



FurnXpert Batch Reheat Application solves Heat Transfer and Combustion Issues in large furnaces to heat large charges like Ingots, Slabs, Billets, and Rounds

Reheat

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

- Batch Furnace Configuration:** Shows furnace shape (Rectangular), dimensions (Length: 10m, Width: 20m, Height: 10m), re-circulating gas (Heating: Air, Cooling: Air), and insulation settings for walls, roof, door, back, and health.
- Reports:** A graph showing temperature (TEMP) vs. time (min) for Furnace Temp, Charge Top Temp, Charge Centre Temp, and Charge Bot. Temp. Summary statistics include: Total Heating Time: 500, Total Cooling Time: 0, No. of Heating Stages: 4, No. of Cooling Stages: 0, Target Temp: 1000, and Time @ Temp: 10.0.
- Place Charge:** Configuration for charge placement (# Across: 2, # Along: 10, Stacks #: 1) and peer details (# of Peers, Peer Weight, Surface Area, Peer Material, Total Peer Weight).
- Charge Orientation & Spacings:** Options for Across orientation, Spacing (C to C), and Stack Spacing.
- Charge Dimension:** Details for charge shape (Slab), diameter, thickness, length, and width.
- Other Details:** View Factor Top, Grade, Target Temperature (1000 Deg C), View Factor Bot, Initial Charge Temp (200 Deg C), and Time @ Temperature (10 min).

The screenshot shows the FurnXpert software interface. On the left is a vertical toolbar with icons for: Furnace, Profile, Create Charge, Charge Detail, Place Charge, Settings, Run, Heat Audit, Reports, Help, and Exit. The main window contains a large graphic with the text 'FURN SIMULATE' and 'FURNXPERT'. A status bar at the bottom displays: UNIT SYSTEM: MKS, FURNACE CREATED BY: HKN, CONTRACT NO: 1234, JOB NAME: Hill, CHARGE: Slab. Ten teal callout boxes with white text point to specific toolbar icons, describing their functions.

**CONFIGURE NEW FURNACES**

**CREATE FURNACE TEMPERATURE PROFILE**

**CREATE PARTS/CHARGES**

**PROVIDE ADDITIONAL DATA FOR THE PARTS/CHARGES**

**CONFIGURE CHARGES/PARTS LOADING**

**RUN SIMULATION**

**RUN HEAT AUDIT**

**CREATE AND PRINT REPORTS**

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

**Furnace Type Selection**

Type

Continuous Furnace

Type

Heat Treat

Reheat

Annealing

**Batch Furnace**

Type

Heat Treat

**Reheat**

Annealing

Cancel **Ok**

**SETUP FURNACES SIMULATE FURNACES**

**FURNXP**ERT

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FurnXP

ERT 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.

Click Ok

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APP MODE: None    UNIT SYSTEM: Default    FURNACE: None    PART: None    ANALYSIS: Two D

The screenshot displays the FurnXpert software interface. The main window has a menu bar with 'File', 'View', 'Parts', 'Profile Option', 'Process', 'Reports', 'Tools', 'Properties', 'Analysis', 'Options', and 'Help'. A 'Select Furnace Type' menu is open, with 'New' highlighted. A callout box labeled 'Select New Furnace' points to this menu item. Below the menu is a vertical toolbar with buttons for Profile, Create Charge, Charge Detail, Place Charge, Settings, Run, Heat Audit, Reports, Help, and Exit. A 'New Furnace' dialog box is open in the foreground, containing three input fields: 'Job Name' (New Job), 'Contract Number' (1234), and 'Engineer's Initial' (HKN). A red oval highlights these fields, and a callout box labeled 'Enter Project Data' points to it. The dialog box also has 'Continue' and 'Cancel' buttons. The background features a graphic with the text 'SETUP FURNACE SIMULATE' and 'PERT is a top software simplifies the job of SETTING UP and SIMULATING'. The status bar at the bottom shows: UNIT SYSTEM: Default, FURNACE CREATED BY: None, CONTRACT NO: None, JOB NAME: None, CHARGE: None.

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

Select Furnace Type

- New
- Open
- Print
- Exit

Profile

Create Charge

Charge Detail

Place Charge

Settings

Run

Heat Audit

Reports

Help

Exit

UNIT SYSTEM: Default FURNACE CREATED BY: None CONTRACT NO: None JOB NAME: None CHARGE: None

SETUP FURNACE SIMULATE

PERT is a top software simplifies the job of SETTING UP and SIMULATING

**Select New Furnace**

**New Furnace**

Job Name: New Job

Contract Number: 1234

Engineer's Initial: HKN

Continue Cancel

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**Enter Project Data**

FurnXpert

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

Furnace  
Profile  
Create Charge  
Charge Detail  
Place Charge  
Settings  
Run  
Heat Audit  
Reports  
Help  
Exit

**Unit Selection**

MKS

Length	m	Energy	J
Time	min	Production Rate	kgs/hr
Temperature	Deg C	Power	kCal/hr
Weight	kg	Energy Consumption	J/kg
Velocity	m/min	Flow	m <sup>3</sup> /hr

Ok Cancel Apply

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UNIT SYSTEM: Default FURNACE CREATED BY: None CONTRACT NO: None JOB NAME: None CHARGE: None

