



# Specialists in Thermal Applications

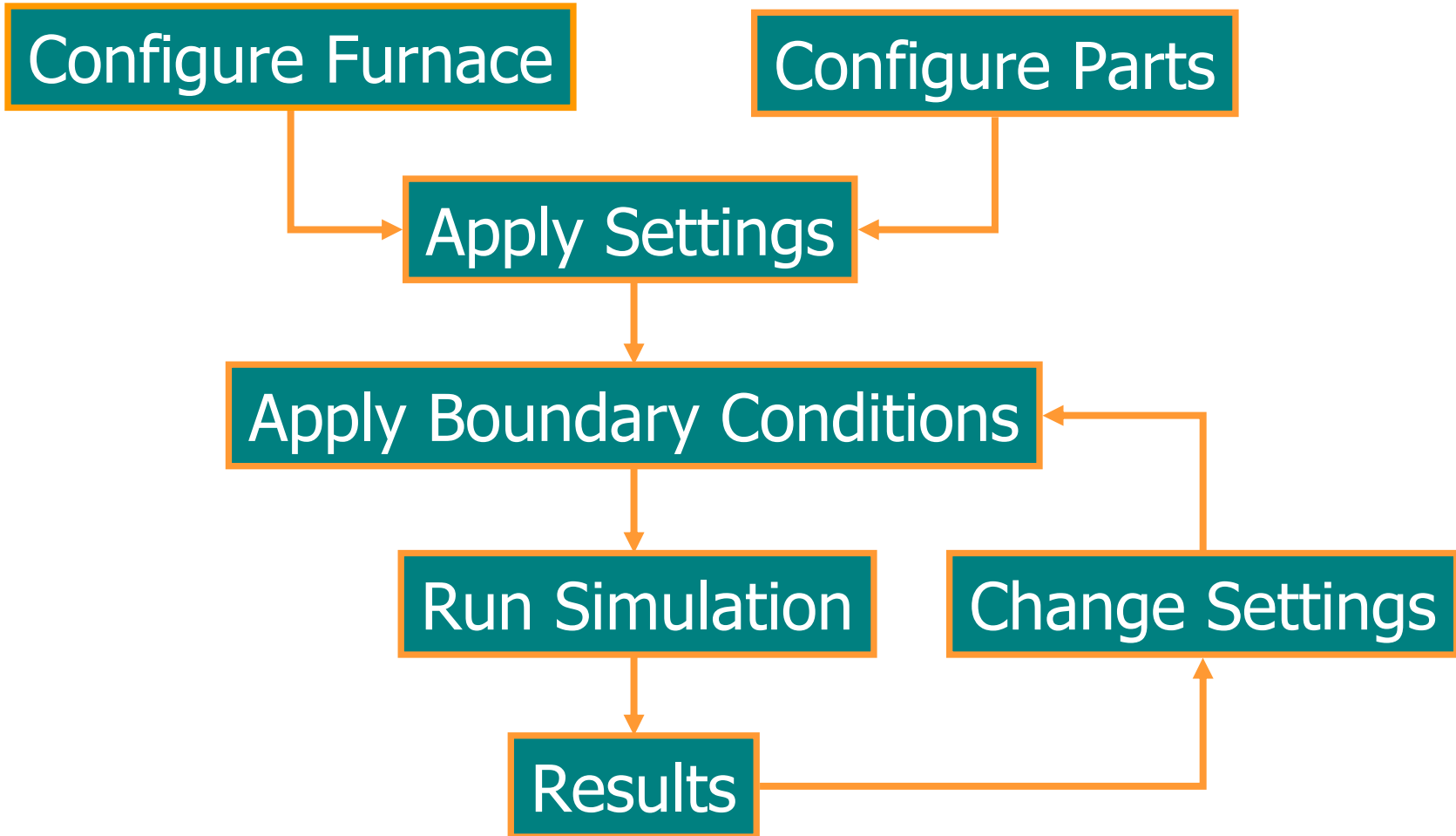


FurnXpert Continuous Heat Treat Application solves Heat Transfer and Thermal Issues in continuous heat treating furnaces to heat small charges like cylinders, bushings, blocks, flanges, etc.

The screenshot displays the FurnXPERT software interface, divided into several key sections:

- Furnace Configuration:**
  - General Information:** Name: Heat Treat Belt; Width: 30 in; Height: 20 in; Type: Belt.
  - Specific Information:** Width: 18 in; Weight: 5 lbs/sq.ft.
  - Zone Information:** Heating Zone: 4; Cooling Zone: 2.
  - Inlet Information:** No of Inlets: 2.
  - Inlet Details:** Inlet 1: Nitrogen, Position: 90; Inlet 2: Nitrogen, Position: 220.
  - Muffle Information:** Material: Metallic; Shape: Rectangular; Dimensions: Width 10 in, Thickness 1 in, Height 12 in.
  - Insulation Details:** Wall, Roof, and Hearth settings for zones 1-4.
- Process Settings:** A small diagram showing three zones labeled Zn 1, Zn 2, and Zn 3.
- Heating Zones:** Number: 4. Zone Temp. #, Deg F, Emissivity [0-1], Fan Sp. rpm.
- Cooling Zones:** Number: 2. Inlets: Number: 2.
- Profile:** A graph titled "FURNACE PROFILE" showing Temperature (T) in degrees Fahrenheit (Deg F) on the y-axis (0 to 2200) versus Distance in Inches on the x-axis (0 to 510). The profile shows a ramp up to a plateau at approximately 1900°F, followed by a ramp down and a final cool-down. Yellow triangles indicate Furnace Set Points at various stages.

