

FurnXpert – Batch 2D



FurnXpert is a desktop software that simplifies the job of sizing, designing and simulating industrial furnaces.

The software has been developed to aid furnace designers, process engineers, and furnace operators configure their furnaces, select parts and run “what if analysis”.

The screenshot displays the FurnXpert software interface with several windows open:

- Batch Furnace - C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert_BatchRH(furnace\BatchReheat_Sam...:** Shows furnace shape (Rectangular), dimensions (Length: 10 m, Width: 20 m, Height: 10 m), and re-circulating gas settings.
- Batch Furnace - C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert_Batch2D(furnace\Sample_Rotary_2...:** Shows furnace shape (Rotary), dimensions (Height: 144 in, Outer Dia: 420 in, Inner Dia: 192 in), and heating type (Top Fired).
- Configure Insulation:** Shows insulation layer settings for walls, roof, hearth, door, and back.
- Reports:** Displays a report with a table of furnace parameters and a graph showing temperature profiles over time.
- Place Charge:** Shows charge placement configuration, including # Across (2), # Along (10), Stacks B (1), and charge weight (1570 kg).
- Charge Details:** Shows charge shape and dimension settings, including width (0.5 m), thickness (0.2 m), and length (2 m).



FurnXpert - Benefits

Benefits

- ⇒ 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

How does it work?

Configure Furnace

Configure Parts

Apply Settings

Apply Boundary Conditions

Run Simulation

Change Settings

Results

CompAS

FurnXpert Functions

ALLOWS USER TO CONFIGURE NEW FURNACE

ALLOWS USER TO CREATE FURNACE TEMPERATURE PROFILE

ALLOWS USER TO CREATE PARTS/CHARGES

ALLOWS USER TO PROVIDE ADDITIONAL DATA FOR THE PARTS/CHARGES

ALLOWS USER TO CONFIGURE CHARGES/PARTS LOADING

RUN SIMULATION

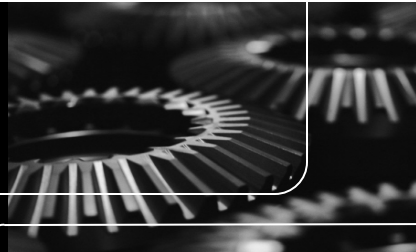
ALLOWS USER TO RUN HEAT AUDIT

ALLOWS USER TO CREATE AND PRINT REPORTS

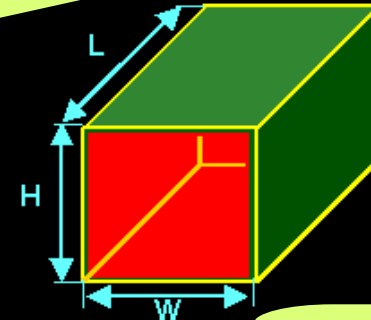
ALLOWS USER TO VIEW HELP TO RUN THE SOFTWARE



Furnace Configurator- Box



Input Fan Data for convective Furnace



List of Fuel is available, Gaseous and Liquid.

Batch Furnace C:\Program Files\CompAS Controls\FurnXpert_Batch2D_Ext\Furnace\Box

Furnace Shape
 Rectangular
 Rotary

Furnace Dimension
Length (L) 7 m
Width (W) 5 m
Height (H) 1.07 m

Process Gas: None

Fan Data
Off On Auto On Auto Off
FlowRate: m³/min Delta P: 10 mm-wc
Area: 0.06452 sq.m Power: 100 KW

Configure Insulation

Layer #	-1- (cm)	-2- (cm)	-3- (cm)	-4- (cm)

Heating Mode
 Electric
 Gas
 Liquid

Burner Type
 Conventional
 Regenerative
 Oxygen

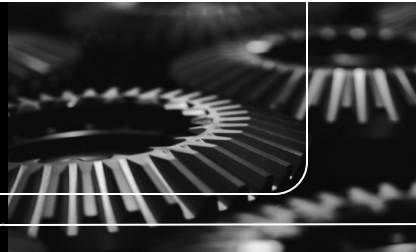
Fuel Specification
Fuel Type: NO.2 OR DIESEL - 9920 net kcal/kg
% of Xs Air / O₂: 10 Oxygen Temp.: Deg C
Comb. Air Temp.: 30 Deg C Fuel Temp.: 30 Deg C
 CAT=(FT)

Default Ok Cancel Apply

INPUT ALL THE FURNACE DETAILS

- Furnace Shape
- Furnace Dimensions
- Re-circulating Gas Info
- Fan Info
- Insulation Type & Info
- Heating Mode
- Fuel Specification
- Burner Type with Oxy Burner

Furnace Configurator - Rotary



Batch Furnace - C:\Program Files\CompAS Controls\FurnXpert_Batch2D_Ext\Furnace\Test_250_NoSavings.bhf

Furnace Shape
 Rectangular
 Rotary

Furnace Dimension
 Height [H] in
 Outer Dia [OD] in
 Inner Dia [ID] in

Process Gas

Fan Data
 Off On Auto On Auto Off
 FlowRate cfm Delta P in-wc
 Area sq.in Power HP

Configure Insulation

Layer #	-1- (in)	-2- (in)	-3- (in)	-4- (in)

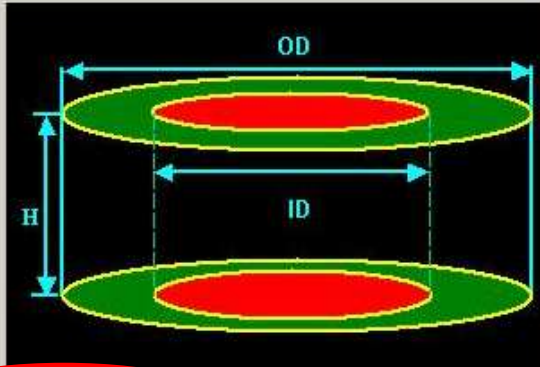
Heating Mode
 Electric
 Gas
 Liquid

Heating Type
 Top Fired
 Top & Bottom Fired

Burner Type
 Conventional
 Regenerative
 Oxygen

Fuel Specification
 Fuel Type
 % of Xs Air / O₂ Oxygen Temp. Deg F
 Comb. Air Temp. Deg F Fuel Temp. Deg F
 CAT=(FT)

