VOLVO

GB1

REPLACEMENT PRIMER OVENS

Contract Appendix B2.2
Oven
Scope of Supply

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REPLACEMENT PRIMER OVENS

1. BASIC DATA AND OVEN SPECIFICATIONS

Coordinates:

- L09 X-416,70
- L10 X-422,60
- L11 X-428,50

Oven type : straight-through, electric powered
Capacity /oven : 32,7 JPH
Body pitch : 5,1 m oven / 5,2 m cooler
Cycle time : 110 s
Fresh air/body : 450 Nm³/h
Exhaust air : 15 000 Nm³/h

Length skids : 4 785 mm
Weight skids : 245 kg (= weight future rigid skid)

Weight of bodies:

XC40	438 kg
XC40	467 kg BEV - 6% Aluminium
C40	452 kg BEV - 6,2% Aluminium
V60	410 kg

Future models (max. 450 kg) will contain mega-casting aluminium parts. => amount of aluminium will be 30 % of the total body mass. This must be taken in account for the dimensioning of the oven.

Heating up time oven: 180 minutes

Conveyor height oven/ cooler: 500 mm

Principle P&ID used for this description: see drawings App G - 02. Project drawings

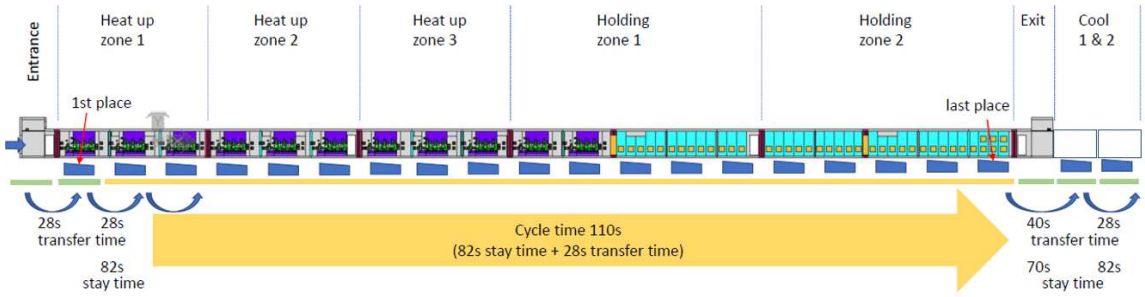
Process and body window: see drawings App G - 03. Process & Body window)

The maximum length of the oven is limited to 115,3 m. Starting after the existing flash-off zone and ending with the cooler in the straight-through part.

Our experience with BEV cars in the existing ovens is that we need a minimum heating up time on the most difficult measuring points of 17’ 00” to get all sealer measuring points above 145°C. These difficult points are situated inside the body at the sills.

To improve the heat transfer efficiency to these points, we need to install stop-and-go ovens with well-oriented nozzles targeting the difficult places in the body.

The cycle time will be **110 s** of which **82 s waiting time** and **28 s transfer time**.



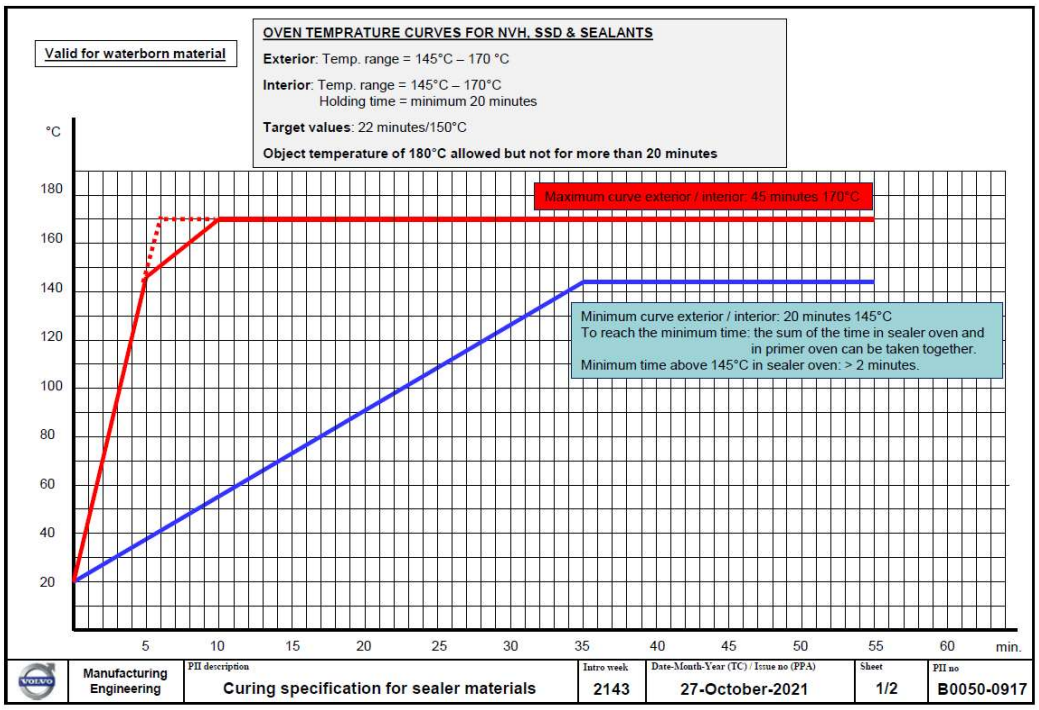
The ovens must be straight-through connection ovens, electrical heated, consisting of the following parts:

- Air seal (4m)
- Heat up zones (3 zones) (9 HU cycles)
- Holding zones (2 zones) (2 HU + 8 hold cycles)
- Air seal (4m)
- Cooler (2 cycles)

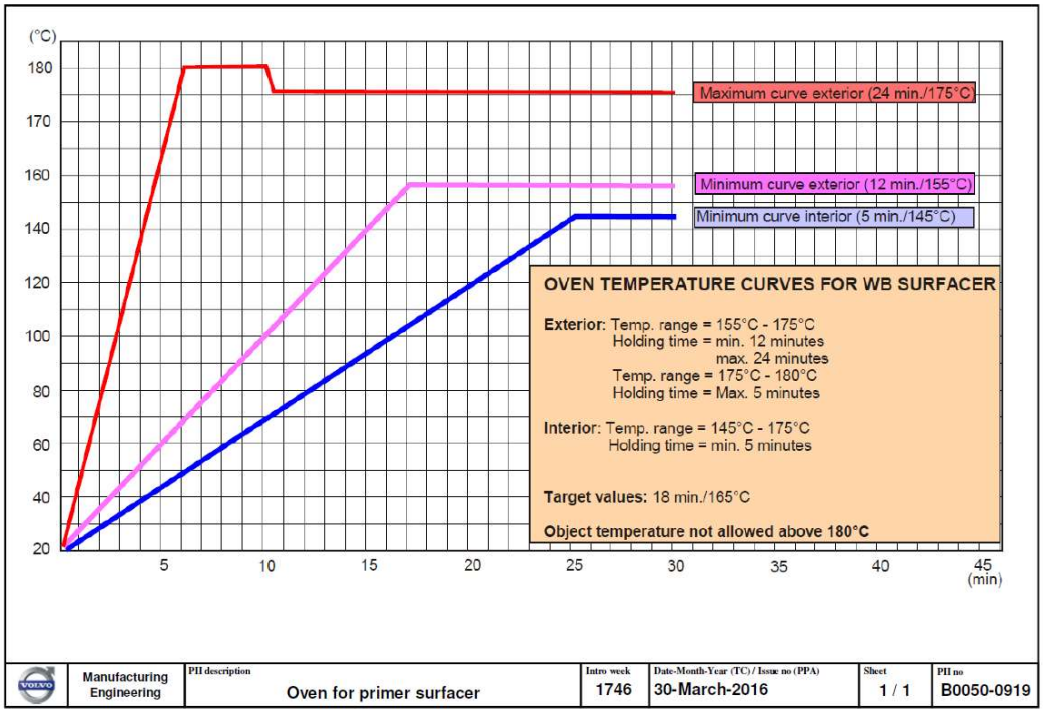
Due to the limitation of the length the cooler will be extended on the cross conveyor towards L13. This part will be commonly used for the bodies coming from L9, L10 and L11

- Cooler extension of 5 body places on the cross conveyor, chilled air will be blown on the sills of the bodies

Oven curve NVH / sealing (see App G, process parameters)



Oven curve primer paint (see App G, process parameters)



2. GENERAL items

2.1. STEEL STRUCTURE AND WALKWAYS

Following steel structures are part of the contract:

- Platform above the oven for the heating units, cabinets, and cat walks
- Platforms for maintenance
- Access-stairs for oven units such as heating units, fans, heat-exchangers, ...
- Beam structures of units located on the upper levels such as the ASU on the roof, ...
- Supporting structures for ductwork and eventual additional stairs to walk over
- Special attention shall be paid during design to evacuated or bring in big parts when a replacement is necessary. This includes also access ways and or lifting rails for maintenance.

1. Safety fences / maintenance doors / portals to be foreseen according to safety concept

All safety fences are to be installed properly and correctly fixed to the floor. In case safety fences are installed on platforms, the platform is to be foreseen of extra support for the mounting of the safety fences. If necessary, the safety fences are to be further stabilised to upper structures. Under no circumstances movement of the safety fences due to building vibrations will be accepted.

2. Oven platform

To check the loads to the building, the calculation of the loads to be delivered for approval during design to company TRACTEBEL ENGIE and the VCG responsible.

The cabinets for the new Primer ovens is to be placed on new platforms. The substructure of the platform is to be foreseen to support the new equipment or cabinets correctly. Also, safety fences, operator panels, electrical cabinets and workstation are to be firm and fixed installed on the platforms. During design of the platform, also the safe passage for maintenance people is to be considered.

Steel structure under the secondary building beams:
The secondary beams of the building are not always foreseen with fixation boxes (fixed in the concrete beam connection point = max 2t) and steel main beams. (To be checked on site) If necessary, the fixation boxes and steel main beams shall be installed by the contractor.
For the new platforms the contractor must build this is according to the VCG 'Standard for steel structures'. In case other supports of cable trays e.g. are in the way, they are to be temporally disconnected and later reinstalled on the new main beam. Note that fixation boxes are to be officially checked on welding before installation and officially checked after installation on the secondary beams by

Vinçotte/AIB. When finally, the complete platform is build-up also a final inspection of the platform must be done and must comply to EN 1090.
Construction of platform:

- Platform shall be designed and constructed for supporting on the floor 13,95. If needed the platform could hang on the secondary beams
- Point loads on the TT floor slabs shall be spread with beams to the stronger part of the TT slab.
- Platform structure to be painted RAL 9010
- Platform covered with steel plates 7/5 painted RAL 9010
- Platform cover plate's edges are always to be firmly supported by a frame
- Unsafe area's must be painted with black/ yellow stripes.
- For more information see 'standard for steel structures'

Platform design drawings are requested per zone

- Layout overview of the complete platform indication the zones – Platform layout'
- Layout per zone with detailed platform elements - Platform elements – Zone x '→ Indicating platform elements, equipment supports, operator panels, safety fences, handrail & hangers
- Section of secondary beam – Section Yxxx.00 – Zone x ' → For each secondary beam section drawing must include existing and future elements (hangers, piping …)
- Layout with all superstructure - Upper beams IPE 220 – Zone x '
- Layout for calculated load - Load plan – Zone x '→ Indicating effective loads and distance in relation to building coordinates or concrete beam, this to be able to check later which load are supported or hanging on which position. → Indicating secondary beam, superstructure, load on fixation boxes, load on hangers
- Separate drawing for each stair

Handrail:

- To be installed where necessary
- The handrail is to be screwed to the platform side and are foreseen of black foot border plate (completely closed till the platform)
- Height of railing: 1100 mm from top of platform. (EN 14122-3)
- Vertical and middle rails: RAL 1018 (yellow), upper rail: RAL 9005 (Black)

Steps / stairs:

- Platform connections must guaranty safe passages (joins of edges)
- Width of stair = 1.000 mm
- Width of the tread (step) = min. 220 mm.
- Height between 2 steps = between 170 & 200 mm.
- Under the stair a aluminium plate is to be foreseen to collect the dust
- Intermediate stair platforms to be foreseen of black foot border plate
- Steel construction painted white RAL 9010, the handrails in yellow/ black.

