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How to ensure greater reliability in hot runner control connections

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As electronics have improved over the years, the failure rate for electronic components has significantly declined because of design and manufacturing advances. So, if we were to create a prioritized list of failures, what is the next most vulnerable component in that system?

To understand where the failure can occur, we must take a closer look at the hot runner temperature control system. Most temperature controls vary their circuitry slightly so we will look at this on a more macro level, beginning at the “input of the controller”:

1. AC power plug
2. AC power cord
3. Temperature controller
4. Thermocouple input, heater output and grounding connectors
5. Thermocouple and heater mold cables
6. Thermocouple and heater mold connector/mold box
7. Terminal blocks, wire lugs, wire crimps, ferrel connectors (on some systems)

Most of the components listed are “interface points” that connect one thing to another much like links in a chain. If one of those links break, it causes part or the entire system to fail.

For most industrial and commercial electronic systems today, the interface points or connectors are typically the most vulnerable for several reasons. The top three are the environment, wear and tear and the wrong connector for the application.

The connector of choice for most hot runner systems is loosely known by a few names — DIN, rectangular, Epic and Amphenol. Some of these names are descriptions, others brands. In general, there is a published standard on these types of connectors used by several manufacturers.

What sorts of problems are seen with connectors?

The most common problem seen from bad connections is erratic temperatures on the controller. The temperature readings will remain stable for a period of time and then become erratic. The likely causes are the entire connector is loose or the pins are damaged. This results in lost production because of quality or reduced number of cavities producing parts.

What environment factors affect the connectors?

The primary elements are dirt, water and plastic dust in a high temperature environment. This type of connector can withstand the harsh industrial environment fairly well over time, but many don't know when to replace the connectors and cables. A good rule of thumb is every three to five years, depending on the environment. We've seen some environments where cables are replaced annually.

Which connectors fail most often?

The most common failure is found in crimped pin insert type connectors. These connectors offer more flexibility by placing more connections in a tighter space, which is always a premium on tools.

Stamped vs. machined pins — why choose?

There are basically two types of pins when it comes to these types of inserts. One is known as a stamped and rolled pin; the other, a "solid" or machined pin.

There are pros and cons with each pin; but overall, the machined pin is a better investment in all connections. The stamped and rolled pin is approximately 30 percent less expensive than the machined pin, but in three key performance points machined pins are the choice of all molders:

1. They are significantly more rigid and do not bend as easy.

2. They are stronger in withstanding “push back” (pins pushing back into the insert and loosing their connection).
3. They carry more current and “run cooler” than the stamped and rolled pins.

There are two main reasons pins bend or are pushed back:

1. The connector is not inserted “straight on." Instead when it is eased in from one side to the other, it can cause a slight bend on a group of pins. This can cause the pin to catch on the lip of the mating socket. Another common root cause is different brands of pins do not work well together. We'll say more on this below.

2. The wrong mating pin is chosen. Some brands of pins will move around and catch the lip of the mating pin, causing it to bend the pin.

Why use guide pins for crimped inserts?

A guide pin is a special set of screws that replace the existing screws found on all crimp type inserts. These guide pins actually force the operator to connect them first, and by doing so aligns the inserts straight on. This eliminates the side cocking that causes most pin failures.

Ensure the right insert is chosen for the right pin.

Most manufacturers of crimp type inserts realized that the problems of pushed back pins are caused by the holding strength of the plastic insert that houses them. They then created a different insert for machined pins and a different insert for stamped and rolled pins. Most maintenance people, and even some controls and hot runner system manufacturers, are not aware of this and tend to use a stamped and rolled insert with machined pins. This results in erratic temperatures showing up on the controller.

What is a “wire protector” insert?

Most have heard about the wire protection feature in the crimp type inserts, but initially looking at this type of insert you can’t immediately notice a difference until you look at the hole size on the mating side of the insert. It is significantly smaller than it is for a standard insert. The reason for this is a common failure of the pin catching the top edge of the socket while being inserted. The smaller hole simply does not allow the pin to catch on the socket causing either pin to push back.

The problem with this type of insert is it makes replacing these crimped pins much harder. For standard inserts a simple removal tool is used to remove the single pin and a replacement can be done in seconds. The wire protection type requires that the entire plastic insert be completely disassembled with a specialized tool. This takes up to 10 minutes to do. You have to disassemble the insert, replace the pin, align the pins (tough to do) and snap the two halves of the insert together.

Why do some inserts turn dark brown and brittle and then completely fall apart?

An initial look at an insert with this type of problem indicates that the plastic has gone under some type of heat stress. Most maintenance people chalk this up to the tool overheating the mold connector or mold box. Though this is possible, in most cases the wire going to the connector did not burn. The wire is typically rated for 105C, where the plastic insert a much higher temperature, so something else is causing this failure.

Again, most maintenance, and even some controls and hot runner manufacturers, don’t realize that the crimped pins can only handle a certain amount of current. If you exceed that current, those pins and ultimately the plastic insert that houses them over heats and fails.

If a crimped pin insert must be used for heater connections, ensure that the load current in amps is considered for each zone.

- A typical stamped and rolled pin is rated at 10 amps of current at 240vac.
- A typical machined pin is rated at 15 amps of current at 240vac.

Exceeding these currents will cause overheating of the pins, insert and eventually the wire and cause a catastrophic short effecting the heating element and possibly the controller.

In conclusion, ensuring the greatest reliability is our primary focus. We at Fast Heat do extensive testing on the failure points mentioned above and take the greatest amount of care in implementing correct design for all applications. All Fast Heat cables are correctly rated for current, use machined pins on the crimped inserts as well as guides for larger connection densities.