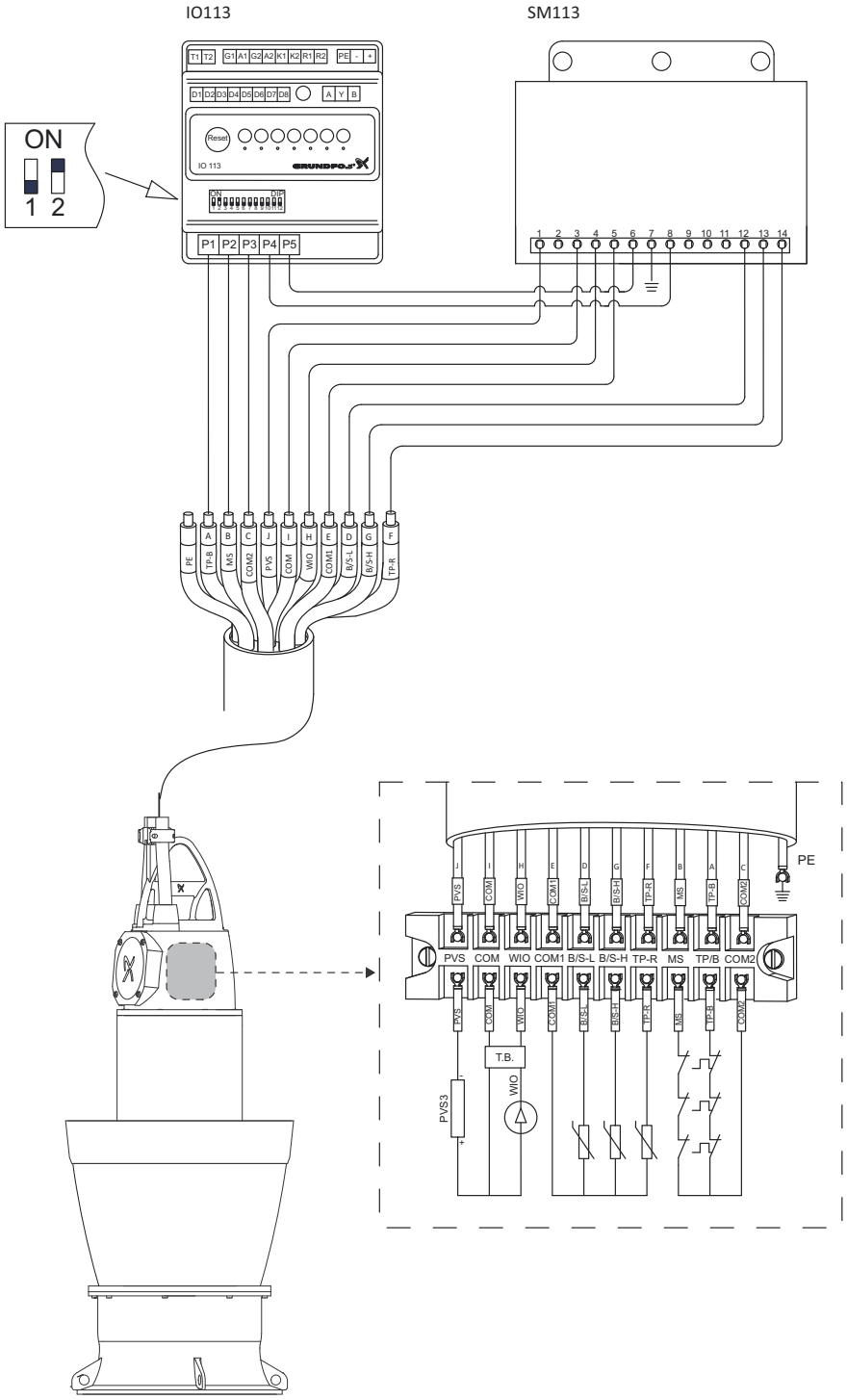

Fig. 2 Wiring diagram of IO 113 and SM 113 in a control cabinet outside a pump with sensor options

