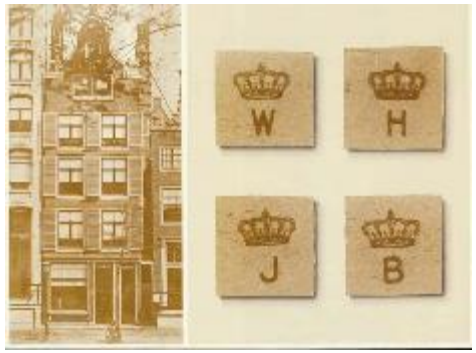
CENTURION

- Vitronics Soltec was founded in Amsterdam in 1916, over 100 years ago
- Centurion was a leader of a centuria (100 men) in the Roman army
- Centurion derives from Centrum – Latin for 100



Vitronics Soltec
100
1916 YEARS 2016

- Maximum efficiency in heat transfer allows reflow soldering at the lowest possible setpoints, resulting in minimal ΔT and minimized power consumption
- Minimizing your downtime using a new and patented flux management technology and fast change over opportunities
- Compatible to all your requirements for cycle time, either in dual lane applications or process length
- Improved sustainability-driving power and nitrogen consumption to a minimum
- Full product traceability and connectivity to host computers
- OpenApps to customize to your data needs for Industry 4.0

Configurations and Dimensions

Model	Zones	Heating /Cooling Zones	Total Heated Length mm/inch	Total Cooling Length mm/inch	Overall System Length Air ① mm/inch	Overall System Length Nitrogen ① mm/inch	Overall System Width mm/inch	Overall System Height② mm/inch	Onload and Offload Length mm/inch	Net System Weight Air③ kg/lb	Net System Weight Nitrogen③ kg/lb
CT820VP	10	8 / 2	2840 / 111.8	710 / 28.0	4150 / 163.4	4860 / 191.3	1600 / 63.0	1420 / 55.9	80 / 3.1	2100 / 953	2300 / 1043
CT930	12	9 / 3	3195 / 125.8	1065 / 41.9	4860 / 191.3	5570 / 219.3	1600 / 63.0	1420 / 55.9	80 / 3.1	2300 / 1043	2500 / 1134
CT1040	14	10 / 4	3550 / 139.8	1420 / 55.9	5570 / 219.3	6280 / 247.2	1600 / 63.0	1420 / 55.9	80 / 3.1	2500 / 1134	2700 / 1225
CT1240	16	12 / 4	4260 / 167.7	1420 / 55.9	6280 / 247.2	6990 / 275.2	1600 / 63.0	1420 / 55.9	80 / 3.1	2700 / 1225	2900 / 1315

① = In cold condition. Length increases with approximately 3 to 4 mm/ 0.12 to 0.16 inch in hot condition.

② = System height at conveyor height of 952 mm / 37.5 inch.

③ = Depending on configuration

- Models ranging from 820VP to 1240
- Conversions possible to 1020, 1130 or 1330
- Heated lengths from 285 cm (112 in) to 426 cm (168 in)
- Model 820 available in a VP package (top-side heating in all zones, bottom-side in 2 zones)

Standard Features

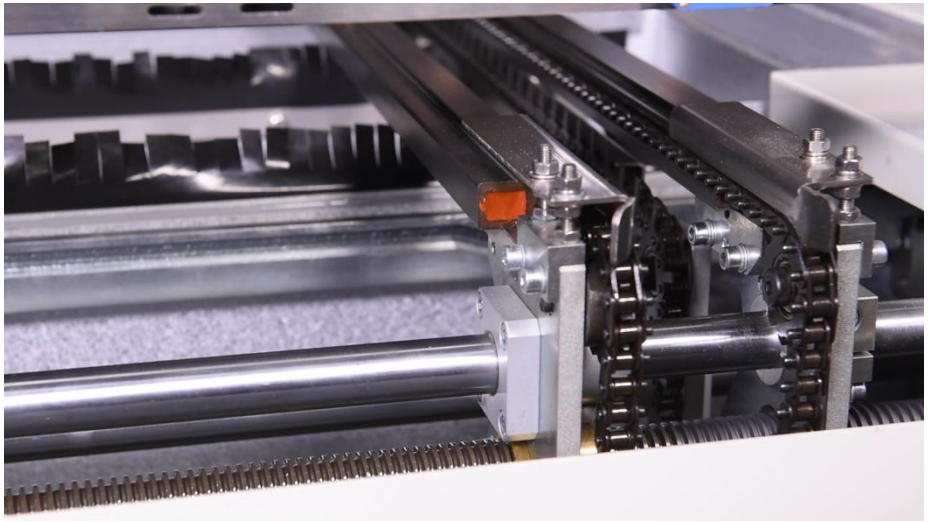
- Maximum 508 mm [20"] wide printed circuit boards
- Electromechanical powered hood lifts
- Maximum operating temperature 350°C
- Quick exchange heaters and motor/fan combinations
- Standard voltage 380V 3 Ph 50Hz/60Hz
- Closed loop conveyor speed control
- Flux Flow Control integrated flux management system
- Integrated exhaust stack filters
- Slip clutch protected conveyor drive unit
- Motorized conveyor width adjust through rocker switch
- Standard conveyor speed control by frequency inverter, speed range 250-2.000 mm /min [10-750 ipm]
- Transport height adjustable between 898 - 978 mm [35.4" - 38.5"]
- Standard fixed rail at front side
- Single Lane 5 mm pin chain conveyor
- Computer-controlled chain lubrication for single lane chain conveyor (incl. board support)
- Life-time warranty on cell heaters and cell motors
- 350°C maximum set-point temperature (in reflow zones)
- High Performance Convection Cells with indirect calrod heaters, top and bottom side heating (VP only top reflow with 2 bottom-side)
- Fan speed control, 2 groups (all non VP machines)
- PID controls on all heating and cooling cells (VP top only)
- Gas temperature measurement and control by PT100 with failure detection
- Power management
- Main power disconnect
- Light Tower
- Touchscreen
- Packing - Pallet

Subsystems overview

Conveyor systems

- Pin Chain Rail only – Standard
- Meshbelt only
- Combo conveyor with meshbelt/pin chain
- Rail only with CBS
- Dual lane pin chain conveyor
- Dual lane/dual CBS

*CBS = Center Board Support

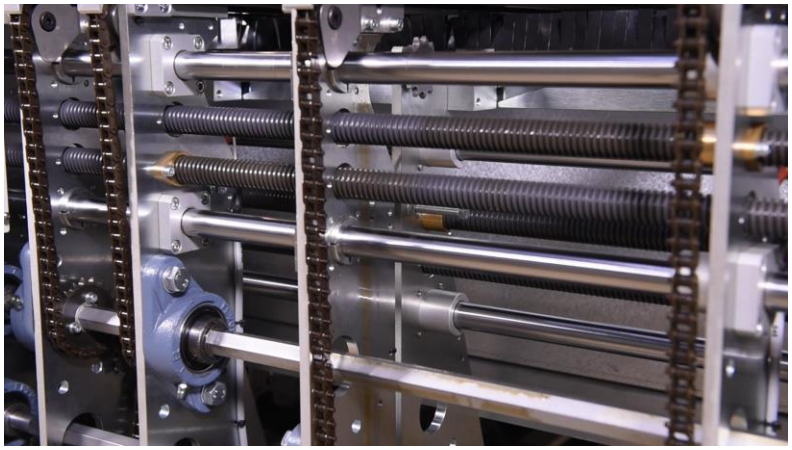


Mesh and Combination conveyor

- 20” belt standard with 24” optional
- 0.50” pitch STD with 0.286” “fine” mesh belt optional
- 20” combination belt and rail standard with 24” optional
- Board support is not available on Belt Systems

Pin-chain conveyor

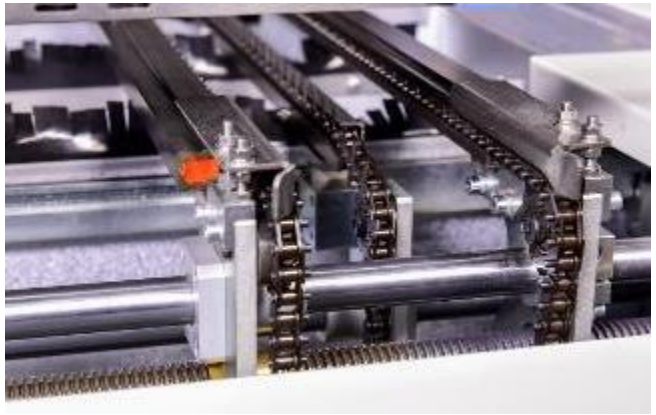
- Maximum board width: 508 mm (20”) standard
  - Optional 610 mm (24 in)
- Rail parallelism ±0.5 mm
- Maximum topside component height : 40 mm (1.57”)
- Bottom-side clearance: 30 mm (1.18”)
- Conveyor speed range: 0.25- 2.0 m/min Optional low speed range 0.02 – 0.17 m/min
- Speed accuracy 1%
- Standard motorized width-adjust through rocker switcher
  - Optional motorized width-adjust through software
- Optional board support system with park position
- Ceramic bearings on drive units
- Standard Auto Chain Lubrication

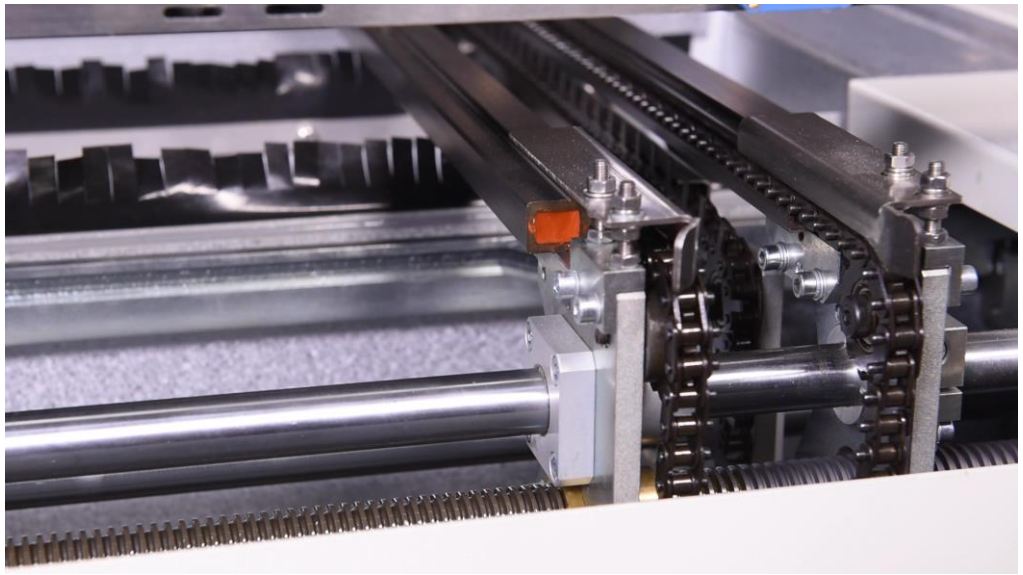


Auto lubrication system

- Lubricate rails
- Lubricate PCB supports
- Relieves maintenance crew from periodic chain lubrication
- Prevents excessive lubrication as seen with gravity-fed systems
- Full computer control functionality allows user to optimize lubrication sequence and volume

Center board support

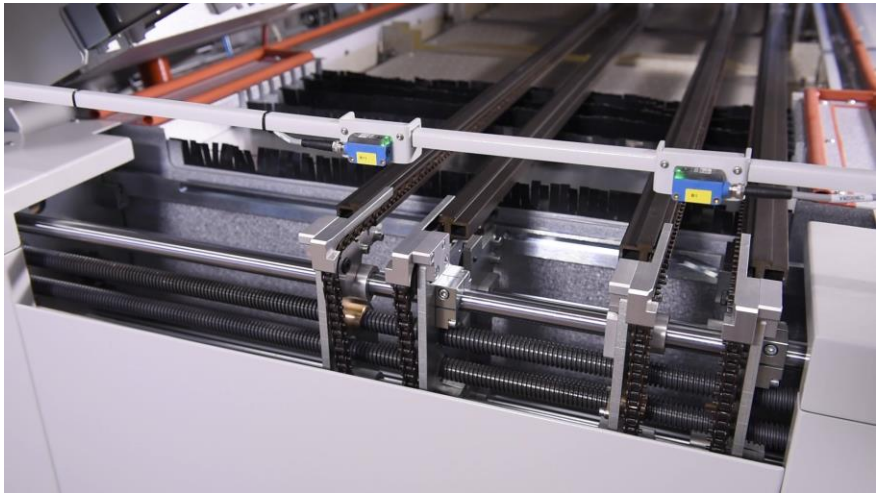




- Requires 5 mm non-populated track on PCB
- Width adjustment standard via switch – optional via PC
- Parks under fixed rail when not in use
- Pin height support system 8.5 mm (0.33 in)
- Dual board support; minimum distance between supports 50 mm (2 in)

