



FurnXpert Batch Heat Treat Application solves Heat Transfer and Combustion Issues in small furnaces to heat small charges like cylinders, bushings, blocks, flanges, etc

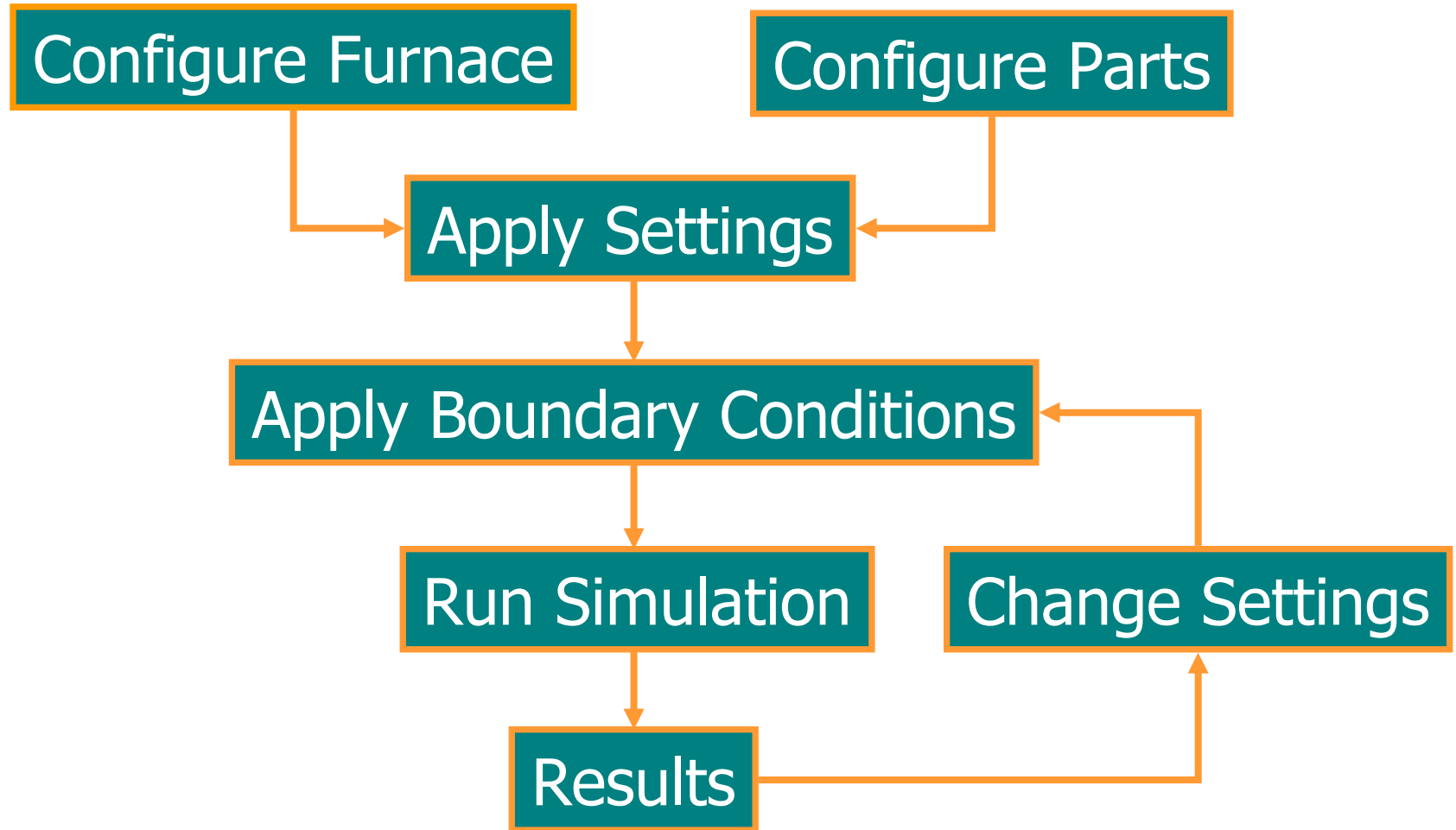
The screenshot displays the FurnXPERT software interface with several windows open:

