Section 8

ORIGINAL SPECIFICATIONS

8.1 FURNACE PRODUCT SPECIFICATION (ORIGINAL)

RTC Product Specification, Controlled Atmosphere Infrared Furnace S-Series Models, Specification No. 77104 Rev D, June 1997

Section 8

PRODUCT SPECIFICATION

RTC

CONTROLLED ATMOSPHERE INFRARED FURNACE

MODEL:	S-1215X
Specification Number:	77104
Revision:	D
Date:	June 1997

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Near-Infrared
Heating Technology

1. SCOPE

This document specifies the performance, configuration, and available options for the Model S-1215X infrared furnace system.

2. FURNACE DESCRIPTION

2.1 The S-1215X infrared furnace is designed for processes requiring close control of both temperature and atmosphere. Primarily intended for semiconductor packaging applications including chip joining, lid sealing, solder bump reflow, and silver glass die attach, these furnaces can also perform many lower temperature processes requiring air, nitrogen, or hydrogen (optional) operating atmospheres. The maximum operating temperature of the system is 650°C.

2.2 The chamber construction, gas controls, and exhaust are designed to control in-process atmosphere by maintaining equilibrium between input exhaust and leakage. Typical performance allows furnace-induced gaseous contaminants to be held at or below 10 ppm above source gas using either nitrogen, hydrogen (optional), or mixing gas (optional) operating atmospheres.

2.3 The system will provide a load station, multi-zone infrared heating section, three stage controlled atmosphere cooling and an unload station. Furnace operation is left to right as viewed from the operator control panel.

2.4 Typical Energy and Gas Consumption

Operating Power	Gas Consumption	Power Consumption
39 KW	1320 SCFH	1.5 - 2.5 watts/IN^2 belt/hr

3. MECHANICAL SPECIFICATIONS

3.1 Overall Size

3.1.1 Length
285 in. (7.24 m) without Options
300 in. (7.57 m) with CE-15 Conveyor Extension Option
315 in. (8.01 m) with HO/NHM/OA Hydrogen and CE-15 Conveyor Extension Options

3.1.2 Width

32.5 in. (82.6 cm)

3.1.3 Height

67.8 ± 1.5 in. (172.2 ± 3.8 cm)

3.2 Transport Specifications

3.2.1 Conveyor Width

15.0 in. (38 cm)

℞ 3.2.2 Conveyor Height

Adjustable 36.9 ± 0.6 in. (93.7 ± 1.52 cm)

3.2.3 Conveyor Material

Niobium stabilized nichrome V, close weave balanced spiral (CTB42-36-18 mesh).

3.2.4 Product Clearance

2 in. (5 cm) maximum above belt level.

3.2.5 Speed Range

2-40 in./min. (5-102 cm/min.)

3.3 Handling Stations

3.3.1 Load Station:

13.2 in. (33.7 cm)
10.2 in. (25.9 cm) with HO/NHM/OA Hydrogen Operation Option
5.0 in. (12.7 cm) with HO/NHM/OA Hydrogen Operation and HD Hydrogen Sensor Options

3.3.2 Unload Station:

13.2 in. (33.7 cm)
25.2 in. (64.0 cm) with HO/NHM/OA Hydrogen Operation Option and CE-15 Conveyor Extension Option
19.7 in. (50.0 cm) with HO/NHM/OA Hydrogen Operation, HD Hydrogen Sensor and CE-15 Conveyor Extension Options

3.4 Process Area Dimensions

3.4.1 Input Curtain, Baffle and Exhaust:
15 in. (38.1 cm)
30 in. (76.2 cm) with HO/NHM/OA Hydrogen Operation Option

3.4.2 Infrared Heated Length: 120 in. (304.8 cm)

3.4.3 Transition Tunnel, Baffle and Exhaust:
15 in. (38.1 cm) (Non-insulated aluminum finned tunnel)

3.4.4 Controlled Atmosphere Cooling Tunnel: 90 in. (228.6 cm)

3.4.5 Exit Baffle and Curtain (insulated): 15 in. (38.1 cm)
(Exhaust stack and igniter added with HO/NHM/OA Hydrogen Operation Option)

4. ELECTRICAL SPECIFICATIONS

4.1 Input Service

The S-1215X furnace is wired for a 3 phase, 4 wire system with safety ground, but no neutral.

4.2 Input Voltage

240 volts

NOTE: Multi-tapped transformers are provided for operation at 220 and 208 volts. Maximum power and recovery will be obtained when operating at 240 volts.

480 volts (Optional)

NOTE: Multi-tapped transformers are provided for operation at 380, 415, 440, and 480 volts. Maximum power and recovery will be obtained when operating at 480 volts.

4.3 Peak Instantaneous Power Consumption

240 V	480 V
97 KW	97 KW

4.4 Applicable Specifications

4.4.1 The electrical system as manufactured by RTC will meet the following U.S. electrical codes:

4.4.1.1 NFPA 70 - 1993: "The National Electrical Code"
4.4.1.2 UL-508: "Industrial Control Equipment"
4.4.1.3 NFPA 79 - 1991: "Electrical Standard for Industrial Machinery"

4.4.2 Changes to RTC standard electrical practice required to comply with customer requirements will be negotiated prior to sale, and will be subject to review and approval by both RTC and the customer.

5. AIR/NITROGEN REQUIREMENTS

5.1 Volume (Maximum Inputs): 3200 SCFH

5.2 Input Line/Pressure Requirement

Input lines are sized for feed lengths of 20 feet or less with 90 psi minimum at the supplying manifold. An input regulator is required at the furnace.

