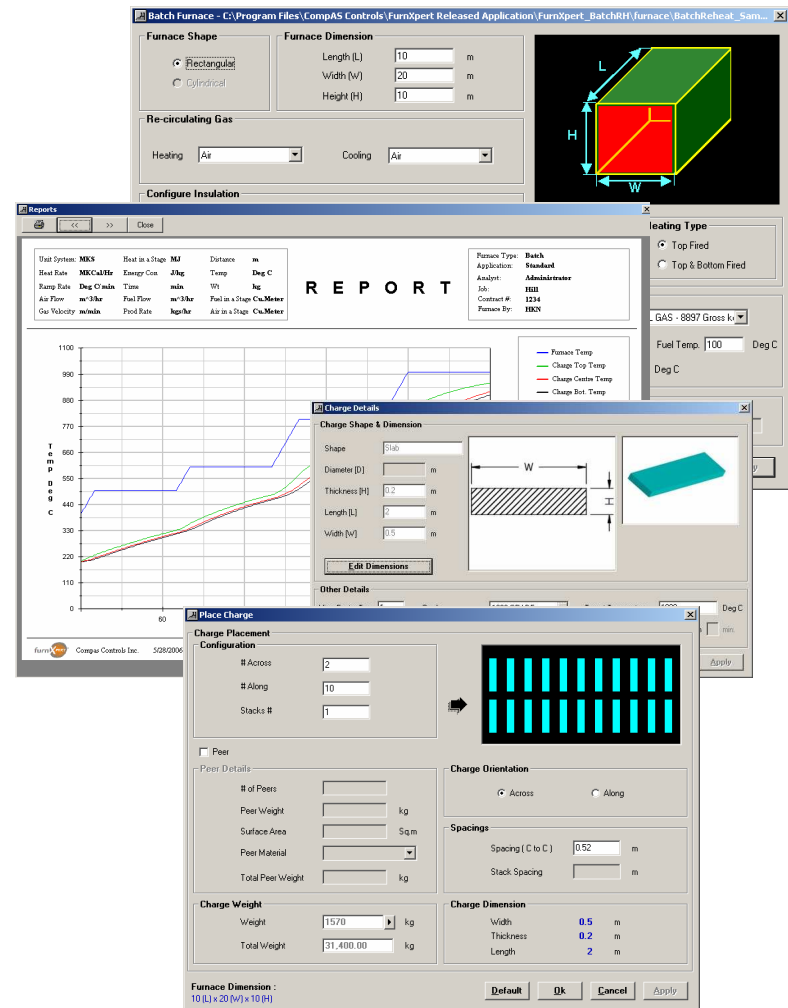


FurnXpert – Batch 1D



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”.



