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The Original® Hot Surface Igniter

ASGE 2013

HOT SURFACE IGNITER APPLICATION

Surface Igniter Products

- Products
  - Silicon Carbide
  - Silicon Nitride
  - Spark Igniters/Flame Rods
- All OEM products CSA certified

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Surface Igniter Locations

Mayaguez, Puerto Rico

Mayaguez, PR Facility

- Started 1953
- 150,000 sq. ft. plant
- One of first manufacturing plants in PR
- Fabricates silicon carbide igniter core
- ISO 9001:2008 registered

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Surface Igniter Locations

Carbide High Temp, China

Jiangsu Province, PRC Facility

- Since 2002
- ISO 9001:2008 registered
- Distribution for Asian customers
- Assembly work for :
  - Silicon Carbide
  - Silicon Nitride
  - Spark Igniters

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Surface Igniter Locations

Chagrin Falls, Ohio

Chagrin Falls, OH Warehouse

- ❑ 12,000 sq. ft. warehouse
- ❑ Distribution for North America & Europe
- ❑ ISO 9001:2008 registered

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Silicon Carbide Igniter

- First Product—Silicon Carbide
- Unique Double Helix or “Spiral” Design
- Over 40 years of reliable, cost effective use in home appliances

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Silicon Carbide History

Silicon Carbide Discovery

- Edward Acheson-1891
- Experimenting to separate iron from ore
- Inserted a carbon rod into iron/ore clay
- Electricity caused clay to heat
- No iron but silicon/carbon crystals

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What is Silicon Carbide?

- Compound of Silicon & Carbon
- Also known as Carborundum
- SiC
- Uses
  - Igniters
  - Abrasives
  - Automotive
  - Cutting Tools

Silicon Carbide Igniter

- Acheson founded Carborundum Co.
- Made a smaller version of their 5 ft. heating element
- Original silicon carbide igniter in 1969

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Surface Igniter Timeline

- Formerly the Carborundum Co.
- Double helix Igniter developed in 1960's
- First silicon carbide gas igniter
- Introduced as clothes dryer ignition source
- Carborundum sold in 1997
- Became Surface Igniter LLC

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Silicon Carbide Igniter Uses

- ❑ HVAC
- ❑ Ranges
- ❑ Dryers
- ❑ Water heaters
- ❑ Scientific instrumentation

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Manufacturing Igniter Cores

- Dry Mixes Blended
  - Graphite
  - Silicon Carbide
- Wet Mixes
  - Used as a binder
  - Including water & syrup

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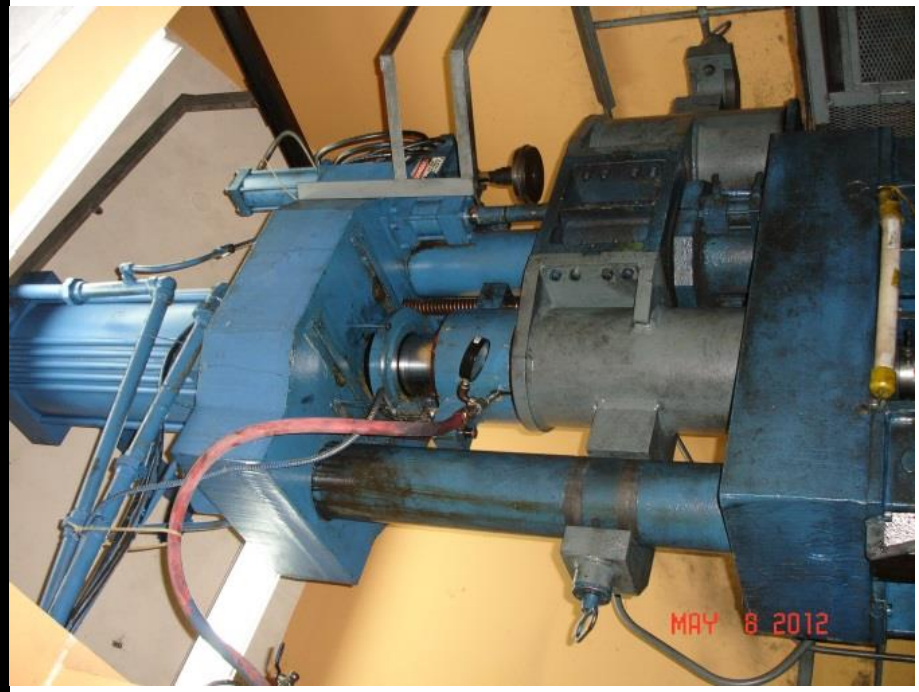
Manufacturing Igniter Cores



