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 FurnacePros DIVISION OF LOCHABER CORNWALL, INC. CONTINUOUS BELT IR FURNACE	EQUIPMENT SPECIFICATIONS	DOC NBR: 10-004 - 802-101401 R1		
		MODEL: LA-309	CUSTOMER: OMS RATTO	
		SERIAL NBR: 1303091001	SHT 1 OF 1	PRNT 10/06/10

Equipment Model

Model	Base Equipment	Control	Furnace Heated Length		Nominal Belt Width	
LA-309	Continuous Belt Controlled Atmosphere Furnace	3	30 in	76.2 cm	9 in	22.9 cm

Equipment Arrangement

Phase	Process	Length		Process Gas		Temperature (typ)
Phase 1	IR Furnace, 3 Zones	30 in	76.2 cm	N2		400 C
Phase 2	Closed Atmosphere Cooling Tunnel	30 in	76.2 cm	N2		< 150 C

Process Sections

Function	Name	Location	Length		Process Gas	Temperature (typ)
Product Load	IR-E (optional)	Entrance Interface Roller	2.5 in	6.4 cm	none	ambient
	Load Station	Entrance	15.0 in	38.1 cm	none	ambient
IR Furnace	Baffle & Exhaust Eductor	Entrance Barrier	15.0 in	38.1 cm	N2	25-80°C
	Zone 1	Heating Chamber 1	7.5 in	19.1 cm	N2	80-300°C
	Zone 2	Heating Chamber 1	15.0 in	38.1 cm	N2	300-400C
	Zone 3	Heating Chamber 1	7.5 in	19.1 cm	N2	300-400°C
	Transition Tunnel / Exhaust Eductor	Furnace Exit Barrier	15.0 in	38.1 cm	N2	25-80°C
Cooling Section	Closed Atmosphere Cooling Tunnel	Cooling Exit Barrier	30.0 in	76.2 cm	N2	25-150°C
Product Unload	Unload Station	Exit	15.0 in	38.1 cm	none	ambient
	IR-X (optional)	Exit Interface Roller	2.5 in	6.4 cm	none	ambient
	Frame Allowance		3.0 in	7.6 cm		
	Total		128.0 in	325.1 cm		

Process Gas

	Actual Conditions		Minimum		Typical		Max (all flowmeters open)	
Chamber Replenishment Rate			1.0 rep/min		2.0 rep/min		3.5 rep/min	
	Temp °C	Press psi	Min Flow scfh	Min Flow	Typical scfh	Typical sL/m	Max Compressor scfh	sL/m
CDA SUPPLY	30	70.0	19	9.1	38	18	39	18
N2 SUPPLY	30	70.0	192	90.7	384	181	709	335
TOTAL PROCESS GAS		140.0	211		423	199	748	353

Exhaust Gas

	Temp °C	inch H ₂ O	Min Flow scfh	Min Flow sL/m	Typical scfh	Typical sL/m	Max Supply scfh	sL/m
CDA & N2 mix	< 300	6	211.3	99.7	422.6	199	906	427

Exhaust Cooling Air

CABINET EXHAUST - HEATING CHAMBER	Flowrate	1000 cfm (1700 m3/h)	Temperature	<104°F (<40°C)	1000 cfm (1700 m3/h)	<104°F (<40°C)
CABINET EXHAUST - CONTROLLED ATMOSPHERE	Flowrate	1000 cfm (1700 m3/h)	Temperature	<104°F (<40°C)	1000 cfm (1700 m3/h)	<104°F (<40°C)
CABINET EXHAUST - TURBULENT AIR COOLING	Flowrate	0 SCFM 0 Nm/hr	Temperature	LESS THAN 40°C	0 SCFM 0 Nm/hr	LESS THAN 40°C
STANDARD CONDITIONS	Pressure	14.7 psia (101.3 kPa)	Temperature	70 °F (21 °C)		

Transport System


Belt width	9.5 in	9.5 in
Belt material	Nichrome V, 80%Ni / 20%Cr alloy 1% Fe), balanced spiral weave.	
Product clearance	4" (10 cm)	
Belt support	Quartz rods in process chamber, UHMW-PE on belt return.	
Belt speed range	2-20 ipm	5-50 cm/m
Conveyor height	36 in ± 1.5; user adjustable.	91.4 cm ± 3.8; user adjustable.

Electrical System


Voltage	380 Vac	
Phase	3 ph	
Line Frequency	50 Hz	
Parameter	Max	Typical
Current	35.8 A	0.0 A
Power	23.6 kW	6.0 kW

Furnace Dimensions

Configuration	Length	Width	Height	Net Weight
Standard	123.0 in	37.0 in	68.0 in ± 1.5 in	1600 LB
	3.12 m	0.94 m	1.73 m ± 038 m	726 kg
With IR-E & IR-X	128.0 in	37.0 in	68.0 in ± 1.5 in	1650 LB
	3.25 m	0.9 m	1.73 m ± 038 m	748 kg

 FurnacePros DIVISION OF LOCHABER CORNWALL, INC.	EQUIPMENT LIST	DOC NBR: 10-004 802-101410 R1		
	BASE FURNACE	MODEL: LA-309	DATE 10/07/10	
OMS RATTO S.p.A		S/N: 1303091001	APVL JCLARK 4/14/10	
		SIZE: A	PRINT 10/07/10	SHT 1 of 1

Code	Equipment	Y or #=In Base Price O=Priced Option N=not included
AR1	AIR RESERVOIR (BELT TENSIONER)	Y
AR10	AIR RESERVOIR (10 GAL)	N
BE	ENTRANCE BAFFLE W/ EDUCTOR	1
BNV	BELT, NI-CHROME V (<1% Fe CONTENT)	Y
BSS	BELT, STAINLESS STEEL	1
BX	EXIT BAFFLE W/ EDUCTOR	1
BXO	EXIT BAFFLE W/O EDUCTOR	Y
CACT	CONTROLLED ATMOSPHERE COOLING TUNNEL	1
CAWC	CLOSED ATMOSPHERE WATER COOLED TUNNEL	N
CFL	CABINET FANS, LOWER	N
CM	TURBULENT AIR COOLING MODULE	N
CMB30	CROSS-FLOW FAN COOLING MODULE, 30"	N
CMB45	CROSS-FLOW FAN COOLING MODULE, 45"	N
CWWC	COLD WALL WATER COOLING MODULE, 20"	N
DOCM	FURNACE OWNERS MANUAL	1
DOCR	FURNACE REFERENCE MANUAL	1
EME	EMO, ENTRANCE, VERTICAL MOUNT	1
EMX	EMO, EXIT, VERTICAL MOUNT	1
EMT	EMO, ENTRANCE, TOP MOUNT	N
ENG	ENGLISH UNITS OF MEASURE (OI)	N
ETM	ELAPSED TIME METER	Y
FM	INDEPENDENT ZONE FLOW CONTROL	Y
IE	INTERMEDIATE EXHAUST, EDUCTOR	N
LOAD	LOAD STATION, 15 INCH	Y
LTR	BELT DIRECTION, LEFT TO RIGHT	1
NO	NITROGEN PROCESS GAS SYSTEM	1
OI	FURNACE CONTROL SOFTWARE	1
OIT	FURNACE CTRL OPERATOR INTERFACE TERMINAL	1
OSXP	WINDOWS XP OPERATING SYSTEM	Y
PC	COMPUTER, DELL, DUAL RAID	1
PCM	COMPUTER, MONITOR, 17" LCD	Y
PH2	STD PRODUCT HEIGHT, 2 INCHES (50 mm) HIGH	N
PLC	FURNACE CONTROLLER	Y
SCR	COMPUTERIZED SCR LOAD MANAGEMENT	Y
SI	METRIC UNITS OF MEASURE, (OI)	Y
SPL	SPLIT FOR SHIPMENT	N
TT	TRANSITION TUNNEL, SINGLE EDUCTOR	N
TTDE	TRANSITION TUNNEL, DUAL EDUCTORS	N
ULOAD	UNLOAD STATION, 15 INCH	Y
UT	UNIVERSAL TRANSFORMERS	Y

 FurnacePros <small>DIVISION OF LOCHABER CORNWALL, INC.</small>	EQUIPMENT LIST	DOC NBR: 10-004 802-101411 R1		
	FURNACE OPTIONS	MODEL: LA-309	DATE 10/07/10	
OMS RATTO S.p.A		S/N: 1303091001	APVL JCLARK 4/14/10	
		SIZE: A	PRINT 10/07/10	SHT 1 of 1

Code	Equipment	Y or #=In Base Price O=Priced Option N=not included
AFR	AIR FILTER / TRAP / REGULATOR	N
APS	AIR PURIFICATION SYSTEM	N
AR10	AIR RESERVOIR (10 GALLON)	N
BNV	BELT, NI-CHROME V (<1% Fe CONTENT)	N
CACT	CONTROLLED ATMOSPHERE COOLING TUNNEL	N
CB-1	CIRCUIT BREAKER (REQD FOR UL APPROVAL)	N
CDA-L	CDA LOCKOUT, MANUAL, 1/2 INCH, 250 PSI	N
CDA-S	CDA AUTO SHUTDOWN	N
CRTDOM	CRATING FOR DOMESTIC SHIPMENT	N
CRTINT	CRATING FOR INTERNATIONAL SHIPMENT	1
CWWC	COLD WALL WATER COOLING MODULE, 20"	N
CXE15	ENTRANCE CONVEYOR EXTENSION, 15"	N
CXX15	EXIT CONVEYOR EXTENSION, 15"	N
DCA	ADD DRYER CHAMBER, 30"	N
DOCM	FURNACE OWNERS MANUAL	N
DOCR	FURNACE REFERENCE MANUAL	N
DSC	THREE PHASE SAFETY DISCONNECT	1
EH	EDGE HEAT, RIGHT AND LEFT	1
EM	LAMP ELEMENT MONITOR	1
EMT	EMO, ENTRANCE, TOP MOUNT	N
FCA	ADD FURNACE CHAMBER, 30"	N
FZN	ADD FURNACE CONTROL ZONE	N
HC	HERMETIC CHAMBER (FURNACE ONLY)	1
HO	HYDROGEN OPERATION	N
HSK	HANDSHAKE SIGNALING, UP & DOWNSTREAM EQUIPMENT	1
HT	HIGH TEMPERATURE OPERATION (1000C MAX)	1
IPS	INLET PRESSURE SWITCH (GAS)	1
IR-E	INTERFACE ROLLER ASSEMBLY, ENTRANCE	1
IR-X	INTERFACE ROLLER ASSEMBLY, EXIT	1
LFI	POWER LINE INTERFERENCE FILTER	N
LT	LIGHT TOWER, 3-COLOR, PROCESS READY/ALARM	N
MA	MOISTURE (DEWPOINT) ANALYZER	N
N2-S	NITROGEN GAS AUTO SHUTDOWN	1
NFGS	NITROGEN/FORMING GAS SELECTOR	N
OA	OXYGEN ANALYZER	1
OSS	ON-LINE GAS SAMPLING SYSTEM FOR OA AND/OR MA	1
OS7	WINDOWS 7 OPERATING SYSTEM	N
OT	OVERTEMP MONITOR, SHUTDOWN ALARM	N
PCS	COMPUTER, MONITOR, SPECIAL	N
PF-SS	STAINLESS STEEL PLUMBING & FITTINGS	N
PH1	PRODUCT CLEARANCE, 1" MAX HEIGHT, PRECISION HT DESIGN	N
PH4	PRODUCT CLEARANCE, 4" HEIGHT	1
RCT	RAPID COOL TRANSITION, DUAL EDUCTORS	N
PLC	FURNACE CONTROLLER	N
RTL	BELT DIRECTION, RIGHT TO LEFT	N
SB	SWINGOUT BASE	N
SBW	SPECIAL BELT WEAVE	N
SMEMA	SMEMA LANE CONTROL	N
SP1	CRITICAL SPARES KIT	N
SPL	SPLIT FOR SHIPMENT	N
SPP	SPECIAL PAINT	N
SPV	SPECIAL PLUMBING / VALVING	N
TT	TRANSITION TUNNEL, SINGLE EDUCTOR	N
TTDE	TRANSITION TUNNEL, DUAL EDUCTORS	N
UC	ULTRASONIC CLEANER	N
UCD	ULTRASONIC CLEANER DRYER WITH RECIRC	N
UCF	UCD WATER FILTER, EXTERNAL QUICK DISCONNECT	N
UPS	UNINTERRUPTABLE POWER SUPPLY	N
WCT	WATER COOLING TUNNEL, 30"	N