2000 SCFH maximum or less: 1/2 in. inside diameter input line (1.27 cm) minimum
2000 - 5500 SCFH: 3/4 in. inside diameter input line (1.91 cm) minimum

5.3 Air Composition (recommended)

5.3.1 Total Hydrocarbons: 20 ppm maximum

5.3.2 Moisture: 100 ppm maximum

5.4 Nitrogen Composition (recommended)

5.4.1 O_2: 10 ppm maximum
5.4.2 Total Hydrocarbons: 100 ppm maximum
5.4.3 Moisture: 20 ppm maximum
5.4.4 Other inert contaminants: 1000 ppm maximum

5.5 Pressure: 70 - 80 psi (480 - 550 kpa)

6. EXHAUST OUTPUT

Process Stacks (Typical)	Cabinet Cooling Exhaust (Maximum)
1320 SCFH	1000 CFM

6.1 Exhaust Temperature

Process Exhaust: 300°C maximum
Cabinet Cooling Exhaust: 40°C maximum

ℜ 7. CONTROLS

7.1 The RTC furnace is controlled by an off the shelf, 32 bit, industrial controller that uses a PC compatible computer for user interface through a Microsoft Windows graphical interface software.

Security is provided by passwords allowing different users different levels of access and control rights.

The system includes an Arcnet card for communication between the PC and the controller. A modem is installed for remote controlled operation and factory diagnostic support. All inputs and outputs are optically isolated to insure integrity of the controller.

All operational software, recipes and profiles are stored on the hard drive. RTC recommends periodic back up of the system.

7.2 Conveyor speed is regulated by a stand alone motor speed controller, which accepts commands from the control system. The motor speed controller in return provides the control system with the actual speed of the motor. A separate interface is used to obtain the actual speed of the conveyor itself.

7.3 Temperature control is accomplished by the external controller through PID type control loops. User settings include temperature set points, top and bottom maximum power, PID parameters, and top/bottom proportional power for all the zones of the furnace. Type K thermocouples are used to measure the temperature of the zones. Actual power output to the lamps is reported back on the display screen. The lamps' power is controlled by SCR single phase firing modules, controlled individually. Each SCR module has a standard 25 Amps rating.

7.4 All the alarms and safety features are generated and taken care of on the controller. In case of loss of communication between the computer and the controller, the controller will continue to operate normally until the communication is re-established.

7.5 Atmosphere Control Flowmeters:

Flowmeter	Range
Entrance Venturi	0-100
Entrance Baffle	0-400
Element Plenum	0-200
Transition Tunnel	0-400
Transition Tunnel Venturi	0-100
Cooling Tunnel/Exit Baffle	0-400
Subtotal	1600

Flowmeter	Range
Zones 1 - 2	0-400
Zones 3 - 4	0-400
Zones 5 - 6	0-400
Zones 7 - 8	0-400
Chamber Total	1600

NOTE: All flowmeters are calibrated in SCFH air.

8. PROCESS SECTION

8.1 The process section of the S-1215X contains an entrance and exit baffle, infrared heating section, transition section, and cooling section. Together, the individual sections function as a unit to provide a carefully controlled atmosphere, precise temperature profile, and controlled cooling.

8.2 The entrance baffle section is housed inside a welded aluminum shell lined with ceramic fiber insulation. A gas curtain, of either nitrogen or air, is generated by introducing the gases both above the belt, through sparger (2) tubes, and below the belt, through the insulation. These gases, and a series of four (4) equally spaced hanging baffle gates, serve to purge the chamber and prevent ambient air from entering the furnace section. A venturi assisted exhaust stack draws furnace gases across a drip tray to prevent exhaust condensation from falling into the entrance baffle. Baffle gates will have 1.00" clearance from the mesh belt. (A second 15 inch baffle tunnel is added if the HO/NHM/OA Hydrogen Operation Option is selected.)

8.3 The furnace section is of similar construction, and is hermetically sealed, except for the belt openings. This section is composed of four (4) 30.0 inch long heating modules which are joined with bolted flanges to form a 120.0 inch section. (Flanges are welded if HO/NHM/OA Hydrogen Operation Option is selected.)

Inside the composite furnace assembly an array of tungsten filament quartz elements, located above and below the transport belt, generate radiant flux with peak wavelengths between 1.2 and 4.1 um. The element filaments, operating between 700-2500°K, and producing up to 100 watts per inch, heat the oven interior to a state of equilibrium within minutes. Process gas is preheated, before reaching the oven interior, by allowing it to permeate through the porous ceramic fiber insulation. This method of gas distribution does not affect the temperature profile, and helps to keep the furnace interior clean.

8.3.1 The interior of the furnace is partitioned into zones using ceramic fiber dividers. The dividers are designed with the smallest possible opening that can be made to be consistent with the parts clearance specifications. This assures very high thermal isolation between the zones. The zone lengths, element spacing, voltages, and number of lamps determines the heating profile, and are as follows:

Zone	Length (In.)	Elements Top/Bottom	Spacing (In.)	Maximum Voltage
1	10.0	6/6	1.2	Full
2	20.0	8/8	2.3	Full
3	20.0	8/8	2.3	Half
4	10.0	6/6	1.2	Half
5	10.0	6/6	1.2	Half
6	20.0	8/8	2.3	Half
7	20.0	8/8	2.3	Half
8	10.0	6/6	1.2	Full

8.4 Although the heating profile across the belt is extremely uniform, losses through the furnace side walls and element terminations produce temperature drops near the edges of the transport belt.