- Batch Furnace - C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert_BatchHT\ furnace\Sample_Cyl_1.bhf**: The main configuration window. It includes:
 - Furnace Shape**: Rectangular, Cylindrical
 - Furnace Dimension**: Length (L) 72 in, Diameter (D) 60 in
 - Re-circulating Gas**: Heating Air, Cooling Air
 - Heating Mode**: Electric, Gas, Liquid. Heating Type: Top Fired, Top & Bottom Fired
 - Fuel Specification**: Fuel Type, % of Excess Air, Fuel Temp., Deg F, Comb. Air Temp., Deg F
 - Burner Type**: Conventional, Regenerative, Flue Extraction %
- Part Selection**: Shows a diagram of a cylinder with dimensions ID, OD, and TH. Part Shapes list includes: Bushing, Cylinder, Flange, Inverted Flange, Block, I/O Flange, Inv. I/O Flange.
- Part Details**: Dimension fields: OD 30 in, ID 10 in, TH 20 in. Includes a "Select Different P..." button and a file path.
- Place in Furnace**:
 - Part Placement**: Part Configuration (No. of Parts: 1), Part Placement in a Basket (visual representation of parts in a basket).
 - Basket Details**: Tray, Basket. Basket Row # 1, Col # 1, Basket Weight 10 lbs, Surface Area 100 Sq.in, Basket Material Steel, Total Basket Weight 10 lbs.
 - Basket Placement**: Visual representation of a 3x3 grid of parts in a basket.
 - Part Weight**: Weight 3519.04 lbs, Total Weight 3519.04 lbs.
 - Part Dimension**: Shape Bushing, ID 10 in, OD 30 in, TH 20 in.

At the bottom of the "Place in Furnace" window, it shows: **Furnace Dimension :** 72 (L) x 60 (W) x 0 (H) and buttons for Default, Ok, Cancel, and Apply.

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



FurnXpert Functions

The screenshot shows the FurnXpert software interface. The title bar reads "FurnXpert : Batch Heat-treat". The menu bar includes "File", "View", "Parts", "Profile Option", "Process", and "Re". The toolbar contains icons for file operations and a "AU" button. A vertical toolbar on the left lists the following functions: Furnace, Profile, Create Part, Select Part, Place Part, Settings, Run, Heat Audit, Reports, Help, and Exit. The main window displays a "SETUP FURNACES" dialog box with the FurnXPERT logo and contact information for CompAS Controls, Inc. (Sunnyvale, CA 74002, Ph: (724) 388-0577, info@furnxpert.com, www.furnxpert.com). A "Single User License" notice is also visible. The status bar at the bottom shows: APP MODE: Heat-treat, UNIT SYSTEM: Default, FURNACE BY: HKN, CONTRACT NO: 1234, JOB NAME: Cylindrical, PART: Bushing, ANALYSIS : 2D.

CONFIGURE NEW FURNACES

CREATE FURNACE TEMPERATURE PROFILE

CREATE PARTS/CHARGES

SELECT PARTS TO BE HEATED INSIDE THE FURNACE

PLACE PARTS INSIDE THE FURNACE

RUN SIMULATION

RUN HEAT AUDIT

CREATE AND PRINT REPORTS

Select New Furnace

FurnXpert : Batch 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

SETUP FurnXPERT is a

New Furnace

Job Name DEMO
Contract Number 1234
Engineer's Initial HKN

Continue Cancel

info@furnxpert.com
www.furnxpert.com
Single User License

APP MODE: Heat-treat UNIT SYSTEM: Default FURNACE BY: HKN CONTRACT NO: 1234 JOB NAME: Cylindrical PART: Bushing ANALYSIS : 2D

Select New Furnace

Enter Project Data

Select Unit System

FurnXpert : Batch 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 Unit System From Drop Down Menu

Unit selection

Default

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

Ok Cancel Apply

APP MODE: Heat-treat UNIT SYSTEM: Default FURNACE BY: HKN CONTRACT NO: 1234 JOB NAME: Cylindrical PART: Bushing ANALYSIS : 2D

Enter Furnace Data

Batch Furnace - C:\Program Files\CompAS Controls\FurnXpert Released Application\FurnXpert_BatchHT\furnace\Sample_Cyl_1.bhf

Furnace Shape

Rectangular
 Cylindrical

Furnace Dimension

Length (L) in
Diameter (D) in

Re-circulating Gas

Heating Cooling

Configure Insulation

Layer #	-1- (in)	-2- (in)	-3- (in)	-4- (in)
Walls	<input type="text" value="2"/> FB <input type="text" value="3"/>	IB <input type="text" value="3"/>	<input type="text"/>	<input type="text"/>
Door	<input type="text" value="2"/> FB <input type="text" value="3"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Back	<input type="text" value="2"/> FB <input type="text" value="3"/>	<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"/>

Heating Mode

Electric
 Gas
 Liquid

Heating Type

Top Fired
 Top & Bottom Fired

Fuel Specification

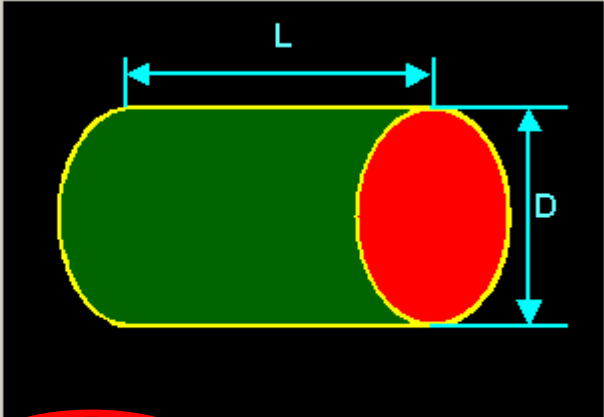
Fuel Type

% of Excess Air Fuel Temp. Deg F
Comb. Air Temp. Deg F

Burner Type

Conventional
 Regenerative

Flue Extraction %



The diagram shows a 3D perspective of a cylindrical furnace. The length is labeled 'L' and the diameter is labeled 'D'. The front face of the cylinder is highlighted in red, and the side is highlighted in green. Blue arrows indicate the dimensions L and D.

