POOL PUMP MOTORS:

Caring for the heart of your pool's circulation system

Nidec

NIDEC MOTOR CORPORATION

US MOTORS

TABLE OF CONTENTS

INTRODUCTION

KEEP THE POOL WATER PUMPING

Next to the lifeguard, the pool pump motor has arguably the most important job at a swimming pool. When your pool pump motor does not work, nothing works.

That's because your pool pump is the heart of your pool's circulation system. It pulls water from the pools' skimmers and main drain, pushes it through the filtering, heating, and disinfecting equipment, and then sends it back to the pool.

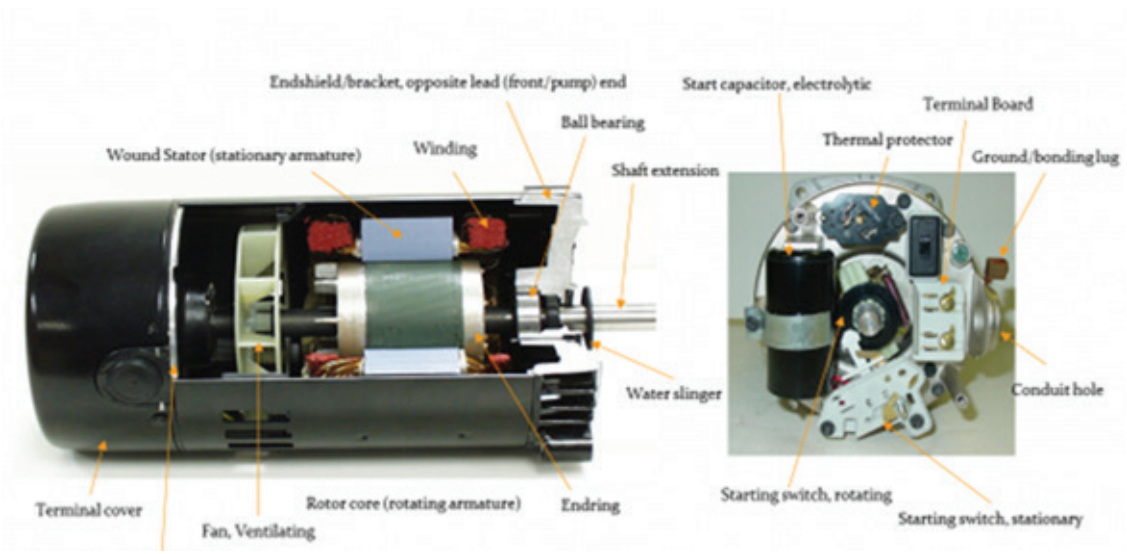
Pool pump motors usually have a 4 to 5-year life span before they must be rebuilt or replaced. You'll know it's time to take a closer look when your motor is loud, smokes, vibrates, or won't run at all.

Many times, owners will replace the entire pool pump when only the motor needs repaired or replaced.

In this e-book, we aim to help you understand your pool motor and its operation better. We'll also pass along essential tips that can help protect and extend the life of your pool motor so it can provide many years of trouble-free service.

Rule #1: Before you inspect a motor and remove its cover, always turn off all power to the motor at the fuse or circuit breaker box.

e-Chapter 1 MOTOR INSTALLATION: Proper power & electrical fit is critical



A pool pump motor has a job to do, and to be effective it must be sized to meet the requirements of the pool it will serve.

Many motor issues arise because the motor is simply not appropriately sized to do the intended job. If you are replacing an existing motor, your first job is to ensure that the new motor rating matches the original one in horsepower and service factor (aka, total horsepower, or THP), RPM, volts, phase, and mounting. Once you know and match up the THP, RPM, Voltage, Phase and Mounting a more thorough review to ensure you have the right replacement motor can be accomplished with these two simple steps:

ENSURE YOU INSTALL THE CORRECT SIZE MOTOR- TWO EASY STEPS

#1 - DETERMINE THE IMPELLER NUMBER

IMPELLER #'s- PUMPS w/ SQ. FLANGE MOTORS

Hayward MaxFlo II	Jandy Stealth	Jandy Flo-Pro	Pentair Challenger	Pentair Whisper Flow	Stay-Rite Dura & Maxi Glass	Waterway SVL56	Waterway Champion
SP2700CM	R0445301	R0479601	355147	73126	C105-92PS	310-3650	310-7400
SP2707CM	R0445302	R0479602	355187	73127	C105-138PEB		310-7410
SP2710CM	R0445303	R0479603	355369	73128	C105-137PEB		310-7420
SP2715CM	R0445304	R0479604	355315	73129	C105-137PDBA	310-3660	310-7430
	R0445305	R0479605	355604	73130	C105-137PDA	310-3670	310-7440
	R0445306		355544	73131	C105-137PKBA	310-3680	310-7450
SP-2700SA	RO479400	RO445500	354545s	71734	17304-0100	VG1000	VG1000

IMPELLER #'s- PUMPS w/ C- FLANGE MOTORS

Hayward SuperPump	Hayward Super II	Hayward Super II Max	Jandy JHP-PP				
SP2605C		SP3005C					
SP2607C	SP3007C	SP3007C	R0555801				
SP2610C	SP3010C	SP3010C	R0555802				
SP2615C	SP3016C	SP3016C	R0555803				
SP1621C	SP3021C	SP3021C	R0555804				
	SP3026C		R0555805				
SP-1600Z2	SP1600Z2		RO479400				

#2 - MATCH THE IMPELLER TO THE MOTOR

COMMON SQUARE FLANGE MOTOR NUMBERS

HP Full Rate	HP Up Rate	THP	Aqua-Shield 48 ASQ-48	Aqua-Shield 56 ASB-56	A-S PRO 208-230	Extreme E 56 208-230	2-speed ASB56	Affinity 2sp/timer	Neptune Variable Speed
	1/2	0.65	ASQ065						NPTQ125
1/2	3/4	0.98	ASQ095	ASB846		ASB845			NPTQ125
3/4	1.0	1.25	ASQ125	ASB847	TEQ125	ASB661	ASB2980	ASB2980T	NPTQ125
1.0	1.5	1.65	ASQ165	ASB848	TEQ165	ASB841	ASB2982	ASB2982T	NPTQ165
1.5	2	2.25	ASQ225	ASB858	TEQ225	ASB842	ASB2983	ASB2983T	NPTQ225
2.0	2.5	2.6	ASQ260	ASB748	TEQ270	ASB843	ASB2984	ASB2984T	NPTQ270
3.0		3.45		ASB844	TEQ345	ASB844			AVSS3
5.0		5.0		ASB850		ASB850			

COMMON ROUND/C-FLANGE MOTOR NUMBERS

HP Full Rate	HP Up Rate	THP	48 AST-48	56 ASB-56	A-S PRO 208-230	E-Extreme 56 208-230	2-speed ASB56	Affinity 2sp/timer	Neptune Variable Speed
1/2	3/4	0.98	AST095	ASB126		ASB657			NPTT125
3/4	1.0	1.25	AST125	ASB127	TET125	ASB638	ASB2973H	ASB2973HT	NPTT125
1.0	1.5	1.65	AST165	ASB128	TET165	ASB654	ASB2975	ASB2975T	NPTT165
1.5	2.0	2.25	AST225	ASB129	TET225	ASB796	ASB2977	ASB2977T	NPTT225
2.0	2.5	2.70	AST275	ASB130	TET275	ASB809	ASB2979	ASB2979T	NPTT270
3.0		3.45		ASB818	TET345	ASB818			AVSJ3
5.0		5.0		ASB819		ASB819			

STEP 1:

Matching up the pump's impeller to the motor THP is always the safest way to ensure you have a proper fit. If you cannot determine the pump impeller part #, matching up the THP is also a perfect option to ensure you have the appropriate power and electrical fit:

A few reminders about THP = Total HorsePower:
• Horsepower, Service Factor and Total Horsepower are all related
• Horsepower is an indication of the motor's strength, power, or torque. 746 Watts = 1 Hp
• Service Factor is a multiplier which, when applied to the rated motor horsepower, indicates a permissible horsepower loading which may be applied to the motor
• Total horsepower is the maximum load that can be applied to the motor. It is simply the Nameplate Horsepower multiplied by the Service Factor. For example: 1.5 (Horsepower) x 1.3 (Service Factor) = 1.95 Total Horsepower.