To compensate for these losses, three sets of heaters are provided along both edges of the transport belt which run throughout the furnace chamber. The heaters are made from coiled resistance wire which runs through quartz tubing and actually supports the edges of the transport belt. The control system allows the power in each element to be adjusted from 0 to 100% in increments of 1%. When the edge heaters are properly trimmed the following deviations between the center and edges of the belt, in one zone, can be expected:

EDGE HEAT "OFF"			EDGE HEAT "ON" AND TRIMMED		
Min.	Max.	Average	Min.	Max.	Average
±1°C	±4°C	±3°C	±1°C	±2°C	±1°C

NOTE: The specification may be exceeded between zones operating at very high temperature differentials.

Edge Heat Element Configuration:

Zones 1-2 Right side edge heat
Zones 1-2 Left side edge heat
Zones 3-6 Right side edge heat
Zones 3-6 Left side edge heat
Zones 7-8 Right side edge heat
Zones 7-8 Left side edge heat

8.5 The transition tunnel, curtain, and exhaust section is constructed of extruded aluminum heat sink material, with the addition of a side removeable access plate. The exhaust will be located in close proximity to the heated tunnel. This section is un-insulated so that it loses heat rapidly. The four (4) equally spaced hanging baffle gates and gas curtain arrangement (2 sparger tubes on top and 2 on bottom) effectively isolate the high temperature furnace section from the controlled atmosphere cooling sections. Baffle gates will have 1.00" clearance from the mesh belt. (Optional external water cooling coils are available.) Sparger tubes will have a special hole pattern and are directed away from the belt towards the interior surfaces of the tunnel.

8.6 The inert cooling section is constructed of extruded aluminum heat sink material, 90 inches long, and is not insulated. Inside the heat exchanger, a carefully controlled inert atmosphere is maintained (by gas flow through sparger tubes arranged six above and four below the belt) to protect the product while cooling it to a safe temperature. As above, sparger tubes will be directed away from belt towards the interior surface of the tunnel.

Outside the chamber, fans force ambient air over the finned surfaces to remove the heat. (External water cooling coils are available as an option.) At the end of the process section, an additional exit baffle (15" long), with four equally spaced hanging baffle gates, is employed to prevent ambient air from entering the inert cooling section. Baffle gates will have 1.00" clearance from the mesh belt. (Exhaust stack and igniter are added with HO/NHM/OA Hydrogen Operation Option.)

9. ADDITIONAL STANDARD FEATURES

9.1 Alarms

The controller includes several standard alarms. Additional options, such as hydrogen control, add additional alarms. Basic alarms are summarized below.

Alarm	Audible	Visible	Shutdown
Exhaust Failure	X	X	X
Low Temperature Alert	X	X	
High Temperature Alert	X	X	
Low Temperature Alarm	X	X	

Alarm	Audible	Visible	Shutdown
High Temperature Alarm	X	X	X
System Self Test	X	X	
Transport Speed Error	X	X	
Transport Motion Fault	X	X	X
Coolant Flow Alarm (Optional with External Water Cooling)	X	X	X
Water Temperature Alarm (Optional with External Water Cooling)	X	X	X

9.2 Sample Ports

This feature includes sample ports at selected points in the process chamber which can be used for monitoring the process atmosphere. Three ports are included and are arrayed as follows:

	Zone									
1	2	3	4	5	6	7	8	9	10	11
X				X			X			

NOTE: The sample ports are not plumbed for operation unless gas sampling options such as OA or MA are selected.

10. DOCUMENTATION

RTC will provide two (2) sets of documentation to include maintenance manual, operating procedures, process manual, and spare parts list with each furnace.

11. CONTACT PEOPLE

Sales Support: Mr. Carson Richert
Process Support: Director of Engineering

12. FINISH

12.1 All exposed parts will be painted with corrosion-resistant epoxy or polyurethane paint.

12.2 Colors will be to RTC specification unless otherwise specified at time of order.

13. ACCEPTANCE CRITERIA

13.1 The furnace, as described in this document, and meeting the requirements herein, will be certified and documented by RTC Quality Assurance before customer acceptance tests begin. Customer acceptance criteria is to be mutually agreed upon and be in writing prior to furnace in-plant acceptance. Upon acceptance of the furnace by RTC Q.A., with or without the customer present, RTC will have fulfilled its obligation of in-plant acceptance and will ready the furnace for shipment.

13.2 Additional customer acceptance tests that are beyond the scope of the original mutually agreed upon acceptance criteria may be performed at RTC by customer representatives, or by RTC personnel, on a time and material basis, to be agreed upon at the time of order.

14. ADDITIONAL FEATURES

14.1 Standard drum drive conveyor system will be used and includes the Interface Roller (IR) Option which provides small diameter entrance and exit rollers for in-line product transfer.

14.2 Trackball keyboard will be provided, replacing touchpad.

14.3 Temperature deviation on-screen readout will be provided.

14.4 On-line/off-line toggle switching will be provided for recipe editing.

14.5 Water cooling tunnel will be insulated to reduce condensation.

15. OPTIONS

15.1 Air Filter/Trap/Regulator (AFR)

The AFR option provides a filter, regulator, and trap to clean and control incoming process air. The prefilter/regulator unit includes a .5 micron impregnated fiber filtering element, manual drain, pressure gauge, and regulator. The after filter is a .5 micron coalescing filter for water/oil removal with automatic drain. This combination unit reduces downstream oil contamination to .5 ppm/wt maximum.

15.2 Air Purification System (APS)

This option provides an air dryer and filtering system which removes moisture, oil, and particulate contamination from air or nitrogen.