INPUT ALL THE FURNACE DETAILS

- Furnace Shape
- Furnace Dimensions
- Re-circulating Gas
- Insulation Configuration
- Heating Mode
- Fuel Specification
- Burner Type

Time Temperature Input

Options

Manual Data Entry
 Data From File

Initial Furnace Temp Deg F
 min
 No of stages

Stages

Stage #	Ramp up Deg F / min	Target Temp. Deg F	Soak Time min	Gas Flow Cfh
1	<input type="text" value="5"/>	<input type="text" value="1600"/>	<input type="text" value="240"/>	<input type="text" value="10"/>
2	<input type="text" value="4"/>	<input type="text" value="1795"/>	<input type="text" value="1"/>	<input type="text" value="10"/>
3	<input type="text" value="0"/>	<input type="text" value="1800"/>	<input type="text" value="60"/>	<input type="text" value=""/>
4	<input type="text" value="5"/>	<input type="text" value="2250"/>	<input type="text" value="630"/>	<input type="text" value=""/>
5	<input type="text" value="4"/>	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>

Stages

Stage #	Ramp-up Deg F / min	Target Temp. Deg F	Soak Time min	Gas Flow Cfh
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

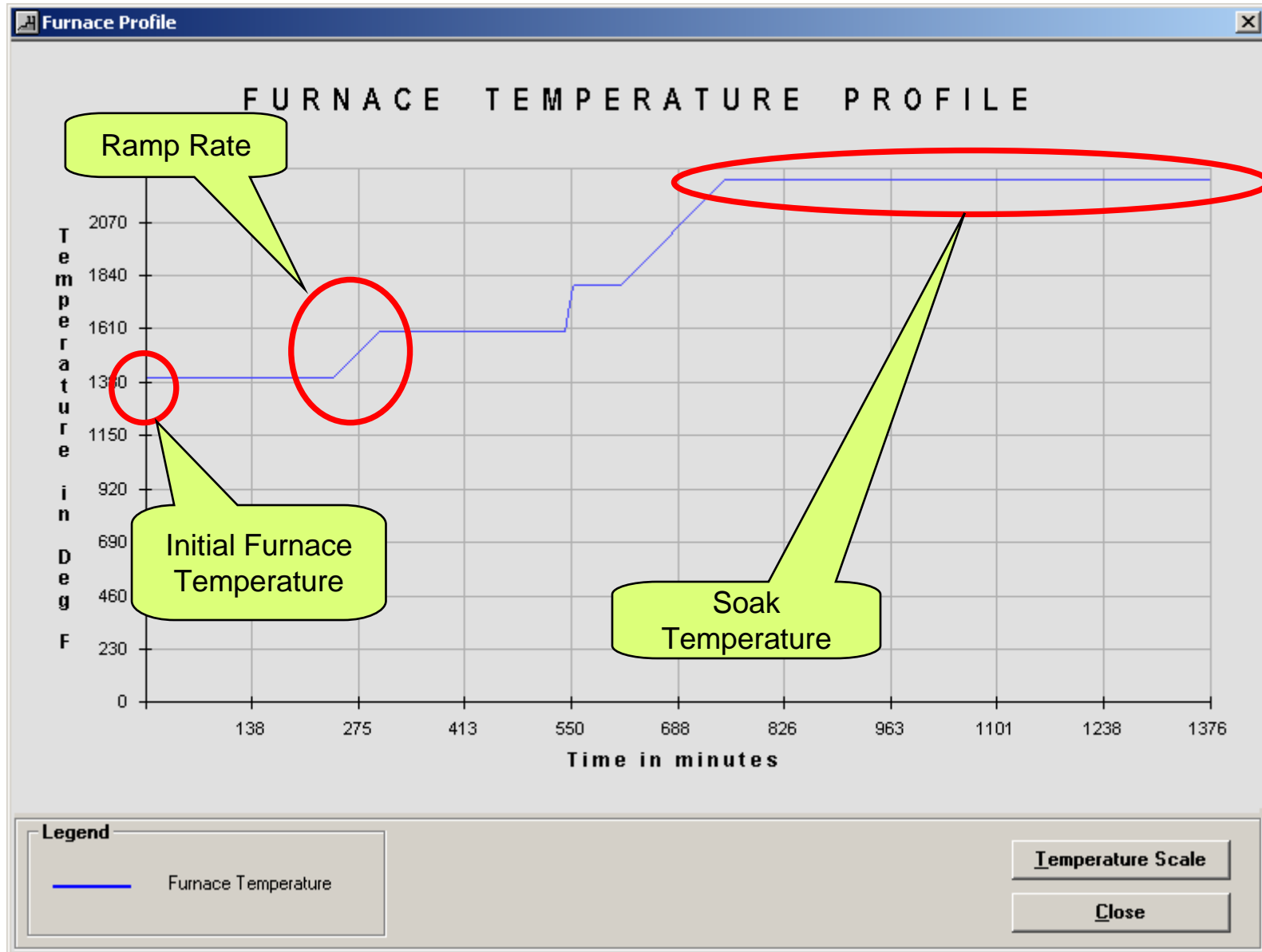
Data can be entered manually or from a file

