Newly developed brazing equipment at SECO/WARWICK: Vertically loaded semi continuous CAB line with vacuum purging.

5-th International Congress
„Aluminium Brazing”

May, 06-08.2008, Düsseldorf

AUTHOR: Piotr Skarbiński, Global Product Director - CAB Furnaces
p.skarbinski@secowarwick.com.pl

CO-AUTHOR: Sławomir Woźniak, CAB Furnaces Team Director
s.wozniak@secowarwick.com.pl

SECO/WARWICK SA
Ul. Sobieskiego 8
66-200 Świebodzin
POLAND

SECO/WARWICK Corp.
P.O.Box 908
180 Mercer Street
Meadville, PA 16335-8400
USA

SECO/WARWICK Tianjin
Industrial Furnace Co. Ltd.
Beisunzhuang Village
Jinwei Road, Beichen District
Tianjin, **CHINA**

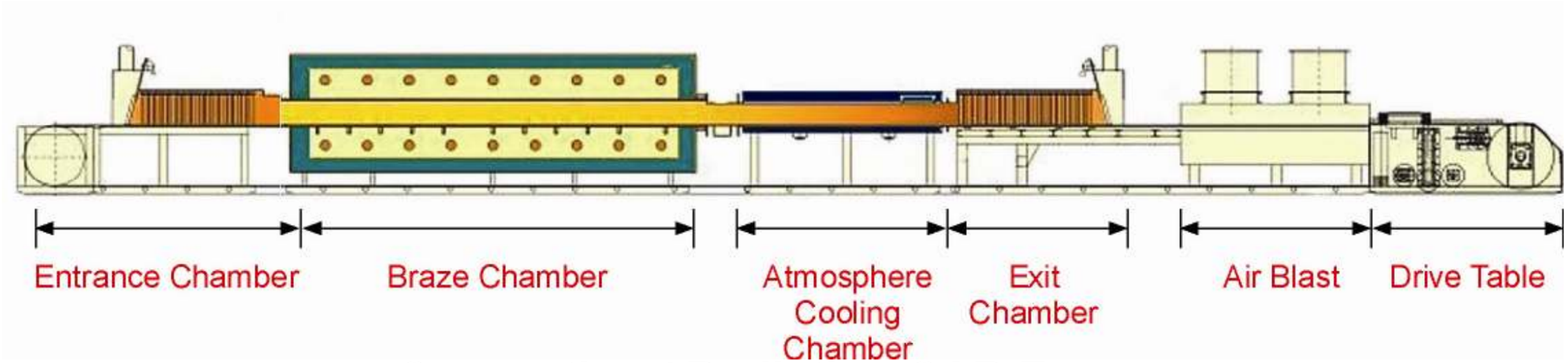
SECO/WARWICK Allied Pvt. Ltd.
Road No.1
Chembur, Mumbai - 400 071.
INDIA

Scope

- ✓ Standard available CAB Furnace Systems.
- ✓ Why vertical core position?
- ✓ Line design and work sequence.
- ✓ Control system.
- ✓ Summary and conclusions.

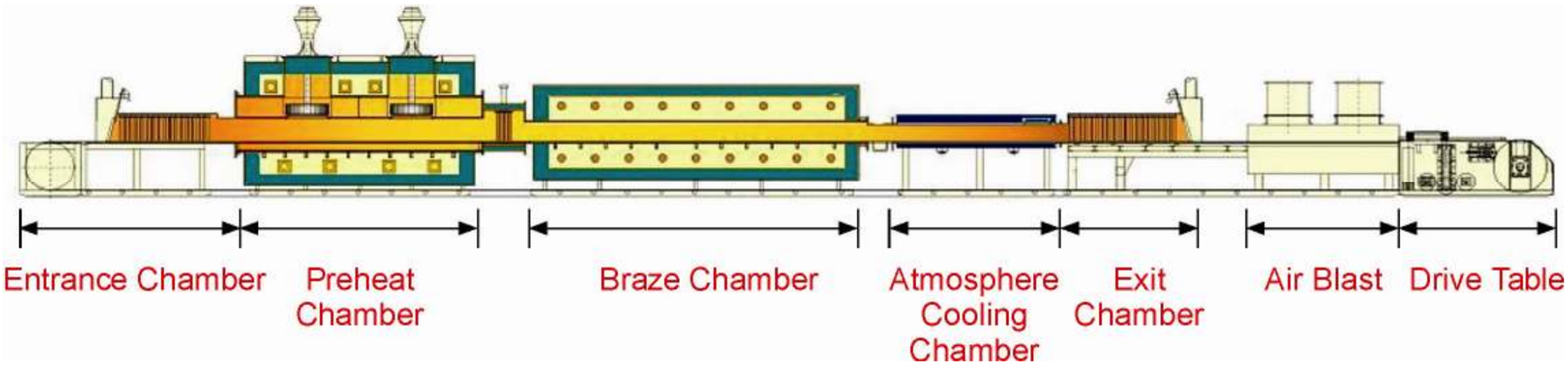
Continuous CAB Systems

Radiation CAB Furnace



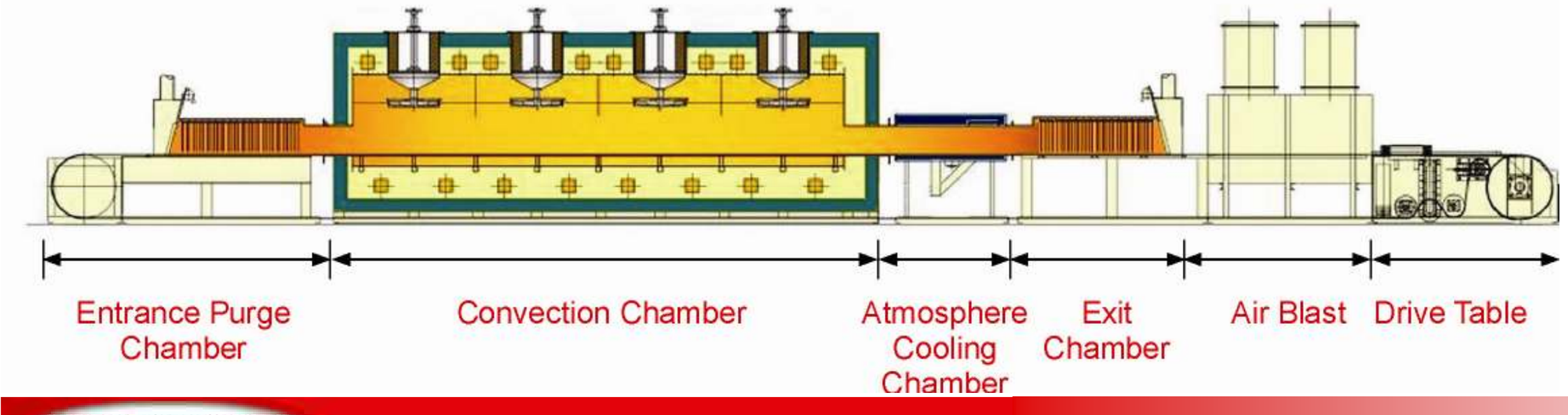
Furnace type	Radiation braze
Time to braze	Hihg
Product intermixing	Low
Temperature uniformity	Medium
Atmosphere consumption	Low
Required maintenance	Low
Brazing efficiency	Medium
Flexibility	Low
Cost	Low

