

6" and 8" rewindable submersible motors

— Assembly and operating instructions —

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Attention: The motors may only be used under strict observation of these instructions. Keep this manual close at hand, so that you have it available whenever questions arise!

1. Intended use

Electric submersible motors from Franklin may be used only to drive pump loads under water.

a) Typical application:

Typical applications for loads (e.g. pumps) driven by submersible motors are:

- **drinking water supply** in cities and villages, even pumping out of rivers,
- **wells** in waterworks, private households and agriculture,
- **stirring machines** in water treatment plants,
- **water supply** for dairies, breweries and mineral water bottling plants as well as in industrial cooling circuits,
- **ground water heat pump systems**
- **irrigation and sprinkling systems** in gardening, agriculture and forestry as well as for fish ponds,
- **dewatering** in civil engineering and mining,
- **pressure boosting systems** in industrial applications (with pump inside pressure vessel),
- **fountains**, also for horizontal installation. Note: In this case one must observe the special regulations for the safety of electric installations for fountains.

b) Permitted media

Submersible motors may **solely** be used in clean and low viscosity fluids, such as

- **drinking water** and **water for industrial use**.

c) Non-permitted media

Submersible motors must not be used under no circumstances in any other media

- especially not for the pumping of **air**, **explosive media** or **waste water**.
- For the use in **aggressive media** there are motors available, which are made of V4A-steel (AISI 316). The person ordering the motor is solely responsible for choosing the material. Corrosion may occur even with V4A-steel.

d) Temperature of medium

The **temperature of the medium** may be between **0 ... +30 °C**. Temperatures down to -8 °C are only permitted with the original motor filling solution.

A coolant flow speed according to table 1 along the motor must be assured. Otherwise the motor will overheat.

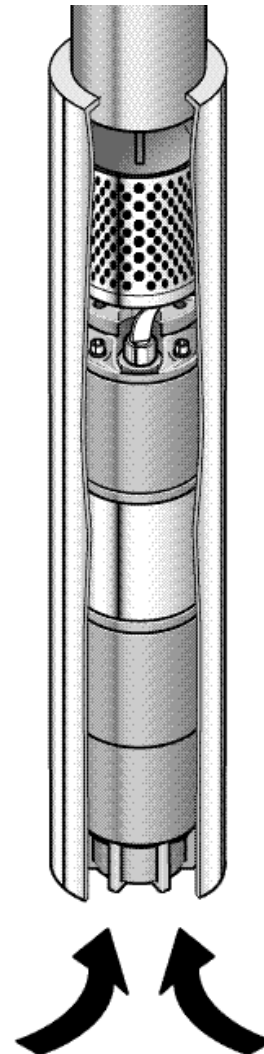
e) Cooling tube or flow sleeve

The coolant flow speed results from the diameter of the well and the displacement of the pump.

If the required minimum speed of the coolant flow cannot be achieved, e.g. if the inlet opening of the well is above the motor or if the well has a very large diameter, a cooling tube or flow sleeve is required.

This should enclose the motor completely and the water inlet opening of the pump in such a way, that the motor is positively cooled (see illustration).

The tube may be made of a corrosion resistant steel or plastic.



Motor type	Motor rating	Use in media up to 30°C
6" motor	4 kW - 18,5 kW	0,2 m/sec.
	22 kW - 37 kW	0,5 m/sec.
8" motor	30 kW - 56 kW	0,2 m/sec.
	60 kW - 93 kW	0,5 m/sec.

Table 1: Minimum coolant speeds

f) With higher temperatures of the medium

operation is only permitted if you increase the coolant speed or reduce the load as shown in table 2.

Water temperature	motor current in % of the maximum allowable nominal current	
	6" motor	8" motor
35°C	95%	90%
40°C	78%	71%
45°C	60%	40%

Table 2: Maximum load in % of nominal power rating at a coolant speed of 1 m/sec.



Attention!

Under no circumstances may the motor be heated to more than +60 °C - neither during operation, nor during storage! Otherwise motor fluid may be lost due to expansion - **the motor would be damaged after a short period of use!**

2. Requirements during use

The maximum submersion depth below the water level must not exceed **350 m**.

If a deeper submersion depth (down to 1000 m) is required, you may order specially tested motors with pre-assembled cables from the manufacturer.

- The **frequency of starting must be limited to 20 starts** per hour - with an **On/Off time** of at least **90 seconds minimum**.
- **You should generally plan the installation of a spring loaded check valve** in the production tube, if the pump is not already fitted with one.
- The distance between check valve and pump must not exceed **7 m**.
- In wells with variable water supply we recommend the installation of the level switch, to avoid **dry running** of motor and pump.
- In applications where the water supply may be insufficient to meet the pump output, dry running protection must be supplied. This is typically in the form of a level sensor or flow switch.

3. Duties of the personnel

For the operating steps described in this manual **expert knowledge** equivalent to a professional education of a **skilled electrician** or a **technician for electric machinery** is required.

- You should therefore perform these steps yourself only, if you have such **expert knowledge**,
- or have the work performed by **personnel** with such expert knowledge.



Requirements of the EC-regulations

Submersible motors are components according to the EC-regulation for "machines".

You must therefore only start to operate the motor if:

- you have manufactured a **complete machine**, e.g. in connection with the aggregate to be driven.
- the **protection requirements** demanded by the applicable EC- and local regulations are met,
- you have confirmed the protection requirements by issuing the **EC declaration of conformity**
- and you have made it clearly visible by attaching the **CE-sign** from outside.