Sets number of stages

Provides the capability to enter Time – Temp Settings

- Time and Temperature stage wise
- Ramp-Rate
- Flow Rates for re-circulating gases

Sets Initial Temperature



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

Flange.prt

Select Different Part

Part Placement – Tray or Basket

Place in Furnace

Part Placement

Part Configuration

No. of Parts:

Part Placement in a Basket

Tray **Basket**

Basket Details

Basket Row #: Col #:

Basket Weight: lbs

Surface Area: Sq.in

Basket Material:

Total Basket Weight:

Basket Placement

Part Configuration
 Select Tray or Basket
 Enter Tray or Basket Information

Part Weight

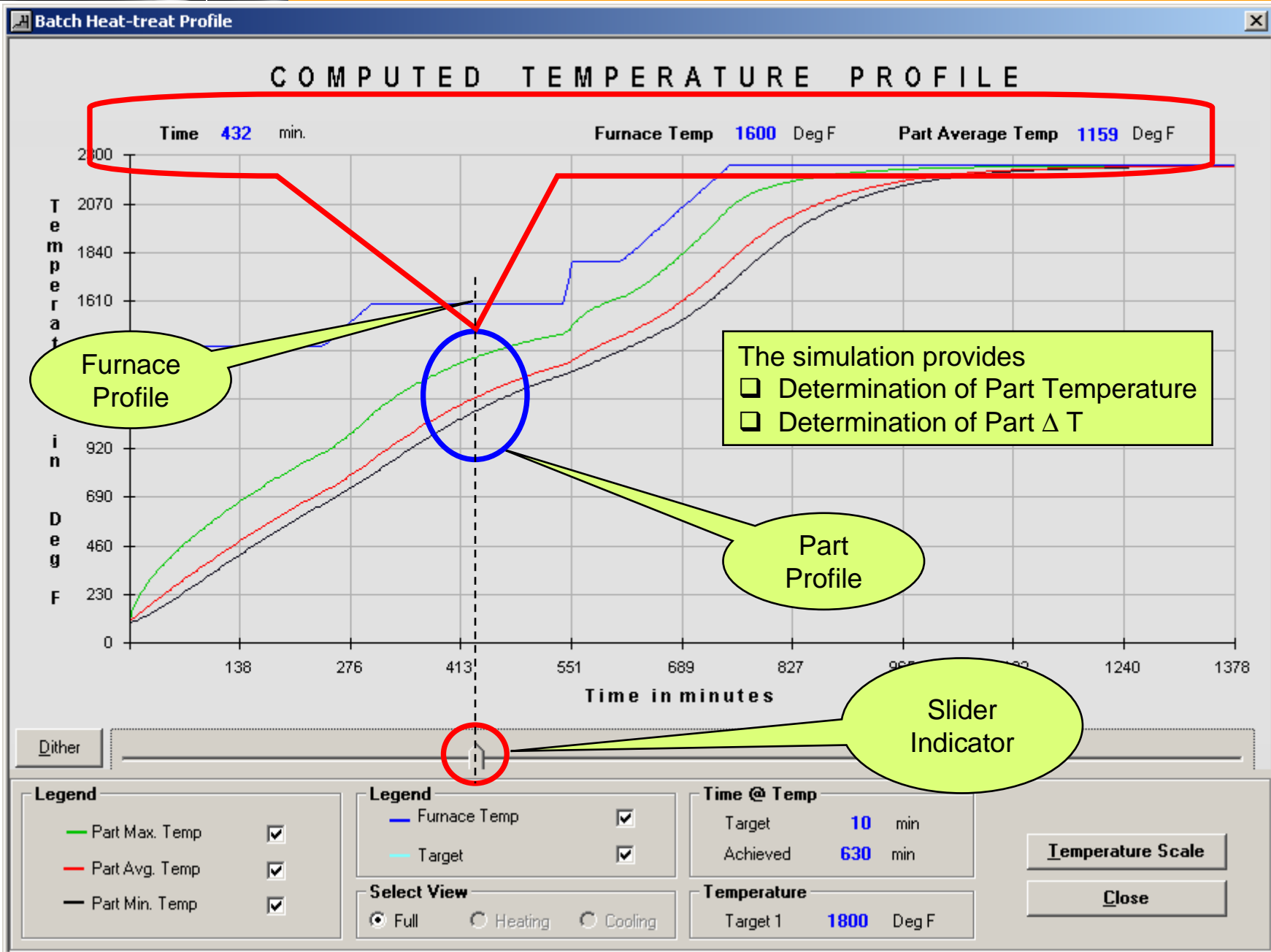
Weight: lbs

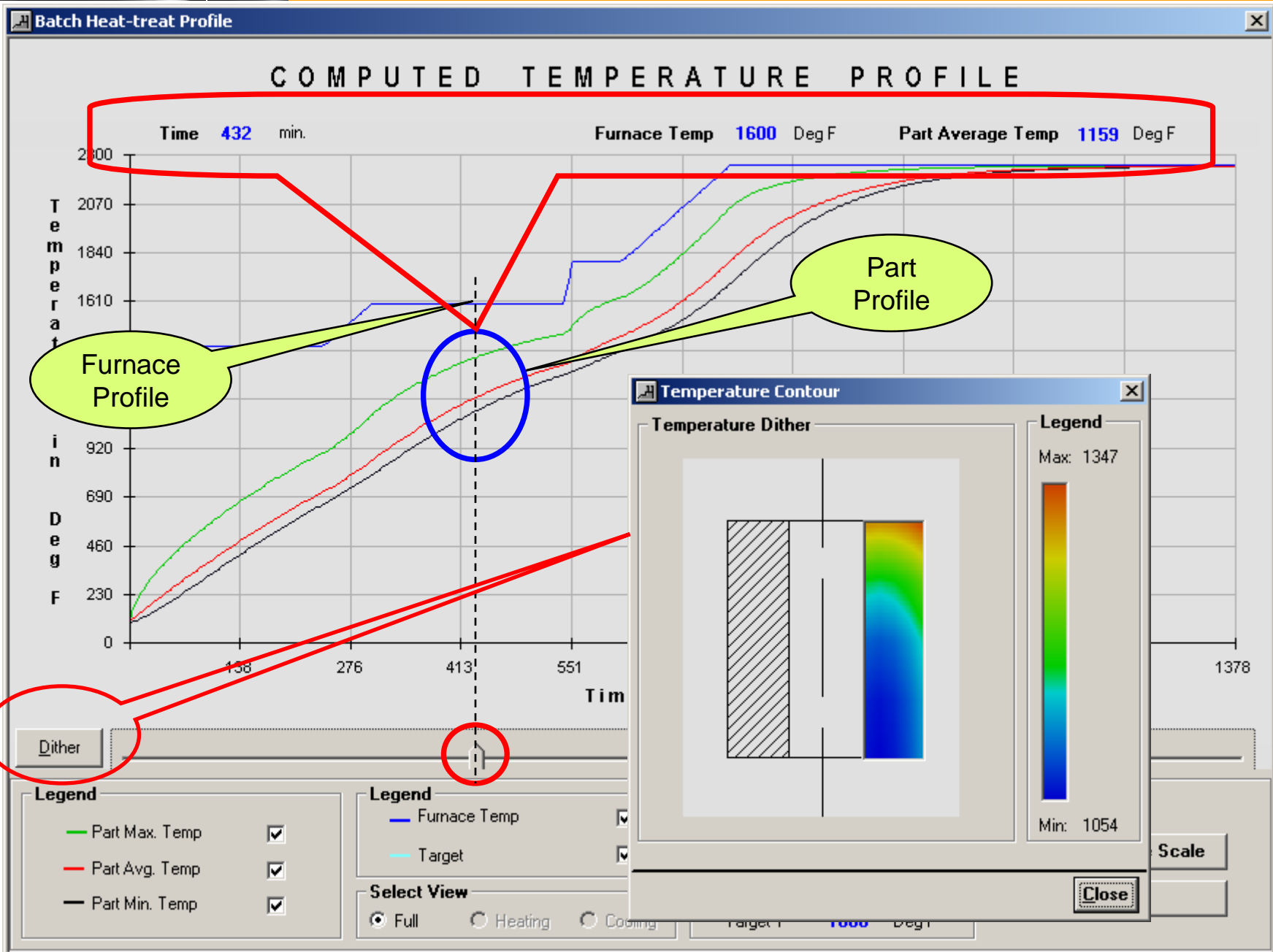
Total Weight:

ID: in

TH: in

Furnace Dimension :
847 (L) x 115 (W) x 144 (H)