- ⇒ Minimizes furnace design time
- ⇒ Reduces the requirements for test runs
- ⇒ Provides opportunity to quickly investigate multiple furnace designs
- ⇒ Enables viewing heat-treating process virtually
- ⇒ Offers platform for improved design accuracy
- ⇒ Bridges the gap between the furnace suppliers and furnace users
- ⇒ Can be used as a sales tool by furnace manufacturers as well as Heat-Treaters



# FurnXpert Functions

The screenshot shows the main window of the FurnXpert software. On the left is a vertical toolbar with icons for 'Furnace', 'Profile', 'Create Part', 'Select Part', 'Place Part', 'Settings', 'Run', 'Heat Audit', 'Reports', 'Help', and 'Exit'. The main area contains a 'SETUP FURNACE SIMULATION' window with a 'furnXPERT' logo and contact information for CompAS Controls, Inc. in Sunnyvale, CA. At the bottom, a status bar displays: APP MODE: Heat Treatment, UNIT SYSTEM: Default, FURNACE: None, PART: None, ANALYSIS: 2 D.

**CONFIGURE NEW FURNACES**

**CREATE FURNACE TEMPERATURE PROFILE**

**CREATE PARTS/CHARGES**

**SELECT PARTS TO BE HEATED INSIDE THE FURNACE**

**PLACE PARTS INSIDE THE FURNACE**

**ADJUST SETTINGS**

**RUN SIMULATION**

**RUN HEAT AUDIT**

**CREATE AND PRINT REPORTS**

# Select New Furnace

FurnXpert : Continuous Heat-treat

File View Parts Profile Option Process Reports Tools Properties Analysis Options Help



Furnace



Profile



Create Part



Select Part



Place Part



Settings



Run



Heat Audit



Reports




Help



Exit

Select New Furnace

SETUP  
FURNACES  
SIMULATE  
FURNACES



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Single User License

FurnXPERT is a desktop software that simplifies the job of SETTING UP and SIMULATING industrial furnaces. The software has been developed to aid process engineers and furnace operators configure their furnaces, select parts, and run what-if analysis to determine the best furnace operating parameters.

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APP MODE: Heat Treatment    UNIT SYSTEM: Default    FURNACE: None    PART: None    ANALYSIS: 2D



# Select Unit System

Select Unit System From Drop Down Menu

**Unit Selection**

Default

<b>Length</b>	in	<b>Energy</b>	Btu
<b>Time</b>	min	<b>Production Rate</b>	lbs/hr
<b>Temperature</b>	Deg F	<b>Power</b>	Btu/hr
<b>Weight</b>	lbs	<b>Energy Consumption</b>	Btu/lb
<b>Velocity</b>	in/min	<b>Flow</b>	Cfh

Ok Cancel Apply

www.furnxper.com

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APP MODE: Heat Treatment    UNIT SYSTEM: Default    FURNACE: None    PART: None    ANALYSIS: 2D

# Enter Furnace Data

FurnXpert

File View Parts Profile Option Process Reports Tools Properties Analysis Options Help

**Furnace**

**Profile**

**Create Part**

**Select Part**

**Place Part**

**Settings**

**Run**

**Heat Audit**

**Reports**

**Help**

**Exit**

### Furnace Configuration

**General Information**

Name: Heat Treat Belt

Width: 30 in

Height: 20 in

Type: Belt

**Muffle**

No  Yes

Maximum Belt Speed: 20 in/min

**Muffle Information**

Material: Metallic Shape: Rectangular

**Dimensions**

Width: 10 in Thickness: 1 in

Height: 12 in Radius of the D: in

**Insulation Details**

	1	2	3	4
Wall	3	3		
Roof	3	3		
Hearth	3	3		

**Specific Information**

Belt

Width: 18 in

Weight: 5 lbs/sq.ft

**Zone Information**

Heating Zone

No of Heating Zones: 4

Type	Fan	Heating Type	Length in	Trans. in	Tc Location in
1 PH	N	Electric	60	0	30
2 PH	N	Electric	60	0	30
3 HH	N	Electric	60	10	30
4 HH	N	Electric	60	0	30
5					
6					
7					
8					
9					

**Inlet Information**

No of Inlets: 2

**Inlet Details**

Inlet Gas	Position in
1 Nitrogen	90
2 Nitrogen	220

APP MODE: Heat Treatment    UNIT SYSTEM: Default    FURNACE: None    PART: None    ANALYSIS: 2D

INPUT ALL THE FURNACE DETAILS

- Furnace Type
- Furnace Dimensions
- Muffle Information
- Insulation Type & Info
- Zone Information
- Inlet Information
- Inlet Details