 FurnacePros DIVISION OF LOCHABER CORNWALL, INC.	EQUIPMENT LIST, COMPUTER	DOC NBR: 10-004 802-101420 R 2	
		MODEL: LA-309	DATE 04/01/10
CUSTOMER OSM RATTO		S/N: 1303091001	APVL JCLARK 8/28/10
		SIZE: A	PRNT 10/06/10 SHT 1 of 1

Part Number	Qty	Description	Dell Service Tag:
802-101420-01	1	Furnace Computer System, Dell Optiplex, consisting of LCD monitor, dual hard drive/RAID array, 2 TC/IP network interface, 1 USB optical mouse, 1 USB keyboard, 1 CD R/RW/DVD Optical drive, and as detailed below:	

Part Number	Qty	Description
[224-6918]	1	OptiPlex 780 Minitower, Pentium Dual Cor E5300 with VT (2.6 GHz, 2MB, 800 FSB)
[317-2600]	1	Intel® Pentium® Dual Core E5300 with VT (2.60GHz, 2M, 800MHz FSB)
[421-1993]	1	Genuine Windows XP Professional, NTFS File System
[317-2465]	1	1GB DDR3 Non-ECC SDRAM, 1333 MHz, DDR3 (1 DIMM)
320-5170	1	Integraged NVIDIA Quadro NVS 210S Graphics
[342-0157]	1	160GB 2.5 SATA 3.0Gb/s and 16MB DataBurst Cache™
[342-0155]	1	160GB 2.5 SATA 3.0Gb/s and 16MB DataBurst Cache™
[341-8016]	1	RAID 1, Dell Optiplex
[320-7407]	1	Integrated Video, Intel® GMA 4500
[313-8645]	1	Optical Drive, 16X DVD+/-RW SATA
[330-2733]	1	Mouse, Optical, 'Dell USB 2-Button with Scroll, Black
[330-1987]	1	Dell USB Keyboard, Black
[320-1095]	1	Monitor, Dell Professional P170S,17 Inch Flat Panel, LCD
467-0811	1	Windows XP Professional Service Pack 3,with Media,DellOptiPlex,English with Vista Business lic
A1234092	1	Ethernet, PCI 10/100Mbps w WOL Adapter
[313-8642]	1	Resource DVD contains Diagnostics and Driver for Dell OptiPlex Systems
[330-1710]	1	Opti 780 Documentation English
[330-4817]	1	Dell Energy Smart Power Management Settings Enabled
[311-9522]	1	Heat Sink, Mainstream, Minitower
[330-5860]	1	OptiPlex 780 Minitower Standard Power Supply

REVISION	DESCRIPTION	BY	DATE
2	CHANGE COMPUTER TO DELL OPTIPLEX 780	JMC	20Apr10
1	CHANGE COMPUTER TO DELL OPTIPLEX 740	JMC	1Sep09

JOB OR LOCATION	<u>10-004</u>		
CUSTOMER OR USER	<u>OMS RATTO</u>		
FURNACE MODEL	<u>LA-309</u>		
Model	<u>OPTIPLEX</u>	<u>780</u>	
SERVICE TAG	<u>7SC2FN1</u>		
EXPRESS SERVICE CODE	<u>16950798253</u>		
OS	<u>WINDOWS</u>	<u>XP / 7</u>	SP <u>3</u>
PRODUCT KEY	<u>38PMC - CKXJJ - DGMMY - 66PBX - 3V69F</u>		
COMPUTER NAME	<u>FURNACE1</u>	IP	<u>10.192.105.100</u>
LOGIN	<u>FURNACE</u>	SUBNET	<u>255.255.255.0</u>
PASSWORD	<u>NONE</u>	GATEWAY	<u>10.192.105.1.</u>
DEVICE	<u>LCM4</u>	IP	<u>10.192.105.102</u>
DEVICE	<u>LCM4</u>	IP	<u>10.192.105.102</u>
INTERFACE	<u>M4SNET-100</u>	SUBNET	<u>255.255.255.0</u>
SOFTWARE	<u>PROCONTROL</u>	ED	<u>11.1118</u>
PRODUCT KEY			
SOFTWARE	<u></u>		
PRODUCT KEY			

BY: JMC

DATE: 9-Sep-10

OPTIPLEx 780



Organizations that demand versatile mainstream desktop computing and robust remote systems management will find a cost-effective solution in the new OptiPlex™ 780 desktops. OptiPlex 780 empowers IT with Intel® vPro™ streamlined remote systems management, data and asset-security solutions, and the kind of chassis serviceability that helps keep working staff productive. The Intel® Core™2 Quad Processor and 88% efficient power supply option on the OptiPlex 780 provide the perfect combination of technology to drive up performance. Because the OptiPlex 780 offers a breadth of configuration options, you can build a customized solution that works for your unique business needs. The stability that the OptiPlex 780 delivers provides the strong foundation you need for ongoing success.

STABILITY AND MANAGEMENT YOU CAN BUILD ON

Built on proven technology, the OptiPlex delivers stability you can depend on.

- Long-range planning support with a targeted 15-month lifecycle, stable images, globally available configurations and managed transitions
- Dell Client Manager helps make OptiPlex easy to own and easy to manage, with centralized hardware and software management, inventory control, automation of routine tasks and a unified, expandable feature set
- Dell Distributed Device Management Services helps you track dispersed assets, distribute software and manage patches - no matter where your PC clients are located on the internet

SECURITY AND DATA PROTECTION YOU CAN DEPEND ON

Choose the right kind of security options to help protect your assets, safeguard data and meet compliance.

- Streamline security operations with Dell Client Manager or Dell Distributed Device Management
- Protect against unauthorized access with built-in TPM 1.2*, Smart Card keyboard and Chassis Intrusion Switch
- Enable secure data protection with Full Disk Encryption Drive or Solid State Drive
- Protect from drive malfunction with RAID 1 storage technology
- Improve login and password authentication, security device management and disk encryption control with Dell ControlPoint™
- Automate, schedule and control backup with Dell Backup and Recovery Manager

WORKING FOR YOUR WORKFORCE

With their highly customizable global service and support offerings, OptiPlex desktops empower IT staff with tools designed for every challenge across the IT life cycle. Give your workforce the desktop features and functions that keep them productive:

- Choose high-performance Intel® Core™2 Quad Processors to provide the power for high productivity
- Improve multi-tasking through integrated video support for dual monitors and an optional graphics card to support up to four monitors
- Time-saving tool-less chassis design and Dell-innovative DirectDetect troubleshooting LEDs were designed to help reduce maintenance and service costs
- Intel® vPro™ technology enables remote system repairs and thereby reduces desk-side visits

ENERGY-EFFICIENCY AT WORK

The OptiPlex 780 employs energy-efficient technologies that are designed to lower the impact on the environment while helping to reduce your organization's energy consumption cost.

- Reduce power consumption — and costs — with optional up to 88% efficient power supplies from Dell
- Minimize power usage with Dell Energy Smart power-management technology (available on select configurations) and recyclable packaging
- Promote environmental sensitivity with the OptiPlex 780 ENERGY STAR® 5.0 and EPEAT® Gold qualified systems (available on select configurations)