Dual lane conveyor

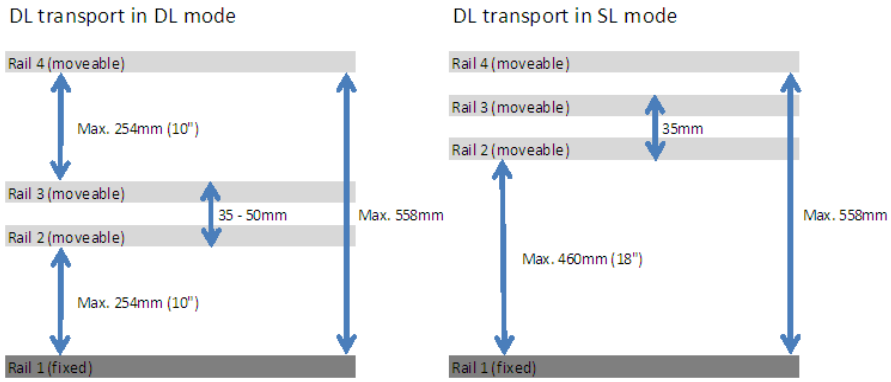
- Dual lane single speed
- Dual lane dual speed
- Standard board size 50 mm (2") - 254 mm (10")
  - Optional 50 mm (2") - 285 mm (11.2")
  - Optional 50 mm (2") - 300 mm (11.8")
- Standard distance between rail 2 and 3: 95 mm (3.74")
  - Optional 35 mm (1.38")
- Rail 1,4 or 1,3 fixed
- Maximum 4 rails can be moved independently
- Dual lane dual CBS

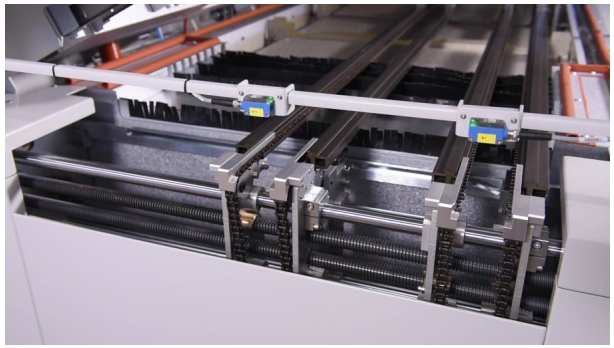


Dual lane conveyor Centurion compatible to the iFlex lines

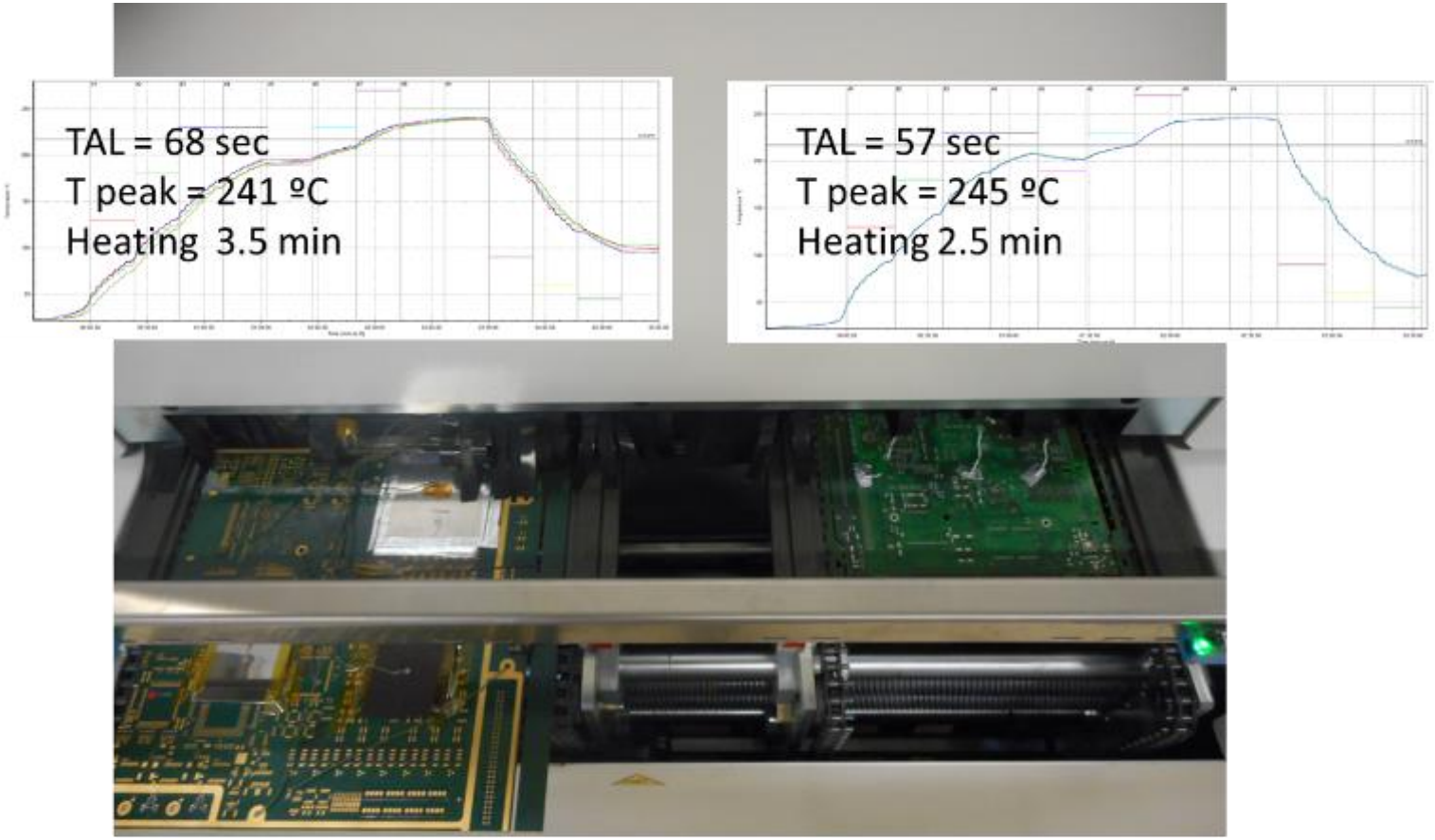
Dual Lane dimmensions:

- Standard 2x 254 mm
- Optional 2x 285 mm
- Optional 2x 300 mm
- Distance between rail 2 and 3:
  - Standard 95 mm
  - Optional 35 mm
- Rail 1,4 or 1,3 fixed
- Maximum 4 rails can be moved independently
- Dual lane dual CBS





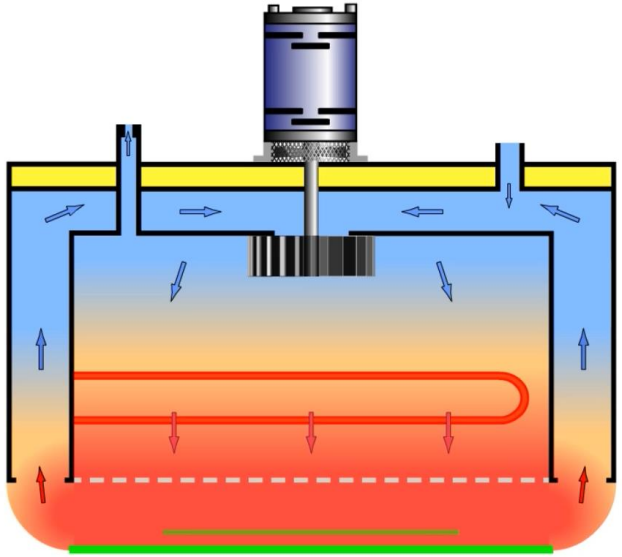
Dual lane Dual Speed conveyor

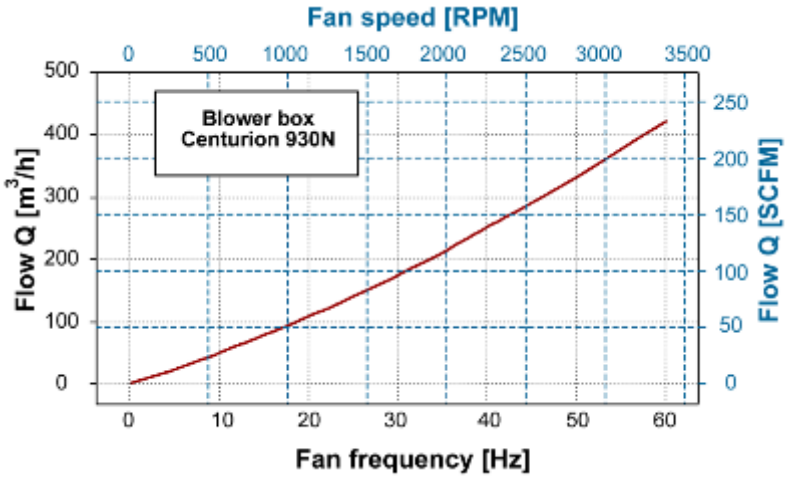


V(lane1) = 91.2 cm/min V(lane2) = 120 cm/min

High performance convection cell

- Top and bottom high-volume forced convection
  - (In 820VP, peak zone only)
- High mass heating, stable profile under maximum load conditions
- Improved thermal insulation
- Blower housing of aluminized steel
- Optimum balance in flow and faceplate construction
- 14” zone with 12” EIA (Effective Impingement Area)

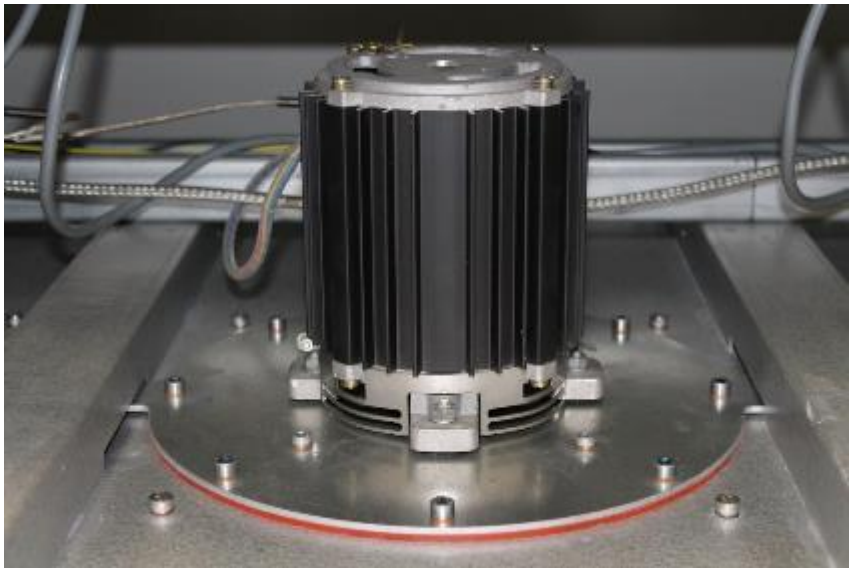




High Performance Convection Cell

Field- Proven motor fan combination

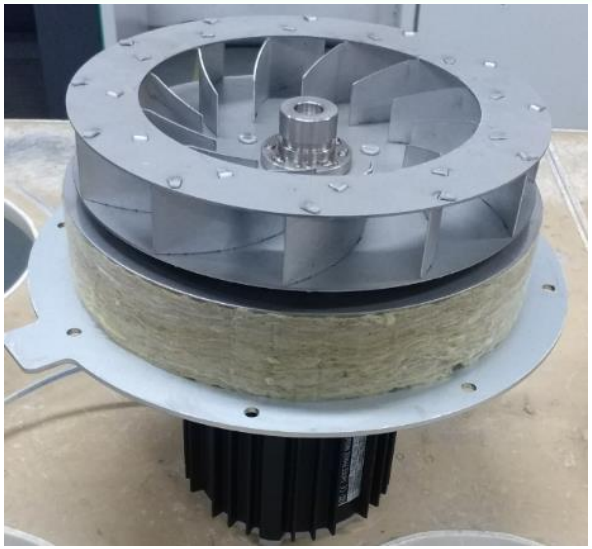
- More than 20 years experience on a large installed base
- MTBF: 50,000+ hrs
- Extremely low field failure rates
- Life time warranty (on motor/ fan combination)



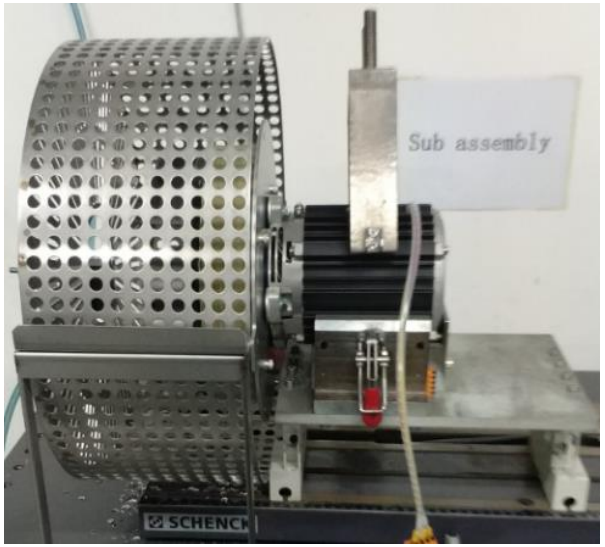
High Performance Convection Cell

Field- Proven motor fan combination

- Blower motor precision balanced
- More than 20 years experience on a large installed base
- MTBF: 50,000+ hrs
- Life time warranty (on motor/ fan combination)