- Graphite tube extruded

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Manufacturing Igniter Cores

- ❑ 14 hours inside a dryer
- ❑ Then calcination process

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Manufacturing Igniter Cores

- Rods cut to proper length

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Manufacturing Igniter Cores

- Spirals or “double helix” is cut into the cores

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Manufacturing Igniter Cores

- Siliconizing process
  - Cores covered with silicon metal and run through furnace
- Crystalizing process
  - 2nd furnace

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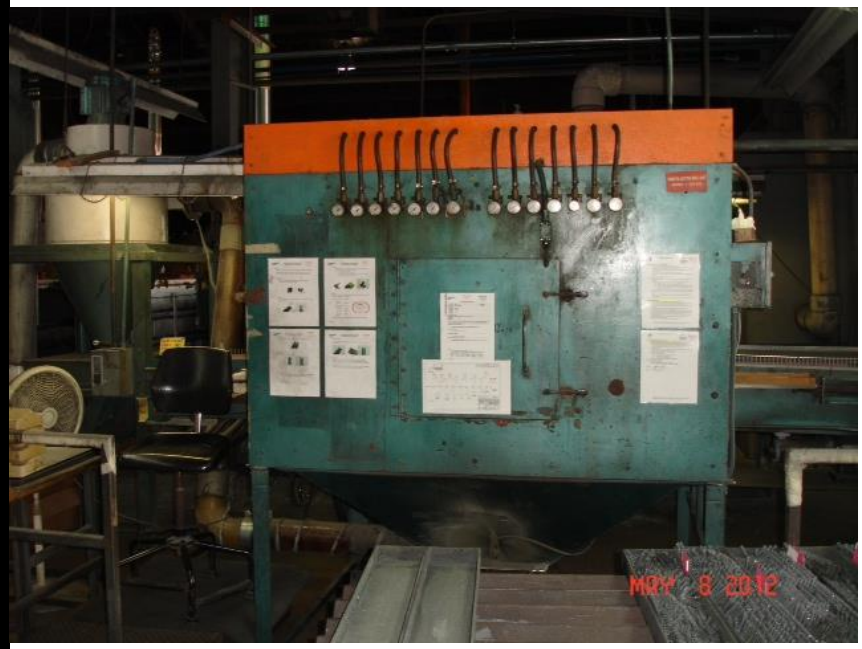
Manufacturing Igniter Cores



- Cores are sandblasted to remove excess crystals

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Manufacturing Igniter Cores

- Cores heated again to stabilize the electrical properties

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Manufacturing Igniter Cores

- Aluminum spray is added to end of core for improved electrical contact

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Manufacturing Igniter Cores

- Cores separated into different appliance categories

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Assembly

- ❑ All assembly work completed at China plant
- ❑ All completed product test fired 25 times before shipped

