

OmniFlo™ 7

FORCED CONVECTION REFLOW SYSTEM

ENGINEERING DATA SHEET

I. FORCED CONVECTION HEATING MODULE:

STANDARD FEATURES:

- Seven (7) heating zones (seven top and seven bottom forced convection heaters).
- One piece cast aluminum panel heaters with embedded heating elements.
- One (1) high volume forced convection blower in top and bottom zones 1 to 5. Zones 6 and 7 have two (2) forced convection blowers each on the top and one (1) forced convection blower each on the bottom.
- Three (3) speed settings for blowers, providing approximately 100%, 75%, and 50% of convection flow. (Zone 1 blowers can be independently locked to low speed via software to reduce the total nitrogen consumption and oxygen ppm levels.)
- Blower failure detection (including blower power failure) with feedback to computer and on-screen warning.
- One (1) mechanical power lifts with ratchet clutch to provide computer controlled automated opening and closing of external hood and upper part of heating chamber tunnel, allowing full access to interior.
- Multifunctional custom extrusion tunnel walls providing captive hardware mounting slots, integral nitrogen feed line, positive chamber sealing, and thermocouple wireways.

OPTIONS:

- **RailHeat** tubular heaters located in pin chain conveyor rails to fine-tune temperature distribution across the process width.
Note: Available only with optional Pin Chain, Combination Pin Chain / Mesh Belt, or DualTrak conveyor systems.
 - Mounted to the pin chain conveyor rails and positioned in the last 1½ zones of the heated process chamber.
 - Reduced thermal gradients and additional process flexibility through independently controlled edge temperature setpoints.
- **IHTSC** (Independent High Temperature Safety Circuit) which provides backup against thermal runaway.
 - Optional safety circuit trips at 410° C (770° F) and cuts power to all heaters via main contactor.
 - Totally independent of machine process controls (not dependent on computer or software).
 - Main disconnect must be reset before machine can be powered up again after the safety circuit is tripped.

SPECIFICATIONS:

- Heating chamber length: 98.0" (2489 mm) - dimension does not include the length of the cooling module
- Panel heater dimensions: Length: 12.0" (305 mm) each
Width: 24.0" (610 mm) each
- Heater power rating: 8000W per panel heater @ 240/415/480V in zones 1 and 7 (top and bottom)
4320W per panel heater @ 240/415/480V in zones 2 - 6 (top and bottom)
1000W per rail heater @ 240/415/480V (optional)
- Maximum heating capacity: 77.2 kW (263,600 BTU/hr) @ 240/415/480V
- Heater control: Proportional-Integral-Derivative (PID) heater control; software adjustable
- Thermocouples: K-type; grounded junction; stainless steel sheathed; stainless steel overbraid
- Heater temperature range: 0° - 280° C (0° - 536° F) measuring forced convection gas temperature
- High temperature protection: Standard machine controls have 3 levels of built-in thermal protection for the heating section:
 - Process temperature deviation alarms (factory set defaults, user selectable parameters)
 - High temperature limit alarm (factory set defaults, user selectable parameters)
 - Thermocouple failure detection (non-adjustable)
- Temperature control accuracy: ±1° C (±2° F) at no-load steady state.
- Bare board maximum ΔT: Without Rail Heaters: ±4° C (±7° F) **Note:** Typical is less than ±2° C (±4° F)
With Rail Heaters: ±2° C (±4° F) **Note:** Typical is less than ±1° C (±2° F)
- Forced convection blowers: High volume forced convection; high temperature sealed bearing; built-in thermal overload protection; class F insulation; re-useable silicone gaskets; quick release electrical connections
- Blower rating at 0 static pressure: 160 cfm (270 m³/hr), 50/60Hz, 230 VAC, 115 W, 0.50 amp

FORCED CONVECTION HEATING MODULE (cont.)

- Total forced convection:

	<u>60 Hz</u>	<u>50 Hz</u>
Top (9 blowers):	1440 cfm (3240 m ³ /hr)	≅ 1368 cfm (3078 m ³ /hr)
Bottom (7 blowers):	1120 cfm (2700 m ³ /hr)	≅ 1064 cfm (2565 m ³ /hr)
Total (16 blowers):	2560 cfm (5940 m ³ /hr)	≅ 2432 cfm (5643 m ³ /hr)

Note: Differences in cfm rating between 50 Hz and 60 Hz show less than ±2° C (±4° F) thermal profile variance between identical process parameters on typical assemblies.
- Typical start-up time: Ambient to full process ready state: 15 min. (±5 min.) (Start-up time may be influenced by convection speed, process temperature setpoints, and power limiting feature.)

II. FORCED CONVECTION AIR COOLING MODULE:

NOTE: For inert atmosphere machines, the standard Forced Convection Air Cooling Module is not installed. Refer to section IV.

STANDARD FEATURES:

- Access to cooling zones is independent of heated chamber section.
- Two (2) cooling zones (top cooling only).
- One (1) high volume forced convection blower in each top cooling zone.
- Three (3) speed settings for blowers, providing approximately 100%, 75%, and 50% of convection flow. (Blower speed settings are independent between cooling zones, providing adjustable cooling rates. Cooling Zones 2 & 3 also have on/off capability.)
- Cooling Zone 1 (Exhaust/Cooling module) includes two lip vents with one cross-flow blower in between; first vent goes to exhaust system; second vent recirculates via plenum to blower inlet to reduce exhaust system requirements.
- Cooling Zone 2 includes one lip vent with one cross-flow blower; flow inlet recirculates via plenum to blower inlet to reduce exhaust system requirements. (Flow inlet draws ambient air for maximum product cooling).
- Thermocouple in Cooling Zone 1 to monitor cooling zone temperature; user selectable alarm parameters. (Thermocouple monitors forced gas convection temperature.)

SPECIFICATIONS:

- Cooling chamber length: 32" (812 mm)
- Thermocouple(s): K-type; grounded junction; stainless steel sheathed; stainless steel overbraid
- Cooling temperature alarm range: 50° - 115° C (122° - 239° F) measuring forced convection gas temperature
- High temperature protection: Standard machine controls have 2 levels of built-in thermal protection for the cooling section:
 - High temperature limit alarm (factory set defaults, user selectable parameters)
 - Thermocouple failure detection (non-adjustable)
- Forced convection blowers: High volume forced convection; quick release electrical connections
- Blower rating at 0 static pressure: 350 cfm (595 m³/hr), 230 VAC, 50/60 Hz, 64 W, 0.28 amp
- Total forced convection:

	<u>60 Hz</u>	<u>50 Hz</u>
Cooling Zone 1 (1 blower):	350 cfm (595 m ³ /hr)	≅ 332 cfm (565 m ³ /hr)
Cooling Zone 2 (1 blower):	350 cfm (595 m ³ /hr)	≅ 332 cfm (565 m ³ /hr)
Total Cooling (2 blowers):	700 cfm (1190 m ³ /hr)	≅ 664 cfm (1130 m ³ /hr)

Note: Differences in cfm rating between 50 Hz and 60 Hz show less than ±2° C (±4° F) thermal profile variance between identical process parameters.