4. Instructions for the reader!

Before unpacking, installing or operating the submersible motor:

Please strictly observe the information in this manual!

The non-observance of this manual may lead to errors during operation,

- **dangers** for health and safety resulting from electric or mechanical effects,
- **damage** to motor or surrounding installations and
- **functional faults** during operation.

When working on electric equipment or when ordering others to do such work you should always remember that you have a **responsibility** for the people around you!

1. For all models:

Design principle: Rewindable (wet wound) two-pole induction motors with PVC- or PE- insulated magnet wire.

Model - No.: 6": 262...
8": 263...
Voltage range: 220 V ... 690V, 3~ 50 Hz

Starting variants: Direct starting
Wye-delta starting

Rotary speed: ~ 2860 rpm at 50 Hz

Weight: Please refer to the technical data sheets.

Power rating: 6": 4kW - 37kW
8": 30kW - 93kW

Connection: 6"/8" NEMA flange

Type of protection: IP 58

Maximum winding temperature:

- PVC insulated wires 70°C
(6": 4kW - 30kW; 8": 30kW - 75kW)
- PE insulated wires 90°C (ISO-class Y)
(6": 37kW; 8": 83kW and 93kW)

Ambient temperature: +30 °C maximum

Coolant speed: see table 1

frequency of starts: maximum 20 switching operations per hour with a minimum On/Off time of 90 seconds

Installation position: vertical (shaft always upwards, never downwards) and slightly inclined for horizontal installation.

Voltage tolerance: +6% / - 10% $U_{nominal}$

Cable: KTW and VDE tested cables

6": Motor cable 4m (included in delivery)
8": Motor cable 8 m (included in delivery, ground conductor not in scope of delivery)

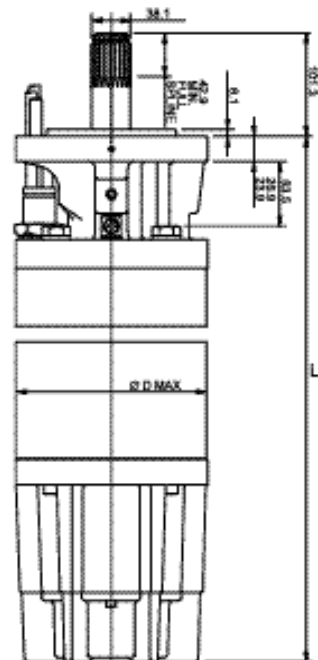
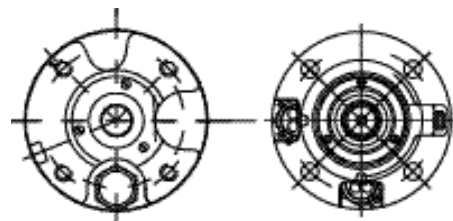
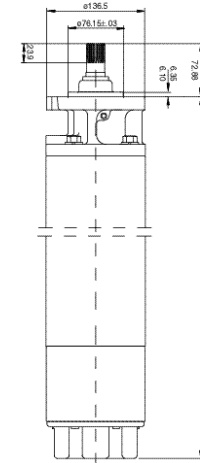
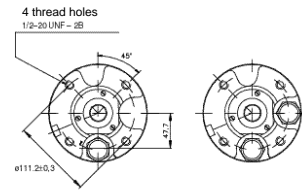
Noise level: < 70 dB(A)

maximum axial thrust: depending on model

- **towards motor** 6": 6.500N, 15.500N, 27.500N
8": 45000N
- **away from motor*** 6": 1.400 N
8": 1.400N

*Note: The data apply for a load period of **max. 3 minutes**. This time is long enough to start the pump.

Motor filling: The composition of the fluid is in accordance with the regulations of the foot protection law. The filling may be replaced by drinking water. Observe frost protection!



For all motors

The 6" and 8" motors are three-phase motors with rewindable wet-wound stator. The specification 6" or 8" refers to the smallest well diameter into which the motor can be installed. For correct dimensions please refer to the drawings and the technical data sheets for the respective motor model.

2. Options

Special materials: AISI 316 SS with SiC mechanical seal

6": 1 or 2 built in **PT 100** - temperature sensors

8": **PT 100** for retrofit second **PT 100**

3. Storing the motor

Correct storage of the motor is decisive for the correct function of the motor at a later date.

- Leave the motor in its **original packaging** until the day of installation.
- When standing the motor upright make sure that it **cannot fall over** (shaft always upwards).
- Do not subject the motor to direct sunlight or other heat sources. **Under no conditions may the motor be heated to above 60 °C.** Otherwise motor fluid may escape because of expansion, this would damage the motor.
- Make sure that the **storage temperature** with original filling does not drop below **-40°C**. If the filling has been replaced by **water**, the motor must be stored in a **frost protected** environment - i.e. do not store below 0°C.

4. Unpacking the motor



Risk of injury!

Mind the weight of the motor.

Use only permitted lifting gear.

Do not step under loads being lifted.

Take the motor carefully out of its packaging in order to avoid damage.

5. Check

after unpacking for visible external damage.

