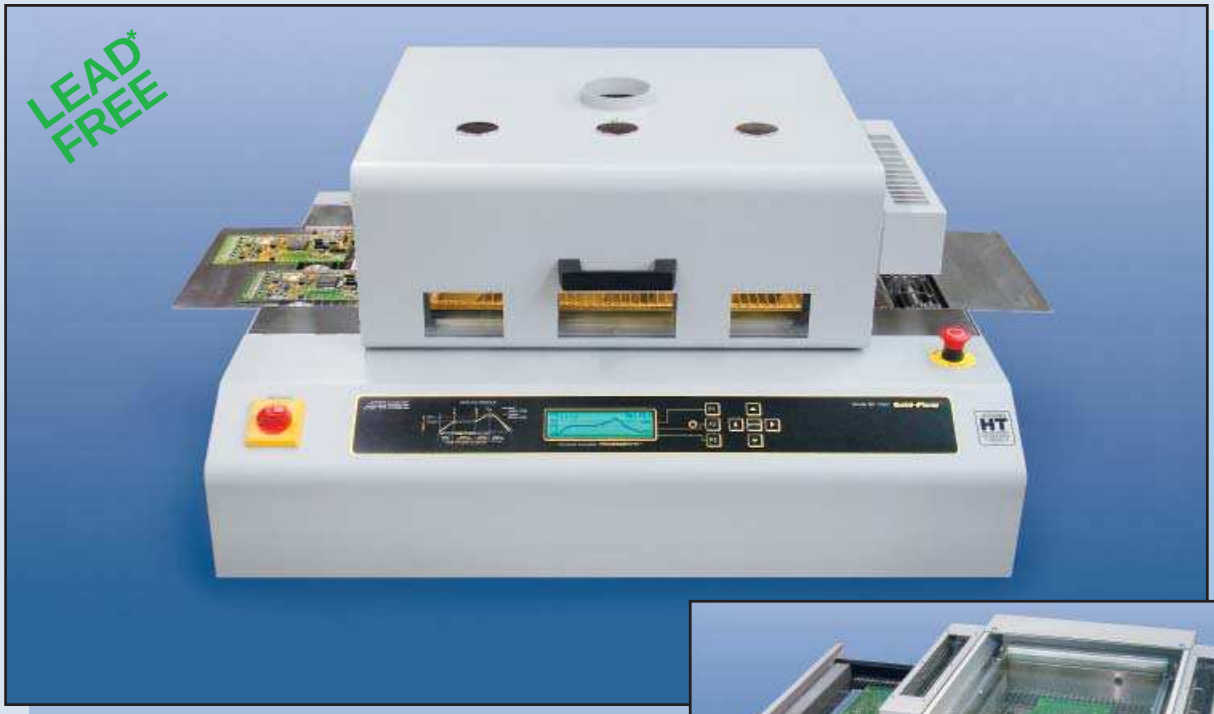
Lead Free Soldering Technology
Conveyor and Batch Reflow Ovens



Conveyor Reflow Oven Features:

- Lead and Lead free Compatible
- 100% forced air Horizontal Convection™ oven**
- 3 vertical heating zones plus cooling zone
- 12" wide conveyor
- Stainless steel conveyor and chambers
- Easy lift clamshell design
- Viewing windows with lighted interior
- Computer controller with:
  - 100 menu profile storage
  - 7 day programmable timer
  - Real time graphic temperature profiler
  - ISO 9000 SPC fault monitoring and reporting
  - Battery memory backup
  - English or metric units
  - Password protection
- Nitrogen gas inerting option
- PC Interface/Windows® software option
- Enhanced printing option

Batch Oven Features:

- Lead and Lead free compatible
- 100% Cyclonic™ forced air convection
- Unique shuttle system enables higher throughput than standard batch ovens
- Individual time and temperature microprocessor controls make profile set-up easy
- Large top window allows the operator to see the board through the entire process
- All stainless steel interior construction
- Dual cooling stations
- Nitrogen gas inerting option
- Up to 12” x 12” boards

