Factors, Influencing Radiant Tube Life

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topics

- tube design
  - material
  - structural design
  - workmanship

- operation
  - production rate
  - burner control and design
  - furnace control

- maintenance
creep strength

100 hrs at 2000°F  
source: Haynes

32 hrs at 1800°F  
source: Rolled Alloys
structural design

structure for stiffness

pinned support

roller support
structural design

ceramic radiant tube

cantilever

metal radiant tube

optional

double-P-tube

U-tube
ideal heating process

![Graph showing the relationship between net heat flux and furnace temperature, strip temperature, and heated length.](image)
furnace control

![Graph showing radiant tube temperature, strip temperature, and net heat flux versus heated length. The y-axis represents net heat flux in BTU/sq in and temperature in °F. The x-axis represents heated length in ft.]
furnace control

![Diagram showing net heat flux, radiant tube temperature, furnace temperature, strip temperature, and net heat flux versus heated length and temperature.](image-url)
real process
real process
control

acceptable

ideal
burner and furnace control

- temperature variations from proper burner on/off control (pulse firing) are generally much smaller than variation originating from the furnace control
- using the safety shut off (radiant tube over-temperature) is by no means intended to be used as a controlling the heat input into the furnace
- the heat flux profile is valuable information
- heat flux (heat output / strip width) should decrease when the strip gets hotter
- heat flux and temperatures should not fluctuate more than required (strip parameter changes)
burner design, flame length

good

too long

too short
burner design, high recirculation

high recirculation requires high velocity burner and on / off control
• proper maintenance helps to detect small defects before they become large problems

• proper maintenance provides the data to understand your equipment and process

• proper maintenance keeps the burners tuned, efficient and clean
conclusions

• tube life can be affected by many factors

• watch the heat flux profile

• analyze tube failures

• suppliers and users should work together (not blame each other)