1. Required tools

For the necessary inspections and correct assembly the following tools are required:

- Filling syringe (308 622 121)
- Test pin (308 343 903 / 904)
- Insulation measuring unit 500V test, display up to 200 M Ohm minimum

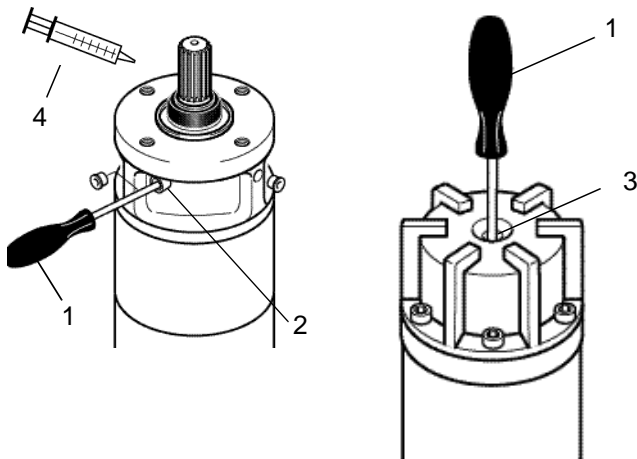
2. Inspection before assembly

Note: Before the installation check the motor filling.

a) Check the motor fluid

The rewindable motors are equipped with a filling and pressure relief valve. These enable trapped air to escape and to top off fluid. The leakage of minor fluid quantities at too high storage temperatures is of no significance.

1. Place the motor horizontally.



2. Press the **test pin (1)** into the **filling valve (2)** until fluid runs out.

If no fluid runs out of the filling valve it is necessary to top up with motor fluid (see section 6).

3. If motor fluid has run out of the filling valve, guide the **test pin (1)** through the hole in the **diaphragm housing (3)**, until resistance can be felt.
4. Measure the diaphragm distance.

Nominal value diaphragm distance:

6" and 8": 44 mm +/- 2mm

If the **nominal value is not reached** the motor is overfilled.

If the **nominal value is exceeded** or if no fluid has run out you must top off the motor fluid.

b) Topping off the motor fluid

If the inspection has revealed that the motor fluid filling level is too low you, must fill with either clean drinking water - **do not use distilled water**, or Franklin Electric genuine filling fluid. Franklin Electric fluid is recommended, because only this ensures sufficient frost protection.

Filling fluid for 6" and 8" motors

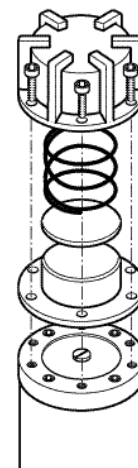
Quantitie	Number
5l	308 353 921
10l	308 353 922
20l	308 353 923

1. Attach the **filling syringe (4)** to the **filling valve (2)** and top up with motor fluid -until the value of the diaphragm position is smaller than the nominal value.
2. Press the **test pin (1)** into the **filling valve (2)** again so that the **overpressure** can be relieved.
3. You should finally **check** the filling level again, as described before.

c) Replacing the motor filling with drinking water

On the 6" rewindable motor:

1. Turn the motor upside down (drive shaft downwards) and remove the **filter plugs** from both valves. **Do not stand the motor on the shaft.**
2. Press the **test pin** for a moment into the **inlet valve**, until the **overpressure** is relieved.
3. Open the **diaphragm housing** and remove the **spring, the spring cup and the diaphragm**.

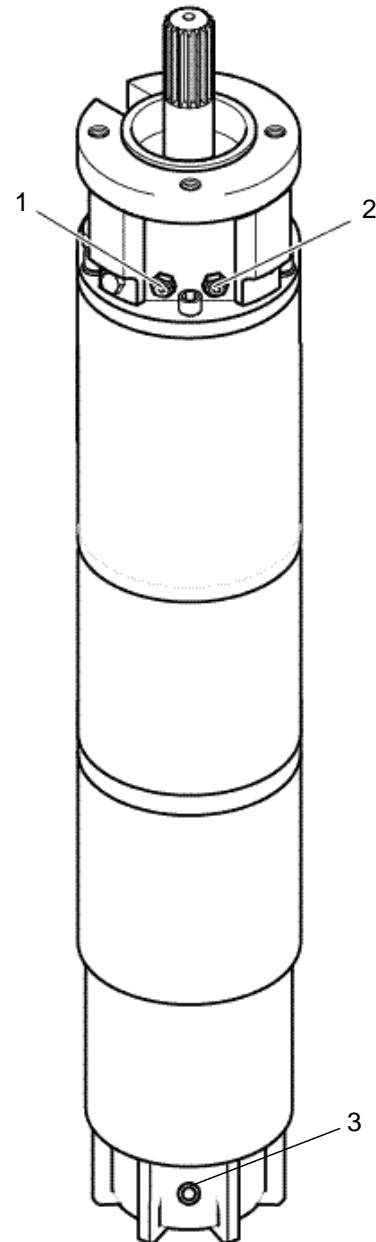


4. Drain the motor.
5. Fill the motor with **clear, clean drinking water (no acidiferous or distilled water)**. Frequently turn the shaft until water comes running out of the **thrust bearing housing**.
6. Assemble the diaphragm, the spring cup and the spring in **the correct position** and bolt the diaphragm housing on **carefully**.
7. **Check the filling level** and, if necessary, top off with water as described above.
8. Replace the **filter plugs** on both valves.

d) Replacing the motor filling with drinking water

On the 8" rewindable motor:

1. Turn the motor upside down (drive shaft downwards) and remove the **filter plugs (1)** and **(2)** from both valves.
2. Press the **test pin** for a moment into the **inlet valve**, until the **overpressure** is relieved.
3. Tilt the motor into an **inclined position** (drain plug downwards). Open the drain plug and let the motor fluid (approx. 11 l - 12 l) run out.
4. Unscrew the **inlet valve screw (2)** from the top bearing plate and the **outlet valve screw (1)**.
5. Once the motor is completely empty screw the **drain plug (3)** back in with the seal.
6. Use a **funnel** to fill in clear, clean drinking water (**no acidiferous or distilled water**) into the **inlet valve (2)**, until water comes running out of the **outlet opening (1)**.
7. Screw **both valve screws** back in.
8. **Check the filling level** and, if necessary, top off with water as described above.
9. Replace the filter plugs on both valves.