**Patent 6,936,793

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RO006_200905

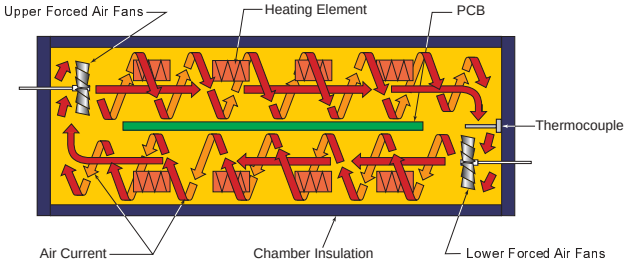
All APS ovens are available with lead free capability and are made in the USA

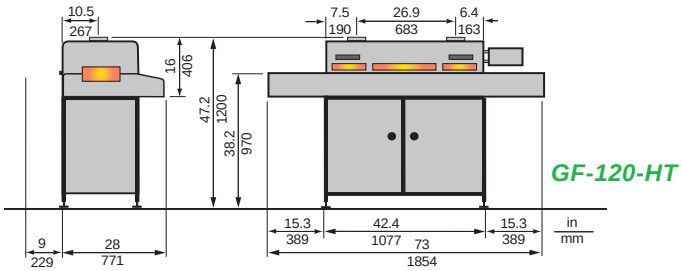
Model
GF-120-HT
shown with
optional stand

GF-120-HT ** with HORIZONTAL CONVECTION™

With the patented** Horizontal Convection™ air is circulated horizontally in one direction above the board, and in the opposite direction below the board. This circular air current, or "cyclone" around the board, produces extremely uniform temperature profiles across the board. The model GF-120HTs are high temperature ovens which are compatible with all lead and **lead free soldering** applications.

GF-120HT chambers cross section





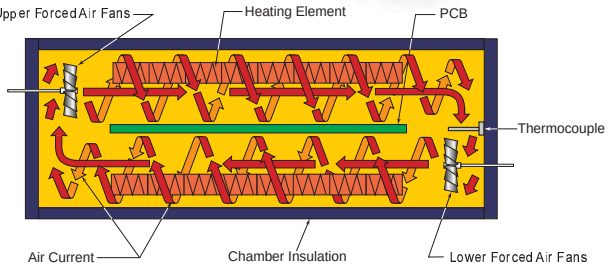
GF-120-HT

The GF-12/120 series heating profiles are superior to other ovens in their class. Each of the vertical heating zones is programmable through the controller which stores up to 100 profiles. The oven includes a real-time temperature profiler port. When a thermocouple is attached to the PC board, the actual board level temperature profile is displayed graphically as the board travels through the oven. The conveyor speed, heating elements, cyclonic generators and cooling fans are all programmable. The oven also features SPC fault monitoring & reporting, battery backup and a 7 day timer for automatic machine start-up.

**Machines covered under Patent 6,936,793

Model
GF-12-HT

GF-12-HT **



Our patented Horizontal Convection™ technology** circulates heated air in each chamber around the board front to back which increases the thermal efficiency and uniformity within each zone. This exposes the circuit board to a uniform temperature profile along the entire assembly. Cyclonic generator speed is independently set in each zone.

PAK-6 temperature profiling kit

GF-12HT
with stand option

The temperature profiling accessory kit includes all the accessories you need to profile PC boards through your reflow oven. It is compatible with any ovens or profiling systems which use standard K-type thermocouples.

Nitrogen Inerting Option

All GF ovens have a nitrogen gas inerting option. With the isolated chamber design (recirculation of atmosphere within reflow zone) low oxygen levels are maintained while conserving nitrogen consumption.

