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CUSTOM HEAT AND MOTION TECHNOLOGIES

tips

10 tips
for Using Infrared Effectively

Using infrared effectively doesn't have to be guess work or a big mystery to solve. A few practical tips can get you prepared to make a better buying decision as well as use an existing oven more effectively.

1. **More is not always better.** More heat does not accelerate some coatings and it can increase the cooling time or create a need for forced cooling. Especially with air dry coatings, they do not harden until the excess heat has cooled back out of the part. Until then the part will be prone to damage and fingerprints. In these cases it is better to minimize the heat to accelerate the cure process and don't treat it like a bake enamel. Reaching 350o F isn't going to help the drying and may change the coating properties or scorch it! Use a medium or long wave emitter for the best results. Force cooling with something as simple as a floor fan can help immensely too.
2. **Bigger or longer is not always the answer.** Look at watt density to determine what will work for you. Don't get over or undersold. Extra oven length uses valuable floor space that could be used for other processes. Would the process be more efficient if a higher watt density emitter is utilized? Some materials or coatings wont handle the increased intensity however if the product can absorb it you can save 1/3 or even half of the floor space. Of course with infrared ovens, you can also plan for a ceiling mounted oven thus utilizing virtually no floor space. This is where an educated buyer would examine all wavelengths to determine the time required and the expected performance of short, medium and long wave emitters.
3. **Line Density — pack it in!** It is best to go for a high line density. Your elements are creating heat and it is a "use it or lose it" situation. The more parts that are in the oven to absorb the heat produced the better. This is especially true of systems that are percentage timer or SCR controlled with no closed loop feedback. The heaters will continue to produce heat according to the cycle setting. If there are no parts in the oven, radiant heat will be reflected between the oven walls and convection heat that is not contained will escape the oven cavity. Different types of emitters will create a different balance between the radiant and convection heat that they produce. For example, a T-3 lamp has a high efficiency in terms of producing upwards of 95% radiant heat out of the energy applied. Emitters with ceramic materials are less efficient in terms of radiant heat, usually 65-80%, however most the balance is converted into convection heat. A good oven builder will design the oven to contain this heat and utilize it in the process. It offers some of the advantages of a convection oven with the speed and efficiency of IR ovens. It is true that line of sight can be a problem but it is primarily an issue with short wave emitters. Uniformly shaped and a fixed presentation to the emitters will result in very fast cure cycles. Various parts, racked with maximum exposure to IR, staggered patterns, or rotated parts can be cured with a well designed medium or long wave radiant oven. The convection produced will cure hidden areas and the parts will also have a longer cycle during which the heat can spread through the part via conduction. Experiment with rack designed to find your optimum arrangement. Generally speaking, if you can easily apply the coatings you should be able to cure it.
4. **Not all elements are created equal.** Different elements deliver heat differently and are therefore better suited to certain applications. As already discussed, the way heat is generated can vary from element to element even though they are all "infrared elements." I can't tell you how many times prospective customers have told me, "We've already tried infrared and it doesn't work." When I ask what kind was used or details of the test rig, they have no idea. That to me is a challenge! I try lots of different emitters. Gas, electric, short, medium, long, ceramic, quartz tube, metal sheath, and combinations of the above are all options until they are ruled out. Don't forget infrared and convection combinations or get wild and throw in UV technology. There is a best way to get the job done and sometimes you have to forget what the old timers told you about this newfangled IR stuff not working. Coatings and materials have changed. Try a different wavelength to put a little different spin on the electrons in your materials.
5. **Try before you buy.** It is always best to take advantage of testing services offered by manufacturers. You wouldn't buy a car without a test drive. Why buy an oven without seeing the results you can expect in your plant? Expect it. Demand it. Don't ignore it. Hopefully by now I have convinced you that the infrared manufacturing wizards can tell you all kinds of things from behind that big curtain. Go see it for yourself. If your process is one that must be done in your plant, most manufacturers can send a test set to your location. Keep in mind that the results from a test set won't be as good as the final engineered oven. Tests prove feasibility and approximate cure cycles. Your actual production results will be even better.
6. **Maintenance** — Are you really going to do it? Maintenance, regardless of how simple it is, is critical for operating an oven at peak efficiency. If you aren't likely to do any maintenance, buy an element that doesn't need much. I have gotten requests to add ovens to a line where actually a little maintenance cured the problem. It is simple to do and usually only required monthly or quarterly but yet most people

