

# Simple, Effective Solutions For Your 1700°C Challenges

## Your World

The life of a materials engineer revolves around the application of science and the use of specialized tools to solve problems.

Imagine for a moment that your responsibility entails materials research and development. You have the necessary knowledge and experience, but you've been given a limited number of specialized tools to conduct your work. For high temperature processing, you have a single small furnace that must be versatile enough to handle most every requirement. Would you prefer to use the furnace equivalent of a screwdriver, or a Swiss army knife?

Or perhaps you're involved in the production of small, high-value components or specialty materials. Problems arise due to inconsistent materials quality, human errors, equipment failures, etc. You want to eliminate variables, establish reliable performance standards, and get consistently excellent results time after time with minimal supervision. For high temperature processing, what would better meet these needs, a flimsy and finicky solution, or a rugged and proven workhorse?

In both cases, the ideal answers are obvious. But in real life, why does it often seem that we end up with less than ideal situations, especially when taking something from R&D into production? This does not have to be the case. Practical, simple, and proven solutions for applications to 1700°C and higher are available.

## Three Critical Elements of Your Solution

So how can you tap into and benefit from these solutions?

First, you've got to find the right "Swiss army knife," the one that integrates the ideal assortment of capabilities for your particular field, whether it's metals, ceramics, electronics, glass, etc.

Then take a look at how well the solution is put together. Is it a Rube Goldberg contraption, a cheap and dirty "knock-off," or a substantial and credible package that's clearly built for performance?

Lastly, find out what kind of support is available to help facilitate your transition to the ideal solution. Will you be dealing with "car salesmen," catalog order entry people, or industry veterans willing to share their experience with you?

## Conducting Your Evaluation

Let's walk through this process using Keith's FastHeat front-loading box furnace by way of example.

### 1. "Swiss Army Knife"

What furnace capabilities might you require to conduct a wide variety of research and development work?

- Temperatures up to 1800°C
- Rapid heating and controlled cooling rates
- Constant use at maximum temperature
- Repeated cycles to maximum temperature
- Uniform temperatures throughout the furnace chamber
- Thermal gradients within the furnace chamber
- Precise control of all heating, soaking, and cooling rates
- Powerful and easy-to-use process controls
- Automation that interfaces with your computer
- Automatic venting of process volatiles
- Firing in air or controlled atmospheres (within specific limitations)
- Special ports for viewing, gathering data, or extracting samples
- Accommodation of special fixtures, platens, gauges, etc.
- Ability to resist degradation from various materials processed



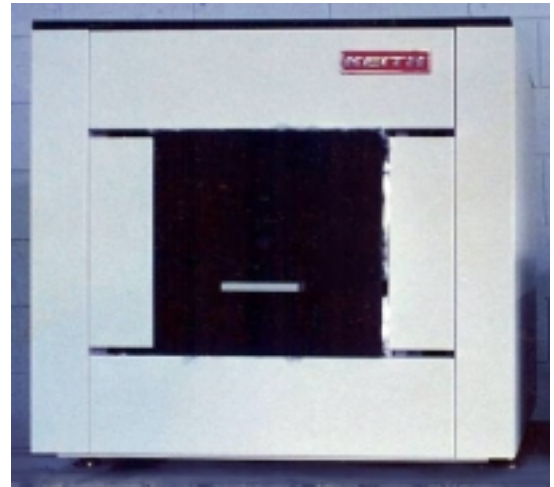
*Model KSK-12 with optional automated exhaust port*

Keith's FastHeat furnace line offers proven and economical solutions to all of these performance requirements. The standard front-loading FastHeat furnace is the starting point. Many options and modifications are offered which deliver a unique combination of performances that's often difficult to find elsewhere. A few examples are shown below.



*The furnace to the left was modified with ports through the front and back walls for insertion of a ceramic process tube, into which small parts can be placed for processing in argon or nitrogen atmosphere. Optical pyrometer ports are also located through the sidewalls.*

*The standard furnace normally includes a base-mounted control enclosure. But this configuration may not be ideal for some applications involving special hearth supporting systems, internal platens, or ports that pass through both the roof and floor of the furnace chamber. So the furnace at right was modified from the standard design to provide free access from the top and bottom to accommodate such needs. The controls are then mounted in a separate enclosure located near the furnace.*



## 2. Rugged and Proven Workhorse

Is the system designed and built for long-term, reliable production use?

- Overall construction is strong, durable, and of a high quality
- System is built for regular firing to maximum temperature with maximum loading
- Floor is designed to support heavy loads at high temperatures
- Uses heavy duty heating elements with ample heating capacity
- Verifies uniform heating BEFORE commencing a firing
- Control system is highly accurate and always delivers repeatable performance
- Construction is of a modular design that simplifies maintenance
- Manufacturer has many years of experience with this technology
- Many customers will confirm great satisfaction with long-term use

Once again, the Keith FastHeat furnace meets all of these criteria. As a furnace builder with more than 50 years of engineering and manufacturing experience, Keith is also a pioneer of fast-firing 1700°C furnace technology. At the 1972 NEPCON Show, Keith exhibited a new electric furnace design that was fiber-lined and heated to 1700°C in 15 minutes. From these beginnings, Keith has led the industry in electric 1700°C laboratory and production furnaces, building systems for companies around the world who demand the very best. Today's FastHeat furnace incorporates nearly 35 years of improvements that deliver the most dependable performance on the market.



