FRANKLIN AID

Franklin Electric

Franklin Application/Installation Data (AID) ... For The Professional Driller-Installer

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OVERLOAD PROTECTION FOR FRANKLIN ELECTRIC 3-PHASE MOTORS

Several conditions can cause a motor to become overloaded. Examples include a bound pump, or a high or low voltage condition. When a motor becomes overloaded, the current (amps) increase, and can reach levels damaging to the motor. Therefore, a motor must be protected from an overload condition, and this is the job of the overload protector, sometimes just called the "overload".

In a recent edition of the Franklin AID, we discussed overload protection in Franklin Electric single-phase motors. These motors contain "built-in" overload protection, either in the motor itself or in the Franklin Control Box, depending on the horsepower rating. In this issue, we will discuss 3-phase motor protection.

Unlike single-phase motors, overload protection for Franklin 3-phase motors is not "built-in", and must be provided by the contractor. The normal location, of course, is in the pump panel.

Remember, there are no internal overloads in Franklin 3-phase submersible motors, and overload protection must be provided.

Because they are so important, Franklin Electric is very specific about the classification of 3-phase overloads, regardless of the type. Franklin-approved overload devices are listed on pages 28 – 30 of the 2003 Franklin AIM (Application-Installation-Maintenance) Manual. If you do not have one, a free copy can be obtained by calling the Franklin Submersible Hotline at 800/348-2420. It can also be downloaded from our website: www.franklin-electric.com.

In general, there are two types of 3-phase overloads: heater strips and adjustable overload relays.

Heater Strips. Most 3-phase motor installers are familiar with heater strips. "Heaters" have been the basic means of 3-phase protection for many years. Heaters are bimetallic strips made of two dissimilar metals bonded together, which bend when heated. An increase in amperage causes a increase in temperature in the heater, and when the temperature increases to a certain level, the entire strip bends enough to break the circuit. Once the circuit is broken and the current stops, the strip cools and returns to its original position, resetting the device and readying if for further operation.

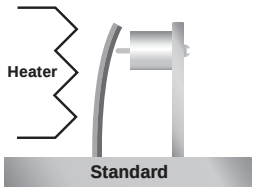
As shown in the 2003 AIM Manual, both the Siemens (Furnas) K series & the General Electric CR123L series heater strips are approved by Franklin Electric for proper protection of FE submersible motors. **Note: The Allen-Bradley J series heater strip no longer appears on Franklin's list of approved motor protectors.**

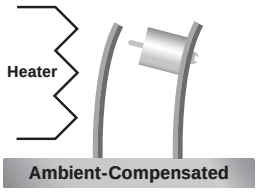
All Franklin-approved overloads are rated as **Ambient-Compensated, Quick-Trip, Class 10**. Let's take a look at what those terms mean, and why there're important:

INSTALLATION TIP

Control panels should never be mounted in direct sunlight or high temperature locations as this could result in unnecessary tripping of overload protectors. A ventilated enclosure, painted white to reflect heat, is recommended for outdoor high temperature locations.

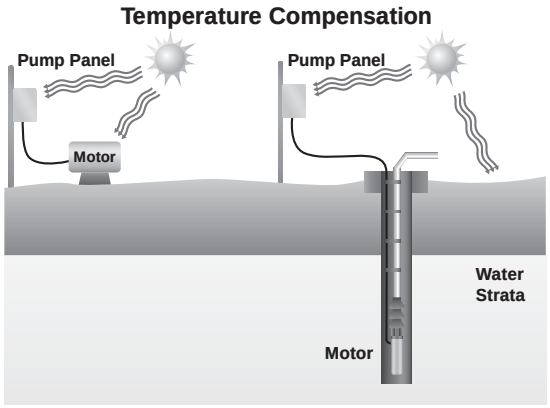
Ambient Temperature Compensation. This term generally applies to the "heater" type overloads. Overloads are "heat sensing" devices, and as a result, temperature changes in their environment can alter their performance. In the case of an above-ground motor, ambient compensation this is not of major concern, since the motor and pump are in the same environment (temperature). A hot or cold control panel probably means the motor is being affected in the same way. However, in the case of a submersible system, the motor is in a completely different temperature environment than the pump panel (underwater versus above ground). An ambient compensated overload ignores this temperature difference, and only detects a change in the temperature condition (current) of the motor itself. The diagram below shows the difference between how a standard and an ambient-compensated heater works.