Convection / Radiation CAB Furnace



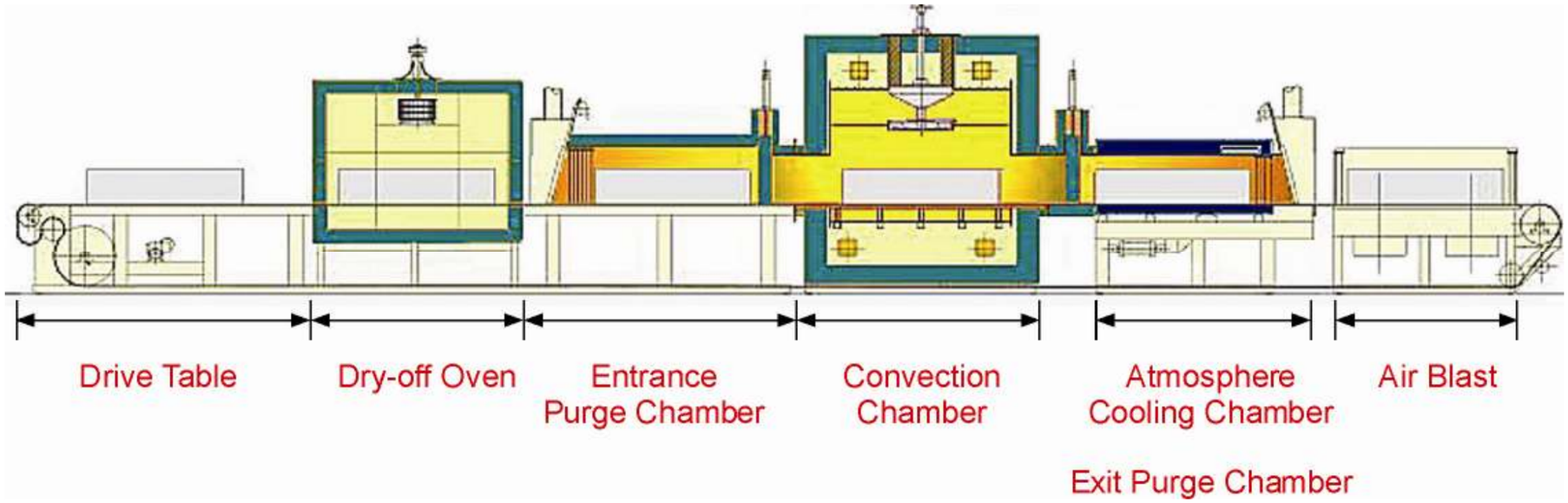
Furnace type	Convection preheat/ radiation braze
Time to braze	Medium
Product intermixing	Medium
Temperature uniformity	Medium/High
Atmosphere consumption	Low
Required maintenance	Low
Brazing efficiency	Medium/High
Flexibility	Medium
Cost	Medium

Convection CAB Furnace



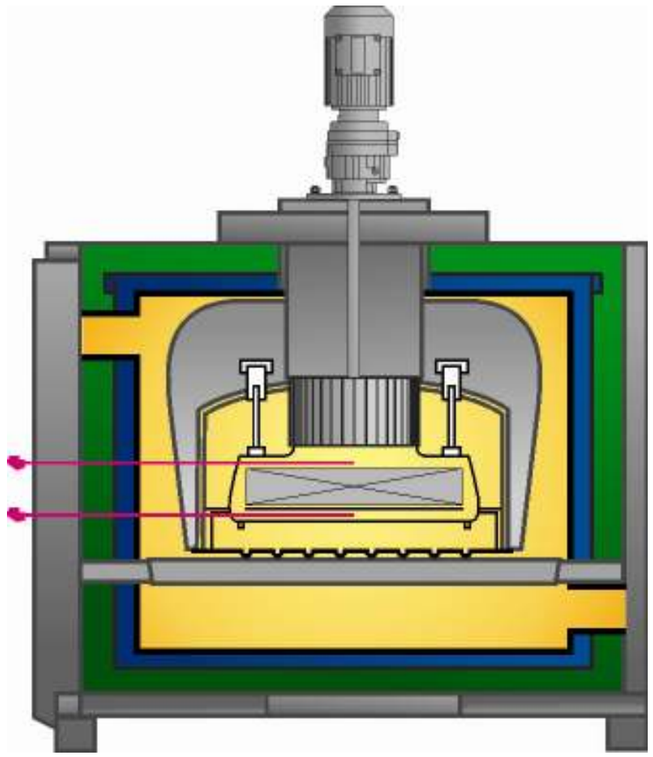
Furnace type	Convection braze
Time to braze	Low
Product intermixing	High
Temperature uniformity	High
Atmosphere consumption	Medium
Required maintenance	Medium
Brazing efficiency	High
Flexibility	High
Cost	High

Active Only® Convection CAB Furnace



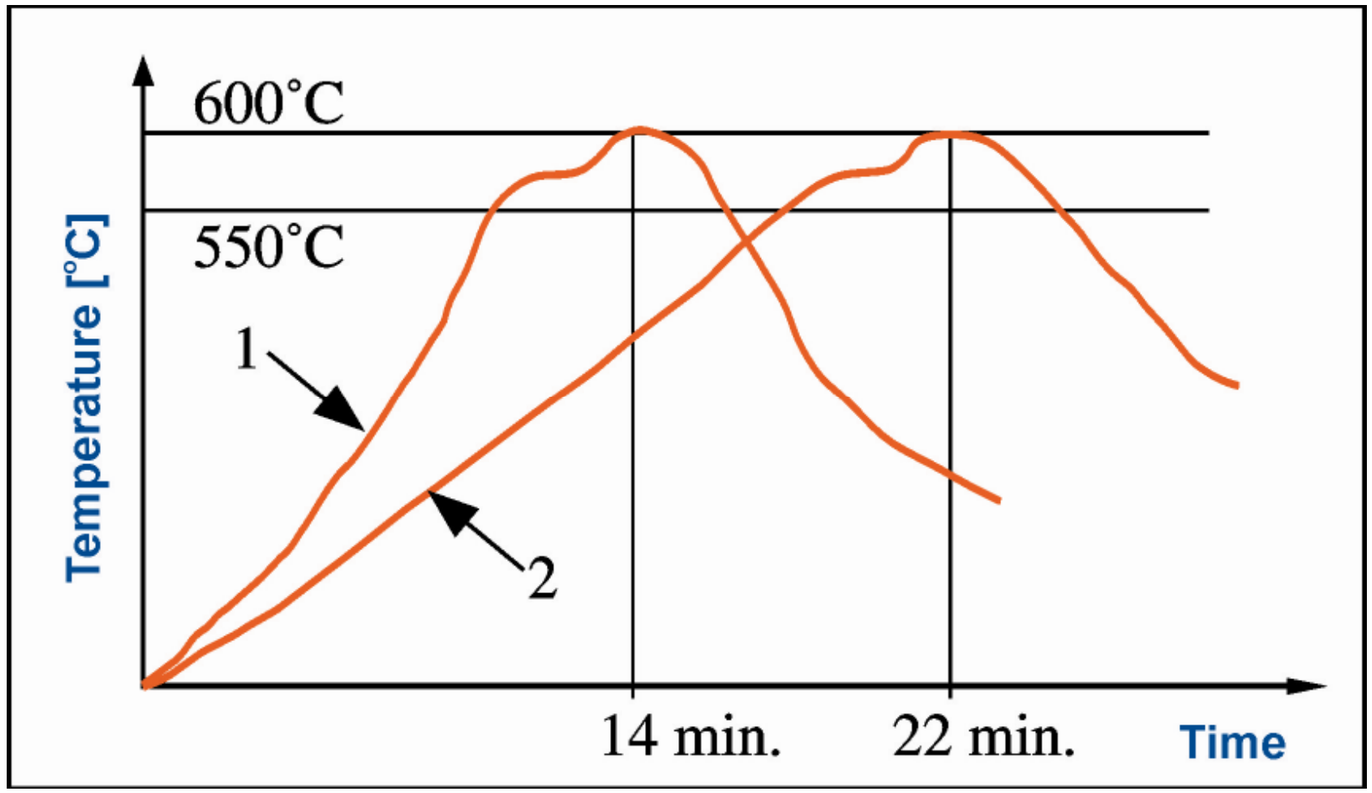
- ✓ Semi-continuous sequence of work.
- ✓ Highest flexibility.
- ✓ Capable to work on a part time basis.
- ✓ Active Only® furnace keeps high brazing quality for diverse products with no need to change process parameters.