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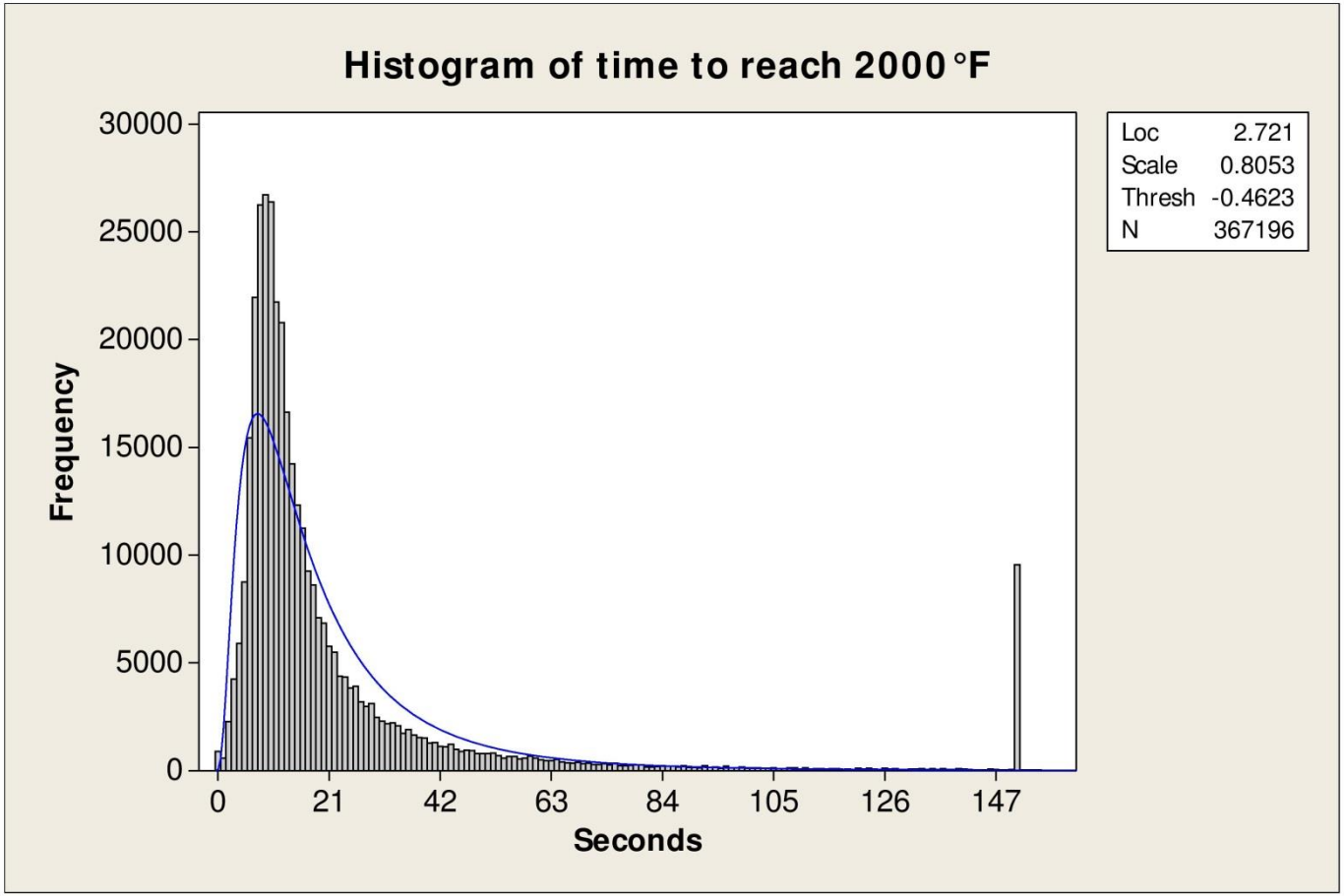
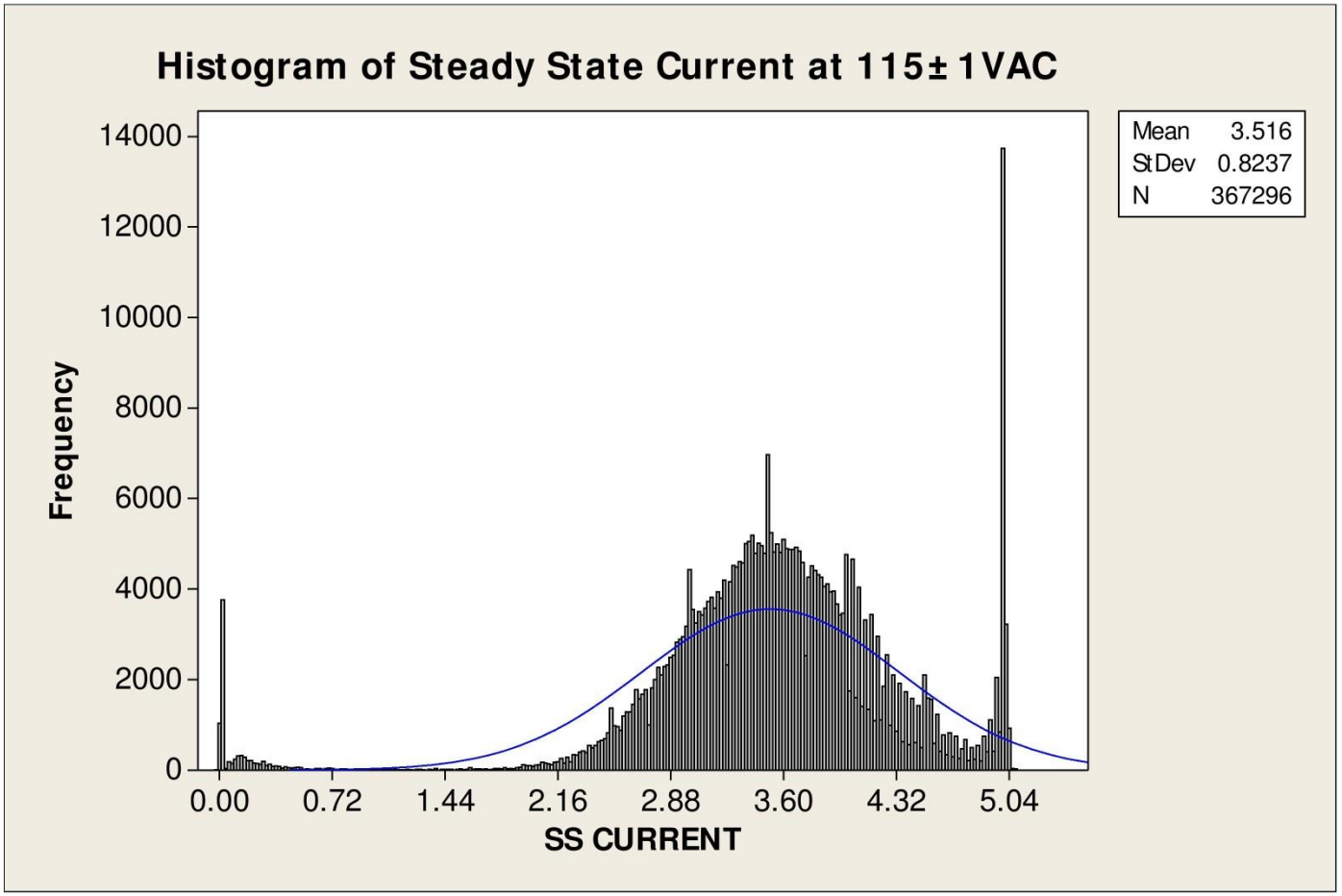
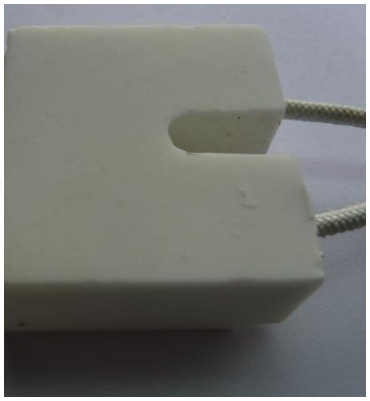
Time To Temperature (TTT)