Performance:

Particulate - Removes particles > 1 um
Oil - Reduces oil and hydrocarbons to a level below 1 ppm
Water Removal -
-01, recommended for S-610, S-615, S-910, S-915, and S-1215, will dry 35 SCFM to a dewpoint of -73°C (100°F)
-02, recommended for S-1224, S-1524, and S-1536, will dry 56 SCFM to a dewpoint of -73°C (-100°F)

NOTE: Higher flowrates will reduce performance. Ask for Addendum X for additional information.

15.3 Brush Belt Cleaner (BC)

This option adds a passive brush cleaner. The belt drive pulls the belt through two facing planar brushes to remove loose particulate.

15.4 Conveyor Extension (CE-HT-XX)

This option allows load or unload stations to be extended (from the standard 13.25 inches each) by 15, 30, 45, or 60 inches, and includes an additional emergency stop switch per extended station.

15.5 Coolant Alarm Flow Switch (CFS)

This feature adds one coolant flow sensing switch to monitor cooling water input for controlled atmosphere cooling tunnel. The switch is of the adjustable flow type with a range of .5-20 gpm.

Two sets of contacts are standard, i.e., N.O., and N.C., which are rated at 20 VA, 120-240 VAC. The customer will provide wiring to suit.

15.6 Element Monitor (EM)

This feature includes circuitry and special programming to sense failed heating elements and edge heats. Multiple diode arrays are arranged to monitor current in each element, and to signal the operator audibly and visually via the CRT should a failure occur. The failure display pinpoints the failed heater location, allowing the operator to quickly discern location and process affected, if any.

15.7 Hydrogen Detection (HD)

This option provides a combustible gas monitor in the furnace cabinet that is used to provide hydrogen shut down in the event of loss of furnace integrity. This detector (a General Monitors Model 580) is linked to the igniter control circuitry to automatically shut down the hydrogen upon detection of more than 1% hydrogen in the furnace cabinet or hydrogen control enclosure. The system uses two detectors for redundancy; a failure of either of the sensors sounds the alarm and shuts off the hydrogen. An alarm and visible indicator shows the cause of the shut down.

15.8 Hydrogen Operation-Nitrogen/Hydrogen Mixing (HO-NHM)

This option provides electronic and pneumatic control of the atmosphere supply required for hydrogen or forming gas operation. Initiation of the hydrogen cycle starts a 10-minute nitrogen chamber purge and provides power to the hydrogen igniter coils. At the end of the purge, hydrogen operation commences. Hydrogen is withdrawn through exhaust stacks at the entrance and exit of the heating chamber and ignited. All curtains and cooling gas remain nitrogen. A 30 inch long entrance baffle is used (replaces standard 15 inch baffle) and therefore adds 15 inches to the overall length of the furnace.

15.8.1 Alarm interlocks are provided for failures as follows:

15.8.1.1 Low igniter current or voltage
15.8.1.2 Low nitrogen flow to curtains
15.8.1.3 Low nitrogen flow to eductors
15.8.1.4 Low nitrogen pressure
15.8.1.5 Low hydrogen pressure
15.8.1.6 Hydrogen LEL Level

15.8.2 Additional Safety Features

All hydrogen operation valves are slave operated using nitrogen for pilot operation. This system provides redundant protection over and above electrical interlocks because hydrogen will be pneumatically turned off if nitrogen pressure drops or fails.

15.8.3 The following flowmeters, calibrated for hydrogen use, are provided for hydrogen control:

Zones 1 - 2	12-120
Zones 3 - 4	12-120
Zones 5 - 6	12-120
Zones 7 - 8	12-120
Chamber Total	480

NOTE: All units are in SCFH hydrogen

15.8.4 The following flowmeter calibrated for nitrogen use is provided for the added exhaust venturi in the exit baffle section.

Exit Baffle Venturi 0-100

Note: Unit above is in SCFH Nitrogen

15.8.5 Hydrogen Supply

15.8.5.1 Volume:

MAXIMUM CONSUMPTION
480

NOTE: All units are in SCFH Hydrogen

15.8.5.2 Composition (recommended):

15.8.5.2.1 O_2: 10 ppm maximum
15.8.5.2.2 N_2: 1000 ppm maximum
15.8.5.2.3 Hydrocarbons: 100 ppm maximum
15.8.5.2.4 Moisture: 20 ppm maximum
15.8.5.2.5 CO_2: 100 ppm maximum
15.8.5.2.6 Inert Contaminants: 1000 ppm maximum

15.8.5.3 Pressure: 70 psig, regulated, (483 kpa) maximum

15.8.6 Hydrogen Safety

Hydrogen is a flammable gas, and it must be used with the proper safety precautions. It is recommended that whenever flammable gas is used to supply the furnace, a hydrogen or combustible gas detector is used to monitor the furnace environment. Plumbing failures, incorrect furnace operation, or inadequate flow settings could release hydrogen into the environment and this should be detected. Hydrogen detectors, such as included in the Options section, should be installed for warning and supply shut off. The hydrogen operation feature includes OA, Oxygen Analyzer and monitoring system, as described in the Options section. In order to comply with the NFPA safety codes it is mandatory that a hydrogen detector or equivalent facility-supplied combustible gas monitor be installed and operational at the furnace.

*Certification will be required from the customer stating that they will install/already have, a hydrogen detection device or equivalent combustible gas monitor installed at the furnace if the HD option is rejected.

15.8.7 Hydrogen/Nitrogen Mixing (NHM Option)

This option provides the facility to mix hydrogen and nitrogen using furnace controls as well as the ability to vary the nitrogen hydrogen ratio along the length of the furnace and cooling section (optional). A selection of the mix gas mode on the microprocessor allows gas to flow through both the nitrogen and hydrogen flowmeters, and allows different zones to receive gas with different N_2/H_2 ratios.