3. Assembly of motor and pump (aggregate)



Attention!

This manual can only describe the work steps related to the motor. Please observe also the **installation instructions for the load device** when assembling motor and load.

Caution!

For your safety!

Do not use the motor with damaged device-sor parts. Due to the high drive forces this may otherwise cause accidents with considerable risks of injury and **danger to life!**

a) Preparatory tests

1. If necessary remove the shaft guard.
2. Before assembly turn the motor shaft by hand - it must rotate freely after overcoming the static friction.

If not, perform trouble shooting, free the shaft and continue.

3. Make sure that the surfaces of the parts to be connected are free of dirt and dust.

b) Assembly

1. Cover the inner part of the coupling on the load with a water resistant, acid-free grease (e.g. Mobil FM 102, Texaco Cygnus 2661, Gleitmo 746).

The grease minimizes the friction and provides additional protection against sand entry.

During assembly of motor and pump unit make sure that the splined section is provided with an O-ring. This O-ring prevents sand and dirt from entering into the splined section of the shaft. The appropriate couplings are available from Franklin Electric.

2. Align the shafts of load and motor to each other and join load and motor together.



Attention!

The shafts of load and motor must not have a **rigid connection** (coupling) in axial direction.

The coupling should be fixed on the pump shaft and free to slide on the motor shaft.

Use fastening screws of appropriate **quality class** and **dimensions**, as specified by the manufacturer of the load device.

Observe the **tightening torques** specified by the manufacturer of the load device.

Note: Mounting bolts for load device assembly

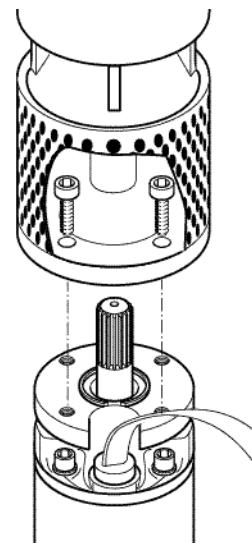
6" motors: Screw thread 1/2" - 20 UNF-2B

8" motors: Bore \varnothing 17,5 mm

3. Bolt motor and load together and tighten the fastening screws crosswise as specified.

c) Final tests

1. Should the coupling be accessible during operation you should protect it sufficiently **against touching!**



4. Motor cable



Threat to life!

The cable must under no circumstances be able to touch sharp edges.

Should this danger exist, you must protect the cable with a sufficient cushion (e.g. a piece of rubber).

Route the cable along the pump and protect it with a cable guard against damage. Observe also the information of the pump manufacturer.

a) Extending the motor cable

The customer can extend the cable supplied with the motor.



Attention!

During operation the cable supplied with the motor must always be **covered** by the pumped fluid for cooling.

Use **only** extension leads which are

- made of suitable **material** for the application
- and which are also sufficiently resistant against the **temperatures** which may develop in your medium.

Protect the cable connection against water. For this purpose there are **shrink hoses, compounds** or prefabricated **cable sets** available.

When choosing such items ensure sufficient **voltage resistance**, but also their **suitability** for the medium (particularly in the case of drinking water).

Observe the instructions of the respective supplier about the use of insulation material.

For the required **cable cross-sections** tables 3, 4, 5 and 6 are only recommendations. The electrician is solely responsible for choosing and dimensioning the cable. The minimum cross-section is specified according to IEC 364 (VDE 0298 Teil 4).

In this context you should also take the notes of the pump manufacturer into consideration.

b) Measuring the insulation resistance

Perform the measurement before **lowering** the completely assembled unit at the place of use.

1. Connect the one measuring cable with the motor housing.
2. Make sure that the contact points are clean.
3. Connect the other measuring cable with each **lead** of the connected motor cable, one after the other, but not with the protective conductor.

The motor is in good condition if the insulation resistance is at least

200 M Ohm on a **new** motor,

20 M Ohm on an **installed** motor and

2 M Ohm on a **used** motor

Chapter D: „Assembling the motor“

**400V / 50 Hz
Direct starting**

Motor power			Cable cross-section [mm ²]									
	kW	min. cross-section in mm ²	1,5	2,5	4	6	8,4	10	16	25	35	50
6"	4	1,5	103	171	271	404	559	663	1038	1573	2131	2912
	5,5	1,5	76	127	202	300	416	494	773	1173	1591	2176
	7,5	2,5	0	105	167	249	345	410	643	977	1327	1820
	9,3	2,5	0	86	137	204	283	335	526	797	1083	1483
	11	4	0	0	117	175	242	288	451	686	932	1279
	13	4	0	0	102	152	210	250	392	596	810	1112
	15	6	0	0	0	133	184	219	344	523	711	977
	18,5	8	0	0	0	0	150	178	280	426	579	796
	22	10	0	0	0	0	0	147	231	352	479	658
	26	10	0	0	0	0	0	129	202	307	418	574
	30	16	0	0	0	0	0	0	172	261	355	486
37	25	0	0	0	0	0	0	0	208	283	389	
Cable cross-section [mm²]			1,5	2,5	4	6	8,4	10	16	25	35	50

Table 3: Maximum cable lengths for 6" motors with direct starting, a voltage of 400 V / 50 Hz and a voltage drop of 5%.