OptiPlex 780 Technical Specifications

Processor Options	Intel® Core™2 Quad (* not available on USFF); Intel® Core™2 Duo; Intel® Pentium® Dual Core; Intel® Celeron® Dual Core; Intel® Celeron®				
Chipset	Intel® Q45 Express Chipset w/ICH10D0				
Operating System Options	Microsoft® Windows 7® Basic; Microsoft® Windows 7® Home Premium; Microsoft® Windows 7® Professional; Microsoft® Windows 7® Ultimate Microsoft® Windows Vista® Home Basic; Microsoft® Windows Vista® Business; Microsoft® Windows Vista® Ultimate; Microsoft® Windows® XP Professional Downgrade via Windows 7® Professional Microsoft® Windows® XP Professional Downgrade via Windows 7® Ultimate Microsoft® Windows Vista® Business Downgrade via Windows 7® Professional Ubuntu® Linux® (select countries); FreeDOS for N-series				
Graphic Options	All chassis- Integrated Intel® Graphics Media Accelerator 4500*; MT/DT/SFF- DVI Adapter card; 256MB ATI® RADEON® HD 3450*; 256MB ATI RADEON HD 3470*; 256MB NVIDIA GeForce 9300 GE*; 512MB NVIDIA NVS420*				
Memory Options	MT/DT/SFF- Four DIMM slots; Non-ECC dual-channel 1066MHz DDR3 SDRAM*, up to 8GB* USFF- Two DIMM slots; Non-ECC dual-channel 1066MHz DDR3 SDRAM* , up to 4GB*				
Networking	MT/DT/SFF- Integrated Intel® 82567LM Ethernet LAN 10/100/1000; optional Broadcom® NetXtreme® 10/100/1000 PCIe card; optional Broadcom® 1505 PCIe WLAN card (802.11 Draft-N) USFF- Integrated Intel® 82567LM Ethernet LAN 10/100/1000; optional Broadcom® 1510 mini PCIe WLAN card (802.11 Draft-N)				
Standard I/O Ports	MT/DT/SFF- 8 External USB 2.0 ports and 1 Internal USB 2.0; 1 Parallel; 1 Serial; 1 RJ-45; 1 VGA; 1 Display Port; 1 eSATA; 2 Line-in (stereo/microphone); 2 Line-out (headphone/speaker) USFF- 7 External USB 2.0 ports; 1 Serial; 1 RJ-45; 1 VGA; 1 Display Port; 1 eSATA; 2 Line-in (stereo/microphone); 2 Line-out (headphone/speaker)				
Hard Drive Options	MT/DT/SFF- 3.5" Hard Drives: up to 500GB* 7200 RPM SATA 3.0GB/s, up to 160GB* 10K RPM SATA 3.0GB/s MT/DT/SFF- 2.5" Hard Drives: up to 250GB* 7200 RPM SATA 3.0GB/s, 160GB* SATA Full Disk Encryption, 64GB* SATA Solid State Drive USFF- 2.5" Hard Drives: up to 320GB* 7200 RPM SATA 3.0GB/s Drives; 160GB* SATA Full Disk Encryption Drives; up to 128GB* SATA Solid State Drives All chassis- Supports Dell's Flexible Computing Solution diskless option MT/DT/SFF- RAID 0 & 1 support on select configurations				
Chassis Options		MINITOWER	DESKTOP	SMALL FORM FACTOR	ULTRA SMALL FORM FACTOR
	Dimensions (H x W x D) Inches/(cm)	16.1 x 7.4 x 17.0 / (40.8 x 18.7 x 43.3)	4.5 x 15.7 x 13.9 / (11.4 x 39.9 x 35.3)	3.65 x 12.4 x 13.4 / (9.26 x 31.4 x 34.0)	9.4" x 2.6" x 9.3" / (23.9cm x 6.5cm x 23.6cm)
	Weight (lbs/kg)	25.8 / 11.7	18.2 / 8.26	15.0 / 6.8	7.0lb / 3.2kg
	Number of Bays	2 internal 3.5" 1 external 3.5" 2 external 5.25"	1 internal 3.5" 1 external 3.5" 1 external 5.25"	1 internal 3.5" 1 external 3.5" (slimline) 1 external 5.25" (slimline)	1 external SATA RMSD (slim) 1 SATA 2.5" internal HDD
	Expansion Slots	1 full height PCIe x16 1 full height PCIe x1 2 full height PCI	1 low-profile PCIe x16 2 low-profile PCI (Optional riser converts the PCIe and PCI into full height slots)	1 low-profile PCIe x16 1 low-profile PCI	N/A
	DIMM Slots	4	4	4	2
	Power Supply Unit (PSU)¹	305W Standard PSU or optional 255W 88% Efficient PSU; Energy Star 5.0 compliant, Active PFC	255W Standard PSU or optional 255W 88% Efficient PSU; Energy Star 5.0 compliant, Active PFC	235W Standard PSU or optional 235W 88% Efficient PSU; Energy Star 5.0 compliant, Active PFC	180W up to 90% Efficient Internal PSU, ENERGY STAR 5.0 compliant, Active PFC
Peripheral Options	Monitors: Dell G-Series and Entry Standard and Widescreen Flat Panel Analog: Dell G2210, G2410, E170S, E190S, E1709W, E1909WDD, E1910H, E1910, E2010H, E2009W, E2210H, E2210, E2310H Dell Professional Digital Standard and Widescreen Flat Panel: Dell P170S, P190S, 1909W, 2009W, P2010H, P2210H, P2210, P2310H Dell UltraSharp™ Digital Standard and Widescreen Flat Panel, Adjustable Stand: Dell 1907FPV, 2007FP, 2209WA, U2410 All-in-One Stand with Display included: 19" Standard, 19" Wide and 22" Wide Additional USFF Options: Wall/ Under-desk mount, Stand only without Display Keyboards: Dell USB Entry Keyboard, Dell QuietKey™ Keyboard, Dell Multimedia Pro Keyboard, Dell Smartcard Keyboard Mouse: Dell USB Optical Mouse, Dell Laser Mouse Audio Speakers: Internal Dell Business audio speaker, Dell AX210 2.0 and AY410 2.1 Desktop Speakers; Dell AX510 and AX510PA Sound Bar Speakers				
Security Options	Trusted Platform Module (TPM) 1.2, Non-TPM (in select countries only), Dell ControlPoint, Chassis lock slot and lock loop support, optional Chassis Intrusion Switch, Setup/BIOS Password, I/O Interface Security, Smart Card keyboards, Intel® Trusted Execution Technology, BIOS support for optional Computrace®*				
Systems Management Options	Intel® vPro Technology Enabled (iAMT Professional 5.x); Intel® vPro Technology Disabled (iAMT Professional 5.x); Intel® Standard Manageability; No Out-of-Band Systems Management				
Environmental and Regulatory Standards	Environmental Standards (eco-labels): (eco-labels): ENERGY STAR® 5.0 (select configurations), EPEAT Gold (select configurations), CECP, TCO 05, WEEE, Japan Energy Law, CES, Japan Green PC, FEMP, South Korea Eco-label, EU RoHS, China RoHS Other Environmental Options: Dell Energy Smart settings (select configurations); Carbon Off-set; System Recycle (Asset Recovery Service)				
Warranty and Service Options	Limited Hardware Warranty*; Standard 3-year Next Business Day On Site Service after Remote Diagnosis* (3-3-3); Optional 3-year Dell ProSupport™ for IT*; 4 year and 5 year extended warranty, service and support options				

¹ This form factor utilizes a more efficient Active Power Factor Correction (APFC) power supply. Dell recommends only Universal Power Supplies (UPS) based on Sine Wave output for APFC PSUs, not an approximation of a Sine Wave, Square Wave, or quasi-Square Wave (see UPS technical specifications). If you have questions, please contact the manufacturer to confirm the output type.

*Important Information:

System Memory and Graphics: Significant system memory may be used to support graphics, depending on system memory size and other factors.

4GB or Greater System Memory Capability: A 64-bit operating system is required to support 4GB or more of system memory.

Hard Drive: GB means 1 billion bytes and TB equals 1 trillion bytes; actual capacity varies with preloaded material and operating environment and will be less.

TPM: TPM is not available in all regions.

Next Business Day Onsite Service after Remote Diagnosis: Remote Diagnosis is determination by online/phone technician of cause of issue; may involve customer access to inside of system and multiple or extended sessions. If issue is covered by Limited Hardware Warranty (www.dell.com/warranty) and not resolved remotely, technician and/or part will be dispatched, usually within 1 business day following completion of Remote Diagnosis. Availability varies.

Other conditions apply.

Limited Hardware Warranty: For copy of Ltd Hardware Warranty, write Dell USA LP, Attn: Warranties, One Dell Way, Round Rock, TX 78682

or see www.dell.com/warranty.

Dell Services: Availability and terms of Dell Services vary by region. For more information,

visit www.dell.com/servicesdescriptions.

Computrace: Not a Dell offer. Certain conditions apply. For full details, see terms and conditions at www.lojackforlaptops.com.





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PRODUCT SPECIFICATION

CONTROLLED ATMOSPHERE INFRARED FURNACE

Model: LA-309
Specification Number: 1303090MS01
Date: April 15, 2009

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Near-Infrared
Heating Technology

PRODUCT SPECIFICATION
CONTROLLED ATMOSPHERE INFRARED FURNACE

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MODEL: LA-309
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1.0 SCOPE

This document lists and defines the specifications, requirements and acceptance criteria for controlled atmosphere continuous belt infrared furnace equipment. The equipment shall be configured as follows (see section 15.0 for definitions of terms).

Model	Base Equipment	IR Heated Length	Nominal Belt With
LA-309	Continuous Belt Controlled Atmosphere Furnace	30 in (76 cm), 3 Zones	9 in (23 cm)

2.0 EQUIPMENT ARRANGEMENT

The equipment arrangement shall be as shown in Drawing 803-091734 FURNACE ARRANGEMENT and as described herein.

Phase	Process	Process Gas	Temperature (typ)
Phase 1	30 in (76 cm) IR Furnace, 3 Zones	N ₂	400°C
Phase 2	30 in (76 cm) Closed Atmosphere Cooling Tunnel	N ₂	Below 150°C

3.0 BASE EQUIPMENT FEATURES & OPTIONS

- 3.1 The maximum design temperature of the furnace shall be 500°C (or 1000°C with HT option).
- 3.2 The furnace shall be constructed so that control of in-process atmosphere can be maintained in all Phases.
- 3.3 **BASE EQUIPMENT.** The base furnace equipment shall be designed with the following standard and special features (see proposal Base Furnace Equipment List for included features, see section 0 for a description of all available features):

LTR	Equipment operation shall be from left to right as viewed from the operator console.	Std
HC	Hermetic Chamber including Plenums for Nitrogen	Yes
NO	Nitrogen process gas: Accepts Nitrogen process gas	Yes
PH2	Product Size: 9 inch (23 cm) wide belt, 2 inch (50 cm) high furnace opening	Std

- 3.4 **OPTIONS.** The system may be configured with the following optional equipment (see proposal for priced options, see section 17.0 for a description of all available options):

DSC	DSC (three-phase safety disconnect)	Opt
EH	EH (edge heaters for fine tune control of temperature across belt width)	Opt
HT	1000°C max operation	Opt
LT	3-color process ready light tower	Opt
IPS	IPS (N ₂ inlet pressure switch)	Opt
IR-E	76 mm diameter entrance interface roller	Opt
IR-X	76 mm diameter exit interface roller	Opt
HSK	Upstream-downstream handshake	Opt
N2-S	Nitrogen auto shutdown with delay	Opt
OA	Oxygen analyzer (use with OSS 3-point sampling system)	Opt
OSS	3-point sampling system (for use with OA and MA)	Opt
EM	Lamp element monitoring system (detects lamp failures)	Opt
PH4	4 inch high max product clearance	Opt

- 3.5 Base offering includes factory assembly and testing in Orange, California USA; installation checkout and startup commissioning at the owner's site in Italy.