Finishing works: when the works are finished all damaged structures are to be local repainted.

See also the "Standard for steel structures" Contract appendix E.

2.2. SPRINKLERS

The fire protection connected to the area sprinkler system will be installed under platforms, big ducts, or other obstacles.
Inside the oven the fire projection system will be by means of a dry sprinkler system. Extra main valve(s) (1 or 2) related to the new oven shall be installed for primer oven L10. For L9 the existing valve (DSP 7E1 and DSP 7E2) could be reused.
The contractor will guarantee the air tightness where the piping is entering the oven enclosure.
In the cooler zones wet sprinklers must be installed. To avoid the activation of the sprinklers, the sprinkler heads in the cooler zones must have a temperature class above the maximum expected temperature in the oven.
The contractor shall execute the adaptations or extensions of the sprinkler fire protection system. This can only be done with a certified supplier.

Usual supplier for VOLVO CAR GENT is the company INTEC.

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BOSEC TCC 7-002/e

T 32 (0) 54 42 17 59
F 32 (0) 54 41 69 95
fp.intec@skynet.be
www.intecfireprotection.eu

Drawings of the adaptations or extension must be approved by our insurance company.

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2.3. CLEANING

On regular base the site must be cleaned during the execution of the works. Package materials or demolished parts shall be direct evacuated from the project area.

Cleaning after installation shall be organised by the Contractor:

- Step 1 in- and outside: Vacuum cleaning
- Step 2 inside : Deep cleaning (with tack rag) before SOP

2.4. MAINTENANCE FACILTIES

Rails for dismantling & maintenance purposes.

Any assembly or assembly component of more than 30 kg which could be dismantled should be fitted with a handling rail. The rails shall be IPN 18, foreseen with trolley.

This rail will be positioned above the element to be dismantled and will allow for shifting it to the proper place for further handling with trolley, lift truck etc.

Easy access and sufficient ground clearance should be provided for replacing wear and tear parts or any other elements eventually.

Special attention shall be paid during design to evacuated or bring in big parts when a replacement is necessary. This includes also access ways and or lifting rails for maintenance.

A test certificate from AIB/Vinçotte shall be delivered. (= Test with a load)

Compressed air for maintenance

For each heater box and for each entrance door to the oven tunnel a VCG standard compressed air connection shall be installed: NORGREN pressure regulator + 2 TEMA connection 1800 B.

2.5. AIR BALANCE FLASH OFF

Before turning off the existing ovens L9 or L11 the contractor shall rebalance the air flows from the booths towards the flash-off zone. The contractor shall ask for the latest balancing report done by the purchaser.

2.6. NOISE LEVEL

Inside the factory the installations must be conform the norms max 75 dB(A), measured at 10 m from the noise source.

Outside factory:

Max 75 dB(A), measured at 10 m from the noise source.

Influence on residential areas see VLAREM addendum 2.2.1. item 2°.

The Contractor must always apply the best available techniques to protect people and the environment, both in the choice of treatment methods at the level of emissions and in the choice of source-limiting measures.

2.7. ENVIRONMENTAL DEMANDS

Related to STS BREF: To be handed over to the VCG environmental department.

2.7.1. To include in the offer

BAT15 (f): **A copy of description /motivation of chosen RTO** including contribution of the project on decreasing of the yearly VOC-emissions.

2.7.2. During the project:

Bat 11: **Evidence document** that for the thermal treatment of off-gases, the temperature in the combustion chamber is continuously measured. This is combined with an alarm system for temperatures falling outside the optimized temperature window.

BAT13: A copy of the identification of critical equipment and a structured program to maximize availability and performance. To reduce the frequency of the occurrence of OTNOC (other than normal operating conditions) and to reduce emissions during OTNOC, BAT is to use both techniques given below.

1/ Equipment critical to the protection of the environment ('critical equipment') is identified based on a risk assessment. In principle, this concerns all equipment and systems handling VOCs (e.g. off-gas treatment system, leak detection system)
2/ A structured program to maximize critical equipment availability and performance which includes standard operating procedures, preventive maintenance, regular and unplanned maintenance. OTNOC periods, duration, causes and, if possible, emissions during their occurrence are monitored.

BAT 19. Evidence document In order to use energy efficiently, energy measuring devices shall be installed.

Energy meters, to be divided into 3 parts:
- Oven
- RTO after-treatment
- Cooler

per part:
- Electricity:
  - Total Meter
  - Heaters
  - Fans
- Hot water
- Cooling water

Temperatures of the RTO
- burner chamber
- Temperature inlet/outlet
- Chimney temperature

The energy meters must still show sufficient measurement accuracy even with low consumption.
All these meters to be connected to eSight. (Energy follow up system from VCG)

A detailed specification of the chimney (s) and measuring holes:
According to VLAREM II article 4.4.2.2 §1 The chimney is equipped with measuring openings, carried out in accordance with a code of good practice and, with a view to the safe and practical execution of the control measurements, with a measuring platform or an equivalent alternative.

Further Article 5.2.3bis.1.13. § 4. The chimney and the exhaust ducts are equipped with measuring openings and a measuring platform in accordance with standard NBN T95-001 or an equivalent standard.
See also compendium air emission measurements. **(In DUTCH)**

Prove that the afterburner is set to the optimum temperature and is continuously recorded.

Unless stated otherwise in the environmental permit for the operation of the classified establishment or activity, the following emission limit values apply to the discharged waste gases:

Parameter	Emission limit Value
organic compounds, expressed as total organic carbon (TOC)	50 mg/Nm³
nitrogen oxides (NOx), expressed as NO2: guideline value	100 mg/Nm³
CO: guide value	100 mg/Nm³
Total dust	3 mg/Nm³

3. MECHANICAL DESCRIPTION

3.1. OVEN

3.1.1. GENERAL

Oven temperature stability:
The oven temperature will be stable at a fixed value all through the production time.

Fans, motors and related electrical equipment shall be dimensioned with start-up parameters, i.e. when the installation is cold.
All fans shall be foreseen with a pressure switch Kromschröder DG-10U.

Air filters only 1/1 filter sizes are allowed. (No ½ filters)
The pressure drop over the air filter walls will be checked with Magnehelic differential measurements connected to the PLC + local Magnehelic gauge M2000.

All welds on ducts must be checked on tightness before the ducts are insulated. The contractor shall propose how to do this, and the purchaser must participate in these tests.

All door to the oven tunnel shall be foreseen with a mechanical system which make it possible to use a padlock before entering the oven tunnel. (safety item)

Commissioning report:
All ducts will be equipped with well identified measurements fittings to be able to measure the flows during commissioning and to use later when the installation is in production, to check the air balance and good function of the installation.
A detailed commissioning report and drawings with measuring points identification and with all measured data (air flows, temperatures, currents, position dampers, …) will be part of the specific documentation.

3.1.2. OVEN TUNNEL

3.1.2.1. *OVEN TUNNEL-ENCLOSURE*

The oven enclosure will be constructed of self-supporting prefabricated modules of approx. 7 meters.
The modules will be fixed and supported by a system with fixed and floating points. To guarantee friction free dilation during heating up and cooling down of the oven, sliding floorplates will be used at the underside of the modules to

guarantee a "floating " concept. These floorplates shall be installed by the oven contractor.

The internal oven skin will be tightly welded and smooth so that the internal oven air does not escape into the insulation, and then into the building atmosphere.
Completely welded U-form metal sheet compensators must be foreseen between the modules to allow a friction free dilation.
Before the expansion joints (between the different oven modules) are insulated the expansion joints must be tested by a dye penetrant inspection. Two types of penetrating liquids are used - a white developer is used with the dye penetrant, which creates a sharply contrasting background to the vivid dye colour. Capillary action draws the liquid into the surface. It makes possible to detect minute traces of penetrant that indicate surface defects

The oven ceiling will support an overload of 100 kg/m2 without permanent distortion.
The oven walls, roof and floor shall be fully insulated. The outer skin will be made of min 1,5 mm galvanized steel plate.
The internal skin shall be made of steel sheet min 1.5 mm with a smooth surface.

- Heat up zones: SS304L
- Holding zones: aluminized steel sheet

The oven floor is to be reinforced to support the conveyor, the body + skid & man load without permanent distortion.
Conveyor supports will be placed every 3 m for running length and special attention to the finishing of the take-up & drive unit support frames will be given.
The lower oven part will be designed to support man load. Closing plates in sheet SS304L (HU zones) or aluminized (holding zones) steel sheet min. 2 mm shall be provided to fill the gap between the lower ducts and the conveyor. The closing plates are to be removable as to allow easy access to the conveyor chain. Embedded handles will allow easy handling.

Removable drip pans will be placed underneath the conveyor chain to collect dirt.

The insulation consists of mineral wool (density min. 35 kg/m3, min. 200 mm thick with min. 2 crossed layers for all zones.).
The average outside temperature of the oven housing may not exceed 15 °C above ambient temperature.
The outside plate shall be smooth. Openings will be provided in the enclosure to fit measuring and regulation devices, as well as the fire protection system.

The supplier will ensure a complete tightness at the passage point of the conveyor shaft. Three access doors of about 800 mm x 1900 mm will be installed so that the oven length is divided into equal parts. Each air seals will

also have an access door. The door locking system will allow for easy opening of the door from both sides.

Outside the oven and next to each access door a pivoting lighting bracket and a double compressed air connection (NORGREN pressure regulator and 2 quick coupling TEMA 1800) will be provided.

Installation of electrical cables inside the oven zone are to be avoided. If not possible, it is necessary to provide special high temperature cables.

Internal ductwork for all Heat-up & hold zones

The configuration of the exhaust-, supply- ducts and their nozzles and slots in the different oven zones will be discussed and defined during the design phase of the oven.