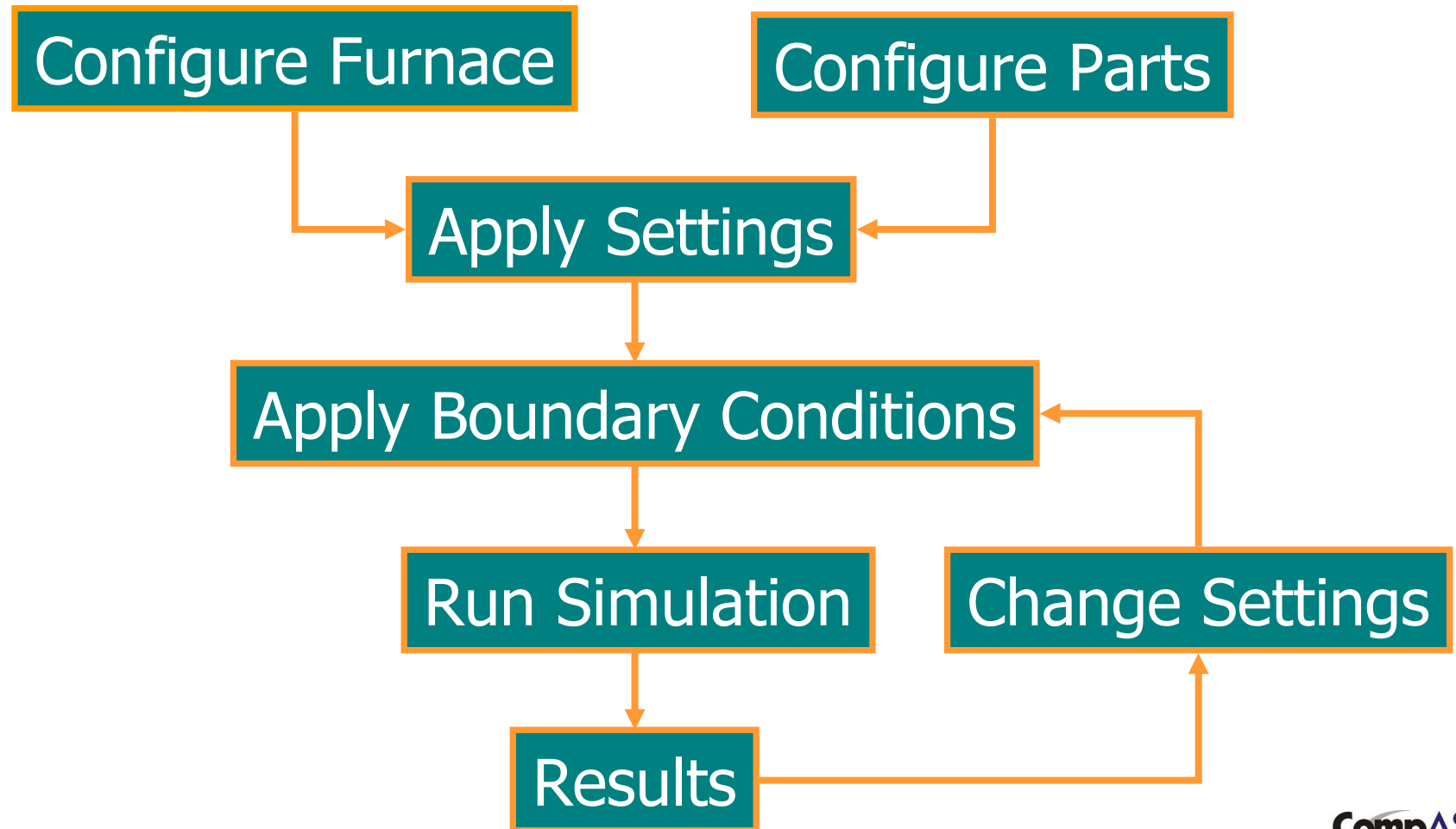


FurnXpert - Benefits

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?



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

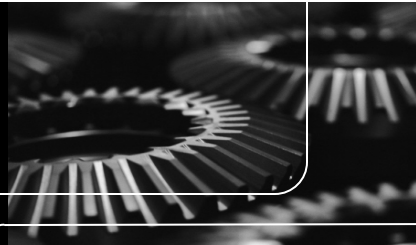
ALLOWS USER TO RUN HEAT AUDIT

ALLOWS USER TO CREATE AND PRINT REPORTS

ALLOWS USER TO VIEW HELP TO RUN THE SOFTWARE



Furnace Configurator- Box



Batch Furnace - C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert_BatchRH\ furnace\BatchReheat_Def_...

Furnace Shape Rectangular Cylindrical

Furnace Dimension

Length (L) in
Width (W) in
Height (H) in

Re-circulating Gas

Heating Cooling

Configure Insulation

Layer #	-1- (in)	-2- (in)	-3- (in)	-4- (in)
Walls	1	FB	12	

Heating Mode

Electric Gas Liquid

Heating Type

Top Fired Top & Bottom Fired

Fuel Specification

Fuel Type
% of X's Air Fuel Temp. Deg F
Comb. Air Temp. Deg F

Burner Type

Conventional Regenerative Flue Extraction %

List of Fuel is available, Gaseous and Liquid.

- 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			

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 Type:

Fuel Specifications

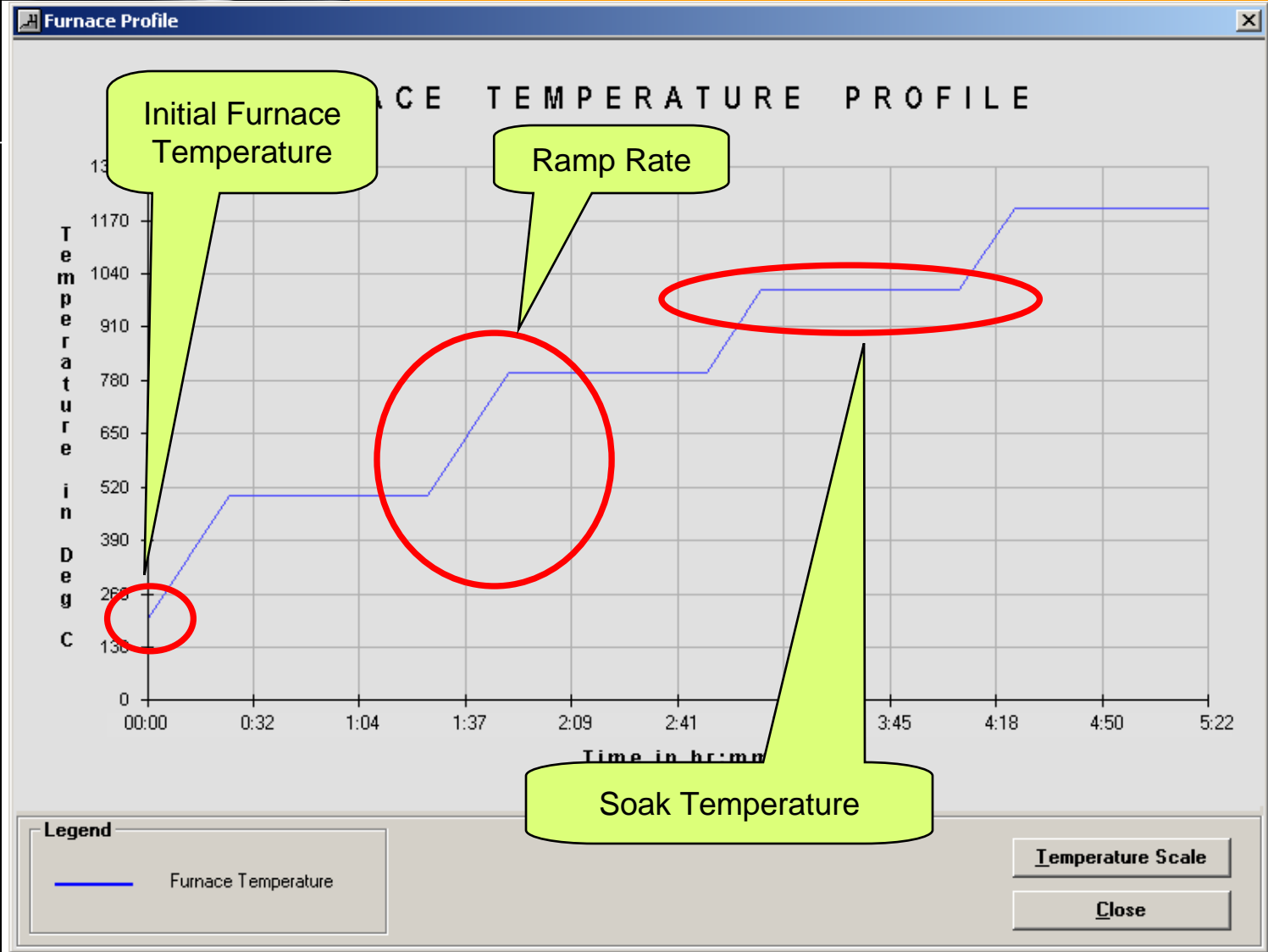
Fuel Type: % of Xs Air / O₂: 10 Oxygen Temp.: Deg C
Comb. Air Temp.: 30 Deg C Fuel Temp.: 30 Deg C