# Enter Refractory Data

**Furnace Configuration**

**General Information**

Name: Heat Treat Belt  
Width: 30  
Height: 20  
Type: Belt

**Muffle**

No  Yes

**Muffle Information**

Material: Metallic

**Dimensions**

Width: 10 in  
Height: 12 in

**Insulation Details**

1	FB		
Wall	3		
Roof	3		
Hearth	3	3	

**Wall Insulation**

Furnace Ambient 80 Deg F

L1	3	FB
L2	3	IB

Number of Layers: 2

Layer 1	Layer 2
Material: Fire Brick	Material: Insulating Brick
Thickness: 3 in	Thickness: 3 in
Layer 3	Layer 4
Material:	Material:
Thickness:	Thickness:

Ok Cancel Apply

**Inlet Information**

No of Inlets: 2

**Inlet Details**

Inlet	Inlet Gas	Position in
1	Nitrogen	90
2	Nitrogen	220
3		
4		
5		
6		
7		

Layout Save As Ok Cancel Apply

APP MODE: Heat Treatment UNIT SYSTEM: Default FURNACE: None PART: None ANALYSIS: 2D

# Enter File Name

The screenshot displays the FurnXpert software interface. The main window is titled 'Furnace Configuration' and contains several panels:

- General Information:** Name: Heat Treat Belt, Width: 30 in, Height: 20 in, Type: Belt.
- Specific Information:** Belt selected, Width: 18 in, Weight: 5 lbs/seg ft.
- Inlet Information:** No of Inlets: 2.
- Insulation Details:** Wall, Roof, and Hearth sections with FB and IB options.

A 'Save' dialog box is overlaid on the main window. The 'Save in' field shows the path 'furnace'. The file list includes:

- Belt-1.frs
- Belt-2.frs
- Car Bottom.frs
- car\_bottom\_2.frs
- car\_bottom\_feet.frs
- car\_bottom\_meter.frs
- Sample pusher 2.frs
- Sample pusher.frs

The 'File name' field is highlighted with a red circle and contains the text 'Sample Belt English'. A green speech bubble points to this field with the text 'Enter the name of the Furnace File'. The 'Save as type' is set to 'FurnXpert Furnace File (\*.frs)'.

**Profile creation wizard**

**Profile Creation Wizard** Step - 1

Options for Profile Creation

- From Zone Temperatures
- From Distance Vs Temperature Input
- From Existing Part Profile
- From Existing Furnace Profile

Input setpoints for every zone to generate a furnace profile

Legend

- Furnace Temperature
- ▼ Furnace Set Points

Profile Info

Profile Source	None
Profile Mode	None

CL 2 510

Cancel <<Back **Next>>** Finish

**Create Profile** Temp. Scale

OK Cancel

File Path : None

APP MODE: Heat Treatment UNIT SYSTEM: Default FURNACE: Heat Treat Belt PART: None ANALYSIS: 2 D

# Enter Profile

**Profile Creation Wizard** *Step - 2*

Profile From Zone Temperature

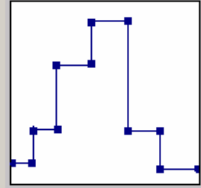
Set Points

Zone 1	<input type="text" value="100"/>	Deg F	Zone 6	<input type="text"/>	Deg F
Zone 2	<input type="text" value="200"/>	Deg F	Zone 7	<input type="text"/>	Deg F
Zone 3	<input type="text" value="300"/>	Deg F	Zone 8	<input type="text"/>	Deg F
Zone 4	<input type="text" value="400"/>	Deg F	Zone 9	<input type="text"/>	Deg F
Zone 5	<input type="text"/>	Deg F			