Default Ok Cancel Apply



List of Fuel is available

- INPUT ALL THE FURNACE DETAILS**
- Furnace Shape
 - Furnace Dimensions
 - Re-circulating Gas Info
 - Fan Info
 - Insulation Type & Info
 - Heating Mode
 - Fuel Specification
 - Burner Type with Oxy Burner

Insulation Configurator - Box

Furnace Shape

Rectangular
 Rotary

Process Gas: None

Furnace Dimension

Length (L): 7 m
Width (W): 5 m
Height (H): 1.07 m

Fan Data

Off On Auto On Auto Off

FlowRate: m³/min
Delta P: 10 mm-wc
Area: 0.06452 sq.m
Power: 100 KW

Configure Insulation

Layer #	-1- (cm)	-2- (cm)	-3- (cm)	-4- (cm)
Walls	2 BI 2.54 CB 17.78			
Roof	2 BI 2.54 CB 17.78			
Door	2 BI 2.54 CB 17.78			
Back	2 BI 2.54 CB 17.78			
Hearth	2 FB 14 IB 9.4			

Wall Insulation

Number of Layers: 2

Layer 1: Material: Fire Brick, Thickness: 3 cm
Layer 2: Material: Insulating Brick, Thickness: 3 cm

Layer 3: Material: , Thickness: cm
Layer 4: Material: , Thickness: cm

Heating:

Burner T:

Fuel Spe: CAT=(FT)

Fuel Type: % of Xs Air / O₂: 10 Oxygen Temp.: Deg C
Comb. Air Temp.: 30 Deg C Fuel Temp.: 30 Deg C

Buttons: Ok, Cancel, Apply

Provides the capability to enter custom insulation data

Insulation Configurator - Rotary

Furnace Shape

Rectangular

Rotary

Furnace Dimension

Height [H] in

Outer Dia [OD] in

Inner Dia [ID] in

Process Gas

Fan Data

Off On Auto On Auto Off

FlowRate cfm Delta P in-wc

Area sq.in Power HP

Configure Insulation

Layer #	-1- [in]	-2- [in]	-3- [in]	-4- [in]
Walls	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> ▶
Roof	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> ▶
Hearth	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> ▶
Door	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> ▶
Back	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> ▶