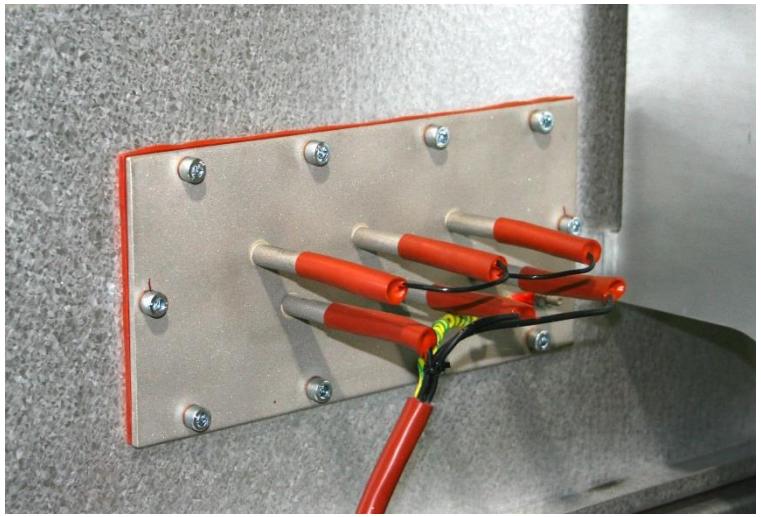
Cell Fan Kit

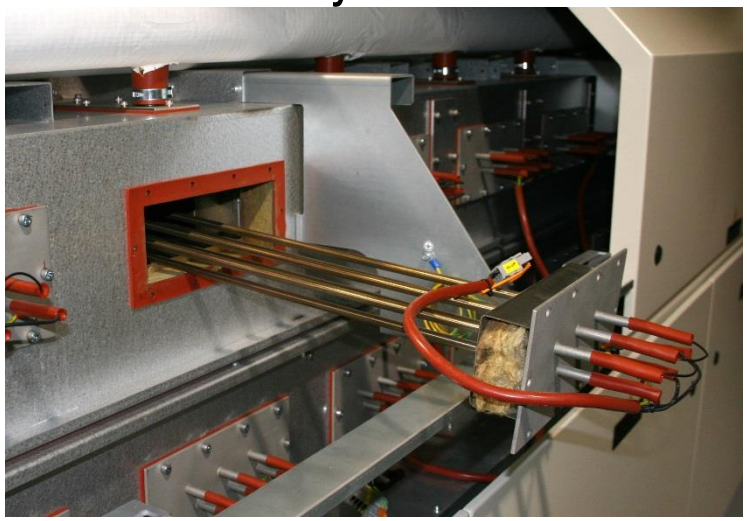


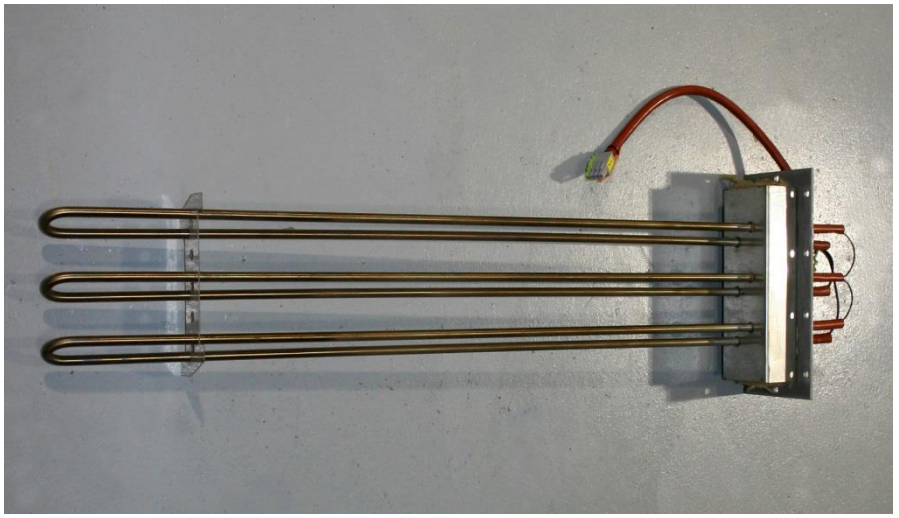
Fan Balance

Heating element

- Calrod Cr-Ni steel
- Easily removable
- 9 kW per zone (top and bottom)
- 350 C max standard
- Extremely low field failure rates
- Lifetime warranty







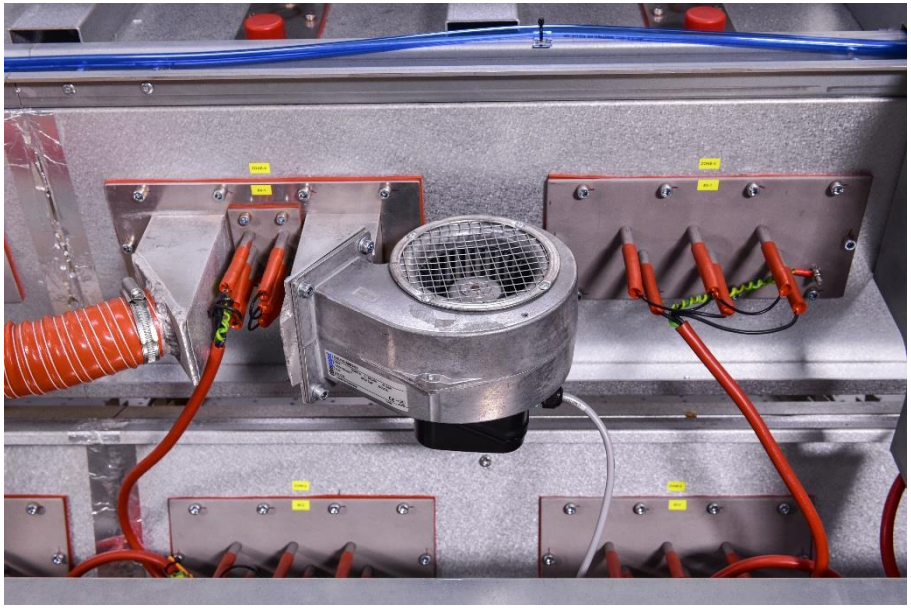
Heating

- Cold start up in less than 40 minutes

  (non-controlled cooling)
- Maximum set points 350°C
- PT100 sensors in every zone
  - More accurate and reliable over type K TC's
- Gas temperature control accuracy 1°C
- Repeatability on Mega Profiler under loading tests, 1.2 °C

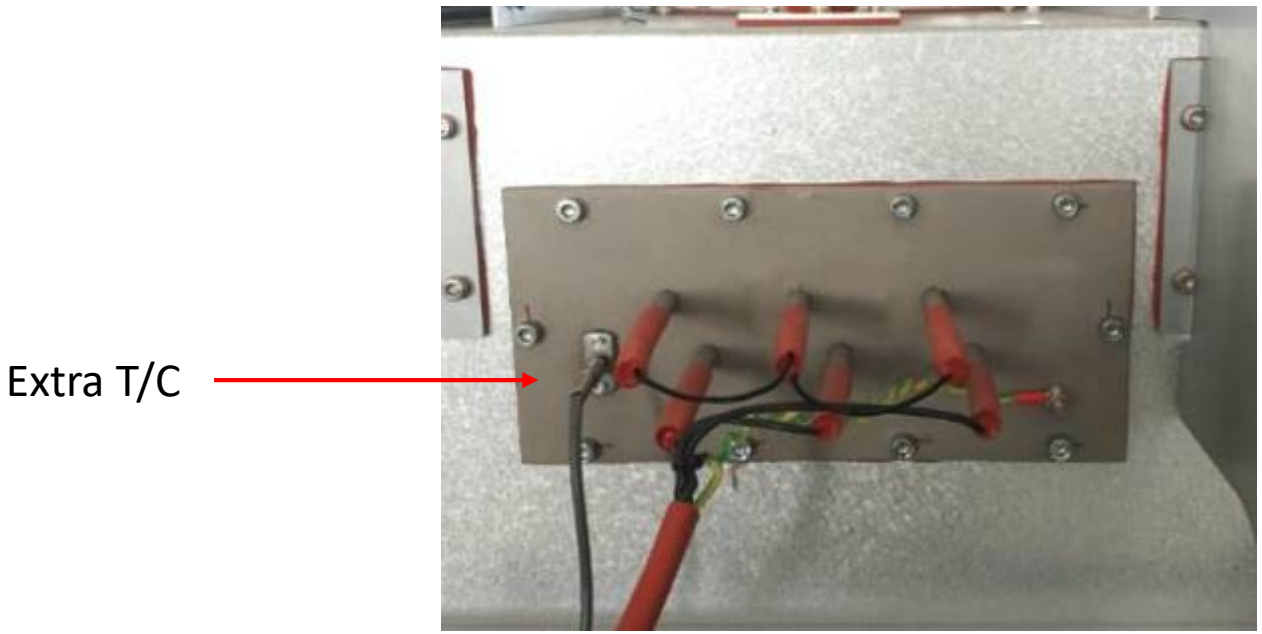
Zone separation

- Maximum achievable temperature
- Difference between two zone's 50°C
- Between last soak zone and first peak max 80°C
- Optional enhanced zone definition between last soak and first peak allows 140°C difference in setting



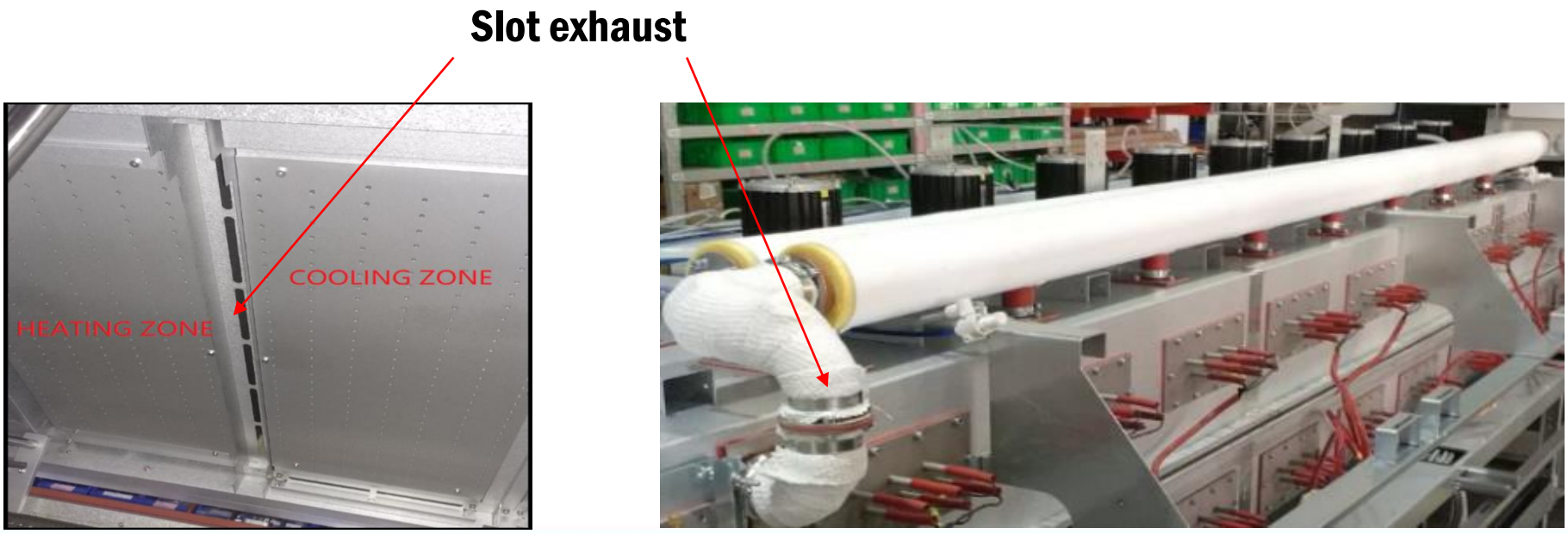
Redundant Over Temperature Detection

- Extra T/C to detect over temperature besides PT100
- Automatic power-off at detection of over temperature



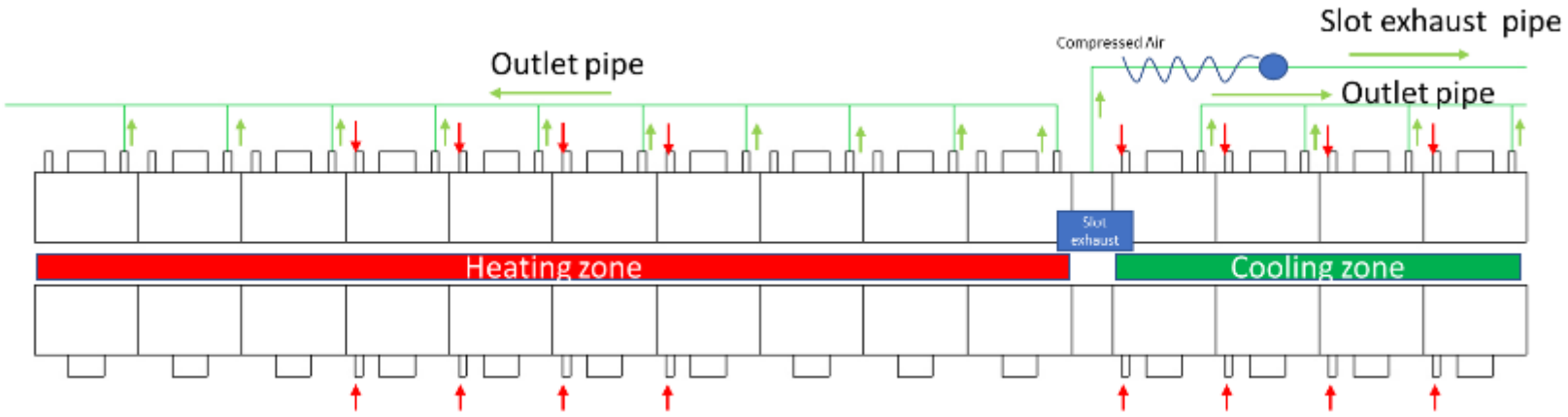
Slot exhaust

- Standard in every machine and located between last peak zone and first cool zone
- Exhausts polluted air before it enters the cool zone, preventing condensation inside the tunnel
- Slot exhaust is connected to the stack filter (air) or Cathox unit (N2)