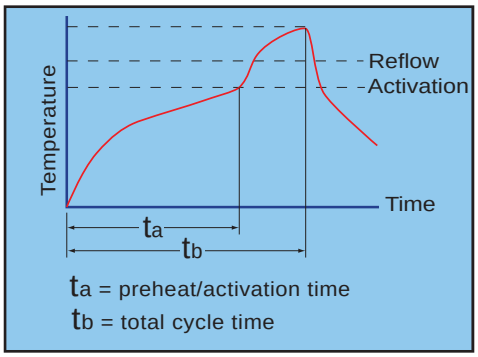
- Decreases wetting angle
- Increases flux efficiency
- Enhances fine pitch solder fillets
- Improves surface finish of solder joints

Conveyor and batch ovens for solder reflow, curing, drying and thermal cycling

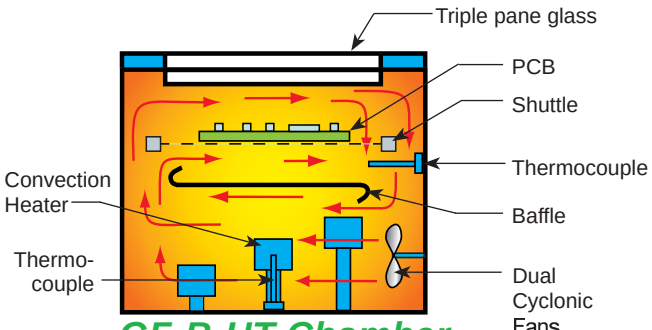
High temp model ***GF-B-HT*** * shown

*GF-B-HT Batch Oven** Features:*

- High temperature GF-B-HT for lead and lead-free soldering
- Unique shuttle system enables higher throughput than standard batch ovens
- Large top window allows the operator to see the board through the entire process
- 100% Cyclonic™ forced air convection
- Independent time and temperature microprocessor controls with membrane keypad make set-up easy
- 99 menu storage with password protection
- All stainless steel interior construction
- Dual cooling stations
- English or metric units
- Nitrogen gas inerting option



GF-B-HT Reflow Profile



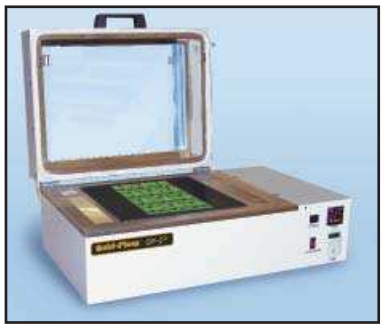
GF-B-HT Chamber

Model ***GF-C²-HT*** conduction/convection oven

*GF-C²-HT Batch Oven** or Hot Plate:*

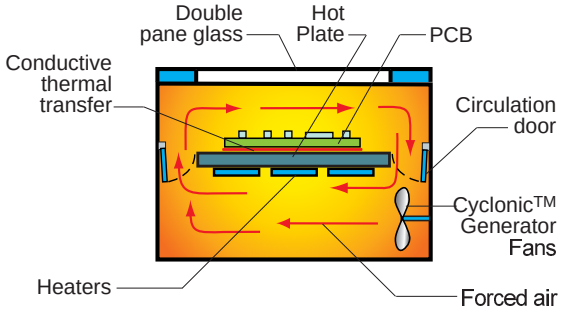
The GF-C²-HT oven is ideal for batch SMT reflow, curing and hot plate applications. With its heavy duty construction and stainless steel chamber, the oven is designed for many years of reliable service.

- Can be used as a batch oven or a hot plate.
- Large heating area of 12” x 12”.
- Combination forced air convection/conduction heating for consistent process control.
- Large viewing window allows the operator to see the entire product and process.
- 3/4” thick aluminum heat plate.
- Digital temperature controller precisely and automatically regulates temperatures.
- Programmable digital timer with alarm.
- Nitrogen gas inerting option.