Wall Insulation

Number of Layers

Layer 1

Material

Thickness in

Layer 2

Material

Thickness

Layer 3

Material

Thickness in

Layer 4

Material

Thickness in

OK Cancel Apply

Heating

Fuel S

Fuel Ty

% of Xs Air / O₂ Oxygen Temp. Deg F

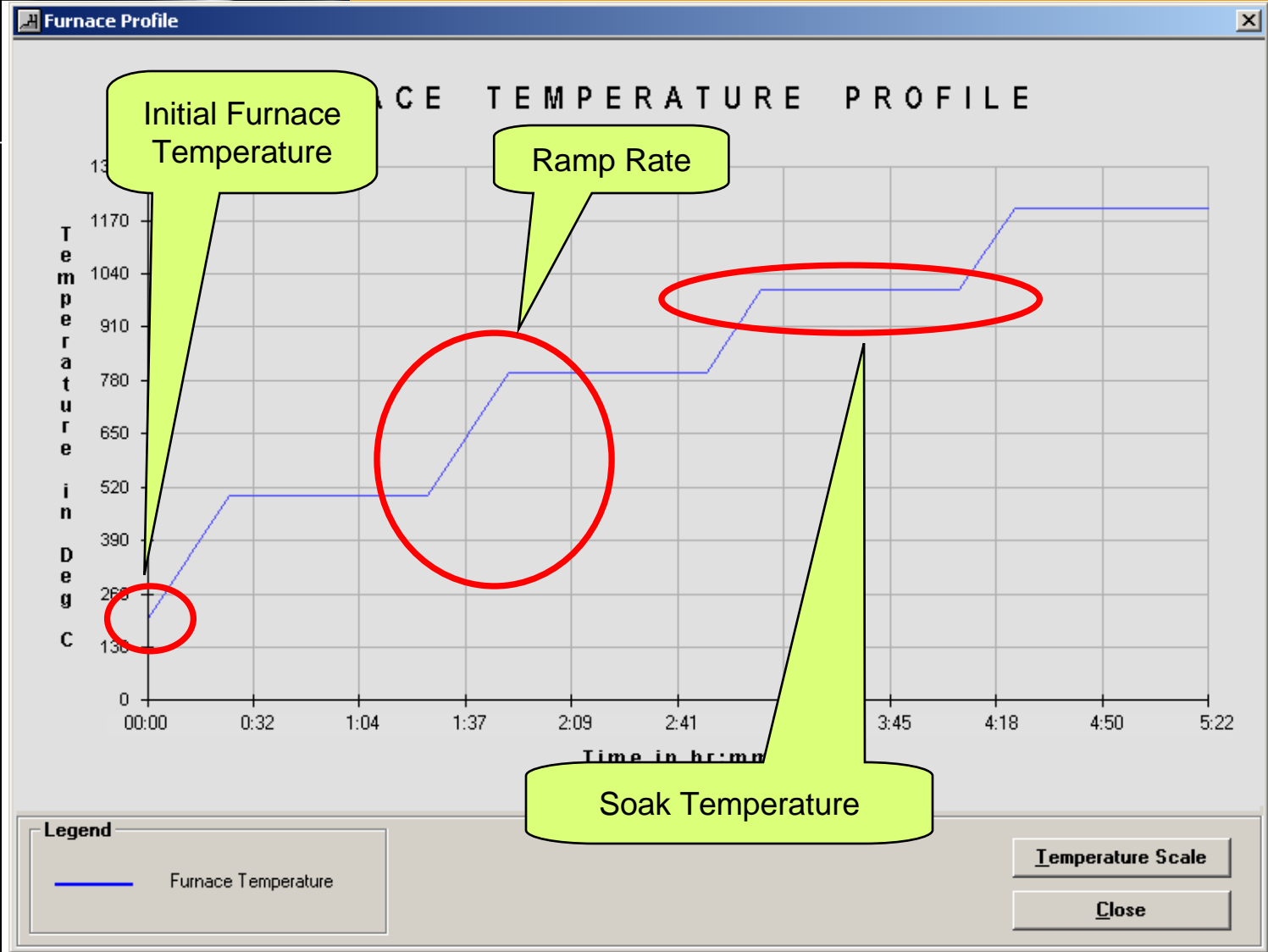
Comb. Air Temp. Deg F Fuel Temp. Deg F

CAT=(FT)

Provides the capability to enter custom insulation data



Profile Creation



Charge/Part Creation

Create charges/parts from list of shapes

The screenshot shows the 'New Charge' dialog box with several sections:

- Charge Shapes:** A list of shapes including Round Ingot, Round, Slab, Ingot, Billet, and Shell. The 'Round Ingot' option is selected and circled in red.
- Part Drawing:** A 2D technical drawing of a round ingot with dimensions TD (Thickness) and BD (Billet Diameter) indicated. This area is circled in red and labeled 'Part Drawing'.
- Part Drawing 3 D:** A 3D perspective view of a blue cylindrical ingot. This area is circled in red and labeled 'Part Drawing 3 D'.
- Input Part Dimensions:** A section with input fields for BD (m), TD (m), and L (m). This section is circled in red and labeled 'Input Part Dimensions'.
- Properties:** A section with radio buttons for Standard, Powder Metal, MIM, and High Temp. It includes fields for Material, Target Temp (Deg C), Time at Temp (min), and Initial Temp (Deg C). The 'Material' dropdown menu is open, showing a list of grades: 1008 GRADE, 1040 GRADE, HI CARBON (1.22%) GRA, 2330 GRADE, T1/T4 TOOL GRADE, 3435 GRADE, 5130 GRADE, and 304SS GRADE. This area is circled in red and labeled 'Select Grade'.

Buttons at the bottom include New, Delete, Ok, Cancel, and Apply. The File Path is shown as None.

Charge Placing - Box

Charge in Furnace

Charge Placement

Place charges in rectangular furnace

Charge Configuration

Arrangement

Up

Down

Across: 1

Along: 1

Stacks #: 1

Peer

Peer Details

of Peer: []

Peer Weight: [] kg

Surface Area: [] Sq.m

Peer Material: []

Total Peer Weight: [] kg

Charge Weight

Weight: 621.68 kg

Total Weight: 621.68 kg

Charge Orientation

Across

Along

Spacings

Spacing (C to C): []

Stack Spacing: []

Part Dimension

Shape: Billet

L: 0.5842 m

W: 0.3683 m

H: 0.3683 m

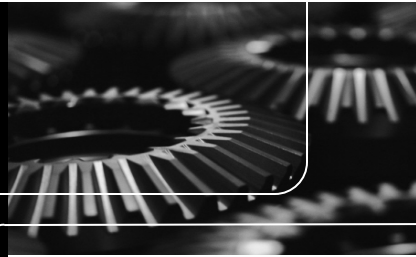
Furnace Dimension : 7 (L) x 5 (W) x 1.07 (H)

Default Ok Cancel Apply

Provides the capability of place charges in certain orientation. Information required are:

- Part Configuration with spacing
- Peer or support details
- Charge orientation inside the furnace

Charge Placing - Rotary



Place charges in circular furnace

Charge Configuration

Arrangement

Up

Down

Across

Along

Stacks #

Peer

Peer Details

of Peer

Peer Weight lbs

Surface Area Sq.in

Peer Material

Total Peer Weight lbs

Charge Weight

Weight lbs

Total Weight lbs

Charge Orientation

Across Along

Spacings

Spacing Along (C to C)

Spacing Across (C to C)

Part Dimension

Shape **Round**

OD in L in

Furnace Dimension :
420 (OD) x 192 (ID) x 144 (H)

Provides the capability of place charges in certain orientation. Information required are:

- Part Configuration with spacing
- Peer or support details
- Charge orientation inside the furnace

Estimation of Heating Time Reverse Calculation

Charge Shapes

- Round Ingot
- Round
- Slab
- Ingot
- Billet
- Shell

Dimension

L: m

W: m

H: m

Material:

Target Temp: Deg C

Time at Temp: min

Initial Temp: Deg C

Furnace Temp: Deg C

COMPUTED TIME PROFILE

Temp (Deg C) vs Time in minutes

Time (min)	Furnace Temp (Deg C)	Charge Temp (Deg C)
0	1200	20
22	1200	300
45	1200	550
67	1200	700
90	1200	800
112	1200	900
134	1200	980
157	1200	1050
179	1200	1100
202	1200	1130
224	1200	1150