Air flow system – Patented Individual Cell Exhaust

- Enhanced cleanliness of tunnel and safe production environment
- Continually exhausts flux laden gas out of the heated tunnel in each zone.
- Standard on air machine

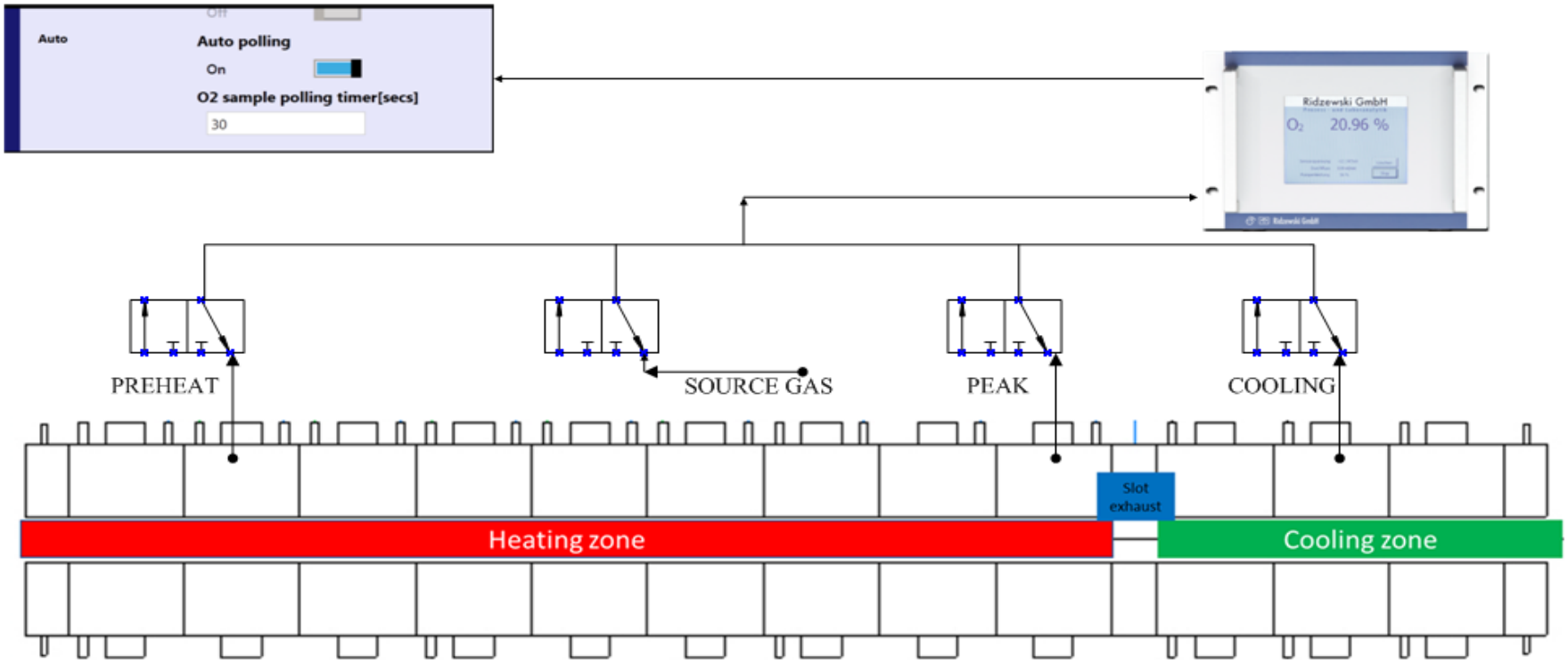


N2 Atmosphere

- Baffle zones separate nitrogen from air environment and decreases air creep into the system
- Standard Flow meter, N2 reduction apertures, Smart Purge System, Manual 4 sample ports
- Optional Oxygen Analyzer
- Optional N2 consumption monitoring
- Optional True N2/Air Switching
  - To be released in Q3
- Optional Closed-Loop PPM Control to automatically regulate O2 levels between 500 and 3000 PPM
  - To be released in Q3

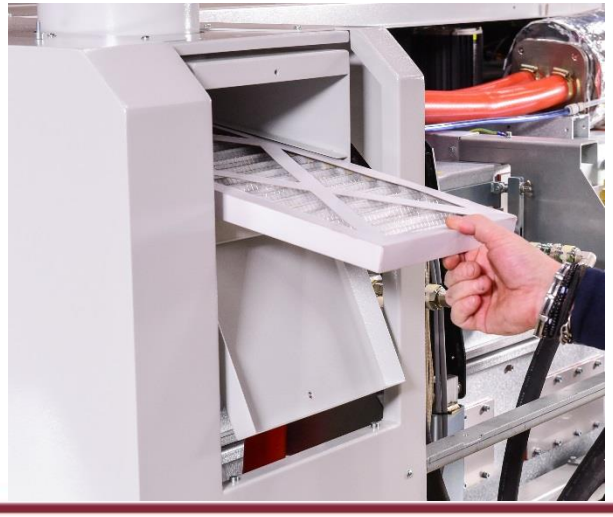
Automatic O2 Sampling Port

- Real-time monitoring of PPM level switching among four ports
  - Source, preheat, peak, and cooling



Integrated exhaust stack filter - Std

- Once the flux is evacuated from the tunnel, the negative pressure from the facility exhaust will draw the flux laden gas through a series of easily removed filters where it will condense.
- Filters can be removed during production and will not impact the inert tunnel environment.
- Disposable Filters can be bought anywhere where they sell A/C or heater filters, Home Depot etc.



CATHOX gas purification

CATHOX
CATALYTIC THERMAL OXIDIZER

The goal we set ourselves developing the next generation flux management system:

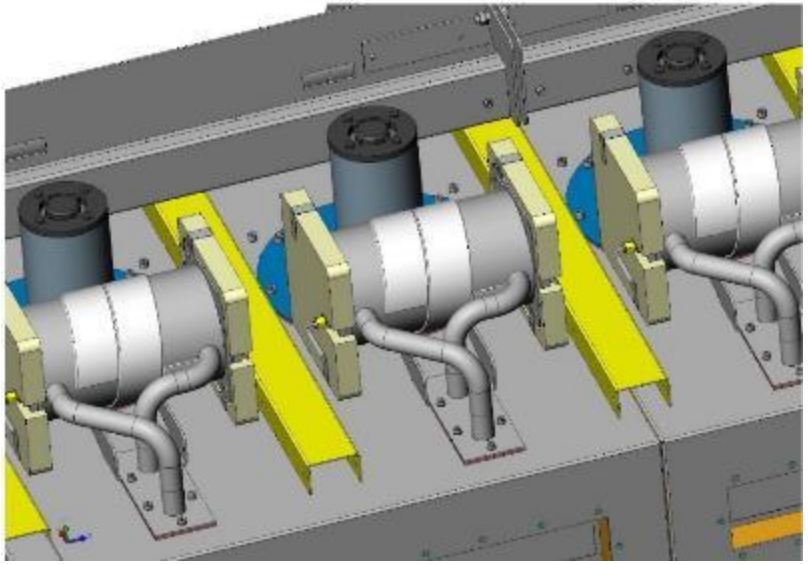
- Avoid the requirement of external devices like chillers
- Provide maximum maintenance intervals for cleaning activities
- Sustainability; next generation should use as little energy possible and provide a minimum of waste
- Preferable backwards compatible with our large installed base
- Potential maintenance needs to be as simple as possible and avoid the need for tools whenever possible

Patented concept: "Reflow Soldering Oven with Enhanced Gas Purification System"

CATHOX
CATALYTIC THERMAL OXIDIZER

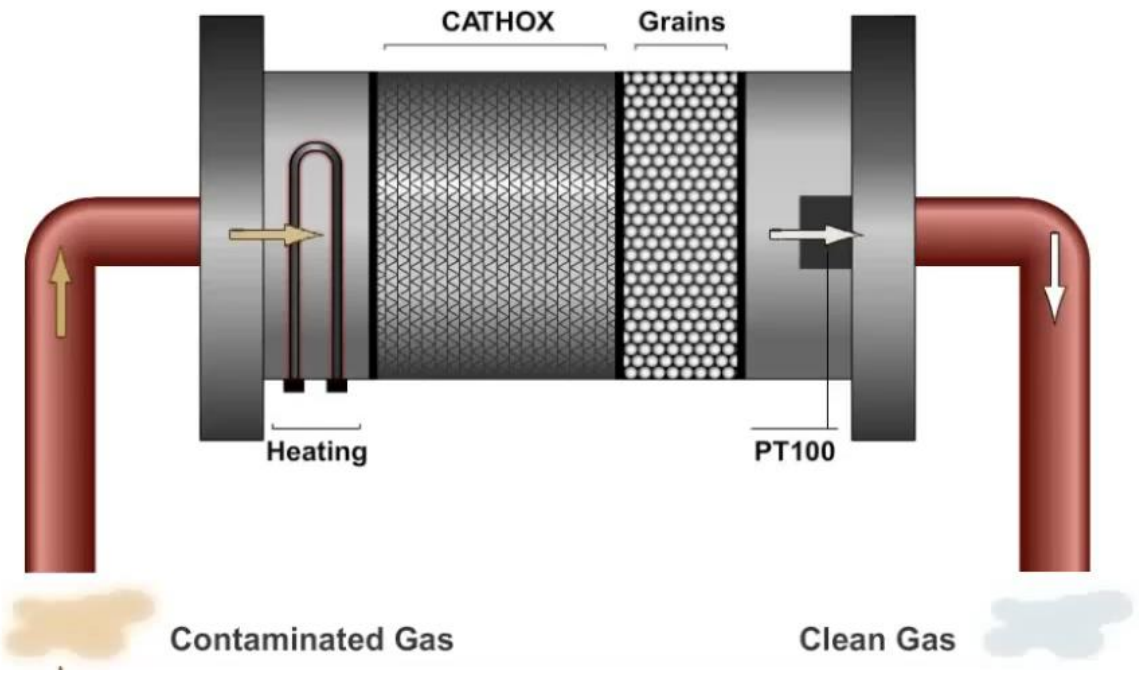
Benefits to customers:

- Primarily for nitrogen systems
- Heating zones remain clean, no cleaning required
- Less build up of flux on width adjust units and other mechanical drive mechanisms
- Long lasting units requiring very little maintenance
- Flexible and easy removable
- Cost effective, process operates under temperatures typically seen in reflow ovens
- No chillers required
- Negligible waste