CAT=(FT)

Buttons: Ok, Cancel, Apply

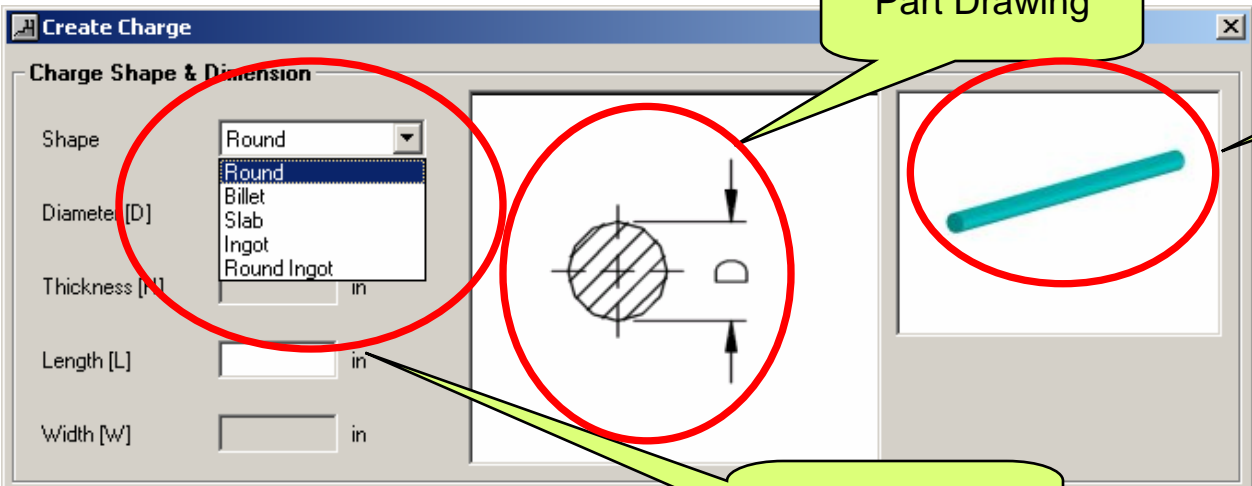
Provides the capability to enter custom insulation data