Active Only® Convection CAB Furnace



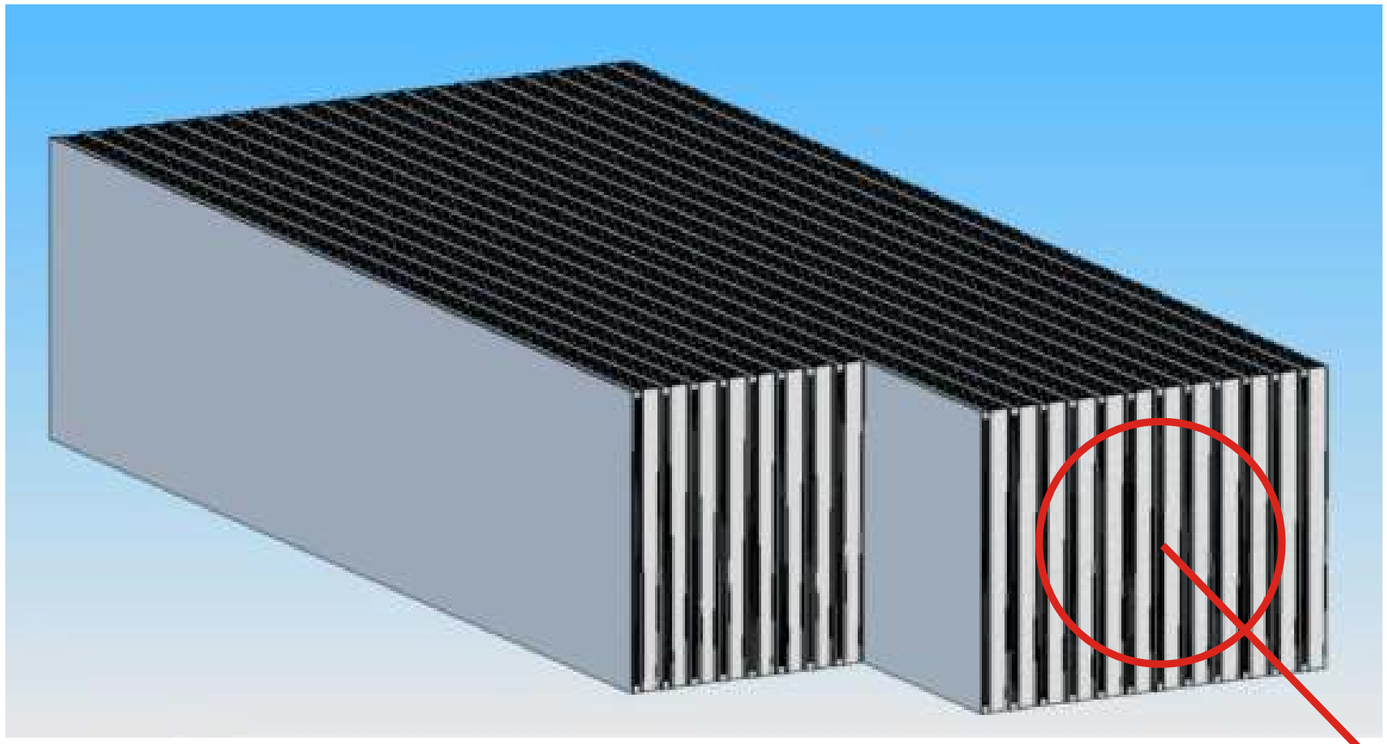
- ✓ Load thermocouples read the load real temperature.
- ✓ During heating phase system provides as high as possible heating rate.
- ✓ During brazing phase system assumes fixed soak time with reduced airspeed and highest temperature uniformity.

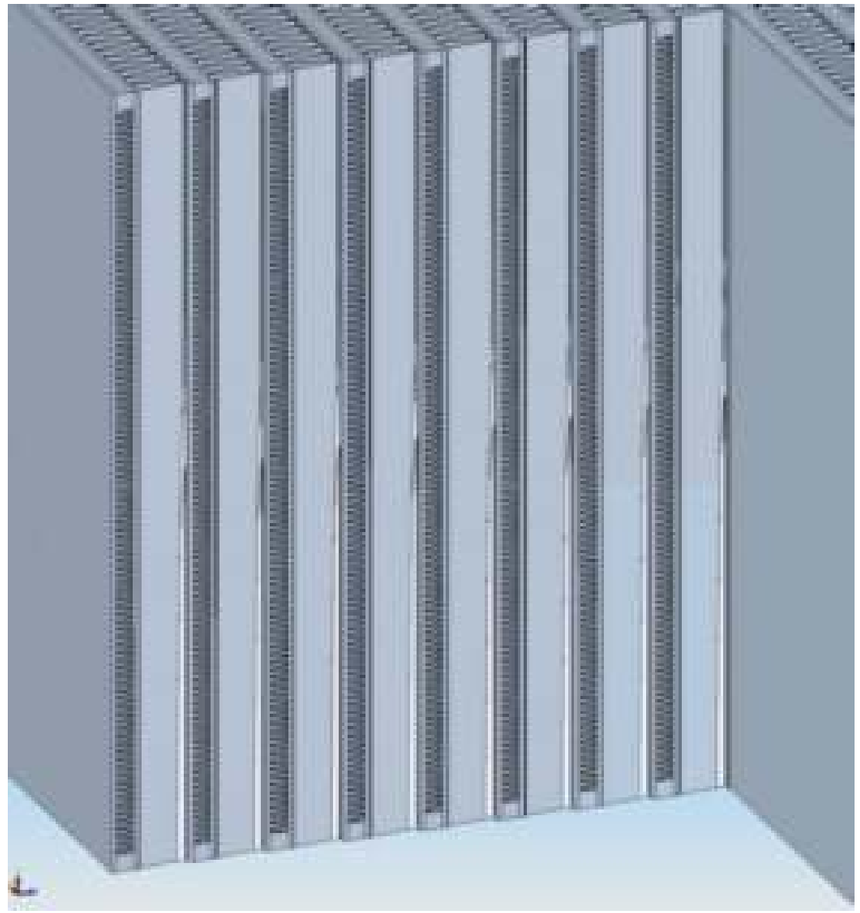
Active Only® Convection CAB Furnace



✓This control strategy provides different but possibly highest heating rate and very similar temperature profile around brazing phase.

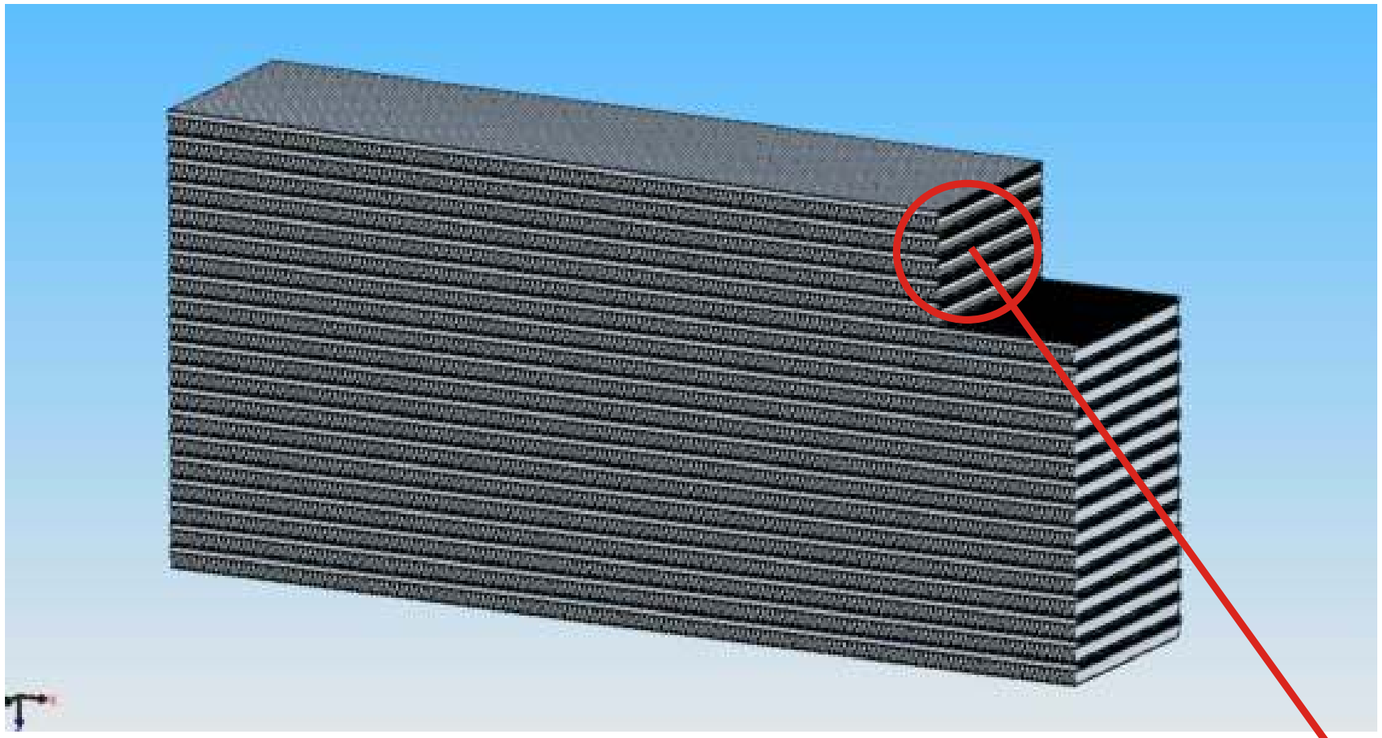
Why vertical core position?