Result: Time 225 min

Legend: — Furnace Temp, — Charge Temp

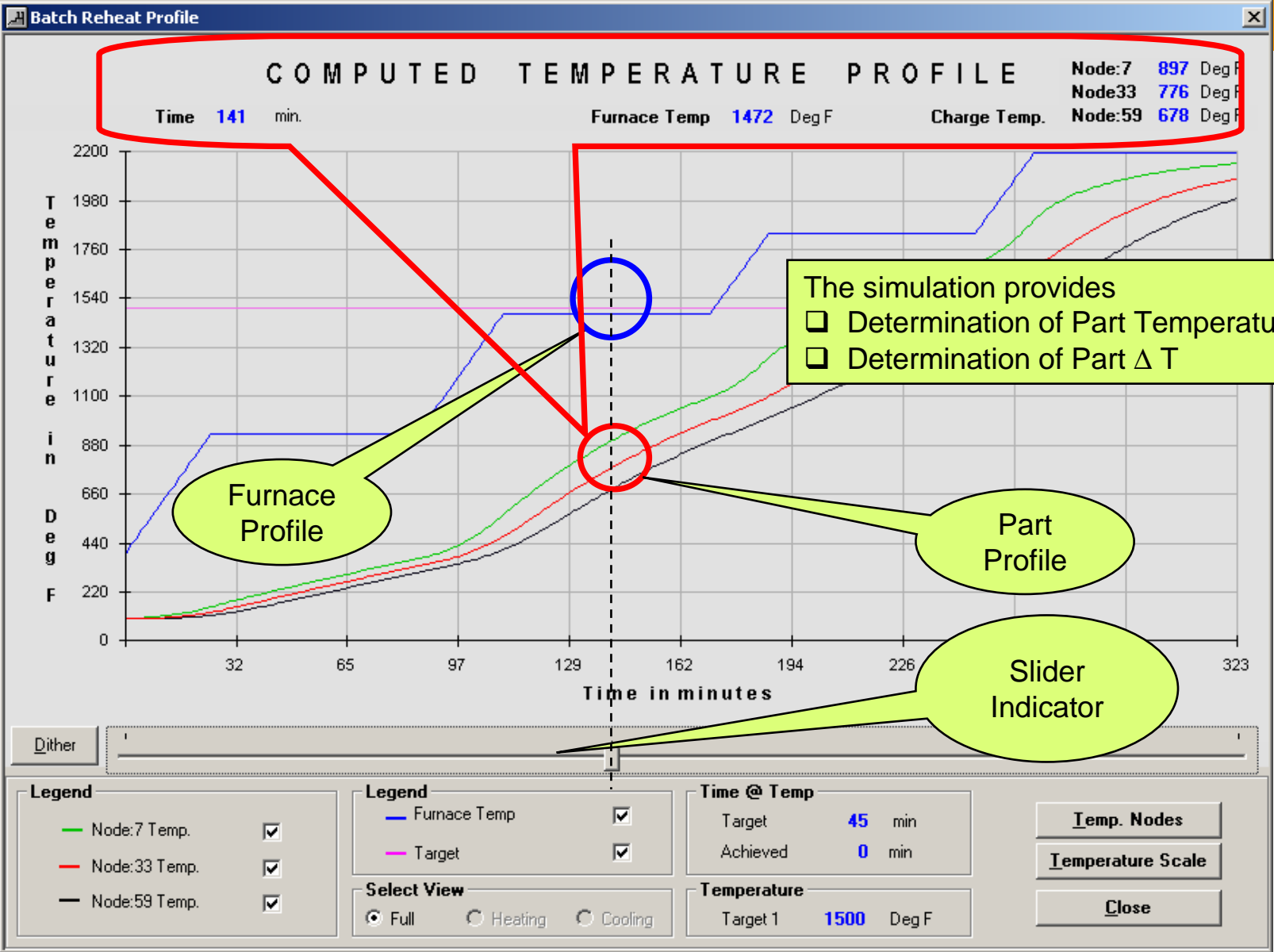
Buttons: Calculate Time, Close

Part Information

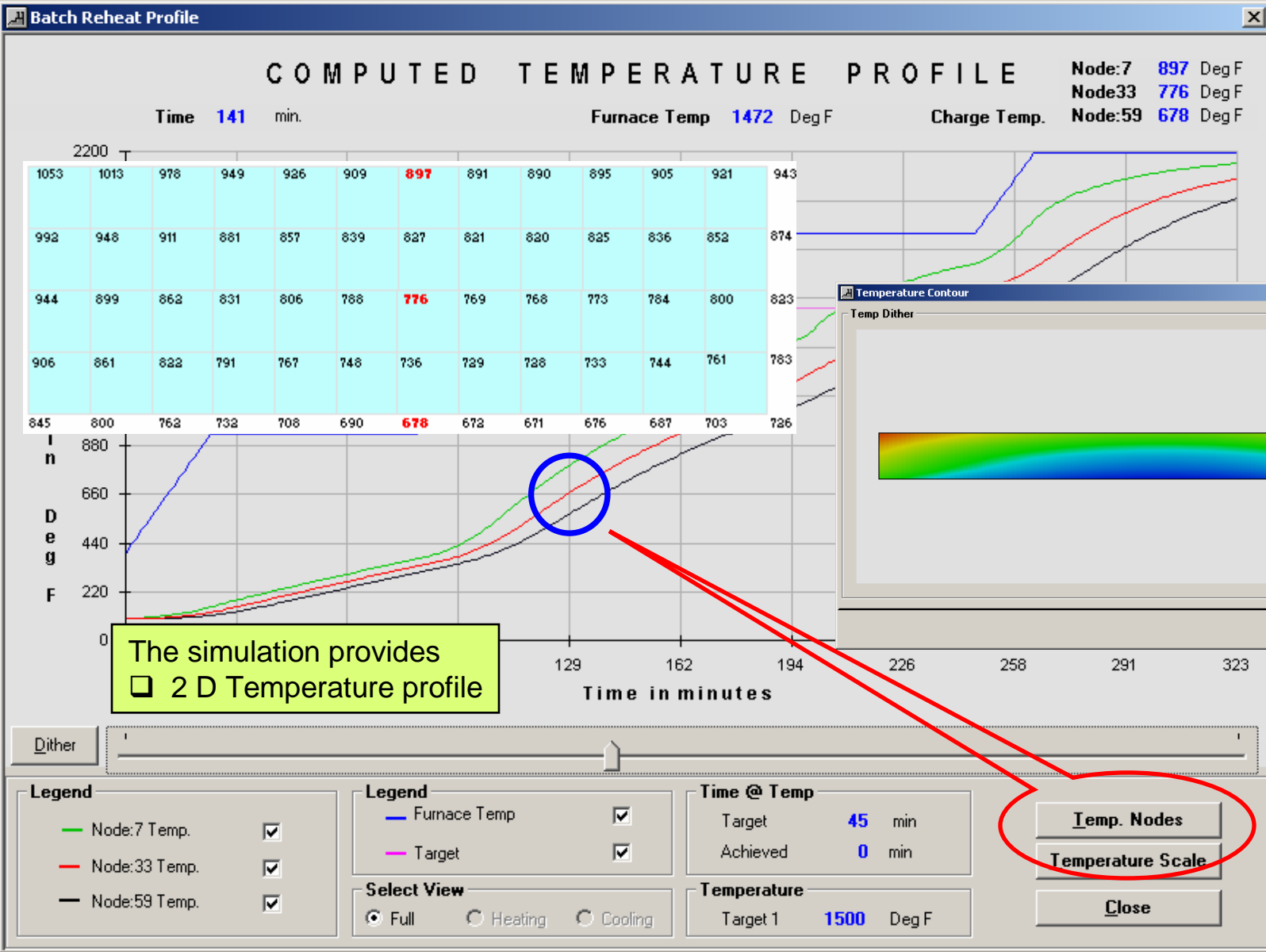
The Setting determines time to heat at a Target temp