Profile Creation



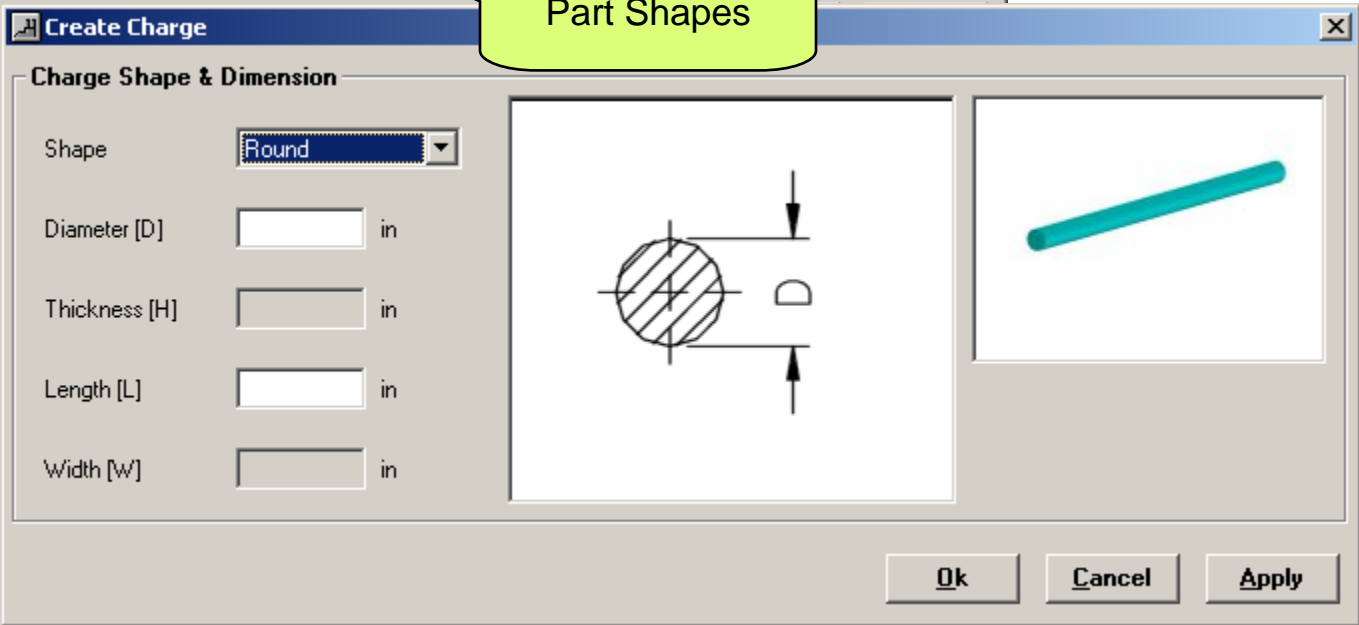
Charge/Part Creation

☐ Create charges/parts from list of shapes



Part Drawing

Part Drawing 3 D



Part Shapes

Select Charge

Charge Details

Charge Shape & Dimension

Shape: Round

Diameter [D]: 20 in

Thickness [H]: in

Length [L]: 40 in

Width [W]: in

Other Details

View Factor Top: 1

View Factor Bot.: 1

Material Selection: 1008 GRADE

Target Temperature:

Time @ Temperature:

Buttons: Edit Dimensions, Ok, Cancel, Apply

Select from a list of material

Input View Factor

Charge Placing - Box

Place charges in rectangular furnace

Charge Placement Configuration

Across: 10
Along: 2
Stacks #: 1

Peer

Peer Details

of Peers: 10
Peer Weight: 1000 lbs
Surface Area: 10 Sq.in
Peer Material: Steel
Total Peer Weight: 10000 lbs

Charge Weight

Weight: 3573 lbs
Total Weight: 71,460.00 lbs

Charge Orientation

Across Along

Spacings

Spacing (C to C): 25
Stack Spacing: []

Charge Dimension

Diameter: 20 in
Length: 40 in

Furnace Dimension :
100 (L) x 100 (W) x 100 (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 - Box

Place charges in rectangular furnace

Charge Placement Configuration

Across: 1
Along: 2
Stacks #: 1

Peer

Peer Details

of Peers: 10
Peer Weight: 1000 lbs
Surface Area: 100 Sq.in
Peer Material: Steel
Total Peer Weight: 10000 lbs

Charge Weight

Weight: 3573 lbs
Total Weight: 7,146.00 lbs

Charge Orientation

Across Along

Spacings

Spacing (C to C):
Stack Spacing:

Charge Dimension

Diameter: 20 in
Length: 40 in

Furnace Dimension :
100 (L) x 100 (W) x 100 (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

Heat Audit – Heat Demand

Stage	Type	Heat To Charge MKCal/Hr	Wall Loss MKCal/Hr	Wall Store MKCal/Hr	Heat to Peer MKCal/Hr	Heat To Gas MKCal/Hr	Total Heat MKCal/Hr
1	HS	0.9816	1.4460	1.5736	0.0035	0.0732	3.0859
2	HS	1.1625	1.9503	1.5789	0.0074	0.0892	4.7883
3	HS	1.9616	2.7217	2.7572	0.0123	0.1174	7.5702
4	HS	2.4657	3.6225	2.7437	0.0151	0.1467	8.9938
Max. Value		2.4657	3.6225	2.7572	0.0151	0.1467	8.9938

Buttons: **Combustion Parameters**, **Heating Rate Profile**, **Cumulative Heat**, **Close**

The simulation provides

- Heat Audit to determine stage wise heat losses
- Combustion details for Gas heating

Heat Audit – Stage Wise Combustion Parameter

Stage	Type	Gross Heat MKCal/Hr	Fuel Rate m ³ /hr	Air Rate m ³ /hr	Recup. Heat MKCal/Hr	Flue Loss MKCal/Hr	Efficiency %
1	HS	5.2330	443.37	1,977.98	0.6360	1.9834	76.17
2	HS	6.6625	565.25	2,518.27	0.8862	2.7914	71.87
3	HS	12.0090	1,018.85	4,539.16	1.5973	6.0160	63.04
4	HS	16.6719	1,414.45	6,301.64	2.2175	9.7592	53.95
Max. Value		16.6719	1,414.45	6,301.64	2.2175	9.7592	76.17