You should take the min. cross-section acc. to IEC364 (VDE298 part 4) into account.

Motor power			Cable cross-section [mm ²]									
	kW	min. cross-section in mm ²	16	25	35	50	70	95	120	150	185	240
8"	30	16	172	261	355	486	648	829	986	1157	1335	1572
	37	25	0	208	283	389	519	666	795	936	1082	1278
	40	25	0	182	248	341	455	583	695	818	945	1116
	52	35	0	0	220	300	390	510	600	710	820	970
	56	35	0	0	202	277	371	475	567	667	771	911
	60	50	0	0	0	256	341	436	518	608	701	825
	67	50	0	0	0	230	307	393	469	551	636	750
	75	50	0	0	0	210	281	361	431	508	588	696
	83	50	0	0	0	190	250	320	390	460	530	630
	93	70	0	0	0	0	221	285	340	402	465	552
Cable cross-section [mm²]			16	25	35	50	70	95	120	150	185	240

Table 4: Max. cable lengths for 8" motors with direct starting, a voltage of 400 V / 50 Hz and a voltage drop of 5%. You should take the min. cross-section acc. to IEC364 (VDE298 part 4) into account.

If the operating voltage U_B in your installation deviates from the nominal voltage U_N , you can calculate the permissible maximum length L_{MAX} as follows:

Chapter D: „Assembling the motor“

$$L_{\text{Max}} = L_{\text{TAB}} (U_B / U_N)^2 L_{\text{TAB}} = \text{table value}$$

400V / 50 Hz
Wye-delta starting

Motor power			Cable cross-section [mm ²]									
	kW	min. cross-section in mm ²	1,5	2,5	4	6	8,4	10	16	25	35	50
6"	4	1,5	154	256	407	606	839	995	1557	2359	0	0
	5,5	1,5	115	190	303	451	624	740	1160	1759	2386	0
	7,5	1,5	95	158	251	374	518	615	965	1465	1991	2730
	9,3	1,5	78	129	205	306	424	503	788	1196	1624	2224
	11	1,5	67	111	176	262	364	431	677	1028	1898	1918
	13	1,5	58	96	153	228	316	375	588	894	1216	1669
	15	2,5	0	84	134	200	277	328	515	784	1067	1465
	18,5	2,5	0	68	109	163	225	267	420	639	869	1194
	22	4	0	0	90	134	186	221	347	528	719	988
	26	6	0	0	0	117	163	193	303	461	627	861
	30	6	0	0	0	100	138	164	258	392	532	730
37	8,4	0	0	0	0	110	130	205	312	424	583	
Cable cross-section [mm²]			1,5	2,5	4	6	8,4	10	16	25	35	50

Table 5: Maximum cable lengths for 6" motors with wye-delta starting, a voltage of 400 V / 50 Hz and a voltage drop of 5%.

You should take the min. cross-section acc. to IEC364 (VDE298 part 4) into account.

Motor power			Cable cross-section [mm ²]											
	kW	min. cross-section in mm ²	8,4	10	16	25	35	50	70	95	120	150	185	240
8"	30	8,4	138	164	258	392	532	730	972	1243	1479	1736	2002	2358
	37	8,4	110	130	205	312	424	583	779	999	1192	1403	1623	1917
	45	10	0	115	180	273	372	511	682	875	1043	1227	1418	1674
	52	16	0	0	160	240	320	440	590	760	910	1060	1230	1450
	56	16	0	0	146	222	303	416	556	713	850	1001	1157	1367
	60	16	0	0	136	206	280	384	511	645	778	912	1052	1238
	67	16	0	0	122	185	252	345	461	590	703	826	954	1126
	75	25	0	0	0	168	229	315	421	541	646	762	882	1044
	83	25	0	0	0	150	210	280	380	490	580	680	790	940
	93	35	0	0	0	0	180	248	332	427	511	602	698	828
Cable cross-section [mm²]			8,4	10	16	25	35	50	70	95	120	150	185	240

Table 8: Maximum cable lengths for 8" motors with wye-delta starting, a voltage of 400 V / 50 Hz and a voltage drop of 5%.

If the operating voltage U_B in your installation deviates from the nominal voltage U_N , you can calculate the permissible maximum length L_{MAX} as follows:

You should take the min. cross-section acc. to IEC364 (VDE298 part 4) into account.

$$L_{\text{Max}} = L_{\text{TAB}} (U_B / U_N)^2 \quad L_{\text{TAB}} = \text{table value}$$

1. This chapter assumes that

- the motor has been correctly assembled, as described in chapter „D“,
- the insulation resistance has been measured with motor cable and has been found correct, as described in chapter „D“,
- the completely assembled aggregate has been correctly installed at the place of use, as described in the instructions of the manufacturer.



Caution!

For your safety!

Before making any connections you must first make sure that

that the complete system is electrically dead and

nobody is able to accidentally switch the power on, while work on the system is in progress.

Do not work on electric installations if there is the risk of a thunderstorm or during a thunderstorm. Lightning can cause dangerous surge voltage.

There is an **acute threat to life** by electric shock if you do not observe these notes.