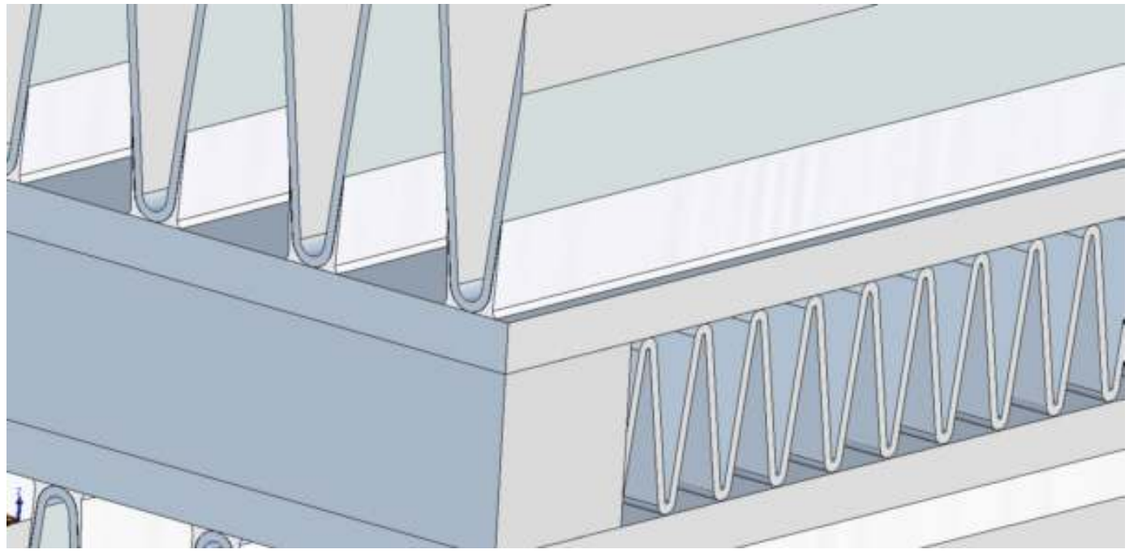




- ✓ Horizontal alignment of the core = vertical alignment of the brazed joins.

Why vertical core position?





- ✓ Vertical alignment of the core = **horizontal** alignment of the brazed joins.

Vacuum purged vertically loaded semi-continuous CAB Line

HOW THE CONCEPT AROSE:

- Basically SECO/WARWICK Active Only furnace design was turned by 90°.
- Mesh belt load transfer system was exchanged by monorail system with racks.
- Other main design features remained unchanged.
- A process control strategy from Active Only furnace is used.
- Brazing chamber is doubled for higher output.
- Standard purging and cooling chamber was exchanged by vacuum purged vestibules.

Vacuum purged vertically loaded semi-continuous CAB Line

APPLICATIONS:

- Large and heavy aluminium heat exchangers.
- Non-automotive, industrial heat exchangers.
- Ideal for plate and bar technology .
- All cases where it is prefered to braze cores in vertical position.

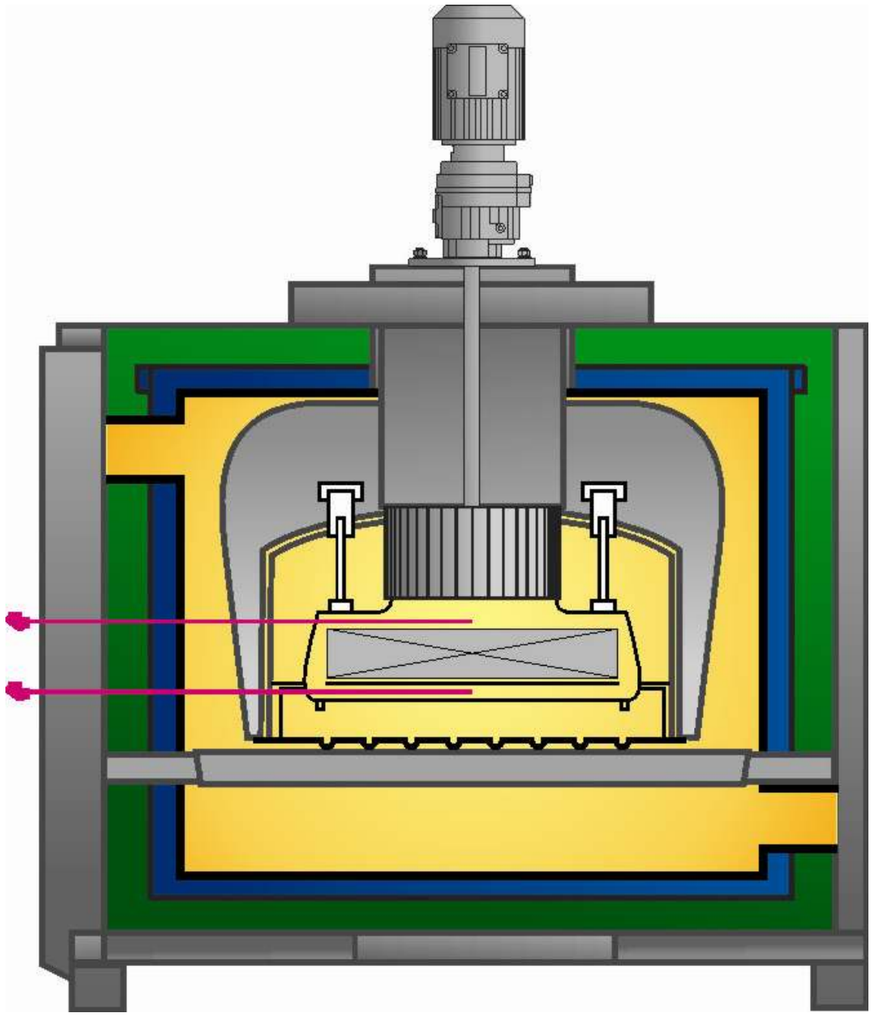
Vacuum purged vertically loaded semi-continuous CAB Line

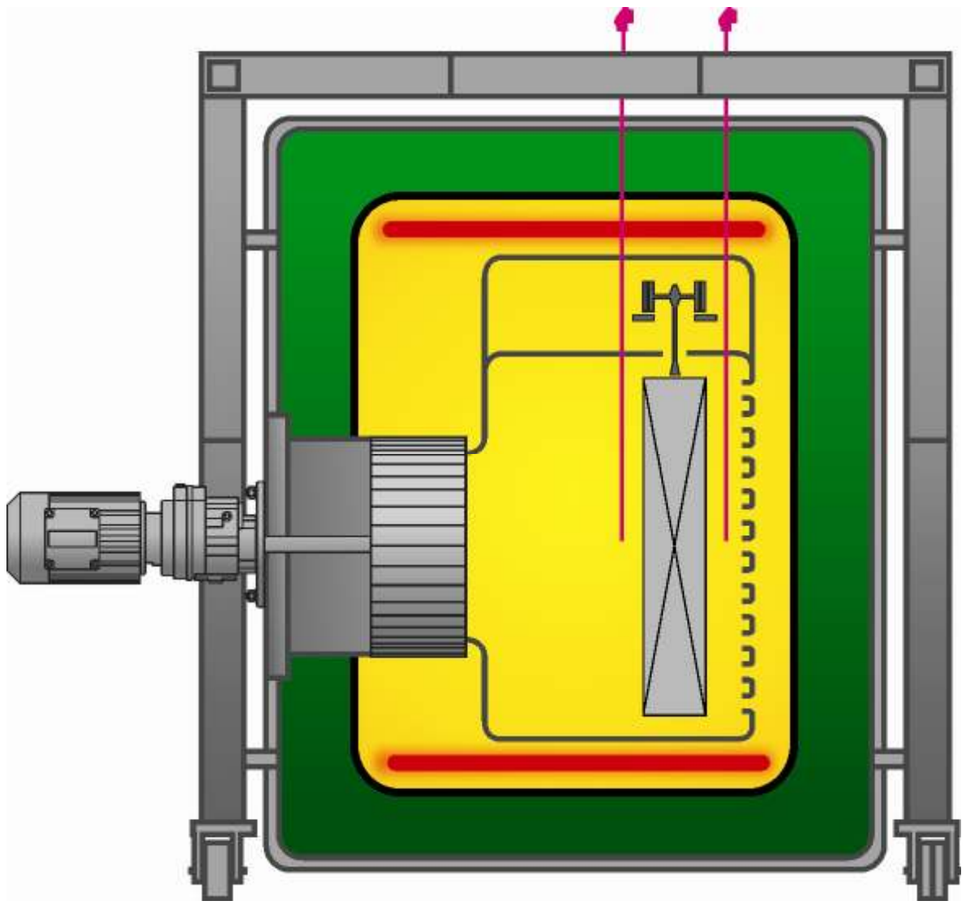
CHARGE DATA:

- Maximum charge gross weight: 300 kg incl. brazing elements and fictures.
- Load Area (WxLxH) 250x2100x1350 mm.
- Production output: 3 to 4 loads per hour.