Again, matching the THP is a way of determining the proper replacement motor. Of course, though, if the previous motor failed due to being overloaded, we must take further action. See the checking amperage section in Step 2 below and e-chapter 5 in this e-book.

STEP 2:

Over time, a voltage that is too high or low can stress a pool pump motor, causing stressed or failed windings or blowing out the capacitor. Motors that are miswired or use incorrect wire size can also experience problems. Supply 240V to a motor wired for 120V, for example, and you can expect sparks, smoke and – if you don't turn the motor off quickly – motor failure.

Proper power & electrical fit, in other words, is critical to long-term motor life.

It's also important to check the motor load amps with a meter to avoid overloading the motor. Load amps should be no more than 10% over the nameplate rating – load amperage greater than 10% higher than nameplate amps indicates the motor is being overloaded, and you may need the next larger motor size. If you are also replacing old wires, make sure to match the wire size with the original as well. Using a larger wire size is okay but never a smaller size wire.

When installing a replacement motor, double-check to see that the line voltage matches the motor voltage. Review the wiring diagram on the motor label to be sure that your power leads and ground wire are correctly connected.

In addition to following the manufacturer's instructions, there are other things to always keep in mind when installing a pool pump motor:

• Make sure your motor shaft turns freely by hand before starting the motor.
• Confirm proper voltage at the motor terminals.
• Follow the motor connection diagram on the motor nameplate.
• Make sure the motor is properly grounded and complies with local and national electrical codes.

KEY TAKEAWAY:

A pool pump motor has a particular job. If it or the pump it drives is improperly sized, it can be overworked, which is a leading cause of pump failure. So, know what you are buying and be wary if you are told a replacement motor is "close enough." That is no guarantee that it actually meets your customer's requirements.

e-Chapter 2 MOTOR INSTALLATION: Protecting your motor to lengthen its life

We protect workers from on-the-job dangers so they can safely and effectively complete their tasks. A pool pump motor, likewise, should be protected from hazards that could interfere with its efficient performance.

A pool pump motor has three mortal enemies: heat, contaminants, and moisture. An installer's job is to protect a motor from all three.

To protect against heat -- Built-in open spaces that offer little shade, outdoor swimming pools provide people with a cool place to beat the heat. That can be bad news to pool pump motors, which are already hot to the touch, with shell temperatures running at about 120 degrees Fahrenheit. The inside of the motor runs even hotter approaching 200 degrees Fahrenheit.

Installers can do several things to help motors run as cool as possible, which helps them last longer. Because good air circulation helps lower motor temperature, it's crucial to install them in places where they are protected from fallen leaves, mulch, and other debris that can clog ventilation openings. Good cross-ventilation is also important. Nearby plants, bushes, and overhanging trees also need to be trimmed regularly to impede their ability to restrict airflow.

To protect against moisture – If moisture becomes trapped in a pool pump motor, corrosion can result. Nearly one-half of all pool pump failures can be traced to leaky pipe joints or pump seal failures. That's why it is recommended these motors must be protected from rain, snow, and pool water – and regularly maintained to ensure they remain so.

But wrapping them in plastic or other air-tight materials is not the answer as this can cause rust and may result in improper motor cooling. A motor needs sufficient airflow on all sides so that it can "breathe," helping to keep moisture from becoming trapped inside.

Many pumps start their lives well above the ground. Over time, however, sediment and debris can raise the ground and limit clearance. A motor submerged in water, even partially, is not likely to survive and voids the warranty.

A better solution is to locate the motor on a slight elevation away from splashing water. The area around your pool equipment should be designed to drain rapidly during heavy rains. That will prevent water from running or puddling nearby. Adding gravel around the pump and filter area can also help to reduce moisture and slow weed growth.