Steady State Current (SSC)



Ceramic Body Types



Ceramic Bases

- ❑ Customized to most any shape and size
- ❑ Common types of materials
  - ➢ Steatite
  - ➢ Alumina
  - ➢ Cordierite
- ❑ Glazed or non-glazed

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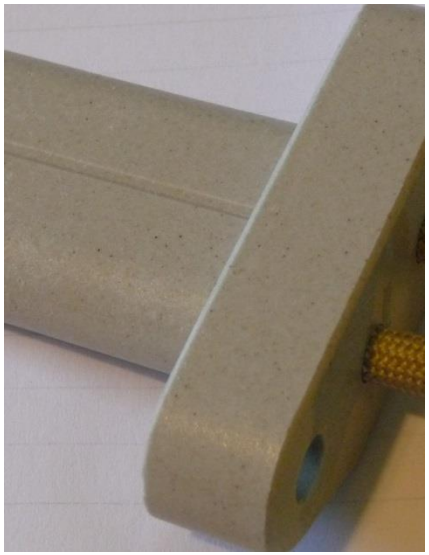
Ceramic Body Types

- Alumina
  - White
  - 0% Water Absorption
  - 2800 F
- Steatite
  - Off White
  - 0% Water Absorption
  - 2350 F
- Cordierite
  - Tan
  - 10% Water Absorption
  - 2350 F



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Ceramic Bodies

- If water tightness is needed, an additive is added to the cement used in assembly to make the assembly water tight

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Igniter Application Specifications

- Physical Size
- Type
  - Silicon Nitride
  - Silicon Carbide
- Time to Temperature
- Voltage
- Steady State Current
- Mounting Method
- Wire Type
- Environment
- Terminations

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Silicon Carbide vs. Silicon Nitride

Silcon Carbide	Silicon Nitride
Rough Texture	Smooth Finish
More Fragile	Physically Stronger
Less Expensive	More Expensive
Larger in Size	Smaller Size

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Silicon Nitride Discovery

- First Report 1857
- Unknown how to use it
- Carborundum patents 1948-1952
- By 1958 Carborundum was producing SN thermocouple tubes, rocket nozzles & crucibles for melting metals
- Discovered in meteorites 1990's

What is Silicon Nitride?