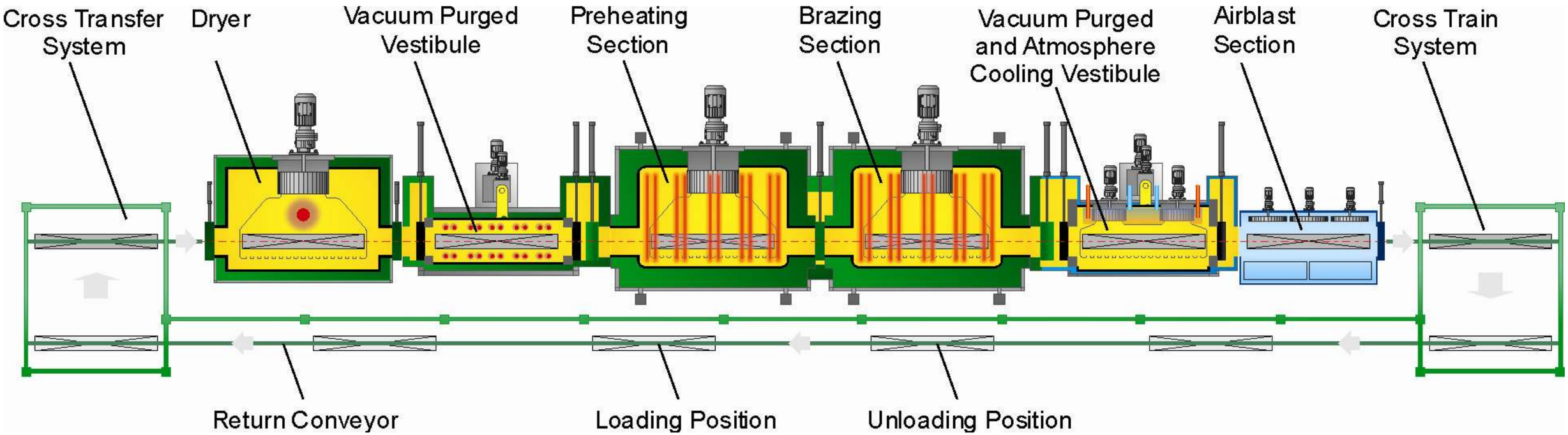
COMPOSITION OF THE LINE:

- CAB Line consists of: Dry-Off Oven, Vacuum Purged Loading Chamber, Preheating Chamber, Brazing Chamber, Fast Atmosphere Cooling Chamber with Vacuum Purging, Air Cooling Chamber, External Rack Conveyor System.