III. INERT ATMOSPHERE HEATING MODULE (OPTIONAL):

STANDARD FEATURES:

- Sealed upper and lower heater chambers with inerting gas introduced directly to the chamber via heating tunnel extrusion.
- Gas controls including: solenoid valve on feed line, manual safety shut-off valve, pressure regulator and pressure gauge, adjustable metered flow rate.
- Computer controlled gas selector solenoid to permit recipe selection of nitrogen or compressed gas process atmosphere.
- Two (2) atmosphere isolation curtain modules (one before the first heating zone, one after the second cooling zone) prevent air infiltration to the process chamber. Each curtain module has a quick release latch for ease of maintenance.
- Retractable nitrogen containment curtain at load and unload ends on all pin chain conveyor configurations.
- Sensors on the top heating chamber and exhaust outlets to automatically shut off the main nitrogen feed when the chamber is opened or when the exhaust flow rate is too low.

INERT ATMOSPHERE HEATING (cont.):

OPTIONS:

- **Integrated Oxygen Analyzer** (wet-cell oxygen monitor):
 - On-screen display with user selectable recipe specific alarm parameters; 0 - 1000 ppm range.
 - O₂ sampling port in reflow zone with software controlled sampling frequency.
 - Valve arrangement to permit purging of instrument and sampling of feed nitrogen.
 - In-line particle filter and overpressure protection for the O₂ analyzer wet cell module.
- Note:** Use only de-ionized or distilled water when replenishing evaporated fluids in the O₂ analyzer wet cell.
- **QuickPurge** automatic nitrogen purge solenoid for reducing oxygen purge time:
 - User adjustable flow rates and timer to balance nitrogen consumption with purge time requirements.
 - Typical oxygen purge times are reduced to less than 10 minutes from ambient to fully inert.

SPECIFICATIONS:

- Required gas supply¹: Both nitrogen and clean, dry, compressed gas (CDA) supply lines should be installed
- Minimum supply line pressure: 54 psi (363 kPa)
- Maximum supply line pressure: 100 psi (670 kPa)
- Minimum available flow rate: 2500 SCFH (71 m³/hr)
- Typical nitrogen consumption²: 600 - 1500 SCFH (17 - 43 m³/hr)
- Typical oxygen levels²: 15 - 30 ppm along the length of the process tunnel
- Typical oxygen purge time (Std.): 15 min. (±5 min.) ambient to full process ready state.
- Oxygen purge time w/QuickPurge: 10 min. or less from ambient to full process ready state.

Note: Preheat zones may be higher due to load end effect and product throughput.

Note¹: External pressure regulators and gauges, shut-off valves, and filters are to be installed by the customer on the gas supply lines at the machine inputs.

Note²: Actual nitrogen consumption is strongly influenced by machine configuration and operating conditions. Severe conditions may require higher consumption rates to achieve low ppm levels. Factors influencing consumption include:

- Product width, height, required component clearance, and throughput loading or board spacing
- Forced convection speed settings in heating and cooling zones
- Conveyor configuration (Combination Pin Chain / Mesh Belt, Center Board Support, and DUALTRAK conveyor options will increase consumption when compared to Pin Chain or Mesh Belt conveyor configurations)

IV. INERT ATMOSPHERE COOLING MODULE (OPTIONAL):

NOTE: For standard air atmosphere machines, the Inert Atmosphere Cooling Module is not installed. Refer to section II.

STANDARD FEATURES:

- Two (2) sealed cooling zones (top only) with separate nitrogen feed providing recirculated inert product cooling after reflow.
- One (1) high volume forced convection blower and one (1) heat exchanger in each top cooling zone.
- Lift-up hinged housing for each module allows easy access to each cooling zone without opening the heating chamber.
- Double latching system and external quick disconnects for the water lines allows the heat exchanger to be raised with the housing or left in place over the conveyor for easy maintenance access and low production downtimes.
- Three (3) speed settings for blowers, providing approximately 100%, 75%, and 50% of convection flow. (Blower speed settings are independent between the first and last two cooling zones, providing adjustable cooling rates and time above liquidous.)
- Thermocouple in Cooling Zone 1 to monitor cooling zone temperature; user selectable alarm parameters between 50° to 115° C. (Thermocouple monitors forced gas convection temperature providing alarm/shutdown if cooling system rises above setpoint.)
- Solenoid valve on chilled water inlet cycles water on and off during controlled machine shutdown.
- Flow switches on water outlets from heat exchangers provide alarms if there is no flow of chilled water to the heat exchangers.

INERT ATMOSPHERE COOLING MODULE (cont.):

OPTIONS:

- **Cool Clean Inert Cooling** re-routes process gases to enhance the capture of flux volatiles and lengthens the time between cleaning cycles:
 - System replaces the first cooling zone only of the Inert Atmosphere Cooling Module with the new Cool Clean Inert Cooling unit.
 - Easy removable catch tray for flux volatiles to aid in the maintenance of the cooling unit.
 - Recirculating high volume forced convection blower.
 - Three (3) speed settings for blower, providing approximately 100%, 75%, and 50% of convection flow.
- **Enhanced NitroCool** gas knife cooling system in lieu of the four-zone forced convection module provides low-maintenance cooling:
 - Two (2) heat exchangers: one (1) heat exchanger in Cooling Zone 1 (with no forced convection blower); one (1) high volume forced convection blower and one (1) heat exchanger in top Cooling Zone 2.
 - Cooling Zone 1 module has three (3) gas knives with associated gas flow controls (one for A/K 1 and one for A/K 2&3).
 - Automatic software controlled self-clean heat cycle for the gas knives to burn off flux residues.
 - Quick release gas knives and gas knife heaters provide ease of maintenance when required.
 - Three (3) speed settings for Cooling Zone 2 blower, providing approximately 100%, 75%, and 50% of convection flow. (Blower speed settings for Cooling Zones 2, and 3 also have on/off capability.)
- **Matched External Water Chiller** (refrigerated, compressor type):
 - This option is only required if a factory chilled water supply or water-to-drain supply is not available.
 - Provides temperature controlled refrigerated coolant water to the internal heat exchanger(s) in a closed-loop water circuit.
 - Available as either an air-cooled or water-cooled refrigerated heat exchanger, according to customer requirements.
 - Please contact Electrovert regarding additional specifications for the Matched External Water Chiller.
- **Integrated Air-to-Liquid Heat Exchanger (non-refrigerated)**
 - This option is only available in conjunction with the Standard NitroCool gas knives cooling option, and cannot be used with the standard inert cooling module or with the Integrated Flux Management (IFM) option
 - Provides on-board water cooling to the internal heat exchanger in a closed-loop water circuit
 - Ambient air-to-liquid heat exchanger (no refrigerant compressor)
- **On-Board Refrigerated Chiller**
 - Closed-loop chilled water in space saving footprint.
 - Contact factory for pricing and details
- **Spare Standard Heat Exchanger:**
 - This option provides a spare radiator for the cooling section on inert atmosphere cooling modules.
 - Enables quick exchange of the radiators during maintenance of the cooling section.
 - Four radiators are required for the OmniFlo 10E cooling module.
- **Process Volatile Active Cleaning (PVAC)**
 - Replaces the first Cooling Zone with the PVAC Inert Cooling Unit
 - Re-routes process gases to control cooling slopes and lengthen the time between cleaning cycles