4.0 PROCESS SECTIONS

4.1 **CONFIGURATION.** The equipment may be configured with options as follows:

Table 4-1. Furnace Configuration						
Function	Name	Location	Length		Process Gas	Temperature (typ)
Product Load	IR-E (optional)	Entrance Interface Roller	2.5 in	6.4 cm	none	ambient
	Load Station	Entrance	15 in	38.1 cm	none	ambient
IR Furnace	BE - Baffle & Exhaust Eductor	Entrance Barrier	15 in	38.1 cm	N ₂	25-80°C
	Zone 1	Heating Chamber 1	7.5 in	19.1 cm	N ₂	80-300°C
	Zone 2	Heating Chamber 1	15 in	38.1 cm	N ₂	300-400°C
	Zone 3	Heating Chamber 1	7.5 in	19.1 cm	N ₂	300-400°C
	Transition Tunnel / Exhaust Eductor	Furnace Exit Barrier	15 in	38.1 cm		
Cooling Section	Closed Atmosphere Cooling Tunnel	Cooling Exit Barrier	30 in	76.2 cm	N ₂	25-150°C
Product Unload	Unload Station	Exit	15 in	38.1 cm	none	ambient
	IR-X (optional)	Exit Interface Roller	2.5 in	6.4 cm	none	ambient
Overall frame allowance			3 in	7.6 cm		
Total			128 in	325.1 cm		

4.2 **PRODUCT LOAD.** The equipment shall provide access to the entrance of the heating chambers via the following:

- [IR-E](#) Entrance Interface Roller (optional)
- [Load Station](#)

4.3 **IR FURNACE .** The IR furnace section shall consist of the following:

4.4 [BE](#) - Entrance Baffle & Exhaust Eductor. The entrance baffle section shall be housed inside an aluminum shell lined with ceramic fiber insulation. The system shall include a metal air rake to introduce a gas curtain above the belt. This gas curtain and a series of four equally spaced hanging baffle gates shall serve to purge the chamber and prevent ambient air from entering the heating section. A venturi-assisted exhaust stack shall draw gases from the entrance of zone 1, across a drip tray and out of the furnace to prevent exhaust condensation from falling into the entrance baffle. Proper operation of this system shall keep the furnace heating section clean.

4.5 **Furnace Heating Section.** The heating section shall be comprised of 30 inch (76.2 cm) long chambers; each chamber shall be partitioned into temperature controlled zones using ceramic dividers. The dividers shall be configured with the smallest possible opening that can be made to be consistent with the parts clearance specifications to assure very high thermal isolation between the zones.

4.5.1.1 **Chambers.** Each chamber shall be contained within an aluminum shell lined with ceramic fiber insulation. Gas introduced into a plenum between the shell and the porous insulation shall be heated as it passes through the insulation to enter the chamber at chamber temperature. This method of gas distribution shall not affect the temperature profile, shall assist in keeping the interior of the furnace clean and shall speed the cool down process when the lamps are turned off.

4.5.1.2 **Control Zones.** The interior of the furnace chamber shall be partitioned into controlled zones using ceramic dividers. The dividers shall be designed with the smallest possible opening that can be made to be consistent with the parts clearance specifications to assure very high thermal isolation between the zones. The chambers shall be divided into zones as follows:

Chamber	Zone	Length	Number of Lamps (Top, Bottom)	Lamp Spacing
1	1	7.5 in (19.1 cm)	4T, 4B	1.2 in (3 cm)
1	2	15 in (38.1 cm)	6T, 6B	2.3 in (5.8 cm)
1	3	7.5 in (19.1 cm)	4T, 4B	1.2 in (3 cm)

4.5.1.3 **IR Lamps.** An array of tungsten filament, halogen gas quartz lamps shall be located above and below the transport belt. These lamps shall generate near-wave IR light at a color temperature of approximately 2500K (peak wavelength centered at 1.16 μ m) with most IR power delivered throughout the chamber in wavelengths of 0.5-3 μ m. The lamps, producing up to 100 watts per inch, shall be capable of heating the furnace chamber interior to a state of equilibrium within minutes.

4.5.1.4 **Hermetic Chamber Sealing** (See [HC](#) option). Gas-fed plenum boxes with removable covers shall enclose all IR lamp ends on both sides of each chamber. The system shall be designs so that Process Gas can be fed into the boxes under pressure to eliminate air and prevent ambient air from entering the furnace chamber through the lamp seals. An adjustable flow meter shall control the flow of gas into the plenum boxes (see 5.3).

4.5.1.5 **Edge Heat Elements** (See [EH](#) option). Edge heat elements shall be included to compensate for heat loss at the edges of the belt, through the chamber sides and through the ends of the lamps that would otherwise cause a drop off in temperature at the outer edges of the belt. Edge heat control shall enhance the benefits of diffuse gas distribution and emission uniformity of tungsten filament elements in maintaining a precise and uniform temperature profile across the belt width.

- Edge heat elements shall be made of resistance wire and shall be installed in the quartz belt support tubes along the edges of the belt.
- Power levels in the left and right edge heaters shall be capable of independent adjustment to vary the proportion of energy delivered by the left and right heater elements. Each side shall be varied from 0-100% power.

Zone	Length	Location
1 - 3	30 in (76.2 cm)	Left & Right (far & near facing console)

4.5.1.6 **BX** - Exit Baffle & Transition to Cooling. The transition tunnel and transition exhaust eductor shall be included to prevent contaminants from passing from the last zone in the furnace section into the cooling section. The exit baffle shall be housed inside a aluminum shell lined with ceramic fiber insulation. The system shall include a metal air rake to introduce a gas curtain above the belt and four (4) equally spaced hanging baffle gates and gas curtain arrangement. A venturi-assisted exhaust stack shall draw furnace gases from the entrance of the last zone, across a drip tray and out of the furnace.

4.6 **CACT.** A controlled atmosphere cooling section shall be included consisting of one (1) controlled atmosphere-cooling tunnel (CACT) to further reduce temperature of the product. The tunnel shall be constructed of extruded aluminum heat sink material, and shall not be insulated. The heat exchanger shall be designed with air rakes inside arranged above the belt so process gas can cool the product to a safe temperature. Outside the chamber, fans shall be included to force ambient room air over the finned surfaces of the heat sinks on the outside of the tunnel to expedite heat removal.

4.7 **PRODUCT UNLOAD.** Product shall exit the Furnace via the following:

- [Unload Station.](#)
- [IR-X](#) - Exit Interface Roller

5.0 MECHANICAL SYSTEMS

5.1 OVERALL SIZE

Table 5-1. Furnace Dimensions				
Model	Length (overall)*	Width (overall)	Height (overall)	Net Weight (approx.)
LA-309	128 in (3.13 m)	37.9 in (0.963 m)	67 ± 1.5 in adjustable (1.702 ± .038 m)	1600 LB (730 kg)

*length includes optional IR-E & IR-X interface rollers at entrance and exit respectively.

5.2 TRANSPORT SYSTEM

Table 5-2. Transport System	
Belt width	9 in (23 cm)
Std belt material, BSS	316 Stainless Steel, balanced spiral weave.
HT Belt material, BNV	Nichrome V, 80%Ni / 20%Cr alloy (<1% Fe), balanced spiral weave.
Product clearance, PH2	0.4-2 in (1-5.1 cm) above belt level. The entrance and exit throat, baffle plates, and zone dividers shall be set to provide this clearance.
Belt support	Quartz rods in process chamber, UHMW-PE on belt return.
Belt speed range	2-20 ipm (5.1-51 cm/min)
Conveyor height	36 in ± 1.5 in (91.4 ± 3.8 cm); user adjustable.

5.3 [FM](#) MECHANICAL INDEPENDENT ZONE GAS CONTROL

- 5.3.1 **Flowmeters.** A system of variable rate flowmeters and piping shall enable operators to control introduction of Process Gas into the furnace diffused through porous ceramic refractory chamber walls. Variable rate flowmeters shall also control flow to other equipment shown in Table 5-3.

Table 5-3. Furnace Atmosphere Gas Flow Control			
Location	Flow Meter Range Scale Graduation	Flow Meter Range Scale Graduation	Gas
Entrance Exhaust Eductor	0-20 L/min	0-50 scfh	CDA
Entrance Baffle	0-50 L/min	0-100 scfh	N ₂
Heating Chamber, Zone 1	0-50 L/min	0-100 scfh	N ₂
Heating Chamber, Zones 2 & 3	0-50 L/min	0-100 scfh	N ₂
Exit Baffle - Insulated Transition Tunnel	0-50 L/min	0-100 scfh	N ₂
Transition Tunnel Exhaust Eductor	0-20 L/min	0-50 scfh	CDA
CACT Cooling Air Rakes	0-90 L/min	0-200 scfh	N ₂
Lamp Plenum Seals	0-50 L/min	0-100 scfh	N ₂
Total – LA-309	380 L/min	800 scfh	

- 5.3.2 **Security.** The variable rate flowmeters shall be enclosed behind a clear panel. Customer can restrict access to the flowmeters by one of three methods: Keyed lock, mechanical latch or fastened by screws (lock and latch shall both be provided).
- 5.3.3 Atmosphere shall be controlled by manual adjustment of the flowmeters.

6.0 ELECTRICAL SYSTEMS

6.1 **INPUT SERVICE:** 380 Vac, 50 Hz, 3-phase, 4-wire (safety ground, no neutral).

Table 6-1. Power Consumption		
Model	Max. Power, Current	Typical Power, Current*
LA-309	380 Vac: 24 kW, 36 A	380 Vac: 9 kW, 14 A
*Typical Power, Current estimated at 20% total lamp power. See 802-101500 POWER data sheet for details		

6.2 **CODES.** The electrical system shall meet the following US and European (optional) electrical codes:

- ANSI/UL 508, Industrial Control Equipment, 17th Edition
- UL-508A: Industrial Control Panels, First Edition
- ANSI/NFPA 79: Electrical Standard for Industrial Machinery
- ANSI/NFPA 70: National Electrical Code (NEC)

6.3 The system shall include proper shielding from heat, high voltage and moving parts.

6.4 If changes to Manufacturer's standard electrical practice are required to comply with Customer's requirements, these changes shall be negotiated prior to sale, and shall be subject to review and approval by both Customer and the Manufacturer.