Supply ducts will be located on both sides of the oven tunnel. Return ducts will be in the tunnel at the upper part. All internal ducts will be made of min. 2 mm:

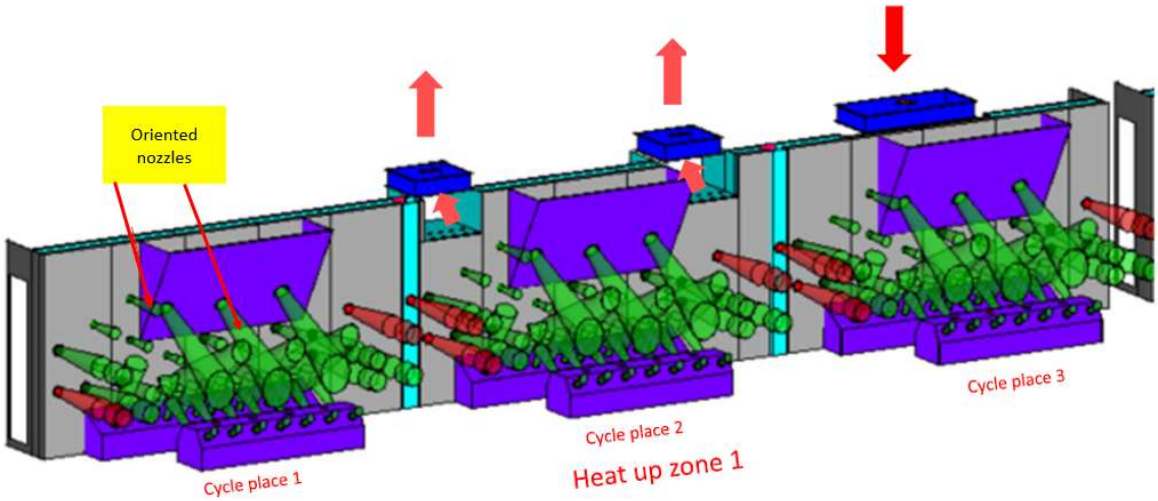
- Heat up zones: SS304L
- Holding zones: aluminized steel sheet

Supply ducts will be fitted with directional air nozzles. The distribution and position of the nozzles to get an even temperature on the body shall be done according to the mass distribution of the body.
Nozzles supporting panels and return ducts will be smooth for cleaning purposes. The smooth surface of the internal oven will always be respected. The nozzle plates at the bottom, between the chains, are reinforced to prevent deformation.

The fresh air duct supplying the entry and exit air seal, could be installed at the bottom or ceiling inside the tunnel. But this duct may not interact with the different temperature settings of the different zones, therefor the duct will be properly insulated. The duct will be equipped with inspection traps every 3 m. This duct will be equipped with compensators which are easily accessible, from inside.

Expansion compensators should be provided where necessary.

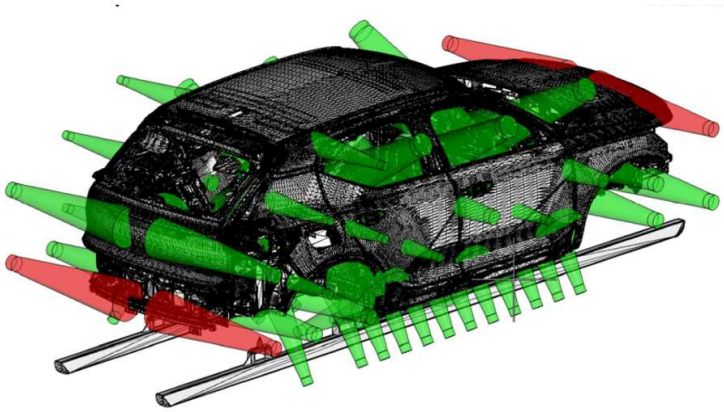
3.1.2.2. *HEAT-UP ZONES*



The internal oven profile will be adjusted to the car body outline so that a maximum heating efficiency is ensured.
The supply ducts will be located on both sides of the oven tunnel.
Return ducts will be in the tunnel at the upper part.
All internal ducts will be made of SS304L 2 mm:

Supply ducts will be fitted with directional air nozzles (SS304L). Since we build stop and go ovens, special attention shall be paid for the repartition of the nozzles. The positions will be designed for different models to get for the best heat transfer efficiency towards the difficult measuring points when the body is stopped.

Nozzles supporting panels and return ducts will be smooth and designed as "door type" for cleaning. The locking system supports will not be removable and respect the smooth internal surface. The "closed" position of doors can be visually checked. Extra secure locks must be installed to avoid open doors during production in case the main locks are not well closed

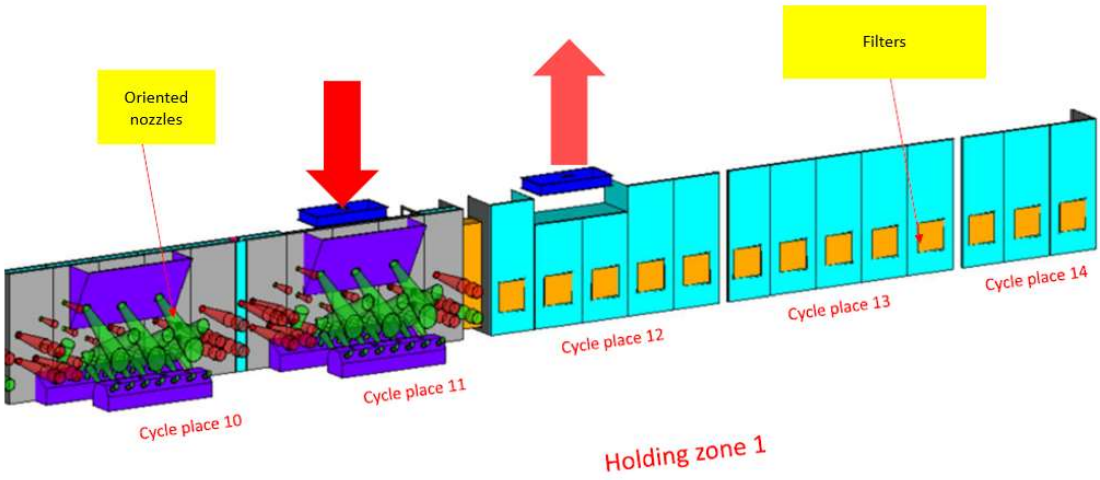


Heat resistant filters from DELTRIAN, will be provided in front of the nozzles. Filter - oven tunnel:

HE-MP95A/HT38 610 X 610 X 78: F8 / ePM1 60%

Expansion compensators should be provided where necessary.

3.1.2.3. *HOLDING ZONES*



The supply ducts will be located on both sides of the oven tunnel.
Return ducts will be in the tunnel at the upper part.
All internal ducts will be made of aluminized steel sheet 2 mm

The first 2 cycles of the first holding zone will be built up similar as the heat up zones. (also the same material specification as for heat up zones) Supply ducts will be fitted with directional air nozzles for the first 2 cycles.

For the rest of the holding zones the air will be supplied by the filters in the wall.

Filter type:
Type: HE-MP95A/HT38 610 X 610 X 78: F8 / ePM1 60%

3.1.2.4. *AIR SEALS CONSTRUCTION*

The entry and exit air seal shall be constructed of self-supporting insulated modules, same principle as the oven tunnel.

Preheated fresh air will be filtered and introduced into the oven ends through adjustable slot openings which are creating a homogeneous air lock (air knife) located in the oven seal zones.

Filter type:
HE-MP95A/HT38 610 X 610 X 78 : F8 / ePM1 60%

All internal skin and ducts will be made of :

- Entry air seal: SS304L 2 mm.
- Exit air seal: aluminized steel sheet 2 mm.

The airflow volume per seal will be the volume to get a good air balance in the oven plus the volume with an extra circulation fan, necessary to get a good air seal.
The entrance air seal will be equipped with a roller shutter door. The roller shutter opens automatically during start-up phase when the oven set-point temperatures are reached and before the conveyor system is released.
During normal operation (production) the door is open. When the oven is switched off (end of production) the door is closed automatically as soon as the conveyor has transported the last car body out of the oven tunnel.
In case of fire alarm, the door is also closed automatically, when the oven is emptied.
Each air seals will also have an access door of about 800 mm x 1900 mm. The door locking system will allow for easy opening of the door from both sides.

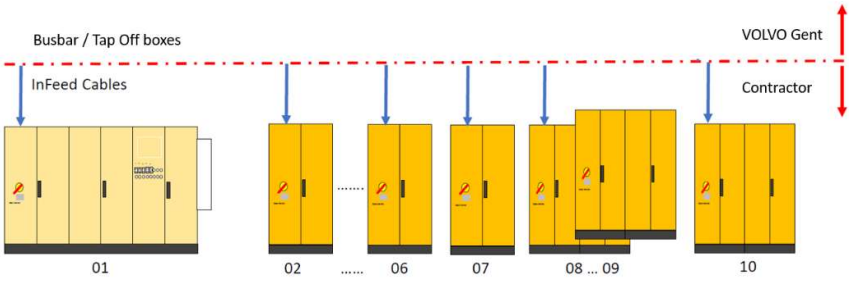
3.1.2.5. *SCOPE OF SUPPLY OVEN TUNNEL AND AIR SEALS*

Enclosure		HU 1	HU 2	HU 3	HZ1	HZ2
Length	mm					
External width	mm					
External height	mm					
Insulation thickness	mm					
Inside SS 304L thickness	mm				//////////////////	//////////////////
Inside aluminized skin thickness	mm	//////////////////	//////////////////	//////////////////		
Flow	m3/h					
Material						
Diameter side nozzles		…/…/…/...	…/…/…/..	…/…/…/..	…/…/…/..	
Quantity side nozzles	#	…/…/…/..	…/…/…/..	…/…/…/..	…/…/…/..	
Diameter floor nozzles		…/…/…/..	…/…/…/..	…/…/…/..	…/…/…/..	
Quantity floor nozzles	#	…/…/…/..	…/…/…/..	…/…/…/..	…/…/…/..	
Quantity of nozzle doors						
Filters just before nozzles	#					
Filters holding zones	#					
Floor plates between conveyor chains	#					
Position of exhaust to RTO						
Position exhaust openings recirculation air.						