SPECIFICATIONS:

- Cooling chamber length: 32" (812 mm)
- Thermocouple(s): K-type; grounded junction; stainless steel sheathed; stainless steel overbraid
- Cooling temperature alarm range: 50° - 115° C (122° - 239° F) measuring forced convection gas temperature
- High temperature protection: Standard machine controls have 2 levels of built-in thermal protection for the cooling section:
 - High temperature limit alarm (factory set defaults, user selectable parameters)
 - Thermocouple failure detection (non-adjustable)
- Forced convection blowers: High volume forced convection; high temperature sealed bearing; built-in thermal overload protection; re-useable silicone gaskets; quick release electrical connections
- Blower rating at 0 static pressure: 160 cfm (270 m³/hr), 50/60Hz, 230 VAC, 115 W, 0.50 amp
- Total forced convection:

	<u>60 Hz</u>	<u>50 Hz</u>
Cooling Zone 1 (1 blower):	160 cfm (270 m ³ /hr)	≅ 152 cfm (256 m ³ /hr)
Cooling Zone 2 (1 blower):	160 cfm (270 m ³ /hr)	≅ 152 cfm (256 m ³ /hr)
Cooling Zone 3 (1 blower):	160 cfm (270 m ³ /hr)	≅ 152 cfm (256 m ³ /hr)
Total Cooling (4 blowers):	480 cfm (1080 m ³ /hr)	≅ 456 cfm (1024 m ³ /hr)

Note: Differences in cfm rating between 50 Hz and 60 Hz show less than ±2° C (±4° F) thermal profile variance between identical process parameters.

INERT ATMOSPHERE COOLING MODULE (cont.):

- NitroCool gas flow: 400 SCFH (11.5 m³/hr) maximum per gas knife (qty. 3)
Note: This gas flow is part of the flow requirement specified in Section III for inerting, not in addition, therefore will not increase the total nitrogen consumption requirements.
- Chilled water requirements: These specifications are listed for factory supplied chilled water requirements only.
 - Flow rate: 1.0 - 3.0 US gal/min (3.79 - 11.4 l/min)
 - Inlet size and pressure: 0.5" male NPT; 45 - 70 psi (310 - 483 kPa)
 - Pressure drop: 30 psi @ 3 US gal/min (200 kPa @ 11.4 l/min)
 - Feed temperature: 7° - 30° C (45° - 86° F)
 - Check valve: To be installed by customer on return line to factory chilled water system**Note:** Typical temperatures in the cooling zone range from 30° - 100° C (86° - 212° F). Coolant flow rates and temperatures of the factory chilled water supply, optional external chiller, or optional integrated heat exchanger may be modulated to give higher temperatures in the cooling zone which may reduce maintenance requirements in some applications. The machine will operate normally, provided that the maximum permitted temperature of the cooling zone heat exchanger is not exceeded.

V. CONVEYOR MODULE:

STANDARD FEATURES:

- Mesh Belt conveyor; 304 stainless steel
- DC motor with closed-loop speed control; pulse feedback from digital shaft encoder
- Product input photocell for on-screen product monitoring and recipe specific work-in-process tracking
- Conveyor direction: left-to-right

OPTIONS:

- **Pin Chain Conveyor** with computer controlled motorized width adjust in lieu of standard mesh belt; semi-automatic oiler system for pin chain conveyor.
- **Standard 135mm DualTrak Conveyor** – available as an option with the Pin Chain Conveyor. Additional pin chain conveyor for dual track throughput; semi-automatic oiler system for each pin chain conveyor
 - Dual Pin Chain Conveyors with computer controlled motorized width adjust
 - Dual process lanes allowing for doubled production throughput.
 - Computer controlled motorized width adjust for each process lane with recipe selectable width per lane.
 - Independent product input photocell on each process lane for on-screen product monitoring.
 - Independent speed control for each process lane allowing for mixed product throughput.**Note:** The Standard DualTrak Conveyor option is available *in addition to* the Pin Chain Conveyor option (not in lieu of the option).
- **Combination Conveyor:** single lane pin chain conveyor with standard mesh belt conveyor
 - Mesh Belt conveyor; 304 stainless steel, 0.5" pitch
 - Semi-automatic chain oiler system for each pin chain conveyor
 - Recipe selectable, computer controlled motorized width adjust for the Pin Chain Conveyor system.
 - Standard pin length is 0.189" (4.8 mm) . By request, 0.118" (3 mm) and 0.291" (7.4 mm) are also available at no charge.
- **CBS Conveyor** (Center Board Support) Conveyor:
 - #35 steel product support chain synchronized with pin chain conveyor speed; semi-automatic chain oiler system.
 - Automatic height retract by 0.5" (12 mm) when board support is not required.
 - Computer controlled motorized width positioning and vertical retraction. .**Note:** The Center Board Support option is only available with the Pin Chain conveyor option. It is not available with the standard Mesh Belt, Combination Conveyor, or any of the DualTrak conveyor options.
- **Auto Chain Oilers:**
 - The Auto Chain oilers option is a remote chain oil reservoir that allows the user to program the automatic oiling of the conveyor chain system. This option replaces the standard semi-automatic chain oilers.
 - The auto chain oilier option includes brush chain oilers, remote oil reservoir, and timers for operation. Air pressure is used to oil the conveyor chains on a customer selected schedule of operation. Two timers are used in the operation of the system. A hour of conveyor operation timer is used to determine the hours between the oiling of the system. Another timer is used to set the minutes of operation of the chain oilier system. Both timers allow the user to determine the schedule of operation.

CONVEYOR MODULE (cont.):

- **SMEMA 35mm DualTrak dual lane pin chain conveyor system** in lieu of the standard mesh belt conveyor
 - 35mm distance between the two (2) center rails, as well as 8.5" (215.9 mm) process width per lane for SMEMA compliance.

Note: If SMEMA compliance is unnecessary, 9.37" (238 mm) process width per lane is achievable

 - Automated chain oiler system for each pin chain conveyor
 - Computer controlled motorized width adjust for each process lane with recipe selectable process width control
 - Independent product input photocell on each process lane for on-screen product monitoring.
 - Independent seed control for each process lane allowing for mixed product throughput.
- **SMEMA 35mm Dual Combination Conveyor:** Dual lane pin chain conveyors and dual mesh belt conveyors
 - Dual Mesh Belt conveyors; 304 stainless steel, 0.5" pitch
 - Automated chain oiler system for each pin chain conveyor
 - Recipe selectable, computer controlled motorized width adjust for the Pin Chain Conveyor system.
 - Standard pin length is 0.189" (4.8 mm) . By request, 0.118" (3 mm) and 0.291" (7.4 mm) are also available at no charge
 - Independent speed control for each process lane allowing for mixed product throughput. .