Furnace Temp

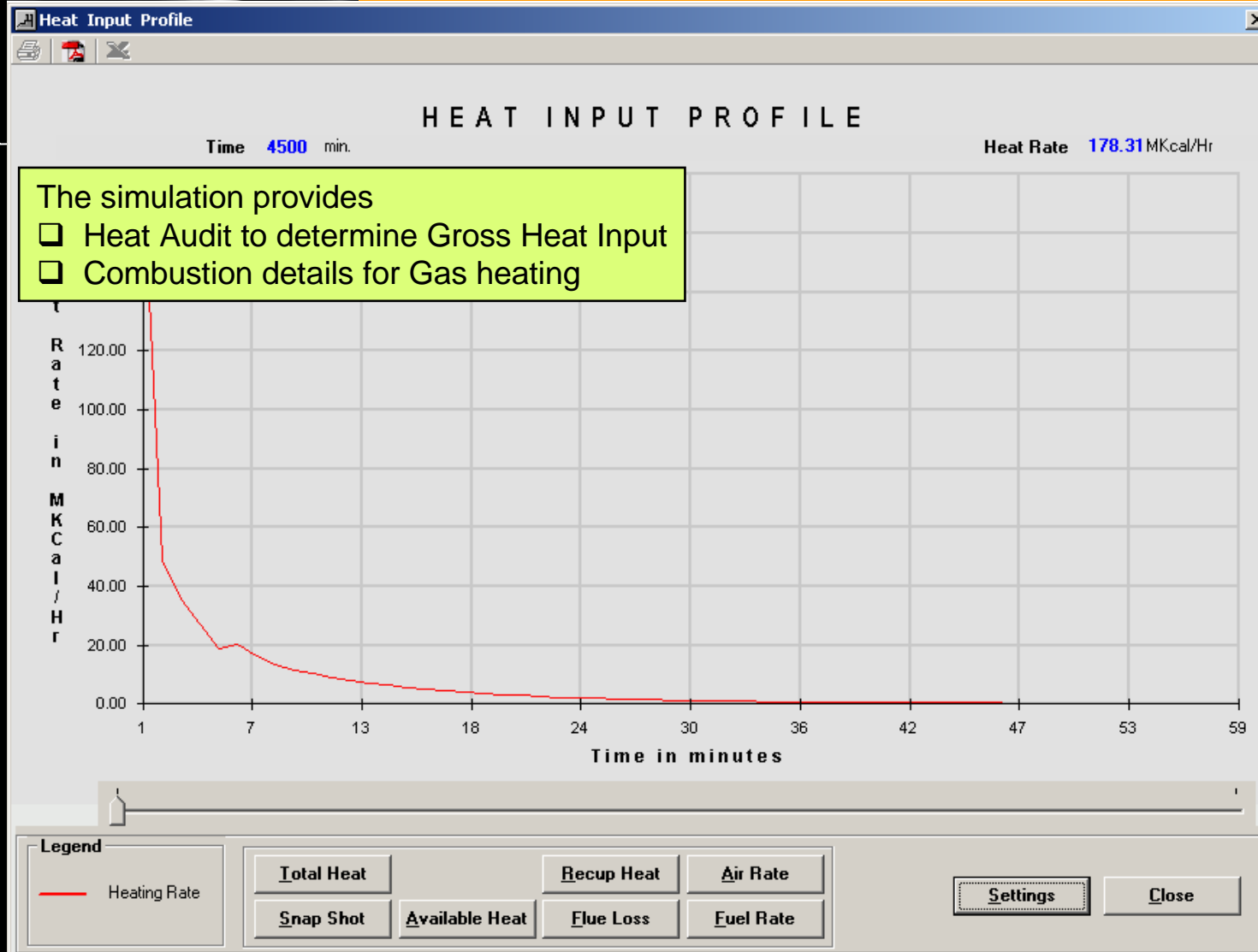
Run - Simulation



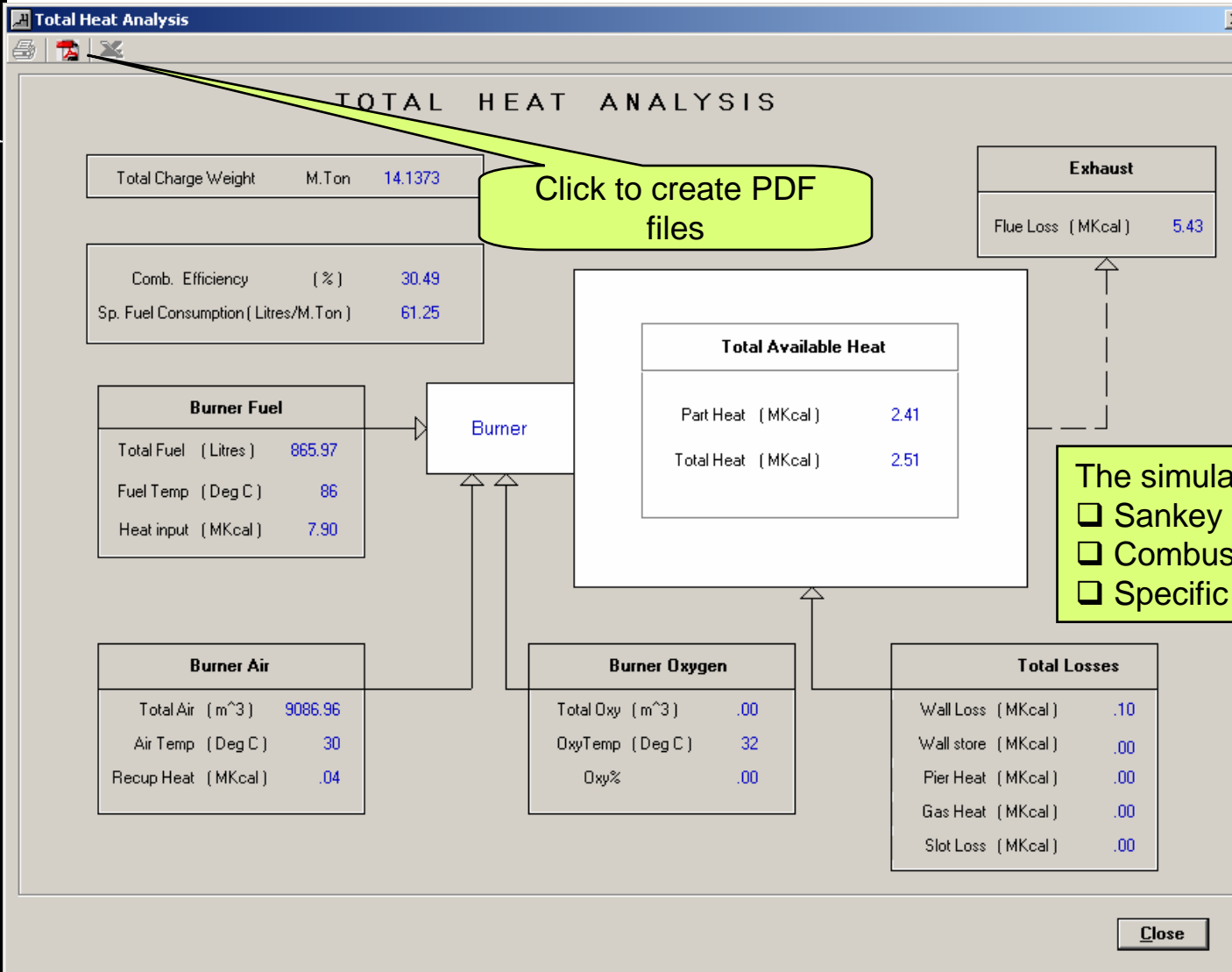
2 D Temperature Display



Heat Audit – Heat Input



Total Heat Report for Entire Cycle



The simulation provides

- Sankey Diagram for Heat Analysis
- Combustion Efficiency
- Specific Fuel Consumption

Reports

Unit System: **Default** Heat in a Stage **Btu** Distance **in**

Heat Rate **Btu/hr** Energy Con **Btu/lb** Temp **Deg F**

Ramp Rate **Deg F/min** Time **min** Wt **lbs**

Air Flow **ft³/Hr** Fuel Flow **lbs/Hr** Fuel in a Stage **lbs**

Gas Veloc **ft/min** Prod Rate **lbs/hr** Air in a Stage **ft³**

Furnace Type: **Batch**
Application: **Standard**
Analyst: **Administrator**
Job: **Ialyani**
Contract #: **2e423**
Furnace By: **nln**

Fuel Specification

Fuel Type NATURAL GAS - 8897 Gross kcal/cu.m
% of Xs Air / O₂ 10 Oxygen Temp. 0 Deg F
Comb. Air Temp. 300 Deg F Fuel Temp. 75 Deg F
Oxy % 0

Available Heat

Heat to Steel (MMBtu)	17.92
Wall Loss (MMBtu)	.10
Wall store (MMBtu)	.14
Pier Heat (MMBtu)	.02
Gas Heat (MMBtu)	.05
Slot Loss (MMBtu)	3.19
Door Loss (MMBtu)	1.52
Leakage Loss (MMBtu)	.41
Total Heat (MMBtu)	23.35