Heat Audit/Combustion Details

Heat Rate Details							
Stage	Type	Heat To Part	Wall Loss	Wall Store	Heat to Basket	Heat To Gas	Total Heat
		Btu/hr	Btu/hr	Btu/hr	Btu/hr	Btu/hr	Btu/hr
1	HS	1,058,763,000	347,034	81,679	3,117.23	255.99	1,059,195,000.00
2	HS	952,029,900	420,299	1,296,672	3,400.62	291.01	953,750,500.00
3	HS	1,142,805,000	522,170	37,217,140	5,076.27	345.74	1,180,550,000.00
4	HS	1,078,929,000	524,898	159,048	4,530.39	337.83	1,079,617,000.00
5	HS	569,403,100	710,957	1,270,775	1,734.73	410.57	571,387,000.00
Max. Value		1,142,805,000	710,957	37,217,140	5,076.27	410.57	1,180,550,000.00

Combustion Details							
Stage	Type	Gross Heat	Fuel Rate	Air Rate	Recup. Heat	Flue Loss	Efficiency
		Btu/hr	Cfh	Cfh	Btu/hr	Btu/hr	%
1	HS	1,418,068,000	1,284,661.00	4,030,194.00	336,111,000.00	686,765,800.00	74.69
2	HS	1,313,809,000	1,190,210.00	3,450,945.00	349,365,500.00	697,119,400.00	72.59
3	HS	1,672,925,000	1,515,542.00	4,091,906.00	493,830,900.00	964,607,500.00	70.57
4	HS	1,531,027,000	1,386,993.00	3,738,236.00	453,093,300.00	884,594,900.00	70.52
5	HS	870,724,500	788,809.70	1,835,157.00	317,038,800.00	597,609,200.00	65.62
Max. Value		1,672,925,000	1,515,542.00	4,091,906.00	493,830,900.00	964,607,500.00	74.69

The simulation provides

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

Cumulative Heat Details/Combust Parameter

Total Stage Heat Audit

Cumulative Heat Details

Stage	Type	Time min	Heat To Part Btu	Wall Loss Btu	Wall Store Btu	Heat to Basket Btu	Heat To Gas Btu	Total Heat Btu
1	HS	242	4,252,699,000	1,393,920	328,079	12,520.89	1,028.23	4,254,435,000.00
2	HS	300	4,744,283,000	2,094,489	6,461,748	16,946.41	1,450.20	4,752,858,000.00
3	HS	11	190,467,600	87,028	6,202,858	846.05	57.62	196,758,400.00
4	HS	61	1,078,929,000	524,898	159,048	4,530.39	337.83	1,079,618,000.00
5	HS	765	7,250,400,000	9,052,849	16,181,200	22,088.90	5,227.90	7,275,661,000.00
Tot. Value (HS)		1379	17,516,780,000	13,153,190	29,332,930	56,932.64	8,101.78	17,559,330,000.00
Tot. Value (CS)								