Air seals		Entrance	Exit
Length	mm		
External width	mm		
External height	mm		
Insulation thickness	mm		
Inside SS 304L thickness	mm		//////////////
Inside aluminized skin thickness	mm	//////////////	
Fan			
Make			
Type			
Total flow	m3/h		
Numbers of fans	#		
Flow by fan at … °C	m³/h		
At temperature	°C		
Static pressure	Pa		
Dynamic pressure	Pa		
Consumption fan at 20°C	kW		
Consumption fan at X C°	kW -… °C		
Rotation speed	rpm		
Efficiency	%		
Motor			
Make			
Type			
Motor consumption power	kW		
Motor installed power	kW		
Rotation speed	r/min		
Protection rating			
Energy Efficiency class			
Filters			
Class			
Quantity	#		
Initial pressure drop	Pa		
Final pressure drop	Pa		
Delta p measurement filters	Type		

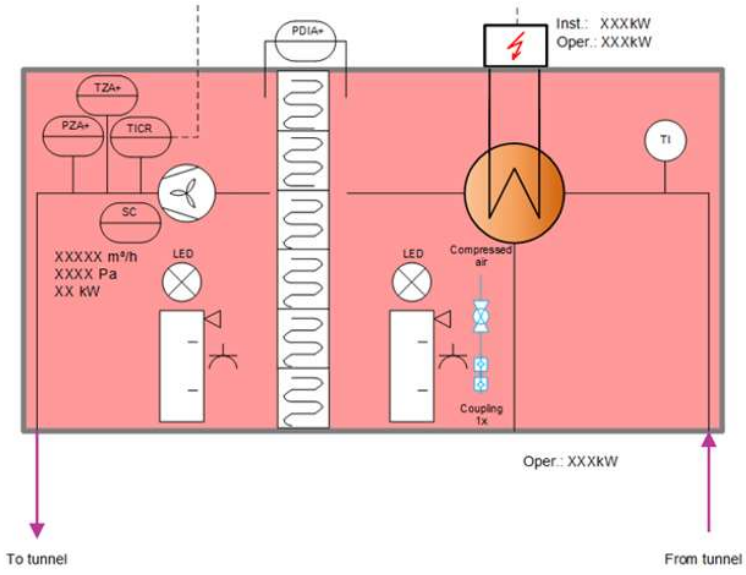
3.1.3. HEATING UNITS

The heating units of the heat-up and hold zones will ensure heating and regulation of the recirculated air.
The recirculation air heater units are convection hot boxes, located on top of the oven on a platform structure.
The heating unit will contain the electric powered heat exchanger, the filters and fan.
The power supply busbar and tap-off boxes will be supplied by VOLVO.
The infeed cables will be supplied by the Contractor. (see also App B1)



The recirculation air fan in the heater unit extracts the air from the oven tunnel via the recirculation air inlet of the heater unit, then conducts it through the electric powered heat exchanger and through a filter wall.

The pressure side the fan blows the hot filtered air through the recirculation air outlet and connection ducts back into the oven tunnel.



The minimum air: flow quantity for heat-up zone will be 4550 m3/h/m.
The minimum air: flow quantity for hold zone will be 3.000 m3/h/m for cycles 10 and 11 and 2.550 m3/h/m for the remaining cycles.

Recycling fan, filters and heat exchanger will be housed in an insulated airtight-welded casing made of steel sheet, materials:

- Outer skin heat up - holding zones: galvanized min. 1,5 mm

The insulation consists of mineral wool (density min. 35 kg/m3, min. 200 mm thick with min. 2 crossed layers for all zones.).

All internal skin and connecting ducts between zone and heater boxes will be made of:

- Heat up zones: SS304L min. 1,5 mm.
- Holding zones: aluminized steel sheet min. 1,5 mm

The heating unit casing will meet the same characteristics as the related oven part enclosure.

The casing will be fitted with access doors 1.900 x 800 mm to the filter compartment, so that filters can be easily replaced, and an access to the heat exchanger.

The doors will be similar as the doors of the oven enclosure. They will have a clamp to ensure the open position during quick cooling.

The casing side wall will be bolt-assembled and the insulating material removable without any deterioration so that the heat exchanger can be easily removed from the heating unit, if necessary.

The heating unit will be provided with the necessary temperature sensors for control and 2 additional openings (1 1/2" tube with internal threading and screwed cap) between each equipment component so that temperature and pressure drop can be measured.
Magnehelic pressure drop measurements must be foreseen.
Temperature gauges (+ each time an additional opening (1 1/2" tube with internal threading and screwed cap) shall be installed to show the inlet temperature and outlet temperature of the unit.

The fan will be positioned after the heat exchanger and the filter (air-extraction) The filter bank will be installed between the exchanger and the fan.

The filtering system will be composed of filters from company DELTRIAN.
Filter clogging will be checked by means of a pressure gauge Magnehelic M2000.

Filter - heater box: RPV65-6HT35/Z M6 / ePM10 70%

The fan: see chapter 4 specific requirements of recycling fans.

Temperature control:

In each heating unit the recirculation air temperature is kept constant by a temperature control circuit:
The temperature control equipment consists of:

- a resistance thermometer TIC (Pt100) connected to the PLC. This Pt100 will be placed in the recirculation air pressure duct at the outlet of the heating unit, (+an additional opening (1 1/2" tube with internal threading and screwed cap, to check the measurement)
- A controller for the thyristors
- PID control of the temperature in the PLC: output 0-100% connected to Thyristors controller.
- The electric heater (resistor) in the unit.

The temperature setpoint is set in the PLC.
By means of a thyristor module the power of the electric heater is controlled stepless.

Temperature control sequence:
Recirculation air temperature < set-point temperature
If the current measured temperature is below the setpoint, the power of the electric heater is increased automatically.
Recirculation air temperature > set-point temperature
If the current measured temperature is above the setpoint, the power of the electric heater is reduced automatically.

Each unit must be foreseen with an overtemperature alarm sensor.

3.1.3.1. *SCOPE OF SUPPLY HEATING UNITS*

Heating units		HU 1	HU 2	HU 3	HZ1	HZ2
Length	mm					
Width	mm					
Height	mm					
Inside plate thickness	mm					
Material inside plate						
Access doors	#					
Insulation, material, thickness	mm					
Flow	m³/h					
Fan	-					
Make						
Type						
Total flow	m³/h					
Numbers of fans	#					
Flow by fan at … °C	m³/h					
At temperature	°C					
Static pressure	Pa					
Dynamic pressure	Pa					
Consumption fan at 20°C	kW					
Consumption fan at X C°	kW - °C					
Rotation speed	rpm					
Efficiency	%					
Motor						
Make						
Type						
Motor consumption power	kW					
Motor installed power	kW					
Rotation speed	r/min					
Protection rating						
Energy Efficiency class						
Temperature probe	#					
Temperature probe	Type					

		HU 1	HU 2	HU3	HZ1	HZ2
Filters	Make					
	Class					
Quantity	#					
Heating units						
Flow per filter	m³/h					
Initial pressure drop	Pa					
Final pressure drop	Pa					
Delta p measurement filters	Type					
Heat exchanger	Type					
Material						
Heat exchanger Dimensions number of tubes, height, Diameter						
Output power	kW					
Delta P	Pa					
Temperature gauges						
Temperature gauge inlet	#					
Temperature gauge outlet	#					
Temperature switch:						
Number						
Type						
Pressure switch:						
Make						
Number	#					
Type						
Detection range	Pa					

3.1.4. LCVA

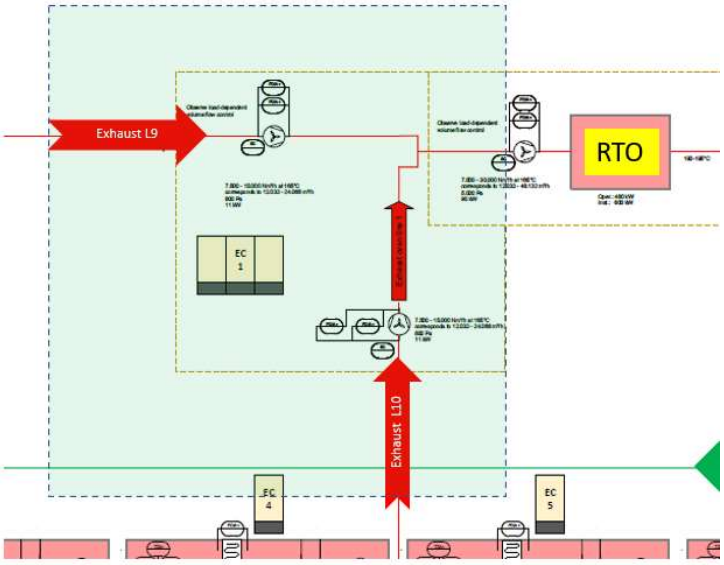
The ovens shall be equipped with a **L**oad **C**ontrolled **V**olume **A**djustment system. The amount of fresh air per body will be as much possible constant when production capacity is varying.
Therefor the related fans shall be regulated with the LCVA system with frequency converters:

- Common fresh air fan
- fresh air fan from the associated ovens
- exhaust air fan from the associated ovens
- Common exhaust air fan in front of the RTO

A body counter will count the number of bodies inside the oven. Depending on the number of bodies inside the oven the ventilation will be adjusted. The adjustment will be done in 6 steps.

Step	Capacity max.	Capacity min.	Corresponding exhaust volume
1	32,70 jph	29,43 jph	15000 Nm³/h
2	29,42 jph	26,16 jph	13500 Nm³/h
3	26,15 jph	22,89 jph	12000 Nm³/h
4	22,88 jph	19,62 jph	10500 Nm³/h
5	19,61 jph	16,35 jph	9000 Nm³/h
6	16,34 jph	0 jph	7500 Nm³/h

3.1.5. OVEN EXHAUST FAN



One insulated exhaust fan per oven air will be installed on a platform on top of the oven.
Exhaust Air volume 15.000 Nm³/h.

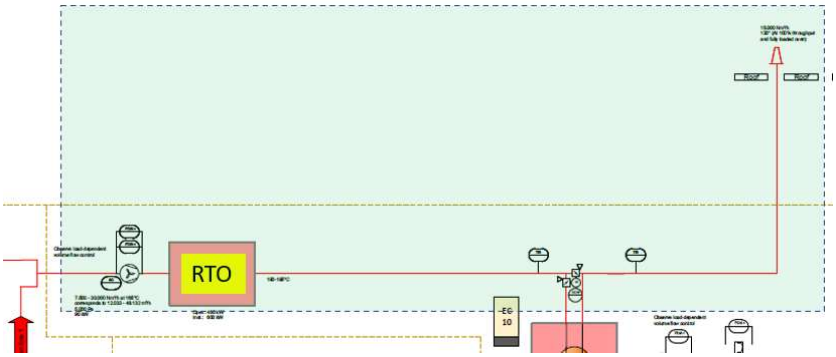
This fan will meet the requirements according to chapter 4 specific requirements for fans.

The exhaust point will be at the end of the heat up zone 3. The air will be transferred with an airtight welded duct, insulated with mineral wool 200 mm inside the factory, density min 80 kg/m3 + aluminium cladding.
The duct will end in a common exhaust duct for both ovens (30 000 Nm³/h) over the roof towards the fan of the RTO. The common duct will be insulation min. 300 mm thick, density min 80 kg/m3, with min. 2 crossed layers + aluminium cladding.
The duct shall be designed and installed with the necessary compensators.
The exhaust duct material till the RTO shall be aluminized steel sheet min. 2 mm.
Special attention shall be paid to the supports and structures on the roof and building side wall.