**Profile Creation Wizard** *Step - 3*

Profile From Zone Temperature

Profile Type



- Step "Up" / Step "Down" Ramp
- Slant Gradient Ramp
- Smooth Slope Ramp

**Profile Creation Wizard** *Step - 4*

Profile From Zone Temperature

Cooling Zone Input

- Cooling Gradient
- Zone Temperature

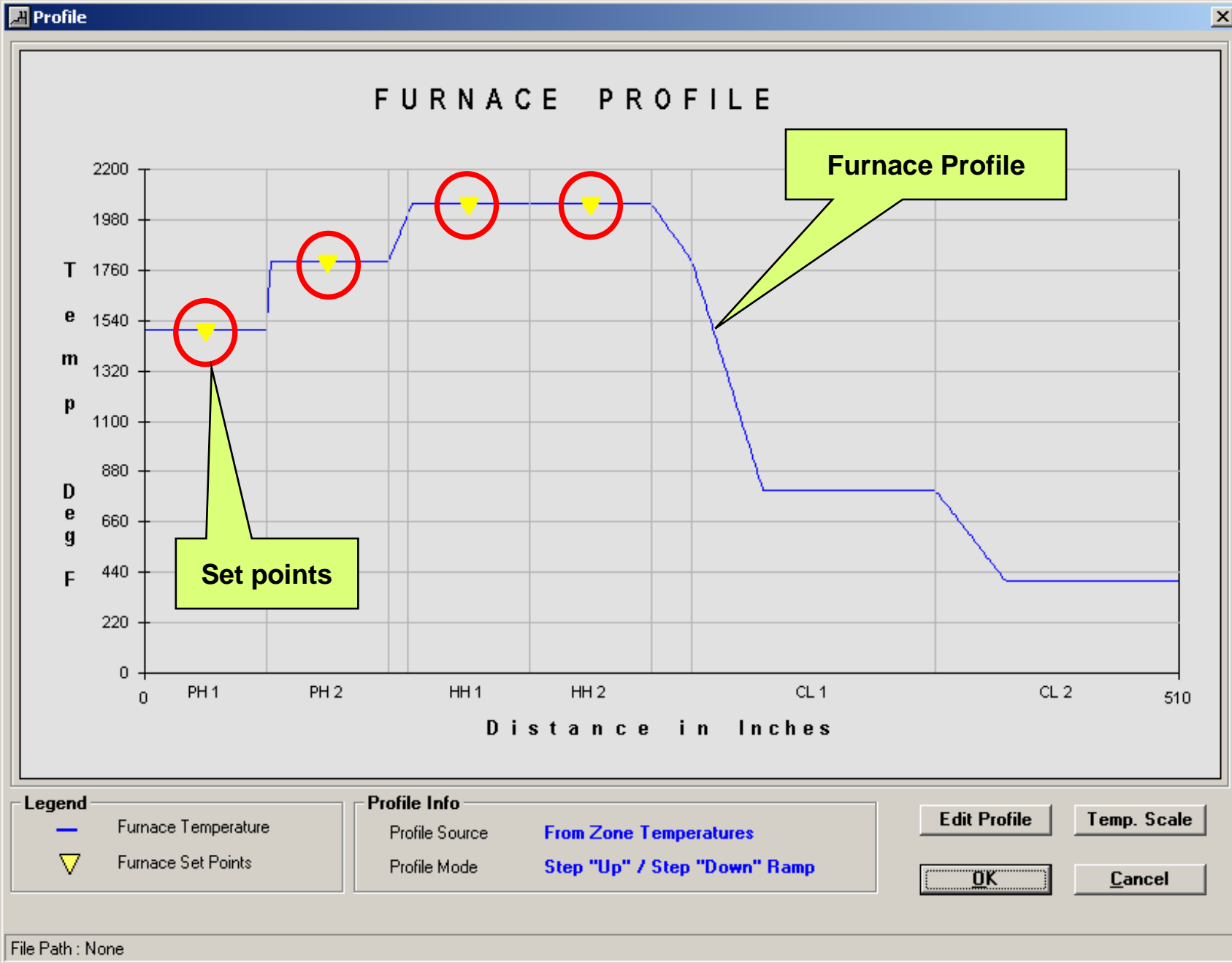
Transition Zone

Gradient ( Deg F / in )	Exit Temp. ( Deg F )
Zone <input type="text" value="5"/>	<input type="text"/>

Cooling Zones

Zone 1	<input type="text" value="800"/>
Zone 2	<input type="text" value="400"/>
	<input type="text"/>
	<input type="text"/>
	<input type="text"/>
	<input type="text"/>

Three options to choose from



# Enter Profile

### Profile Creation Wizard

Step - 1

#### Profile From Distance Vs Temperature Input

Distance & Temperature

# of Inputs: 8

Dist 1	0	Temp 1	500	Dist 6	150	Temp 6	2000
Dist 2	10	Temp 2	1500	Dist 7	200	Temp 7	2050
Dist 3	30	Temp 3	1800	Dist 8	250	Temp 8	2050
Dist 4	50	Temp 4	1900	Dist 9		Temp 9	
Dist 5	100	Temp 5	2000	Dist 10		Temp 10	
Dist 11		Temp 11		Dist 11		Temp 11	

[ Distances in: in ] [ Temperatures in: Deg F ] [Click here for Zone Length](#)

Buttons: Cancel, <Back, Next>, Finish

### Profile Creation Wizard

Step - 3

#### Profile From Distance Vs Temperature Input

Set Points

Zone 1	1500	Deg F	Zone 6		Deg F
Zone 2	1800	Deg F	Zone 7		Deg F
Zone 3	2050	Deg F	Zone 8		Deg F
Zone 4	2050	Deg F	Zone 9		Deg F
Zone 5		Deg F	Zone 9		Deg F