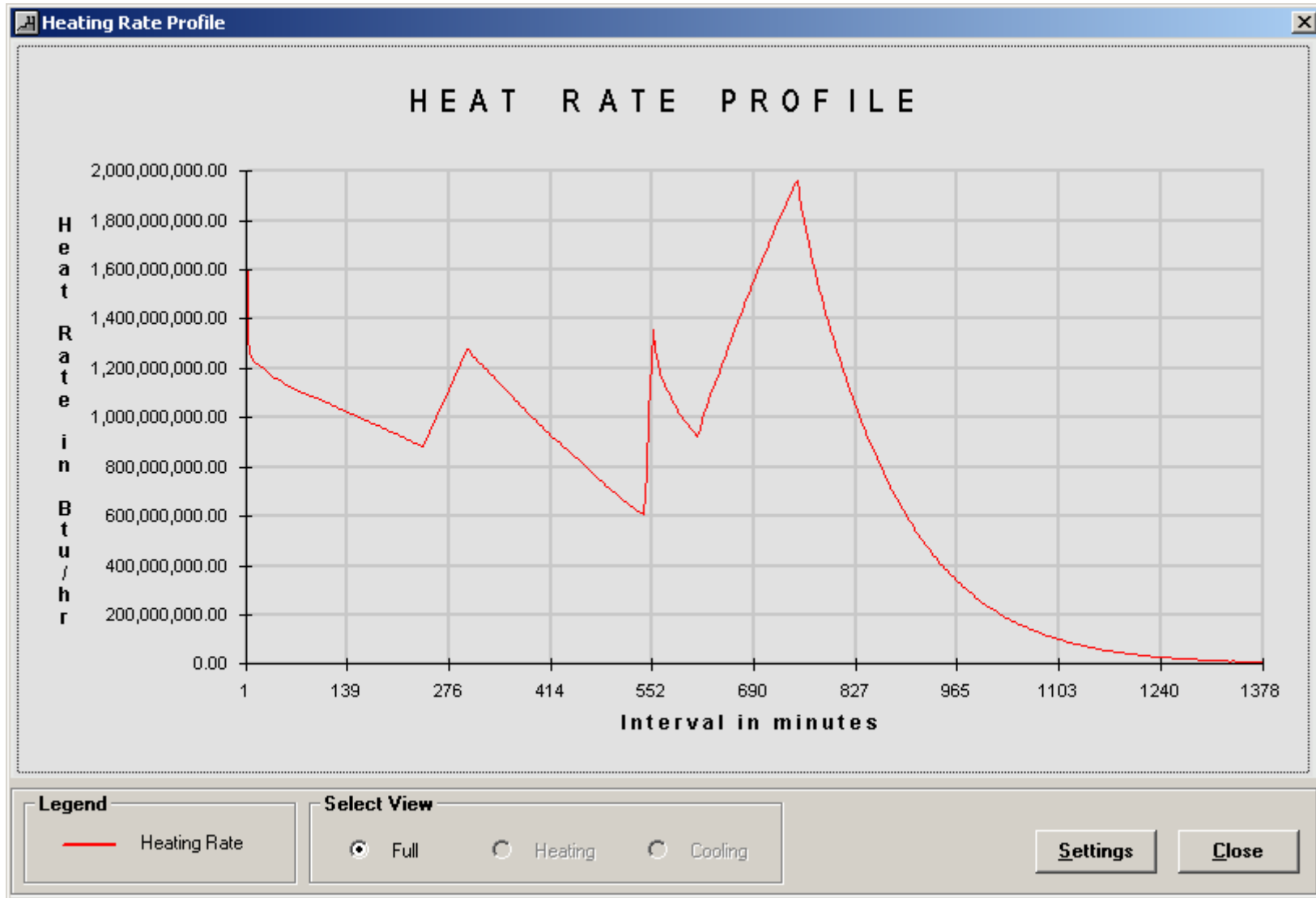
Cumulative Combustion Parameters

Cumulative Combustion Details

Stage	Type	Time min	Gross Heat Btu	Fuel Cubic Feet	Air Cubic Feet
1	HS	242	5,695,906,000	5,160,054	16,187,950
2	HS	300	6,547,148,000	5,931,214	17,197,210
3	HS	11	278,820,800	252,590	681,984
4	HS	61	1,531,027,000	1,386,993	3,738,236
5	HS	765	11,087,230,000	10,044,180	23,367,670
Total Value		1379	25,140,130,000	22,775,030	61,173,040

Close

Heat Audit – Heat Rate Profile



Click to print the report



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 **Cfh** Fuel Flow **Cfh** Fuel in a Stage **Cu.Feet**
 Gas Velocity **in/min** Prod Rate **lbs/hr** Air in a Stage **Cu.Feet**

Furnace Type: **Batch**
 Application: **Standard**
 Analyst: **Administrator**
 Job: **Furnace**
 Contract #: **1234**
 Furnace By: **HKM**

R E P O R T

Furnace Data

Length : 847
 Width : 115
 Height : 144
 Heating Type : Gas
 Fuel Type : NATURAL GAS - 8897 Gross kcal/cu.m
 InitFurnace Temp. : 1390

Insulation (in)

Walls : 9 Roof : 12 Doors : 14.5 Back : 16.5 Hearth : 17.5
 Layers : 3 Layers : 1 Layers : 3 Layers : 3 Layers : 3
 1. CF : 3 1. CF : 12 1. HC : 9 1. HC : 9 1. FB : 6
 2. IB : 3 2. FB : 2.5 2. FB : 2.5 2. HC : 6.5
 3. BI : 3 3. BI : 3 3. LC : 5 3. LC : 5

Part Matrix and Weight

No. of parts 1000 Basket 16
 Part Weight: 3519
 Total Part Weight : 56304000

Heating Stages

Stage	Time	Temperature	Ramp Rate	Gas Flow
1	240	1400	5	10
2	240	1600	3.34	10
3	1	1795	20	10
4	60	1800	5	10
5	630	2250	3.34	10