7.0 PROCESS GAS

- 7.1 The furnace shall be plumbed to accept process gas as described in Table 4-1 Furnace Configuration. All powered exhaust ductors and the belt drive pinch roller shall be plumbed for [CDA](#). All piping is aluminum and all fittings are brass.
- 7.2 If [AFR](#) option is not included, the pressure regulator for the CDA gas source shall be supplied by Customer. Regulators require 90-150 psig (620-1030 kPa) at furnace connection.
- 7.3 Input Line Requirements:
- 7.3.1 For 6 m (20 ft) feed length, assuming 620 kPa (90 psig) at supply manifold, line should be 13 mm (0.5 inch) diameter, schedule 40.
- 7.3.2 Required standard gas flow at expected operating conditions (1 and 2 x gas purge/min.):

Table 7-1. Typical Process Gas Consumption During Operation		
Chamber Purge Rate: Norm = 1x per minute (Max = 2x per minute)		
Gas	sL/min	scfh
CDA Norm (Max)	9.45 (18.9)	20 (40)
N ₂ Norm (Max)	94.5 (189)	200 (400)
*See 802-101-600 FLOW data sheet for details		

8.0 EXHAUST

8.1 FURNACE PROCESS EXHAUST

8.1.1 Typical Volume:

Table 8-1. Typical Process Gas Exhaust Volume During Operation		
Chamber Purge Rate: Norm = 1x per minute (Max = 2x per minute)		
Gas	sL/min	scfh
CDA + N ₂ Mix Norm (Max)	104 (208)	220 (440)
*See 802-101-600 FLOW data sheet for details		

- 8.1.2 Typical Temperature: $\leq 300^{\circ}\text{C}$
- 8.1.3 Composition: Process gas and process-induced contaminants
- 8.1.4 Source: Two venturi-assisted exhausts (eductors)
- 8.2 CABINET INTERIOR FAN EXHAUST
- 8.2.1 Typical Volume: 2000 scfm (56.6 m³/m)
- 8.2.2 Typical Temperature: $\leq 40^{\circ}\text{C}$
- 8.2.3 Composition: Uncontaminated room air
- 8.2.4 Source: Fan driven exhaust from cabinet top cover openings

8.3 VENTING (BY OTHERS)

- 8.3.1 In all applications, Customer shall vent process exhaust to the outside atmosphere; in some applications, Customer may desire to vent cabinet exhaust outside to reduce thermal load to the environment. However, there must not be any direct connection between any of the exhausts (process or cabinet) and any facility hood/duct arrangement.

9.0 SOFTWARE CONTROL

- 9.1 **Overview.** The furnace control system shall consist of an [OIT](#) and [PLC](#). The OIT shall allow operators to view and control furnace operation, store and retrieve production process recipes, handle system alarms and log furnace events, and communicate with the PLC. The PLC shall locally send and receive information to/from the OIT and process furnace IO (input/output) to control the furnace.
- 9.2 **PLC.** The furnace controller (PLC) shall be a commercial 32-bit industrial controller that provides real-time control and communication to the furnace IO. The controller shall provide 10/100 Mbps Fast Ethernet communication to the OIT PC. The furnace controller shall generate and process all alarms and safety features. All sensor and control inputs and outputs shall be optically isolated to insure integrity of the controller. In case of loss of communication between the OIT and the controller, the controller shall continue to operate the furnace normally until communication is re-established with the PC.
- 9.3 **OIT.** Operators communicate with the PLC is through an OIT (operator interface terminal) graphical user interface running on a Windows-based PC located at the furnace. The PC shall include a local PC monitor, keyboard and mouse at the system console mounted on top of the furnace cabinet.
- 9.3.1 The OIT hardware shall include a WindowsXP™ Dell Optiplex™ managed-platform computer ([PC](#)).
- 9.3.1.1 The PC shall be equipped with a RAID Level 1 system consisting of two (2) mirrored hard drives to provide ongoing automatic system data backup to insure continuous operation and integrity of the furnace program, process recipes and data in case of hard disk drive failure.
- 9.3.1.2 The PC shall be equipped to store all operational software, user-defined recipes and profiles for retrieval for archive or use in furnace operation.
- 9.3.1.3 The PC shall be equipped with an optical CDRW for software restoration and archival storage.
- 9.3.1.4 The furnace and computer shall include and offer access to USB ports for easy transfer of recipes and operation of temperature profiling systems.
- 9.3.1.5 The PC shall include a TCP/IP Ethernet port for communication with the furnace controller.
- 9.3.1.6 The Furnace shall include a second TCP/IP port for providing network access and, if internet enabled, factory diagnostic support. In addition to the second TCP/IP connection, a modem shall be installed to provide a second method of remote factory diagnostic support.
- 9.3.2 The PC and monitor shall be wired directly to the furnace primary transformer thereby bypassing the control system on/off switch. This unswitched arrangement allows reliable startup and shutdown of the PC under the WindowsXP™ operating system, allows the PC and monitors to be used without powering up the furnace, and extends PC life and reliability.
- 9.4 ProControl™ Furnace Software
- 9.4.1 The software shall consist of Logic and the OI. The PC shall contain the program and logic that is downloaded to the PLC. On startup an OI compiled runtime program shall load and run the Furnace graphical user interface software.
- 9.4.2 **Logic.** The PLC shall use Flow Chart based logic consisting of two primary blocks. The Operation block shall contain the basic program complete with multilevel case statements and if-then-else logic and loops to reduce program size and increases speed. Condition blocks shall contain additional program AND/OR conditions for furnace operation and feedback.
- 9.4.2.1 **Conveyor speed** shall be regulated by a stand-alone motor speed controller, which accepts commands from the control system. The motor speed controller in return shall provide the control system with the actual speed of the motor. A separate interface shall be used to

obtain the actual speed of the conveyor itself. Speed accuracy shall be maintained to within $\pm 0.5\%$.

9.4.2.2 **Temperature control** within the furnace process areas shall be performed by the controller through PID type control loops. User profile settings shall include temperature set points, maximum power and PID parameters for each zone of the furnace. Individual type K thermocouples shall be used to measure the temperature of the zones. Actual power output to the lamps shall be displayed on the PC monitor. Lamp power shall be controlled by SCR single phase firing modules individually controlling lamp zones. Phase angle type SCRs shall provide steady state, true proportioning control of the lamps without flicker. Thermocouple break monitoring shall be provided.

9.4.2.3 **Power.** The PLC shall control the power level of the lamps in each zone, automatically maintaining each zone at the set point temperature.

9.4.3 **OI.** The furnace OI software shall provide a graphical interface for the user to view and modify the furnace operation: The software shall:

9.4.3.1 depict units in English (**ENG**) or metric (**SI**) units as specified at time of order.

9.4.3.2 depict date in US (mm/dd/yyyy), or (dd/mm/yyyy) style if specified at time of order.

9.4.3.3 allow user addition of new users, multiple levels of log-in security and control rights.

9.4.3.4 include online display and modification of current furnace zone temperature and temperature and power set-points.

9.4.3.5 facilitate storage and retrieval of recipes and offline edit of recipe parameters including temperature and power set-points, belt speed, PID loop parameters and alarm and alert levels.

9.4.3.6 allow user to store and display user maintenance items and intervals

9.4.3.7 display and store events, alerts and alarms.

9.4.3.8 allow user to enter, display and store flowmeter set points in recipe files.

10.0 ALARMS

10.1 The controller shall include several standard alarms. Some options, such as the lamp element monitor, add additional alarms. Basic alarms shall be included as summarized below:

Alarm	Audible	Visible	Shutdown
Low Temperature Alert	X	X	
High Temperature Alert	X	X	
Low Temperature Alarm	X	X	
High Temperature Alarm	X	X	X
Transport Speed Error	X	X	
Transport Motion Fault	X	X	X
IPS Gas Flow Switch*	X	X	X

* IPS switch sends audible alarm and shuts down the lamps in the event of loss of process gas into furnace.

10.2 The furnace shall be equipped with four (4) emergency-off (EMO) palm switches that are easy to locate and reach. There shall be one EMO switch at each end of the unit on each side.

10.3 All side panels covering the computer/UPS and high voltage sections shall be protected with interlock switches. In the event these panels are opened, all circuitry shall be de-energized, protecting any service/maintenance personnel.

11.0 FINISH

- 11.1 All exposed parts (frame, uprights, and panels) shall be painted with corrosion-resistant paint. Color shall be to Manufacturer's specification unless otherwise specified at time of order: Sherwin Williams Stone Gray, P/N F63TXA-0382-2322 Polane-T Texture or equal.

12.0 FACILITIES IMPACT

- 12.1 Thermal Load: Properly exhausted systems shall induce approximately the following thermal load upon the facility: 1-1.5 kW
- 12.2 Hazardous Exhausts or Products: Customer product induced only.
- 12.3 Noise Impact: Negligible
- 12.4 Water requirements: none

13.0 DOCUMENTATION

- 13.1 Manufacturer shall provide Owner's manual documentation as follows:
 - 13.1.1 One (1) printed copy of Owner's manual including machine specific instructions for installation; equipment operation; service and troubleshooting; specifications; engineering data sheets; drawings and schematics; and MSDS.
 - 13.1.2 One (1) perfect bound printed copy of FurnacePros Continuous Belt IR Furnace Reference Manual including information on IR furnace nomenclature, thermal processing; furnace control and software; maintenance, troubleshooting and calibration; and process engineering.
 - 13.1.3 One (1) Reinstallation Software CD-ROM shall be supplied containing the furnace program, software utilities, and soft versions of the Owner's Manual, Reference Manual and drawings.
- 13.2 In addition, soft versions of items 13.1.1 and 13.1.2 shall be installed on the furnace computer, along with the Dell™ help screen for access at the furnace PC.

14.0 ACCEPTANCE CRITERIA

- 14.1 Manufacturer's QA shall assure that the furnace is manufactured as described in this document and meeting the requirements herein. The furnace shall be certified and documented according to Manufacturer's standard quality assurance procedures before Customer factory witness testing (FAT) begins.
- 14.2 Any Customer acceptance criteria shall be mutually agreed upon and must be presented in writing at least 4 weeks prior to furnace in-plant acceptance testing (FAT).
- 14.3 Manufacturer shall provide Purchaser with a minimum of 2 weeks notice of when the equipment will be ready for Factory Acceptance Testing (FAT). Purchaser may witness FAT in Manufacturer's facility. Duration of FAT testing is normally 1-2 days.
- 14.4 The furnace shall be fully shop tested before shipment. Contract price is based on all testing performed with 480 Vac, 60 Hz, 3-phase power source. Alternate power requirements can be provided at additional cost.
- 14.5 Upon acceptance of the furnace by Manufacturer's QA (with or without Customer representative present) and upon completion of final punch-list items, Manufacturer shall have fulfilled its obligation of in-plant acceptance and shall ready the furnace for shipment.
- 14.6 Purchaser shall then receive a notification that the equipment has successfully completed the Factory Acceptance Testing (FAT) and is ready for shipment.
- 14.7 Manufacturer shall provide startup and training services as purchased and if so provided, final testing shall be performed at Purchaser's site after completion of installation and startup.