Buttons: Cancel, <Back, Next>, Finish

**Distance  
Temperature Data**

**Setpoints**

### Profile Creation Wizard

Step - 4

#### Profile From Zone Temperature

Cooling Zone Input

Cooling Gradient  
 Zone Temperature

Transition Zone

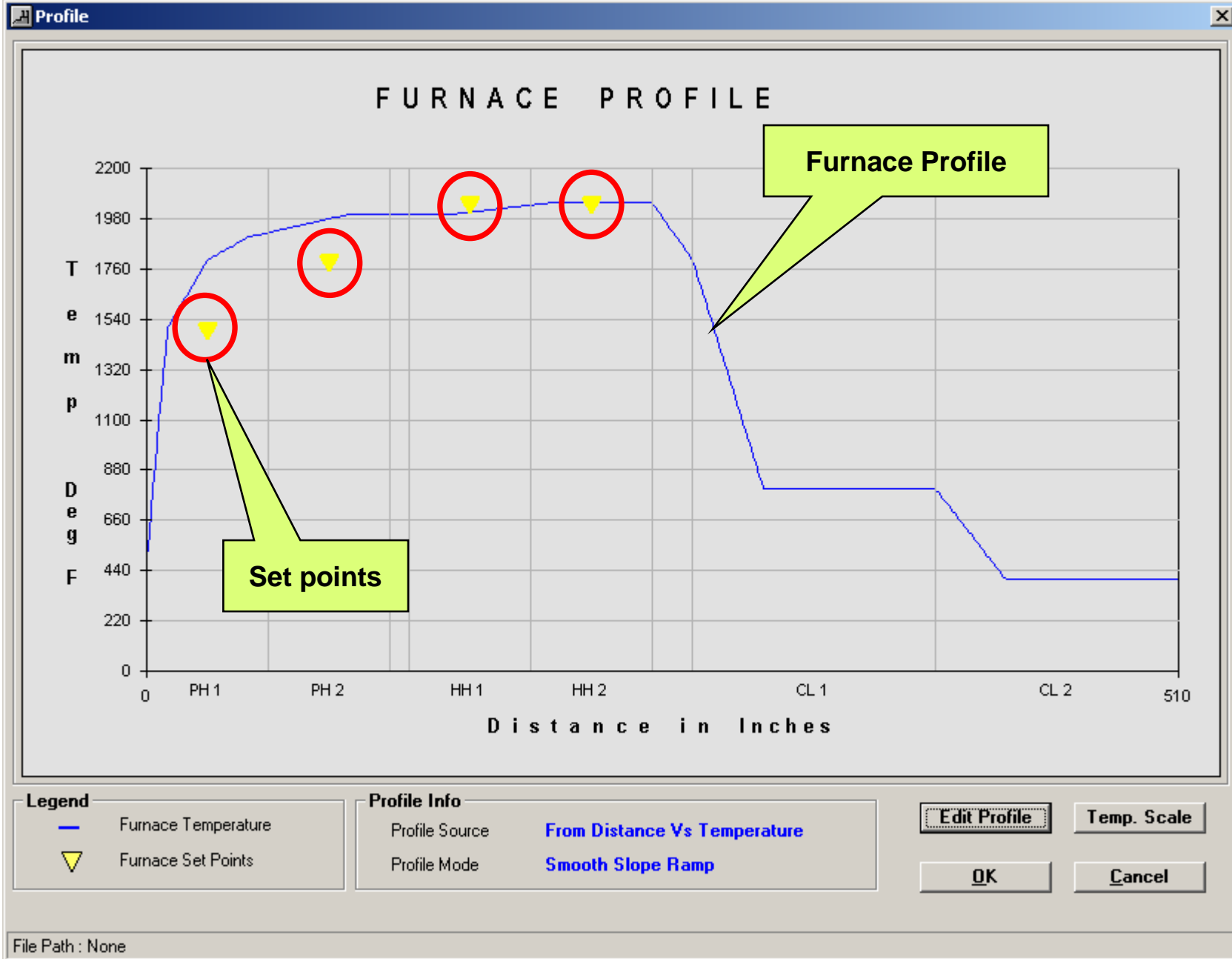
Zone	5	Exit Temp.	
------	---	------------	--

Buttons: Edit, Set Default

Cooling Zones

	Gradient ( Deg F / in )	Zone Temp. ( Deg F )
Zone 1		800
Zone 2		400

Buttons: Cancel, <<Back, Next>>, Finish



**Create Parts from list of shapes**

**Part Drawing**

**Input Part Dimensions**

**Select Material and Target Temperature**

**Save Data in file**

**Part Shapes**

- Bushing
- Cylinder
- Flange
- Inverted Flange
- Block
- I/O Flange
- Inv. I/O Flange

**Part Details**

**Dimension**

OD  cm

**Properties**

Standard

**Save**

Save in: Part

- Bush 1.prt
- Cylinder 1.prt

File name:  Save

Save as type:  Cancel

**Part Details**

**Dimension**

OD	<input type="text" value="10"/>	cm
ID	<input type="text" value="5"/>	cm
D1	<input type="text" value="8"/>	cm
TH	<input type="text" value="10"/>	cm
FH	<input type="text" value="3"/>	cm

**Properties**

Standard

Material:

Target Temp:  Deg C

Time at temp:  min

17-4PH  W-NiFe

New Delete Ok Cancel Apply

File Path : None

# Select Part

**Part Selection**

**Part Shapes**

- Bushing
- Cylinder
- Flange
- Inverted Flange
- Block
- I/O Flange
- Inv. I/O Flange

**Part Details**

**Dimension**

OD	10	cm
ID	5	cm
D1	8	cm
TH	10	cm
FH	3	cm

**Open**

Look in: Part

- Bush 1.prt
- Cylinder 1.prt
- Flange.prt

File name: Flange.prt

Files of type: FurnXpert Part File (\*.prt)

**Select Different Part** Delete Ok Cancel Apply

File Path : C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert\_BatchHT\Part\Flange.prt

APP MODE: Heat-treat UNIT SYSTEM: Custom FURNACE BY: HKN CONTRACT NO: 1234 JOB NAME: BHT PART: Inv.Flange ANALYSIS : 2D

Select Part Button

Select from a existing list if parts

# Part Placement - Trays

**Place Part : Bushing**

**Select Part**

Name: Bushing    Weight: 7.1341 lbs    Surface Area: 69.12 Sq.in

**Add Tray Information**

**Tray Info**

Material: [Dropdown]  
Length: [Slider] in  
Width: [Slider] in  
Thickness: [Slider] in  
Gap: [Slider] in  
Weight: [Slider] lbs  
# Total Trays: [Slider]