- Compound of Silicon & Nitrogen
- Si_3N_4
- Uses
  - Igniters
  - Bearings
  - Automotive
  - Cutting Tools
  - Gas Turbines

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Silicon Nitride-12 & 24V

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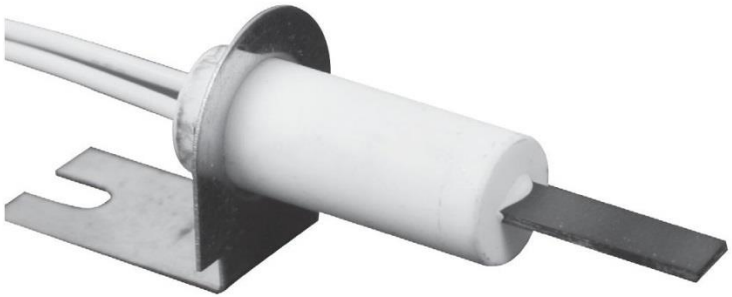
Surface Nitride Products

Silicon Nitride-120V



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Silicon Nitride 12 & 24V Core

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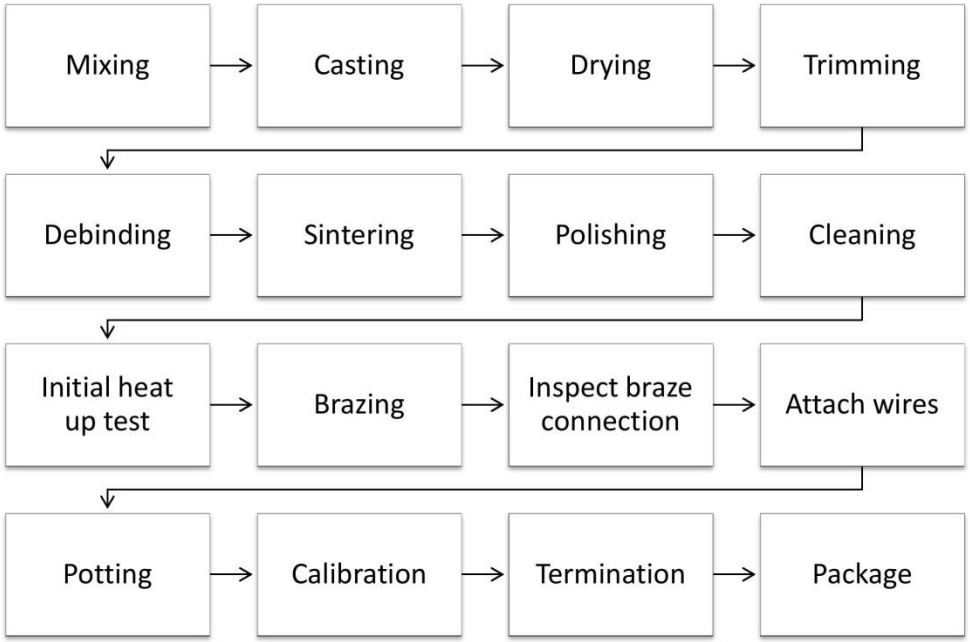
Silicon Nitride Process Flow Chart



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Igniter Comparison

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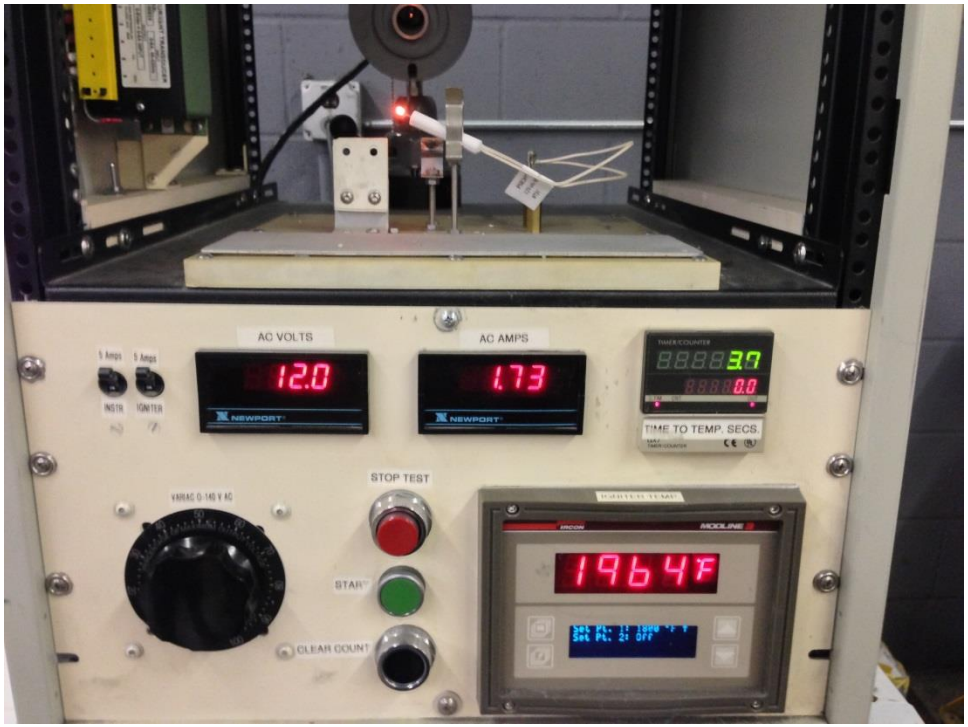
Hot Surface Igniter Applications

