THE POWER OF SMARTHEAT

HIGH THROUGHPUT AT LOW TEMPERATURES

Everyone claims their soldering iron offers the latest technology to help you do your job better. But only Metcal Systems have demonstrated superior performance and ease-of-use. In test after test, Metcal provides unparalleled performance in a wide range of applications.

One of the key requirements in forming a strong solder joint is raising the connection temperature to the proper level for the proper amount of time. So, conventional soldering iron manufacturers have spent a lot of time and energy on the accurate and precise control of tip temperature.

However, this focus on controlling tip temperature to yield strong solder joints assumes that perfect tip temperature control equals perfect connection temperature. This is not necessarily the case!

Why? Because different solder joint loads require different amounts of heat to reach the right connection temperature. Even if you know exactly how much heat you have at the tip, you don’t know how much each joint needs. Manufacturers should focus on controlling how much heat is delivered to the solder joint, but conventional technology limits their ability to do so.

Controlling tip temperature to control connection temperature is like controlling the speed of a car by the amount of pressure you put on the gas pedal.

Of course, a very skilled operator can adjust the amount of heat being delivered by varying the time on the pedal (dwell time) or quickly changing pressure (tip temperature). In addition, if all the solder joints were alike (like driving on a flat road with no wind factors), controlling only tip temperature could effectively result in a consistent joint.

To compensate for real-world demands, Metcal SmartHeat® Systems use a completely different technology called SmartHeat. Instead of just using the tip to store heat, Metcal tip cartridges sense the load and instantly adjust power to quickly deliver the right amount of heat precisely where it is needed.

Metcal is like a space-age cruise control for your car. Not only does it vary the amount of gas (power) going to the engine (solder tip) based on the speed (connection temperature) desired, but it has an automatic, instantaneous braking system to ensure that you never, ever go too fast (no overshoot). And, because the Metcal Systems can deliver high power you won’t run out of gas along the way, even on the steepest hills.

What does this mean to you? You can solder faster at lower temperatures with a Metcal than with any other iron. This can mean substantial savings in production costs.

Want us to run an analysis of your operations? Simply call your local Metcal distributor or representative and ask for a “Value Analysis” demonstration.

HOW SMARTHEAT TECHNOLOGY WORKS

Metcal heaters consist of two basic elements – a constant current power supply and a heating element. The radical difference between it and standard heaters is that the heating element itself is capable of seeking and maintaining a predetermined temperature.

Here’s how it works: The basic design of Metcal devices depends on the electrical and metallurgical characteristics of two different metals: one a material with high thermal and electrical conductivity, the other a magnetic material with relatively high resistance.

When the device (shown here as a solid cylinder) is energised by a low frequency alternating current (AC) power source, the current will naturally flow throughout the entire conductive cross-section. However, as the frequency of the alternating current increases, a useful physical phenomenon occurs – the current flow becomes increasingly confined to the skin of the device. Known as the “skin effect”, this phenomenon serves the purpose...
of driving the current primarily through the high resistance magnetic layer, causing rapid heating.

As the outer layer reaches a certain temperature (predetermined by its constituent elements), another physical phenomenon occurs – the layer loses its magnetic characteristics. This temperature, called the Curie Point of the magnetic material, causes the skin effect to decrease, thus permitting the migration of current into the highly conductive core. Since the overall resistance to current flow is considerably decreased by both the low-resistance path of the inner core and the greater cross-sectional area through which the current travels, and the power supply provides a constant current, the overall power consumption decreases proportionally to the reduction in resistance.

The selection of a material with a given Curie point results in a device that will produce and maintain a specific self-regulated temperature. The result? A system that requires no calibration and responds dynamically to loads.

SMARTHEAT TECHNOLOGY SIMPLIFIED

We all know what happens when the sun shines on a black surface like asphalt: The surface absorbs the sun's energy and heats up. Conversely, a white concrete path reflects the sun's energy and does not heat up as much. The asphalt heats more because a black surface is better at absorbing energy than a white one.

Now, imagine what would happen if asphalt could absorb energy until it reached a pre-set temperature, and then turn white to reflect the energy away.

When the temperature dropped a few degrees, it would turn black again. You would have a road that could regulate its own temperature and never overheat or become icy.

This analogy is close to the way Metcal’s technology works. The “asphalt” is made from a metal alloy which has the ability to absorb energy from an electrical field and turn it into heat. When the alloy reaches a certain temperature, it stops absorbing energy – in our analogy, it turns white – and its temperature stops rising. When a solder joint draws heat from the heater, the alloy reacts immediately by becoming “black” again to take on more energy and reheat.

TO SUM IT ALL UP:

BECAUSE METCAL SYSTEMS USE SMARTHEAT® TECHNOLOGY,

- THEY ARE INCAPABLE OF OVERSHOOT.
- THERE IS NO NEED FOR CALIBRATION - EVER.
- THEY DELIVER HIGH THROUGHPUT AT LOWER TEMPERATURES.
- AND YOU GET AN EASY TO USE, VERSATILE CONDUCTION TOOL FOR ALL YOUR REWORK NEEDS.