**Part Setup**

**Select Charge Matrix**

Single  
 2 Rows X 2 Columns  
 3 Rows X 3 Columns  
 4 Rows X 4 Columns  
 5 Rows X 5 Columns  
 6 Rows X 6 Columns  
 7 Rows X 7 Columns  
 8 Rows X 8 Columns  
 Custom >>

**Tray Configuration**

# Across: [Slider]  
# Along: [Slider]  
# Stack: [Slider]  
Stack Gap: [Slider] in

Matrix Space: W 12.0 in    L 39.5 in

ROWS ↑    ↓ W    W  
← L    → COLUMNS

Tray Dimensions : None    Row 1    Column 1

File Path : C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert\_ConHT\Par

Part Configuration  
 Tray Details

# Process Settings

The screenshot shows the 'Process Settings' window. At the top, a legend identifies symbols: a red vertical line for 'Tc Location', a yellow dot for 'Inlet Location', and a blue fan icon for 'Fan'. Below this is a schematic of a furnace with six zones labeled 'Zn 1' through 'Zn 6'. Callouts point to various settings:

- 'Can change the Zone Setpoints' points to the temperature input fields in the Heating Zones table.
- 'Can change Flow rates' points to the 'Flow Rate Cfh' input fields in the Cooling Zones table.
- 'Can change belt speed' points to the 'Speed' input field in the Belt Parameter section.

At the bottom, a summary box states: 'Provides the capability to change the process settings:'

- Zone Setpoints
- Heat Transfer Coefficients in cooling zones
- Gas Flow Rate

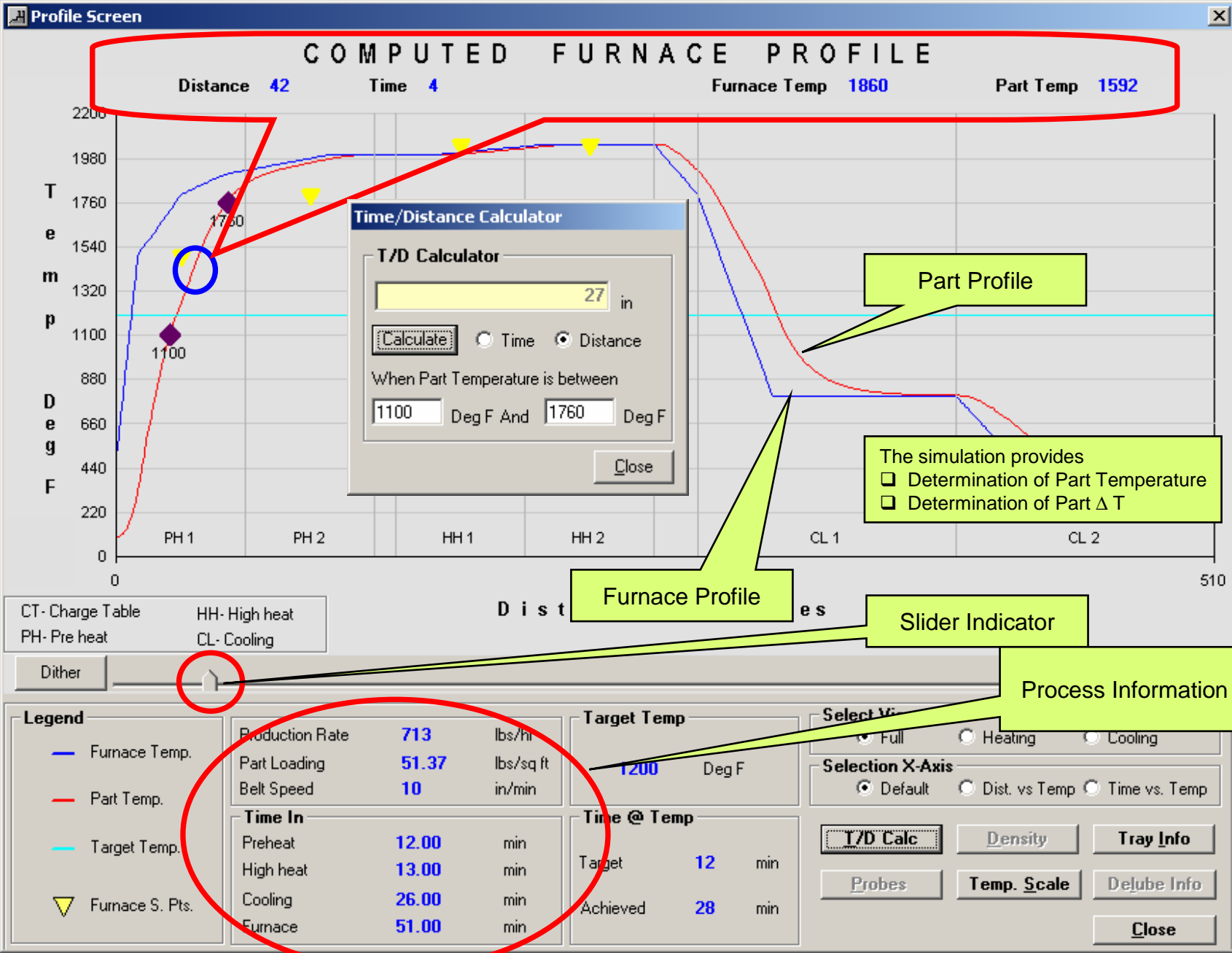
Buttons for 'Set Default', 'Edit Data', 'OK', 'Cancel', and 'Apply' are visible at the bottom of the window.

