

# PS Pool CS Series Solar Surface Pump Systems

Manual for Installation, Operation, Service



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All specifications and information are given with good intent, errors are possible and products may be subject to change without notice. Pictures may differ from actual products depending on local market requirements and regulations.

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## 1 Introduction

**Thank you for purchasing a LORENTZ pump system.**

**Before you begin** – All pump systems are equipped with nameplates, which contain all important data. Check the model numbers of all the components of your system to verify that they are items that you ordered and ensure that the packaging is undamaged and complete.

Also check against the pump specifications to be sure the system is appropriate for your application.

**Please fill in the SYSTEM REPORT!**

This will be essential information if any problems occur.

## 2 Storage and Handling

LORENTZ pumps are supplied from the factory in proper packing in which they should remain until they are to be installed. Handle the pump with care and avoid unnecessary impacts and shocks.



**CAUTION – Do not attempt to use the controller for any purpose other than LORENTZ PS pump systems. Do not attempt to run the motor without the controller.**

Prolonged intermediate storage in an environment of high humidity and fluctuating temperatures must be avoided. Moisture condensation may damage windings and metal parts. Non-compliance will void any warranty. It is recommended that you store the parts in a closed and dry room.

The motor and the pump end can be stored (not used) in the range of  $-30^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$  to  $+131^{\circ}\text{F}$ ), the PS Controller in a range of  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$  to  $+122^{\circ}\text{F}$ ). The components should not be exposed to direct sunlight.

## 3 Operating Conditions

The pump should be sited in a well-ventilated and frost-free position. The distance between the pump unit and other objects should be at least 150 mm / 6" in order to ensure a proper air circulation.

If the pump is installed outside, the pump must be protected from rain and direct sunlight. This will increase the durability of your pump.

Table 1: Permitted ambient temperatures

Controller	$-30^{\circ}\text{C}$ to $+50^{\circ}\text{C}$	$-22^{\circ}\text{F}$ to $+122^{\circ}\text{F}$
Pump unit (pump end + motor)	$0^{\circ}\text{C}$ to $+50^{\circ}\text{C}$	$+32^{\circ}\text{F}$ to $+122^{\circ}\text{F}$
Fluid temperature	$0^{\circ}\text{C}$ to $+60^{\circ}\text{C}$	$+32^{\circ}\text{F}$ to $+140^{\circ}\text{F}$



**WARNING – If there is a danger of freezing, the pump must be drained in good time. To do this, open the drain plug to drain off all liquid. Also drain all pipes that may be subject to freezing.**

**Fluid** – PS solar pump systems for pools can be used in chloride water, salt water and sea water swimming pools. When used in salt and sea water pools, the pump must be inspected and cleaned regularly.

**Humidity and air salinity** – The pump system must not be operated where daytime average humidity is above 80 % or in saline air with more than  $2\ \mu\text{g}/\text{m}^3$ .

**Altitude** – The pump system must not be installed at altitudes above +3,000 m / +9,840 ft mean sea level (other altitudes on request).

**Operating noise** – Make sure, by applying appropriate measures, that the local environment will not be impaired by pump operating noise.

Table 2: Operating noise

Pump system	Max. noise level
PS600 CS-17-1	65 dB
PS1800 CS-37-1	68 dB

## 4 Declaration of Conformity

We, BERNT LORENTZ GmbH & Co. KG Germany, declare under our sole responsibility that the products

**PS600 Pool CS-17-1**  
**PS1800 Pool CS-37-1**

to which the declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to:

- Machinery (2006/42/EC)
- Electromagnetic compatibility (2004/108/EC)
- Electrical equipment designed for use with certain voltage limits (2006/95/EC)

Henstedt-Ulzburg, Germany  
1 January 2013



Bernt Lorentz, CEO

## 5 Certification

### 5.1 MET

Electrical Safety



Certified according to UL standards as follows:

- **Controller: UL 508** seventeenth ed. Industrial Control Equipment, Rev. Jan. 28, 1999 and **CSA C.22.2 No 14**, eleventh ed. Industrial Control Equipment, Rev. Feb. 1, 2010
- **Pump unit** (or also called surface pump): **UL 1081** sixth ed. Swimming Pool Pumps, Filters and Chlorinators Rev. January 29, 2008 and **CSA 22.2 No 108**, fourth ed. Liquid Pumps, Rev. January 2001
- **Surface motor: UL1004** fifth ed. Electric Motors and **CS22.2 No 100** sixth ed.: Motors and generators

### 5.2 NSF/ANSI 50



Certified according to NSF/ANSI 50 standards

## 6 Safety Instruction

Safe operation of this product depends on its correct transportation, installation, operation and maintenance. Failure to follow these instructions can be dangerous and/or void the warranty.

# READ AND FOLLOW ALL INSTRUCTIONS!

When installing and using this electrical equipment, basic safety precautions should always be followed, including the following:



**WARNING** – To reduce the risk of injury, do not permit children to use this product unless they are closely supervised at all times.



**WARNING** – To reduce the risk of electric shock, replace damaged cords or cables immediately.



**WARNING** – It must be ensured that all grounding connections are properly made and that the resistances meet local codes or requirements.



**WARNING** – This pump is for use with permanently-installed pools. Do not use with storable/temporary pools. A permanently-installed pool is constructed in or on the ground or in a building such that it cannot be readily disassembled for storage. A storable pool is constructed so that it is capable of being readily disassembled for storage and reassembled to its original integrity.

# RETAIN THESE INSTRUCTIONS FOR FUTURE USE!

- The manual contains basic instructions which must be observed during installation, operation and maintenance. Before installation and start-up, the manual should be carefully read by the person in charge of the installation. The manual should also be read by all other technical personnel/operators and should be available at the installation site at all times.
- **Personnel qualifications and training** – All personnel for the operation, maintenance, inspection and installation must be fully qualified to perform that type of job. Responsibility, competence and the supervision of such personnel must be strictly regulated by the operator. Should the available personnel be lacking the necessary qualification, they must be trained and instructed accordingly. If necessary, the operator may request the manufacturer/supplier to provide such training. Furthermore the operator/user must make sure that the personnel fully understand the contents of the manual.
- **Dangers of ignoring the safety symbols** – Ignoring the safety directions and symbols may pose a danger to humans as well as to the environment and the equipment itself. Non-observance may void any warranties. Non-observance of safety directions and symbols may for example entail the following: Failure of important functions of the equipment/plant; failure of prescribed methods for maintenance and repair; danger to persons through electrical, mechanical and chemical effects; danger to the environment because of leakage of hazardous material; danger of damage to equipment and buildings.
- **Safety-oriented operation** – The safety directions contained in the manual, existing national regulations for the prevention of accidents as well as internal guidelines and safety-regulations for the operator and user must be observed at all times.
- **General safety directions for the operator/user** – If hot or cold equipment parts pose a danger then they must be protected by the operator/user against contact with people. Protective covers for moving parts (e.g. couplings) must not be removed when the equipment is running. Leaks (e.g. at the shaft seal) of hazardous pumping media (e.g. explosive, toxic, hot liquids) must be disposed of in such a way that any danger to personnel and the environment is removed. All government and local regulations must be observed at all times. Any danger to persons from electrical energy must be eliminated by using good installation practices and working to local regulations (e.g. VDE in Germany).
- **Safety directions for maintenance, inspection and assembly work** – It is the user's responsibility to make sure that all maintenance, inspection and assembly work is performed exclusively by authorized and qualified experts sufficiently informed through careful study of the Operating Instructions. The accident prevention regulations must be observed. All work on the equipment should be done when it is not operational and ideally electrically isolated. The sequence for shutting the equipment down is described in the manual and must be strictly observed. Pumps or pump units handling hazardous liquids must be decontaminated. Immediately upon completion of the work, all safety and protective equipment must be restored and activated. Before restarting the equipment, all points contained in chapter "Initial start-up" must be observed.
- **Unauthorized changes and manufacturing of spare parts** – Any conversion of or changes to the equipment may only be undertaken after consulting the manufacturer. Original spare parts and accessories authorized by the manufacturer guarantee operational safety. Using non-authorized parts may void any liability on the part of the manufacturer.
- **Unauthorized operation** – The operational safety of the equipment delivered is only guaranteed if the equipment is used in accordance with the directions contained in this manual. Limits stated in the data sheets may not be exceeded under any circumstances.
- **Cited standards and other documentation** – DIN 4844 Part 1 Safety marking; Safety symbols W 8, Supplement 13; DIN 4844 Part 1 Safety marking; Safety symbols W 9, Supplement 14
- **Ensure all power sources are disconnected when working on the system. Follow all appropriate electrical codes. There are no user-serviceable parts inside the motor or the controller.**

### Explanation of Warning Symbols



**WARNING** – Disregard might lead to injury or damage of the installation.



**CAUTION** – Recommended to avoid damage or premature ageing of the pump etc.

## 7 Product Description

**LORENTZ PS surface pumps for pools** are high-quality products designed for use in residential and commercial swimming pools and spas.

In most pool applications all of the filtration needs can be met directly from solar panels meaning no electricity costs and significant benefits to the environment.