Total Heat

Heat input (MMBtu)	51.98
Flue Loss (MMBtu)	29.87
Recup Heat (MMBtu)	2.33
Air (ft ³)	350205.20
Fuel (lbs)	2218.94
	34.4743
	82.78

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CompAS

Data creation - Material

Material Data

Material Name: 1008 GRADE

Units: English Unit Metric Unit

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

Emissivity: 0.85

Conductivity

Temperature Deg C	Conductivity Watt/m-Deg C	Temperature Deg C	
16	59.34479	10	482
38	59.04548	11	538
93	57.99775	12	593
149	55.603	13	649
204	53.05856	14	704
260	50.21483	15	732
316	48.86777	16	760
371	47.25047	17	816
427	44.67695	18	871

Material Data

Material Name: 1008 GRADE

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

Emissivity: 0.85

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		
16	0.4594	10	482	0.66735	19	927	0.92885
38	0.46819	11	538	0.71086	20	982	0.93303
93	0.48953	12	593	0.75437	21	1038	0.93722
149	0.51212	13	649	0.79788	22	1093	0.93931
204	0.53555	14	704	0.84139	23	1149	0.6481
260	0.55354	15	760	0.88490	24	1204	0.65061
316	0.57153	16	816	0.92841	25	1260	0.66442
371	0.58952	17	871	0.97192	26	1316	0.71295
427	0.60751	18	927	1.01543			