KEY TAKEAWAY:

Proper installation of a pool motor pump requires more than following the manufacturer's instructions. It requires analyzing the environment the motor will operate in and protecting it from anything that could impede its long-term performance. That's the secret to a successful installation.

e-Chapter 3 MOTOR TROUBLESHOOTING: First things first

In the absence of information, we often jump to conclusions. Your son isn't answering his phone? There must have been an accident. You wake up with a new pain? It must be an incurable disease. The good news is, the conclusions we jump to are usually wrong.

The same can be true of pool pump motors. When one malfunctions, take a step back and methodically identify – or rule out – possible sources of the problem. Begin with the easiest to resolve options.

Is the power on? -- Check the voltage at the motor terminals with a meter. If no, check any mechanical switches that supply power to the motor.

And remember: if you're going to perform maintenance, make sure the power is off. Just because a motor is not running does NOT mean the power is off. Check to be sure.

Does the motor have a timer or controller? -- If the motor has one of these, check to see if it is turned on.

Fuse or circuit breaker -- If the timer or controller is on and the motor still won't run, check the fuse or circuit breaker box. Replace any fuses that are blown. Reset circuit breakers that have been tripped by turning them all the way to the off position and then back on again.

If you still do not have power at the motor terminals, it's time to call a qualified electrician to troubleshoot the problem (if you haven't already).

KEY TAKEAWAY:

When in doubt, always have a qualified electrician troubleshoot your pool pump motor problems. But you can save yourself some time – and money – if you first check the obvious reasons a motor won't start. And remember, even if the motor is not running, the power can still be on!

e-Chapter 4 MOTOR TROUBLESHOOTING: When your pool pump motor won't start

The tools needed for troubleshooting include:

- A standard screwdriver
- A wide-blade screwdriver
- 1/2-inch and 7/16-inch open-end wrenches
- A clamp-on ammeter/voltmeter/Ohm meter
- 1/4-inch nut driver
- Needle-nose pliers

If the motor makes no sound at all

If the power is on, your motor won't start and makes no sound whatsoever, it means one of two things: a bad motor or something is keeping the power from reaching the motor. An electrician's job is to find out why power is not reaching the motor.

The two things which need to be checked:

1. The power connection to the motor – With the power off, check to see that all electrical connections (where the power wires connect) are tight. Also, check for visual evidence of corrosion or insect infestation. One of the power leads may be loose, corroded, or shorted.

2. Voltage to motor – Turn on the power and use an AC voltmeter to check the motor line leads and verify that power is reaching the motor. If power is coming into the motor, but it is making no noise whatsoever, an open circuit may exist in the motor. A new motor is likely needed.

If the motor hums but won't start

Many issues can cause a motor to hum:

1. A locked bearing -- To find out if you have a locked bearing, try spinning the motor shaft by hand, working from the back end of the motor. If it doesn't spin freely, check for a tight pump seal, an obstruction in the pump housing, or a bad bearing.

2. Incorrect connections – Compare your motor's connections with those on the motor connection diagram. Do the same with the control circuit diagram and make any needed corrections.

3. Low voltage – Low voltage can cause a motor to hum, but not start. Check the voltage with a voltmeter. To operate properly, the motor terminal voltage must be +/- 10 percent of the listed nameplate voltage. Many new pool pump motors are wired for 230 volts. So, if you hook up a 230 volt wired motor to a 115-volt power supply, it may only hum, cycle or not start at all.

4. Excess load – Check for a binding or oversized pump impeller, bent shaft or bad bearing, any of which can create excessive load on the motor. Recheck Table 1 to ensure the motor and impeller are appropriately sized.

5. Motor circuit problems –Check for a short, open or ground in the winding, the lead connections, or the connections from the windings to the motor leads.

6. An open start switch (If Applicable) – Stationary start switch contacts should be closed when the motor is off. Check for continuity between the motor switch contacts.

7. Loose capacitor connections – Check the capacitor connections to make sure the capacitor terminals are tight to the lead terminals.

8. Start capacitor failure (If Applicable) – Check for debris near the start capacitor, the black cylinder on the back of the motor that gives the motor the extra "oomph" it needs to start up. A failed start capacitor is usually indicated by a burnt hole visible between the capacitor terminals.