14.8 Additional Customer acceptance tests that are beyond the scope of the original mutually agreed upon acceptance criteria may be performed at Manufacturer's facility by Customer representatives, or by Manufacturer' personnel, on a time and material basis, to be agreed upon at the time of order.

15.0 DEFINITIONS

The section describes terms used in this document.

Table 15-1. Definitions	
KEY	DESCRIPTION
CDA	<u>C</u> lean, <u>d</u> ry <u>a</u> ir. Compressed air supply that has been filtered of particulate and moisture.
FG	Forming gas, a mixture of H ₂ and N ₂ gasses usually with 4% H ₂ or less in the mixture.
H₂	Hydrogen gas; a concentration > 8% in air is considered explosive. For concentrations higher than 4%, FurnacePros requires inclusion of the Hydrogen Operation (HO) option to safely use hydrogen as a process gas in a furnace.
IO	Input/Output signals as an aggregate. IO is comprised of signals from one or more of these sources: AI (analog input), AO (analog output), DI (digital input), or DO (digital output).
N₂	Nitrogen gas. Inert. Usually used to displace oxygen from the furnace during processing. The Oxygen Analyzer (OA) option can be used with our automatic sampling system to continually monitor O ₂ (oxygen) levels present in any of 3 zones in a furnace, displaying results on the OI and alerting and alarming when detecting levels above pre-set limits.
PID	Proportional, integral derivative control loop that calculates an output to correct the error between a measured process temperature and a desired set point temperature.

16.0 DESCRIPTION OF STANDARD AND SPECIAL FEATURES

Table 16-1 describes standard features which may be included on the specified furnace. See section 3.3 for list of items included in the base bid and section 3.4 for those offered as options.

Table 16-1. Base Equipment Features	
KEY	DESCRIPTION
AR1	Gas Reservoir (Belt Tensioner). Pressurized gas system with tank, check valve and separate regulator to maintain constant pressure on belt even during short term failure or disconnect of the supply gas. <i>Standard on all furnaces.</i>
AR10	Air Reservoir, System Purge. Adds 30-56 L (8-15 gal) reservoir for supplying process gas in adequate quantity to assure purging the furnace chamber of volatile or toxic gas in the event of a plant power failure. System includes pressure switch and alarm integrated with the OI. <i>Standard on some applications, option available on most furnaces.</i>
BE	Entrance Baffle with Eductor. The Entrance Baffle/Exhaust Eductor is a 38.1 cm (15 inch) long section that serves to isolate the furnace atmosphere from the facility atmosphere. The entrance baffle is housed inside an aluminum shell lined with ceramic fiber insulation and includes a metal air rake to introduce a gas curtain above the belt. This gas curtain purges the baffle and a series of four equally spaced hanging baffle gates prevents ambient air from entering the furnace chamber. A venturi-assisted exhaust stack (eductor) draws gases from the entrance of furnace zone 1, across a drip tray and out of the furnace to prevent exhaust condensation from falling into the entrance baffle. Proper operation of this system keeps the furnace interior clean. <i>Standard on most furnace models.</i>
BNV	Belt, Ni-Chrome V. The high temperature belt is a balanced spiral weave of 18 gauge wire wound with 16 gauge cross wire of Nichrome V, 80%Ni/20%Cr alloy (<1% Fe). Because of the balanced construction, it is 50% stronger than conventional weave and any belt tendency toward side travel is greatly reduced. <i>Standard on high temperature furnaces (>550 C), option available for most furnaces.</i>
BSS	Belt, Stainless Steel. The standard furnace conveyor belt is a balanced spiral weave of 18 gauge wire wound with 16 gauge cross wire made of type 316 stainless steel. Because of the balanced construction, it is 50% stronger than conventional weave and any belt tendency toward side travel is greatly reduced. <i>Standard on low temperature (<550 C) furnaces.</i>
BX	Exit Baffle with Eductor. The Exit Baffle/Exhaust Eductor is a 38.1 cm (15 inch) long section that serves to isolate the heating chamber from the ambient atmosphere at the furnace exit. The exit baffle is housed inside a metal shell lined with ceramic fiber insulation and is fully insulated so that it will lose heat gradually. The baffle includes a metal air rake to introduce a gas curtain above the belt to purge the baffle and a series of four (4) equally spaced hanging baffle gates to effectively isolate the high temperature furnace section from the ambient atmosphere at the furnace exit. A venturi-assisted exhaust stack draws furnace gases from the last zone, across a drip tray and out of the furnace to prevent exhaust condensation from falling into the exit baffle. Proper operation of this system keeps the furnace interior clean. <i>Standard on most furnace models.</i>
BXO	Exit Baffle. The Exit baffle is a 38.1 cm (15 inch) long section that serves to isolate the closed atmosphere cooling section from the ambient atmosphere at the furnace exit. The exit baffle is housed inside an aluminum shell lined with ceramic fiber insulation. The baffle includes a metal air rake to introduce a gas curtain above the belt to purge the baffle and a series of four equally spaced hanging baffle gates to effectively isolate the controlled atmosphere cooling section from the ambient atmosphere at the furnace exit. <i>Standard on some furnace configurations.</i>
CACT	Closed Atmosphere Cooling Tunnel. The CACT is a 76.2 cm (30 inch) long, high efficiency heat exchanger that reduces the temperature of the product. Inside the CACT, process gas flows through air rakes arranged two above the belt to cool the product to a safe temperature. To expedite heat removal, fans outside the chamber force ambient room air over the heat sink finned surfaces on the outside of the tunnel. Multiple tunnels may be joined end-to-end to obtain required cooling. <i>Standard on many furnace configurations, option available on most furnaces.</i>
CAWC	Closed Atmosphere Water Cooled Tunnel. The CAWC is a 76.2 cm (30 inch) long, high efficiency heat exchanger that reduces the temperature of the product, but without externally mounted heat sink cooling fans. Instead, water flowing through chambers above and below the tunnel removes heat from the tunnel walls without adding to the heat load in the clean room. Includes OI integrated outlet water temperature sensors and alarms. Requires water supply and drain. Multiple tunnels may be joined to obtain required cooling. Upgrade from CACT. <i>Standard on many furnace configurations, option available on most furnaces.</i>
CFL	Cabinet Fans, Lower. Provides a high air volume impeller fan, located below the belt, to remove excess heat from the product and cabinet interior. Used with CMB30 and CMB45 Cross-flow Fan Cooling Modules. <i>Standard on all furnace configurations with CMB30 or CMB45 modules.</i>
CM	Turbulent Air Cooling Module. Provides a 76.2 cm (30 inch) long, fan-driven cooling module consisting of two rows of 3 m ³ /min (106 cfm) fans that force ambient air over all surfaces of the product. This module can be used to bring massive or high-speed product to handling temperature quickly. Controlled atmosphere processes should be reviewed to assure that the product is below its oxidation temperature before reaching the air cooling. The fan speed is controlled via the control console. <i>Standard on some furnace configurations, option available on most furnaces.</i>

Table 16-1. Base Equipment Features

KEY	DESCRIPTION
CMB30	Forced Air Cooling Module. Supplies fan-driven ambient air for rapid convection cooling of product on the belt. This 76.2 cm (30 inch) long, forced air cooling module uses two top-mounted cross-flow 13.3 m ³ /min (471 cfm) fans to force ambient air into a plenum assembly located above the belt, resulting in a downward laminar flow over the entire surface area of the belt directly under the cooling module. Controlled atmosphere processes should be reviewed to assure that the product is below its oxidation temperature before reaching the air cooling. Fan speed is controlled via the control console. Multiple modules may be joined to obtain required cooling. <i>Standard on some furnace configurations, option available on most furnaces.</i>
CMB45	Forced Air Cooling Module. Supplies fan-driven ambient air for rapid convection cooling of product on the belt. This 1.143 m (45 inch) long, forced air cooling module shall use three top-mounted cross-flow 13.3 m ³ /min (471 cfm) fans to force ambient air into a plenum assembly located above the belt, resulting in a downward laminar flow over the entire surface area of the belt directly under the cooling module. Controlled atmosphere processes should be reviewed to assure that the product is below its oxidation temperature before reaching the air cooling. Fan speed is controlled via the control console. Multiple modules may be joined to obtain required cooling. <i>Standard on some furnace configurations, option available on most furnaces.</i>
CWWC	Cold Wall Water Cooling Module. High efficiency, 50.8 cm (20 inch) long, water-cooled module that improves heat transfer from cooling tunnel, more rapidly reducing the temperature of the product. Includes OI integrated inlet and outlet water temperature sensors and alarms. Requires water supply and drain. Multiple modules may be joined to obtain required cooling. Upgrade from CACT. <i>Standard on some furnace configurations, option available on most furnaces.</i>
DOCM	Furnace Owner's Manual. Installation, startup operating, and troubleshooting instructions for a specific furnace. Includes specific customer drawings, schematics and engineering calculations. <i>Standard on all furnaces.</i>
DOCR	Furnace Reference Manual. Continuous Belt IR Furnace Reference Manual including information on IR furnace nomenclature, thermal processing; furnace control and software; maintenance, troubleshooting and calibration; and process engineering. <i>Standard on all furnaces.</i>
EME	Entrance Emergency Machine Off, Vertical Mount. Two (2) SEMI approved 40 mm diameter emergency shutoff buttons are located on either side of the entrance on the vertical face of the furnace approximately 1.27 m (50 inches) above grade. <i>Standard on all furnaces.</i>
EMX	Exit Emergency Machine Off, Vertical Mount. Two (2) SEMI approved 40 mm diameter emergency shutoff buttons are located on either side of the exit on the vertical face of the furnace approximately 1.27 m (50 inches) above grade. <i>Standard on all furnaces.</i>
ENG	English Units of Measure or US customary units. Furnace control software shall depict belt speed in inches per minute (in/min), gas flow in standard cubic feet per hour (scfh). Temperature units shall be degrees Celcius (°C). <i>Standard on all furnaces unless SI is selected at time of order.</i>
ETM	Elapsed Time Meter. Adds a mechanical meter to keep track of the cumulative time the furnace is ON. <i>Standard on all furnaces.</i>
FM	Independent Zone Flow Control. Process Gas is controlled by variable rate flowmeters enclosed behind a clear panel. Panel access can be restricted by one of three methods: Keyed lock, mechanical latch or fastened by screws (lock and latch shall both be provided). Atmosphere shall be controlled by manually adjustment of the flowmeters. <i>Standard on all furnaces.</i>
IE	Intermediate Exhaust Eductor. An exhaust stack with eductor that is located between selected chambers to increase control of process gas flow, to promote isolation of specific furnace chambers and to evacuate volatile emissions off-gassed from product. <i>Standard on some furnaces.</i>
LOAD	Load Station. The load station is an area 381 mm long (15 inch) at the entrance of the furnace which provides open access to accommodate loading of product on the continuous belt for processing by the furnace. <i>Standard on all furnaces.</i>
LTR	Left to Right: Belt moves from left to right as viewed from the operator console. This is the default furnace configuration. <i>Standard on all furnaces if RTL is not specified with original order.</i>
OI	Operator Interface. Operator Interface also known as MMI (man machine interface), and HMI (human machine interface). OI refers to the furnace graphical display software that the operator uses to communicate with the furnace PLC and to observe data collected by the Furnace PLC. Furnace graphical interface software that allow the user to view and modify furnace operating parameters and communicate with the PLC. <i>Standard on most furnaces.</i>
OIT	Operator Interface Terminal. Furnace computer with OI , OIT refers to the furnace computer that the operator uses to communicate changes to the furnace PLC and to observe data collected by the Furnace PLC. Furnace computer and monitor are wired to stay "ON", regardless of control panel ON/OFF pushbuttons, as long as power is supplied to furnace. This arrangement allows reliable startup and shutdown of the furnace computer, allows use of the furnace computer without powering up the furnace, and extends furnace computer life and reliability. <i>Standard on most furnaces.</i>
OSXP	XP Operating System. Microsoft WindowsXP™ operating system on the OI .