12V Silicon Nitride (TTT)



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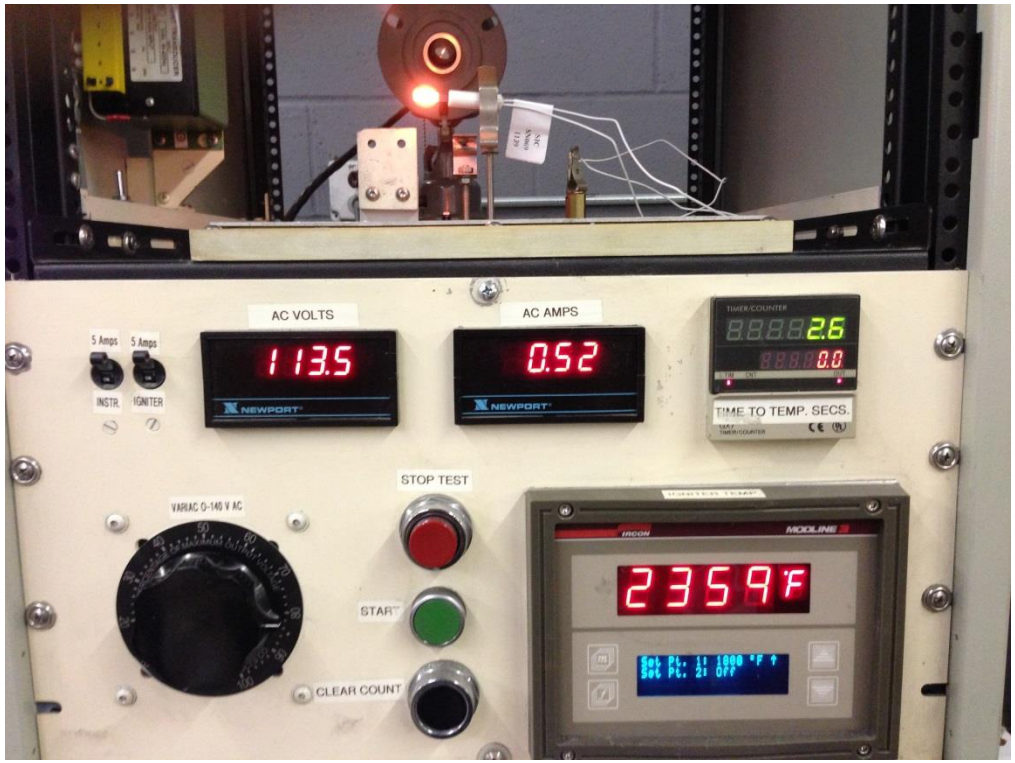
Hot Surface Igniter Applications

120V Silicon Nitride (TTT)



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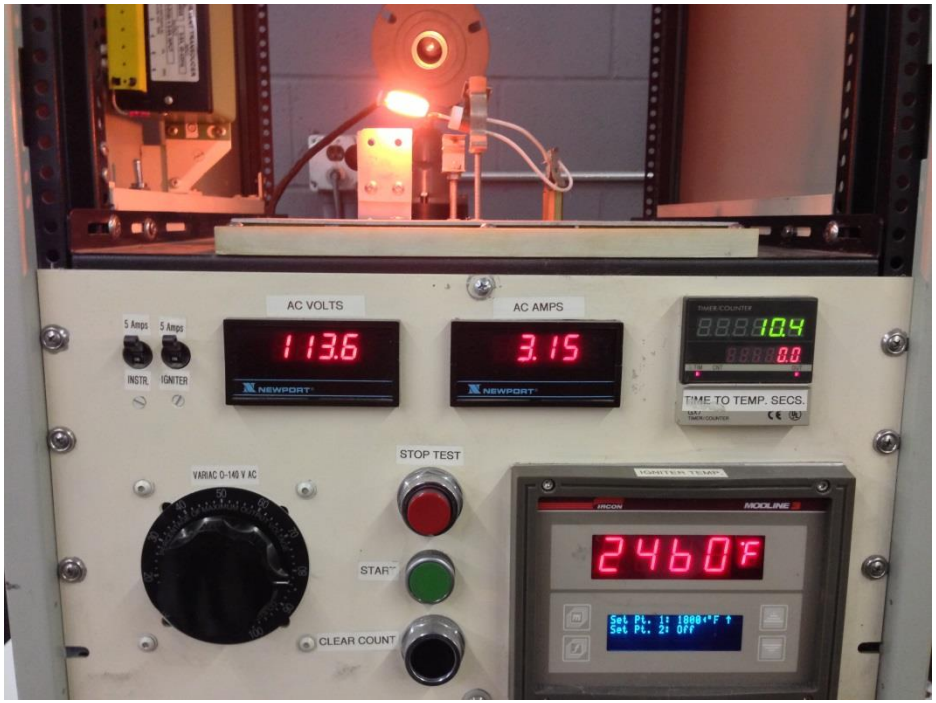
Hot Surface Igniter Applications