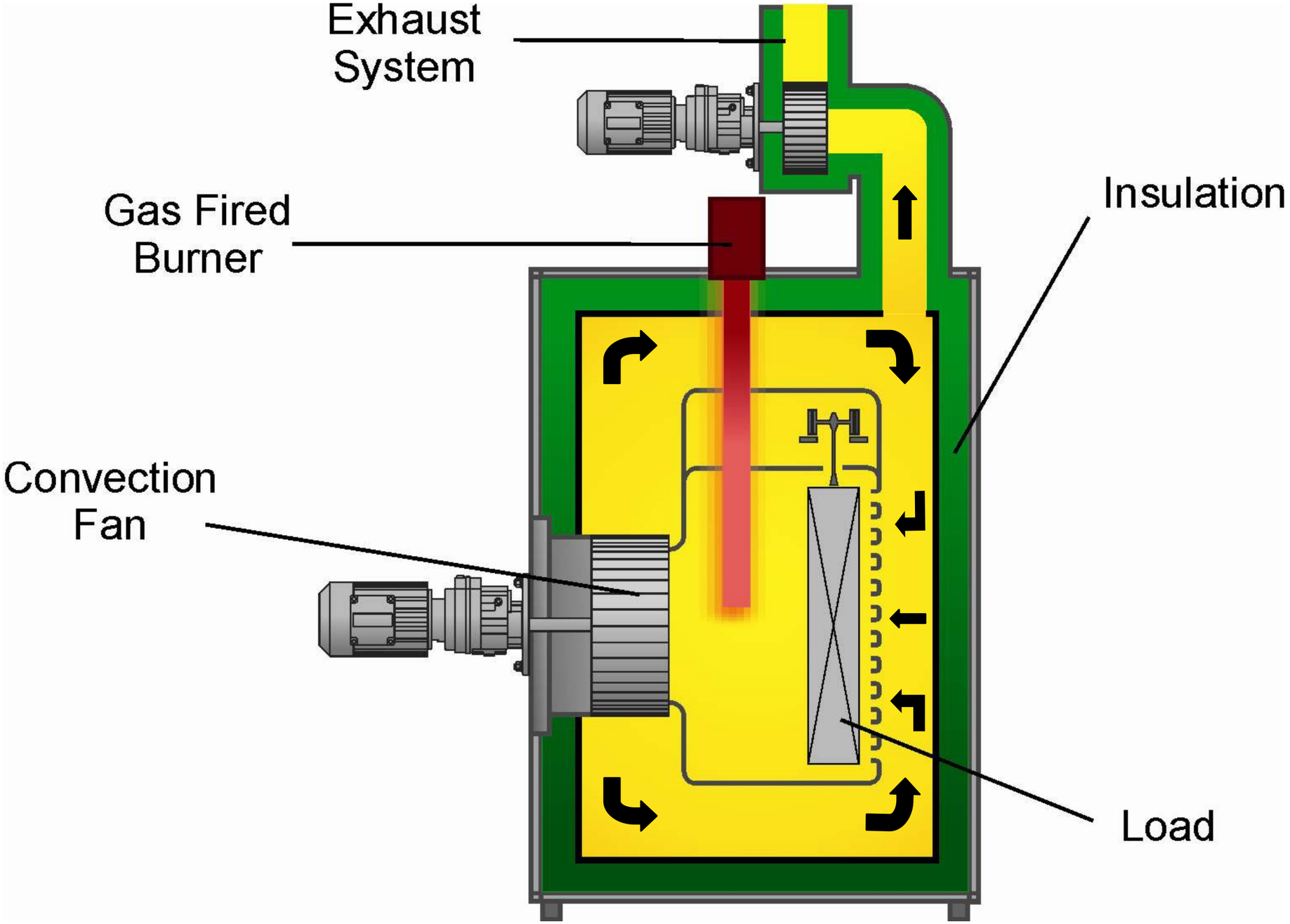


Vacuum purged vertically loaded semi-continuous CAB Line



Vacuum purged vertically loaded semi-continuous CAB Line

Dryer

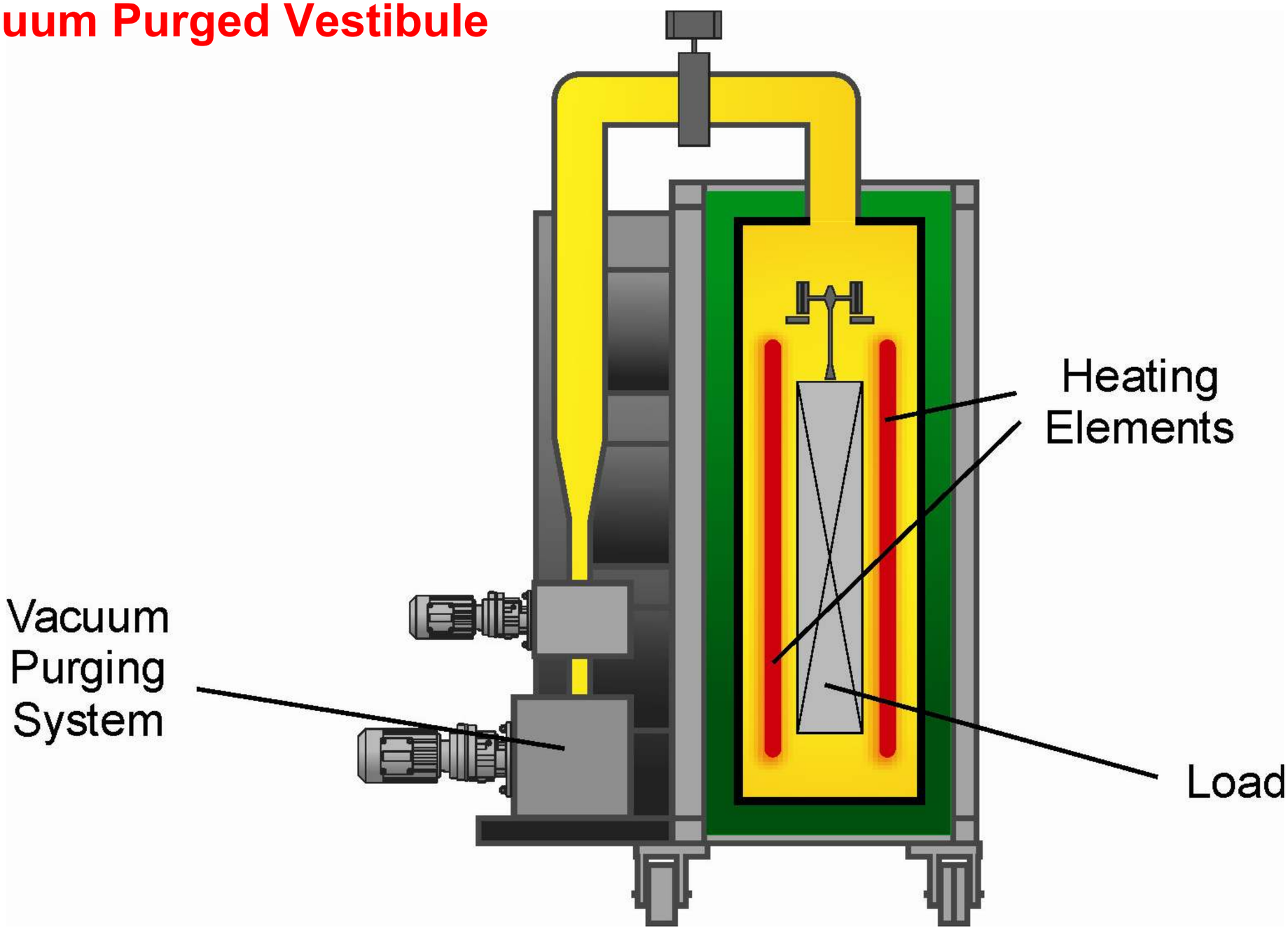


Vacuum purged vertically loaded semi-continuous CAB Line

Dryer

Vacuum purged vertically loaded semi-continuous CAB Line

Vacuum Purged Vestibule



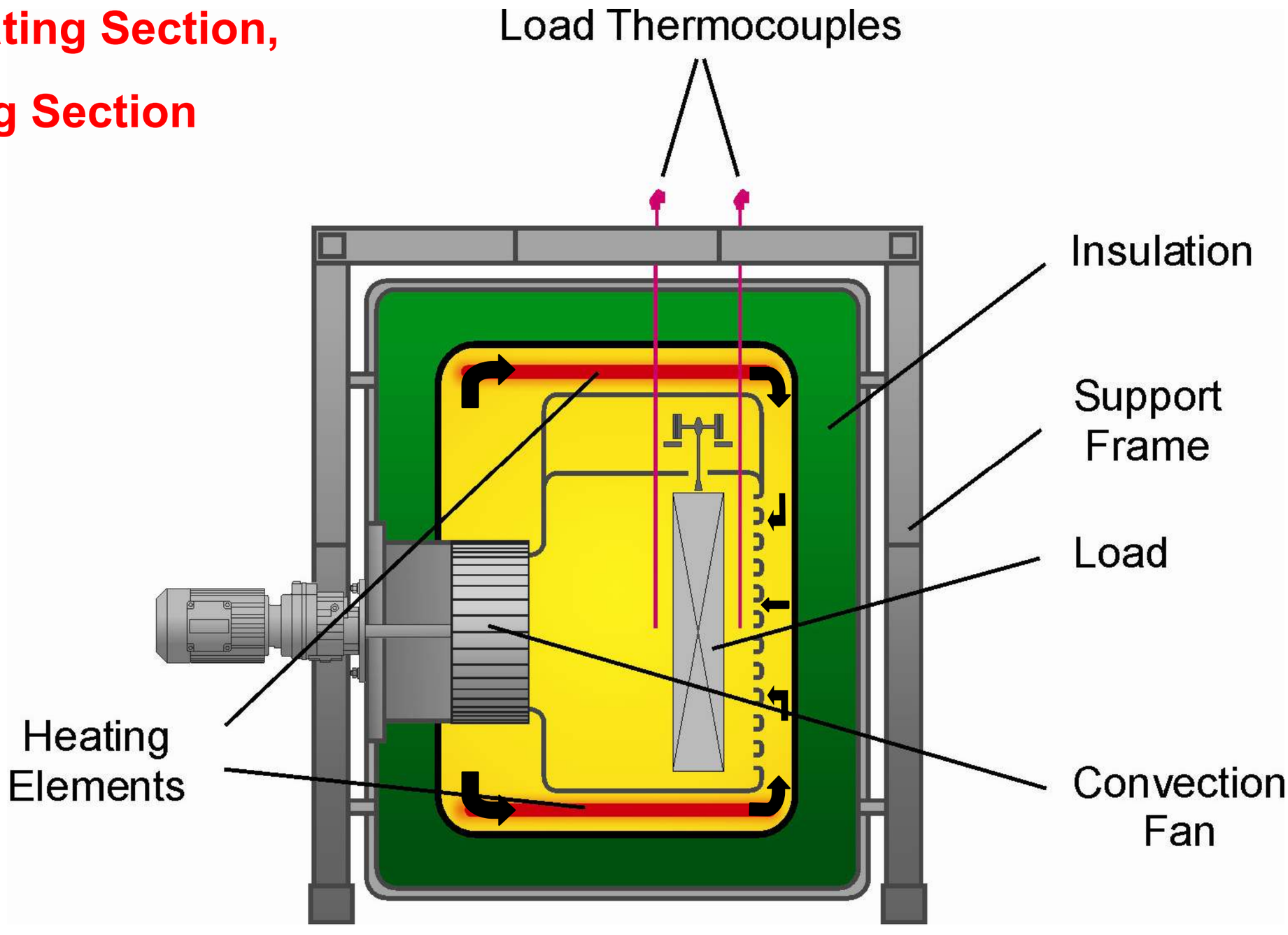
Vacuum purged vertically loaded semi-continuous CAB Line