Note: The SMEMA 35mm Dual Combination Conveyor is not available with a standard (single) Mesh Belt conveyor. It is **only** available with dual Mesh Belts (and dual Pin Chain Conveyors).
- **Auto Chain Oilers:**
 - The Auto Chain oilers option is a remote chain oil reservoir that allows the user to program the automatic oiling of the conveyor chain system. This option replaces the standard semi-automatic chain oilers.
 - The auto chain oilier option includes brush chain oilers, remote oil reservoir, and timers for operation. Air pressure is used to oil the conveyor chains on a customer selected schedule of operation. Two timers are used in the operation of the system. A hour of conveyor operation timer is used to determine the hours between the oiling of the system. Another timer is used to set the minuets of operation of the chain oilier system. Both timers allow the user to determine the schedule of operation.
- **Alternate Conveyor Direction**

Right-to-left in lieu of left-to-right conveyor travel.

SPECIFICATIONS:

- DC permanent magnet motor: 1/4 hp, with speed reduction gearbox
- Conveyor speed: 1 to 70 in/min (3 to 178 cm/min)
- Speed accuracy: ± 0.4 in/min (± 1.0 cm/min)
- Mesh belt process width: 21" (533 mm) maximum usable process; 22" (559 mm) overall belt width

Note: With Combination Conveyor option, the maximum usable mesh belt width is 19" (480 mm).
- Pin Chain Conveyor
 - Min: 2.0" (50 mm)
- Process Width:
 - Note:** 2.75" (70 mm) if equipped with CBS Conveyor
 - Max: 20.0" (508 mm)
- Standard DualTrak Conveyor
 - Min: 2.0" (50 mm) per process lane
 - Max: 7.4" (188 mm) per process lane
- Conveyor chain pin length:
 - Std: 0.189" (4.8 mm)
 - Opt: 0.118" (3.0 mm), 0.291" (7.4 mm), or custom lengths upon request
- Conveyor rail parallelism: ± 0.020 " (± 0.5 mm)
- Process height:
 - Belt: 2.50" (64 mm)
 - Rail: 1.50" (38 mm) above; 1.0" (25 mm) below
- Conveyor height from floor:
 - Belt: 32" (813 mm) to 36" (914 mm); adjustable by leveling bolts
 - Rail: 33" (838 mm) to 37" (940 mm); adjustable by leveling bolts

Note: The height can be raised to meet SMEMA standards. Please consult factory for details.
- Mechanical clutch torque rating:
 - 180 lb-in (20.3 Newton-m) for standard mesh belt conveyor
 - 300 lb-in (33.9 Newton-m) for optional pin chain or combination conveyor
 - 85 lb-in (9.6 Newton-m) for motorized pin chain width adjust
- Center Board Support: Requires 0.12" (3 mm) clear track on circuit board
- Semi-automatic pin chain oilers: Located at load end of conveyor rails; manual valve control and drip-rate adjustment

Note: Oilers must be configured to use 10cc's of oil per lubrication, set to approx. one drip every 7 to 10 seconds. Reference owner's manual for lubrication intervals.

VI. SYSTEM CONTROLS:

HARDWARE:

- Mechanical main power disconnect; ESD grounding jacks at load and unload ends
- Control circuit 120 volts (all systems are circuit breaker protected) with 24 VDC emergency stop circuit
- Four (4) emergency stop switches; located on the front and rear of the load and unload ends
- PC to STD bus I/O interface for controller hardware; integrated watchdog timer circuitry
- Standard PC-based computer control with the following minimum hardware setup:
 - Intel Pentium™ - based computer (166 MHz processor or faster)
 - 32Mb RAM; 256Kb cache
 - Available ISA 8-bit and 16-bit expansion slots; PCI expansion slots
 - 8X CD-ROM; 1.44Mb 3.5" floppy disk; 1.2Gb hard disk
 - SVGA monitor, PC keyboard with integrated trackball
 - One (1) EPP/ECP parallel printer port; two (2) 16550 UART compatible serial port

SOFTWARE:

- Microsoft Windows™ NT 4.0 Workstation multi-tasking operating system
- On-screen indexed help, maintenance screens, and system debug utility screens
- Real-time graphic animation of system with display of process parameters, setpoints, alarm status, and product flow tracking
- Recipe manager; stores 1000+ unique recipes for rapid process setup
- Integrated software timer utility providing programmable seven-day automatic start/stop timer
- Alarm screen containing user defined alarm parameters, actions, and high/low deadbands
- Print capability provides screen and recipe printing as well as on-line alarm logging
- History log stores machine events such as recipe changes, alarms, and start/stop functions to disk
- Software controlled thermocouple failure detection
- Integrated phased power startup and peak power limiting to 65% reduces machine peak power rating

VII. DOCUMENTATION

STANDARD FEATURES:

- Documentation Set: includes one (1) set of manuals, bills of materials, and schematics on CD ROM.

OPTIONS:

- **Additional User Manuals Set** includes one (1) additional set of complete machine user manuals in either printed format or CD ROM format.
- **Additional Documentation Set** includes the bills of materials and schematics in either printed format or CD ROM format.

Note: Printed manuals or documentation are priced higher than CD ROM format.

VIII. GENERAL SYSTEM OPTIONS:

MACHINE OPTIONS:

- **Integrated Flux Management** system enables offline flux removal with no impact on production.
 - Two (2) heat exchanger condensing units to capture flux volatiles from recirculated process gas.
 - Nitrogen purge valve arrangement for inert atmosphere configurations to purge oxygen from IFM after maintenance.
 - Chilled water requirements (specifications are listed for factory supplied chilled water requirements only):
 - Flow rate: 1.0 - 3.0 US gal/min (3.79 - 11.4 l/min)
 - Inlet size and pressure: 0.5" male NPT; 45 - 70 psi (310 - 483 kPa)
 - Pressure drop: 30 psi @ 3 US gal/min (200 kPa @ 11.4 l/min)
 - Feed temperature: 7° - 30° C (45° - 86° F)

GENERAL SYSTEM OPTIONS (cont.):