- Model ***GF-C²-HT*** for lead free soldering

Model ***GF-C²-HT*** with hood up for hot plate use



GF-C²-HT Chamber

**Machines covered under Patent 6,936,793

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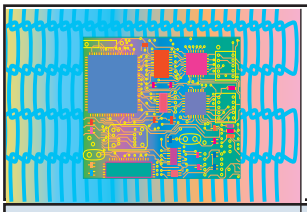
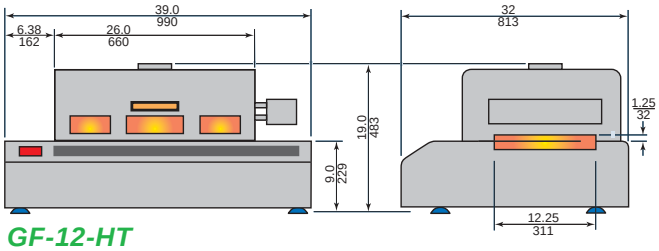
Conveyor and Batch Reflow Ovens

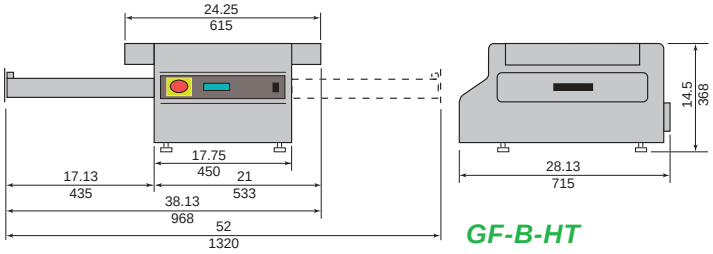




Model:	GF-120-HT	GF-12-HT	GF-B-HT	GF-C²-HT
Heating zones	3 top, 3 bottom	3 top, 3 bottom	1	1
Cyclonics™ (forced air)	3	3	1	1
Conveyor extensions	NA	yes	Dual board shuttle	NA
Electrical power	220 VAC, 50/60 Hz 1Ø (3Ø option), 50A 8.7 Kw	220 VAC, 50/60 Hz 1Ø (3Ø option) 5.5 Kw	15A @220 VAC, 50/60 Hz 1Ø, 2.7 Kw	110 VAC, 50/60 Hz, 20A 220VAC, 50/60 Hz, 10A 1.8 Kw
Max board width	12” (305mm)	12” (305mm)	12” x 12” (305 x305mm)	12” x 12” (305 x 305mm)
Max board height	1.375” (35mm)	1.375” (35mm)	1.250” (32mm)	3” (76mm)
Cooling station(s)	1	1	2	NA
Max temperature: **Lead free compatible**	752°F (400°C)	662°F (350°C)	600°F (315°C)	600°F (315°C)
Venting	(2) 4” flanges 100 CFM ea. max.	4” flange 100 CFM max.	4” flange with integral fan	NA
Heating technology	Forced air Horizontal Convection™	Forced air Horizontal Convection™	Forced air convection	Forced air convection
Heat tunnel length	41” (1042mm)	26” (660mm)	NA	NA
Nitrogen option	Yes	Yes	Yes	Yes
Stand option	Yes	Yes	Yes	no
PC interface option	Yes	Yes	no	no
Overall dimensions	73” x 34” x 19”H 1854 x 864 x 483 mm	39” x 32” x 19” H 990 x 813 x 483 mm	38.13” x 28.13” x 14.5” H 968 x 715 x 368 mm	29.12” x 16.5” x 12” H 740 x 420 x 305 mm
Approximate weight	600 lbs (272 kg)	220 lbs (98 kg)	102 lbs (46 kg)	56 lbs (25 kg)