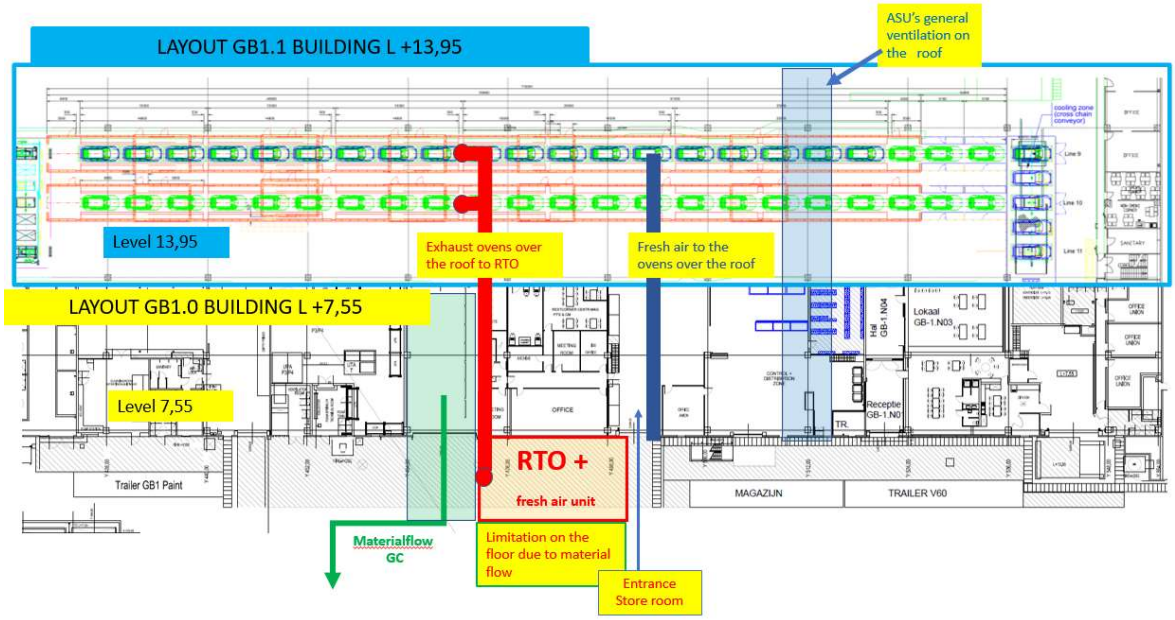
3.1.5.1. *SCOPE OF SUPPLY EXHAUST FAN*

Exhaust fan per oven	-	
Make		
Type		
Flow by fan at … °C	m³/h	
At temperature	°C	
Static pressure	Pa	
Dynamic pressure	Pa	
Consumption fan at 20°C	kW	
Consumption fan at X C°	kW - °C	
Rotation speed	rpm	
Efficiency	%	
Noise level	dB(A)	
Motor		
Make		
Type		
Motor consumption power	kW	
Motor installed power	kW	
Rotation speed	rpm	
Protection rating		
Energy Efficiency class		

3.1.6. RTO



The ovens will use a common electric powered RTO which will be placed on the basement, level + 7.55, outside of the building. The floor area to install the RTO is limited due to material flow to our assembly shop and the entrance to the main storage room. The electrical power supply will be done by VOLVO. (Busbar)



The bidder shall include in the offer a detailed description, technical and functional information to clarify the proposed RTO solution.

RTO :

Size L x W x H : ……

Weight : ……

Thermal efficiency : ……

Purification efficiency : ……

Delta T (inlet / outlet) : ……

Installed electrical power : ……

Consumed power heat up : ……

Consumed power operation: ……

Combustion temperature : ……

Heating up time from 20°C : ……

Temp. drop after 48 h : ……

Heating up time after 48h : ……

Remaining max TOC : ……

Insulation specification : ……

CO max content : ……

NOx max content : ……

Dust particles : ……

Other energy media needed?

The remaining RTO outlet temperature will be used to heat the fresh air. Therefor the necessary steered motorized dampers will be foreseen in the outlet duct. After the purified air will be exhausted with a chimney.

The chimney will be at **least 1 m higher than the highest point, in a radius of 50 m.**

Emission measuring openings shall be foreseen following ISO 9096 /ISO10780 - NBN T 95-001 EN15259.
(*See also "Compendium lucht emissiemetingen: in Dutch*)

All ducts behind the RTO and chimney shall be constructed from minimum 2 mm SS 304L steel and airtight welded.
All duct work including fans outside the oven shall be fully insulated against heat loss (mineral wool, 200 mm density min. 80 kg/m3).. The ducts which are running outside (roof, sidewall) shall be insulated with 300 mm mineral wool, density min. 80 kg/m3
The average outside temperature of the oven housing may not exceed 15 °C above ambient temperature.
The air speed inside the ducts will not exceed 10 m/sec.

All ducts will be airtight welded, delivered as removable sections and assembled with flanges and bolts.

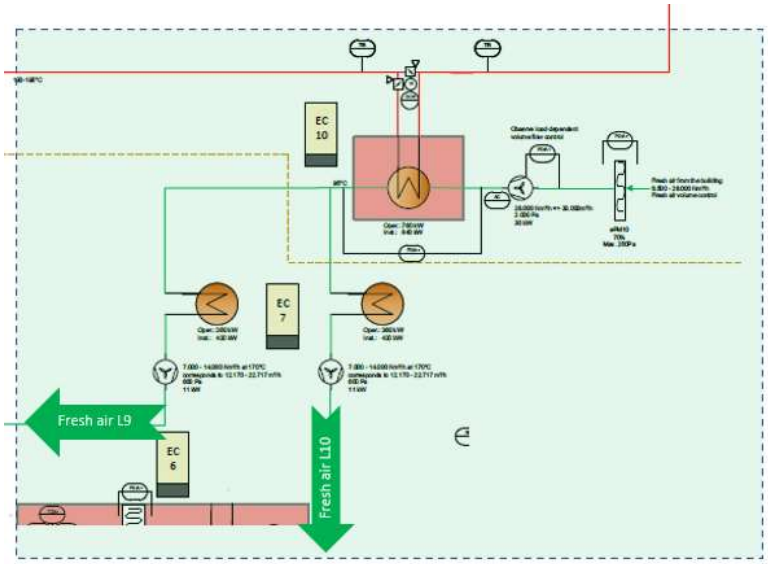
The ducts will be fitted with tapping openings to allow for spot measurements. Tapping quantity and location will be defined in common agreement with VCG.

The dampers shall be foreseen with position indication. The necessary facilities must be installed to guarantee correct inspection and maintenance.

3.1.6.1. *SCOPE OF SUPPLY RTO FAN*

Fan	-	
Make		
Type		
Total flow	m³/h	
At temperature	°C	
Static pressure	Pa	
Dynamic pressure	Pa	
Consumption fan at 20°C	kW	
Consumption fan at ... C°	kW - °C	
Rotation speed	rpm	
Efficiency	%	
Noise level	dB(A)	
Motor		
Make		
Type		
Motor consumption power	kW	
Motor installed power	kW	
Rotation speed	rpm	
Protection rating		
Energy Efficiency class		

3.1.7. FRESH AIR HEATING UNIT



The fresh air for the ovens (2 X 14000 Nm³/h) will come from the factory hall. Therefor the contractor shall make a hole in the façade to pass with an insulated duct. The contractor will close the gap between the duct and the façade.
The air will be filtered at the inlet. The filter unit shall be easy reachable for filter exchange.
Duct material will be aluminized steel sheet min. 1.5 mm insulated with mineral wool 35 kg/m³ and aluminium cladding.

Filter type :
PA50-6/600/06 592 x 592 x 600 ePM10 60% (M5); Deltrian: 1709045
A Magnehelic pressure drop measurement must be installed over the filters.
From the filter unit an insulated duct will to the fresh air fan.

A fresh air supply fan foreseen with frequency converter will transfer the fresh air through a heat exchanger which will pre-heat the fresh air with the remaining heat from the RTO. The fresh air fan and heat exchanger shall be installed on a platform close to the RTO.
The fresh air heat exchanger will be designed for a low as possible chimney outlet temperature (***proposal 90°C***).

The heat exchanger shall be designed to be cleaned easily in case of deposition of dirt due to condensation.
A Magnehelic pressure drop measurements, on the side of the clean gas, must be installed over the heat exchanger.

The heat power from the RTO towards the heat exchanger will be regulated with motorized dampers.

The heat exchanger will be installed in an insulated casing. Insulation mineral wool (density min. 80 kg/m3, min. 300 mm thick with min. 2 crossed layers for all zones + aluminium cladding.).

After the heat exchanger the pre heated fresh air will be transferred by a well-insulated duct over the roof towards the primer ovens. Insulation mineral wool (density 35 kg/m3, min. 300 mm thick with min. 2 crossed layers for all zones + aluminium cladding. The duct aluminized steel sheet min. 1.5 mm shall be designed and installed with the necessary compensators and supports.

The contractor shall make an opening in the roof to bring the duct in the factory hall. The opening is provided with raised sides to prevent water leaks. Once the duct is installed, everything must be watertight and sealed.
Once the duct is in the factory hall the duct will split to the related ovens.

Motor steered air dampers shall be foreseen where necessary in case the ovens are running separate.

Then the air will be heated to the desired temperature and transferred with a fan foreseen with a frequency converter, to the air seals of the associated oven.

The fans: see chapter 4 specification requirements for fans.

All ducts shall be constructed from minimum 1,5 mm thick aluminized sheet steel and airtight welded. All duct work including fans outside the oven shall be fully insulated against heat loss (mineral wool, 200 mm density min. 35 kg/m3). The ducts which are running outside (roof, sidewall) shall be insulated with 300 mm mineral wool, density min. 30 kg/m3
The air speed inside the ducts will not exceed 10 m/sec.

All ducts will be airtight welded, delivered as removable sections and assembled with flanges and bolts.

The ducts will be fitted with tapping to allow for spot measurements. Tapping quantity and location will be defined in common agreement with VCG.

3.1.7.1. *SCOPE OF SUPPLY FRESH AIR FANS*.

Fresh air fan common	-	
Make		
Type		
Total flow	m³/h	
At temperature	°C	
Static pressure	Pa	
Dynamic pressure	Pa	
Consumption fan at 20°C	kW	
Consumption fan at X C°	kW - °C	
Rotation speed	rpm	
Efficiency	%	
Noise level	dB(A)	
Motor		
Make		
Type		
Motor consumption power	kW	
Motor installed power	kW	
Rotation speed	rpm	
Protection rating		
Energy Efficiency class		

Fresh air fan per oven	-	
Make		
Type		
Total flow	m³/h	
At temperature	°C	
Static pressure	Pa	
Dynamic pressure	Pa	
Consumption fan at 20°C	kW	
Consumption fan at X C°	kW - °C	
Rotation speed	rpm	
Efficiency	%	
Noise level	dB(A)	
Motor		
Make		
Type		
Motor consumption power	kW	
Motor installed power	kW	
Rotation speed	rpm	
Protection rating		
Energy Efficiency class		

3.1.8. EXTERNAL DUCTWORK

3.1.8.1 SCOPE OF SUPPLY External ductwork

Connection ducts oven heating units to oven :	**Unit**	
Material		
Thickness	mm	
Insulation material		
Insulation thickness	mm	
Dimensions duct	mm	
Air speed	m/s	
Oven exhaust duct :		
Material		
Thickness	mm	
Insulation material		
Insulation thickness	mm	
Air speed	m/s	
Adjusting dampers	make	
Tight class damper		
Size manhole for inspection air damper	mm	
air duct after RTO towards fresh air unit:		
Material		
Thickness	mm	
Insulation material		
Insulation thickness	mm	
Air speed	m/s	
Adjusting dampers	make	
Tight class damper		
Steered Adjusting dampers amount	#	
Size manhole for inspection air dampers	mm	
Chimney:		
Material		
Thickness	mm	
Insulation material		
Insulation thickness	mm	
Air speed	m/s	