15.9 High Voltage Operation (HV-3 Option)

This option provides for operation on 380, 415, 440, or 480 V, 50/60 Hz. This requires a 4 wire service, 3 phase with safety ground but not neutral. Peak instantaneous power consumption, when selecting this option, will be as shown in Section 2.1.

15.10 Interface Roller (IR Option)

This option provides rollers at the entrance and exit that permit transfer of small boards across the larger diameter drums at the ends of the furnace. The rollers will be less than 2.5 inches (6.4 cm) in diameter and will permit transfer of boards as small as 5 inches (12.7 cm) in length.

15.11 Light Tower (LT)

This option provides a three stage alarm status light tower. The status system has three solid state relay outputs, and activates a three element alarm light, located above the upper frame, as follows:

15.11.1 Red Indicator: Alarm Condition
15.11.2 Yellow Indicator: Process Not Ready, No Alarms
15.11.3 Green Indicator: Process Ready, No Alarms

15.12 Moisture Analyzer (MA)

This option provides a moisture monitoring system for the process atmosphere. A gas sample is withdrawn continuously from one of the sample ports 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 1 um filter for removal of particulate from the sample flow, as well as a purge system to improve cell response during start-up of sampling. The sampling system provides four (4) selectable inputs; three (3) sample ports in the furnace, and one port and 2 psi regulator for source gas monitoring or cell purging.

15.13 Oxygen Analyzer (OA)

This option provides an oxygen monitoring system for the process atmosphere. 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 1 um filter for removal of particulate from the sample flow, as well as a purge system to improve cell response during start-up of sampling. The sampling system provides four (4) selectable inputs; three (3) sample ports in the furnace, and one port and 2 psi regulator for source gas monitoring or cell purging.

ℜ 15.14 On Screen Profiling (OSP)

Optional On Screen Profiling is designed to store data points up to 60 readings per second and to automatically integrate belt speed/process length to calculate the time increment. Six thermocouple outputs can be plotted simultaneously in operator selectable ranges.

Six data segment pointers are available to closely examine data segments along the time axis. These pointers can be placed as necessary to generate instantaneous temperature readouts at any point or rate of change data between cursors.

Data management includes provisions for complete identification, disc storage, and printouts in either tabular or graphical format.

Profile "predictor" software is also included with this option.

15.15 Overtemperature Shut Down (OT)

This option provides an overtemperature scanner to monitor each zone and respond to overtemperature conditions. A dual thermocouple is provided with independent elements for zone monitoring and control. The redundancy in the sensors is designed to provide shut down of the heat even in the event of multiple component failures. The overtemperature shut down system allows operator selection of the maximum temperature and will shut down the heating elements if that temperature is exceeded. This system is factory set to shut down at 50°C above the rated temperature of the furnace or 999°C, whichever is lower.

15.16 Printer and Printer Cable (PPC)

An industry standard dot matrix printer with a parallel port is provided for printout of screen information or other reports. Color feature is optional

15.17 Spare Parts Kits (SP-1 and SP-2)

These options provide a set of spare parts for the system that are preselected for one (SP-1) or two (SP-2) years of operation. The kits are made available at a substantial discount when selected as a furnace option.

15.18 Low Friction Teflon/Quartz Wearstrips (TQ)

This option adds teflon and quartz wearstrips at critical points in the furnace to reduce metal-to-metal contact between the belt and stationary sections, thereby reducing particulate contamination. Teflon wearstrips will be added between the conveyor belt and load/unload station support surfaces; quartz wearstrips will replace formed metal supports in the cooling sections.

15.19 Ultrasonic Belt Cleaner (UC)

This option adds an ultrasonic tank and timer to provide cleaning of the belt. The belt is drawn through an ultrasonic tank controlled by a timer. Facility is provided to connect the system to plant water and drains.

15.20 Ultrasonic Cleaner with Dryer (UCD)

This option adds an ultrasonic tank and timer system to provide automatic cleaning and drying of the belt. The belt is drawn through an ultrasonic tank that is automatically filled by a timer and control circuitry. Facility is provided to connect the system to plant water and drains. This option includes a compressed air blowoff system (15 and 24 inch models only) and a heated belt dryer to remove all moisture from the belt following cleaning, eliminating the introduction of moisture into the furnace at belt speeds of up to 30 ipm.

15.21 Uninterruptible Power Supply (UPS)

This option adds an uninterruptible power supply, which keeps the belt, fans, and control system running 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, whether provided by generator backup or city power. 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.

15.22 Water Cooling (WC)

The controlled atmosphere cooling tunnel is fitted with optional water cooling coils made of copper tubing. Because product temperature is continuously dropping while advancing through the tunnel, water cooling is used exclusively to insure high rates of heat transfer. The cooling section is 90 inches long and has grid cooling coils installed both top and bottom on the outside surfaces of each of the three thirty inch heat sinks. Grid cooling coils are also provided on the top and bottom outside surfaces of the fifteen inch transition tunnel aluminum heat sinks. Cooling water is customer supplied. A temperature sensing thermocouple is installed in the water output lines and is linked to the monitor to display water output temperature. Water plumbing lines to the grid cooling coils will be wrapped in insulation to prevent condensation.

15.22.1 Cooling Water (Customer Supplied)
Average Flow: 12 gpm @ 30 psi
Inlet Temperature Recommended: 20°C (68°F) or lower

15.23 High Traction Transport Drive (HTTD)

This option increases the pulling power of the transport drive at low speeds by over 100%. The modification requires decreasing the dynamic range of the drive system from 20:1 to 10:1. The top speed of the system will be geared for 20 in/min. See paragraph 7.2.