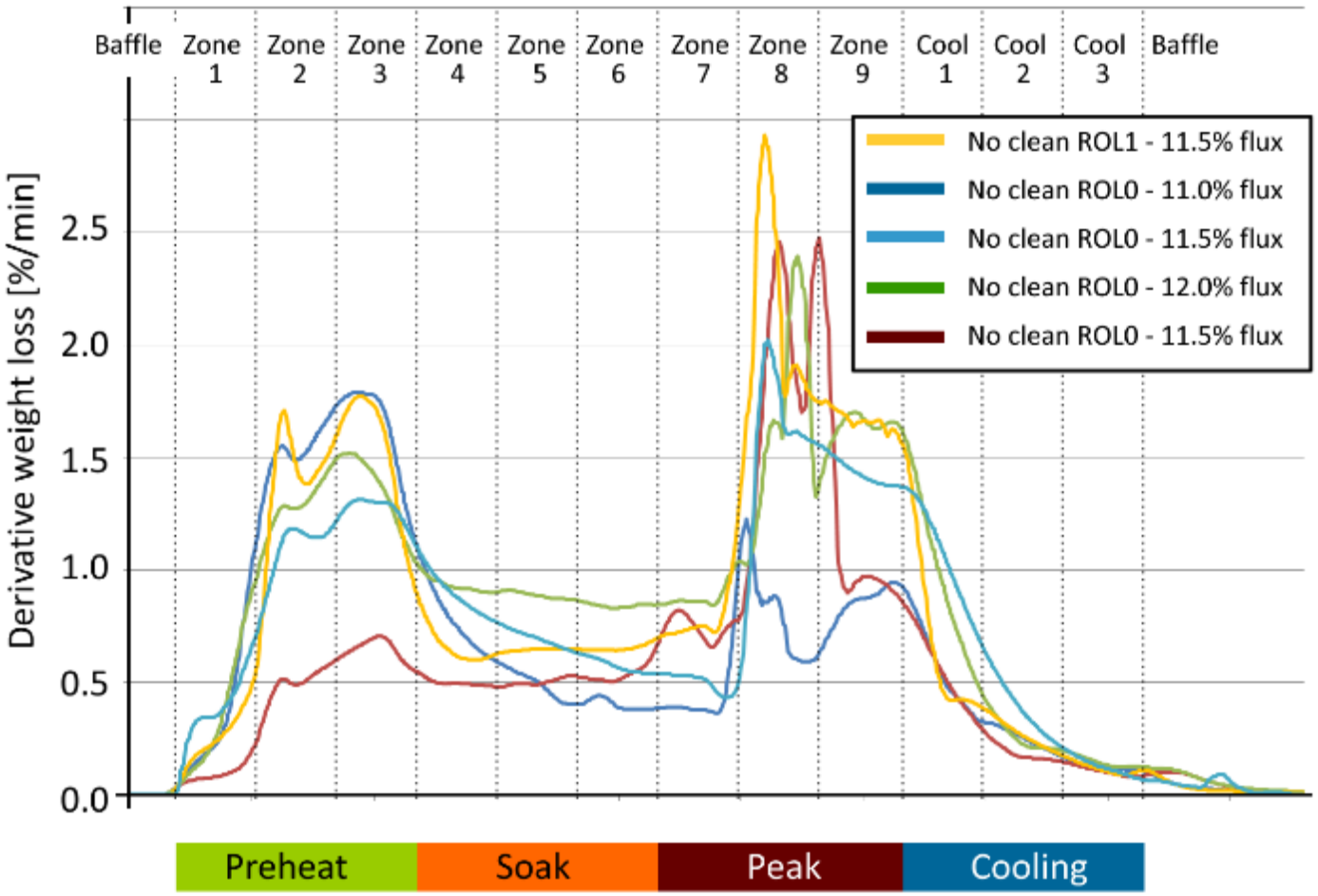
CATHOX

CATALYTIC THERMAL OXIDIZER

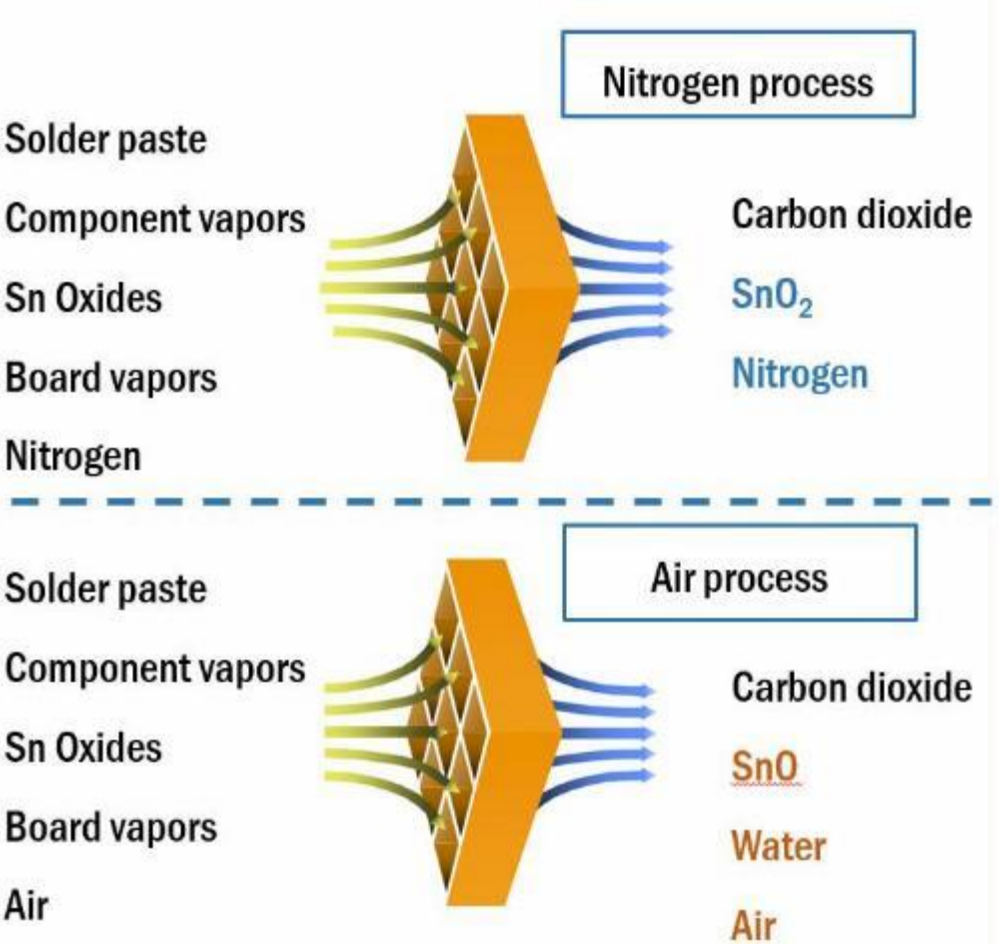


Approximately 5% of the volume per zone is continuously filtered through a Cathox unit

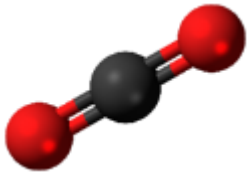
Vapors in reflow oven - 9 heating zones



Principle of catalyst



Carbon dioxide is a colorless gas. At low concentrations it is also odorless.



CATHOX
CATALYTIC THERMAL OXIDIZER

Basic kit includes:

- 4 Cathox units: zone 2-3, last 2 peak zones, slot exhaust and 1st cool zone
- Cathox units can be added per 2 heating zones

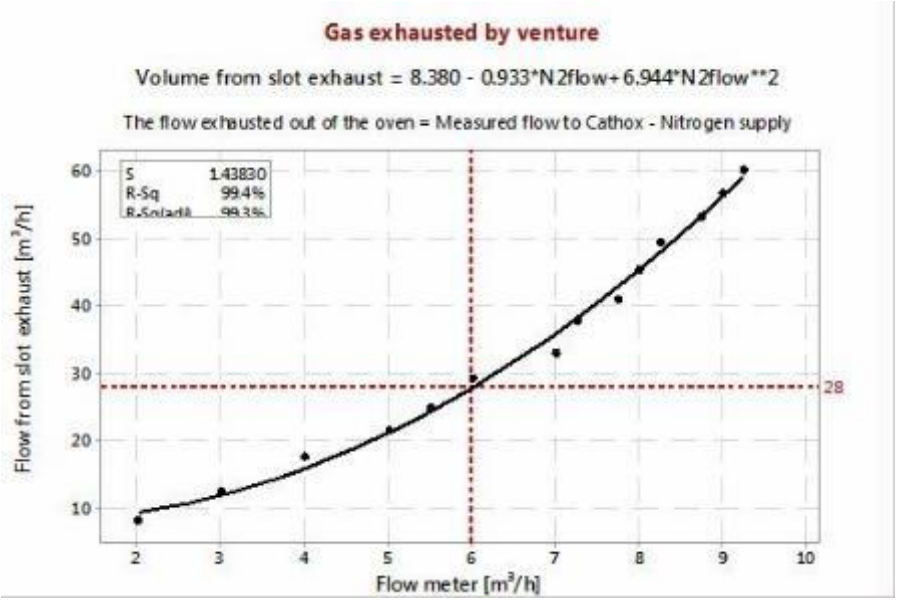
Vitronics Soltec advise on Cathox configuration:

0 – 5 kg solder paste consumption per week basic configuration
5 – 10 kg solder paste consumption per week basic + 1
10 – 15 kg solder paste consumption per week basic + 2
> 15 kg solder paste consumption per week full configuration

CATHOX
CATALYTIC THERMAL OXIDIZER

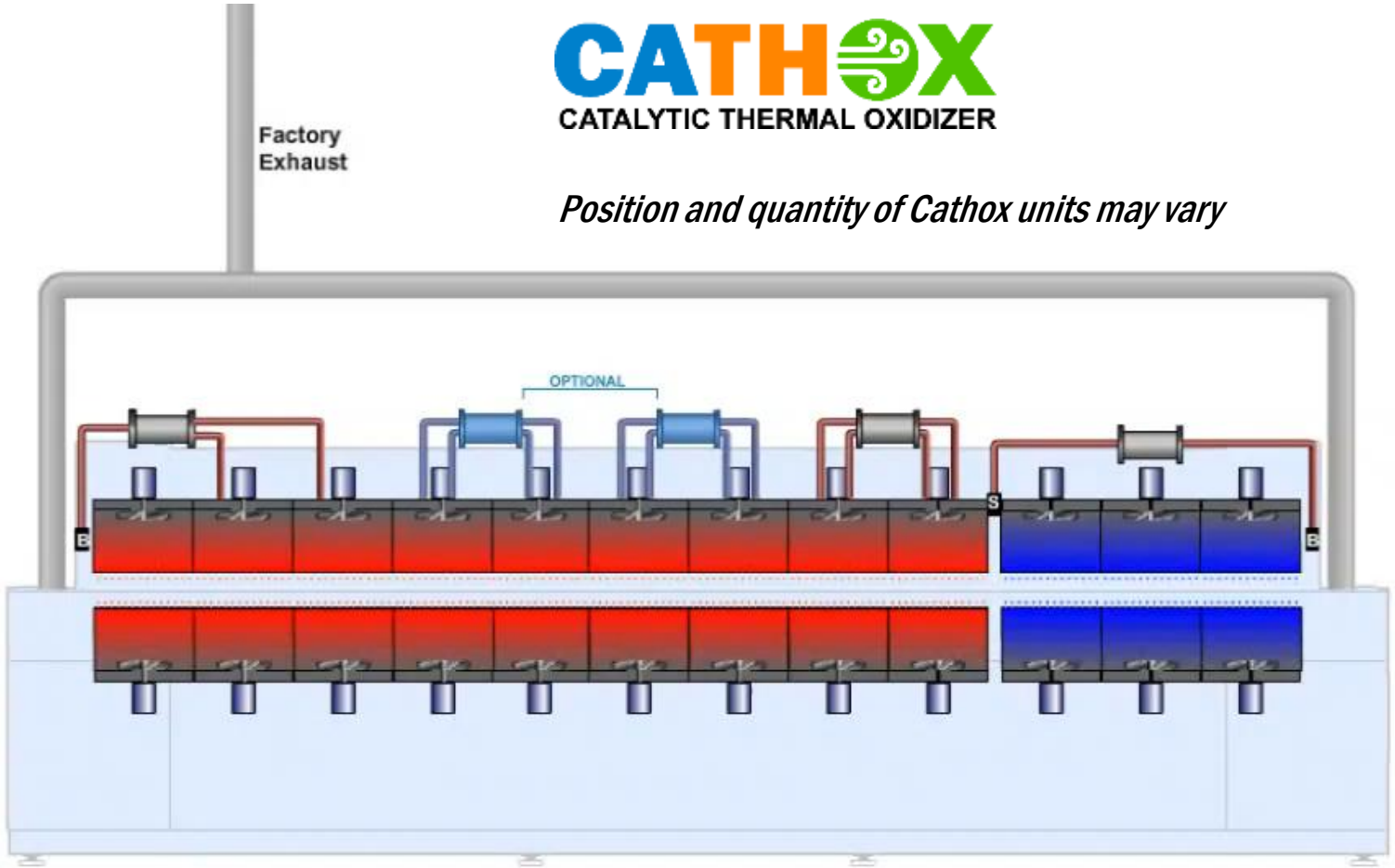
Venture installed behind Cathox unit

- Slot exhaust volume between 12 and 16 m3
- Low maintenance due to Cathox filtration



CATHOX
CATALYTIC THERMAL OXIDIZER

Position and quantity of Cathox units may vary



S Slot Exhaust

B Baffle Box

CATHOX
CATALYTIC THERMAL OXIDIZER

Field experience:

- Heated section remains dry, no maintenance
- Flux condensation, mainly in first cool zone, is inevitable
- Maintenance intervals vary from once every week up to once every 5 weeks
  - Depends on amount of Cathox units
  - Depends on amount of solder paste consumed
  - Depends on solder paste type (efficiency and crystallization type)
  - Depends on machine utilization

✓downtime reductions achieved up to 80 % !!
✓considerable savings in maintenance cost
✓expected decrease of unscheduled downtime
✓expected decrease of part consumption
✓expected increase s on machine utilization

Cooling

Multiple Cooling Configurations possible

Basic Air Cooling
- Ambient air intake

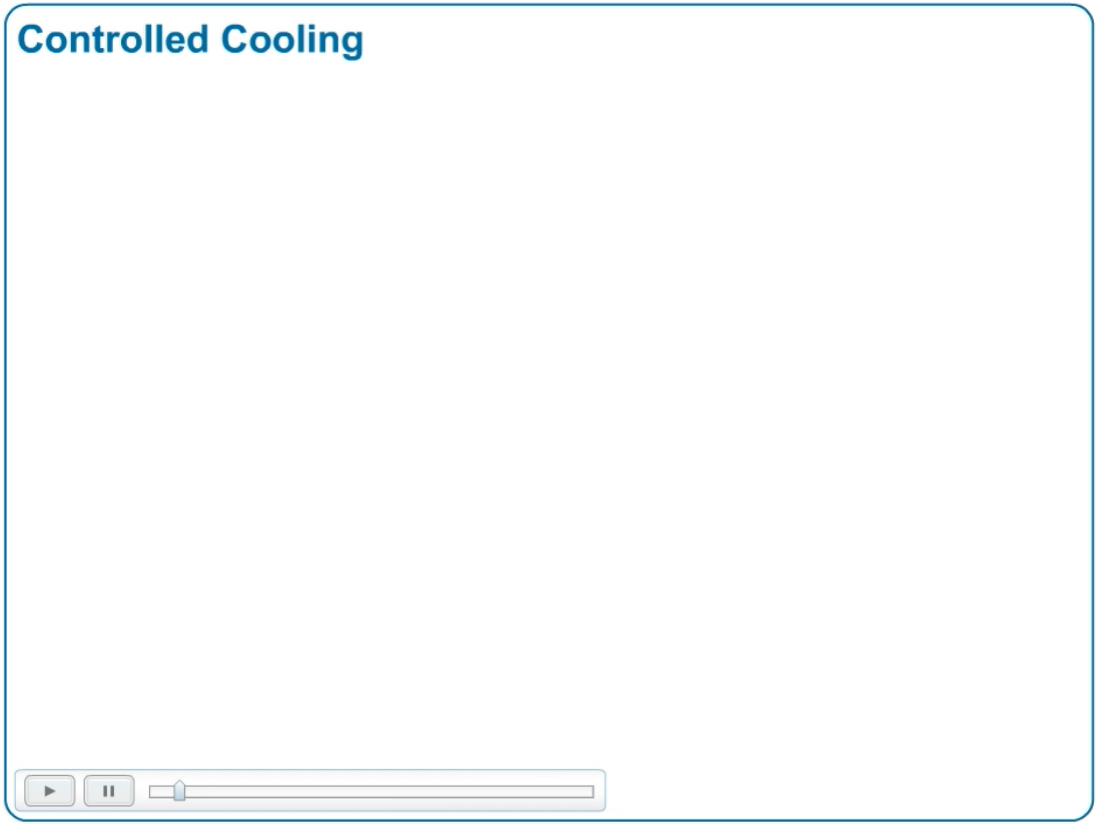
Smart Air to Air Cooling
- Forced ambient air cooling