The system is composed of a PV generator array, a pump and a solar pump controller. See "Figure 1: Components of a solar pool pumping system" below.

**The PV generator**, an aggregation of PV modules connected in series and in parallel, absorbs solar irradiation and converts it into electrical energy, providing power for the whole system. The pump controller controls and adjusts the system operation to drive the pump.

**The PS Controller** starts the pump slowly and adjusts its speed according to the pumping load and the power available from the solar array. Power output from the array is optimally matched to the load by **maximum power point tracker (MPPT)** and **linear current booster (LCB)** functions, to produce maximum power transfer throughout all conditions. The LCB function is analogous to an automatic transmission in an automobile. It starts the pump in "low gear" (it lowers the array voltage and boosts the current). Under low sun conditions, it stays in "low gear" to resist stalling. As sunlight increases, it advances continuously toward "high gear" (higher voltage). The MPPT system refines the LCB function by tracking changes in the array voltage. Array voltage varies primarily with temperature (it is higher at low temperatures). When the pump stalls in low sunlight, the controller switches the pump off.

The controller converts the DC power from the solar array to digitally created DC signal to run the motor. Due to the special nature of this pulse-width modulation (PWM) signal it cannot be measured with a multimeter. Motor speed (RPM) is proportional to the signal frequency and increases gradually up to maximum of 3,300 RPM.

- All parts in contact with the pumping medium are mostly of polypropylene PP, the impeller consists of PPO and thus the parts possess excellent corrosion resistance against the pool water and the usual chemicals for treatment of the pool water.
- The pump housing does not contain any inserts, therefore it can easily be recycled.
- The motor shaft also serves as the pump shaft on which the impeller is mounted. The seal for the shaft is a bellows-type mechanical seal arranged on a plastic impeller hub. This guarantees positive electrical separation between the pool water and the electric motor.
- Because of the pump's close-coupled design, a minimum of space is required.
- Integrated in the pump housing is a strainer basket, which keeps coarse impurities from the pump's interior.

The LORENTZ PS Surface Pumps for Pools have the following benefits and features:

- Zero energy costs provide a very fast return of investment
- MPPT technology to maximize power use from PV modules
- Long life expectancy and proven in-service record
- Quiet and efficient
- Smart modular design for simple and cost effective servicing and repair
- Fast and simple installation, direct replacement for an existing pool pump
- Engineered in Germany
- LED display operating panel
- High-quality non-corrodible materials used throughout
- Solar direct connect with AC connection options
- ECDRIVE DC brushless motors, designed for solar with up to 90 % efficiency
- Optional DataModule with integral data logger and remote control

### Pump model definition for PS Pool CS-17-1 and PS Pool CS-37-1 pumps

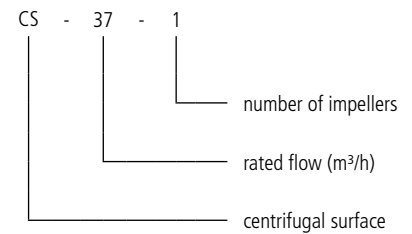
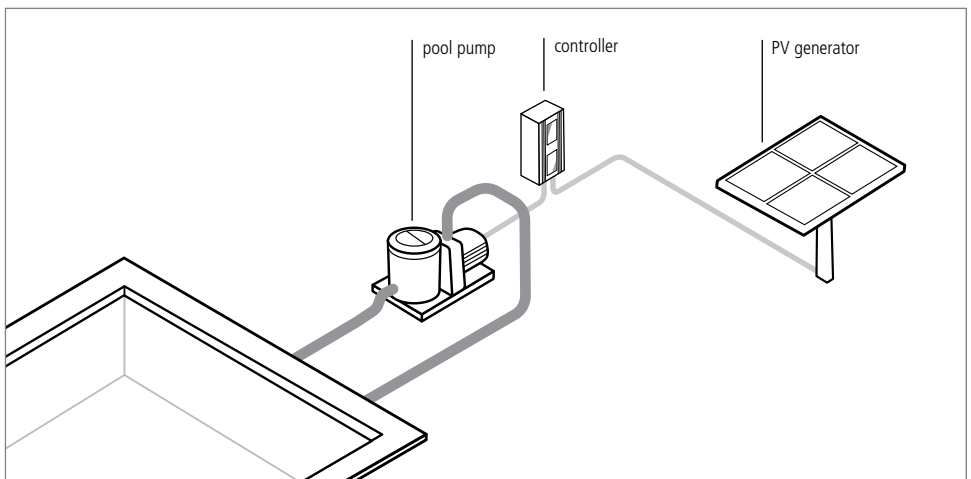


Figure 1: Components of a solar pool pumping system



## 8 Electrical Installation

### 8.1 General



**WARNING – All electrical connections should be performed by qualified experts only!**

The pump system must be equipped with a properly sized DC disconnect switch. The switch must be installed between the solar generator and controller. It must meet the following requirements:

- minimum 200VDC
- continuous current rating according to maximum current of pump controller or higher
- the switch must be rated for DC current, **NOT AC**

A PV disconnect switch, matching all of the requirements above, can be purchased from LORENTZ.



**WARNING – The use of a properly sized disconnect switch is an important safety measure and obligatory for a professional installation of a solar pumping system.**

**Electrical conduit is recommended.** We recommend the use of electrical conduit (pipe) to protect outdoor wiring from the weather, from people and from animals. If you do not use conduit, use strong, high-quality outdoor cable. Where cables enter the junction box, install sealed strain-relief cable glands.



**WARNING – The use of pumps for swimming pools and the restricted area around them is only permitted if pumps are installed in accordance with DIN/VDE 0100 part 702 or other local standards. Please consult your licensed electrician!**



**WARNING – A cord and plug connected unit shall be provided with a permanently attached flexible cord of a water-resistant type, e.g. SEW, SEOW, SJW, SJOW, SJEW, SJEOW, SJTW, SJTOW, SOW, STW, or STOW. When the pump is connected by cable, use extra-hard type (toughened) cable for connections.**



**WARNING – When the motor is installed within 1.5m/5ft of the inside walls of a swimming pool, spa, or hot tub, a solid-copper bonding-conductor not smaller than 8.4mm<sup>2</sup>/AWG 8 must be connected from the accessible wire connector on the motor to all metal parts of the swimming pool, spa, or hot tub structure and to all electrical equipment, metal conduit, and metal piping within 1.5m/5ft of the inside walls of the swimming pool, spa, or hot tub.**

### 8.2 Controller placement

Place the controller close to the solar array, not the pump. This will reduce the risk of lightning damage. The controller's input circuitry is more sensitive to surges than its output. It is safest to minimize the length of the input wiring.

Electronic devices are most reliable when they are protected from heat. Mount the controller in the shade of the midday sun, e.g. directly under the solar array. If no shade is available, cut a piece of sheet metal and bolt it behind the top of the controller. Bend it over the controller to provide shade. This is especially important in extremely hot locations. Extreme heat may trigger a thermal switch in the controller and cause it to turn off. If possible, place the controller in a dry and sufficiently ventilated environment. This will increase the durability of the controller.



**CAUTION – To ensure effective cooling, installation inside an additional enclosure must be avoided. If this procedure is unavoidable allowance must be made for convective air flow from the bottom to the top of this extra enclosure!**

Use the rubber plugs to seal the unused conduit holes in the bottom of the controller to ensure that the controller is sealed from moisture, insects, etc.

Figure 2: Controller dimensions for installation

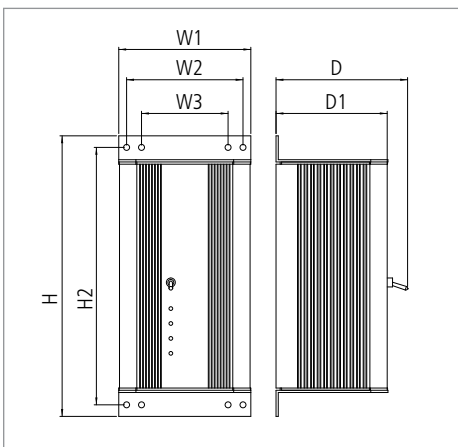


Table 3: Controller dimensions for installation

Model	Dimension [mm]						Weight [kg]	
	W1	W2	W3	H	H2	D		D1
<b>PS600 Pool</b>	178	156	116	395	364	165	150	4.5
<b>PS1800 Pool</b>								



### 8.3 Controller terminal wiring

The LORENTZ PS Pool controllers are available as a standard version with conduit fittings and rubber caps or with prewired plug connections. Plug connections are easy to assemble without opening the controller housing. The socket parts of the plug connections are prewired and preassembled in the controller housing.

If using the standard controller version, open the housing by unscrewing the four screws on the bottom cover. After removing the cover the terminal rail will slide out for easier access. If the controller with prewired plugs is used, pay attention to chapter "8.3.5 Controller with plug connection". All warnings and instructions mentioned for the wiring of the standard controller version must be considered and strictly observed.

Before starting to work on the electrical system make sure that all components are disconnected from the power source. Only switch on the system when you have finished all work.