Fresh air inlet duct till fresh air unit:		
Material		
Thickness	mm	
Insulation material		
Insulation thickness	mm	
Air speed	m/s	
Fresh air duct from fresh air unit till oven air seals :		
Material		
Thickness	mm	
Insulation material		
Insulation thickness	mm	
Air speed	m/s	
Steered adjusting dampers	make	
Tight class dampers		
Steered adjusting dampers amount	#	
Size manhole for inspection air damper	mm	

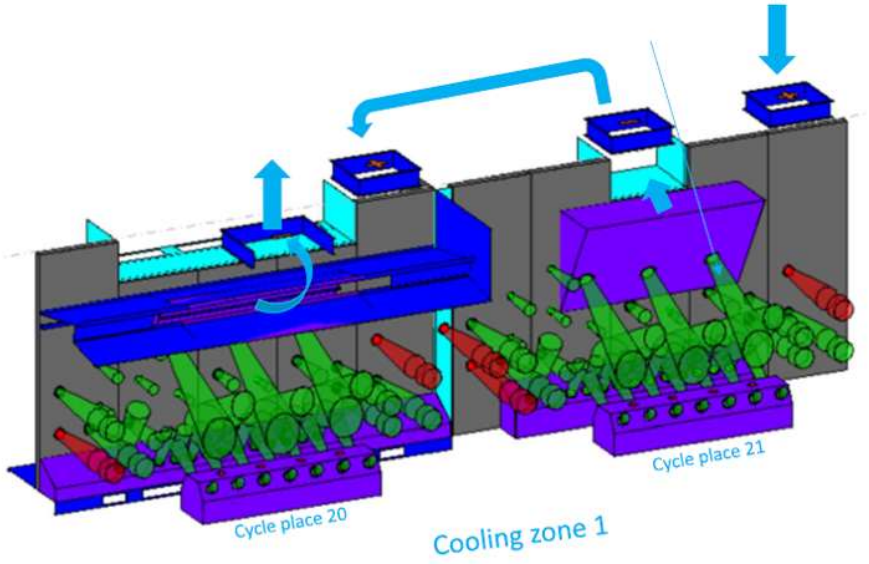
3.2. COOLER

3.2.1. GENERAL

After the oven, two cooling zones will be installed to reduce the body temperature to 30° C, when the outside temperature is 20°C. The supply / exhaust units of the coolers will be located on a platform on top of the coolers.

Cooling zone 1: in line with the oven

- This cooler consists of 2 cycles places. (20 and 21)



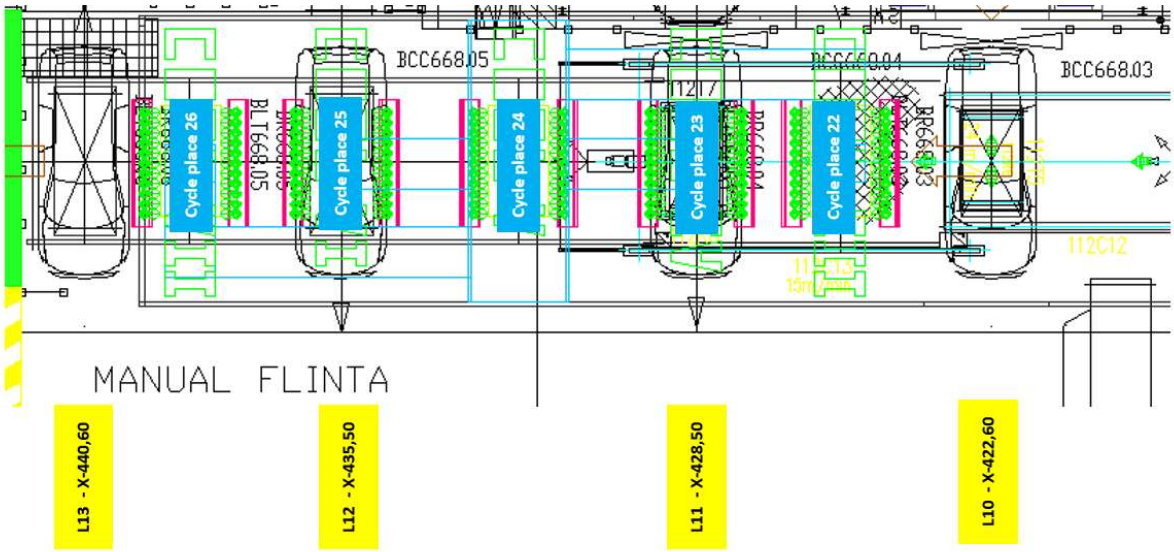
- Fresh air is supplied from the outside. After being filtered to G4..M5 this air will, either be heated when outside temperature is below 15° C or cooled when the outside air is above 25°C.
- The air will be blown through adjustable built-in nozzles at the side walls and through nozzles below the body which are oriented to the sills.

- The airflow will then be forced to pass over the entire body surface and will be exhausted by exhaust openings at the ceiling corners for place 21 and to exhaust slot openings at the ceiling and at the bottom of the cooler for place 20.

- The exhaust fan from place 21 will reuse (in cascade) the exhausted air as supply air for place 20. A second exhaust fan on place 20 will sent the air into the atmosphere.

Cooling zone 2 = extension on the cross conveyor:

- This cooler extension will be made on the cross conveyor after the ovens. To get extra cooling time, in total 5 cycle places will be created.



- Fresh air is supplied from the outside. After being filtered to G4..M5 this air will, either be heated when outside temperature is below 15° C or cooled when the outside air is above 23°C.
- The air will be blown through adjustable built-in nozzle at the bottom of the body with nozzles oriented to the sills.

- The airflow will then be forced to pass around the body and will be exhausted by exhaust openings at the ceiling.

- An exhaust fan on top of the platform above cooling zone 2 will sent the air into the atmosphere.

3.2.2. COOLER TUNNEL

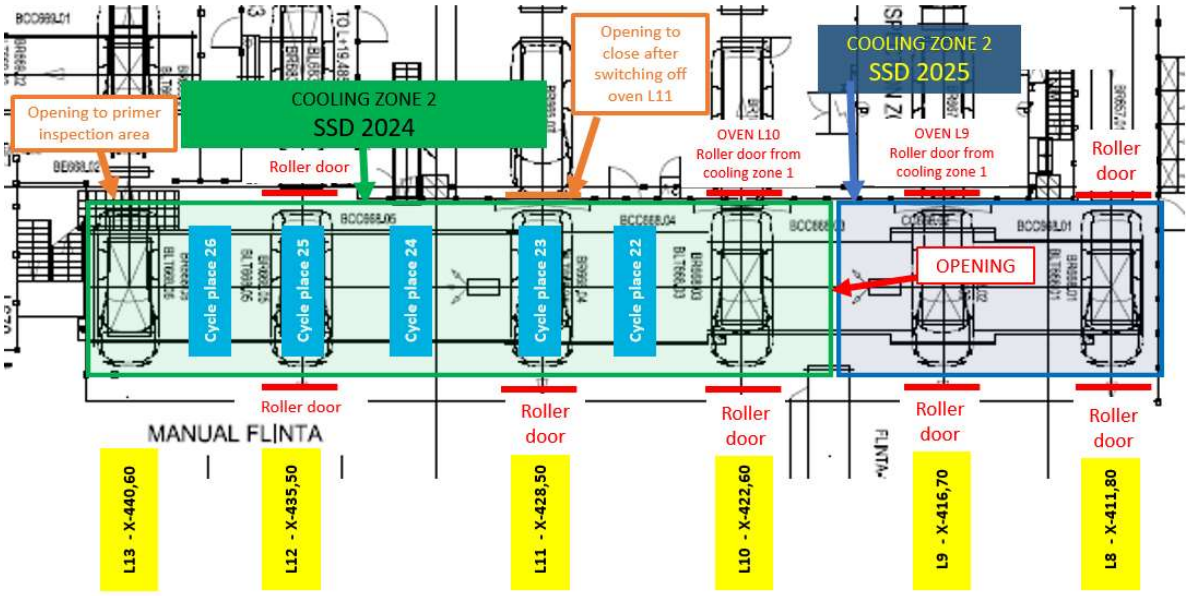
Cooling zone 1:

The cooling tunnel enclosure will be constituted of self-supporting elements. The outer walls and roof shall be constructed of sheet metal panels made of minimum 1,5 mm galvanised steel.
An insulation layer of 50 mm thickness is foreseen. The insulation consists of mineral wool (density min. 35 kg/m3)
Then inner wall is made of aluminized steel sheet min. 1,5 mm.
The lower part shall be designed to support the load of the roller table + body-& skid load + man load.

The cooler enclosure will be mounted on a metal structure. The cooler ceiling will support an overload of 100 kg/m2 without permanent distortion.

A motor steered roller door shall be foreseen at the end of cooling Zone 1 (shut-off when no production)

Cooling zone 2:



The cooling tunnel will be created with booth wall panels and a self-supporting roof. In SSD2024 from L10 till L13, in SSD 2025 an extra part for L9 towards L8 will be installed. The contractor must maximize the surface of windows to get a good view what is happening on the cross conveyor. Six (6) maintenance doors must be installed to be able to enter the zone. (See also B2.4 Electrical part)

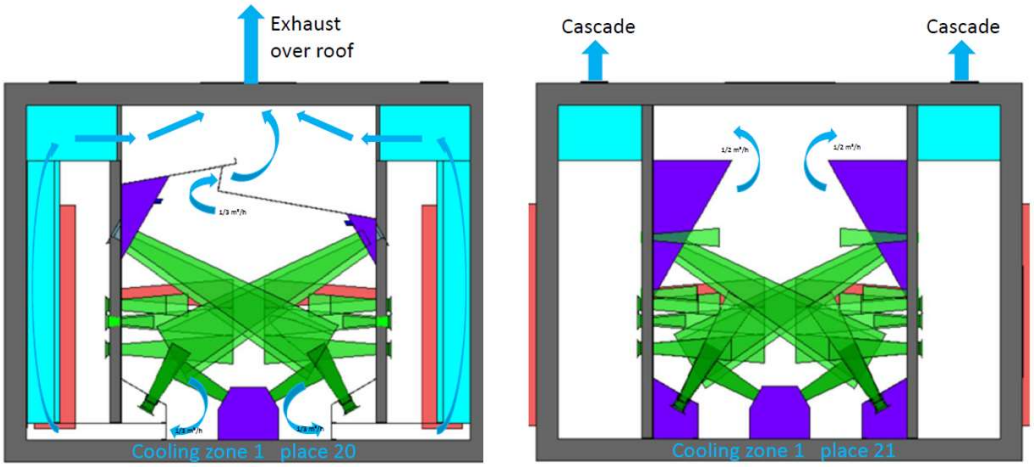
Motor steered roller door shall be foreseen to have the possibility to take out bodies from the cross cooler towards the FLINTA with a manual operation.
Four roller doors in SSD2024, with positions at coordinates L10, L11, and 2 doors for L12.
Three roller doors in SSD2025, with positions at coordinates L9, L8 and L8 towards buffer L8 in SSD 2025.
When the old primer oven L11 is switch off the related opening to feed in bodies from oven L11 must be closed.