Select Unit System From Drop Down Menu

**INPUT ALL THE FURNACE DETAILS**

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

**Can select between conventional and Regenerative Burner**

**Batch Furnace - New**

**Furnace Shape**

Rectangular  
 Cylindrical

**Furnace Dimension**

Length (L) 10 m  
Width (W) 8 m  
Height (H) 8 m

**Re-circulating Gas**

Heating Air Cooling Air

**Configure Insulation**

Layer #	-1- (cm)	-2- (cm)	-3- (cm)	-4- (cm)
Walls	2 FB 7 IB 7			
Roof	2 FB 7 IB 7			
Door	2 FB 7 IB 7			
Back	2 FB 7 IB 7			
Hearth	2 FB 7 IB 7			

**Heating Mode**

Electric  
 Gas  
 Liquid

**Heating Type**

Top Fired  
 Top & Bottom Fired

**Fuel Specification**

Fuel Type NATURAL GAS - 8897 Gross kJ  
% of Excess Air 10 Fuel Temp. 38 Deg C  
Comb. Air Temp. 260 Deg C

**Burner Type**

Conventional  
 Regenerative Blue Extraction %

Application Units Default Ok Cancel **Apply**

UNIT SYSTEM: MKS FURNACE CREATED BY: HKN CONTRACT NO: 1234 JOB NAME: New Job Charge : None

The screenshot displays the FurnXpert software interface. The main window is titled "FurnXpert" and has a menu bar with options: File, View, Parts, Profile Option, Process, Reports, Tools, Properties, Analysis, Options, Help. A toolbar contains icons for file operations and furnace management.

The "Wall Insulation" dialog box is open, showing a furnace profile with two layers, L1 and L2. The ambient temperature is 27 Deg C. The "Number of Layers" is set to 2. Layer 1 is Fire Brick (7 cm thick) and Layer 2 is Insulating Brick (7 cm thick). The "Burner Type" is set to Conventional. The "Fuel Specification" dialog box is also open, showing a list of fuel types with "NATURAL GAS - 8897 Gross kcal" selected. The "Heating Mode" is set to Gas, and the "Heating Type" is set to Top Fired. The "Fuel Specification" dialog box also shows the fuel type, percentage of excess air (10), fuel temperature (38 Deg C), and combustion air temperature (260 Deg C). The "Burner Type" is set to Conventional. A red circle highlights the "Burner Type" dropdown menu in the "Fuel Specification" dialog box. A red arrow points from the "Burner Type" dropdown menu to the "Burner Type" section in the "Wall Insulation" dialog box. A green callout box with a white background and black text says "Can select between conventional and Regenerative Burner".

**Wall Insulation Dialog:**

- Furnace: L1, L2
- Ambient: 27 Deg C
- Number of Layers: 2
- Layer 1: Material: Fire Brick, Thickness: 7 cm
- Layer 2: Material: Insulating Brick, Thickness: 7 cm
- Layer 3: Material: , Thickness: cm
- Layer 4: Material: , Thickness: cm
- Buttons: Ok, Cancel, Apply

**Fuel Specification Dialog:**

- Fuel Type: NATURAL GAS - 8897 Gross kcal
- % of Excess Air: 10
- Comb. Air Temp.: 260 Deg C
- Fuel Temp.: 38 Deg C
- Burner Type: Conventional
- Flue Extraction %:
- Buttons: Default, Ok, Cancel, Apply

**Callout:** Can select between conventional and Regenerative Burner

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

**Batch Furnace - New**

**Furnace Shape**      **Furnace Dimension**

**Save As**

Save in: furnace

- BatchReheat\_Sample\_1.bfs
- BatchReheat\_Sample\_2.bfs

File name: **BatchReheat\_MKS\_1**      Save

Save as type: BATCH Furnace File(\*.bfs)      Cancel

**Enter the name of the Furnace File**

**Heating Mode**

- Electric
- Gas
- Liquid

**Heating Type**

- Top Fired
- Top & Bottom Fired

**Fuel Specification**

Fuel Type: NATURAL GAS - 8897 Gross kJ

% of Excess Air: 10      Fuel Temp: 38      Deg C

Comb. Air Temp: 260      Deg C

**Burner Type**

- Conventional
- Regenerative

Flue Extraction %

Application Units    Default    Ok    Cancel    Apply

Back 2 FB 7 IB 7

Hearth 2 FB 7 IB 7

UNIT SYSTEM: MKS      FURNACE CREATED BY: HKN      CONTRACT NO: 1234      JOB NAME: New Job      Charge : None

**Profile can be created manually or retrieved from a file**

**Manual Profile can be saved in a file**

Stage #	Ramp-up Deg C/ min	Target Temp. Deg C	Soak Time min	Gas Flow m <sup>3</sup> /hr
1	12	500	60	9
2	12	800	60	9
3	12	1000	60	9
4	12	1200	60	9

Stage #	Ramp-up Deg C/ min	Target Temp. Deg C	Soak Time min	Gas Flow m <sup>3</sup> /hr