*Keith's standard heating elements are twice the diameter used in some competing designs. Heavier elements simply last longer, and deliver more heating power without overloading the heating system. Also seen in the photo to the left is the insulation hot-face, which features a proprietary construction that allows for the insulation to expand and contract with minimal stresses during regular heating and cooling to maximum temperatures. This prolongs the life of the insulation. And the heating elements and insulation walls are modular, which makes them easy and economical to maintain.*

The standard FastHeat furnace is designed as a small-scale production furnace. Some performance characteristics you need may be optional, so be sure to specify your most important considerations during your evaluation to ensure the solution you select will in fact meet with all your needs.

One example of a useful option is a heating element monitoring system that ensures all elements are intact before a firing cycle starts. Normally, a broken element will not prevent the furnace from heating, but it will cause temperature uniformity problems that can damage an entire batch of product. The element monitoring system alerts the furnace operator to replace a broken element before a cycle begins, so the load fires with the expected temperature uniformity.

What have Keith's customers said about their FastHeat furnaces?

"Keith designed and built a system with superb temperature uniformity and with the flexibility we needed at a cost that kept the CFO off my back. They have been exceptional to work with, acting as direct members of my production team whenever needed. We were so pleased with our initial experience that we converted our entire sintering line to Keith furnaces."

Robert Senn, EMS Technologies

"We've made a tremendous investment in Keith equipment – and it has paid off! Whenever we need help, Keith is there. They really listen to what we need, and they come up with reliable solutions that work. Their reliability is unbeatable, and we've developed a great working relationship."

Mario Bonafede, American Technical Ceramics

"I've known Keith for 30 years, and their technology makes good business sense. Their energy efficient designs are right on target. We've been very pleased with the quality and performance of our Keith kilns."

Dan Devoe, Presidio Components

"Our process requires precise temperature ramp rates, and the FastHeat furnace accurately meets the heating rates we program into the control system. We've found Keith Company to be very helpful and knowledgeable about the furnaces and features they provide."

Russell Smith, Oxane Materials

### 3. Technical Support

Can your requirements be met from a catalog, or do you need the assistance of an expert to ensure you get what you need? Consider the following questions when you talk to a supplier of 1700°C furnaces:

- What kind of support do you receive when you call with technical questions?
- Does the company make a real effort to understand all your needs?
- Can your requirements be met with proven and economical solutions, or does the company offer an expensive experimental design?
- Can the company adequately demonstrate expertise with your needs before asking for your business?
- What kind of technical support will be provided with your furnace, and for how long?

Keith rates very high in this area. Your own experiences when contacting suppliers and evaluating these questions will likely reveal your best source of technical support. If you need something special or unique, it should be even easier for you to observe differences in the type and quality of technical support you receive, further simplifying the process of selecting your ideal problem-solving partner.

"Our FastHeat furnaces are designed and constructed to a very high standard. And because we have the technical know-how and a willingness to work with unusual applications, we often customize these furnaces to meet challenging requirements. This include applications where the user may process a material that chemically reacts with the refractory insulation, or needs to be radar transparent, or requires special sensors and ports, or integrates press platens or devices used for hot modulus of rupture testing, etc. Our success in large measure is a function of our commitment to find the most reliable and economical solution that meets ALL of our customer's needs. I'm delighted to report that we have an excellent track record."

Wendell Keith, Keith Company



## Summary

It's not hard to find simple, effective solutions for your 1700°C challenges. It can be as easy as contacting the right company – one that can provide all the utility, dependable performance, and technical support you need. They should be able to get right to the heart of your requirements, and address them with solutions that make good technical and business sense.

That's the kind of partner Keith Company strives to be. And that's one reason why the Keith FastHeat has been the furnace of choice for many leading companies and universities around the world, including Samsung, American Technical Ceramics, Boeing, General Electric, NASA, Nanotech, Rath Performance Fibers, Vesuvius, Texas Instruments, the University of Washington, UCLA, USC, Georgia Tech, Alfred University, and many others.

For more information about the Keith FastHeat furnace, visit [www.KeithCompany.com](http://www.KeithCompany.com), or call 800.545.4567.

## FastHeat Article Excerpt

### Batch Furnace Technology for Space Shuttle Tile Manufacture

*With more than 20,000 ceramic tiles covering a space shuttle vehicle, it is often necessary to replace a great many tiles after the shuttle returns from a mission in space.*

Replacement is required because the fragile tiles are easily damaged in flight and flight data being measured in or around a tile may require their replacement. To achieve a greater speed and economy of tile manufacture in small quantities, NASA engaged Rockwell Manufacturing to create a Single-Tile Manufacturing Line at the Kennedy Space Center (KSC). Essential to the firing of new tile on this Single-Tile Manufacturing Line are precisely controlled high temperature FastHeat batch furnaces developed by the Keith Company . . .



Read the entire article online at <http://66.34.205.109/keithcompany/web/Article%201-23.asp>.