KEY TAKEAWAY:

Several issues may keep a motor from starting up properly. A systematic review of this checkup can usually identify the cause.

e-Chapter 5 MOTOR TROUBLESHOOTING: My motor starts, but...

Pool pump motors are simple devices. That makes it relatively easy to pinpoint the cause of motor malfunction.

If your motor is....

... Experiencing excessive noise and/or vibration

When a running motor is louder than usual and vibrates excessively, it can usually be traced to one of three things:

1. Defective motor bearings – With the power and motor off and not running, check for noise while rotating the unloaded motor shaft. Also, check for a "rough" feeling on your hand when rotating the motor shaft. The noise will be present even when the motor is not at full speed.

2. Loose or binding parts – Inspect the pump and motor for loose fasteners and re-tighten as needed.

3. A bent shaft – Remove the motor from the wet-end and check the shaft run-out or straightness. If the shaft is bent, you will need to replace the motor.

... Overheating

All properly functioning motors are too hot to touch. A hot motor that is also smoking or cycling is overheating.

If your motor is overheating, ask these questions:

Is the motor overloaded? -- Your motor may be being worked harder than designed. Check the nameplate. If the maximum load current exceeds the maximum amps identified on the nameplate by more than 10 percent, the pump load may be excessive. Recheck Table 1 to ensure the impeller is appropriately sized.

Are air openings clogged? – Inspect and clear any debris from the ventilation openings in the frame and/or the end shield openings.

Is voltage correct? – Voltage that is too low or high can overheat a motor. Voltage must be within +/- 10 percent of the nameplate rating.

Are the power connections correct? – Review the nameplate and power lead connection diagrams to make sure.

Has the run capacitor failed? – (If Applicable) Check to see if the run capacitor, the capacitor with the steel case, is bulging at the terminal end. This sometimes indicates an open-interrupted part failure. If it's bulging, it will be necessary to troubleshoot (see e-Chapter 6) and replace the capacitor with one of identical size and rating (voltage and uF/capacitance value).

KEY TAKEAWAY:

A motor that regularly overheats may be nearing the end of its useful life. By addressing smoking, cycling, and excess heat issues promptly, you may be able to intervene and address the issue with a repair instead.

e-Chapter 6 Troubleshooting your capacitor

A pool pump can have two types of capacitors: a start capacitor and a run capacitor. Switched into the motor's winding circuits, a start capacitor helps the motor start-up, turn over and come up to speed. When the motor approaches running speed, the start capacitor is switched out of the winding circuits. The run capacitor is incorporated in the motor circuit to help increase running efficiency.

Before troubleshooting issues with either capacitor, turn off all power to your motor.

1. Begin by removing the leads with pliers. Then, discharge any stored power in the capacitor by touching two opposite terminals at the same time using the metal end of an insulated screwdriver with a plastic or rubber handle. If there is stored power, it may make a popping sound.

2. The capacitor can then be tested with an Ohm meter. If you are using an analog Ohm meter with a needle indicator, set it to the highest resistance range and attach the meter leads to the capacitor terminals. A suitable capacitor will drop to the zero-range and then slowly rise on the meter, while a shorted or dead capacitor will remain at zero. If the needle remains at the high value, rather than drop to zero, the capacitor has an open circuit.

If you are using a digital Ohm meter, use the "check capacitor" option, if the meter has one. Otherwise, follow the resistance displayed digitally. Resistance moving to zero and rising slowly signals the capacitor is good. Resistance that goes to zero and stays there or resistance that remains at a high value (mega Ohm range) indicates the capacitor has gone bad.

If the capacitor is deemed to be bad, replace it with a new capacitor of the same microfarad (MFD) and voltage rating. You'll find this rating printed on the capacitor. A rating of 124-149 MFD is a typical capacitor size used for 3/4 - 1 hp motors.

KEY TAKEAWAY:

If the capacitor is deemed to be bad, replace it with a new capacitor of the same microfarad (MFD) and voltage rating. You'll find this rating on the capacitor. For example, a rating of 124-149 MFD is a typical capacitor size used for 1.25-1.65 THP pool pump motors.

NIDEC MOTOR CORPORATION

† All marks shown within this document are properties of their respective owners.