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don't do anything to their ovens. If you buy a short wave oven, expect to keep the area clean and dust free. Dust or fingerprints on the lamps will cause premature element burnouts. Reflectors must be clean or they become re-radiators thus changing the wavelength produced and the results of the cure.

Medium wave quartz tubes are much the same situation. Other sorts of medium and long wave elements can tolerate less maintenance but you will pay for it through bottom line operating costs. Gas or electric makes no difference here. Ignoring gas catalytic heaters that need repacked is just as costly as dirty reflectors and burnt out elements. Maintenance is not that much different from a convection oven. Exhausts should be checked for proper operation and filters changed as applicable. Reflectors or side wall should be cleaned per the manufacturer's guidelines. Tighten all electrical connections that may have loosened due to plant vibrations. Replace or repair elements that are not operating at peak efficiency. Clean the floor of the oven and remove any parts that may be in the cavity. That is about it. Surely you can reserve a little maintenance time to prevent a disaster or emergency later when you are pressed for more production.

7. **Don't over engineer controls.** Match the controls to the reaction speed of the heater. If the emitter takes five minutes to heat up, controlling them with SCR's is over kill. You won't reap the benefits of SCR control. Any style of quartz tube heater cannot be controlled with a percentage timer. The thermal shock on the element will cause element failure very quickly and your parts won't receive proper heat. PLC controls can be a cost savings if your oven has several zones. They can be used as a time controlled device or they will also accept thermocouple inputs. Another benefit is the ability to lock out the controls so the settings cannot be changed at anyone's whim. Since infrared emitters respond quickly, adding a phase down controller can save you money when the line stops for breaks. When the conveyor stops or when the controller is activated, the oven temperature drops to a lower temperature setting. When work resumes or the conveyor starts, normal operating parameters are restored. It also saves parts from over baking when they are left in the oven for longer times than the proper cure cycle.
8. **IR can go around corners** — sort of. Depending on the amount of convection vs. infrared that is created, heating around corners and into blind spots can be a breeze. As already discussed, certain emitters are better for this than others. Medium and long wave emitters are best because they produce some convection heat along with the infrared. They are also going to have a bit slower cure cycle which gives the convection heat time to help cure hidden areas. This convection heat is no different than the heat in a convection oven. IR ovens usually have minimal air flow which helps to minimize contamination. Infrared is not limited to strictly flat parts or those that are rotated.
9. **Make it flexible.** Use zoning, adjustable width or height to operate in the "zone." There are many options that can be built into an oven to make it more flexible. Adjustable widths on vertical ovens or adjustable heights on a horizontal oven are common. Both allow you to maintain optimal focal distance for your emitter. Zone controls allow the operator to use only the portions of the oven that are needed to cover a part. If you are running small parts, there is no reason to turn on the entire oven as you would with a convection oven. You can also zone in length which allows ramping the temperature up or down for optimal curing. The additional money that is spent on zone controls will have a very short payback time if you properly utilize the features.
10. **Infrared technology is not rocket science.** Even the most casual cook is familiar with the principles behind infrared by using appliances in their own kitchen. The gas burner or electric resistance heater in your oven function just like a gas or electric infrared heater. Enclosing that heat and the other convection heat produced turns it into a convection oven. It isn't new in the market place. It isn't experimental. It has been around since the 1940's or maybe even earlier. Don't be afraid to examine IR as potential solution for your heating, drying or curing needs. n

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