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

**Time Temperature Input**

**Options**  
 Manual Data Entry  Data From File

Initial Furnace Temp: 200 Deg C No of stages: 4 Total Time: 322 min

**Stages**

Stage #	Ramp-up Deg C/ min
1	12
2	12
3	12
4	12

**Save As**

Save in: Profiles

- Profile 1.prf
- Profile 2.prf
- Profile 3.prf
- Profile 4.prf
- profile 5.prf
- profile 6.prf

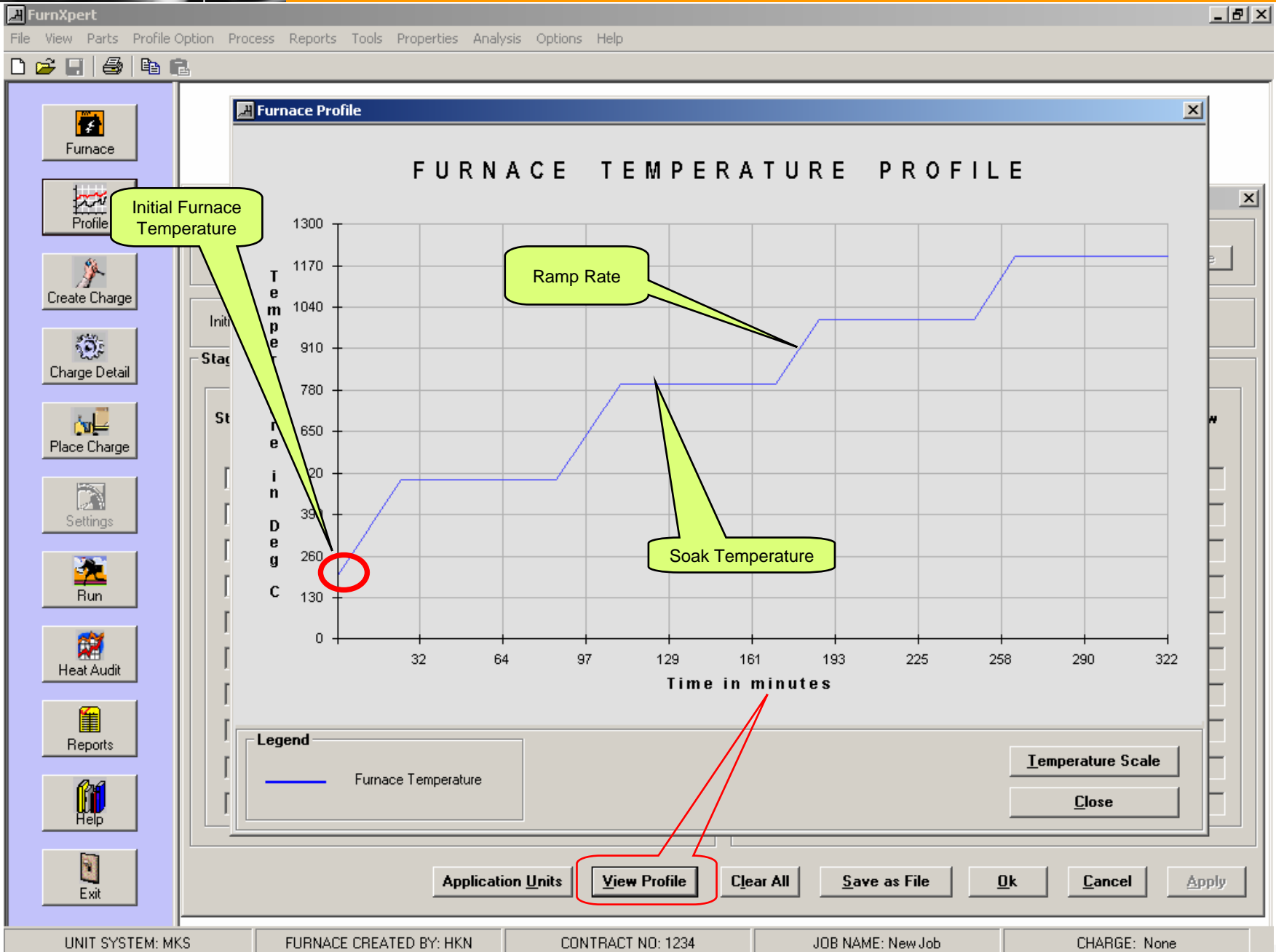
File name: Profile\_Example\_MKS

Save as type: PRF File \*.prf

Manual Profile can be saved in a file

Save as File

Application Units View Profile Clear All Save as File Ok Cancel Apply



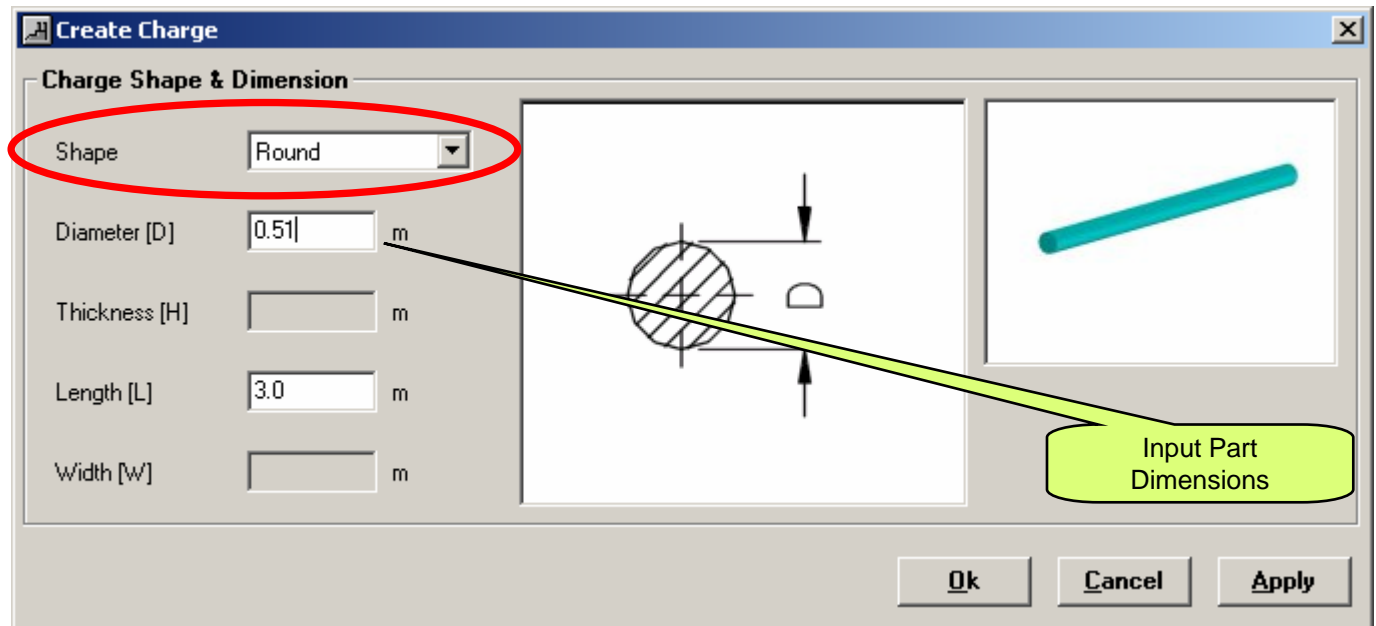
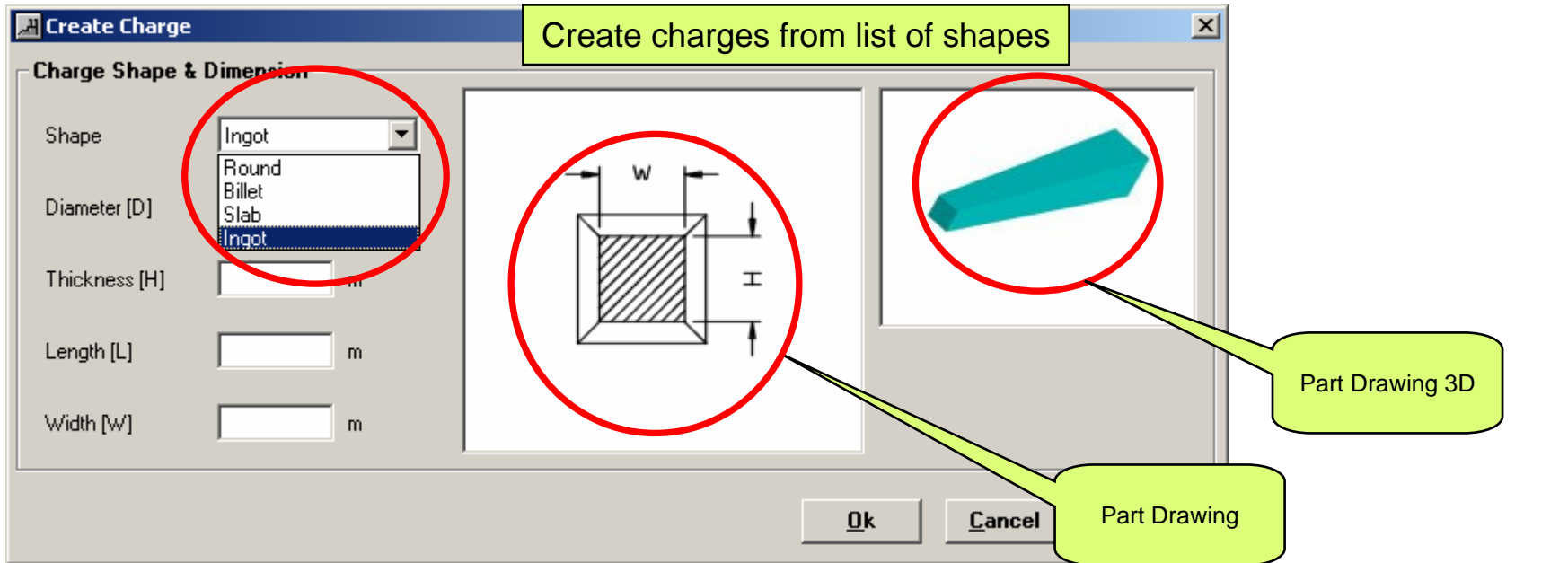
UNIT SYSTEM: MKS