Vacuum Purged Vestibule

Vacuum purged vertically loaded semi-continuous CAB Line

Preheating Section,

Brazing Section



Vacuum purged vertically loaded semi-continuous CAB Line

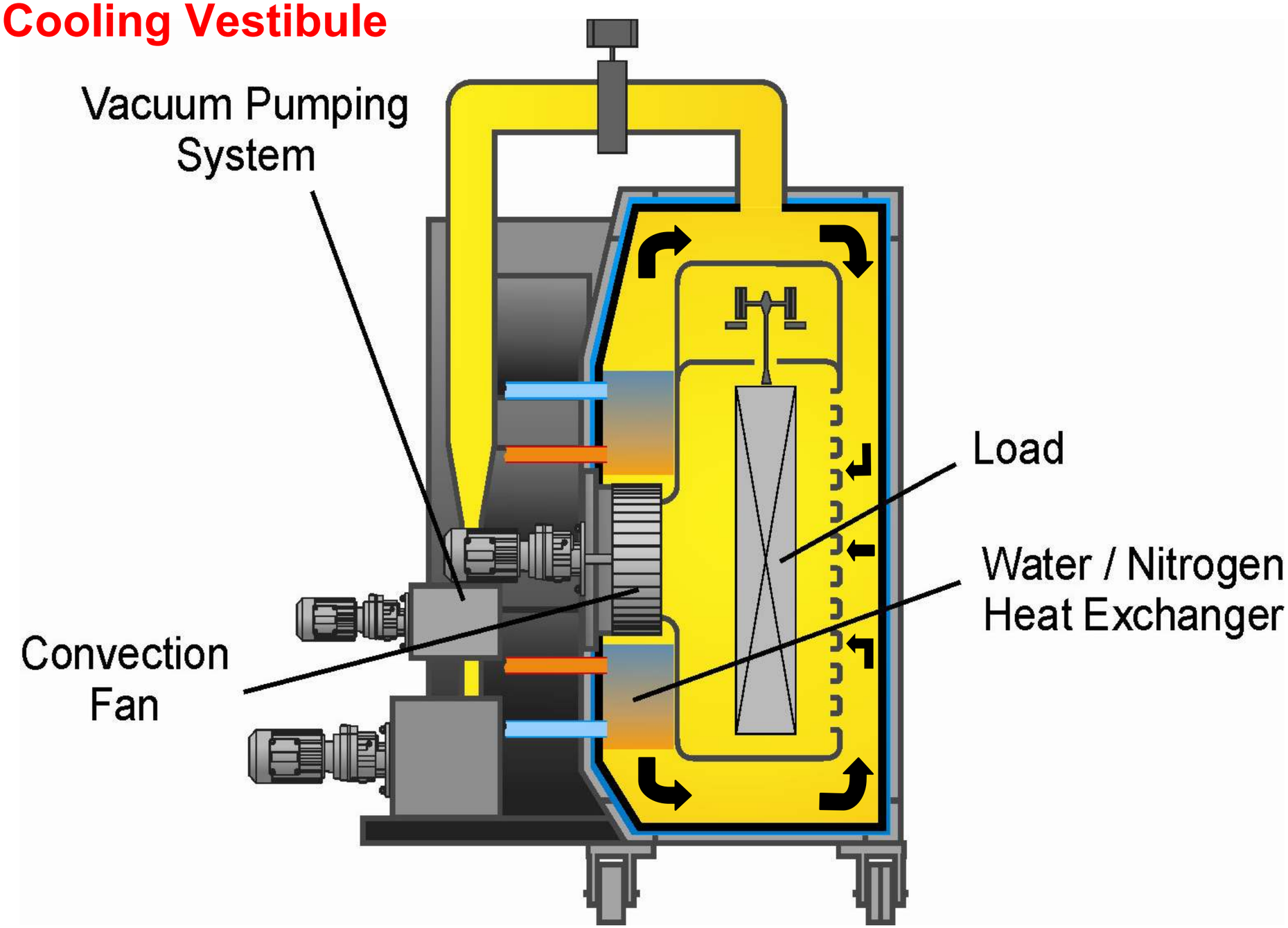
Preheating Section,

Brazing Section

Vacuum purged vertically loaded semi-continuous CAB Line

Vacuum Purged

Atmosphere Cooling Vestibule



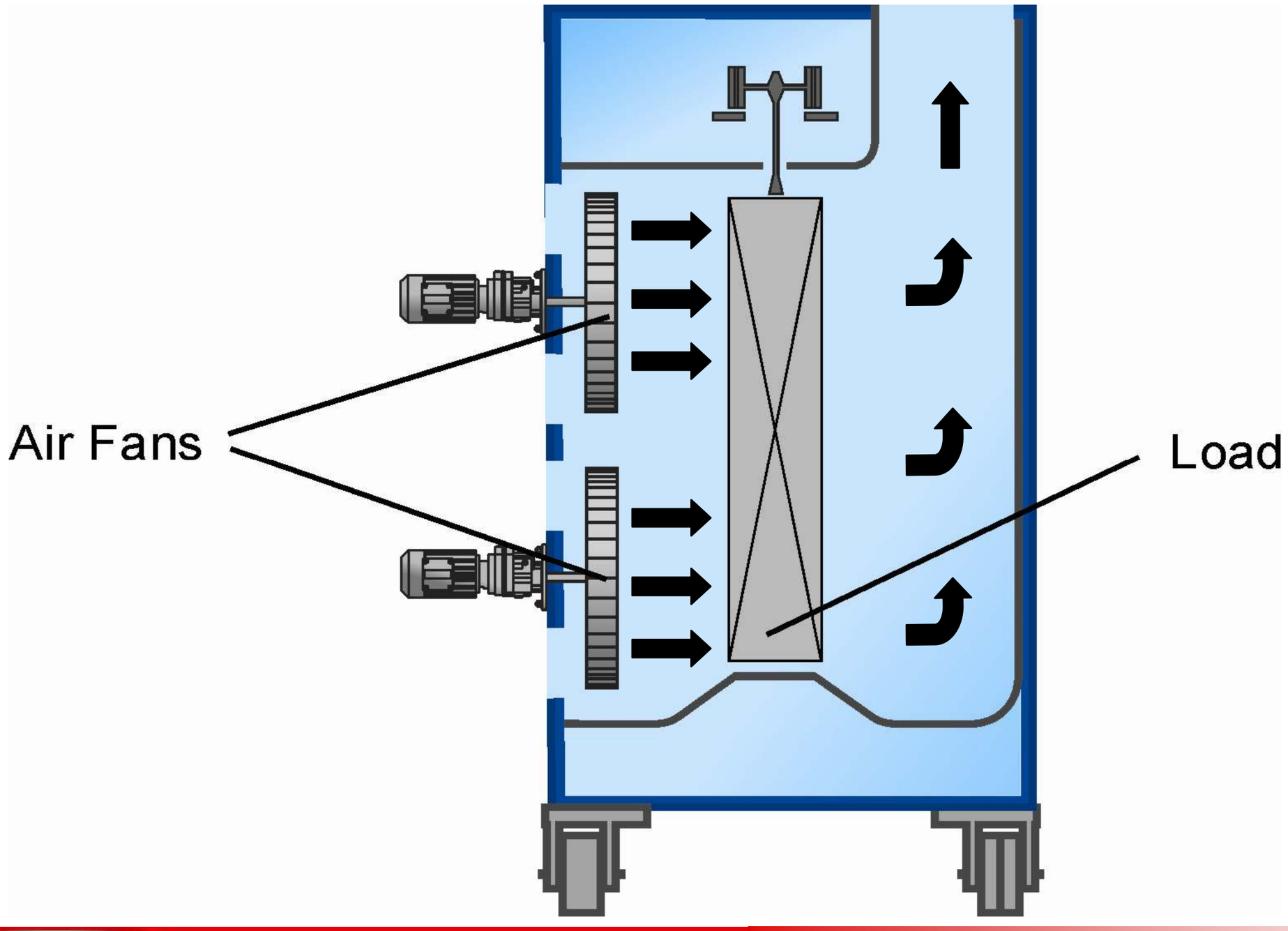
Vacuum purged vertically loaded semi-continuous CAB Line