Heating Zones				Cooling Zones			
Zone #	Temp. Deg F	Emissivity [0-1]	Fan Speed rpm	Zone #	Temp. Deg F	Emissivity	Fan Speed
1	1500	0.7		1			
2	1800	0.7		2			
3	2050	0.7					
4	2050	0.7					

Zone #	Gas	Flow Rate Cfh
1	N2	100
2	N2	100

Belt Parameter: Speed  in/min

# Simulated Results



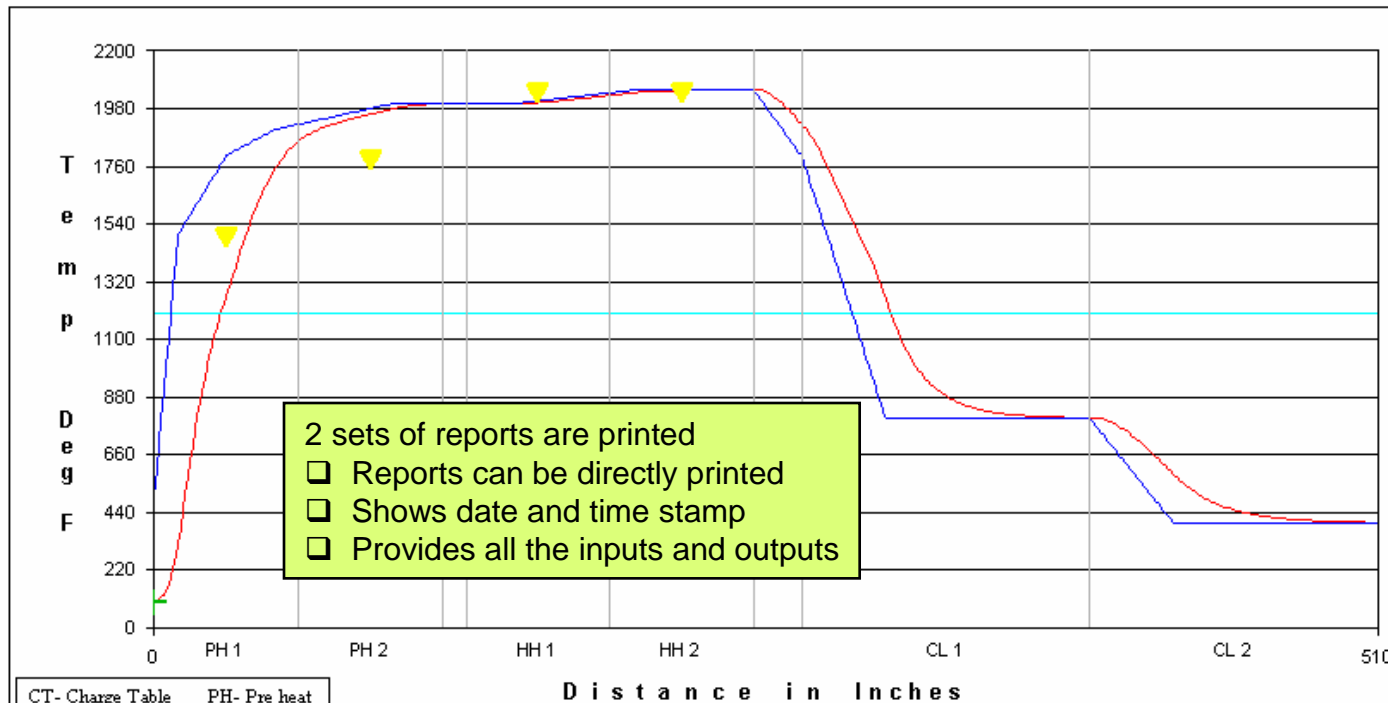


Click to print the report



## CHART REPORT

Furnace Type: **Continuous**  
 Application: **Standard**  
 Analyst: **Administrator**



2 sets of reports are printed  
 Reports can be directly printed  
 Shows date and time stamp  
 Provides all the inputs and outputs

**Legend**

- Furnace Temp.
- Part Temp.
- Ref Part Temp.
- Target Temp.
- ▼ Furnace S. Pts.

