

## ELEMENT BURN-IN PROCEDURES

Element burn-in prior to the installation of the tube and other hardware forms aluminum oxide on the element wire. This oxide increases the tensile strength of the wire at high temperatures, prolongs the life of the wire, and provides protection against elongation of the wire throughout the life of the element. Ceramic fiber is hydroscopic in its nature. It is important that the heating chamber be dried out thoroughly and slowly during initial heat up in order to remove any residual moisture in the insulation.

When preparing the element for burn-in, pack the openings at the furnace end zones with insulating material. Leave a 1.50 to 2.00 inch diameter hole in the center of the packing to allow for airflow into the element. This opening is necessary to provide sufficient oxygen to form adequate amounts of oxide on the wire. Aluminum oxide is gray in color and it must be observed on the wire after the burn-in process is completed. Oxide formation is a function of time and temperature and the best results are achieved with a longer burn-in period of gradual temperature ramping, rather than initial higher temperatures.

### Element Burn-In Procedure for Kanthal A1 or APM Furnace Chambers

**Large Gage Helical Elements (DSF Vulcan or Hercules, 1300°C max):** Ramp from ambient temperature to 400°C with maximum power values. Soak for 2 hours. Ramp to 1000°C with maximum power values. Soak for 4 hours. Ramp at 5°C per minute to 1200°C or 25°C above process temperature, whichever is greater and soak for 8 hours.

**Low Mass/Low or Mid Temp Elements (DSF Mercury or Apollo, 1000°C max):** Ramp from ambient temperature to 200°C at 5°C per minute. Soak for 2 hours. Ramp to 500°C at 5°C per minute. Soak for 2 hours. Ramp at 5°C per minute to 1000°C or 25°C above process temperature, whichever is greater and soak for 4 hours.

**Low Mass/High Temp Elements (DSF Mercury APM, 1150°C max):** Ramp from ambient temperature to 200°C at 5°C per minute. Soak for 2 hours. Ramp to 500°C at 5°C per minute. Soak for 2 hours. Ramp at 5°C per minute to 1000°C. Soak for 4 hours. . Ramp at 5°C per minute to 1150°C or 25°C above process temperature, whichever is greater and soak for 12 hours.

### Element Burn-In Procedure for Ceramic Fiber Heaters

Install heater in enclosure or follow the directions above. In a box type enclosure, create an opening sufficient to ensure a ventilation path for excess moisture. Ramp from ambient temperature to 200°C at 5°C per minute. Soak for 1 hour for each inch of insulation thickness. Ramp to 500°C at 5°C per minute. Soak for 2 hours. Ramp at 5°C per minute to 25°C above process temperature. Soak heaters with a maximum process temperature of 1050°C or less for 4 hours. For processes of 1051°C to 1150°C soak for 8 hours. Above 1150°C, soak for 12 hours to insure proper oxidation of the element wires.

### Burn-In Procedure for Silicon Carbide Chambers

Create an opening sufficient to ensure a ventilation path for excess moisture. Ramp from ambient temperature to 250°C at 5°C per minute. Soak for 4 hours. Close furnace. Ramp at 5°C per minute to 25°C above process temperature or 1500°C, whichever is greater and soak for 12 hours.

### Burn-In Procedure for Molybdenum Disilicide Chambers

Create an opening sufficient to ensure a ventilation path for excess moisture. Ramp from ambient temperature to 250°C at 5°C per minute. Soak for 4 hours. Ramp at 5°C per minute to 25°C above process temperature or 1500°C, whichever is greater and soak for 12 hours. We recommend repeating the last step for all continuous process furnaces upon restart to re-oxidize the elements; especially furnaces with high power densities (over 40 watts/inch) or in the case of large diameter elements (type 9/18 or higher) as these elements contract during cool down and often lose part of their oxide protection.

### Burn-In Procedure for TEL FTPS Molybdenum Disilicide Chambers

OEM recommended burn-in procedure: Ramp from ambient temperature to 400°C at 5°C per minute. Soak for 30 minutes. Ramp at 5°C per minute to 600°C. Soak for 2 hours. Ramp at 5°C per minute to 800°C. Soak for 2 hours. Ramp at 5°C per minute to 1100°C. Soak for 24 hours. Note: The ramp and soak steps below 1100°C are in place to burn-off organics in the insulation. DS Fibertech's insulation is organic free. Oxide growth on molybdenum disilicide is minimal at 1100°C.

DS Fibertech refurbishments recommended burn-in procedure: Ramp from ambient temperature to 500°C at 5°C per minute. Soak for 2 hours. Ramp at 5°C per minute to 800°C. Soak for 1 hour. Ramp at 3°C per minute to 1150°C. Soak for a minimum of 24 hours; 48 hours preferred to maximize wire oxidation. Note: Repeat the last step every 4 – 6 weeks to maximize element life.

**CAUTION:** Faster ramp may damage the furnace insulation.