Combustion Parameters

- Stage wise combustion parameters
- Cumulative combustion details

Heat Audit – Cumulative Combustion Details

Stage	Type	Time min	Gross Heat MJ	Fuel Cubic Meter	Air Cubic Meter
1	HS	70	25,194	511	2,275
2	HS	70	32,076	650	2,896
3	HS	80	66,197	1,341	5,977
4	HS	80	91,899	1,862	8,297
Total Value		300	215,367	4,364	19,444

Close

Cumulative Combustion Parameters

Stage wise cumulative combustion parameters

Heat Audit – Stage Wise Cumulative Heat Loss Details

Stage	Type	Time min	Heat To Charge MMBtu	Wall Loss MMBtu	Wall Store MMBtu	Heat to Peer MMBtu	Heat To Gas MMBtu	Total Heat MMBtu
1	HS	242	1.8885	0.9533	0.2956	0.0000	0.0010	3.1384
2	HS	738	2.6637	5.7828	26.6390	0.0000	0.0048	35.0903
Tot. Value (HS)		980	4.5522	6.7361	26.9346	0.0000	0.0058	38.2287
Tot. Value (CS)								

To XLS Close

Cumulative Heat Loss Details

- Stage wise cumulative heat loss details

Data Export to Excel

Data can be exported to excel spread sheet

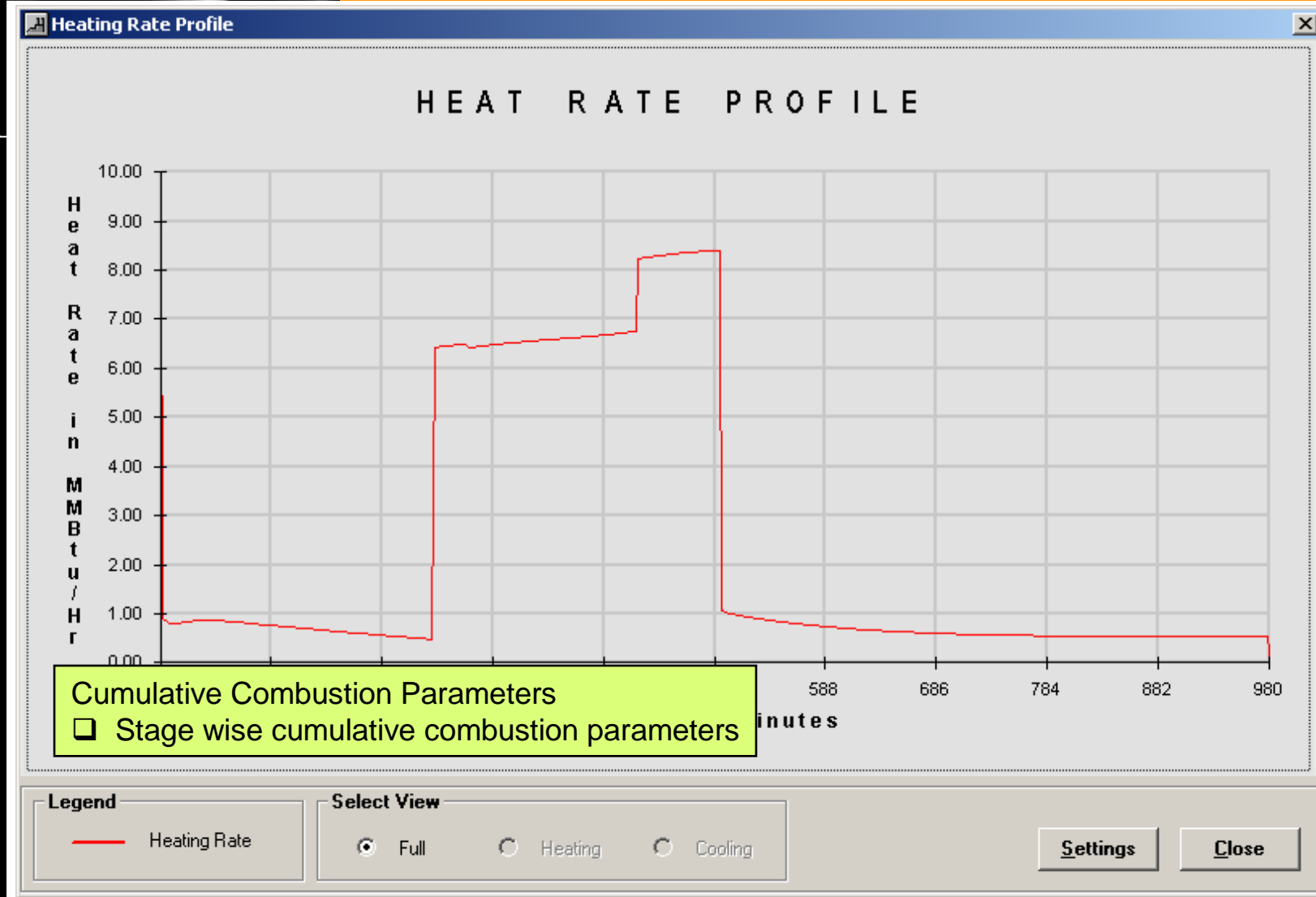
The screenshot shows the 'Heat Audit' software interface. A 'Select export-destination' dialog box is open, showing a file named 'report file.xls' and a 'To XLS' button. A red arrow points from the 'To XLS' button to the 'Cumulative Heat' row in the data table. A large blue arrow points from the 'report file.xls' file to the 'To XLS' button.