**CAUTION – Loose connections are the most common cause of system failures. Pull each wire connection SLIGHTLY to confirm that it is tightened securely.**

Figure 3: PS controller



Figure 4: Bottom of controller with prewired plugs



Figure 5: Controller terminals

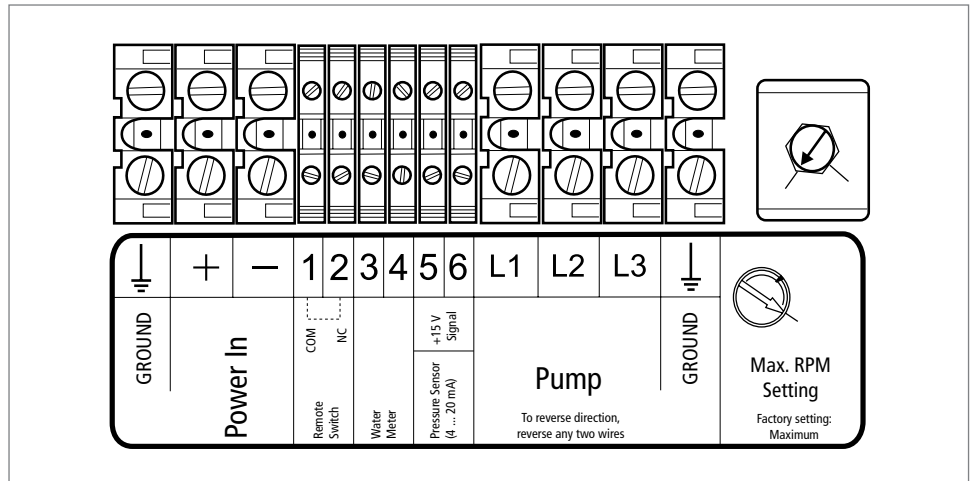


Table 4: Controller terminals

Name	Terminal	Connection
Ground	⊕	To proper ground
Power in	+	To positive terminal of solar generator
	-	To negative terminal of solar generator
Sensors	1	Common ground for 2
	2	Remote switch NC
	3	To water meter
	4	
	5	To pressure sensor according to sensor manual Observe polarity of sensor
	6	
Pump	L1	To motor phase 1
	L2	To motor phase 2
	L3	To motor phase 3
	⊕	To protective motor ground wire

### 8.3.1 ECDRIVE wiring

The ECDRIVE must be connected to the terminals L1, L2, L3 and GROUND. The ECDRIVE requires four-conductor (four-wire) cable between the controller and the motor. The three wires L1, L2 and L3 carry power. The fourth wire carries ground. Connect the ground wire to the ground connection in the controller. Grounding helps to prevent shock hazard if there is a fault in the motor.

The correct order of the three motor phases is marked on the motor cables. Prior to splicing the order of the motor phases should be transferred to the cable. This will simplify the wiring.



**WARNING – No disconnect switches must be installed in power wires between the motor and pump controller. Connecting the motor wires to a switched-on controller may cause irreparable damage which is excluded from the warranty.**



**WARNING – If the pump wires are in the wrong order, the motor will run in reverse and may damage the pump. Never let the pump run dry, not even for the purpose of checking the direction of rotation.**

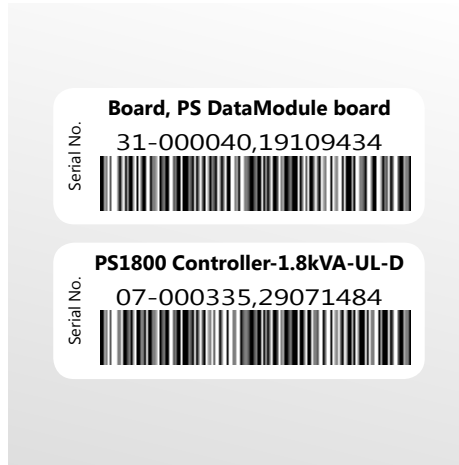
Check the correct rotation direction after the pump is filled with water, see chapter “9.6 Initial start-up”.

### 8.3.2 Pump accessories wiring

**Terminals 1 and 2** – Connect any kind of external switch (NC type) for remote control of the controller. If no switch is used the terminals have to be connected with a jumper cable (factory setting).

**The following terminals are only used if the PS DataModule is installed.** If you are not sure whether a DataModule is preinstalled check the controller housing for the following label.

Figure 6: DataModule label on controller housing



**Terminals 3 and 4 (only with DataModule)** – Install a water meter in the pipeline and connect it to terminals 3 and 4. An impulse input of the water meter between 1l/impulse to 10l/impulse is recommended. The DataModule can handle up to 1,000 impulses per second. The flow can be viewed with the LORENTZ PumpScanner software.

**Terminals 5 and 6 (only with DataModule)** – Connect the cables of the pressure sensor to terminals 5 and 6. The input voltage is 15V DC, the current (signal) range 4 mA to 20 mA and the load impedance 100 Ω. Choose a pressure sensor which works with these characteristic values. Control and monitor the pump system with the PumpScanner software.



**WARNING – Never connect anything other than a suitable pressure sensor to terminals 5 and 6 (never create a short circuit). Otherwise the DataModule will be damaged immediately. Observe the polarity of the pressure sensor.**

### 8.3.3 Input wiring for solar-direct systems

The solar array can produce hazardous voltage even under low light exposure. To prevent shock hazard while wiring the array, leave one or more wires disconnected or cover the array with opaque material.



**WARNING – An input voltage higher than specified below will damage the controller and void the warranty. Damage may occur if the solar generator array is wired incorrectly. Measure the voltage and confirm the polarity BEFORE connecting the power to the controller.**

Table 5: Maximum controller input voltage

Pump system	Max. input voltage
PS600 Pool	150V DC
PS1800 Pool	200V DC

Solar-direct systems use a variety of array configurations. PV modules can be connected in series and also in parallel. Refer to the System Wiring Diagram which is provided by COMPASS and to the module manufacturer’s instructions that are packed with the modules. Make strong connections that will hold for many years. Most array failures are caused by loose, corroded or shorted connections.



**WARNING – Do not connect any electrical load to the solar array if it is not part of the LORENTZ Pump System. Connection of a battery charger, active solar tracker controller, electric fence charger, or other load simultaneously with LORENTZ PS systems may “confuse” the controller and prevent proper operation.**

### 8.3.4 Grounding

Grounding is mandatory to protect the users from potentially fatal electric shocks. It also protects against electric charging or a short circuit inside the device. This is accomplished through clamping, bolting or other mechanical means to provide an effective grounding path to the earth to ensure safe operation at all time.


The grounding cable is a copper cable with a cross section of not less than 10 mm<sup>2</sup>/AWG 7. The grounding profile rod should be located 4–5 m/13–16 ft from the controller. The cable must not carry any mechanical loads. The rod must be completely buried in the ground. In any case you need to refer to local standards and requirements.

### 8.3.5 Controller with plug connection

**Read this section only if you ordered the PS controller with the prewired plugs.**

The socket parts of the plug connections are prewired and preassembled in the controller housing. The counterparts, which are included in the delivery, must be connected to the wires.

**Plug W** – “Figure 7: Plug W for motor cable” below shows the arrangement of the pins. The pins are numbered and the plug has small grooves, which ensure correct assembly. The following configuration must be maintained to:

- Pin 1: motor cable L1
- Pin 2: motor cable L2
- Pin 3: motor cable L3
- Pin : motor grounding cable

**Mini plug** – For the connection of the pump accessories (water meter, pressure sensor, etc.) the mini plug is used, see “Figure 8: Mini plug for pump accessories”.

Cut the wire of the plug in half and splice the cables of the corresponding pump accessory to it. Use a proper crimping tool and sleeves matching the cable size. The polarity does not matter. If a plug socket is not used plug it into the socket of the controller housing without cutting the wire in half – mini plugs are connected as normally closed to the controller terminals.

**MC4 plug** – A male and a female MC4 plug is prewired to the controller, type PV-KBT4/6II-UR and PV-KST4/6II-UR. The counterparts are not included in the delivery, see “Figure 9: MC4 plug for power input”.

Figure 7: Plug W for motor cable



Figure 8: Mini plug for pump accessories



Figure 9: MC4 plug for power input



## 9 Pump Installation



**CAUTION** – This pump is for use with permanently-installed pools. Do not use with storable/temporary pools. A permanently-installed pool is constructed in or on the ground or in a building such that it cannot be readily disassembled for storage. A storable pool is constructed so that it is capable of being readily disassembled for storage and reassembled to its original integrity.



**WARNING** – The drain hole/pipe on the bottom between pump housing and motor must never be clogged or sealed. Blocking the drain hole will result in an internal build-up of water which will damage the motor! Ensure that any drainage cannot cause consequential damage! If necessary provide a suitable drip pan.

### 9.1 Placement and foundation

**Rain and weather protection** – The pump is equipped with IPX4-type motor protection. If it is installed outside, the pump must be protected from rain and direct sunlight. This will increase the durability of your pump.