2. The power supply

must at least meet the following demands, to avoid damage to motor and undesired feedback effects to the supply network:

a) Power supply by mains connection

The following tolerances must not be exceeded, as otherwise the motor may be damaged:

- The total voltage tolerance must be within the range from -10% bis +6% (measured on the motor terminals).
- The deviation of the motor current from the mean value of all three currents must not exceed max. 5%.

b) Power supply by generator



Attention!

The applicable tolerances from mains supply must also be applied by power supply via generators!

When operating a motor via a generator please bear in mind that the starting current of the motor is five times the nominal motor current and that a mean cos phi of 0,6 for starting can be expected.

Also make additionally sure that a sufficient generator power is permanently available (see table 7) and that the voltage must be at least 65% of the nominal voltage during starting.

Motor power [kW]	Generator power [kVA]
3,7	18,75
5,5	25
7,5	37,5
11	50
15	75
18,5	94
22	125
30	125
37	188
45	220
55	313
75	375
93	469
110	563
130	656
150	750

Table 7: Required permanent generator power

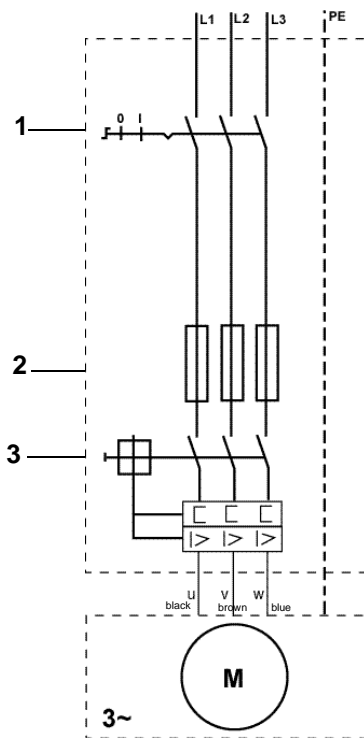
3. Connecting the motor

Also in this case observe the specifications of the motor type plate and dimension the electric installation accordingly.

The following connection examples refer only to the motor - they are no recommendation with respect to the preceding control elements!

The installation electrician is solely responsible for the correct planning and execution of the complete system.

a) Fusing and motor protection



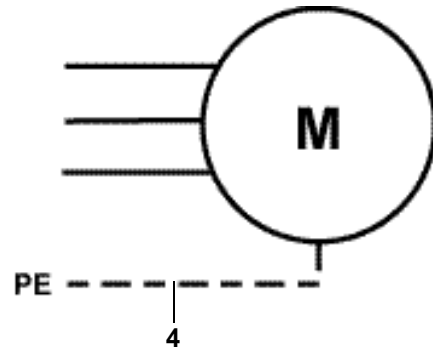
Plan the installation of an external **mains switch** (1) so that you can cut the voltage supply off at any time - e.g. in case of danger or when working on the installation.

Plan the installation of **fuses** (2) for each individual phase at the place of use.

Plan the installation of a **motor starting and protection switch** (3) as shown in the following connection descriptions for the respective models.

You should also plan the installation of an **emergency shut-off**, as far as this is specified or found necessary for your application!

b) Earthing

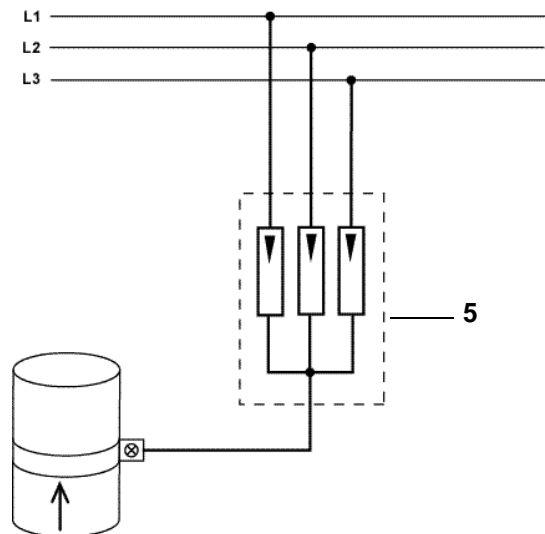


When **dimensioning** the **ground connection** (4) you must particularly consider the motor power.

Expert rules can be found in EN 60099 VDE 0675 and IEC 64 (VDE 0100) and in the European standards.

The motor must be earthed. Ensure a correct **protective conductor connection** (4) according to IEC 64 (VDE 0100) - especially for a good contact!

c) Surge voltage protection



Consider the installation of an appropriate **surge voltage protection (lightning protection)** (5) in the supply line.

d) 6" and 8" 3-phase model

Motors from Franklin Electric are suitable for both clockwise and anti-clockwise rotation -depending on the connection:

The motor **rotates in anti-clockwise direction** (looking onto the motor shaft), if ..

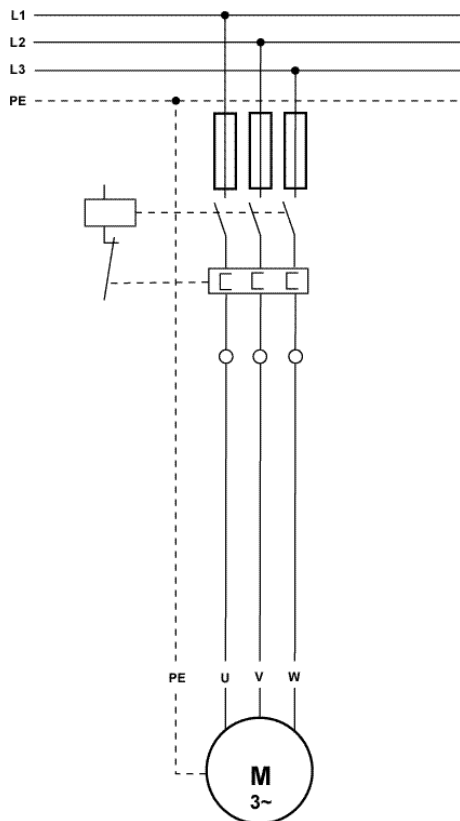
- the conductor sequence L1 - L2 - L3 provides a **right-hand field** (you can check this with a rotating field tester)
- and you connect the motor as shown (L1-U, L2-V, L3-W).