Stage	Type	Heat To Charge (MMBtu/Hr)	Wall Loss (MMBtu/Hr)	Wall Store (MMBtu/Hr)	Heat To Peer (MMBtu/Hr)	Heat To Gas (MMBtu/Hr)	Total Heat (MMBtu/Hr)
1	HS	0.4702	0.2373	0.0736	0	0.0003	0.7814
2	HS	0.2169	0.4708	2.1687	0	0.0004	2.8567
Max.Value		0.4702	0.4708	2.1687	0	0.0004	2.8567

Heat Audit							
Stage	Type	Heat To Charge (MMBtu/Hr)	Wall Loss (MMBtu/Hr)	Wall Store (MMBtu/Hr)	Heat To Peer (MMBtu/Hr)	Heat To Gas (MMBtu/Hr)	Total Heat (MMBtu/Hr)
1	HS	0.4702	0.2373	0.0736	0	0.0003	0.7814
2	HS	0.2169	0.4708	2.1687	0	0.0004	2.8567
Max.Value		0.4702	0.4708	2.1687	0	0.0004	2.8567



Heat Audit – Heat Rate Profile



Cumulative Combustion Parameters
 Stage wise cumulative combustion parameters

Reports

REPORT

Unit System: **Default** Heat in a Stage: **MMBtu** Distance: **in**
Heat Rate: **MMBtu/Hr** Energy Con: **Btu/lb** Temp: **Deg F**
Ramp Rate: **Deg F/min** Time: **min** Wt: **lbs**
Air Flow: **Cfm** Flow: **Cfm** Fuel in a Stage: **Cu.Feet**
Gas Velocity: **in/min** Prod: **lbs/hr** Air in a Stage: **Cu.Feet**

Furnace Type: **Batch**
Application: **Standard**
Analyst: **Administrator**
Job: **Demo Default unit**
Contract #: **1234**
Furnace By: **HKN**

Furnace Data

Length : 100
Width : 100
Height : 100
Heating Type : Gas
Fuel Type : NATURAL GAS - 8897 Gross kcal
InitFurnace Temp. : 500

Heating Stages

Stage	Time	Temperature	Ramp Rate	Gas Flow
1	60	1000	15	
	60	1500	15	
3	60	2000	15	

Insulation (in)

Walls : 12 Roof : 12 Doors : 12 Back : 12 Hearth : 12
Layers : 1 Layers : 1 Layers : 1 Layers : 1 Layers : 1
1. FB : 12 1. FB : 12 1. FB : 12 1. FB : 12 1. FB : 12