**WARNING** – If the pump is installed in a humid area, effective ventilation and aeration must be provided, in order to prevent condensation.



**WARNING** – When installing in very small spaces the natural cooling may be insufficient and additional ventilation may be required. Carefully consider the ventilation in order not to exceed the maximum ambient temperature.

During installation, make sure that there is enough space available to permit subsequent disassembly of the motor unit in the direction of the motor fan (minimum 120 mm/4.7") and of the strainer basket above (minimum 140 mm/5.5").

Installing the pump on a concrete foundation is recommended. The foundation must be completely even and level. Its purpose is to absorb vibration and strain in addition to preventing stress on pipe flanges.



**WARNING** – The pump might heat up in operation. The pump must not be installed on combustible surfaces. Strong incombustible surfaces should be used, e.g. cement or stone surfaces.

**Connecting the pump to the foundation** – Fastening the pump to the foundation should be done exclusively by means of M8 bolts or threads (dowels) in order to avoid any movement of the pump unit.



**WARNING** – The pump must be mounted in horizontal position.

### 9.2 Pipe sizing

LORENTZ pump systems are extremely efficient. It is important to keep this efficiency throughout the entire system. A main reason for loss of efficiency is pipe pressure losses. Make sure that you have allowed for pipe pressure losses during the sizing process of your system.



**CAUTION** – Consult COMPASS or a pipe pressure sizing chart to determine the correct pipe size. Oversize the pipe line to reduce the pressure drop.



**CAUTION** – The length of the inlet and of the outlet pipeline must be taken into consideration when calculating pressure losses.



**CAUTION** – Air locks must be avoided at the inlet pipeline. Avoid sharp 90° elbows and sharp pipe size adaptors.

Figure 10: Prevent air locks in pipes

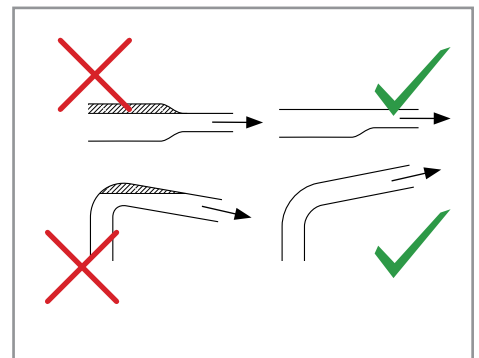
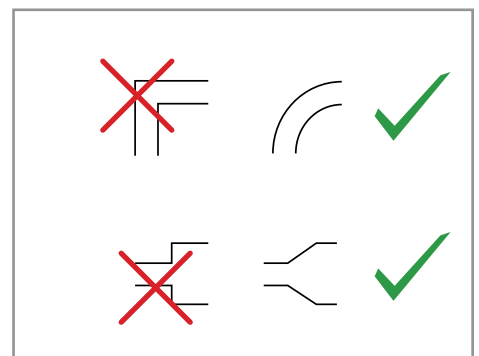


Figure 11: Avoid sharp 90° elbows and size adaptors



### 9.3 Installation and handling



**WARNING – The pump unit may be installed either a maximum of 3 m/9'10" below (gravity feed) or above (suction mode) the water level.**

The suction lift may be significantly reduced by flow resistance in the suction line (if the pipes are very long and/or insufficiently dimensioned). The suction/inlet pipe should be as short as possible

#### IMPORTANT – Pipe sizing and connecting pipework to the pump housing!

Inlet and outlet of PS surface pumps for pools are metric sized. The pumps are supplied with adaptors which are compatible with local market requirements.

When ordering pumps for US/imperial (inch) markets adaptors are provided to connect standard NPS (inch) pipes.

When ordering pumps for metric markets adaptors are provided to allow connection of the next sized up metric pipe. The table below shows the outer pipeline dimensions for the pump inlet and outlet pipe using the supplied adaptors.

Table 6: Nominal pipe size (NPS) and outer dimension (OD)

Model	US/Imperial	Metric
CS-17-1	Adaptor provided to connect 2.375" for pipe with NPS 2"	50 mm native connection and adaptor for 63 mm
CS-37-1	Adaptor provided to connect 3.5" for pipe with NPS 3"	63 mm native connection and adaptor for 90 mm

The nominal pipe size (NPS) and the outer dimensions (OD) values are not equal between 1/8 to 12" sizes. For example, the OD of an NPS 2" pipe is actually 2.375". Please pay attention to the actual dimensions of the pool pipework.

Before joining the pipework to the connecting pieces of the housing, the adhesive surfaces must be cleaned completely. Pay attention to the gluing and safety instructions of the adhesive manufacturer.

**Pipe system** – We advise that pipe expansion joints are used on both sides near to the pump to reduce noise and vibration. It is recommended that you install a gate valve in the suction and discharge pipeline close to the pump to avoid draining of the pipe while cleaning (e.g. filters), repairing, servicing or replacing the pump system.



**WARNING – Inlet and outlet pipes must be mounted to the pump housing in a way that is free of tension.**



**CAUTION – Make sure that the suction pipe is sealed with no leaks, otherwise the pump will not prime or will prime insufficiently.**

**Check valve** – If the pump is installed above water level a check valve at the bottom of the inlet pipe is needed in order to ensure that the pump and its suction pipeline remain completely water filled during the time the pump is OFF. In order to minimize pressure losses, the check valve should be sized correctly. Always install a check valve which is one inch (1") larger than the suction pipe in order to avoid too much suction pressure drop. For example, with a 3" suction pipe a 4" check valve should be installed.

**Strainer** – Never operate the pump without having the strainer basket in the pump housing. A full or dirty strainer will impair the flow rate and the filtration. The strainer basket must be regularly emptied and cleaned. Pay attention to chapter "12.2 Cleaning the strainer".

### 9.4 Remote control switch installation

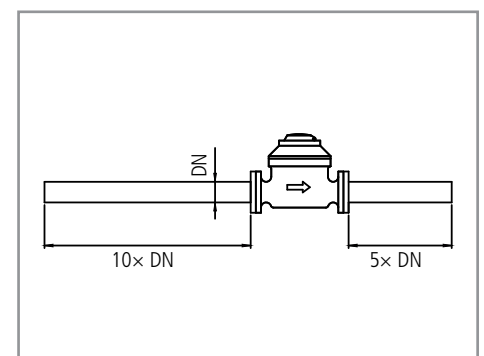
A manual switch can be used to turn the pump on and off remotely. It has to be connected to the remote switch terminals (NOT to "Power in"). Use any simple on/off switch available from an electronic supplier, electrical supplier, or hardware store. You only need a 2V switch for very low currents.

### 9.5 Water meter installation

For information about water meter installation please refer to the manufactures manual. Pay attention to the installation position, flow direction and the calming section.

Basic rule: The water meter should have 10 nominal diameters straight pipe ahead of the meter and 5 nominal straight pipe after to ensure proper flow through the meter.

Figure 12: Water meter installation



## 9.6 Initial start-up



**CAUTION – Never start the pump if it is not filled with water**

### 9.6.1 Filling pump with water

#### Where the water level is above the pump inlet:

1. Close the gate valve of the inlet and outlet pipe.
2. Loosen the lid above the strainer basket by turning anticlockwise (i.e. you may use the opening device included in the delivery). Coat the O-ring seal with petroleum jelly, close the lid by hand and make sure that it fits properly (thread is not jammed). Failure to do this will result in the pump not priming correctly.
3. Open the gate valve in the inlet and outlet pipe slowly.
4. Reopen the lid a little to remove the remaining air below the lid. As soon as water starts to stream out of the lid, tighten it by hand.

#### Where the water level is below the pump inlet:

The suction pipeline and pump must be filled with water.

1. Open the gate valve in the suction pipeline.
2. Loosen the lid above the strainer basket by turning anticlockwise (i.e. you may use the opening device included in the delivery). Slowly fill the pump and the suction pipeline with water until the pump housing is completely filled with water. Coat the O-ring seal with petroleum jelly close the lid by hand and make sure that it fits properly (i.e. that the thread is not jammed). Failure to do this will result in the pump not priming correctly.

**NOTE: A check valve must be installed at the beginning of the inlet pipeline.**



**WARNING – Do not start the pump until it has been filled with water completely.**

### 9.6.2 Rotary direction



**WARNING – Make sure the pump turns freely, especially after extended periods of down-time. To check this, put a screwdriver into the slot at the fan end and turn by hand in the direction of rotation. If necessary remove fan cover and turn the fan by hand.**



**WARNING – Never let the pump run dry, not even for the purpose of checking the direction of rotation!**

An arrow on the pump unit indicates the correct direction of rotation. Switch on the power supply and look at the rotary direction by looking at the motor fan. If the direction is wrong, swap over any two of the power wires at the controller

### 9.6.3 Final start-up

Check that the foundation bolts are fastened, the strainer basket is installed, the pump is fully filled with water, the voltage of the power supply is correct and that the pump turns correctly. Make sure all pipelines are connected tightly and can supply water normally. Recheck the tight fit of the lid, after the pump has run. Due to suction pressure it might be necessary to retighten it.