3.2.3. INTERNAL EQUIPMENT

Cooling zone 1:
The internal shape (sides and roof) of the cooler will similar as the oven and made of aluminized metal sheet of minimum 1,5 - 2 mm thick.

The design will avoid any condensation inside the tunnel. The inner ceiling will be inclined.

Blowing ducts with adjustable built-in nozzles will be positioned on both sides of the tunnel from the ceiling to the level of the roller table. When not reachable from both sides, the nozzle supporting plates will be designed as pivoting doors for maintenance reasons. The nozzles will be properly positioned as to reach the whole car body for cooling. Their locking systems should not be removable and the "closed" position of the locking systems should be visually controlled. Extra secure locks must be foreseen. (ref oven part)



The air will be exhausted by exhaust openings at the ceiling corners for place 21 and to exhaust slot openings at the ceiling and at the bottom of the cooler for place 20.

Cooling zone 2:
Blowing ducts with adjustable built-in nozzles will be positioned on the left and right side under the body at each of the 5 body stop places from the cross conveyor. The nozzle supporting plates will be designed as pivoting doors or easy dismountable for maintenance reasons. The nozzles will be properly positioned to reach the sills and floor of the bodies for cooling. Their locking systems should not be removable and the "closed" position of the locking systems should be visually controlled. Extra secure locks must be foreseen. (ref oven part)

The supply ducts to the different body stop places will be foreseen with the necessary dampers to be able to adjust and balance the airflows to the different body places.

Inside the cooling zone area also exhaust ducts will be foreseen with the necessary dampers to be able to balance the total zone in an easy way.

All ducts will be equipped with measurements fittings to be able to measure the flows during commissioning and later when the installation is in production.

3.2.3.1. *SCOPE OF SUPPLY TUNNEL COOLING ZONE 1 AND 2*

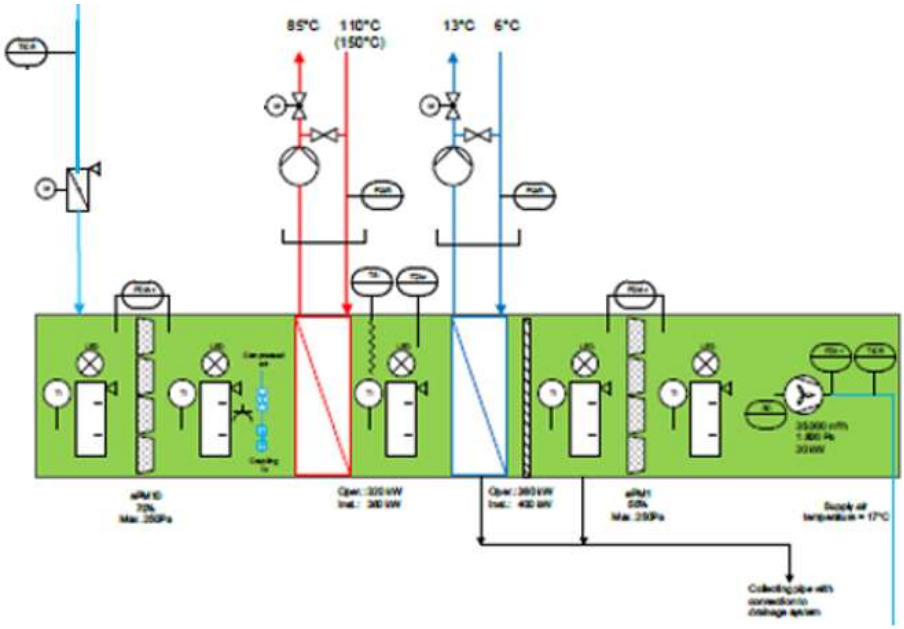
Enclosure			**Cooling Pos 20**	**Cooling Pos 21**
Length		m		
Width		m		
Air Flow		m3/h		
Material				
Diameter side nozzles				
Quantity side nozzles		#		
Diameter floor nozzles				
Quantity floor nozzles		#		
Quantity of nozzle doors				
Floor plates between conveyor chains		#		

Enclosure			**Cooling zone 2 / 2024**	**Cooling zone 2/2025**
Length		m		
Width		m		
Flow		m3/h		
Material				
Diameter floor nozzles				NA
Quantity floor nozzles		#		NA
Quantity of nozzle doors				NA

3.2.4. AIR SUPPLY UNIT

Cooling zone 1:

Each cooler will have a separate ASU. The unit will supply fresh air to the cooler after being conditioned.
A temperature sensor on the air intake will control the need of preheating before starting in wintertime.



Components to be integrated in the unit :

- Air inlet louvers
- Inlet filter
- Heating coil (incl. antifreeze sensor)
- Cooling coil
- Second filter
- Supply fan

The ASU unit will be located on a platform on top of the coolers and will be accessible from a catwalk which is connected to the one on top of the oven.

Cooling zone 2:

A similar ASU as for cooling zone 1.

3.2.4.1. *HOUSING*

The housing shall be a stable, vibration free profile frame construction with bolted galvanised (outside) sheet elements. To facilitate the cleaning and to avoid dust, the inside surfaces shall be smooth. (Inside material min 1,5 mm aluminized steel sheet)

The inner depth between the components will be at least 800 mm. Each compartment shall be provided with access door and lighting for maintenance reasons.

Doors will be provided with observation windows and with locks which can be opened from both sides. The door latches shall be made of metal, plastic handles are not allowed.

The ASU will be connected to the air intake and to the supply duct from the cooler. The individual sections are to be jointed together with strong airtight joints able to withstand positive or negative pressure of at least 2500 Pa.

3.2.4.2. *AIR INTAKE LOUVERS*

Motorized multi-plate dampers shall be installed on all air intakes of the ASU. The dampers shall be made of galvanised steel. The construction shall be sufficiently robust to withstand the air pressure, even in case of misfunctioning. The dampers shall be airtight in closed position.
The motor quantity will be determined according to the air intake sizes. Each motorized damper shall be equipped with two limit switches for open/close positions.

Motor make BELIMO
Type: BMO SM24 AMP 20Nm 24V
Type: BMO LM24 AMP 5Nm 24V

3.2.4.3. *FILTERS*

The filters will be:
Pre-filter:
PA40-6/600/06 592 x 592 x 600 coarse 80% (G4); Deltrian: 1709042

Second filter:
PA50-6/600/06 592 x 592 x 600 ePM10 60% (M5); Deltrian: 1709045

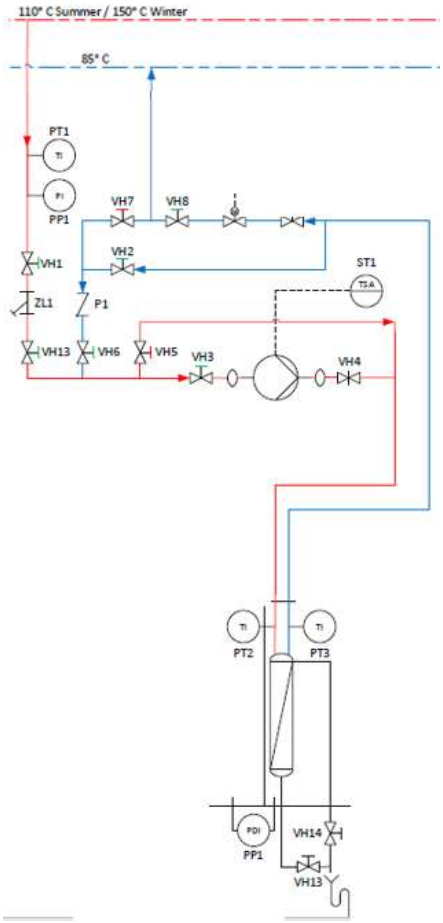
A pressure gauge will indicate the pressure drop over the filters.

3.2.4.4. *HEATING COIL*

The heating coil will be made of elliptical steel tubes with completely hot dip galvanised steel fins. The fin distance shall be 4 mm. Make: GEA Happel or equal

The coil shall be composed of separate elements and installed in a way to simplify later removal. Each element shall be fitted with lifting hooks (max. weight per element 500 kg).
Coils shall be installed in such a way that no air can pass beside the coil.
The coil shall have the required approvals including tests from authorities and be marked with an identification plate.

Max. pressure drop:
water side :5 000 Pa
air side : 150 Pa
The pressure drop over the coils will be checked with a pressure gauge.



A mixed loop operation is foreseen. Constant hot water circulation independently of the heat load will be guaranteed in the heating coil by using a pump.
The heating coil will be equipped with a regulation train for High Pressure Hot Water (HPHW) distribution (150 - 85°C).
The heating coil and regulation train shall be calculated for a HPHW supply 110°C - 85°C. The regulation train is preassembled and factory-insulated and complete with circulation pump, control valves (HONEYWELL valve type 5049A and electric linear valve actuator ML6425)), shut-off and adjusting valves (Tour & Andersson), check valve, thermometers, pressure gauges, required piping, fittings, and mounting frame.
The heating coil will be equipped with an antifreeze protection and with a pressure gauge to indicate the air side pressure drop.

To be able to measure the energy consumption (environmental demand) , a flow meter and temperature sensors on supply/ return To be able to measure the energy consumption (environmental demand) , a flow meter and temperature sensors on supply/ retour will be installed.

SCOPE OF SUPPLY

Heating coil with High pressure hot water train including:

1 High pressure hot water circulation pump

1 2-way control valve PN 25

12 Stop valves PN 25

2 Regulation valves PN 16 (T&A)

1 Filter PN 25

1 Check valve PN 25

1 Manometer

3 Mechanical thermometers

Vent valves PN 25

Drain valves PN 25

The HPHW circulation pump (make: KSB) shall be following the “VCG standard for piping plant”

The welding shall be tested following the VCG standard for piping item 11 .4 "Tests and inspections for HPHW plant".

A drain pan in stainless steel 304 will be installed under the heating coil. The drain pan shall be connected via a siphon (with sufficient height to guarantee a good function) to a main drainage system. Rust protections guarantee on all galvanised coils shall be 10 years.

All parts used in the regulation train shall be following VCG standards.

3.2.4.5. *COOLING HEAT EXCHANGER*

In the summer we have the possibility to cool down the air temperature by means of a cooler (heat exchanger) The regulation train will be similar built up as the HPHW regulation train. All parts used in the regulation train shall be following VCG standards.

3.2.4.6. *DUCTWORK*

Each ASU unit will be connected to an outside fresh air intake duct.

All ducts will be airtight welded, delivered as removable sections and assembled with flanges and bolts. The ducts inside the building will be fabricated in aluminized steel, minimum thickness 2 mm. Above the roof galvanized steel, minimum thickness 2 mm.

All ducts will be equipped with measurements fittings.

All openings for the ducts which are passing the roof will be made by the contractor. Reuse of old openings are allowed in agreement with VCG. The supply shall close (airtight) the gaps between the duct and the roof opening.

To avoid risk of condensation all ducts and also the related fans, which are not placed in separate housing will be insulated with ARMAFLEX covered with an aluminium cladding inside the building.