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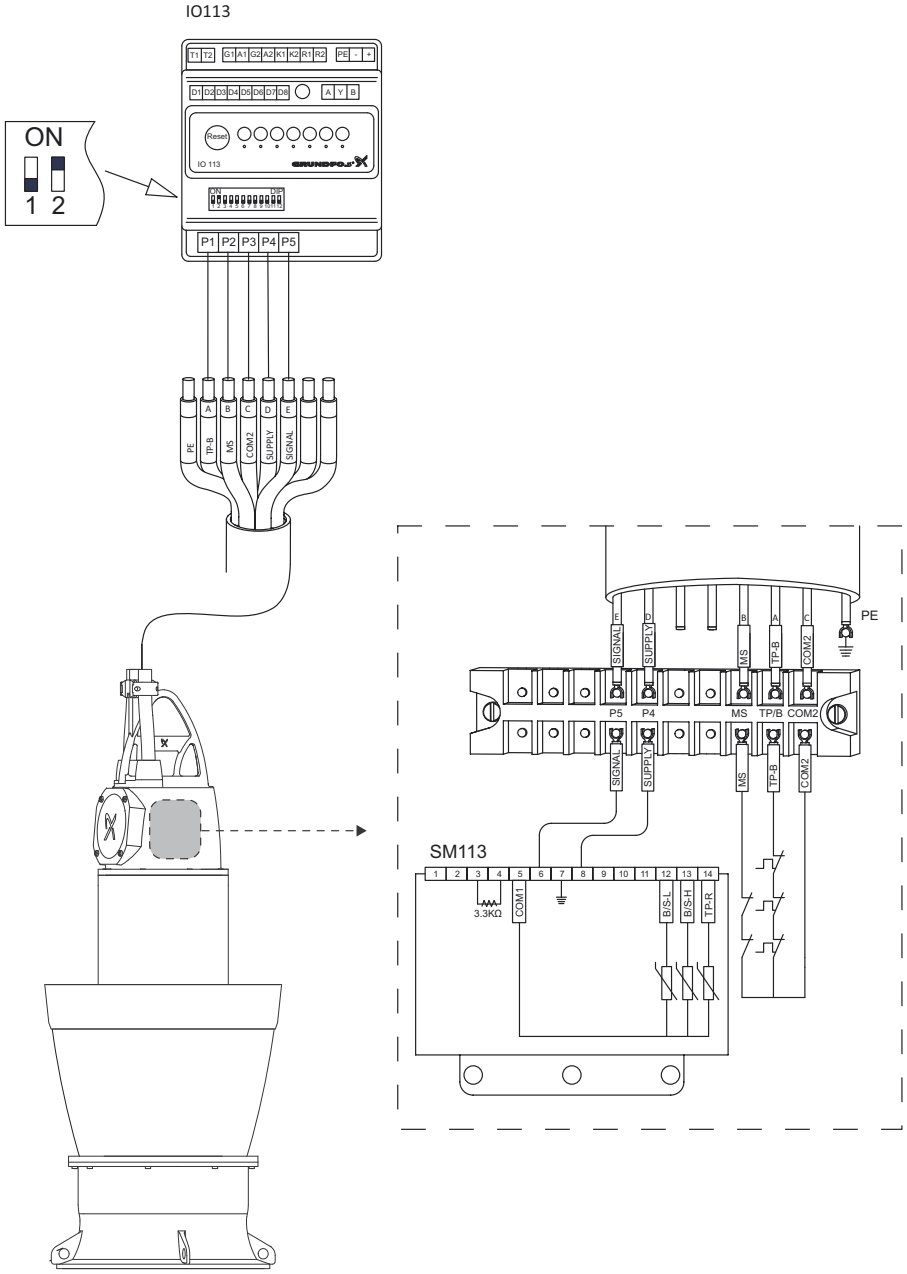

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Fig. 3 Standard wiring diagram of IO 113 and SM 113 placed inside of the KPL and KWM pump