NOTE: The slowest transport speed available will be 1/10 of top speed. In addition to the special gearing, this modification replaces the standard pinch roller springs with pneumatic cylinders and an adjustable air regulator to control tension. An accumulator and check valve maintains constant tension, even if the plant air pressure drops below setpoint. The standard safety slip clutch rated at 40 lb/ft is upgraded to 110 lb/ft to complete the modification.

15.24 SMEMA Sensor Switching

This option provides entrance and exit on/off software switching for SMEMA sensors.

15.25 High/Low Temperature Limits for Cooling

This option provides software and hardware for programmable high and low water cooling temperature limits. Two thermocouples are included and installed in the water input and output ports. The incoming source water will be used for low temperature limit and the discharge water from the cooling section will be used as the high temperature limit.

RNACE ORDER 4/22/98 Factory Order No. 32526

OK/cm

Commission Information
Split Commission Yes No
Due on Invoice No.
Account Name
Pay Commission to: Advantec
Percent basic unit: 4 Percent Options: 4
Mail extra copies of invoice to: (Exclusive of Advantec crating + start-up)
Commission Amount (Split) $
Commission Amount (Non Split) $

Sold To:
AMD
P.O. Box 3622, M/S 3
Sunnyvale CA 94088-3622
Attn: Accounts Payable

Ship to:
Advanced Micro Devices - Plant
Free Trade Zone Batu Uban
Pulau Pinang Malaysia Attn: Receiving
Customer Contact:
Telephone No.:
Purchasing Name: Donna Rosemont
Telephone No.: 408-982-6637

START-UP (YES) NO

DATE OF ORDER	ORDER REC FROM	ORDER TAKEN BY	SOURCE INSPECT	CUSTOMER PO.	DISCOUNT	RTC REP.	INSURANCE
4/22/98	Dan Raatjes	C. Richert	(YES) NO		10.5%	Advantec	YES (NO)
__TAXABLE __RESALE __O.O. STATE ✓O.O. COUNTRY	TERMS __NET 30 FROM DATE OF SHIP __LETTER OF CREDIT __40%DOWN,BAL 20 DAYS FDOS ✓OTHER 30% Down	SHIP VIA __VAN ✓AIR __TRUCK __CRATED __CALL CUSTOMER __BEST WAY __OCEAN __UPS			__FOB DESTINATION ✓FOB FACTORY EARLY SHIP OK YES NO	SHIP DATE 7/17/98	✓SHIP COLLECT __PREPAID __PREPAY & BILL

Basic Equipment 60% Net 30 days from date of shipment; 10% Net 30 days from final acceptance. Acceptance not to exceed 45 days from date of shipment if no fault of RTC. Traffic Contact: Telephone:

MODEL NO. S-1215X
BELT WIDTH 15"
VOLTAGE: 415 Volt 3 Phase 50 Hz

SPECIFICATION NO. 77104, RWD
APPLICATION

BASE PRICE	$ 112,100
OPTIONS	$ 118,050
TOTAL WITH OPTIONS	$ 230,150
TOTAL LESS DISCOUNT	$ 205,984
TRAVEL/FREIGHT CHARGES	$ 3,500
CRATING	$ 4,450
L/C DOC. & HANDLING	$ —
TOTAL ORDER	$ 213,934

QTY	DESCRIPTION	UNIT PRICE	TOTAL	QTY	DESCRIPTION	UNIT PRICE	TOTAL
	AA: EC Auto Width Adjustment				PA-1: Profiling Accessories Kit, 1 Channel		
	AFR: Air Filter/Trap/Regulator				PA-3: Profiling Accessories Kit, 3 Channel		
	APS: Air Purification System				PH-4: Four Inch Parts Clearance		
	BC: Flat Brush Belt Cleaner				PPC: Printer & Printer Cable		
	BTS: Board Transfer System				PPD: Process Profile Development		
	CC: 30" Controlled Atmosphere Cooling Module				PC: Mobile Cart		
✓	CE-HT-15: Conveyor/Frame Extension Entrance ✓ Exit	1050			PMP-1: Panel Mounted Profiler, 1 Channel		
✓	CFS: Coolant Alarm Flow Switch	760			PMP-3: Panel Mounted Profiler, 3 Channel		
	CM: 30" Turbulent Air Cooling Module				QEH: Quad Edge Heat		
	CTB: Cleat Track Belt				RBC: Rotary Brush Belt Cleaner		
	DS-310: Dryer Section, Single Zone			✓	SP-1: Spare Parts Kit - 1 year	4500	
	DS-315: Dryer Section, Single Zone				SP-2: Spare Parts Kit - 2 years		
	DS-610: Dryer Section, Two Zones				SP-EC: Edge Conveyor Spare Parts Kit		
	DS-615: Dryer Section, Two Zones			✓	SPECIAL PAINT	550	
	DS-624: Dryer Section, Two Zones			✓	SPLIT FOR SHIPMENT	N/C	
	EC: Edge Conveyor Transport				TIC: Temperature Indicator Water Cooling		
✓	EM: Element Monitor	6600			TP-5: Wireless Thermal Profiler, 5 Channel		
	FRC: Fan Rapid Cooling				TCW-1: Thermocouple Wheel, Single Only		
	HC: Hermetic Chamber				TCW-3: Thermocouple Wheel, Triple Only		
	HCS: Host Communication Software Program				TC-20: 20 Foot "K" Thermocouple		
✓	HD: Hydrogen Detector	9200			UC: Ultrasonic Belt Cleaner		
	HEH: Hex Edge Heat			✓	UCD: Ultrasonic Cleaner with Dryer	8350	
✓	HO/NHM/~~OA~~: Hydrogen Operation	14900			UV: Ultrasonic Curing Section		
✓	HV-3: 380/415/440/480 High Voltage Operation	1050		✓	UPS: Uninterruptable Power Supply	3250	
	IFC: Installation/Facility Checkout			✓	WC: Water Cooling	3900	
	IPS: Input Pressure/Alarm Switch entrance/exit only				CR-1: Single Channel Chart Recorder Only		
✓	IR: Interface ~~Rollers~~ small dia. rollers at	N/C			CR-3: Three Channel Chart Recorder Only		
✓	KIC: KIC Profiler, 650°C operation	18,650		✓	TQ: Teflon/Quartz Wear strip	2700	
	ITB: Independent Top & Bottom Temperature Control			✓	Stainless Steel Work Surfaces.	700	
	LFI: Line Filter				Entrance & Exit. & Extensions		
	LRS: Low Range Belt Speed			✓	Belt Slip Interrupter	N/C	
✓	LT: Process Ready/Alarm Light Tower	850		✓	Lexan Shields	2200	
✓	MA: Moisture Analyzer + Sampling System	9950		✓	CB: Circuit Breaker	2700	
✓	OA: Oxygen Analyzer	10,600			TERMS: 40% Down, Balance Net 20 days fdos		
	OSP: On-Screen Profiling in Real Time, 3 trace			✓ (2)	(~~1~~) day electrical/mechanical start-up assistance and service maintenance training at customer's facility. FOB ~~Anaheim~~, CA Fullerton (assembly)	N/C	
✓	OT: Overtemperature Shutdown	2780		✓	Travel costs will be billed at actual (estimated)	3500	
				✓	(2)(~~3~~) manuals	N/C	