GF-12-HT



GF-B-HT

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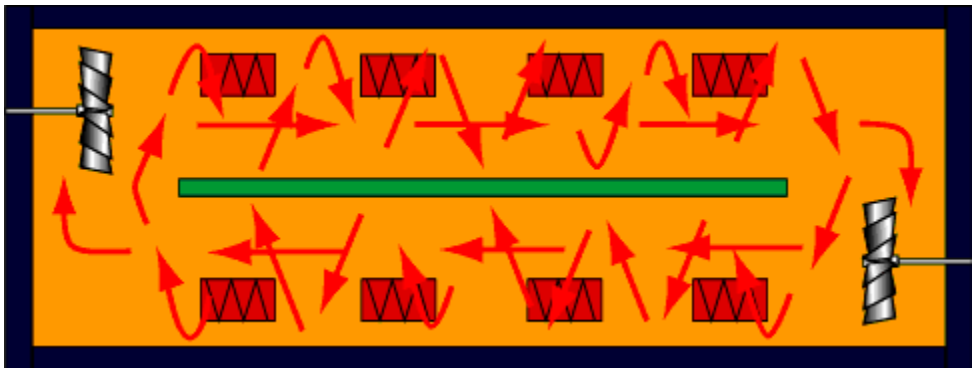
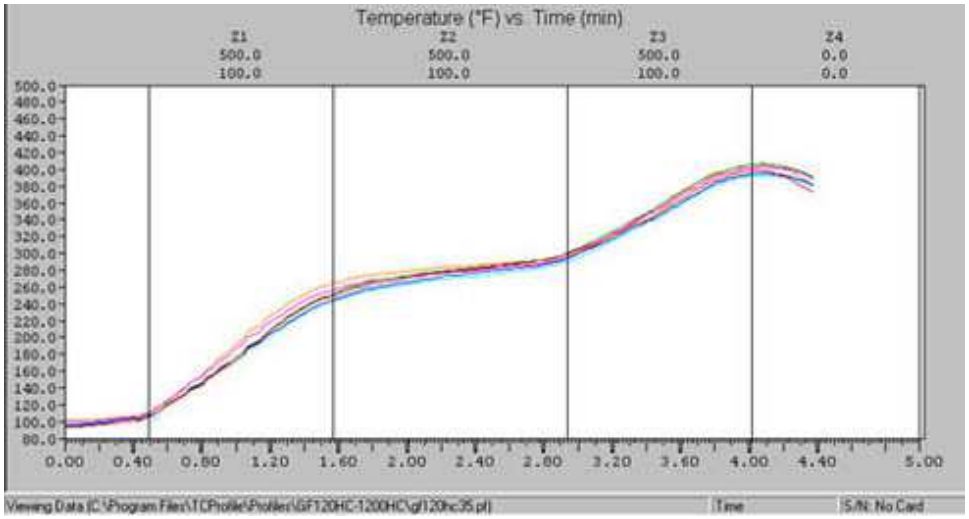
Horizontal Convection™ Reflow Technology Defined

Leading up to the development of lead-free soldering alloys, Horizontal Convection* was developed for the reflow process. Getting the correct temperature profile, with the narrow process window in lead-free applications, is now more important than ever. In each reflow chamber or zone, air is circulated toward one side of the oven above the printed circuit board (PCB) and toward the opposite side of the reflow oven below the PCB, forming a "cyclone" around the board. The forced air circulation results in a uniform temperature profile along the entire circuit board assembly. This technology is ideal for the precise profiles needed for lead-free soldering.



Cross-section of a GF-120 reflow oven with Horizontal Convection. Air is recirculated within the confines of each reflow chamber as shown.



Reflow profile taken in a GF-120, 3 zone reflow oven showing actual board temperatures recorded with 6 thermocouples evenly positioned across the board.

* Patent # 6,936,793

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HORIZONTAL CONVECTION Defined

1. **The main difference between Horizontal Convection and traditional reflow oven technology.**

   In traditional reflow ovens, air currents are introduced vertically above and below on the PCB while in Horizontal Convection air is circulated horizontally in one direction across the top of the board and in the opposite direction beneath the board. This is key. This prevents hot spot and because of this parallel "angle of attack" the air stream's ability to infiltrate the spaces underneath component bodies such as BGAs and J-leaded devices is enhanced. Temperatures across the entire PCB front to back are virtually identical.

2. **Lower overall equipment and operation cost.**

   Because the Horizontal Convection system requires neither plenum nor air reintroduction apparatuses, it is (due to its simplicity) more reliable and less costly. There is no need for costly flux management systems as there is no sticky flux residue in the oven which greatly reduces the need for constant cleaning, maintenance, and servicing.