FURNACE CREATED BY: HKN

CONTRACT NO: 1234

JOB NAME: New Job

CHARGE: None



**Charge Details**

**Charge Shape & Dimension**

Shape: Round

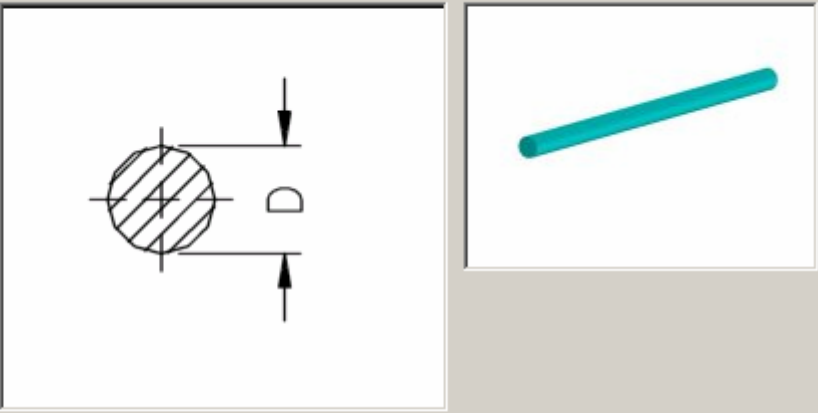
Diameter [D]: 0.51 m

Thickness [H]: m

Length [L]: 3 m

Width [W]: m

**Edit Dimensions**



**Other Details**

View Factor Top: 1.0

View Factor Bot.: 0


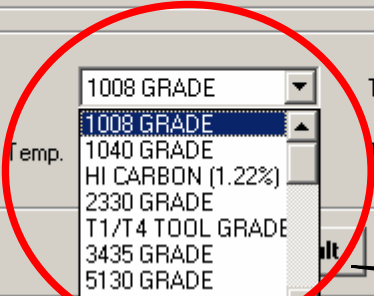
Grade: 1008 GRADE

Initial Charge Temp.: m

Target Temperature: 1450 Deg C

Time @ Temperature: 10 min

**Ok** **Cancel** **Apply**



Input View Factors

Select from a list of material

**Other Details**

View Factor Top: 1.0

View Factor Bot.: 0

Grade: 1008 GRADE

Initial Charge Temp.: 95 Deg C

Target Temperature: 1450 Deg C

Time @ Temperature: 10 min

**Default** **Ok** **Cancel** **Apply**

**Place Charge**

**Charge Placement Configuration**

# Across: 2  
# Along: 10  
Stacks #: 1

Peer

**Peer Details**

# of Peers: 4  
Peer Weight: 5000 kg  
Surface Area: 500 Sq.m  
Peer Material: Steel  
Total Peer Weight: 20000 kg

**Charge Orientation**

Across  Along

**Spacings**

Spacing (C to C): 0.6 m  
Stack Spacing: m

**Charge Weight**

Weight: 4813 kg  
Total Weight: 96,260.00 kg

**Charge Dimension**

Diameter: 0.51 m  
Length: 3 m

Furnace Dimension : 10 (L) x 8 (W) x 8 (H)

Ok Cancel Apply

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

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

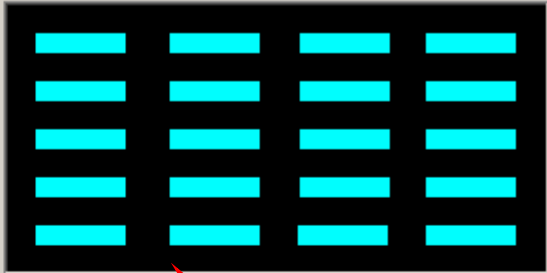
Place Charge
✕

**Charge Placement Configuration**

# Across:

# Along:

Stacks #:

➔


Peer

**Peer Details**

# of Peers:

Peer Weight:  kg

Surface Area:  Sq.m

Peer Material:

Total Peer Weight:  kg

**Charge Orientation**

Across  Along

**Charge Weight**

Weight:  kg

Total Weight:  kg

**Spacings**

Spacing (C to C):  m

Stack Spacing:

**Charge Dimension**

Diameter: **0.51** m

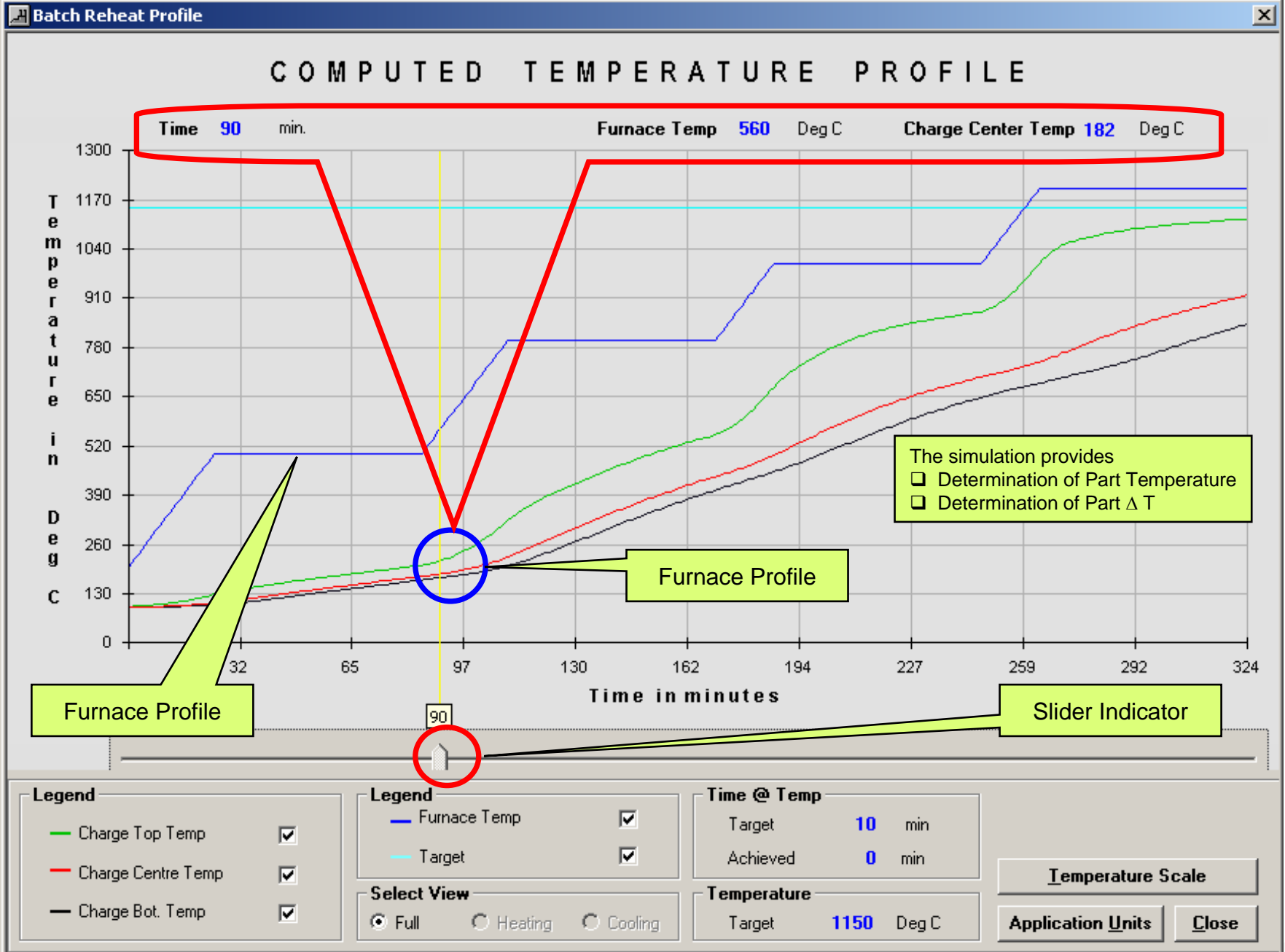
Length: **3** m

**Furnace Dimension :**  
10 (L) x 8 (W) x 8 (H)

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

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

Ok Cancel Apply



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

**Heat Audit**

**Heat Rate Details**

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	0.7170	0.2607	4.0098	0.1402	0.0012	5.1289
2	HS	2.6439	0.5604	3.9931	0.5136	0.0021	7.7131
3	HS	3.9339	0.7841	2.9207	0.7488	0.0027	8.3902
4	HS	3.6935	0.9918	3.3075	0.7403	0.0032	8.7362
Max. Value		3.9339	0.9918	4.0098	0.7488	0.0032	8.7362

**Total Stage Heat Audit**

**Cumulative Heat Details**

Stage	Type	Time min	Heat To Charge MJ	Wall Loss MJ	Wall Store MJ	Heat to Peer MJ	Heat To Gas MJ	Total Heat MJ
1	HS	85	4,203	1,528	23,502	821	7	30,061
2	HS	85	15,496	3,285	23,404	3,010	12	45,207
3	HS	77	20,861	4,158	15,488	3,971	14	44,492
4	HS	77	19,586	5,259	17,539	3,926	17	46,327
Tot. Value ( HS )		324	60,146	14,230	79,933	11,728	50	166,088
Tot. Value ( CS )								

The simulation provides

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

UNIT SYSTEM: MKS      FURNACE CREATED BY: HKN      CHARGE: Round

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

**Heat Audit**

**Heat Rate Details**

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	0.7170	0.2607	4.0098	0.1402	0.0012	5.1289
2	HS						
3	HS						
4	HS						
Max. Value							

**Combustion Parameters**

**Combustion Details**

Stage	Type	Gross Heat MKCal/Hr	Fuel Rate m <sup>3</sup> /hr	Air Rate m <sup>3</sup> /hr	Recup. Heat MKCal/Hr	Flue Loss MKCal/Hr	Efficiency %
1	HS	7.2591	739.04	4,156.87	0.6045	2.7513	70.65
2	HS	13.4085	1,365.10	7,678.26	1.1166	6.7171	57.52
3	HS	17.3240	1,763.73	9,920.39	1.4426	10.1409	48.43
4	HS	22.3630	2,276.75	12,805.93	1.8623	15.0323	39.07
Max. Value		22.3630	2,276.75	12,805.93	1.8623	15.0323	70.65

**Cumulative Combustion Parameters**

**Cumulative Combustion Details**

Stage	Type	Time min	Gross Heat MJ	Fuel Cubic Meter	Air Cubic Meter
1	HS	85	42,547	1,035	5,820
2	HS	85	78,589	1,911	10,750
3	HS	77	91,868	2,234	12,566
4	HS	77	118,589	2,884	16,221
Total Value		324	331,592	8,064	45,356