Water Cooling at Top Side
- Water cooled heat exchangers at top side

Advanced Controlled Water Cooling at Top Side
- Temperature controlled

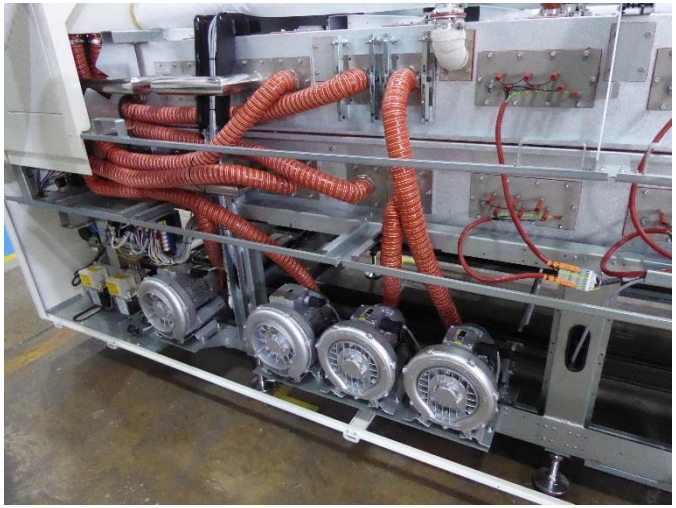
Cooling water supply options

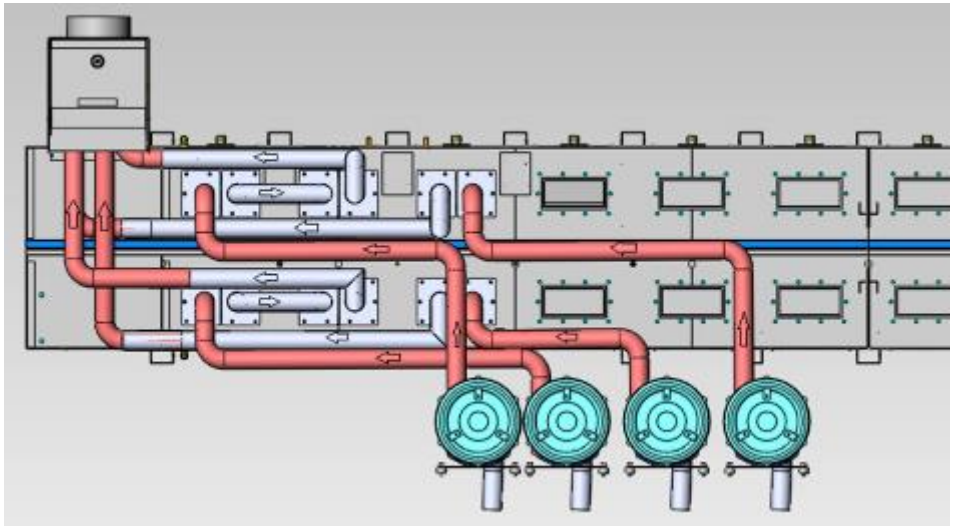
Bottom side cooling



Smart air-to-air cooling

- Improved cooling gradient without cold water supply
- Works in air and nitrogen
- No glycol needed, no risk for leakage or spill
- Hot air is exhausted, less impact to the production environment
- Cooling gradient regulated by fan speed control
- Top and bottom side cooling
- Cooling rates comparable to water to air alternatives
- No closed loop regulation





Water to air cooling

- Closed loop water to air cooling system
- Additional option of Advanced Controlled Cooling for cooling temperature control
- Top and/or bottom side
- Low maintenance

Water to air cooling

- Transparent flow detectors allowing visible control
- Sensors on backside automatic detect flow alarms

- Heat exchangers standard equipped with quick disconnects in first cooling zone
- Heating element in first cool zone for optimal temperature control

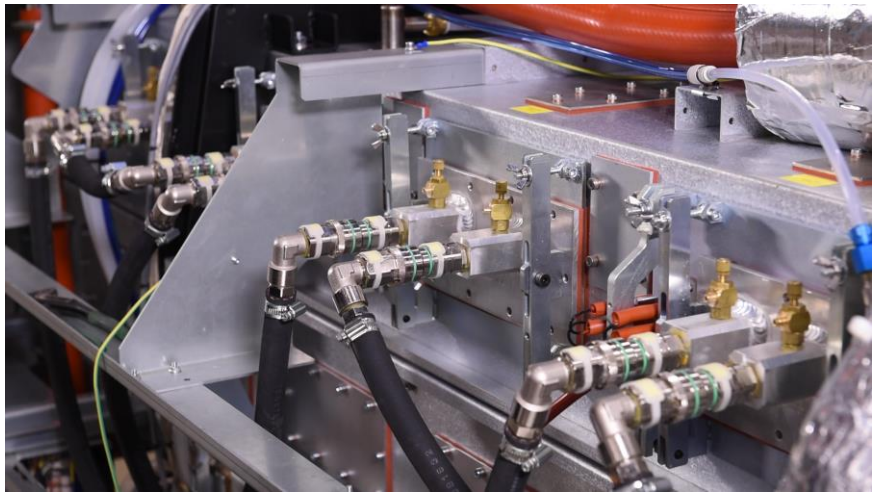
- Cold water supply on swing arm for optimal accessibility
- Non-pressurized system

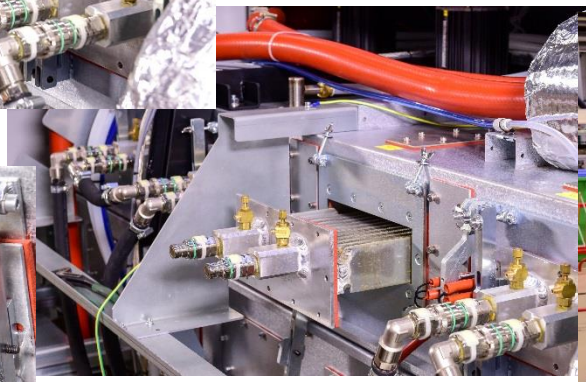
Chiller or factory water connection

- Provides stronger cooling rates
- Chiller and Factory water cooling only as secondary
- Additional option of Advanced Controlled Cooling for cooling temperature control
- System (no direct water input into the zones)
- 10kW chiller can be up to 35 m from the machine

Removal of heat exchangers

- Standard quick disconnect system in first cool zone, optional in other zones



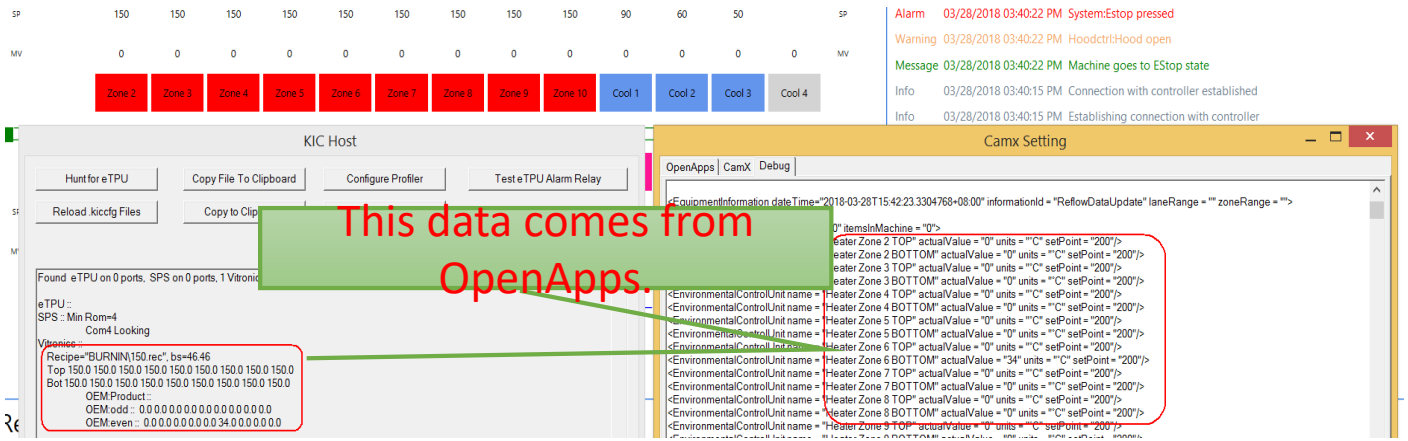


Software

- Windows 7™ based software package (Windows 10 per July'18)
- Full function recipe management
- Password protected
- Auto start/stop function with 7 day timer and calendar
- Alarm, event and process data logging
- Trend analysis
- User-friendly operator interface
- KIC, ECD profiling software pre-installed

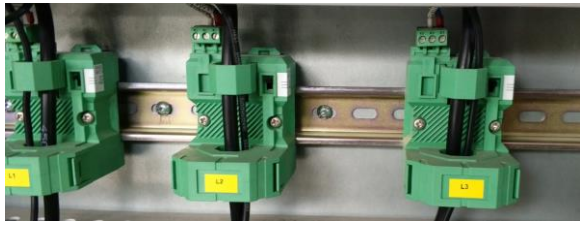
OpenApps

- OpenApps is a data exchange interface which allows programmers to develop custom software packages (or plug-ins). These plug-ins can request data from Centurion application, make decisions, or command Centurion application to perform an action (i.e. start / stop machine, run / save recipe from remote/MES side, etc.).
- We have developed such plug-ins as CAMX, Hermes, Harman-PDES, ASYS, KIC, etc.
- Customers can develop their own plug-ins by OpenApps.

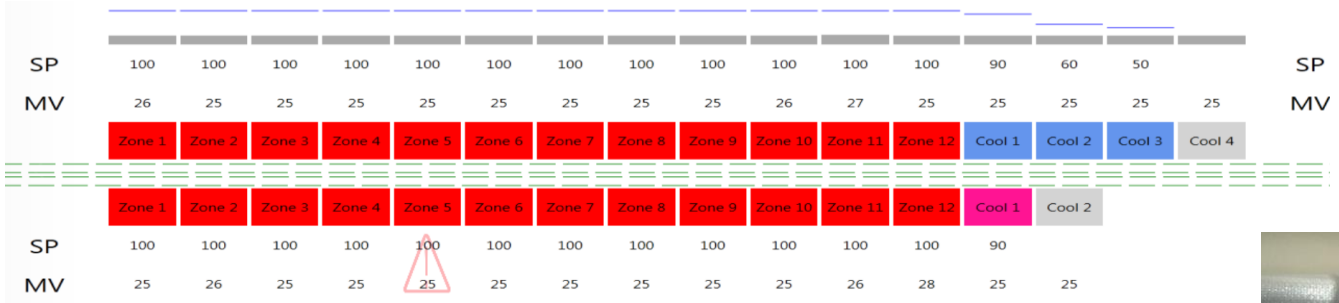


System Performance Verification System

- Heating Element Check
  - During heating element start-up, the current of each heating element is checked.
  - If there is a failure, the system generates an alarm and identifies which heating element has failed

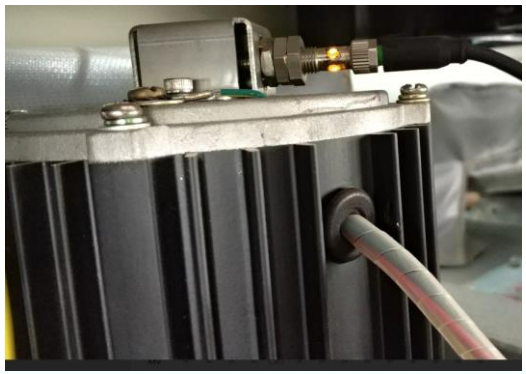


Alarm 4/2/2018 9:50:27 AM Heater Zone 5 Bottom:Open heater element



- Individual Cell Fan Sensing
  - Real-time detection of cell fan motor rotation
  - If there is a failure, the system will generate an alarm and identifies which fan motor has failed

Alarm 4/2/2018 9:53:57 AM Heater Zone 6 Bottom:Cell fan fail



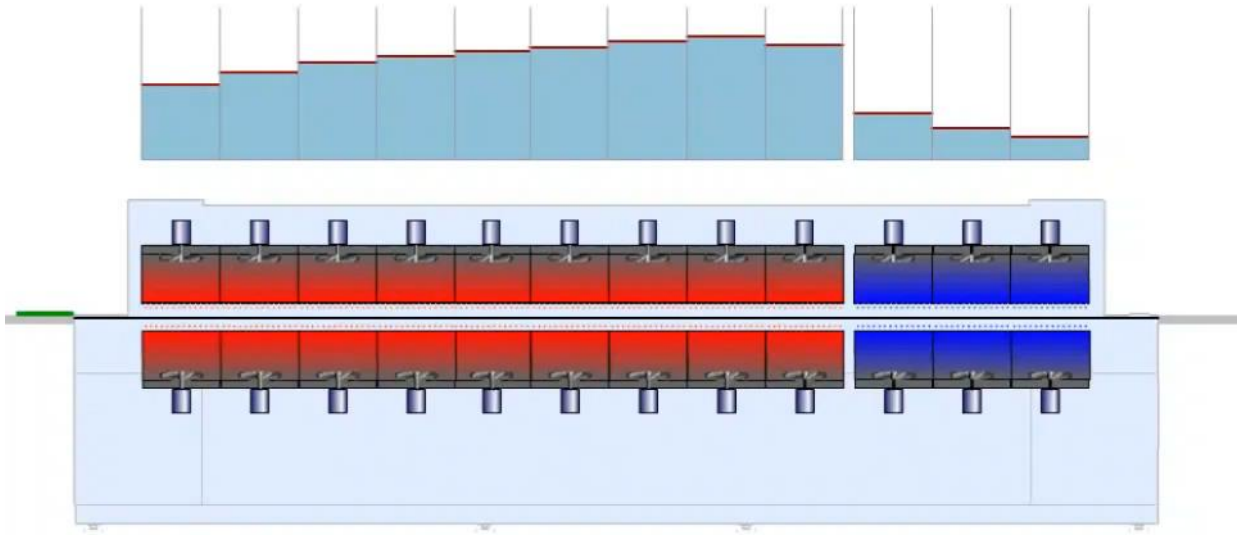
Additional Options

- UPS (Uninterupted Power Supply)
  - runs PC, hoodlift and conveyor in case of power interruption