Table 16-1. Base Equipment Features	
KEY	DESCRIPTION
PC	Computer, Managed Platform. PC configured to act as the interface the operator uses communicate with the furnace PLC, store process recipes, log furnace behavior and reinstall furnace software. Includes dual drives in RAID1 array and dual Ethernet network interface ports.
PCM	Monitor, LCD. Standard 4:3 aspect ratio, 17 inch LCD monitor. <i>Standard on most furnaces.</i>
PH2	Product Height. Standard furnace clearance allows a maximum of 50 mm (2 inch) high product to pass through all baffle and cooling section throats, and zone dividers. <i>Standard on all furnaces.</i>
PLC	Programmable Logic Controller. The 32-bit industrial computer that controls the actual operation of the furnace. It sends and receives analog and digital signals from the furnace to control the furnace behavior. Programming of the PLC is performed from the PC . <i>Standard on most furnaces.</i>
SCR	Computerized SCR Load Management. Computer/PLC controlled SCR power modules that operate the furnace efficiently through phase angle firing, providing steady state, true proportioning control of the IR lamps without flicker. Each SCR firing circuit accepts process command signals from the PLC to regulate the power delivered to the heating elements in each furnace zone. Actual power output to the lamps in each zone is displayed directly on the OIT. Each SCR can be calibrated for maximum voltage output and maximum permissible power applied to each zone can be limited via the OI. Loads shall be balanced across phases. <i>Standard on all furnaces.</i>
SI	Metric Units of Measure. Furnace control software shall depict belt speed in centimeters per minute (cm/min). Temperature units shall be degrees Celcius (°C). <i>No cost option in lieu of ENG on most furnaces if SI is selected at time of order.</i>
SPL	Split for Shipment: Furnace may be manufactured to allow separation into sections to facilitate shipping and relocation. <i>Standard on all furnaces 5.7 m (225 in.) long or longer. Option available on furnaces 4.6 m –5.3 m (180 in.- 210 in.) long.</i>
TT	Transition Tunnel. Similar to the BX Exit Baffle/Exhaust Eductor, the transition tunnel works as a barrier to prevent contaminants from passing from the heating section into the cooling section. The transition tunnel is housed inside an aluminum shell lined with ceramic fiber insulation and is fully insulated so that it will lose heat gradually. A metal air rake introduces a gas curtain above the belt to purge the tunnel and a series of four equally spaced hanging baffle gates effectively isolate the high temperature furnace section from the cooling section. A venturi-assisted exhaust stack draws furnace gases from the last zone, across a drip tray and out of the furnace to prevent exhaust condensation from falling into the transition baffle. Proper operation of this system keeps the furnace interior clean. <i>Standard on most furnace models.</i>
TTDE	Transition Tunnel, Dual Eductors. The TTDE module is similar in construction and design to the TI Transition Tunnel with the addition of a 2 nd Exhaust Eductor to prevent contaminants from passing from the heating section into the cooling section. The transition tunnel is housed inside an aluminum shell lined with ceramic fiber insulation and is fully insulated so that it will lose heat gradually. A metal air rake introduces a gas curtain above the belt to purge the tunnel and a series of four equally spaced hanging baffle gates effectively isolate the high temperature furnace section from the cooling section. Two exhaust eductors, one at each end of the tunnel, expedite removal of gaseous contaminants from the furnace atmosphere and establish a counter flow of cooler gas from the cooling section, raising a high barrier to contamination passing from furnace to cooling section. Each eductor shall have a separate flow meter control for proper balancing of the exhaust flow. <i>Standard on some furnace models with multiple CACT or CACW cooling modules. Option available on most other furnaces.</i>
ULOAD	Unload Station. The unload station is an area 38.1 cm long (15 inch) at the exit of the furnace which provides open access to accommodate removing product from the continuous belt after processing by the furnace. <i>Standard on all furnaces.</i>
UT	Universal Transformers. Multi-tap transformers that convert power lines ranging from 208 Vac to 480 Vac to voltages required by the furnace control system and accessories, and allow change to a different power line voltage with a single tap change. Other voltages can be accommodated upon request. <i>Standard on all furnaces.</i>

17.0 DESCRIPTION OF OPTIONS

Table 17-1 describes optional equipment available or included on the specified furnace. See section 3.3 for list of items included in the base bid and section 3.4 for those offered as options.

Table 17-1. Optional Equipment	
KEY	DESCRIPTION
AFR	Air Filter/Trap/Regulator. High volume air filter, moisture trap and pressure regulator to assure supply compressed air is clean, dry and at the proper pressure before entering the furnace. <i>Option available on most furnaces.</i>
CB-1	Circuit Breaker. Three phase circuit breaker. <i>Required for UL approval. Option available on most furnaces.</i>
CDA-L	CDA Lockout. Manual lockout for CDA supply line, 1724 kPa, 250 psi. <i>Option available on most furnaces.</i>
CDA-S	CDA Auto Shutdown. Automatically shuts off CDA supply after actual furnace Power OFF to reduce compressor load and gas consumption. Includes timed delay to assure clearing of all process gas and emissions from furnace chamber. Note: furnace control delays actual Power OFF until furnace cools to 100 C. <i>Option available on most furnaces.</i>
CXE15	Entrance Conveyor Extension. Extends load station at the entrance of the furnace or dryer. Adds 0.381 m (15 inches) to length of furnace. <i>Option available on most furnaces.</i>
CXX15	Exit Conveyor Extension. Extends unload station at the exit of the furnace or dryer. Adds 0.381 m (15 inches) to length of furnace. <i>Option available on most furnaces.</i>
DCA	Additional Dryer Chamber. Adds one heating chamber with lamp elements in the top row only. Adds 0.762 m (30 inches) to length of furnace. <i>Option available on most furnaces.</i>
DSC	3-Phase Safety Disconnect: On-board circuit breaker to meet local codes or customer requirements. Disconnects furnace power distribution system (all on-board electrical components and wiring) from facility 3-phase power lines. Lockable for safety. <i>Option available on most furnaces.</i>
EH	Edge Heat: Edge heat elements allow trim of the furnace for a precise and uniform temperature profile across the belt width. EH serves to compensate for heat loss at the edges of the belt, through the chamber sides and through the ends of the lamps that would otherwise cause a drop in temperature at the outer edges of the belt. The power levels in the left and right edge heaters can be adjusted to vary the proportion of energy delivered by the left and right elements. Each side can be varied from 0% to 100% power. When properly trimmed, typical temperature deviations across the belt can be held to a minimum for profiles with modest temperature differences between adjacent zones. <i>Standard on 24, 36 and 48 (nominal belt width, inches) model furnaces, option available on most furnaces.</i>
EM	Element Monitors: Adds circuitry and special programming to sense and alert on failed heating lamps. Signals the operator audibly and visually via the OI should a failure occur. The failure display indicates the failed lamp location, allowing the operator to quickly discern location and process affected, if any. <i>Option available for most furnaces. Recommended on furnaces with plenum covers (see HC).</i>
EMT	Entrance Emergency Machine Off, Top Mount. Two (2) SEMI approved 40 mm diameter emergency shutoff buttons located at the entrance on the horizontal surface of the furnace load area approximately 0.94 m (37 inches) above grade, or on top of the furnace 1.5 m (64.5 inches) above grade, or at customer specified location. <i>No cost option replaces EME, if specified at time of order.</i>
FCA	Additional Furnace Chamber. Adds one heating chamber with lamp elements in the top and bottom rows. Adds 0.762 m (30 inches) to length of furnace. <i>Option available on most furnaces.</i>
FZN	Furnace Control Zone. Adds additional control zone in an existing furnace or dryer chamber. Additional zone is integrated with the OI. <i>Standard on -X models. Option available on most furnaces.</i>
HC	Hermetic Chamber. Adds sealed lamp-end plenums, plumbing and flowmeters necessary to operate the furnace at the lowest level of oxygen (O ₂) or moisture contamination from ambient air. During operation, process gas, under flow meter control, is fed to the plenum boxes under pressure to prevent ambient air from entering the furnace chamber through the lamp seals. Chamber gaseous contamination levels can be held typically to ≤20 ppm. This option, when utilized with nitrogen (N ₂) or forming gas (N ₂ /H ₂ mix) process atmospheres prevents the oxidation of metal surfaces during processing. <i>The option must be ordered before NO, HO, OSS, OA or MA options can be included. Option available on most furnaces.</i>
HO	Hydrogen Operation. Electro-mechanical control of the atmosphere required for hydrogen (H ₂) operation with more than 5% H ₂ concentration. The H ₂ cycle includes a nitrogen (N ₂) chamber purge and provides power to H ₂ igniter coils on exhaust stacks at the entrance and exit of the heating chamber. Included is fail-safe automatic N ₂ purge, and audio and visual alarms in the event of a failure of an igniter coil, or loss of N ₂ or H ₂ pressure. Includes special H ₂ valve and controls enclosure with constant N ₂ purge and H ₂ detector. Also, includes additional H ₂ detectors at furnace entrance and exit. Control circuitry visibly indicates the gas or gases flowing to the process and all alarm conditions. All curtain, eductor and cooling gas is N ₂ . <i>Requires HC, OSS and OA options. Optional on some furnaces.</i>