**WARNING – Make sure that the installed shut-off valves in the suction (inlet) and pressure (outlet) lines are completely open during operation. The pump must never be allowed to run with shut-off valves closed.**

## 10 Operating the Pump

This chapter explains the function of the switch and the indicator lights on the pump controller in detail.

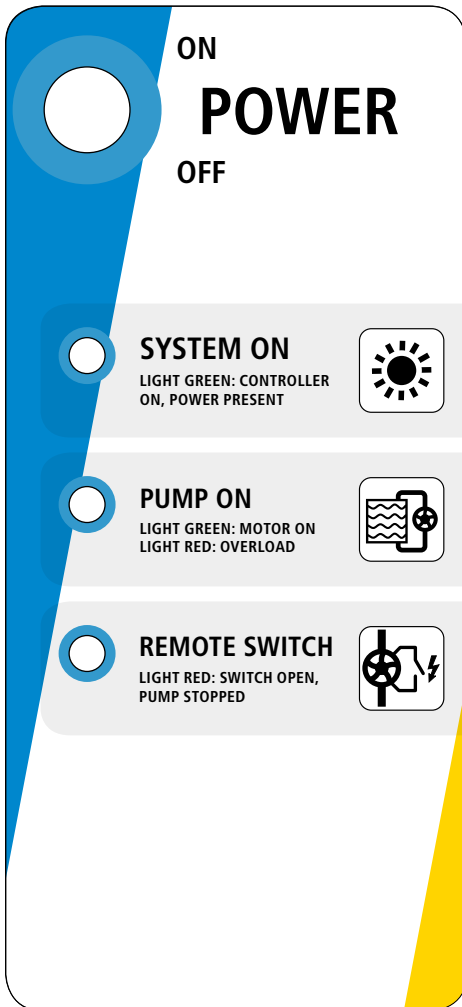


Figure 13: Control panel of the controller

### 10.1 Switch and indicator lights

**POWER ON/OFF SWITCH** – When switched off/on during operation, it resets the system.

#### INDICATOR LIGHTS

- **SYSTEM ON (green)** – The controller is switched on and the power source is present. In low-power conditions, the light may show even if there is not enough power to run the pump.
- **PUMP ON (green)** – Motor is turning. Sequence of flashing indicates pump speed. Pump speed (RPM) is indicated by the flashing sequence of the PUMP ON LED:

Table 7: Pump speed indication

Indication	RPM
LED ON	> 900
one flash	> 1,200
two flashes	> 1,600
three flashes	> 2,000
four flashes	> 2,400
five flashes	> 2,800

- **PUMP ON (red)** – The system has shut off due to an overload. This can happen if the motor or pump is blocked or very difficult to turn and is drawing excessive current. This can be caused by a high concentration of solids in the pump, high water temperature, excessive pressure due to too high lift or a restriction in the pipe, or a combination of these factors. Overload detection requires at least 250 W output of the solar array. The controller will make three start attempts before shutting down the system. The SYSTEM ON LED will be OFF and the red PUMP ON LED on. The system will not reset until the ON/OFF switch is turned OFF and ON again.
- **REMOTE SWITCH (red)** – The pump has been turned off by activation of the remote switch.

### 10.2 Starting the pump

Be sure there is not a closed valve or other obstruction in the water line. Switch on the array disconnect switch in the junction box and toggle the power switch on the controller. It is normal to leave the disconnect and system switches on at all times. A solar-direct pump should start under the following conditions:

1. There is clear sunshine at an angle of 20° or more to the surface of the solar array;
2. Cloudy conditions if the sunshine is bright enough;
3. Any remote switch is closed (ON).

**When sunshine is insufficient** – When sunshine on the array is present but too weak for the pump to run, it will attempt to start about every 120 seconds. During each attempt you will see the PUMP ON light come on.

When pump runs slowly (PUMP ON) under weak sun conditions the pump may spin without lifting water all the way to the outlet. This is normal.

**When the pump stops due to a sudden shadow on the solar array** – If a shadow suddenly passes over the array, e.g. if you walk in front of it, the controller will be unable to effectively track the input voltage. It may make rapid on/off noises and a high-pitched noise, then stop. This does not indicate a problem. The pump will attempt to restart after the normal delay, see below.

#### Time delays

1. After the pump stops due to insufficient sunshine – 120 seconds.
2. After the remote switch is turned on – 2 to 3 seconds.

## 10.3 Parameter setting with PS DataModule

For parameter setting of the PS Controller and reading the stored data, PS DataModule and PumpScanner application are needed. It is also possible to use remote access by linking the PS DataModule to a PS Communicator.

Parameter setting such as:

- Speed limitations
- Timers
- Water meter
- Pressure sensor

can only be done with the PumpScanner mobile application or via remote access (PS Communicator).

### PumpScanner Application

The PumpScanner App is used to control and read the PS controller's values via the DataModule of the controller.

To run the PumpScanner App use an Android™ Smartphone with operating software version not less than 2.3. The Smartphone has to be Bluetooth®-compliant. (Most Android™ Smartphones are Bluetooth®-compliant.)

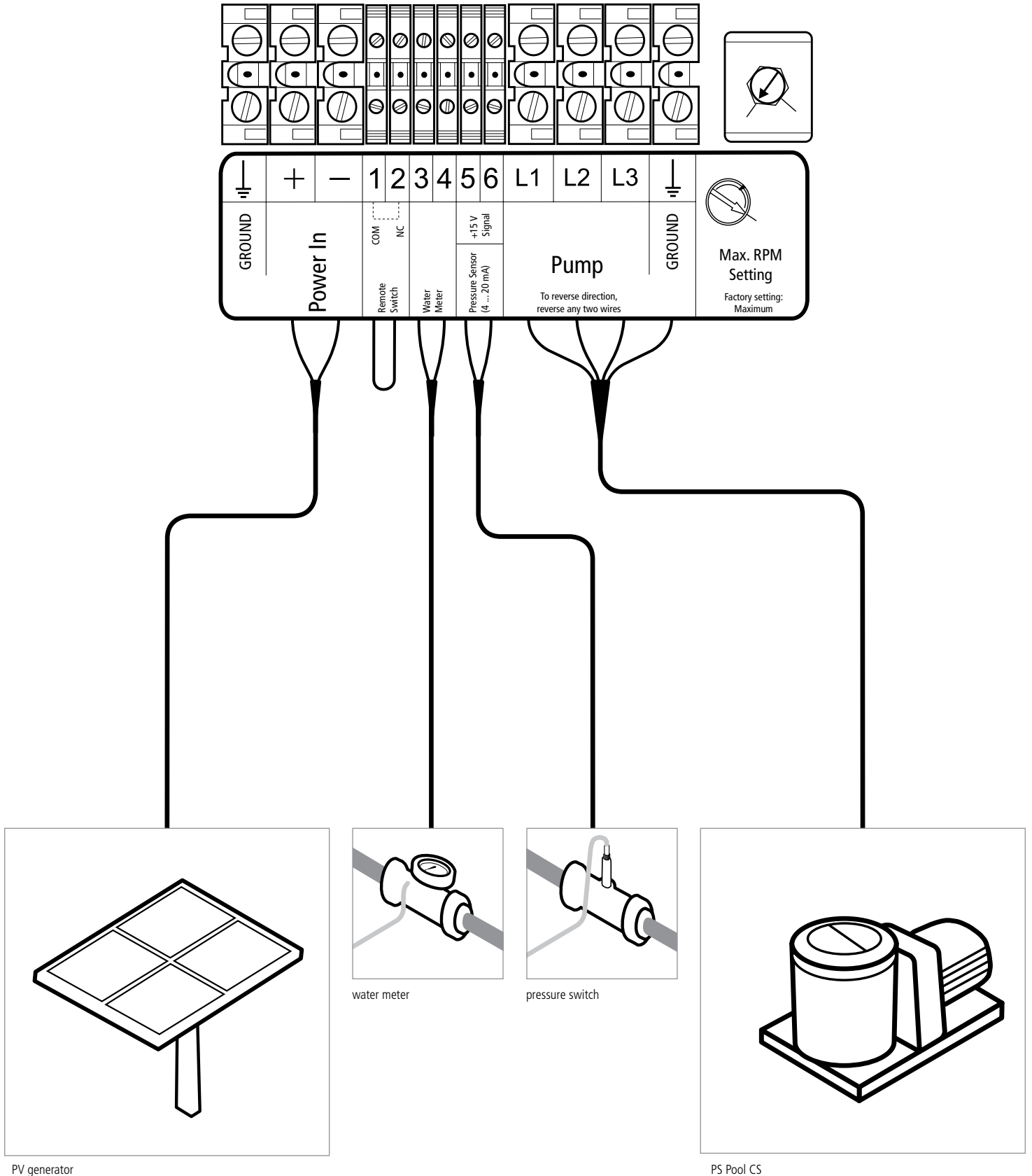
The PumpScanner App and the updates are not available through the Android™ Marketplace. You will find the latest version of PumpScanner on partnerNET under the Support section. Please refer to PumpScanner manual for further information.