- **Spare IFM Condensers** (left and right condensers):
 - This option provides spare condensers for the Integrated Flux Management system.
 - Enables quick exchange of the filter condensers during maintenance of the IFM.
 - Two condensers are required for the IFM system.
 - **Nitrogen Ready Package** to facilitate future inerting option retrofitting:
 - Mechanical preparation includes fittings and brackets for load and unload isolation modules, retractable nitrogen containment curtain at load and unload ends for all pin chain conveyor configurations, preparatory nitrogen plumbing with nitrogen injector tubes in heating chamber, and preparatory cooling water plumbing.
 - Electrical preparation includes circuit breakers for nitrogen and coolant solenoid valves, terminal blocks or connectors for exhaust interlock switches, coolant flow switch, and cooling chamber interlock switches and relays. All electrical preparatory components are wired into the main control panel.
- Note:** Available only with air configuration machines.
- **ExternalCool** external mount cooling module
 - 350 cfm (595 m³/hr) @ 0 static pressure; 230 VAC, 50/60Hz, 64 W, 0.28 amp
 - PCB exit temperatures are typically 20° - 30° C (36° - 54° F) cooler when measured at the end of the conveyor.
 - **Light Tower** for machine status indication (3 color: red, amber, green)
 - **UPS Backup** (Un-interruptable Power Supply) battery backup (900 VA):
 - Integrated battery backup provides power to the control system and conveyor in the event of a power failure for automatic product evacuation from the process chamber; on-screen audible and visual alarms
 - On-line battery charging; 30+ minutes of battery backup with a fully charged battery
 - Continuous monitoring of line power; onboard self-test diagnostics
 - **Output Photocell** for board count verification (input photocell is standard)
 - **Programmable Outputs**¹ offers three (3) user programmable dry contact output relays
 - **SMEMA Interface**^{1,2} electrical equipment interface with connections at load and unload end of machine
- Note**¹: The SMEMA Interface utilizes two of the three available I/O channels from the Programmable Outputs option.
- Note**²: Due to the continuous nature of the reflow process, the system cannot be stopped if the downstream equipment is busy.
- **SMEMA Mechanical Interface** includes leveling leg risers to enable the top end conveyor height of the SMEMA Mechanical Interface Specification (see conveyor height dimensions for height of standard conveyors).
 - **GEM/SECS (Generic Equipment Model/SEMI Equipment Communication Standard) Communications Protocol:**
 - Year 2000 Compliant
 - Support provided via RS-232 or Ethernet link
 - Complies with SEMI standard E30-0997 (GEM)
 - Complies with SECS standards:
 - SECS-I SEMI Standard, Section E4
 - SECS-II SEMI Standard, Section E5
 - Uses SECS protocols for Message Transfer [SECS-I or HSMS (High Speed SECS Message Service)] and Message Content (SECS-II):
 - SECS-II on top of SECS-I for RS-232
 - SECS-II on top of HSMS for Ethernet
- Note:** Requires Ethernet Card Option
- **Ethernet Card** for use in connecting the machine's computer to the customer's network via Ethernet. **Note:** an Ethernet card will be needed to utilize the SECS-II portion of the GEM/SECS option, which is the preferred manner of communication of GEM/SECS data.
 - **Non-Standard Paint Color(s)** for custom appearance requirements
 - Applied to the exterior machine panels including enclosure doors, front access panels, end covers, and top access hood(s)
 - Creates ability to achieve a customized appearance or to match existing production equipment color specifications

GENERAL SYSTEM OPTIONS (cont.):

- Clean Room Class 10,000

Controls airborne particles according to Federal standard 209E – Not more than 10,000 particles per cubic foot measuring 0.5 M (micrometers) and not more than 70 particles per cubic foot measuring 5 M or greater. Enhancements include modification to the insulation to prevent release of fibers into the atmosphere.

Note: Process environment must have downdraft ventilation in a unidirectional airflow.

THERMAL PROFILING OPTIONS:

Portable Thermal Profiler Kits: Offer an easy method to measure, record and document thermal profiles.

ECD AutoM.O.L.E. â Xpert - guides you through the design of a target robust profile. The system will automatically sets-up the oven to achieve your target robust profile for a specific PCB or assembly. Then can automatically verify and adjust oven settings to be certain the target profile is actually achieved. This software interfaces with the Omniflo operating software to ensure accurate transfer of data and desired setpoints.

- **ECD Thinline SuperM.O.L.E. â** Thermal Profiler Kit including the following: SuperM.O.L.E. Thinkline Profiler, Windows™ Software, PC Interface Cable, Operations Manual, SuperM.O.L.E. Thinline Boot Thermal Barrier, Spare Lithium Battery, Two sets of Type K Thermocouples, Certificate of Traceability to N.I.S.T., Aluminum Carrying Case.
 - Five-channel portable temperature profiler
 - Temperature measurement range: -101° to 649° C (-150° to 1200° F)
 - Profiler dimensions: 0.70" H x 3.5" W x 6.5" L (17.8 mm x 89 mm x 165.0 mm)
 - Thermal barrier dimensions: 1.3" H x 5.2" W x 9.75" L (33.0 mm x 132.1 mm x 247.6 mm)
 - Lithium 6-volt battery
 - **ECD Gold SuperM.O.L.E. â** Thermal Profiler Kit including the following: SuperM.O.L.E. Gold Profiler, Windows™ Software, PC Interface Cable, Operations Manual, SuperM.O.L.E. Gold Survivor Thermal Barrier, Rechargeable Power Pack, Two sets of Type K Thermocouples, Certificate of Traceability to N.I.S.T., Power Pack Charger, Aluminum Carrying Case.
 - Six-channel portable temperature profiler
 - Temperature measurement range: -129° to 1300° C (-200° to 2372° F)
 - Profiler dimensions: 0.37" H x 3.5" W x 6.0" L (9.4 mm x 89 mm x 152.4 mm)
 - Thermal barrier dimensions: 1.4" H x 5.2" W x 10.2" L (35.6 mm x 132.1 mm x 259.1 mm)
 - Rechargeable Ni-Cad battery pack
 - **ECD Gold RF SuperM.O.L.E. â** Thermal Profiler Kit including the following: SuperM.O.L.E. Gold RF Profiler, Windows™ Software, PC Interface Cable, Operations Manual, SuperM.O.L.E. Gold Survivor RF Thermal Barrier, Rechargeable Power Pack, Two sets of Type K Thermocouples, Certificate of Traceability to N.I.S.T., Power Pack Charger, SuperM.O.L.E. Gold RF Receiver, Aluminum Carrying Case.
 - Six-channel RF portable temperature profiler with 15 user selectable RF transmission channels
 - Temperature measurement range: -129° to 1300° C (-200° to 2372° F)
 - Profiler dimensions: 0.40" H x 3.5" W x 8.8" L (10.2 mm x 89 mm x 233.52 mm)
 - Thermal barrier dimensions: 1.19" H x 4.19" W x 10.5" L (30.2 mm x 106.4 mm x 266.7 mm)
 - Rechargeable Ni-Cad battery pack
 - **SlimKIC-II™ Datalogger Kit** – connects to product with K type thermocouples and follows it through the process tunnel. Nine (9) channel unit that logs data into the profilers memory. Data can then be downloaded into a PC after it exits the machine. Comes with: SlimKIC II data acquisition unit, set of nine (9) thermocouples (K-type, .010"/0.25mm colored wire), thermal shield, PC connect/download cable (6ft (2.8m)), KIC software for Windows, user manual, calibration sheets, aluminum tape, four (4) 9V batteries, and a case.
 - **SlimKIC-II™ Transmitter Kit** – connects to product with K type thermocouples and follows it through the process tunnel. Nine (9) channel unit that transmits the data to a receiver. The receiver will need to be connected to a PC in order to download the data. Comes with: SlimKIC II data acquisition unit, receiver, power supply, set of 9 thermocouples Type-K .010" (0.25mm) colored wire, thermal shield, Communication cable to PC with pigtail to power supply (20ft (9.4m)), F-8 belt check cable, four 9-Volt batteries, KIC software for Windows, User manual, Calibration certificate, aluminum tape, and carrying case.
 - **SlimKIC-II™ Dual Kit** – connects to product with K type thermocouples and follows it through the process tunnel. Nine (9) channel unit that both logs and transmits data. This unit will log the data to memory, as well as transmit it to a receiver. Comes with: SlimKIC II data acquisition unit, receiver, power supply, set of 9 thermocouples Type-K .010" (0.25mm) colored wire, thermal shield, Communication cable to PC with pigtail to power supply (20ft (9.4m)), F-8 belt check cable, four 9-Volt batteries, KIC software for Windows, User manual, Calibration certificate, aluminum tape, and carrying case.
- Note:** all SlimKIC-II™ units have the following specifications
- Temperature measurement range: -150° C to 1050° C
 - Profiler dimensions: 0.75" H x 3.0" W x 10.5" L
 - Powered from a 9-volt alkaline battery
 - Thermal Receiver: 433.93 Mhz (on transmitter units only)