3. **Eliminates hot spots across the board.**

   By controlling the air flow around the board by having consistent temperature, air pressure, air velocity, volume, and direction across the board, temperature uniformity is ensured. The top and bottom of the board receive the air from the outsides toward the center, which acts to counter the center hot-spot/cool-outside condition. This minimizes thermal stress to PCB materials and components.

4. **No flux management system is needed.**

   There is no flux residue because the air is recirculated within the confines of each reflow chamber. Chambers each contain all the elements needed to be self-sufficient: heating elements, fan blades, inert gas suffusers, and exhaust ports. The air never comes in contact with cooler surfaces and thus does not condense on anywhere within the reflow oven.

5. **Uses less nitrogen in inert atmosphere applications.**

   An advantageous side effect of the Horizontal Convection system is an ability to produce low oxygen ppm (parts per million) levels when purging the inert gas, because the volume of space affected include only the confines of each reflow chamber. In traditional reflow oven design, by contrast, the chamber, as well as the upper and lower plenums, must be purged.

6. ***The best profiles…Period!***

   There are multiple reasons for this claim. Heated air within each reflow zone is extremely controllable and precise. Temperatures across the PCB are uniform with no hot spots because air is circulated horizontally in a circular or "cyclone" motion around the PCB.

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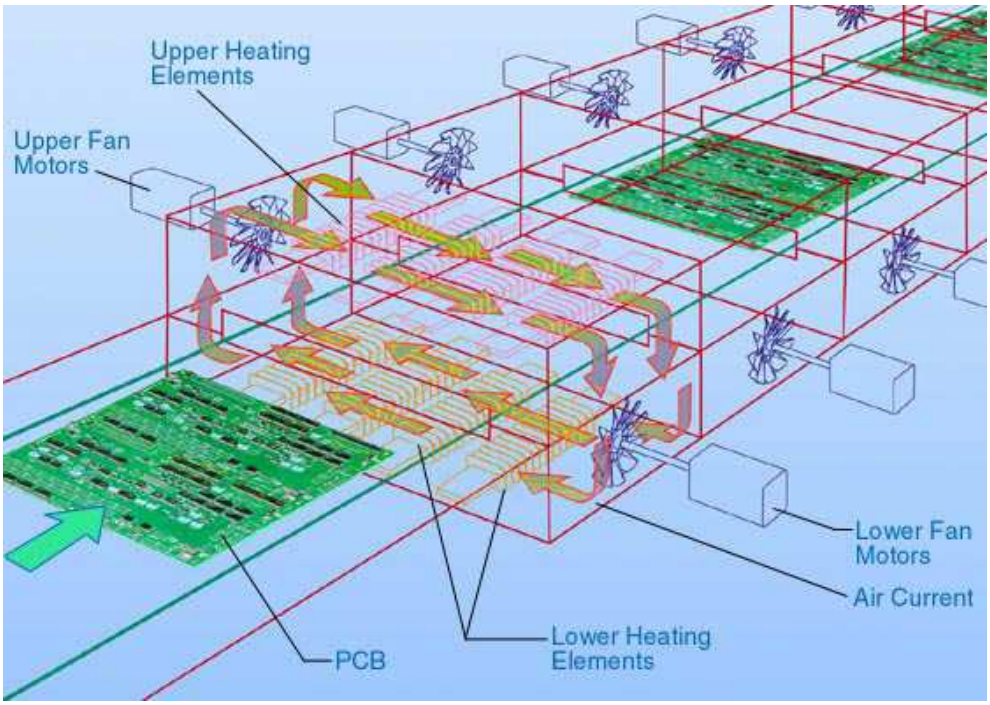
Temperatures across the entire PCB front to back are virtually identical. APS Novastar is willing to compare its superior profiles to any other profiles in the industry. Let us prove it. Send us your PCB assembly. Then compare our Horizontal Convection profile with any other reflow oven's profile.



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