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## 11 System Wiring Diagram



PV generator

PS Pool CS

water meter

pressure switch

## 12 Service and Maintenance

### 12.1 General maintenance

**Controller** – The controller has no moving or wearing parts. It requires no maintenance. There are rubber plugs to seal the unused conduit holes in the bottom of the controller. Inspect them to ensure that the controller is sealed from moisture, insects, etc. Check that mounting and conduit hardware is tight.

**Motor** – The motor requires no maintenance. It has no brushes or other frequently wearing parts.



**CAUTION – If ball bearings need replacing, bearings with C3 air and high-temperature grease (approx. 180 °C / 360 °F) must be used!**

**Pump end** – The pump mechanism (pump end) is lubricated only by water and requires no maintenance. It may wear after some years, especially if there are abrasive solids in the water. If sand accumulates in the pool or pipes as a result of normal pumping, it is best to take periodic measurement of the pump's performance. A worn pump end can be easily replaced in the field.

If the pump is running with seawater, the pump end must be cleaned periodically. The strainer basket must also be cleaned regularly to avoid excessive salt built-up.

### 12.2 Cleaning the strainer



**WARNING – The strainer basket must be periodically emptied. A full or dirty strainer will impair the pump's flow rate and the filtration.**

1. Shut down pump
2. Close shut-off valves
3. Open lid. If this is not possible by hand, use the opening device (included in the delivery). Remove the strainer basket, clean and replace it.
4. Close lid
5. Open shut-off valves
6. Restart pump

### 12.3 Use with salt water or sea water

In use, crystallized salt will build up in the pump. The rate of build-up (crystallization) will depend on the concentration of the salt and the temperature of the air and water. In salt water pools, the pump must be inspected and cleaned regularly by removing the drain plug and filter. When the salt deposits cannot be easily cleaned the pool professional must disassemble the pump and clean it. See chapter "12.4 Replacement of the mechanical seal" for disassemble instruction.

### 12.4 Replacement of the mechanical seal

The sealing between the motor and the pump housing is done by means of a mechanical seal. It is normal for a few drops of water to seep in once in a while, especially during the break-in period. Depending on the nature of the water and the duration of operation, the mechanical seal may become leaky after some time. If the water penetrates continuously, replace the complete mechanical seal with a new one. The seals must be replaced by a competent person.

**Dismantling** – Switch off the pump and disconnect it from the power supply. The mechanical seal always has to be replaced completely. To do so it is not necessary to dismantle the complete pump – only the motor unit has to be removed from the housing by loosening the hexagonal socket screws.

Remove the fan cover of the motor by loosening the three screws. Put a screwdriver into the slot of the motor shaft (fan side), hold it and remove the impeller cap screw and the O-ring.



**WARNING – The impeller cap screw (with plastic head) has a left-handed thread. That means the screw must be turned clockwise (top view) to remove it.**

The impeller is screwed onto the motor shaft (right-handed thread). Hold the motor shaft with the screw driver (fan side) and unscrew the impeller.



**CAUTION – The impeller is secured by LOCTITE 480 (similar to Cyanoacrylate immediate glue).**

Carefully lever the mechanical seal out of their fixations with a screwdriver.

**Assembly** – Apply some petroleum jelly at the edges of the mechanical seal before pressing it in.



**CAUTION – Before reassembly clean the surfaces of the components with alcohol or with a clean paper tissue.**

Follow these instructions in reverse for reassembly.

## 13 Troubleshooting

### Please read this section before calling for help.

If you call for help, please quote the model and serial numbers.

**If the pump does not run** – Most problems are caused by incorrect connections (in a new installation) or failed connections, especially where a wire is not secure and falls out of a terminal. The SYSTEM ON LED will indicate that system is switched on and connected to the controller. It indicates that VOLTAGE is present but (in a solar-direct system) there may not be sufficient power to start the pump. It should attempt to start at intervals of 120 seconds.

**If the pump attempts to start every 120 seconds but does not run** – The controller makes a slight noise as it tries to start the pump. The pump will start to turn or just vibrate a little.

1. There may be insufficient power reaching the controller. A solar-direct system should start if there is enough sun to cast a slight shadow.
2. If the pump was recently connected (or reconnected) to the controller, it may be running in the reverse direction due to a wiring error.
3. If the motor shaft only vibrates and will not turn, it may be getting power on only two of the three motor wires. This will happen if there is a broken connection or if you accidentally exchanged one of the power wires with the ground wire.
4. The pump or pipe may be packed with mud, clay, sand or debris.



**CAUTION – If the pump seizes, it has to be cleaned. Repeated starting of a blocked pump may cause damage to the motor. If this occurs, any warranty will become void.**

**PUMP OVERLOAD – If the PUMP ON LED on the control panel has changed to red** – The system has shut off due to an overload. This can happen if the motor or pump is blocked or very difficult to turn and is drawing excessive current. This can be caused by a high concentration of solids in the pump, high water temperature, excessive pressure due to too high lift or a restriction in the pipe, or a combination of these factors. Overload detection requires at least 250 W output of the solar array. The controller will make three start attempts before shutting down the system. The SYSTEM ON LED will be OFF and the red PUMP ON LED on. The system will not reset until the ON/OFF switch is turned OFF and ON again.

### Inspect the solar array

1. Is it facing the sun?
2. Is there a partial shadow on the array? If only 10 % of the array is shadowed, it can stop the pump!
3. Inspect and test the solar array circuit and the controller output.

### Inspect all wires and connections

1. Look carefully for incorrect wiring (especially in a new installation).
2. Make a visual inspection of the condition of the wires and connections. Wires are often chewed by animals if they are not enclosed in conduit (pipe).
3. Pull wires with your hands to check for failed connections.

### Inspect the controller

1. Remove the screws from the bottom plate of the controller. Move the plate downward (or the controller upward) to reveal the terminal block where the wires connect.
2. First, check for a burnt smell. This will indicate a failure of the electronics. Look for burnt wires, bits of black debris, and any other signs of lightning damage.
3. Inspect the grounding wires and connections. Most controller failures are caused by an induced surge from nearby lightning where the system is NOT effectively grounded. Ground connections must be properly made and free of corrosion.
4. There is a "max. RPM" adjustment in the controller. It may have been set to reduce the flow to as low as 30 %.

### Check the remote switch system

If the controller indicates "Remote Switch" when the switch is turned ON, inspect the remote switch system. If inspection is not feasible, you can bypass the switch or test it electrically.

If the pump responds to the bypass tests but not to the remote switch, the wires may be shorted (touching each other) or open (broken), or the switch may be damaged.

### Flow rate too low? Pool is still dirty?

Check if the pipeline dimensions are correct as pressure losses will reduce the daily circulation flow. Ensure that there is no leakage in the pipeline.

## 14 Appendix

### 14.1 Exploded view drawings

Table 9: Parts list PS600 Pool CS-17-1

Position	Quantity	Description
1	1	Pump casing
2	1	Pump flange
3	1	Strainer basket
4	1	Lid
5	1	Ring for lid
6	1	Diffuser insert
7	1	Impeller
8	1	O-ring 122 x 4.5 x 5.5
9	1	O-ring 190 x 4.5 x 6
10	1	O-ring 12.1 x 2.9

Position	Quantity	Description
11	1	Seal ring 57.5 x 6.2 x 6
12	2	O-ring 48.5 x 3.5
13	1	Mechanical seal coupling
14	1	Splash ring
15	4	Screw M5x25
16	1	Rubber buffer
17	2	Union
18	6	Hexagonal socket screw M6x30
19	4	Stud for motor base
20	1	Drain plug

