Constant Wattage & Self-Limiting

Trace Heating is the practise of running a heat source (heating tape) along the length of a pipe, thermal insulation is then fitted over the pipe and the heat source (heating tape). The theory is that the heat source (heating tape) replaces the heat lost through the thermal insulation, therefore maintaining a temperature this could be for frost protection or maintaining a process temperature.

Electric Trace Heating systems have been around for many years. Originally the heaters had to be manufactured to suit pipe length, the out put required and the available supply voltage. A change in any of these criteria resulted in a total re-design of the systems with technological advances parallel resistance, constant wattage heaters were developed, advantageous in that they can be cut to length without affecting the watts per metre output. More recently self-limiting heating tapes, having a semi-conductive heating core matrix, the resistance of which increase with its own developed temperature, have come onto the market. Despite the extensive use of both of these two systems, constant wattage and self-limiting, confusion and misunderstanding of their differences and advantages are still rife.

Constant wattage heaters exist in various forms, of which the more recent zonal parallel circuit devices are the most convenient, since these may be “cut-to-length” on site. The output of constant wattage tape is virtually constant along the tape length, due to the consistent nature of the wire element. The heater output is always close to the nominal output stated by the manufacturer. Indeed the British Safety Standard BS6351 requires a maximum manufacturing tolerance of plus or minus 10%; on the nominal output stated in the published literature. In direct comparison the very nature of self-limiting tapes is their propensity for the output to change a long the length as dictated by the requirements of the situation. However, due to the non-homogenous heating matrix the temperature along a length of tape can sometimes vary by a large amount; with the possibility of the heater output not always resembling the output curves predicted by manufacturers. Although this is not a problem in frost protection systems where temperature is critical this output tolerance is clearly not desirable.

The start up of a self-limiting system involves very high currents at low temperatures, making it impossible to provide safe over current protection, For example, a 65 metre length of self-limiting tape, with a rated output of 10w/m (240v) @ 10 °c may need a 16 amp fuse to allow for in-rush current surges, whereas the normal operating current is only 2.7 amps. Resulting in an obvious compromise for safety. Constant wattage tapes generally do not exhibit an increased start up load, hence over current protection at the correct levels may be selected. Further problems may occur in self-limiting systems when high temperatures above their maximum withstand temperatures, usually about 65 °c. they may go “open circuit”. The semi-conductive heating matrix may also lose its “elastic memory” when subjected to higher temperatures and constant expansion and contraction over a period of time. Without extensive thermal monitoring equipment this mayn’t become evident until heater failure results in unacceptable process temperature and possible pipeline blockages. The service life and reliability of such heaters is therefore and important consideration for users of self-limiting systems.

The nickel chrome alloy heating element in our constant wattage tapes by contrast are unaffected by high temperatures. Indeed their practical temperature limitation is constrained by the surrounding electrical insulation material. Likewise constant wattage trace heating systems are not affected by thermal cycling therefore such a system correctly designed and installed should cause no concern with questions of life expectancy and reliability.
The very nature of constant wattage heating tapes with their substantially constant resistance and current ensures that monitoring is comparatively simple and effective using resistance monitors or

ammeters. Whereas self-limiting systems cannot be tested and monitored for correct operation due to the altering nature of the resistance and current consumption.

A final disadvantage of self-limiting tapes for process heating is the very nature of their mode of operation. The higher the desired process temperature, the greater the heatlosses and hence the heating requirements. Conversely the higher pipe temperature, the lower the heater output due to its self-limiting nature. It is often necessary therefore to spiral onto the pipe a large quantity of heating tape, install multiple lengths or install a extremely high output heater in order to achieve a suitable installed loads at the desired operating Temperature. Whereas with constant wattage tape, straight tracing may be possible consequently resulting in a substantial reduction in capital cost. The view is that whilst acknowledging the significance of their self-limiting characteristics self-limiting heating systems when used for process heating have a number of shortcomings. This information is by no means detailed, but hopefully will clarify some of the differences between constant wattage heaters and self-regulating heaters.

Global Trace Heating Ltd, 4 Kenworthy Road, Aston Fields Industrial Estate, Stafford, ST16 3DY
Phone: +44(0) 1785 220360 Fax: +44(0) 1785 220360 e-mail: sales@globaltrace.co.uk
www.globaltrace.co.uk