Vacuum Purged

Atmosphere Cooling Vestibule

Vacuum purged vertically loaded semi-continuous CAB Line

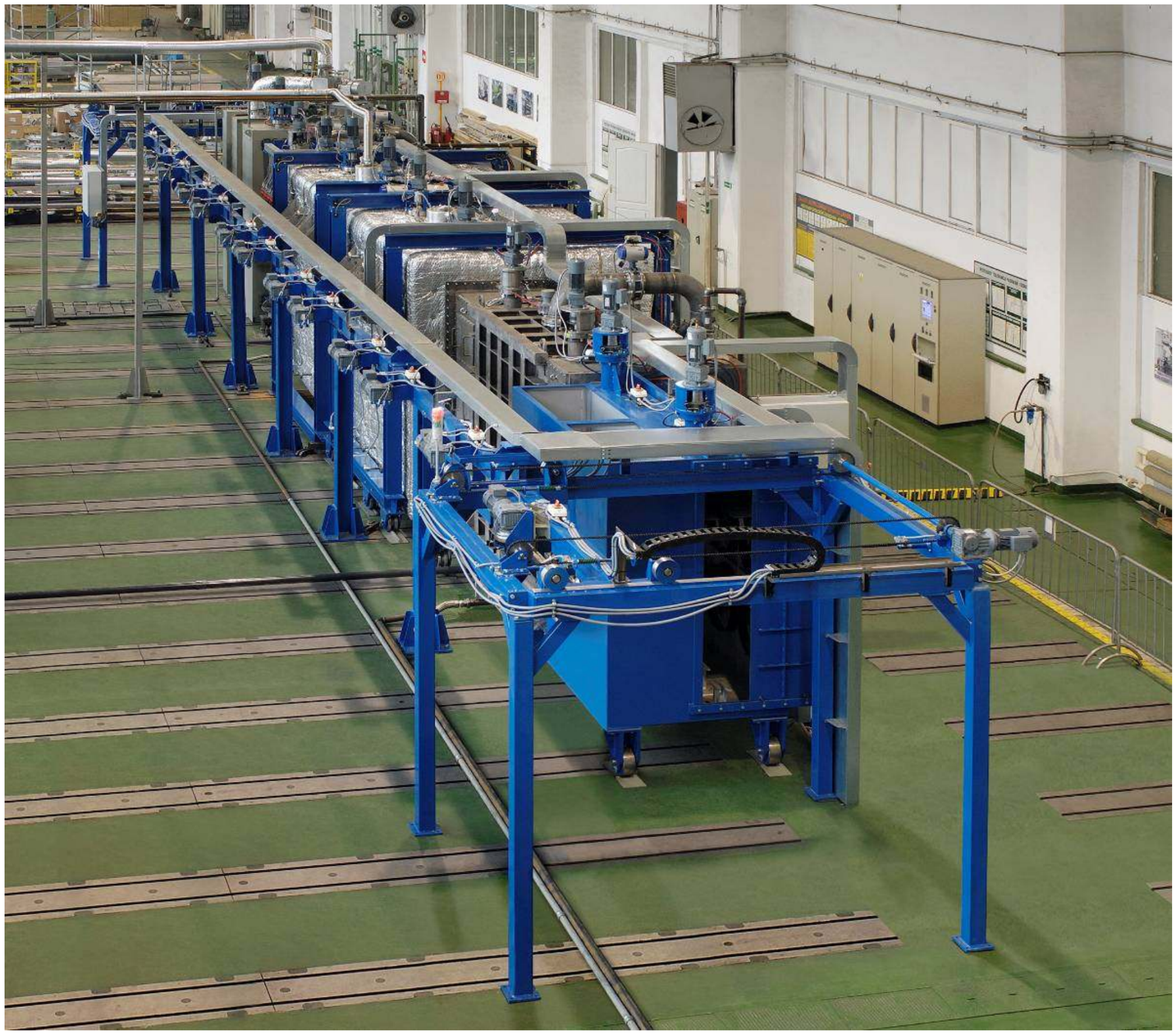
Airblast Section



Vacuum purged vertically loaded semi-continuous CAB Line

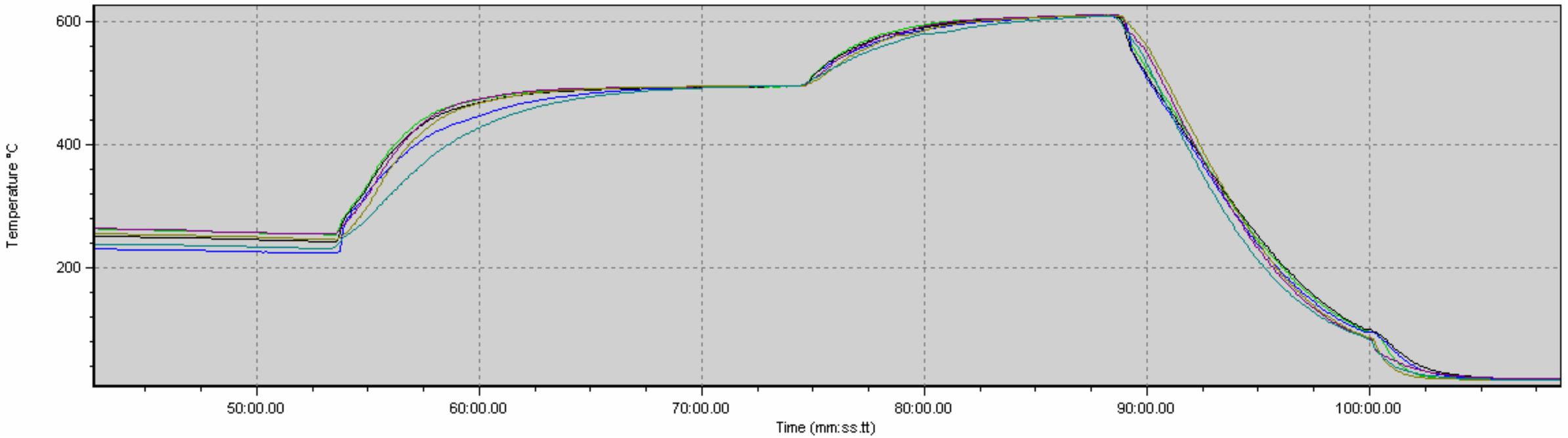
Airblast Section

Vacuum purged vertically loaded semi-continuous CAB Line



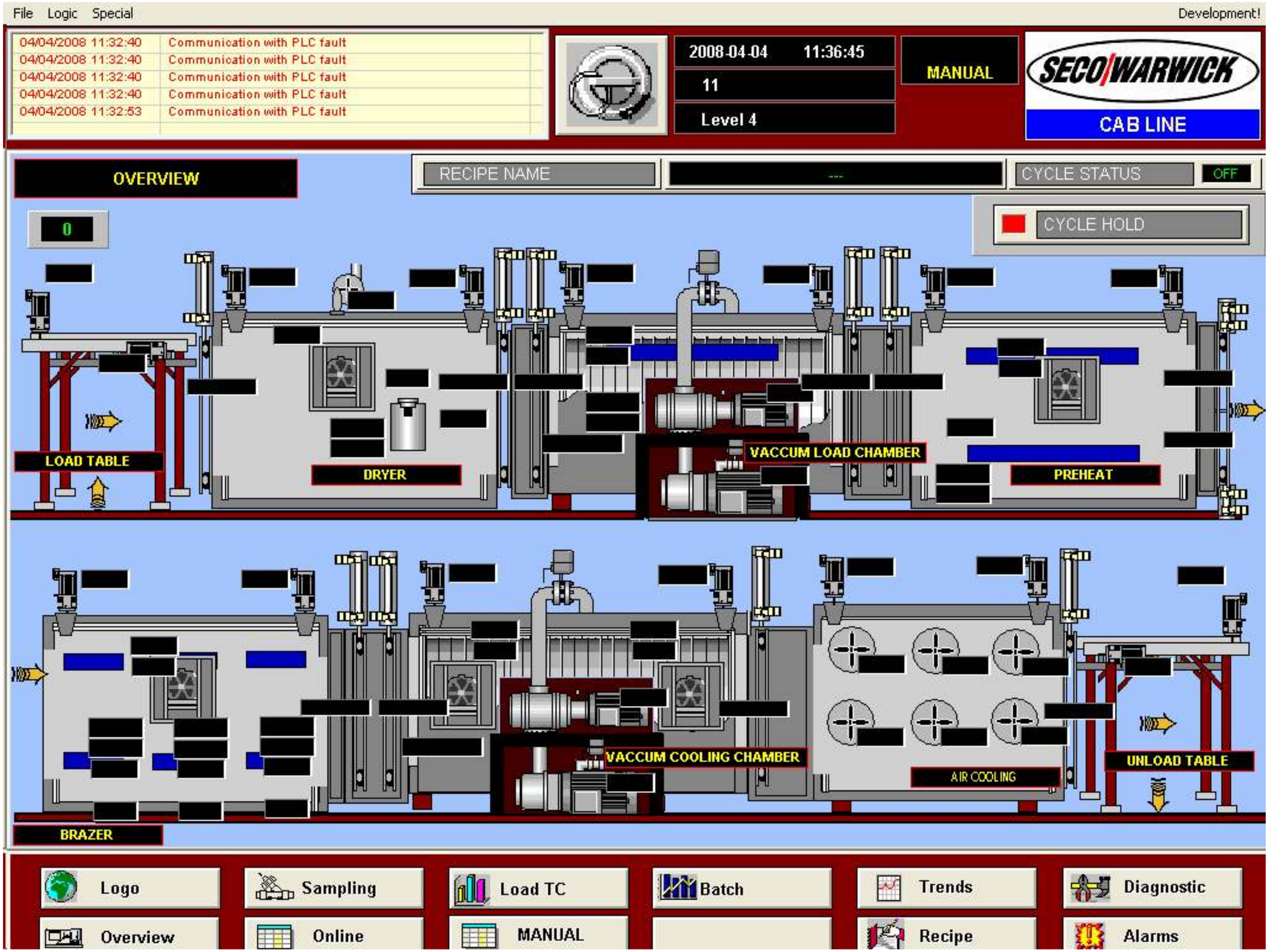
Vacuum purged vertically loaded semi-continuous CAB Line

Vacuum purged vertically loaded semi-continuous CAB Line



Temperature survey from the system done on maximal size load.
Brazing point with +/- 3 ◦C uniformity reach in the brazing chamber within 10 minutes.

Control system - Line overview



Summary and conclusions

✓Controlled Atmosphere Brazing of heavy loads (i.e. of the plate and bar design) in vertical position provides two advantages:

- uniform propagation of filler metal in brazing joint since the brazing joints are positioned horizontally,
- reduced deformation of the brazed cores since in vertical position the core is more stable.

✓ Excellent atmosphere purity, better than 10 ppm due to vacuum purging system enables to reduce flux loading and provides excellent brazing quality and totally oxides free „shiny" core surface.

✓ Vacuum purging system removes all oxygen also from internal space of the core.

✓ Additional advantage of vacuum purging system is a dramatic reduction of nitrogen consumption (at least by the factor of 2).

✓ High flow atmosphere fans in both heating and cooling chambers provide excellent temperature uniformity at the brazing point, sharp temperature profile for both heating and cooling phase and finally high production output.

Summary and conclusions

In many cases the Controlled Atmosphere Brazing plant based on presented Vacuum purged vertically loaded semi-continuous CAB Line can be a lower investment and running cost alternative for a vacuum aluminium brazing technology.