**Cumulative Combustion Details** [Close]

parameters.  
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Cumulative Combustion Parameters  
 Stage wise cumulative combustion parameters

Close

UNIT SYSTEM: MKS

FURNACE CREATED BY: HKN

CONTRACT NO: 1234

JOB NAME: New Job

CHARGE: Round

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

**Heat Audit**

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
-------	------	----------------------------	-----------------------	------------------------	--------------------------	-------------------------	------------------------

**Heating Rate Profile**

**HEAT RATE PROFILE**

Heat Rate in MKCal/Hr

Interval in minutes

**Legend**  
— Heating Rate

**Select View**  
 Full  Heating  Cooling

**Settings** **Close**

UNIT SYSTEM: MKS    FURNACE CREATED BY: HKN    CONTRACT NO: 1234    JOB NAME: New Job    CHARGE: Round

Click to print the report

Unit System

Reports



Close

Unit System: **MKS**    Heat in a Stage **MJ**    Distance **m**  
Heat Rate **MKCal/Hr**    Energy Con **J/kg**    Temp **Deg C**  
Ramp Rate **Deg C/min**    Time **min**    Wt **kg**  
Air Flow **m^3/hr**    Fuel Flow **m^3/hr**    Fuel in a Stage **Cu.Meter**  
Gas Velocity **m/min**    Prod Rate **kg/hr**    Air in a Stage **Cu.Meter**

# R E P O R T

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

### Furnace Data

Length : 10  
Width : 8  
Height : 8  
Heating Type : Gas  
Fuel Type : NATURAL GAS - 8897 Gross kcal/cu.m  
InitFurnace Temp. : 200

### Insulation ( cm )

Walls : 14	Roof : 14	Doors : 14	Back : 14	Hearth : 14
Layers : 2	Layers : 2	Layers : 2	Layers : 2	Layers : 2
1. FB : 7	1. FB : 7	1. FB : 7	1. FB : 7	1. FB : 7
2. IB : 7	2. IB : 7	2. IB : 7	2. IB : 7	2. IB : 7

### Charge Matrix and Weight

Charge Matrix      2 x 10 x 1  
Charge Weight      4813.00  
Total Charge Weight : 96,260.00

### Heating Stages

Stage	Time	Temperature	Ramp Rate	Gas Flow
1	60	500	12	9
2	60	800	12	9
3	60	1000	12	9
4	60	1200	12	9