- Barcode interface
  - single or dual lane, top and/or bottom

Quick Recipe Change

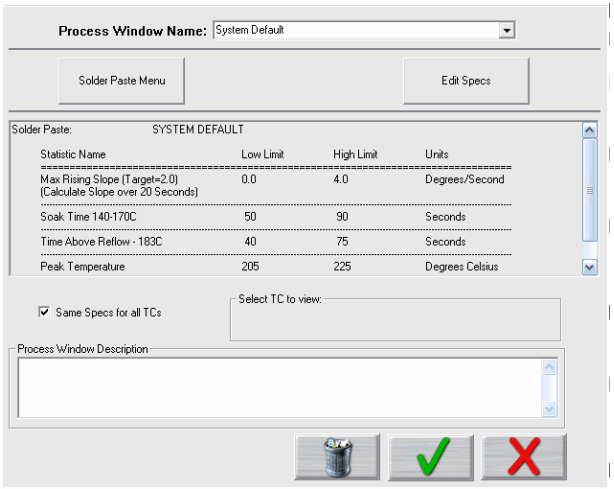
- A normal oven would need to run empty before new set points can be loaded
- QRC can decrease change over times with several minutes

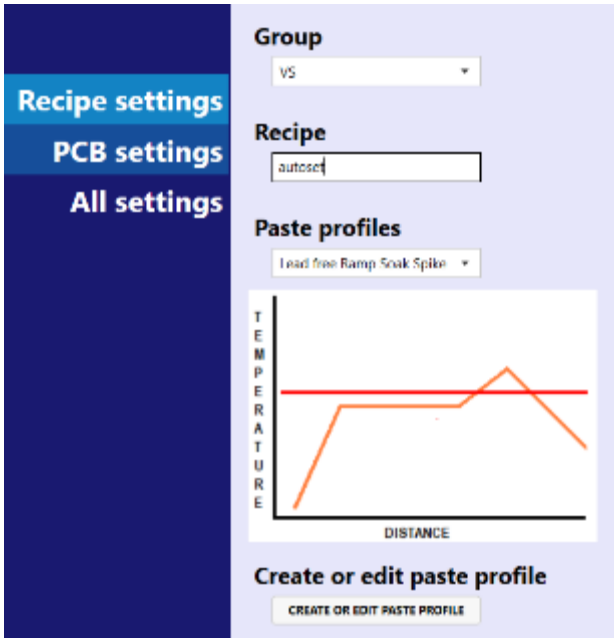


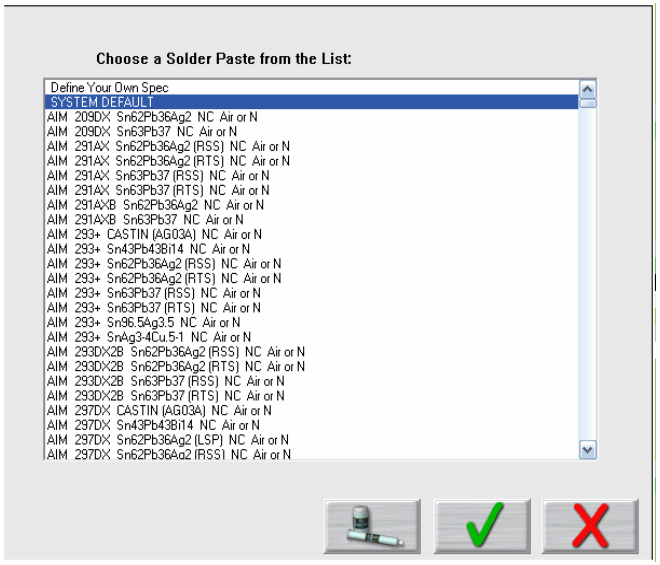
Machine running profile A

AUTOset provides you a fast set up in 3 easy steps

STEP 1: Name recipe and choose solder paste used from the library

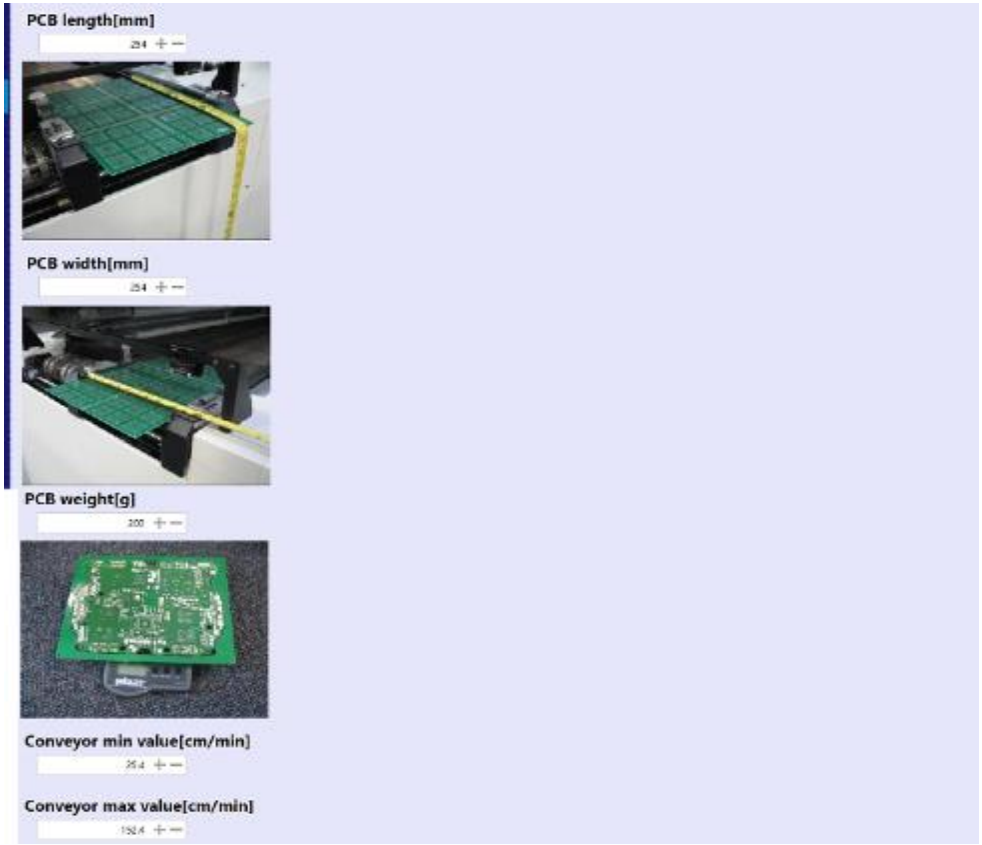






AUTOset provides you a fast set up in 3 easy steps

STEP 2: Enter PCB length, width, weight, min and max conveyor speed



AUTOset provides you a fast set up in 3 easy steps

STEP 3: Create a recipe using the Autoset search engine

- In less then 60 seconds your oven set up is created
- Zone settings and conveyor speed are automatically generated
- Click Finish to run or save the new generated recipe

AUTOset provides you a fast set up in 3 easy steps

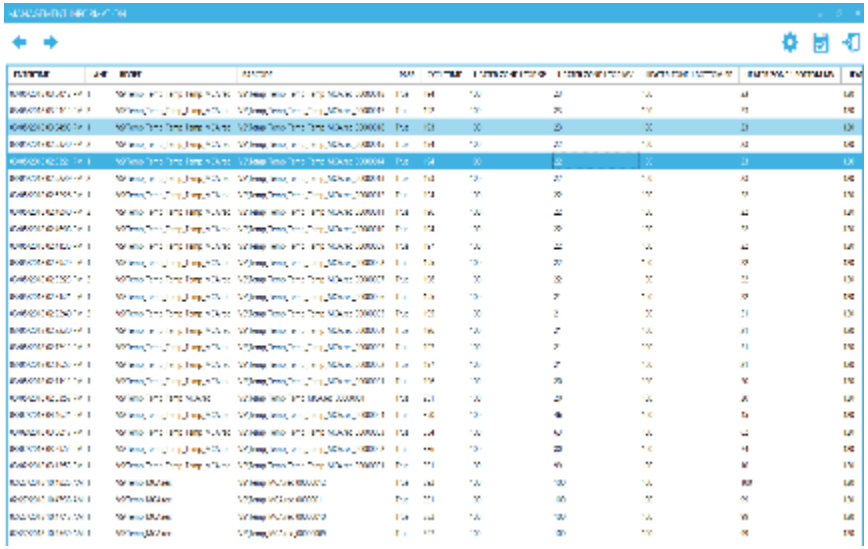
Autoset will benefit you:

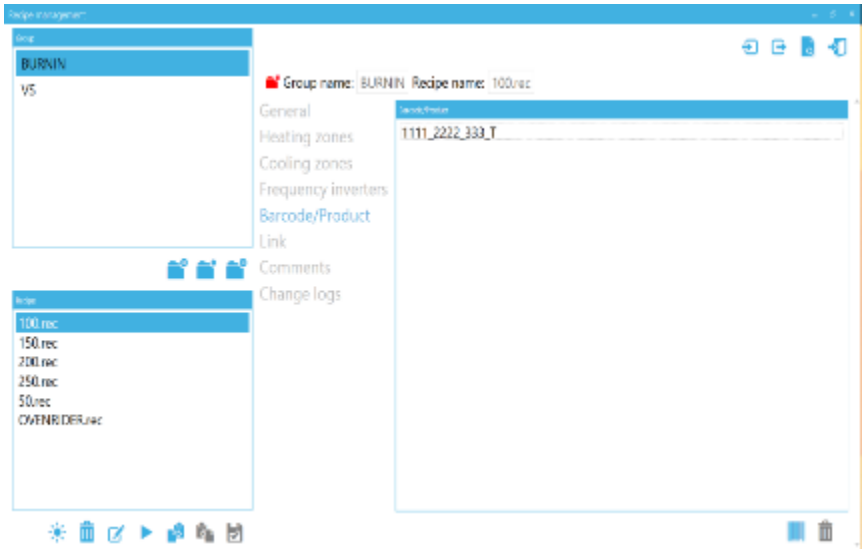
- Eliminates the need for the operator to "guess" at an initial oven recipe, and instead calculates the ideal oven recipe based on input data.
- Avoids conventional oven set up pitfalls.
- Simple, fast and easy to use, requiring minimal input or technical experience.
- Faster set up, process optimization and reduced energy cost.

AUTOset saves you time and money

Traceability

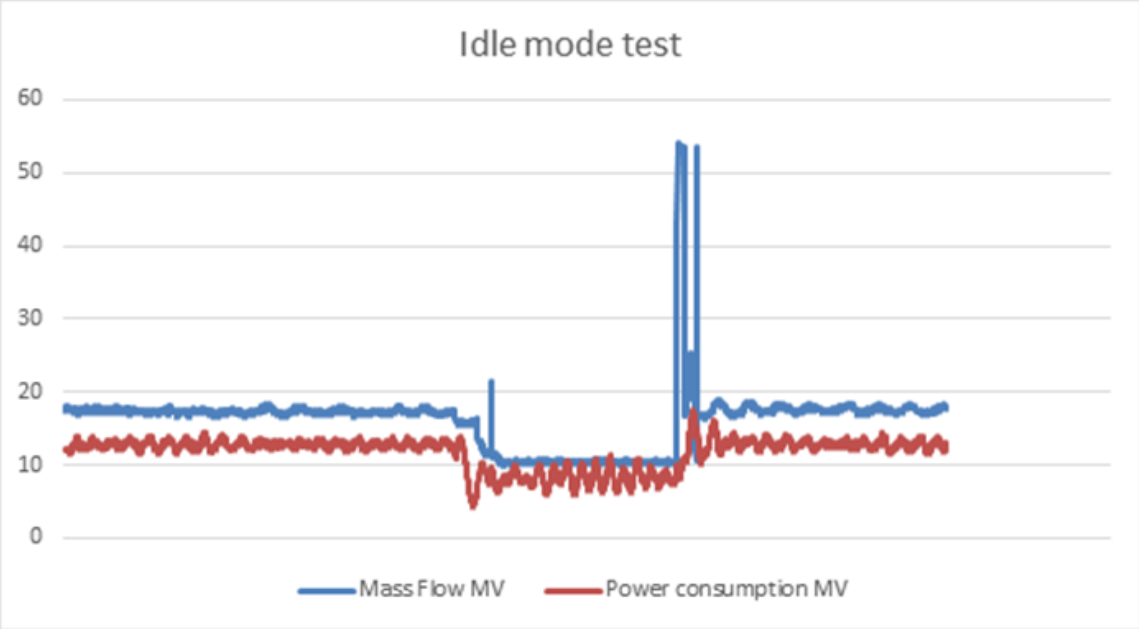
- Management Information System provides a log file with all set and actual values
  - You can program your own parameter set
- Barcode software offers the opportunity to connect this to an individual product
- Barcode software can be used for automatic program selection