GENERAL SYSTEM OPTIONS (cont.):

- **KIC Prophet™ Thermal Manager**-. 30 thermocouples embedded inside two (2) slim stainless steel tubes/probes are permanently mounted just above or below the conveyor..
 - Temperature measurement range: -150° C to 1050°C
 - TPU (Thermocouple Processing Unit) dimensions: 2" H x 8.5" W x 13.5" L
 - Includes training by KIC personnel at the customer site

AIR PURIFICATION OPTIONS (STAND ALONE EXHAUST UNITS)

- **Electroflo 8000/2000** provides a stand alone exhaust unit that filters the exhaust and returns the air to the room.
 - Automatic Flow Control
 - Max flow rate: 2300m3/hr (1440cfm)
 - Electrical: Euro 400V, 3 phase + N, 50 Hz, 3.0 kW
US 220 V, 3 phase + N, 60 Hz, 3.4 kW
 - Sound Rating: 59 dBA
 - Cabinet size: H x W x D - 1100mm (43.25") x 690mm (27.25") x 650mm (25.5")
 - Cabinet weight: 125 kg (275lbs)
 - Vertical filter
 - Filter unit size: H x W x D - 487 mm (19.25") x 690mm (27.25") x 650mm (25.5")
 - Piping: 150mm (6")
 - System comes with one filter set
- **Spare Filter Kit** for the Electroflo 8000/2000. Includes two (2) pre-filters and one (1) HEPA filter.

IX. POWER SPECIFICATIONS:

STANDARD:

- 220-240 VAC, 3-phase, 50 / 60 Hz (4 wires: 3 phase, 1 ground)
- 380-415 VAC, 3-phase, 50 Hz (5 wires: 3 phase, 1 neutral, 1 ground)
- 440-480 VAC, 3-phase, 60 Hz (4 wires: 3 phase, 1 ground)

OPTIONAL:

- 200/208 VAC, 3-phase, 50 / 60 Hz (4 wires: 3 phase, 1 ground)

Note: Please consult the factory for special voltage and/or frequency requirements and specifications not listed.

START-UP POWER REQUIREMENTS:	kVA	220 VAC	240 VAC	380 VAC	415 VAC	440 VAC	480 VAC
- Basic system power consumption:	82.2	182 Amp	198 Amp	105 Amp	115 Amp	91 Amp	99 Amp
- Add optional rail heaters:	2.0	5 Amp	5 Amp	3 Amp	3 Amp	2 Amp	2 Amp
- Add optional external water chiller:	8.4	18 Amp	21 Amp	11 Amp	12 Amp	9 Amp	10 Amp

Note: The values listed are at maximum power consumption during full load start-up. Power consumption is lower at stabilized process conditions, as shown in the table below, but varies based on process parameters and product loading. Typical conditions will draw 20-30% of full load value (based on 20-30% duty cycle) at steady state operating conditions. The supply power requirement may also be limited through software configuration to 65% of the maximum power rating.

PROCESS-READY REQUIREMENTS:	KVA	220 VAC to 240 VAC	380 VAC to 415 VAC	440 VAC to 480 VAC
- Basic system average power consumption:	19.2	37 Amp to 60 Amp	21 Amp to 35 Amp	19 Amp to 30 Amp
- Add optional rail heaters:	1.9	1 Amp to 1.5 Amp	.6 Amp to .9 Amp	.4 Amp to .6 Amp
- Add optional external water chiller:	7.8	18 Amp to 21 Amp	11 Amp to 12 Amp	9 Amp to 10 Amp

Notes: The loads on the machine are single phase, thus load balancing is dependent on the options selected. The actual line amperage may vary slightly from the values given above.

The machine is equipped with a main disconnect switch which is not fused. It is recommended that the main supply power be supplied to the machine via a wall-mounted fused disconnect in accordance with local codes.

European Customers: To comply with EMC Directive 89/336/EEC on electromagnetic compatibility, power cables to the machine must be run in rigid or flexible metal conduit.

X. EXHAUST SPECIFICATIONS:

STANDARD AIR OPERATION:

- Load-end: 150 cfm (255 m³/hr) at the 4" (102 mm) stack (minimum requirement)
- Unload-end: 300 cfm (510 m³/hr) at the 4" (102 mm) stack (minimum requirement)
- Water gauge pressure drop: 1.0" (25 mm) for each 4" (102 mm) stack on the machine

INERT ATMOSPHERE OPERATION:

- Load-end: 150 cfm (255 m³/hr) at the 4" (102 mm) stack (minimum requirement)
- Unload-end: 150 cfm (255 m³/hr) at the 4" (102 mm) stack (minimum requirement)
- Water gauge pressure drop: 0.5" (12 mm) for each 4" (102 mm) stack on the machine

Note: All specified exhaust requirements listed above are minimum values. The external exhaust connections are the same for both standard air and inert atmosphere machines. The internal connections to the lip vents are configured according to the air or inert atmosphere machine configuration.