120V Silicon Carbide (TTT)



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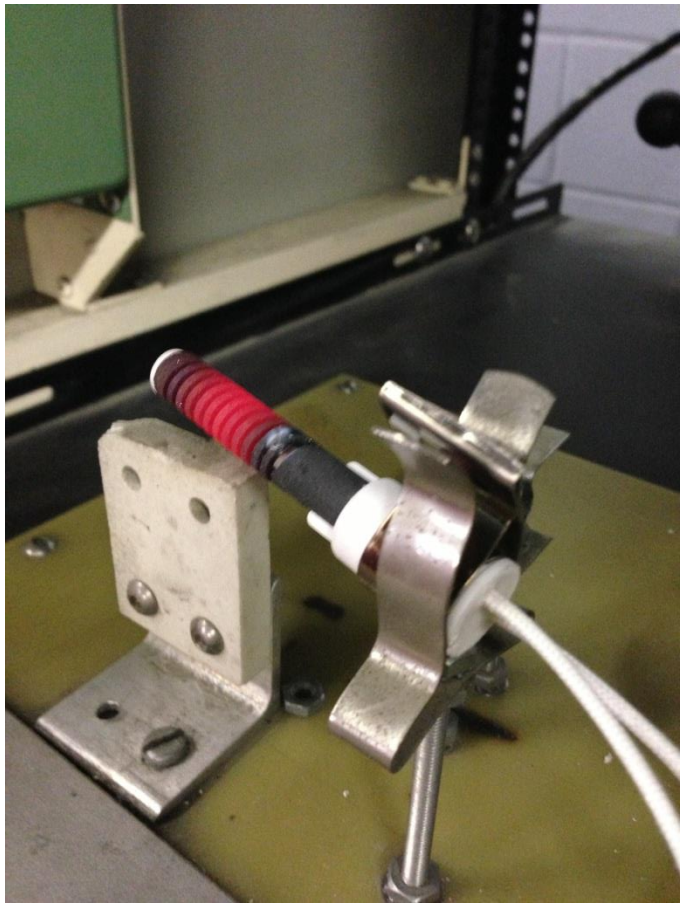
Hot Surface Igniter Applications

Cracked Igniter



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Hot Surface Igniter Applications

HVAC

- ❑ Typically Silicon Nitride
- ❑ Usually 24V or 120V

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Hot Surface Igniter Applications

Dryer

- ❑ Typically Silicon Carbide
- ❑ 120V
- ❑ TTT 20-100 sec
- ❑ 2.5-4.2 Amps
- ❑ Patented Shock Mount

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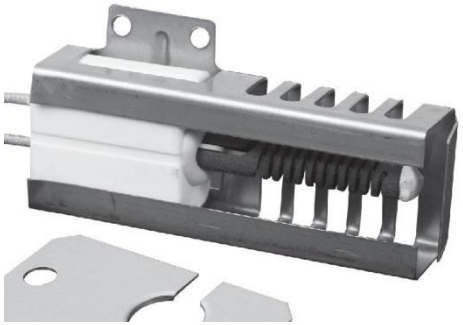
Hot Surface Igniter Applications

Range

- ❑ Typically Silicon Carbide
- ❑ 120V
- ❑ TTT <60 sec
- ❑ 2.5-3.0 or 3.3-3.6 Amps
- ❑ Usually Shielded



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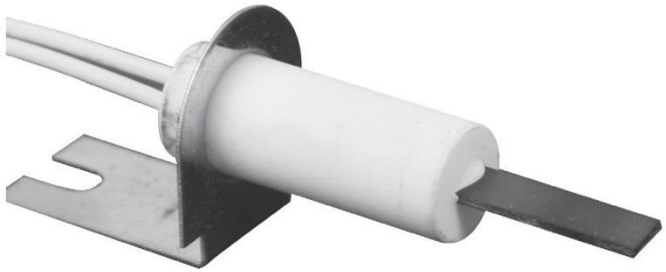
Hot Surface Igniter Applications