Charge Matrix and Weight

Charge Matrix 2 x 1 x 1
Charge Weight 3573.00
Total Charge Weight : 7,146.00

Charge Shape and Dimension

Shape Round
Size:
D 20 L 40

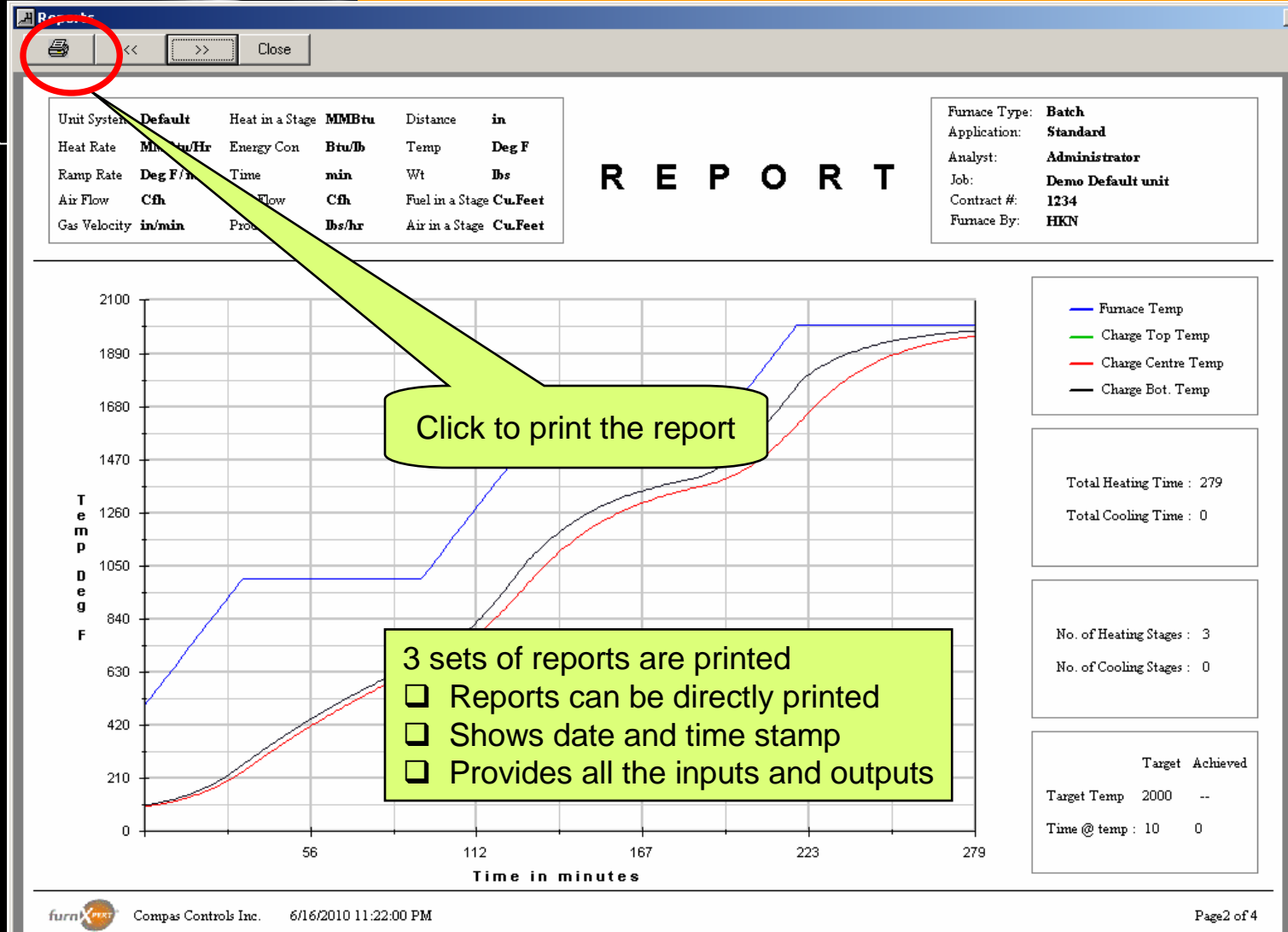
Page 1 of 4

Click to print the report

3 sets of reports are printed

- Reports can be directly printed
- Shows date and time stamp
- Provides all the inputs and outputs

Reports



Reports

Unit System: **Default** Heat in a Stage: **MMBtu** Distance: **in**
Heat Rate: **MMBtu/Hr** Energy Con: **Btu/lb** Temp: **Deg F**
Ramp Rate: **Deg F/min** Time: **min** Wt: **lbs**
Air Flow: **Cfh** Flow: **Cfh** Fuel in a Stage: **Cu.Feet**
Gas Velocity: **in/min** Prod: **lbs/hr** Air in a Stage: **Cu.Feet**

Furnace Type: **Batch**
Application: **Standard**
Analyst: **Administrator**
Job: **Demo Default unit**
Contract #: **1234**
Furnace By: **HKN**

REPORT

Heat							Cumulative Heat Data							
Stage	Chg.Ht.	Wall Loss	Wall Store	Peer Ht.	Gas	Total Ht.	Stage	Time	Charge Ht.	Wall Loss	Wall Store	Peer Ht.	Ht. Gas	Total Ht.
1 HS	0.3267	0.1976	2.8336	0.4813		3.8392	1 HS	93	0.5010	0.3030	4.3449	0.7379	0.0000	5.8868
2 HS	0.6123	0.3526	2.8636	0.6924		4.5558	2 HS	93	0.9389	0.5406	4.3909	1.0617	0.0000	6.9321
3 HS	0.6071	0.4895	2.8829	0.5763	0.0000	4.5558	3 HS	93	0.9309	0.7506	4.4205	0.8836	0.0000	6.9856
Max.	0.6123	0.4895	2.8829	0.6924	0.0000	4.5558	Tot-HS		2.3708	1.5942	13.1562	2.6832	0.0000	19.8044
Max. Heating	4.5558						Tot-CS							

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Reports

Unit System: **Default** Heat in a Stage: **MMBtu** Distance: **in**
Heat Rate: **MMBtu/Hr** Energy Con: **Btu/lb** Temp: **Deg F**
Ramp Rate: **Deg F/min** Time: **min** Wt: **lbs**
Air Flow: **Cfh** Flow: **Cfh** Fuel in a Stage: **Cu.Feet**
Gas Velocity: **in/min** Prod: **lbs/hr** Air in a Stage: **Cu.Feet**

Furnace Type: **Batch**
Application: **Standard**
Analyst: **Administrator**
Job: **Demo Default unit**
Contract #: **1234**
Furnace By: **HKN**

R E P O R T

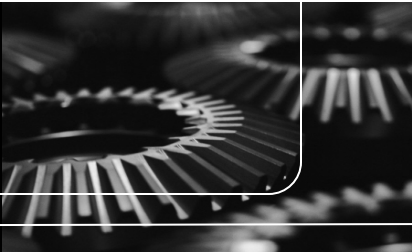
Combustion Parameters							Cumulative Combustion Data				
Stage	Gross Ht.	Fuel Flow	Recup.Ht.	Flue Loss	Eff.	Stage	Time	Gross Ht.	Fuel	Air	
1 HS	6.0644	5,493.88	44,947.25	1.579	2.3900	63.31	1 HS	93	9.2987	8,424	68,919
2 HS	8.8470	8,014.66	68,003.83	0.3091	7.4281	38.37	2 HS	93	13.5653	12,289	100,542
3 HS	11.8737	10,756.66	88,003.83	0.3091	7.4281	38.37	3 HS	93	18.2063	16,494	134,939
Max.	11.8737	10,756.66	88,003.83	0.3091	7.4281	38.37	Total	279	41.0704	37,207	304,400

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Click to print the report

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

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

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

The screenshot shows the 'Fuel Data' software interface. A list of existing fuel types is shown in a dropdown menu, circled in red. The main form contains fields for 'Name', 'Type of Fuel' (Gaseous/Liquid), 'Ratio (in Cu.m / Cu.m)', 'Heating Value (in KCal / Cu.m)', 'Product of Combustion (as fraction 0 - 1)', and 'Fuel Composition (%)'. A 'New' button is circled in red at the bottom.