XI. ADDITIONAL UTILITY SPECIFICATIONS:

INERT ATMOSPHERE OPERATION ONLY:

- Required gas supply: Both nitrogen and clean, dry, compressed gas (CDA) supply lines should be installed
- Minimum supply line pressure: 54 psi (363 kPa)
- Maximum supply line pressure: 100 psi (670 kPa)
- Available flow rate: 2500 SCFH (71 m³/hr)
- Typical nitrogen consumption: 600 - 1500 SCFH (17 - 43 m³/hr)
- Chilled water requirements: (These specifications are listed for factory supplied chilled water requirements only.)
 - Flow rate: 1.0 - 3.0 US gal/min (3.79 - 11.4 l/min)
 - Inlet size and pressure: 0.5" male NPT; 45 - 70 psi (310 - 483 kPa)
 - Pressure drop: 30 psi @ 3 US gal/min (200 kPa @ 11.4 l/min)
 - Feed temperature: 7° - 30° C (45° - 86° F)

Note: External pressure regulators and gauges, shut-off valves, and filters are to be installed by the customer on the gas supply lines at the machine inputs. Also, a check valve should be installed by the customer on the coolant water return line.

XII. ELECTRICAL CODES / COMPLIANCE:

(UL) UNDERWRITERS LABORATORY (200 – 240 VAC, 440 – 480 VAC Machines):

- Listed for Factory Automation Equipment, File #E181408. Testing to specifically include:
 - Standard for Industrial Control Equipment, Part 1
 - Underwriter's Laboratory (UL) 508
 - National Electrical Code (NEC), ANSI/NFPA 70-93
 - Electrical Standard for Industrial Machinery, NFPA 79-91

Note: To view the Underwriters Laboratory Certification File online, go to <http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/gfilenbr.html> and enter E181408 in the search data entry box. The page is also accessible at www.ul.com > Certifications > UL File Number.

(EUROPEAN) CE COMPLIANCE (380 – 415 VAC Machines):

- Declaration of Conformance is based on compliance to European Directives 89/392/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, 89/336/EEC based on the following European Harmonized Standards:
 - EN 292-1 (Basic concepts, general principles for design, basic terminology, methodology)
 - EN 292-2 (Basic concepts, general principals for design, technical principles and specifications)
 - EN 60204-1 (Electrical equipment of machinery)
 - EN 55011 (Limits and methods of measurement of radio disturbance - emissions)
 - EN 50082-2 (Electromagnetic compatibility - immunity)

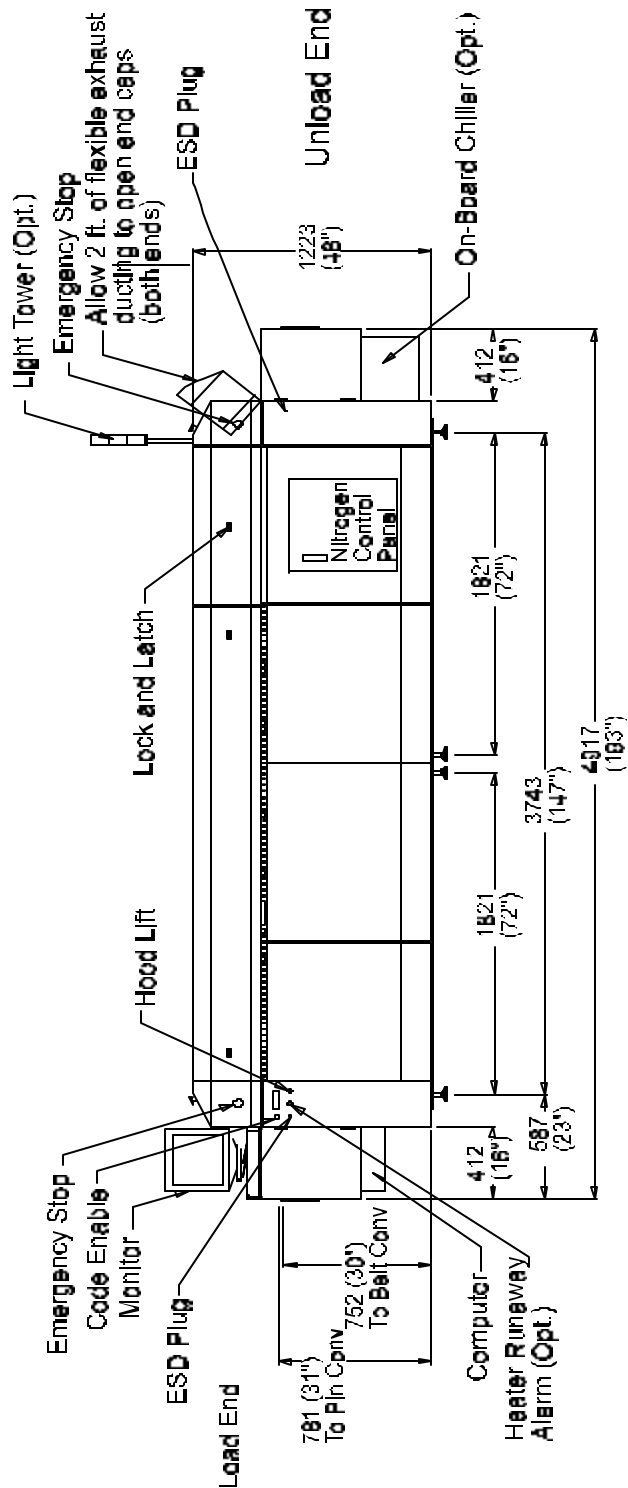
XIII. PHYSICAL CHARACTERISTICS:

		<u>OmniFlo Machine</u>	<u>External Water Chiller</u>
- Dimensions ¹ :	Length:	193.6" (4917 mm)	33.7" (857 mm)
	Width:	51.3" (1304 mm)	25.2" (641 mm)
	Height:	56.0" (1422 mm)	45.9" (1165 mm)
- Conveyor height:	Mesh Belt:	32.0" to 36.0" (813 mm to 914 mm)	N/A
	Pin Chain:	33.0" to 37.0" (838 mm to 940 mm)	N/A
- Access clearance:	Front:	20.0" (508 mm)	Air cooled: 60.0" (1524 mm) on all sides
	Rear:	26.0" (660 mm)	Water cooled: 36.0" (914 mm) on all sides
- Machine weight:	Per leg:	660 lbs. (376 kg)	119 lbs. (54 kg)
	Total:	3960 lbs. (2258 kg)	477 lbs. (216 kg)
- Noise levels ² :	Front:	65 dbA	<75 dbA
	Rear:	65 dbA	<75 dbA
	Load end:	71 dbA	N/A
	Unload end:	72 dbA	N/A