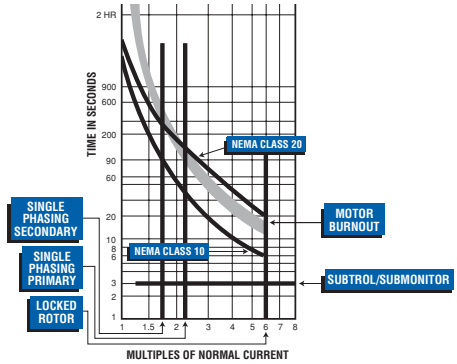




SUBMONITOR IN DEVELOPMENT.
PROTECTS FRANKLIN 3-PHASE SUBMERSIBLE MOTORS RATED 3HP TO 200HP.

The SubMonitor is the latest innovation in 3-phase pump protection from Franklin Electric and will soon be available for purchase. It is designed to protect 3-phase pumps with horsepower ratings between 3 and 200 HP. Current, voltage and motor temperature are monitored using three integrated current transformers. A digital display provides current and voltage readings for all three legs and allows the use to set up the SubMonitor quickly and easily. Ask your motor supplier for more information.





Quick-Trip. If the motor is stalled or the shaft cannot turn, the current in the motor will be 5 to 6 times Maximum Service Factors Amps. In this condition, the overload protector must trip quickly to protect the motor windings. Overload devices are rated by "trip class," which defines the length of time it will take for the device to trip in an overload condition. Quick-trip overloads are typically identified as Class 10, meaning they will trip within 10 seconds of detecting a locked rotor condition. Heater strips marked "Standard Trip" are typically Class 20 devices with a 20 second response time. Use of Standard Trip, Class 20, and even some standard Class 10 protectors can result in motor damage before they trip. Always use Quick Trip Class 10 protectors to provide maximum motor protection. Once again, using the overloads listed in Franklin's AIM Manual will ensure proper protection.

Adjustable Overload Relays. Adjustable overloads are generally electronic devices. Franklin Subtrol/SubMonitor and Siemens (Furnas) ESP100 are examples. Many installers favor adjustable overload relays which may be used in conjunction with heater strips, or independently to protect the motor. While the manufacturers and models of adjustable overload relays are innumerable, the key to selecting the correct overload relay is to understand that those relays are also classified by trip time and class rating. That is, adjustable overload relays, just like heater strips, are designated Quick Trip or Standard and Class 10, Class 20, etc. The correct selection will be one that is a Quick Trip, Class 10 (or better) device. Optimum motor protection may be obtained by setting adjustable overload relays at 5% above actual running motor amperage, as long as the SFA (service factor amps) are not exceeded.

Interpreting the time-current curve. Whether or not an overload meets Franklin requirements is determined by the overload's time-current curve. Figure 1 shows the response time for different classes of overloads under different running scenarios. Note that the shaded area represents motor burnout.

The bottom axis of the chart shows different multiples of normal currents. The side axis shows "Time" in seconds. The first bold vertical line represents the amperage if the power source single-phases on the motor side of the transformer (secondary side). This can occur if a fuse blows or a contact fails. This condition causes the normal line amperage to increase to 173% of normal in two phases and drop to zero in the third phase.

The second bold vertical line represents the amperage if the power source single-phases on the incoming side of the transformer (primary side). This can occur if a power line is broken in a storm or car accident. This condition causes the normal line amperage to increase to 230% of normal in one phase and 115% of normal in two phases.

The third vertical line represents a locked rotor or bound shaft condition. As you can see from the motor burnout curve or shaded area, the motor must be disconnected with a quick-trip device or severe motor damage can occur. The best protection, as the bold horizontal line shows, is Franklin's Subtrol/SubMonitor which disconnects the power within 3 seconds.

NOTICE: Warranty on 3-phase submersible motors is void unless Subtrol/SubMonitor or proper ambient-compensated, quick-trip protection is used on all three motor lines.

TOLL-FREE HELP FROM A FRIEND

Phone Franklin's toll-free SERVICE HOTLINE for answers to your installation questions on submersible pump motors. When you call, a Franklin expert will offer assistance in troubleshooting submersible systems and provide immediate answers to your motor application questions.

Franklin Electric SERVICE HOTLINE 800-348-2420 FAX 260-827-5102
www.franklin-electric.com

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