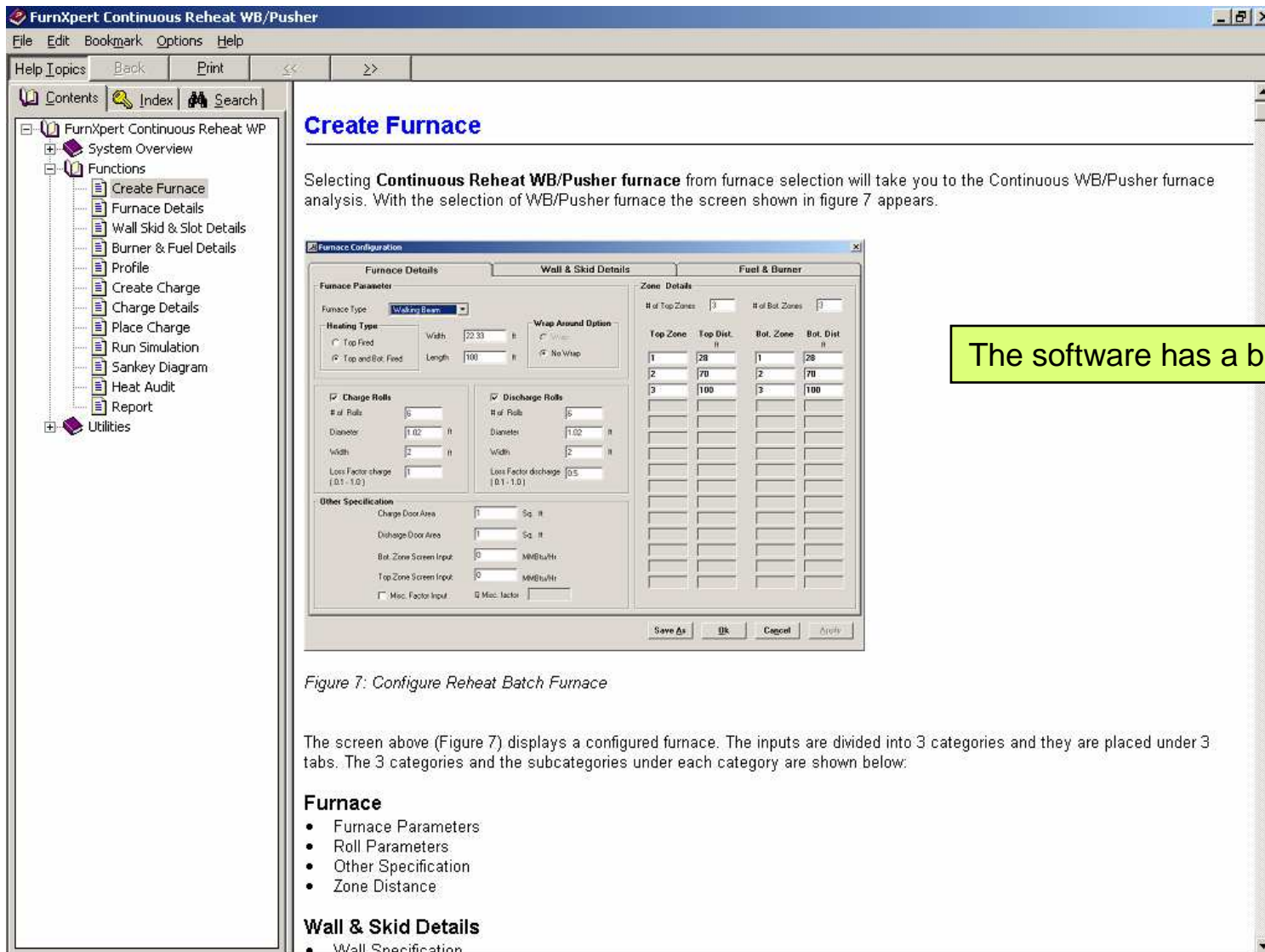
List of existing Insulation

Create New Data

Module to enter fuel data

- A/F, A/FI, HHV, LHV
- POC - CO₂, H₂O, N₂
- Fuel Composition

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. This dialog box is divided into three tabs: 'Furnace Details', 'Wall & Skid Details', and 'Fuel & Burner'. The 'Furnace Details' tab is active, showing various input fields for furnace parameters, heating type, charge rolls, discharge rolls, and other specifications. A table in the 'Zone Details' section shows zone configurations.

Top Zone	Top Dist. ft	Bot. Zone	Bot. Dist. ft
1	28	1	28
2	70	2	70
3	100	3	100

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