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

ID 10 OD 30 H 20

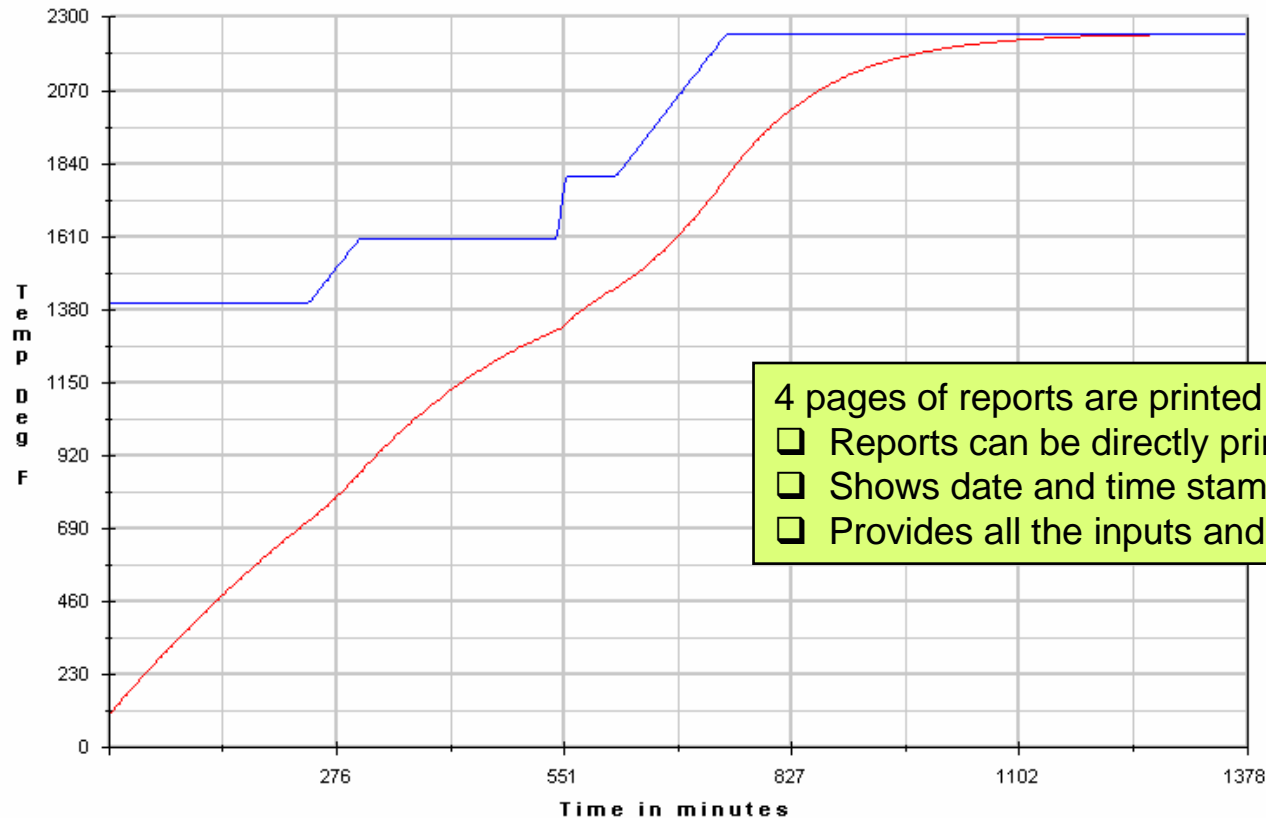
Click to print the report



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 Cfh	Fuel Flow Cfh	Fuel in a Stage Cu.Feet
Gas Velocity in/min	Prod Rate lbs/hr	Air in a Stage Cu.Feet

R E P O R T

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



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

— Furnace Temperature
 — Part Temperature

Total Heating Time : 1379
 Total Cooling Time : 0

Heating Stages : 5
 Cooling Stages : 0

Target	Achieved
Target Temp : 1800	--
Time @ temp : 10	630

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
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
10	482	
11	538	
12	593	
13	649	
14	704	
15	732	
16	760	
17	816	
18	871	

Material Data

Material Name: 1008 GRADE

Units: English Unit Metric Unit

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

Emissivity: 0.85

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	
4	149	0.51212	13	649	
5	204	0.53555	14	704	
6	260	0.55354	15	732	
7	316	0.57153	16	760	0.99153
8	371	0.58952	17	816	0.88533
9	427	0.60751	18	871	0.88701
19	927	0.92885			
20	982	0.93303			
21	1038	0.93722			
22	1093	0.93931			
23	1149	0.6481			
24	1204	0.65061			
25	1260	0.66442			
26	1316	0.71295			

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

Insulation Data

Name: Block Insulation

Short Name: BI

Density: 0.0003 Kg/cc

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

List of existing Insulation

- Block Insulation
- Block Insulation
- Ceramic Fibre
- Fire Brick
- Heavy Castable
- Insulating Brick
- Light Castable
- xxx

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):

Fuel Composition (%):

CO₂ [Dry]: 0.11

Heating Value (in KCal / Cu.m):

HHV: 9122.5 LHV: 8045.6

Product of Combustion (as fraction 0 - 1):

CO₂ [Dry]: 0.11 H₂O: 0.186 N₂: 0.71

Fuel Composition (%):

N₂: 5 O₂: 0 CO₂: 0 CO: 0

H₂: 0 H: 0 O: 0 H₂O: 0

OH: 0 NO: 0 NO₂: 0

SO: 0 SO₂: 0 SO₃: 0

CH₄: 90 C_nH_n: 5

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