OPTION TOTAL: $118,050

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SPECIAL INSTRUCTIONS:

END USER:

RNACE ORDER

Factory Order No. 32526

Commission Information
Split Commission Yes No
Due on Invoice No._____
Account Name_____
Pay Commission to:_____
Percent basic unit:_____Percent Options:____
Mail extra copies of invoice to:
_____
_____
Commission Amount (Split) $_____
Commission Amount (Non Split) $_____

Sold To:
AMD

Ship to:

Customer Contact:_____
Telephone No.:_____
Purchasing Name:_____
Telephone No.:_____

DATE OF ORDER	ORDER REC FROM	ORDER TAKEN BY	START-UP YES NO / SOURCE INSPECT YES NO	CUSTOMER PO.	DISCOUNT	RTC REP.	INSURANCE YES NO
___TAXABLE ___RESALE ___O.O. STATE ___O.O. COUNTRY	TERMS ___NET 30 FROM DATE OF SHIP ___40%DOWN,BAL 20 DAYS FDOS	___LETTER OF CREDIT ___OTHER	SHIP VIA ___VAN ___AIR ___TRUCK ___CRATED ___CALL CUSTOMER	___BEST WAY ___OCEAN ___UPS	___FOB DESTINATION ___FOB FACTORY _____ EARLY SHIP OK YES NO	SHIP DATE	___SHIP COLLECT ___PREPAID ___PREPAY & BILL

Basic Equipment Traffic Contact: Telephone:

MODEL NO. _____
BELT WIDTH _____
VOLTAGE:_____Volt_____Phase_____Hz

SPECIFICATION NO. _____
APPLICATION _____

BASE PRICE $_____
OPTIONS $_____
TOTAL WITH OPTIONS $_____
TOTAL LESS DISCOUNT $_____
TRAVEL/FREIGHT CHARGES $_____
CRATING $_____
L/C DOC. & HANDLING $_____
TOTAL ORDER $_____

QTY	DESCRIPTION	UNIT PRICE	TOTAL	QTY	DESCRIPTION	UNIT PRICE	TOTAL
	SMEMA Interface: SMEMA conditions for furnace. With the exception of the 0.375" gap called out by SMEMA, RTC will comply with and provide the SMEMA interface requirements for both 2 and 3 lane configurations. This Includes sensors for each lane at the entrance and exit ends, as well as the Corresponding "Busy/Ready" and "Boat Available" signals 5,300.00				Channel		
	Manual Adjustable Guides: A manually adjustable guide system will be installed by RTC at the takeoff end of the furnace to align product boats to within 0.030" for transfer to the shuttle pickup mechanism. The manually adjustable guide system can be set for 2 or 3 lanes. Lane selection is going to be part of the RTC furnace "process recipe." Software provisions will be provided for the selection of 1, 2, or 3 lanes to prevent the unused SMEMA lanes from adversely interfering with the line operation 3,450.00				Channel Channel Channel ts Kit		
	Drum drive belt system with same mesh belt as used with clear track system ..... N/C				Cooling		
	HTTD: High traction transport drive 3,250.00				5 Channel		
	(2) thermocouples for water cooling. One for high temp limits (output) and one for low (input). Hardware and software included 950.00				ngle Only iple Only		
	Receptacles for wrist straps at entrance and exit ends with the furnace for standard Banana jacks ..... N/C				yer		
	Plumbing grounding ..... N/C						

