

DIRECT FIRE VS. PREHEAT

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by MIDWEST TUNGSTEN SERVICE

The purpose of this TIPs is to explain the advantages and disadvantages of direct fire metallizing versus those of preheat/flash metallizing.

Direct Fire

Direct fire immediately brings filaments to firing temperature and holds until evaporation is complete. This can be done via rheostat or with a single switch, manually or using a controller to monitor and regulate firing time and temperature. When cycle is complete, the controller automatically shuts the power off and vents the chamber.

Advantages

- Quality and production rate are consistent as there is little operator-induced variance.
- Chances of dripping and balling are greatly decreased due to shorter time in liquid phase.
- Simple technique reduces the need for skilled operators.

Disadvantages

- Rapid rise in temperature may cause the evaporant to spit or pop off of the filament.
- Rapid rise in temperature is hard on the filament leading to shorter filament life.
- Lack of flexibility.

Preheat/Flash

Preheating brings the filaments to the temperature where the evaporant just begins to flow and wet the filaments and then smoothly and steadily brings the heat up to firing temperature.

Advantages

- Operator can make adjustments from cycle to cycle, so there is better control over the quality of the metallizing. This is good for job shops running different parts.
- Wetting of filaments help use entire filament surface for vaporization.
- The slow rise in temperature greatly reduces the chances of spitting and popping.

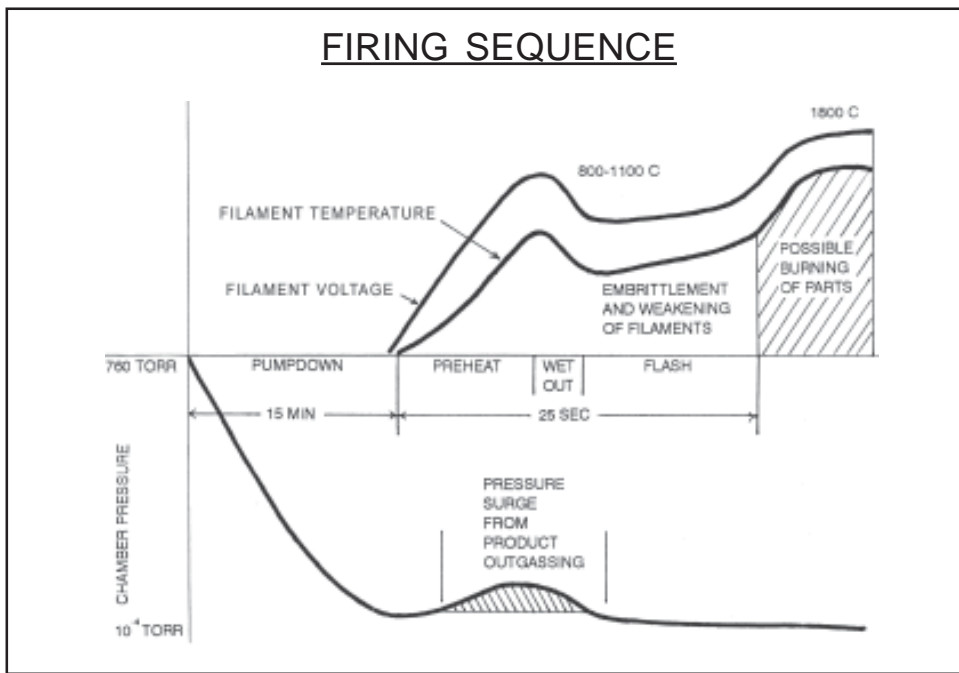
Disadvantages

- Higher operator skill is required.
- If the rise from wetting temperature to firing temperature is improper, dripping or balling will occur.
- Variation from cycle to cycle or from operator to operator gives inconsistent production rates and quality.

Many chambers now use computer controlled firing. This allows the use of preheat for proper wetting while also eliminating variations in firing technique.

There are different methods to control automated firing. One method uses a quartz crystal to measure the thickness of the coating applied. The desired thickness is set on a digital controller. During coating, the crystal communicates with either the voltage or current controller. As the thickness nears the preset value, the voltage or current is reduced. Once the desired thickness is reached, the evaporation cycle is cut off.

Feedback is easily obtainable with this method. Digital readouts can show deposition rate and also condition of the crystal. This is important because if the crystal goes bad, the system can cycle without firing. The quartz



crystal method is ideal for applications such as optics where coating thickness is an issue. Although this method provides us the ability to measure the exact thickness deposited and the deposition rate, it carries a higher initial cost and does not optimize filament life. Comparisons of automated vs. manual firing:

Manual firing

Advantages

- Manual firing allows flexibility in firing techniques.
- Manual firing allows greater flexibility concerning part size. This makes this method good for job shops where the parts being fired can change from one day to the next.
- Filaments are used to their optimum potential.

Disadvantages

- Greater operator skill is required.
- Data is not as reliable as in automated firing.
- Operators have more opportunity to "tweak" the system. This leads to inconsistencies in both quality and production rate.

Automated firing

Advantages

- Less skill is required.
- Automated firing systems offer very accurate data and documentation. Many are programmed to send information right to a connecting spreadsheet.
- More consistency in both cycle times and quality of metallizing.

Disadvantages

- Flexibility concerning part size is diminished.
- The equipment is much harder and more expensive to troubleshoot.
- More expensive capital equipment cost.

MIDWEST TUNGSTEN SERVICE, INC.

800-626-0226

fax: 630-325-3571

630-325-1001

www.tungsten.com

7101 S. Adams St. #6, Willowbrook, IL 60527