Table 17-1. Optional Equipment	
KEY	DESCRIPTION
HSK	Handshake Signaling. NO and NC signals to upstream and downstream equipment or to the production line controller about the furnace status when the furnace is part of an automatic production line. <i>Requires the Process Ready/Alarm Light Tower (LT) option. Option available on all furnaces.</i>
HT	High Temperature Operation. High temperature construction for furnace operation above 500°C up to 1000°C. Includes upgraded insulation and materials, changes BSS 316 stainless steel belt to BNV Nichrome material, and adds cabinet temperature thermocouple plus alert/alarm on cabinet temperature. <i>Option available on most furnaces.</i>
IPS	Inlet Pressure Switch. Pressure switch upstream of the gas distribution system that signals the operator and the furnace control system in the event of pressure loss in the process gas supply line. Furnace PROCESS START mode will be inhibited automatically until pressure is restored to normal. <i>Option available on most furnaces.</i>
IR-E	Interface Roller, Entrance. Small diameter belt rollers at the entrance of the furnace that permit close transfer of parts from upstream conveyor equipment. The rollers are less than 3 inches (76.2 mm) in diameter. Adds 6.4 cm (2.5 inch) to the length of the furnace. <i>Option available on most furnaces.</i>
IR-X	Interface Roller, Exit: Small diameter belt rollers at the exit of the furnace that permit close transfer of parts to downstream conveyor equipment. The rollers will be less than 3 inches (76.2 mm) in diameter. Adds 6.4 cm (2.5 inch) to the length of the furnace. <i>Option available on most furnaces.</i>
LT	Process Ready/Alarm Light Tower: Provides a three stage alarm status light tower. The status system activates a three element alarm light, located above the upper frame, as follows: <ul style="list-style-type: none"> ○ Red Indicator: Alarm Condition, audible alarm ○ Yellow Indicator: Process Not Ready, no alarm ○ Green Indicator: Process Ready, no alarm <i>Option available on most furnaces.</i>
MA	Moisture Analyzer: Provides a moisture monitoring system for the process atmosphere in a furnace with a hermetic sealed chamber. A gas sample is withdrawn continuously from a sample port in the furnace chamber through the analyzer. A switched pump and vacuum break are provided to withdraw the sample. The analyzer is provided with an inline 1µm filter for removal of particulates from the sample flow. ProControl™ OIT displays dew point in °C or moisture as PPM, and alert/alarm conditions. <i>Option available on most furnaces. Requires OSS option.</i>
N2-S	Nitrogen Auto Gas Shutoff: Automatically opens the nitrogen supply inlet valve when the control system is started, prior to furnace entering WARM UP mode, and automatically shuts off that valve at furnace shutdown after COOL DOWN mode is complete. Can help minimize waste of process gas and relieves the operator having to return to the machine to shut off the process gas when the furnace has cooled down. Includes timed delay to assure clearing of all process gas and emissions from furnace chamber. <i>Requires NO or NGFS, option available on most furnaces.</i>
NGFS	Nitrogen/Forming Gas Selector. Allows ability to select between nitrogen (N ₂) or a nitrogen hydrogen (N ₂ /H ₂) mix (forming gas) process atmosphere in heating chamber of the furnace, depending on process requirements. <i>Requires HC. Option available on most furnaces.</i>
NO	Nitrogen Operation. Allows for efficient use of nitrogen (N ₂) in the furnace, minimizing consumption where an N ₂ process atmosphere is required. N ₂ is supplied only to oxygen-controlled areas (entrance baffle, heating chamber, and transition tunnel), while CDA is supplied to eductors and cooling. Controlled atmosphere processes should be reviewed to assure that the product is below its oxidation temperature before reaching cooling section. <i>Order with HC, standard on some furnaces, option available on most furnaces.</i>
OA	Oxygen Analyzer: Provides an oxygen monitoring system for the process atmosphere in a furnace with a hermetic sealed chamber. A gas sample is withdrawn continuously from a sample port in the furnace chamber through the analyzer. A switched pump and vacuum break are provided to withdraw the sample. The analyzer is provided with an inline 1µm filter for removal of particulates from the sample flow. ProControl™ OIT displays oxygen concentration in PPM, and alert/alarm conditions. <i>Requires OSS-On-line Gas Sampling System, option available on most furnaces.</i>
OSS	On-line Gas Sampling System: The sampling system provides 4 selectable inputs: 3 sample ports in the furnace and 1 port with a 13.7 kPa (2 psi) regulator in-line for source gas monitoring or sensor purging to improve sensor response during startup of sampling. System may be turned on/off and any of the 4 inputs selected via the furnace OI. <i>Required for OA and MA options, option available on most furnaces</i>
OT	Over-temperature Monitor & Shutdown Alarm. Provides completely independent temperature measurement in each zone with audible alarm and automatic furnace shutdown for temperatures out of range. Includes second thermocouple for each zone directly connected to separate zone scanner and monitor with display. Alarm integrated with the furnace OI. <i>Option available on most furnaces.</i>
PCMS	Computer Monitor, Special. <i>Option available on most furnaces.</i>
PH1	Parts Height, 1 inch. Reduces clearance at all baffle and cooling section throats, and zone dividers) to 25 mm (1 inch) from the standard 51 mm (2 inch). Allows for larger zone-to-zone temperature differences for small parts. <i>Option available on most furnaces.</i>
PH4	Parts Height, 4 inch. Raises clearance at all baffle and cooling section throats, and zone dividers to 102 mm (4 inch) from the standard 51 mm (2 inch). <i>Option available on most furnaces.</i>

Table 17-1. Optional Equipment	
KEY	DESCRIPTION
RTL	Right to Left: Belt moves from the right to left as viewed from the operator console. <i>No cost option when specified at time of order, available on all furnaces.</i>
SBW	Special Belt Weave. Custom belt in lieu of standard balanced weave design. <i>Option available on most furnaces.</i>
SMEMA	SMEMA Lane Control. Product tracking sensors at entrance and exit which provide SMEMA 1.1 busy/board available signal generation to coordinate product handling from upstream and downstream equipment. The on-screen tracking feature counts the number of product units travelling through the furnace. The tracking feature sets off an alarm if the exit sensor does not detect the arrival of an expected product unit at the unloading station. <i>Option available on most furnaces.</i>
SP1	Critical Spares Kit. Increases furnace availability. Package includes critical parts, such as fuses, SCR, PLC I/O modules and lamps that may be needed to restore full operation of the furnace. An itemized list of included spare parts shall be available. <i>Option available on all furnaces.</i>
SPP	Special Paint. Customer specified color in lieu of standard Sherwin Williams Stone Gray, P/N F63TXA-0382-2322 Polane-T Texture or equal. <i>Option available on most furnaces.</i>
UC	Ultrasonic Cleaner. An ultrasonic belt cleaning system to remove particulate and fines that accumulate on the belt during normal furnace operation. Includes ultrasonic generator, heated tank, pumped water recirculation system, and compressed air blow-off of water droplets. As the belt is drawn through a tank of water, ultrasonic energy removes particulate matter and contamination from the belt. Tank water levels are automatically maintained. As the belt exits the tank, a flow of facility-supplied CDA blows water droplets from the belt to aid belt drying through evaporation. Start of ultrasonic cleaning and its duration are set by the user in the OI. The ultrasonic tank water is automatically filled, heated, and drained at the end of cleaning. The system requires plant clean water supply and drain. Same as UCD option, but without electric heater/blower drying system. <i>Option available on most furnaces.</i>
UCD	Ultrasonic Cleaner with Dryer. An ultrasonic belt cleaning system to remove particulate and fines that accumulate on the belt during normal furnace operation. Includes ultrasonic generator, heated tank, pumped water recirculation system, and an electric heater/blower system to provide automatic cleaning and drying of the belt. As the belt is drawn through a tank of water, ultrasonic energy removes particulate matter and contamination from the belt. Tank water levels are automatically maintained. As the belt exits the tank, a flow of facility-supplied CDA blows water droplets from the belt and then completely dried by an electric heater/blower system. Start of ultrasonic cleaning and its duration are set by the user in the OI. The ultrasonic tank water is automatically filled, heated, and drained at the end of cleaning. The system requires plant clean water supply and drain. Same as UC option, but with electric heater/blower system. <i>Option available on most furnaces.</i>
UCF	UCD Water Filter, External, Quick Disconnect. Filter for UC or UCD ultrasonic cleaner tank recirculation system. Allows the filter, enclosed in a stainless steel filter housing mounted outside furnace cabinet, to be replaced without opening furnace panels. <i>Requires UCD or UC, option available on most furnaces.</i>
UPSC	Un-interruptible Power Supply, Computer. Short term battery backup for emergency power when facility power fails. Provides instantaneous protection to computer system from input power interruptions and power surges. Does not provide power for furnace operation (see UPSF option). <i>Available on most furnaces.</i>
UPSF	Un-interruptible Power Supply, Furnace. Short term battery backup for emergency power when facility power fails. Provides necessary power to run the belt, fans, and control system for at least twenty minutes during a power outage. The transport belt continues to run at set speed which minimizes product loss during brief power failures. The unit automatically switches from standby to PROCESS START upon restoring power if the lower alarm temperature limit has not been reached. The control software includes modification to add automatic reset without using the normal power up and screen menu selection process, so that immediate restart is available after power interruption. Includes power for computer operation (see UPSC option for computer UPS only). <i>Available on most furnaces.</i>

18.0 ALTERNATE MATERIALS

Many furnace components can be manufactured of alternate materials, if requested at the time of order. Key for alternate materials.

Table 18-1. Alternate Materials	
KEY	DESCRIPTION
-AL	Aluminum. Standard material for many furnace components.
-SS	Stainless Steel. Fabricated from stainless steel, various grades.
-304	Stainless Steel. Fabricated from 304 and 304L stainless steel, and 316 and 316L as available.
-316	Stainless Steel. Fabricated from 316 and 316L stainless steel.
-PTFE	Teflon. Components of Polytetrafluoroethylene (PTFE) - manufactured by DuPont as Teflon® or equal.

[end of specification]