Buttons:

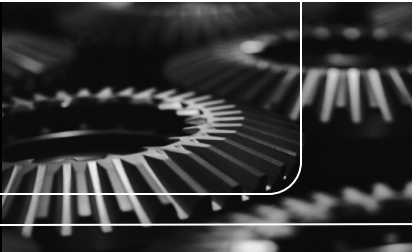
List of existing Insulation

Create New Data

Module to enter material data

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

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

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

- Module to enter insulation data
- Density
 - Conductivity as a function of temperature
 - Specific Heat as a function of temperature



Data creation - Fuel

Fuel Data

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

Type of Fuel: Gaseous Liquid

Ratio (Air / Fuel): 0.11

Product of Combustion (as fraction 0 - 1): CO₂ [Dry] 0.11

Fuel Composition (%):

N ₂	5	O ₂	0	CO ₂	0	CO	0
H ₂	0	H	0	O	0	H ₂ O	0
OH	0	NO	0	NO ₂	0		
SO	0	SO ₂	0	SO ₃	0		
CH ₄	90	C _n H _n	5				

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

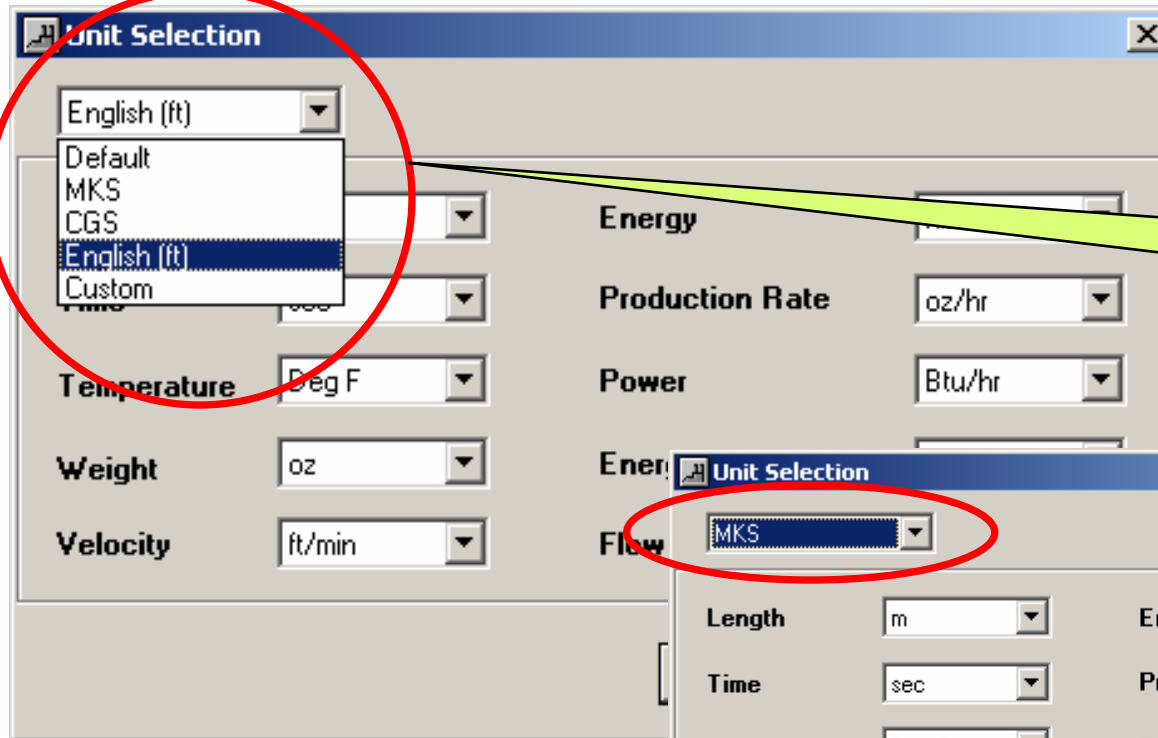
Buttons: Reset, **New**, Ok, Save

List of existing Insulation

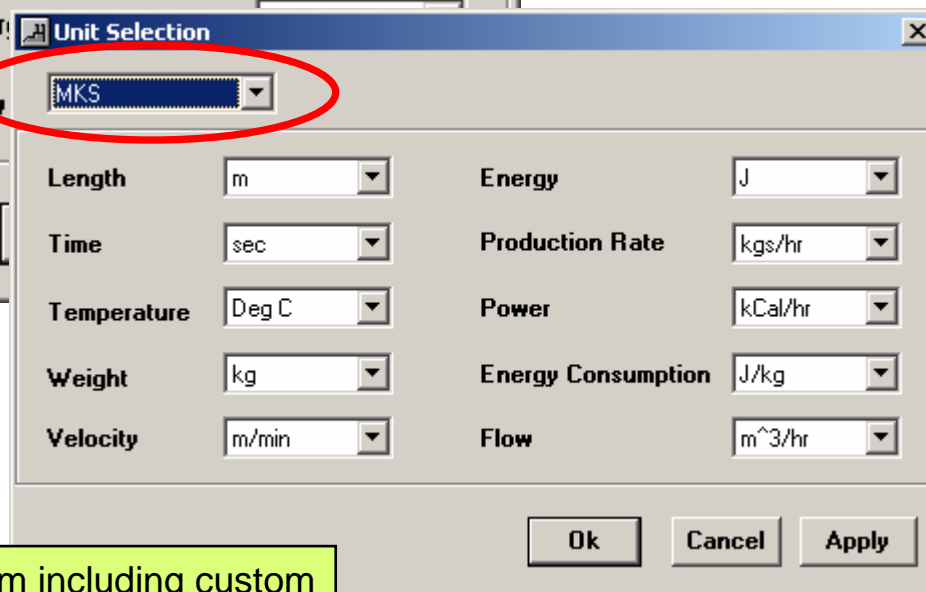
Create New Data

- Module to enter fuel data
- A/F, A/FI, HHV, LHV
 - POC - CO₂, H₂O, N₂
 - Fuel Composition