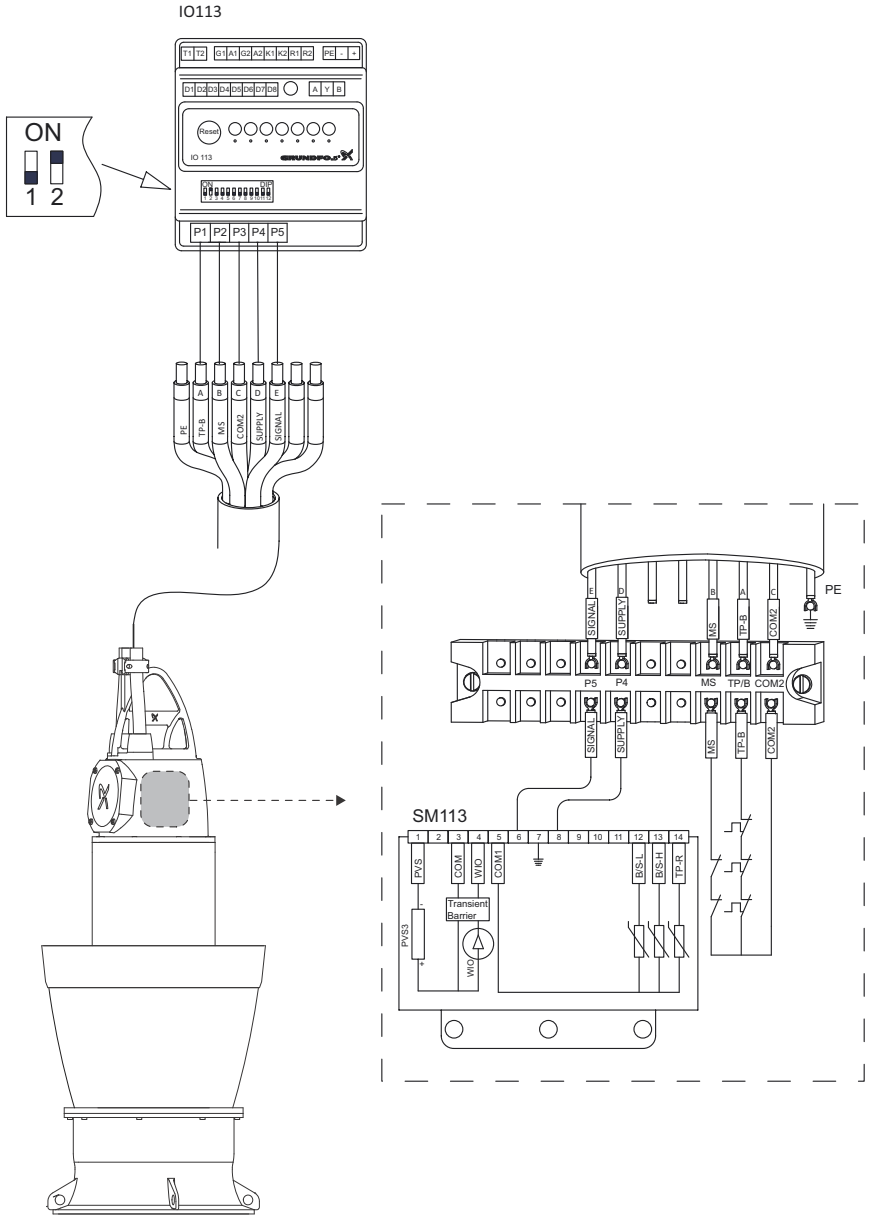

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Fig. 4 Wiring diagram of IO 113 and SM 113 placed inside of the KPL, KPG and KWM pump with sensor options

	Designation GB	Désignation FR	Denominación ES
	Thermal switch	Thermorupteur	Interruptor térmico
M	Moisture switch	Capteur d'humidité	Interruptor de humedad
+T	Pt100 sensor	Capteur Pt100	Sensor Pt100
	Earth conductor	Conducteur de terre	Conductor de tierra
WIO	Water-in-oil sensor	Capteur d'eau dans l'huile	Sensor de agua en aceite

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98344189 09.2020
ECM: 1260965