Power Climber	Service Instruction SI-072	**Electrical Troubleshooting – Start Capacitors**

Application table

Application:	All PC3 Series Hoists
Reason:	Improved product reliability
Frequency:	As needed
Priority:	Important

Background:

Customers have reported the failure of start capacitors in PC3 hoists. Power Climber conducted exhaustive research to verify the operating range of the start capacitors. This investigation included testing of capacitors in operating hoists as well as new capacitor stock in inventory. The results prove the correct performance of the capacitors and their capability to handle the rated voltage and the rated load through extensive duration testing.

Purpose:

This bulletin reminds technicians what causes start capacitor failure and how to remedy it.

Start capacitors are like the canary in the coal mine, they are the first item to indicate a problem in the hoisting system or a potential problem in the hoist itself. They can fail on their first use fresh out of the box if any of the failure modes below are present. It is much easier to blame the capacitor or the hoist than to fix the root cause which is usually external to the hoist. Let's start with what start capacitors do and how they fail.

A start capacitor is designed to remain in the hoist motor circuit for a very short period of time. It gives a kick start by providing extra power at startup. It is quickly removed from the circuit by the centrifugal switch when the motor reaches about 1,200 rpm. If the start capacitor stays in the hoist motor circuit too long, it will become damaged.

Top 10 Causes of Start Capacitor Failure:

1. **Low or Inconsistent Voltage**
2. **Overloading the hoist with excess platform weight – typically live load of men & materials.**
3. **Overloading the hoist by binding against an immovable object – i.e. a balcony, ledge or other façade protrusion.**
4. **Improper location of a buck/boost transformer**
5. **Improperly sized or selected generator**
6. **Improperly adjusted primary hoist brake**

7. **Non-functioning primary brake**
8. **Using a power cord that has been damaged**
9. **Non-functioning centrifugal switch in the hoist motor**
10. **High Voltage**

Signs of Start Capacitor Failure:

- Hoist can't lift a suspended load.
- Hoist only operates in down direction under load, even when depressing the UP control button.
- Hoist will only operate in the UP direction without a load. This symptom will only occur on hoists that use the run capacitor in the UP circuit.
- While the hoist is under load and the UP button is pushed in , the hoist runs downward.
- While the hoist is not loaded, with the UP button pushed in, the hoist runs up. This is described as running up only with a running start.
- Hoist hums in the DOWN direction while being operated without a load. This symptom will only occur on hoists that use the run capacitor in the UP circuit.

FAQ's

How do I correct low voltage?

- First you can't fix what you don't measure. Use your meter correctly to get a run voltage reading and ensure the source is consistently delivering voltage in the rated range.
- Understand that you will lose 2 volts for every 100 ft of 10/3 cord and 4 volts per 100ft of 10/3 if you are using a yoke.
- Run separate electrical cords to each hoist and plug the cords into separate breakers. Understand that running 2 electric cords increases the load the platform is carrying.
- Increase the cross section of the power cord that you are using. Instead of using 10/3 SO you can use 8/3 SO. Understand that doing this increases the cord weight from 33lbs/100 ft to 41lbs/100ft and reduces the platform loading accordingly.
- Install a booster transformer at the power source, especially if the building is prone to fluctuations in voltage during the day when office equipment and air conditioners kick in later in the day.

What's the longest electric cord I can run to 2 yoked PC3 hoists?
The answer depends on what the electric cord is plugged into. Operating 2 hoists on a yoke attached to 500 ft of 10/3 electric cord will see voltage drop of 20V. If the source run voltage is 208V, the run voltage at the hoists is 188V. With 1000lbs of load this is still inside the voltage range.

Where is the best place to use a buck/boost transformer? At the platform? At the power source?
A buck/boost transformer corrects on site voltage conditions before they affect the performance of attached equipment. To "buck" voltage, the voltage is being lowered or decreased in amount. To "boost" voltage, the voltage is being raised. Boosting voltage is the most common reason to use transformers in our industry. The best place to use a buck

boost transformer is an installation **as close to the power source as is possible** to maximize the benefits of a buck boost transformer.

How much overloading does it take to affect the hoist's performance?
No amount of overloading is *ever* acceptable. Remember that the rigging device, counterweight calculation, tiebacks, attachment structure, and wire ropes have been sized to handle 4 times the rated load of the hoist. Thoughtlessly adding another bucket of paint or concrete or another panel of glass to "save a trip" quickly adds up to downtime and potential risk to the operator. Increasing a 1000 lb hoist's load by just 15% or 150 lbs requires rigging for another 600 lbs of moment load. This may exceed the capability of your rigging device or other components of the system. Overloading the PC3 by 15% moves the bottom end of the run voltage operating range by close 20 volts. Moving customers to 1500lb hoists or installing optional overloads to limit platform travel can mitigate this abuse.

How do I correct overloaded platforms?

- Again you can't fix what you don't measure. The hoists will be carrying the entire weight of everything below the shackle of your rigging device. This means the entire wire rope and electric cord length, the yokes, the hoists, platforms, all accessories (i.e wall rollers, welding grounds), the workers and their materials. Among the most commonly forgotten weights to calculate in the stage: 5/16" IWRC wire rope weighs 18lbs/100ft of wire rope and 10/3 electric cord weighs 33lbs/100 ft.
- Train operators to regularly clear platforms of debris.
- Encourage the use of material hoists for moving materials to the working level.
- Encourage the use of 1500lb hoists when there's a likelihood of overloading.

What is the right size Generator to use?
For each hoist, run from one generator you need 5000 watts. Running 2 hoists from one generator requires a generator able to produce at least 10,000 Watts or 10kW. Whether you rent the generator or not, train the operator on using it. Set the voltage on the generator. Use a marker to locate where the needle on the meter should be at all times during normal operation. Then instruct the operators how to use all the equipment that has been supplied to them.

What voltage should I have in order to operate my PC3 hoist most efficiently?
The PC3 hoist is designed to operate efficiently when the run voltage is at +10%/-15% of the nameplate rating. If you are running a 208V PC3 hoist your running voltage range would be between 176.8 VAC and 229V AC.

Understand the electrical performance of hoist within the entire suspended scaffold system is not basic to most mechanics' training, much less to hoist operators or many managers employed by contractors. This is why Power Climber developed the Electrical Troubleshooting Class in our Service School program and teaches technicians how to best manage hoist performance by mitigating the root causes. This is a mandatory class to become a certified technician and it includes training on the use of multi-meters and other key tools in diagnosing electrical problems. Consult with Customer Service on upcoming classes if you would like to send technicians or customer-facing operations support staff to refresh this topic.

Power Climber has led the industry in technical publishing on Electrical Performance topics. As a reminder, available documents on this subject are found on our website via the dealer log-in or can be requested from Customer Service:

www.PowerClimber.com

Topics of Interest: (see documents)

- Voltage Types
- Capacitors
- Start Capacitors
- Run Capacitors
- Voltage Types
- Motor Circuit Performance
- Use of Generators with Power Climber Hoists
- Which Transformer

Other Documents Available Upon Request:

Using Your Meter.Doc This 18 page document is the bible of using a meter, covers checking power cord wiring and continuity, capacitors, verifying inline voltage and much more.
PC3 Voltage Supply. doc Defines start and run voltage and states operating range of hoist. Explains voltage loss due to using a yoke.
Checking Power Cords.doc Subset of the Using Your Meter document, this 4 page document shows how to test the cords for continuity.

As with all Service Instructions, if you are unsure about anything contained in this document, contact Power Climber Product Support at 800-560-2546 or at customerservice@safeworks.com