Figure 14: Exploded view drawing of PS600 Pool CS-17-1

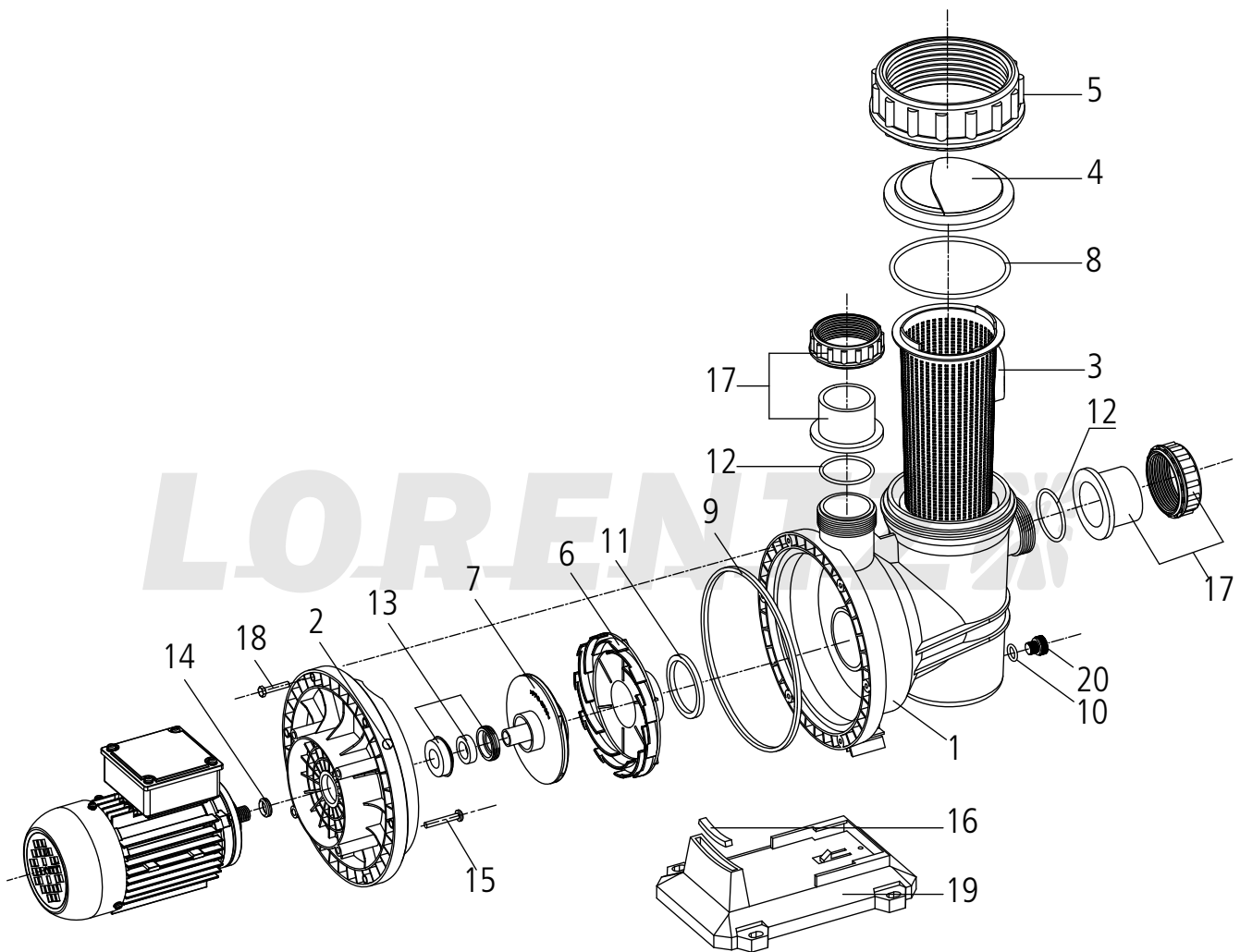
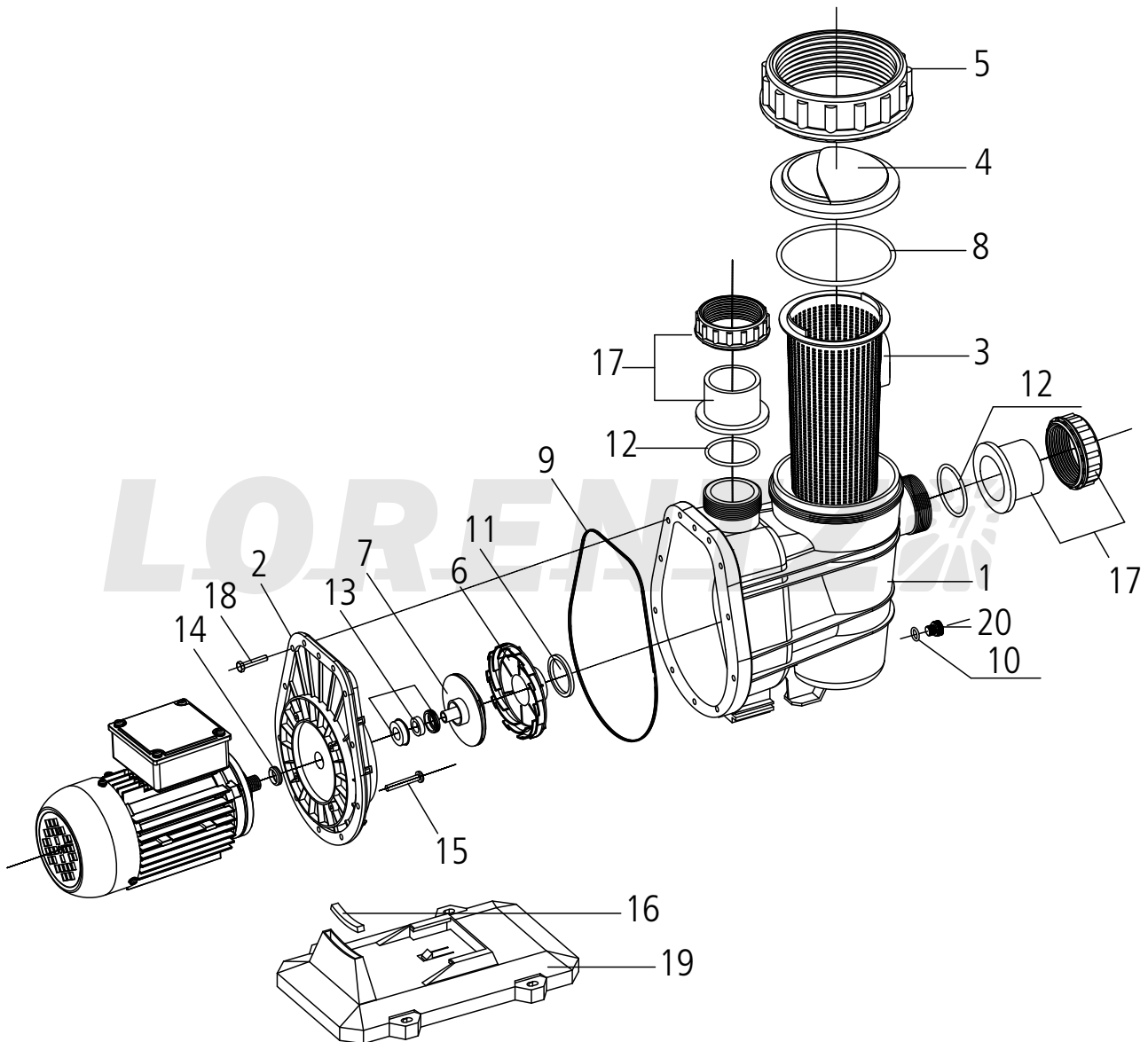


Table 10: Parts list PS1800 Pool CS-37-1

Position	Quantity	Description
1	1	Pump casing
2	1	Pump flange
3	1	Strainer basket
4	1	Lid
5	1	Ring for lid
6	1	Diffuser insert
7	1	Impeller
8	1	O-ring 168.5 x 5.5 x 12
9	1	Seal ring 270 x 5 x 10
10	1	O-ring 12.1 x 3.3

Position	Quantity	Description
11	1	Seal ring 56 x 6 x 5.7
12	2	O-ring 58.5 x 4
13	1	Mechanical seal coupling
14	1	Splash ring
15	4	Screw M5x30
16	1	Rubber buffer
17	2	Union
18	12	Hexagonal socket screw M6x30
19	4	Stud for motor base
20	1	Drain plug