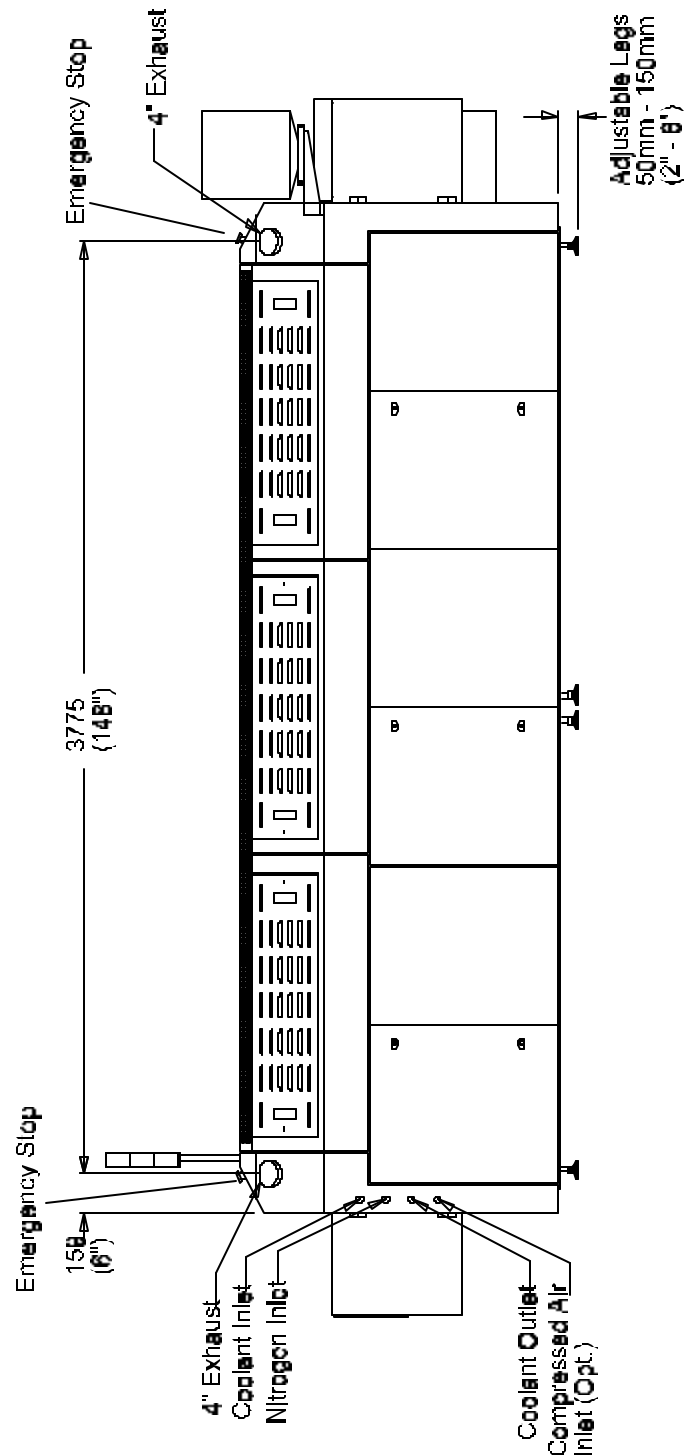
Note¹: The height dimension listed is with the leveling legs at the maximum height setting, excluding the optional light tower.

Note²: The noise levels listed were measured at a 3 foot distance from the equipment per OSHA standards.

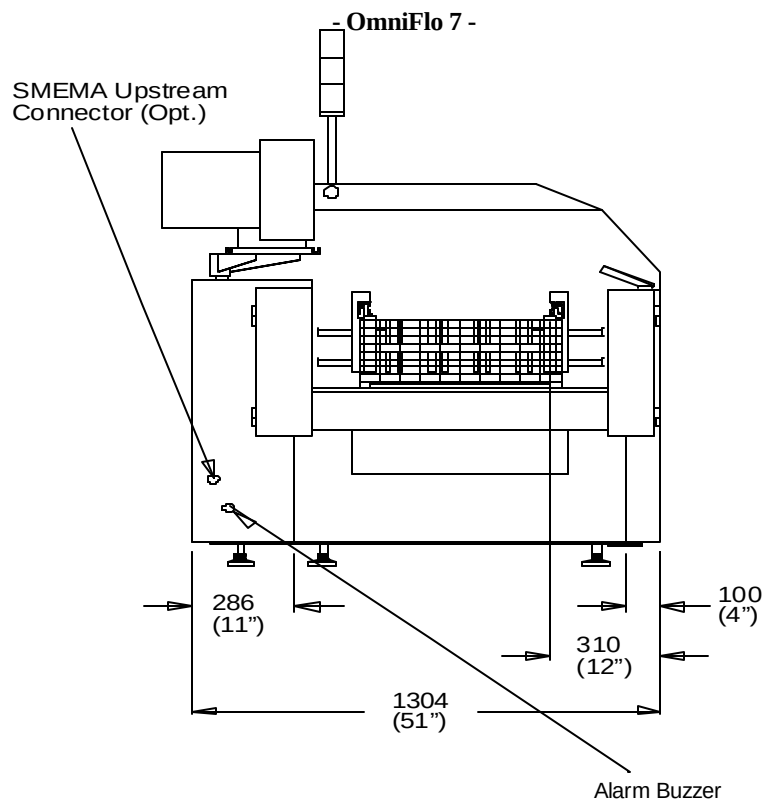
NOTE: In the interests of product improvement, Electrovert reserves the right to change product specifications without prior notice.



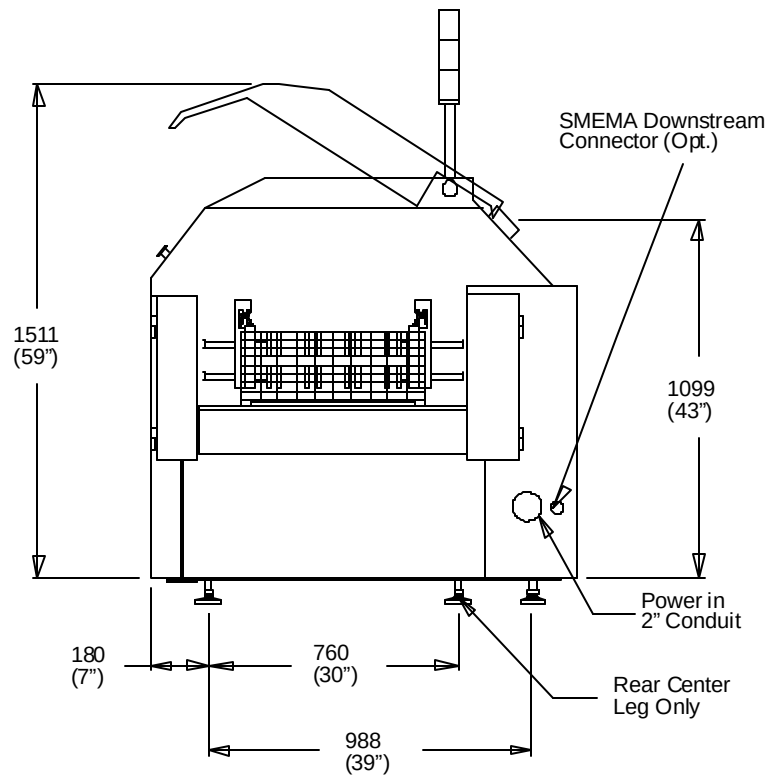
OmniFlo 7 Front View



OmniFlo 7 Rear View



OmniFlo 7 Load End



OmniFlo 7 Unload End



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