The exhaust duct insulation shall also be dimensioned and designed for in the case the exhaust fan is used for the oven quick cooling.

The exhaust ducts shall extend minimum 1 m above the highest ridge of the roof in a radius of 50 meters around the chimney.

Air intake ducts and exhaust ducts will be equipped with bird screens, rain cap and condensate collector with external drain.

3.2.4.7. *AIR SUPPLY FANS*

An air supply fan type plug in will be used to supply the air to the cooler. Details see: Specifications requirement for fans.

3.2.4.8. *EXHAUST FAN FANS*

Details see: Specifications requirement for fans.

Cooling zone 1 (for primer oven L10 and primer oven L9).

The exhaust fan from place 21 will be placed on a platform above cooling zone 1- position 21. This fan will reuse (in cascade) the exhausted air as supply air for place 20.
A second exhaust fan on place 20 will sent the air into the atmosphere.

Cooling zone 2 (common for primer oven L10 and primer oven L9).

The exhaust fan for cooling zone 2 will be placed on a platform above the cooling zone on the cross conveyor. This fan will be connected with a duct to send the air over the roof.

3.2.4.9. *SCOPE OF SUPPLY ASU COOLING ZONE 1 AND 2*

		Cooling zone 1	Cooling zone 2
Length	mm		
Width	mm		
Height	mm		
Inside plate thickness	mm		
Insulation thickness	mm		
Access doors	#		
Air intake louvers			
Make damper			
Type damper /size			
Tight class damper			
Quantity damper	Pcs		
Motor quantity	Pcs		
Make / type motor			
Motor power	W		
Heating coil Make			
Size / weight			
material			
Installed power	kW		
Pressure drop air side	Pa		
Pressure drop HPHW side	Pa		

		Cooling zone 1	Cooling zone 2
Pump HPHW Make -type			
HPHW flow	m³/h		
Motor consumption power	kW		
Motor installed power	kW		
Rotation speed	r/min		
Protection rating			
Energy Efficiency class			
Cooling coil Make			
Size / weight			
material			
Installed power	kW		
Pressure drop air side	Pa		
Pressure drop CW side	Pa		
Pump CW Make -type			
CW flow	m³/h		
Motor consumption power	kW		
Motor installed power	kW		
Rotation speed	r/min		
Protection rating			
Energy Efficiency class			
Filters G4			
Type identification			
Quantity			
Initial pressure drop			
Final pressure drop			
Delta p measurement filters			

Filters M5		**Cooling zone 1**	**Cooling zone 2**
Type identification			
Quantity			
Initial pressure drop			
Final pressure drop			
Delta p measurement filters			
Supply fan:			
Make			
Type			
Total flow	m^3/h		
Numbers of fans	#		
Flow by fan	m^3/h		
Static pressure	Pa		
Dynamic pressure	Pa		
Wheel diameter	mm		
Rotation speed	rpm		
Efficiency	%		
Motor Make			
Type			
Motor consumption power	kW		
Motor mechanical power	kW		
Pressure switch:			
Make			
Number			
Type			
Detection range	Pa		
Rotation speed	r/min		
Protection rating			

Exhaust fans:		**Cooling zone 1**	**Cooling zone 2**
Make			
Type			
Total flow	m³/h		
Numbers of fans	#		
Flow by fan	m³/h		
Static pressure	Pa		
Dynamic pressure	Pa		
Wheel diameter	mm		
Rotation speed	rpm		
Efficiency	%		
Motor Make			
Type			
Motor consumption power	kW		
Motor mechanical power	kW		
Rotation speed	rpm		
Protection rating			
Pressure switch:			
Make			
Number			
Type			
Detection range	Pa		

		Cooling zone 1	Cooling zone 2
Cooler fresh air duct :			
Material			
Thickness	mm		
Air speed	m/s		
Insulation type			
Insulation thickness	mm		
Cooler Exhaust :			
Material inside/outside hall			
Thickness	mm		
Air speed	m/s		
Adjusting dampers	make		
Adjusting dampers	#		
Connection duct cooler ASU to cooler			
Material			
Thickness	mm		
Air speed	m/s		
Insulation type			
Insulation thickness	mm		

4. SPECIFICATIONS REQUIREMENT FOR FANS

4.1. SUPPLY FANS

The fan shall be of the centrifugal type, pull -out system

- Make Pollrich or equal
- Sound level 85 db(A)at 1 m distance
- The fan shall be designed (air flow & total pressure) to meet the airflow requirements of the system as requested with dirty air-conditioning walls, such as heat-exchangers, filters,...
- The efficiency of the fan obtained in the working point shall minimum be
  - 75% for 3.5 <effective power output< 10 kW
  - 80% for 10 <effective power output< 25 kW
  - 85% for effective power output> 25 kW
- Transmission efficiency between motor and fan shall be minimum 95 %. Direct driven fans are preferred.
- All fans shall be foreseen with a pressure switch Kromschröder DG-10U
- The maximum velocity of the fan shall be according to item 8 page 10 of the general ventilation heating and cooling standard. The velocity of the air will be restricted to 16 m/s and the dynamic pressure at the exhaust will always be smaller than a third of the total pressure.
- The casing:
  - Shall be made of completely welded steel min. 5 mm thickness and protected with paint. It will be assembled in parts, which allow the wheel dismantling ; heaviest part shall not exceed 500 kg.
  - The maximum area that isn't reinforced shall not exceed 0.25 m2.
  - On the lower part of the casing hinged cleaning doors (600 x 600) with quick lock systems will be provided.
  - Also water drainage pipe sockets will be provided.

- The rotor:
  - Double or single inlet,
  - With backwards curved blades, which are welded continuously, stress relief after welding
  - Balanced according to DIN 1940 Q= 2.5

- The hub: is assembled with self-securing screws and dowelled

- The shaft: material is St 52.3

- Motor and fan wheel shall be balanced statically and dynamically. The fan vibrations shall be measured by an official authority according to ISO 2372 during the machine Try-out. This report shall be approved before plant acceptance.

- **The bidder shall joint in his offer a curve with working point of the selected fan**.

- Flexible connections at in/outlet made of appropriate silicon-free material and provided with a guide sleeve in St 37.

- An appropriate frame made of profiles, thus meeting the vibration requirements and the specifications of belt tensioning.

- Shock-absorbers will be placed under the frame. These absorbers shall give at least 90% damping (on the overall vibration level and the fundamental frequency). Depending on the rotational speed, springs can be necessary (natural frequency must be taken in account).

- Complete insulation when necessary.

- The fan shall be used with a frequency converter

- The fan itself shall be equipped with:

  - V- belts - make: OPTIBELT calculated for at least a 25000h life time and for 150% motor power .

  - V- belt protection will be according to the ARAB with inspection door, easy dismantling, test- openings for belt-tension-control with a dynamometer of OPTIBELT and velocity-control .

  - Pulleys with taper lock (SERAX or equivalent)

- Bearings make SKF , of the self-aligning type , with cylindrical bore will be selected for an average operating life of l00 000 h in permanent running at the maximum speed of the fan.

- The bearing house will be provided with grease-nipples and drain possibility and will be removable without dismantling the impellor.

- Prepared to install accelerometers if easily accessible.
  Each fan without accessibility in running production will be equipped of accelerometers sensors.
  Per motor: Sensors 2 x CTC AC102 100mV/G and junction box 1 CT101_DS
  Belt driven: 1 sensor per bearing CTC AC102 100mV/G
  All sensors will be collected to 1 junction box

- Lubricating agents will be grease or silicon-free oil.

- Motor
  - ABB
  - Squirrel cage
  - 1500 RPM IP 54
  - IE4
  - B3
  - the carriage will be out of cast - iron or cast – steel

4.2. EXHAUST / RECIRCLE FANS

The fan shall be of the centrifugal type, pull-out system

- Make Pollrich or equal

- Sound level 85 dbA at 1 m distance

- The fan shall be designed (air flow & total pressure) to meet the airflow requirements of the system as requested with dirty air-conditioning walls, such as heat-exchangers, filters,...

- The efficiency of the fan obtained in the working point shall be minimum

  75% for 3.5 <effective power output< 10 kW
  80% for 10 <effective power output< 25 kW
  85% for effective power output> 25 kW

- Transmission efficiency between motor and fan shall be minimum 95%. Direct driven fans are preferred.

- The velocity of the air will be restricted to 16 m/s and the dynamic pressure at the exhaust will always be smaller than a third of the total pressure

- All fans shall be foreseen with a pressure switch Kromschröder DG-10U

- The casing:
  - Shall be made of completely welded steel min. 5 mm thickness and protected with paint. It will be assembled in parts, which allow the wheel dismantling; heaviest part shall not exceed 500 kg
  - The maximum area that isn't reinforced shall not exceed 0.25 m2.
  - On the lower part of the casing hinged cleaning doors (600 x 600) with quick-
  - lock systems will be provided
  - also water drainage pipe sockets will be provided.

- The rotor:
  - Single inlet.
  - With backwards curved blades, which are welded continuously, stress relief after welding
  - Material St. 37
  - Balanced according to DIN 1940 Q= 2.5
  - Additional reinforcement for hub shall be at least the half of the rotor diameter

- The shaft:
  - Material is St 52.3
  - Will be tightened with a labyrinth sealing

- Motor and fan wheel shall be balanced statically and dynamically. The fan vibrations shall be measured by an official authority according to ISO 2372 during the machine Try-out . This report shall be approved before plant acceptance.

- The bidder shall joint in his offer a curve with working point of the selected fan.

- Flexible connections at in/outlet made of appropriate silicon-free material and provided with a guide sleeve in St 37.
- An appropriate frame made of profiles, thus meeting the vibration requirements and the specifications of belt tensioning.

- Shock-absorbers will be placed under the frame. These absorbers shall give at least 90% damping (on the overall vibration level and the fundamental frequency). Depending on the rotational speed, springs can be necessary (natural frequency has to be taken in account).

- Complete insulation when necessary.

- The fan shall be used with a frequency converter

- The fan itself shall be equipped with:

  - V- belts calculated for at least a 25000h lifetime and for 150% motor power.
  - V- belt protection will be according to the ARAB with inspection door, easy dismantling, test- openings for belt-tension-control with a dynamometer and velocity-control.
  - Pulleys with taper lock (SERAX or equivalent)
  - Bearings make SKF, of the self-aligning type , with cylindrical bore will be selected for an average operating life of 100 000 h in permanent running at the maximum speed of the fan.
  - The bearing house will be provided with grease-nipples and drain possibility and will be removable without dismantling the impellor.

  - Prepared to install accelerometers if easily accessible.
    Each fan without accessibility in running production will be equipped of accelerometers sensors.
    Per motor: Sensors 2 x CTC AC102 100mV/G and junction box 1 CT101_DS
    Belt driven: 1 sensor per bearing CTC AC102 100mV/G
    All sensors will be collected to 1 junction box.

  - Lubricating agents will be grease or silicon-free oil.

  - Cooling fins

  - Motor
    - ABB
    - Squirrel cage
    - 1500 RPM IP 54
    - IE4
    - B3
    - The carriage will be out of cast - iron or cast - steel