The motor rotates **in clockwise direction**, (looking onto the motor shaft), if

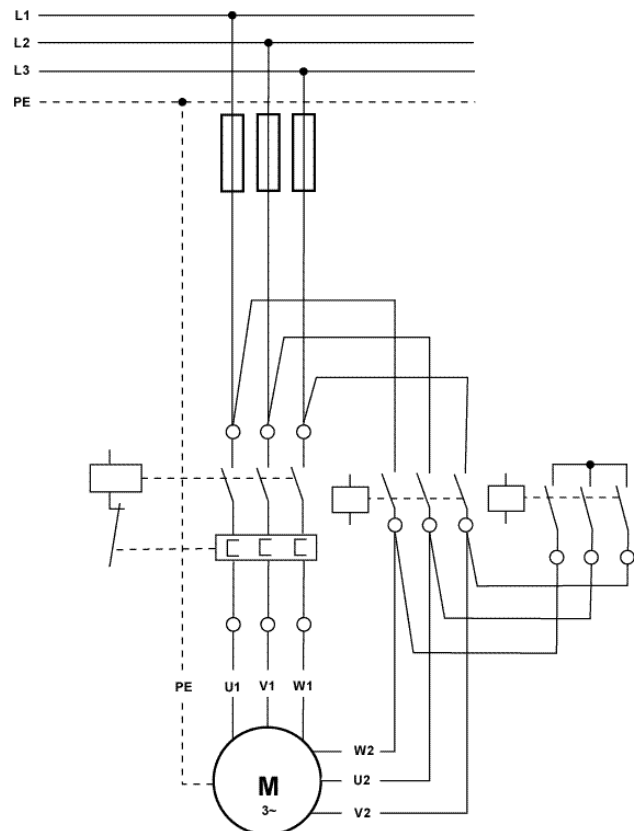
- the conductor sequence L1 - L2 - L3 provides a **left-hand field** and you connect the motor as shown,
- or if you exchange any two **conductors** (e.g. L3 - U, L1- W) in a **right-hand field**.

Connect the **motor** so that the sense of rotation matches the load requirements. The connection examples show the common connection for a right-hand field and an anti-clockwise rotation.

e) Direct starting



f) Wye-delta starting



A **motor protection switch** (over load relay) is strictly required!

For this purpose use only:

- **thermal trips** with a temperature compensation of 20 °C to 40 °C of triggering class 10A or 10 according to EN 60947-4-1 (acc. to VDE 0660 part 102),
- with which the **tripping time** at 500% I_N occurs within 10 seconds (on the basis of cold bi-metals),
- and which are phase-insensitive.

Set the motor protection unit to the value of the measured operating voltage, but **never exceed nominal motor current I_N** (acc. to motor name plate). We recommend an adjustment to 90% of the nominal motor current.

g) Connection to frequency converter

If you want to operate the motor with a frequency converter for variable control of motor speed, you must observe the following points must be observed:

- Make sure that a **coolant speed according to table 1** is ensured when operating the motor with a frequency converter at nominal load of the motor. Due to the higher electric losses of the motor during operation with a frequency converter the **motor load must be reduced** by 5% compared with the normal nominal load.
- Adjust the frequency converter so that the **limit values of min. 30 Hz and max. 80 Hz** are not exceeded. For operation with a frequency converter the maximum **acceleration time** and the maximum **deceleration time** is **3 seconds**.
- When operating the motor with a frequency converter you must strictly limit the **voltage peaks** to the values specified in **EN 60034 (VDE 0530 appendix 2)** (max. allowable rate of rise of applied forward voltage **500V/μs** and max. voltage peak **1000V**). According to experience additional measures must be applied when using **cable lengths of more than 50m** between frequency converter and motor. In

this respect consult the manufacturer of the frequency converter.

- For connection and commissioning of the motor strictly observe the **instruction manual** for the frequency converter.

h) Connection to soft starting units (soft starter)

If you want to operate the motor with a soft starter, you must observe the following points;

- Set the **starting voltage** of the soft starter to 65 % of the nominal voltage
- and the **acceleration time** as well as the **deceleration time to maximum 3 seconds**.
- After acceleration the soft starter should be **bypassed by means of a contactor**, as otherwise the resulting losses in the motor would be too high. This can lead to an **overheating of the motor at nominal power**.

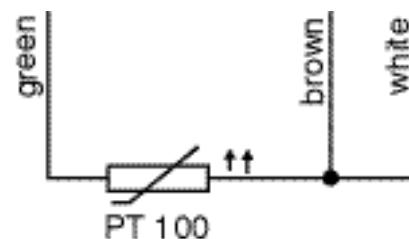
In this respect consult the manufacturer of the soft starter.

When connecting and commissioning the motor observe strictly the instructions for the respective soft starter!

i) Thermal monitoring

For rewindable motors PT 100 temperature sensors are optionally available. For 6" motors these must be ordered together with the motor. On 8" motors these can be installed at a later date.