Figure 15: Exploded view drawing of PS1800 Pool CS-37-1

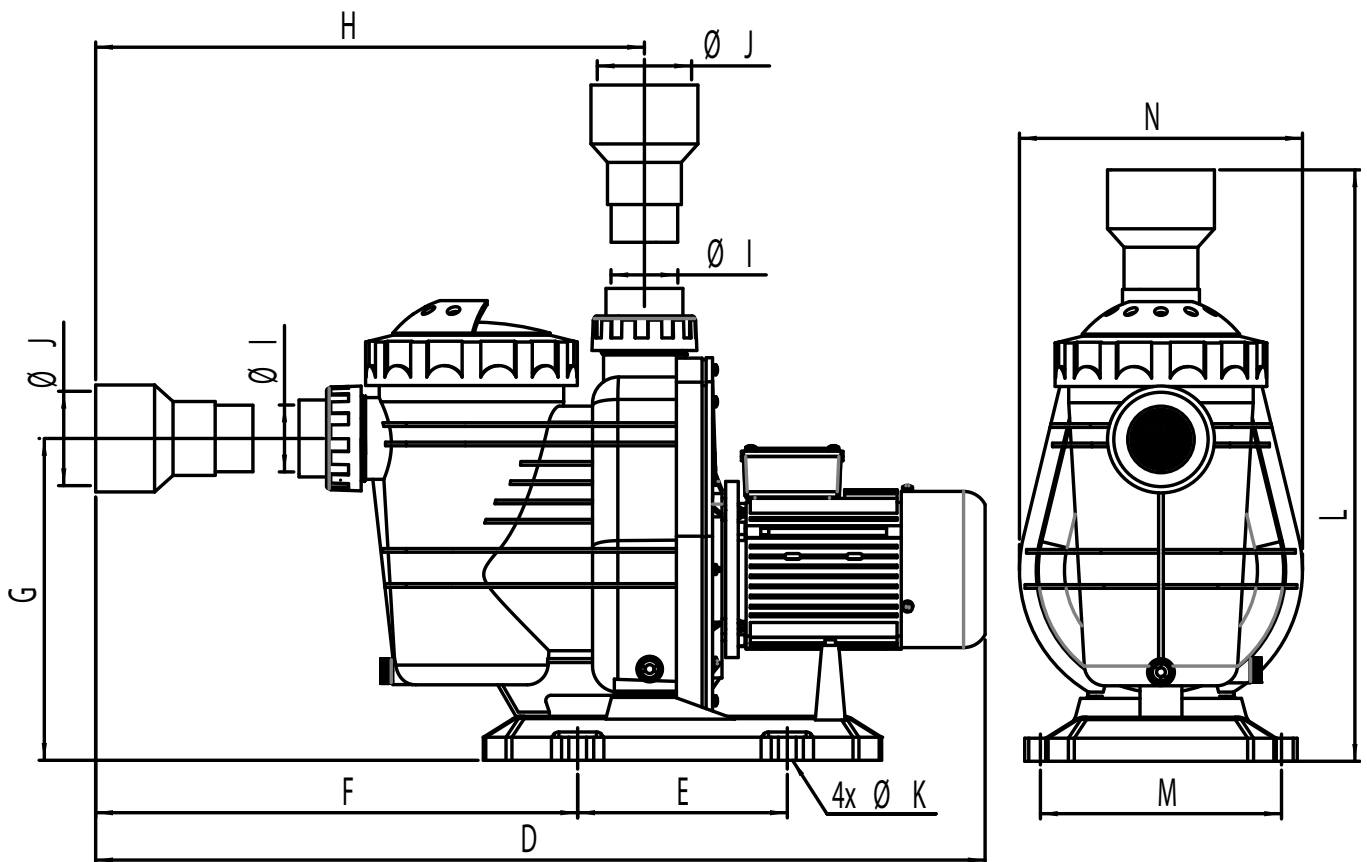


## 14.2 Dimensions

Table 11: Dimensions of PS Pool CS pumps

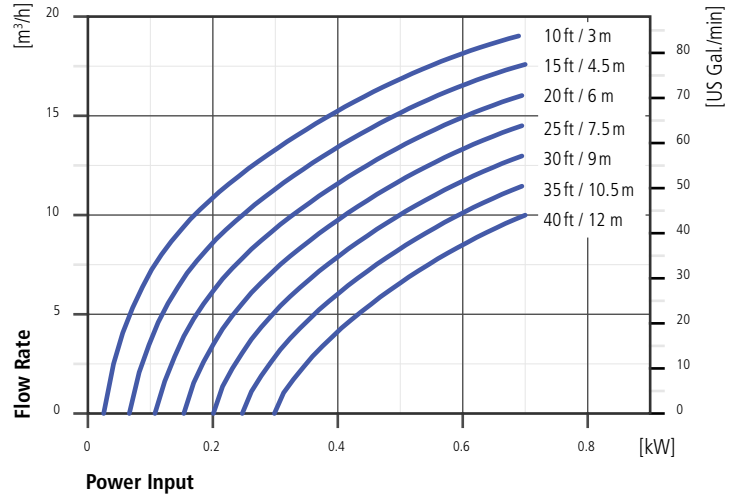
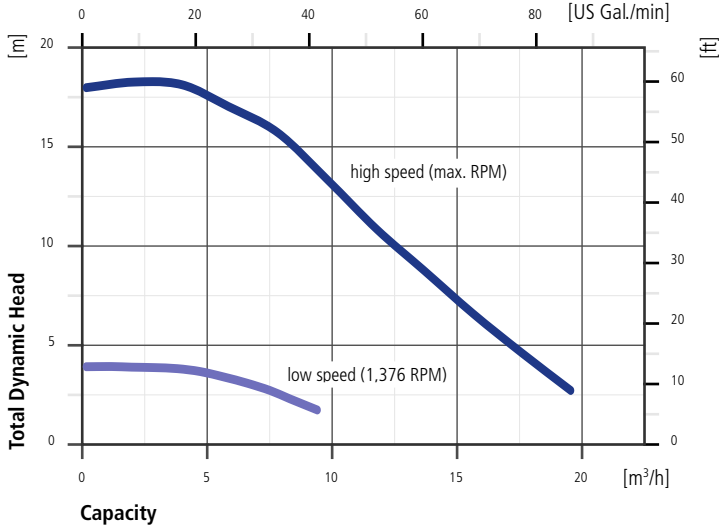
	PS600 Pool CS-17-1		PS1800 Pool CS-37-1	
	[mm]	[inch]	[mm]	[inch]
D	639	25.16	784	30.87
E	170	6.69	200	7.87
F	334	13.15	384	15.12
G	225	8.86	295	11.61
H	348	13.70	449	17.68
I	Ø50	not used for inch pipes	Ø63	not used for inch pipes
J	Ø63	2.375 for pipes with NPS 2"	Ø90	3.5 for pipes with NPS 3"
K	Ø10	0.39	Ø10	0.39
L	439	17.28	564	22.20
M	160	6.30	230	9.06
N	238	9.37	270	10.63

Figure 16: Dimensions drawing of PS Pool CS pumps

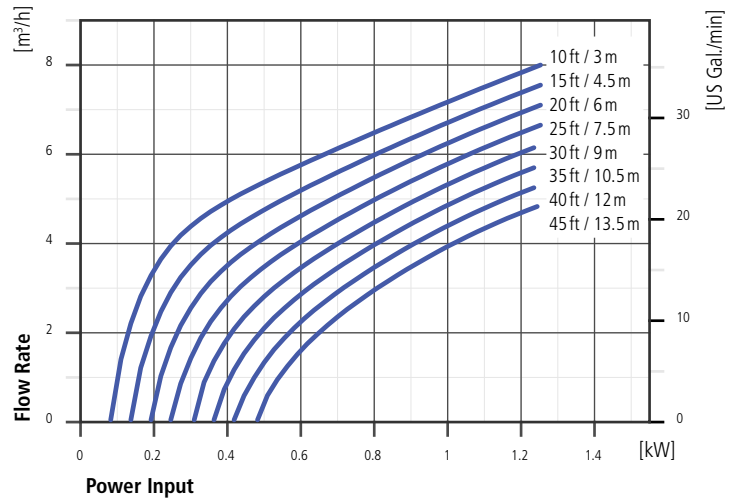
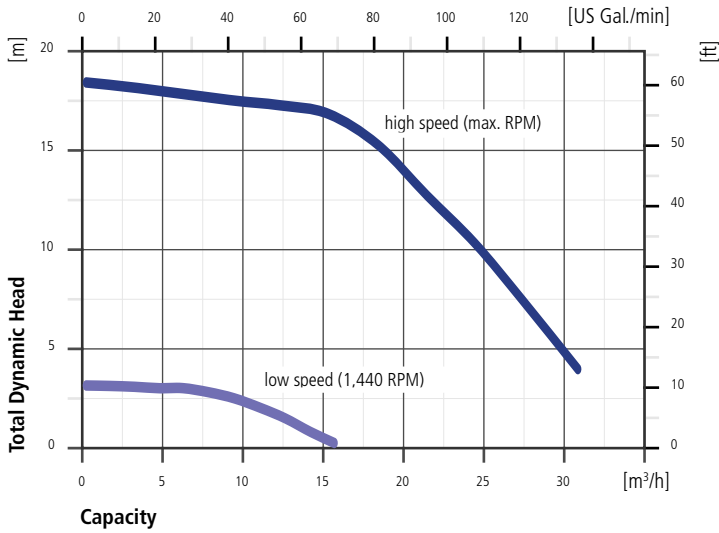


## 14.3 Performance charts

### 14.3.1 PS600 Pool CS-17-1



### 14.3.2 PS1800 Pool CS-37-1



For more detailed performance charts and layout contact your dealer or distributor. Use COMPASS system sizing software for system layout.

## 14.4 System Report

### Purchase

Date of purchase

DD	MM	YYYY
----	----	------

Dealer  
(full contact details)

### System

Pump system

PS600 Pool CS-17-1  
 PS1800 Pool CS-37-1

Controller serial number

Motor serial number

### PV generator

PV module brand

PV module model

Number of panels

	series
	parallel

Total wattage of PV generator

	W
--	---

Total Vmp

	V DC
--	------

Total Voc

	V DC
--	------

### Installation

Date of installation

DD	MM	YYYY
----	----	------

Installer  
(full contact details)

Static head  
(pump outlet to water level)

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

Total dynamic head TDH  
(static head plus pressure losses)

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

Water level

above pump  
 below pump

Maximum suction head  
(water level to pump inlet)

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

Remote switch installed?

yes

### Inlet pipe

Size

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

Type

Length

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

### Outlet pipe

Size

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

Type

Length

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

### Pump cable

Wire size

	<input type="checkbox"/> mm <sup>2</sup>	<input type="checkbox"/> AWG
--	--	------------------------------

Length (controller to pump)

	<input type="checkbox"/> mm	<input type="checkbox"/> inch
--	-----------------------------	-------------------------------

### Max. RPM control

Factory setting is max.

yes

If setting was reduced,  
enter setting here

	Hz
--	----