**Charge Data**

Tray Mtl. **Steel**  
 Tray Size : ( in )

**L 10**  
**W 12**

Trays **1 X 39 X 1**

Part Matrix **3 X 3**

CT- Charge Table    PH- Pre heat  
 HH- High heat      CL- Cooling

Production Rate	<b>713</b>	lbs/hr
Part Loading	<b>51.37</b>	lbs/sq ft
Belt Speed	<b>10</b>	in/min

**Part Data**

Part Shape : **Bushing**  
 Size: ( in )    **ID 2**      **OD 6**  
**H 1**

**Time In**

Preheat	<b>12.00</b>	min
High heat	<b>13.00</b>	min
Cooling	<b>26.00</b>	min
Furnace	<b>51.00</b>	min

**Zone Set Points**

Zone	Set Point
1	<b>1500</b> Deg F
2	<b>1800</b> Deg F
3	<b>2050</b> Deg F
4	<b>2050</b> Deg F

**Time @ Temp**

Temp (tgt)	Time (tgt)	Time (Act)
Deg F	min	min
<b>1200</b>	<b>12</b>	<b>28</b>

7/15/2006 3:09:08 PM

CompAS Controls Inc. Page 1 of 2

Click to print the report



### CHART REPORT

Furnace Type: **Continuous**  
Application: **Standard**  
Analyst: **Administrator**

**Heat Details**

Zone	Heat To Part Btu/hr	Wall Loss Btu/hr	Heat To Gas Btu/hr	Heat to Belt Btu/hr	Radiation Loss Btu/hr	Total Heat Btu/hr
1	152,166.90	22,023.53	0.00	15,933.01	-	190,123.50
2	9,600.57	27,346.87	3,230.78	1,114.54	-	41,292.75
3	2,053.12	28,440.99	0.00	313.88	-	30,807.99
4	1,200.46	28,806.73	3,697.65	144.73	-	33,849.56
<b>Total</b>	<b>165,021.09</b>	<b>106,618.12</b>	<b>6,928.43</b>	<b>17,506.15</b>	<b>-</b>	<b>296,073.81</b>
<b>Total Power</b>	<b>296,073.81</b>	Btu/hr	Energy Consumption	<b>115.28</b>	Btu/lb	



# Data creation - Insulation

**Entry Data**

**List of existing Insulation**

**Create New Data**

Temperature Deg F	Conductivity kcal/m-hr-degC	Specific Heat Kcal/Kg-DegC
38	0.0533	0.203
538	0.0856	0.203
816	0.0856	0.203
1093	0.0856	0.203
1371	0.0856	0.203

Module to enter insulation data

- Density
- Conductivity as a function of temperature
- Specific Heat as a function of temperature

# Data creation - Material

**Material Data**

Material Name: 1008 GRADE

Units:  English Unit  Metric Unit

Density: 7851.597 Kg/cu.m % Carbon: 0.08

Temperature: Deg C Sp. Heat: J/gm-K

Emissivity: 0.85

**Conductivity**

Temperature Deg C	Conductivity Watt/m-Deg C	Temperature Deg C
1	16	59.34479
2	38	59.04548
3	93	57.99775
4	149	55.603
5	204	53.05856
6	260	50.21483
7	316	48.86777
8	371	47.25047
9	427	44.67695

**Material Data**

Material Name: 1008 GRADE

Units:  English Unit  Metric Unit

Temperature: Deg C Sp. Heat: J/gm-K Conductivity: Watt/m-Deg C Density: Kg/cu.m

**Specific Heat**

Temperature Deg C	Specific Heat J/gm-K	Temperature Deg C	Specific Heat J/gm-K	Temperature Deg C	Specific Heat J/gm-K
1	16	0.4594	10	482	0.66735
2	38	0.46819	11	538	0.71086
3	93	0.48953	12	593	0.75437
4	149	0.51212	13	649	0.79788
5	204	0.53555	14	704	0.84139
6	260	0.55354	15	759	0.88490
7	316	0.57153	16	814	0.92841
8	371	0.58952	17	869	0.97192
9	427	0.60751	18	924	1.01543
10	482	0.62550	19	979	1.05894
11	538	0.64349	20	1034	1.10245
12	593	0.66148	21	1089	1.14596
13	649	0.67947	22	1144	1.18947
14	704	0.69746	23	1199	1.23298
15	759	0.71545	24	1254	1.27649
16	814	0.73344	25	1309	1.31900
17	869	0.75143	26	1364	1.36251
18	924	0.76942			

Buttons:

List of existing Insulation

Create New Data

- Module to enter material data
- Density and emissivity
  - Conductivity as a function of temperature
  - Specific Heat as a function of temperature

**Fuel Data**

Name: NATURAL GAS - 8897 Gross kcal/cu.m

Type of Fuel:  Gaseous  Liquid

Ratio (in Cu.m / Cu.m): Air / Fuel: 9.44, Flue / Fuel: 10.46

Heating Value (in KCal / Cu.m): HHV: 9122.5, LHV: 8045.6

Product of Combustion (as fraction 0 - 1): CO<sub>2</sub> [Dry]: 0.11, H<sub>2</sub>O: 0.186, N<sub>2</sub>: 0.71

Fuel Composition (%):

N <sub>2</sub>	5	O <sub>2</sub>	0	CO <sub>2</sub>	0
H <sub>2</sub>	0	H	0	O	0
OH	0	NO	0	NO <sub>2</sub>	0
SO	0	SO <sub>2</sub>	0	SO <sub>3</sub>	0
CH <sub>4</sub>	90	C <sub>n</sub> H <sub>n</sub>	5	H <sub>2</sub> S	0

Buttons: Reset, **New**, Ok, Save

List of existing Insulation

Create New Data

- Module to enter fuel data
- A/F, A/FI, HHV, LHV
  - POC - CO<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub>
  - Fuel Composition