"Hot Wire" cutting and Sealing

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INTRODUCTION

"Hot Wires" are used by a variety of industries to cut material such as plastic, polystyrene, polyurethane, ethafoam, styrofoam and other similar substances. Normally the maximum cutting thickness is between 0.25 and 0.50 inches (0.635 cm - 1.27 cm). "Hot Wires" are also used for sealing packages.

"Hot Wires" are usually made with a Nickel Chromium material. They typically have a low resistance with stable temperature characteristics, and therefore are best suited for low voltage and single phase applications.

In some applications the "Hot Wire" is sized so it may be connected directly to the line voltage. This eliminates any need for an isolation transformer or an SCR Power Control. However, this can be dangerous if the "Hot Wire" is accessible by the user since it will be electrically hot. In these cases, the "Hot Wire" may be longer than needed to accommodate the voltage. Without control of the input voltage, the heating is simply the result of the "Hot Wire's" resistance. This is the least desirable system since some power adjustment is necessary due to changes in ambient temperature or changes in the process such as increases or decreases in operating speed and/or thickness of the material being cut or sealed.

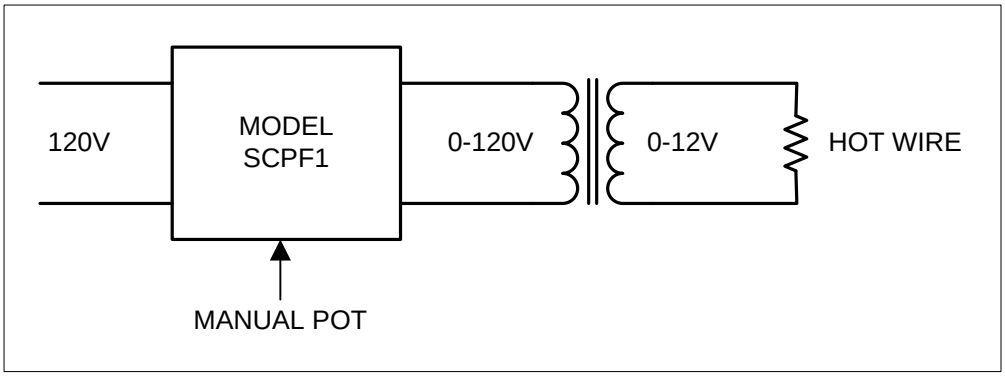

Figure 1 – Typical SCR controlled "Hot Wire" circuit

The use of a variable transformer connected directly to the "Hot Wire" is another solution but has the disadvantages of:

1. Lack of fine voltage and current control
2. Periodic maintenance required due to electrical arcing and mechanical wear
3. Cost becomes prohibitive when large currents are required at low voltages
4. There is no isolation between the line voltage and the "Hot Wire".

Another possible solution is the use of a mechanical contactor. This also requires regular maintenance and does not have provisions for voltage or current control.

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TYPICAL SCR CONTROLLED "HOT WIRE" CIRCUIT CONFIGURATION

Figure 1 illustrates a "typical configuration". A transformer and an SCR Power Control are used to achieve the desired voltage and current. This is the best solution. It provides variable control and eliminates moving parts, thus minimizing maintenance. In addition, the "Hot Wire" is electrically isolated and will provide constant wire temperature regardless of process changes.

The command signal can be either a manual pot or a process signal such as 4-20ma or any other standard process command signal.

SPECIFIC EXAMPLE

In Figure 2 shown below, an HDR model SCPF1 power controller is used with a custom transformer sized for the specific voltage and current required by the "Hot Wire". In this case a manual potentiometer is used to adjust the voltage and current, although a process signal could have been used.

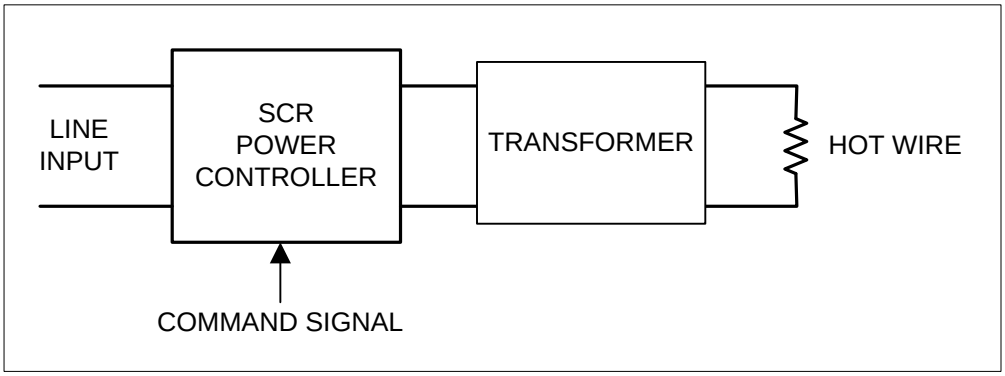

Figure 2 – Specific Example

As mentioned above, the transformer was sized based upon the specific voltage and current required by the "Hot Wire". In addition to this, the SCPF1 Power Controller was selected for the following reasons:

1. A phase fired power controller is required because of the transformer coupled load.
2. "Hot Wire" heating requirements have a tendency to change rapidly with process speed or the thickness of the material being cut and/or sealed so the power needs to be controlled.
3. It has a small physical size.
4. UL, cUL and CE approvals were important to the end customer.

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