Ovens-Commercial

- ❑ Silicon Nitride
- ❑ 24V or 120V
- ❑ TTT <17 sec
- ❑ 0.8-2.0 Amps



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Hot Surface Igniter Applications

Grills

- ❑ Typically Silicon Nitride
- ❑ 12V
- ❑ TTT <10 sec
- ❑ 0.8-2.0 Amps

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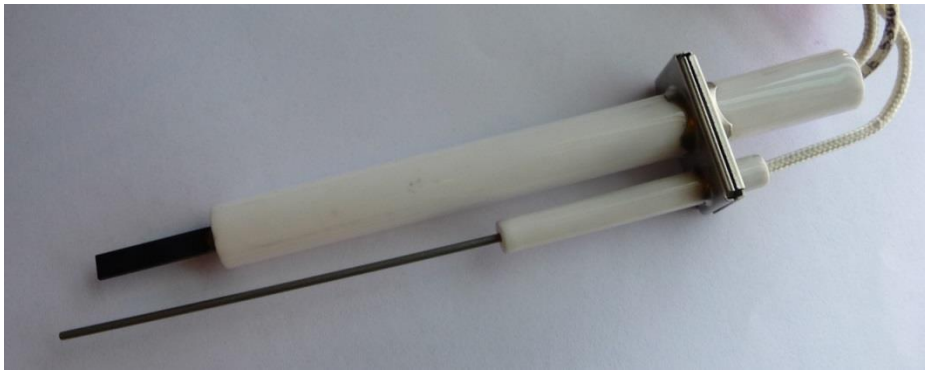
Hot Surface Igniter Applications

Boilers/Water Heaters

- ❑ Silicon Nitride & Silicon Carbide
- ❑ 120V
- ❑ TTT <17 sec
- ❑ 0.8-4.5 Amps



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Hot Surface Igniter Applications

Heaters-Agricultural

- ❑ Typically Silicon Nitride
- ❑ 24V or 120V
- ❑ TTT <17 sec
- ❑ 0.8-2.0 Amps
- ❑ Shield Optional

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Hot Surface Igniter Applications

Medical-Scientific

- ❑ Silicon Nitride or Carbide
- ❑ 24V

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Hot Surface Igniter Applications

Spark Igniters

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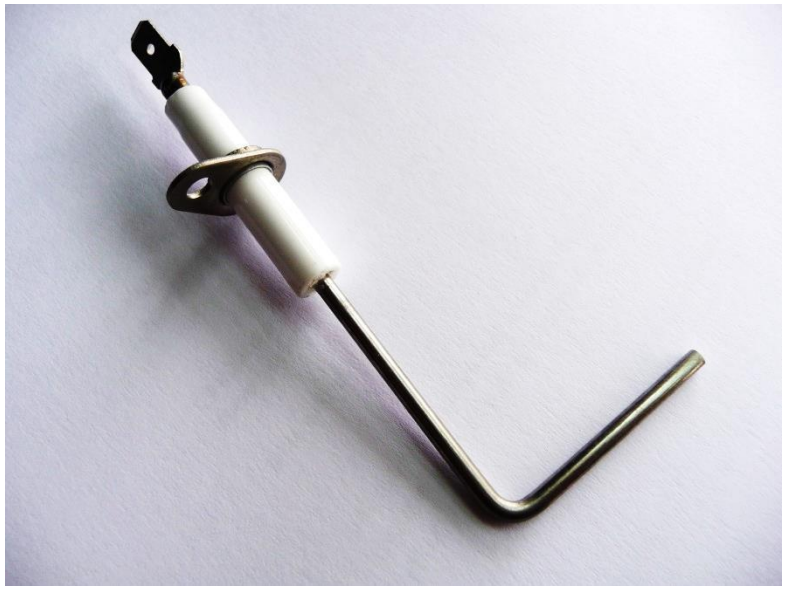
Hot Surface Igniter Applications

Flame Rods



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Igniter Troubleshooting

- ❑ Cracks
- ❑ Contaminants
- ❑ Aging-Igniter body turns gray

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Igniter FAQ's

- Oil from one's hand will not harm igniter
- No direct correlation between cold resistance and SiC's silicon carbide igniter's steady state electrical properties

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SIC Summary

- Igniters
  - Silicon Carbide
  - Silicon Nitride
  - Spark
- Custom Designs
- Can accommodate low volume lots

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SIC Contact Information

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Thank You!

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APPLICATION