For the compensation of wiring resistances we have chosen the three-phase technology as type of connection.



PT 100 evaluation units are commercially available in professional electric control stores or your pump supplier.

The **resistance values** of the PT 100 sensors are **standardized**. The characteristic is linear. At 0°C the resistance is 100 Ohm and at 100°C 138,5 Ohm.

As a measure to avoid winding damage caused by overheating, the winding temperatures listed in table 8 must be observed and the respective tripping units must be adjusted.

Insulation material	Motor rating	Maximum winding temperature
PVC	6" motor 4 ... 30 kW 8" motor 30 ... 75 kW	55 °C
PE	6" motor 37 kW 8" motor 38 kW, 93 kW	75 °C

Table 8: Maximum winding temperatures

1. This chapter assumes that

- the motor is correctly assembled with the **pump**, as described in chapter „D“,
- the motor is correctly **connected and fused**, as described in chapter „D“,
- the **insulation resistance has been measured with motor cable** and found correct, as described in chapter „D“,
- the completely assembled aggregate has been **correctly installed at the place of use**, as described in the instructions of the manufacturer.

2. Before starting to operate the motor

make sure that

- the motor is fully submerged. The motor must only be operated **under water**.
- the **riser pipe or drop has been bled**, to avoid water strokes during starting. Otherwise both aggregate and pumping pipes may be damaged.
- the conditions for commissioning specified by the manufacturer of the load are met.
- all electric connections and protective installations have been **checked** and fuses and circuit breakers are correctly **adjusted**.
- **access to dangerous points has been eliminated**, particularly to rotating parts, suction ports or pressure outlets and electrical connections.
- for motors with original filling the **temperature of the medium** does not drop below -8 °C and for motors with water filling not below 0 °C.

Otherwise you must not start to operate the motor, since this could cause **danger of accident** and damage to the motor!

3. With generator supply

the switching sequence is of utmost importance. If you do not apply this correctly, both motor and generator may be **damaged**.

Therefore:

- Always switch the **generator on and off without load!**

This means:

- **Starting:** always **switch the generator ON first** - and the motor after!
- **Stopping:** always **switch the motor OFF first** - and the generator after!

4. Switching the motor on

Once you have checked all above mentioned points and all adjustments are correct, you may now switch the motor on:

- Measure when switching on
- the **operating current** of the motor for each phase,
- the **mains voltage** while the motor is running,
- the **level** of the medium to be pumped.
- **Switch the motor immediately OFF**, if
- the **nominal current** according to the specification on the type plate is exceeded,
- **voltage tolerances** of more than +6%/-10% of the nominal voltage are measured. For weak supply networks we recommend the installation of a voltage monitor!
- **dry-running** can be expected. In case of unregular supply it is necessary to install a level switch, as a measure to prevent dry running.
- die Abweichung eines Motorstromes vom Mittelwert aller drei Ströme größer als 5% beträgt.

5. During test operation:

Each start applies heat to the motor. Particularly a high frequency of starts contributes to the reduction of the lifetime of the motor!

You should therefore make sure, that the values specified in the technical data concerning the **frequency of start** are not exceeded, even during test operation!

1. General



Warning!

For your safety!

Please observe especially the safety regulations mentioned hereunder. Otherwise there is a risk of accident and a threat to life.

- **Do not perform any other work to the motor than the tasks described in this manual.** Otherwise the engine may be damaged, whereby the operating safety of the system can no longer be assured. Due to the partly quite high driving and pumping forces **considerable risks for accidents** may then arise, **even danger to life** caused by electric shock.
- For trouble shooting and fault rectification on the complete system you must strictly observe the respective notes in the instruction manual of the pump manufacturer.
- **Do not open the motor!** Without the use of special tools the motor cannot be closed again correctly. This would destroy the motor.
- This does not refer to the previously described inspection of the fluid level.
- **Do not carry out any changes or modifications to the motor or the electric connections.** Otherwise the safety of the motor cannot be assured.
- **Work must only be performed with the motor stopped!** No work or inspections are required while the motor is running.
- **The aggregate may be contaminated** when taking it out of a medium, with which health impairing effects cannot be ruled out. **Rests of medium** may accumulate in the bore at the bottom of the **diaphragm cover**, which may then drain out unexpectedly.
- **Mark contaminated motors or aggregates,** before handing them over to third persons (e.g. before returning for repair).
- **Disconnect the voltage supply** before starting the work described hereunder.

- Make sure that nobody **can switch the voltage supply back on by accident** while work on the system is still in progress!
- Do not work on electric equipment during a thunderstorm or if a thunderstorm is expected.
- Make sure that **all guards and safety installations have been completely reinstalled and are fully functional immediately after completing work.**

2. What to do!

The motor is **maintenance free**. No preventive or regular service work is required.

a) In case of electric problems

e.g. in case of repetitive switching off you should have the insulation resistance checked by a specialist, as described before.

- Disconnect the motor connection cable from the system and measure **motor and cable** first of all together. If the insulation resistance is less than 20 kOhm you must have your motor repaired in a workshop authorized by Franklin Electric - or you must install a new motor.
- **Is it neither motor, nor cable?** Have the electric system checked by a specialist.

b) In case of mechanical or hydraulic problems

e.g. unusual noises, concentricity faults of the pump or too frequent switching on or off of the pump, you must perform trouble shooting for the aggregate.

- In this context refer to **instructions of the pump manufacturer** to find the cause of the problem.