3 sets of reports are printed

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

### Charge Shape and Dimension

Shape      Round  
Size:  
**D** 0.51      **L** 3

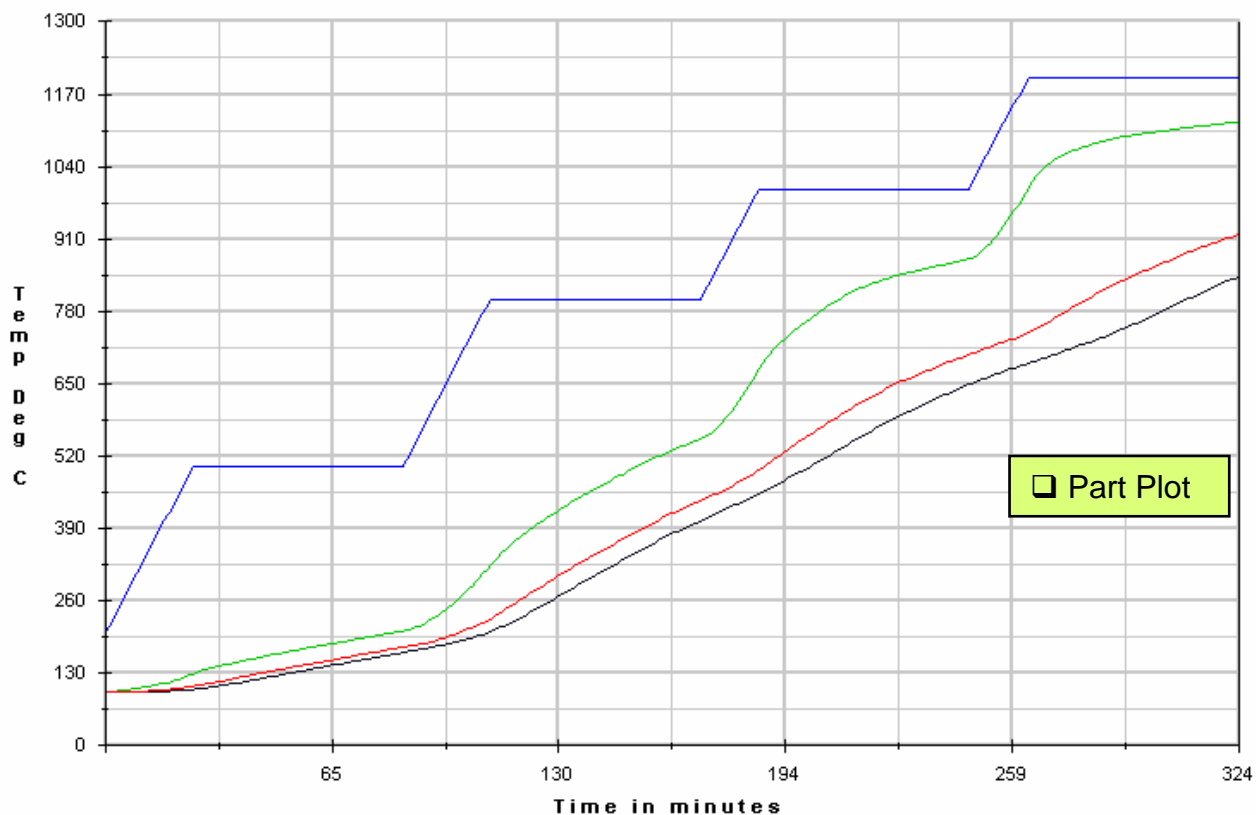
Click to print the report

Unit System

Unit System: <b>MKS</b>	Heat in a Stage <b>MJ</b>	Distance <b>m</b>
Heat Rate <b>MKCal/Hr</b>	Energy Con <b>J/kg</b>	Temp <b>Deg C</b>
Ramp Rate <b>Deg C/min</b>	Time <b>min</b>	Wt <b>kg</b>
Air Flow <b>m<sup>3</sup>/hr</b>	Fuel Flow <b>m<sup>3</sup>/hr</b>	Fuel in a Stage <b>Cu.Meter</b>
Gas Velocity <b>m/min</b>	Prod Rate <b>kgs/hr</b>	Air in a Stage <b>Cu.Meter</b>

## R E P O R T

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



- Furnace Temp
- Charge Top Temp
- Charge Centre Temp
- Charge Bot. Temp

Total Heating Time : 324  
 Total Cooling Time : 0

No. of Heating Stages : 4  
 No. of Cooling Stages : 0

	Target	Achieved
Target Temp	1150	--
Time @ temp : 10		0



Click to print the report

Unit System

Unit System: **MKS** Heat in a Stage **MJ** Distance **m**  
 Heat Rate **MKCal/Hr** Energy Con **J/kg** Temp **Deg C**  
 Ramp Rate **Deg C/min** Time **min** Wt **kg**  
 Air Flow **m^3/hr** Fuel Flow **m^3/hr** Fuel in a Stage **Cu.Meter**  
 Gas Velocity **m/min** Prod Rate **kgs/hr** Air in a Stage **Cu.Meter**

## R E P O R T

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

Heat						
Stage	Chg.Ht.	Wall Loss	Wall Store	Peer Ht.	Ht. Gas	Total Ht.
<b>1 HS</b>	0.7170	0.2607	4.0098	0.1402	0.0012	5.1289
<b>2 HS</b>	2.6439	0.5604	3.9931	0.5136	0.0021	7.7131
<b>3 HS</b>	3.9339	0.7841	2.9207	0.7488	0.0027	8.3902
<b>4 HS</b>	3.6935	0.9918	3.3075	0.7403	0.0032	8.7362
<b>Max.</b>	3.9339	0.9918	4.0098	0.7488	0.0032	8.7362
<b>Max. Heating</b>	8.7362					

Cumulative Heat Data							
Stage	Time	Charge Ht.	Wall Loss	Wall Store	Peer Ht.	Ht. Gas	Total Ht.
<b>1 HS</b>	85	4,203	1,528	23,502	821	7	30,061
<b>2 HS</b>	85	15,496	3,285	23,404	3,010	12	45,207
<b>3 HS</b>	77	20,861	4,158	15,488	3,971	14	44,492
<b>4 HS</b>	77	19,586	5,259	17,539	3,926	17	46,327
<b>Tot-HS</b>		60,146	14,230	79,933	11,728	50	166,088
<b>Tot-CS</b>							

Heat Input

Click to print the report

Unit System

Unit System: **MKS**    Heat in a Stage **MJ**    Distance **m**  
 Heat Rate **MKCal/Hr**    Energy Con **J/kg**    Temp **Deg C**  
 Ramp Rate **Deg C/min**    Time **min**    Wt **kg**  
 Air Flow **m<sup>3</sup>/hr**    Fuel Flow **m<sup>3</sup>/hr**    Fuel in a Stage **Cu.Meter**  
 Gas Velocity **m/min**    Prod Rate **kg/hr**    Air in a Stage **Cu.Meter**

## R E P O R T

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

### Combustion Parameters

Stage	Gross Ht.	Fuel Flow	Air Flow	Recup.Ht.	Flue Loss	Eff.
1 HS	6.0499	615.93	1,574.73	1.3582	2.2930	84.78
2 HS	10.7656	1,096.03	2,802.17	2.4168	5.3931	71.65
3 HS	13.4129	1,365.54	3,491.24	3.0111	7.8514	62.55
4 HS	16.4253	1,672.23	4,275.34	3.6874	11.0410	53.19
Max.	16.4253	1,672.23	4,275.34	3.6874	11.0410	84.78

### Cumulative Combustion Data

Stage	Time	Gross Ht.	Fuel	Air
1 HS	85	35,459	862	2,205
2 HS	85	63,098	1,534	3,923
3 HS	77	71,127	1,730	4,422
4 HS	77	87,102	2,118	5,415
Total	324	256,786	6,245	15,965

Heat Input