	IFC: Installation/Facility Checkout				WC: Water Cooling		
	IPS: Input Pressure/Alarm Swtich				CR-1: Single Channel Chart Recorder Only		
	IR: Interface Rollers				CR-3: Three Channel Chart Recorder Only		
	KIC: KIC						
	ITB: Independent Top & Bottom Temperature Control						
	LFI: Line Filter						
	LRS: Low Range Belt Speed						
	LT: Process Ready/Alarm Light Tower						
	MA: Moisture Analyzer						
	OA: Oxygen Analyzer				TERMS: 40% Down, Balance Net 20 days fdos		
	OSP: On-Screen Profiling in Real Time, 3 trace				(1)(2) day electrical/mechanical start-up assistance and service maintenance training at customer's facility, TOR Anaheim, CA		
	OT: Overtemperature Shutdown				Travel costs will be billed at actual		
					(2)(3) manuals		

OPTION TOTAL:

SPECIAL INSTRUCTIONS:
_____
_____
_____

END USER:_____
_____
_____

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CUSTOMER AMD

F.O.# 32526

PRODUCTION CONFIGURATION CHECKLIST

YES	NO	
____ YES	____ NO	AA: EDGE CONVEYOR AUTOMATIC WIDTH ADJUSTMENT
____ YES	____ NO	AFR: AIR FILTER/TRAP/APPLICATOR
____ YES	____ NO	APS: AIR PURIFICATION SYSTEM
____ YES	____ NO	BC: FLAT BRUSH BELT CLEANER
____ YES	____ NO	BTS: BOARD TRANSFER SYSTEM
✓ YES	____ NO	CE-HT: CONVEYOR EXTENSIONS: ____ ENTRANCE ✓ EXIT
____ YES	____ NO	CPC: COLOR PRINTER & CABLE
____ YES	____ NO	EC: EDGE CONVEYOR TRANSPORT
✓ YES	____ NO	EM: ELEMENT MONITOR
____ YES	____ NO	HC: HERMETIC CHAMBER
____ YES	____ NO	HC/CC: HERMETIC CHAMBER & CONTROLLED ATMOSPHERE COOLING
____ YES	____ NO	HCS: HOST COMMUNICATION SOFTWARE PROGRAM
✓ YES	____ NO	HD: HYDROGEN DETECTOR
✓ YES	____ NO	HO/NHM/~~OA~~: HYDROGEN OPER./NITROGEN-HYDROGEN MIX/~~OXYGEN ANALYZER~~
✓ YES	____ NO	HV-3: HIGH VOLTAGE OPERATION
✓ YES	____ NO	IR: INTERFACE ROLLER
____ YES	____ NO	LFI: LINE FILTER
____ YES	____ NO	LRS: LOW RANGE BELT SPEED
✓ YES	____ NO	LT: PROCESS READY/ALARM LIGHT TOWER
✓ YES	____ NO	MA: MOISTURE ANALYZER AND SAMPLING SYSTEM
____ YES	____ NO	MV-1: MEDIUM VOLTAGE OPERATION
✓ YES	____ NO	OA: OXYGEN ANALYZER AND SAMPLING SYSTEM
____ YES	____ NO	OSP: ON SCREEN PROFILING IN REAL TIME, 3 TRACE
✓ YES	____ NO	OT: OVERTEMPERATURE SCANNER/SHUTDOWN SYSTEM
____ YES	____ NO	PA-1, 3: PROFILING ACCESSORIES KIT
____ YES	____ NO	PH-4: FOUR INCH PARTS CLEARANCE
____ YES	____ NO	PMP-1,3: PANEL MOUNTED PROFILER
____ YES	____ NO	PPD: PROCESS PROFILE DEVELOPMENT
✓ YES	____ NO	SPARE PARTS KIT: ✓ SP-1 ____ SP-2 ____ SP-EC
____ YES	____ NO	TP-5: WIRELESS THERMAL PROFILER, 5 CHANNEL
____ YES	____ NO	UC: ULTRASONIC BELT CLEANER-CHEAP
✓ YES	____ NO	UCD: ULTRASONIC CLEANER WITH DRYER
✓ YES	____ NO	UPS: UNINTERRUPTABLE POWER SUPPLY
____ YES	____ NO	UV: ULTRAVIOLET CURING SECTION
____ YES	____ NO	DCS: DISTRIBUTED CONTROL SYSTEM, (PC CONTROLLER)
____ YES	____ NO	SPECIAL BELT WEAVE
✓ YES	____ NO	SPECIAL COLOR PAINT Exterior Paint Color, Stone Gray, Sherwin Williams, Code F63TXA C352-2322, Polane-T texture
✓ YES	____ NO	SPECIAL COOLING SECTIONS (See Spec)
✓ YES	____ NO	SPECIAL PLUMBING OR VALVING Water Cooling Coils (see spec)
____ YES	____ NO	SPECIAL SAMPLE PORTS
✓ YES	____ NO	SPLIT FOR SHIPMENT
____ YES	____ NO	STANDARD BAFFLE HEIGHT
✓ YES	____ NO	NON-STANDARD BAFFLE HEIGHT; SIZE: (Same as 1st furnace)

✓ YES ____ NO OTHER SPECIAL OPTIONS:

- TQ: Teflon/Quartz wearstrips
- WC: Water cooling in rapid cool transition tunnel and controlled atmosphere
- CFS: Coolant alarm flow switch
- Stainless steel work surfaces, entrance and exit and extensions
- KIC: KIC Profiler, 650°C operation
- Lexan Shields
- Circuit Breaker
- SMEMA interface
- HTTD: High traction transport drive
- Manual adjustable guides
- Receptacles for wrist straps at entrance and exit ends with the furnace for standard Banana jacks
- Belt slip interrupter (now standard with Bodine/OPTO22 package)

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Notes