Unit System



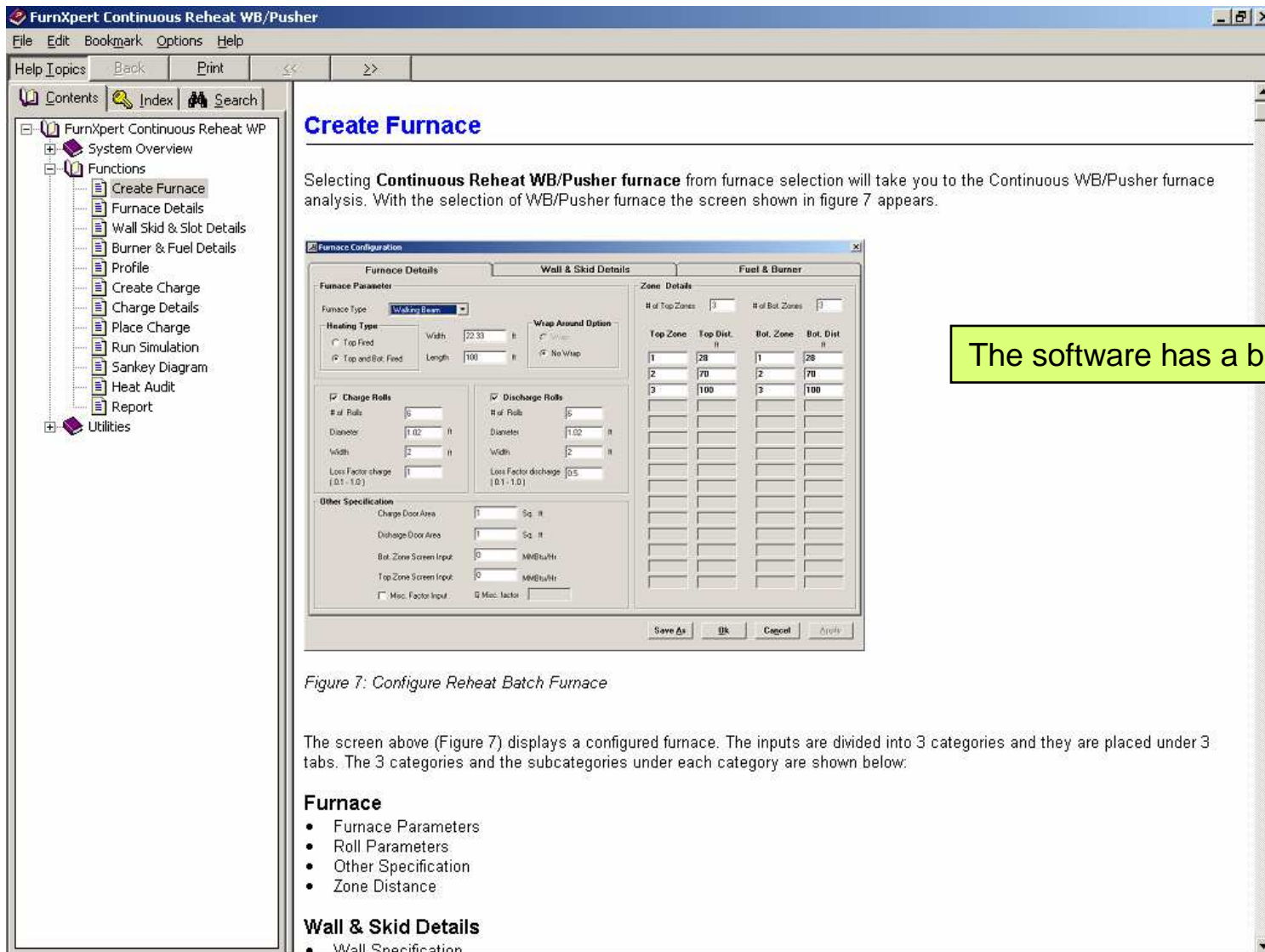
Different unit system can be selected



The software is designed for any unit system including custom

CompAS

Help type user manual



The screenshot shows the 'FurnXpert Continuous Reheat WB/Pusher' software interface. On the left is a tree view with 'Functions' expanded to 'Create Furnace'. The main window displays the 'Create Furnace' help page, which includes a 'Furnace Configuration' dialog box. The dialog box has three tabs: 'Furnace Details', 'Wall & Skid Details', and 'Fuel & Burner'. The 'Furnace Details' tab is active, showing fields for 'Furnace Type' (Walker Beam), 'Heating Type' (Top and Bot. Fixed), 'Charge Rolls' (6), 'Discharge Rolls' (6), and 'Other Specification' (Charge Door Area: 1, Discharge Door Area: 1, Bot. Zone Screen Input: 0, Top Zone Screen Input: 0). The 'Zone Details' section shows a table with 3 zones and their respective top and bottom distances.

Create Furnace

Selecting **Continuous Reheat WB/Pusher furnace** from furnace selection will take you to the Continuous WB/Pusher furnace analysis. With the selection of WB/Pusher furnace the screen shown in figure 7 appears.

The software has a built in user help

Figure 7: Configure Reheat Batch Furnace

The screen above (Figure 7) displays a configured furnace. The inputs are divided into 3 categories and they are placed under 3 tabs. The 3 categories and the subcategories under each category are shown below:

Furnace

- Furnace Parameters
- Roll Parameters
- Other Specification
- Zone Distance

Wall & Skid Details

- Wall Specification