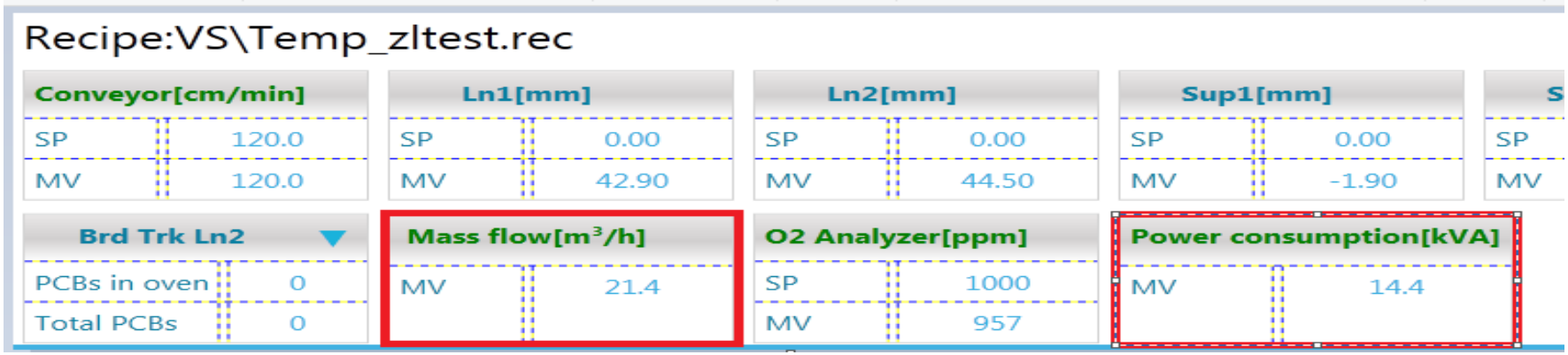
Idle Mode

- Reduces power consumption and N2 consumption when the machine is idle
- Settings can be entered with different production needs
- Saves power up to 35%, N2 up to 40%



Power/Nitrogen Consumption Monitoring

- Real time energy consumption monitoring
- Energy consumption history trend log
- Mass flow N2 meter

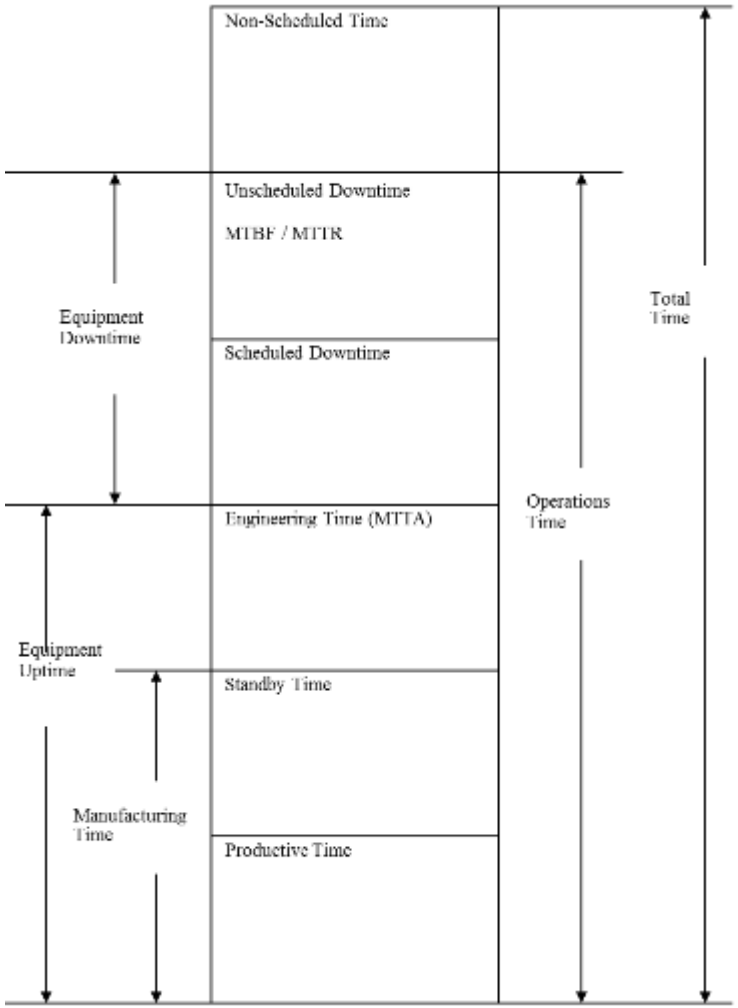


Cost of Ownership

- Low power consumption (13-18 kWh)
  - Depending on configuration and settings
  - Product load typically consumes 1-2 kWh
- Low nitrogen consumption (20-38 m3/h or 700-1300 scfh)
  *Depending on configuration and settings
- Small footprint
  - The best machine length / process length ratio in the industry

Uptime Centurion

$$\text{Operational uptime (\%)} = \frac{\text{Equipment uptime} * 100}{\text{Operations time}}$$



At an MTBF of 1000 MTTR is 2 hrs

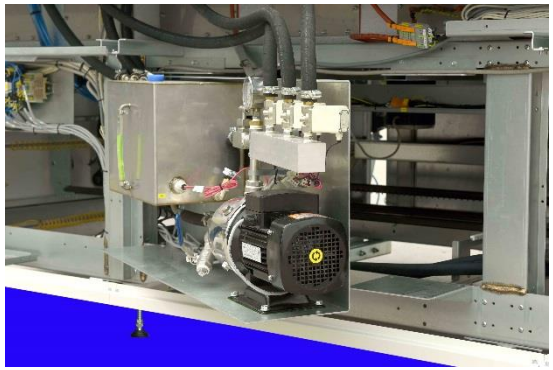
At 8 hrs/shift, 21 shifts/week, 49 weeks/yr

:0.84 % scheduled downtime

0.20 % unscheduled downtime

Operational uptime 98.96 %

Maintenance & Accessibility



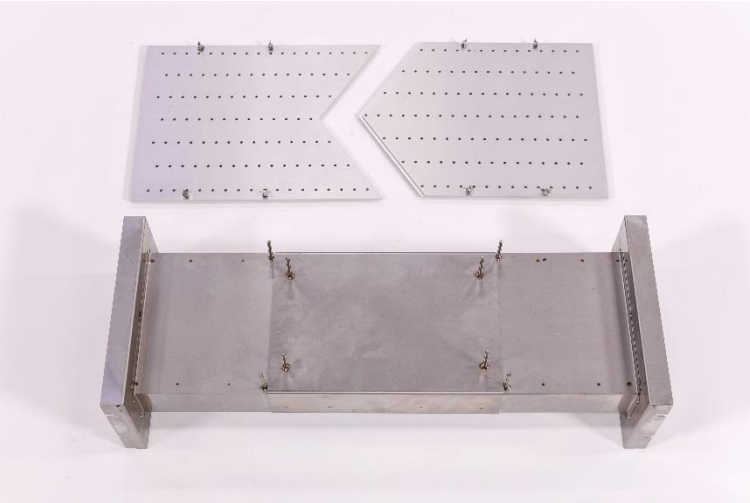
- Swing-arm mounted cooling module, easy access, easy to clean
- Slot exhaust design for tunnel cleanliness
- Exhaust connection with removable filters
- Easy accessible cooling zones for maintenance
- Easy accessible transport system with auto lubrication

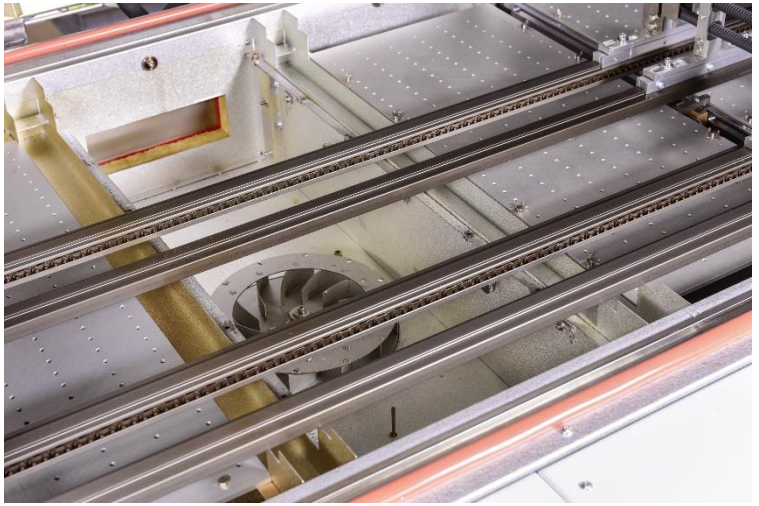
CATHOX
CATALYTIC THERMAL OXIDIZER

Special options

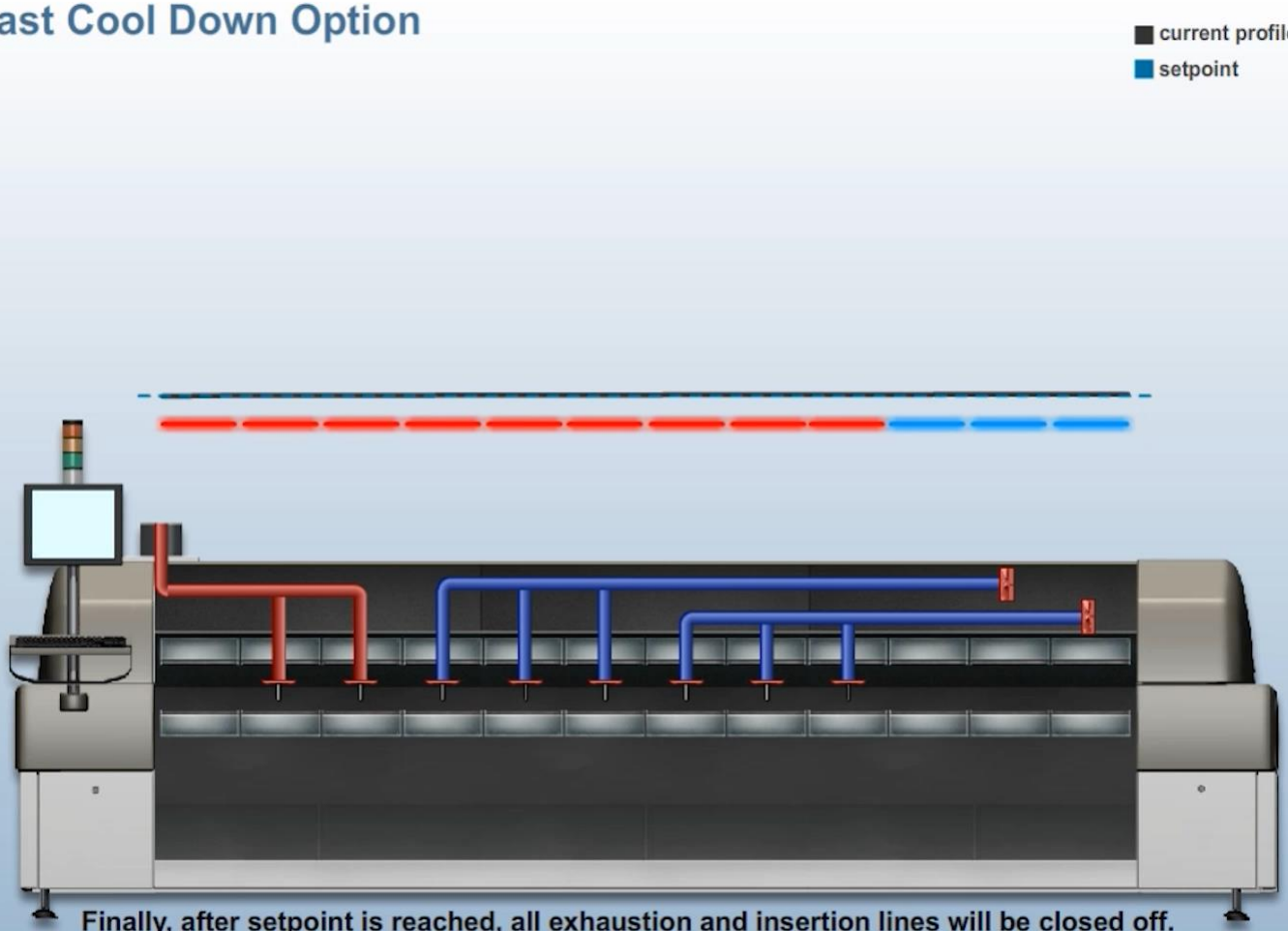
Optional easy removable blow box

- Applicable in areas where maintenance is required, typically first cool zone(s)
- Face plate can be split in two parts
- Inner box can be disassembled into 3 parts for easy access to the complete unit
- Ideal for bottom side units with dual lane configurations





Fast Cool Down Option



Features

- Proven Thermal technology with over 2000 machines installed worldwide
- Unique patented flux management system
- Configurable to your needs

CATHOX
CATALYTIC THERMAL OXIDIZER

- High heat transfer enables you to use lowest set-points resulting in low power consumption and smallest delta T
- Low cost of ownership
- Compact, positive heated length to machine length ratio
- Strong closed loop controlled cooling performance
- Low machine height of 1.4 m (55") improving visibility in your manufacturing facility
- Installed and supported globally
- 610 mm or 24" capability
- Fast cool down capability
- High performance machine against medium price

“Our reliability is your productivity"

- One year full warranty on parts and labor
- Additional 2 years warranty on parts – total of 3 years
- Lifetime warranty on fan-motor combination
- Lifetime warranty on heating elements

Thank You