MICROWAVE TUNNEL 2.45 GHz + HOT AIR

LABOTRON TMW800 AC60 (4 x 2 kW, 2.45 GHz microwave)
LABOTRON TMW480 AC60 (4 x 1.2 kW, 2.45 GHz microwave)

Fig. 1. Labotron TMW800 AC60

This microwave tunnel has been designed for continuous cooking/pasteurisation at small production flows of products packed in containers (pots or trays); the tunnel has been developed to help with the optimization of the process parameters, i.e. microwave power, treatment time, air flow & temperature to get the desired product quality.

The tunnel has a variable speed conveyor belt, a forced air system with variable temperature setting (up to 60 °C) and four (4) microwave generators distributed as follows: 2 at the lower side + 2 at the upper side of the microwave cavity (oven). This design makes it possible:

- To adjust the microwave power distribution & level on top and below the product. Depending on the shape of container (pot or tray) but equally on the product level inside the container, it can be also possible to heat different layers of product at different temperature levels;

- To program a different microwave power levels at the tunnel input and output; for example, higher level at the inlet and lower at the outlet to maintain the product's temperature after fast heating;

- To adjust microwave heating time from 40 s to 10 min. If longer treatment times are required, the conveyor belt can be programed via HMI to stop in the middle of the oven for a given time;

- To check the effect of air temperature on the homogeneity of product heating depending on the container's material and equally, depending on forced air temperature, speed & direction.

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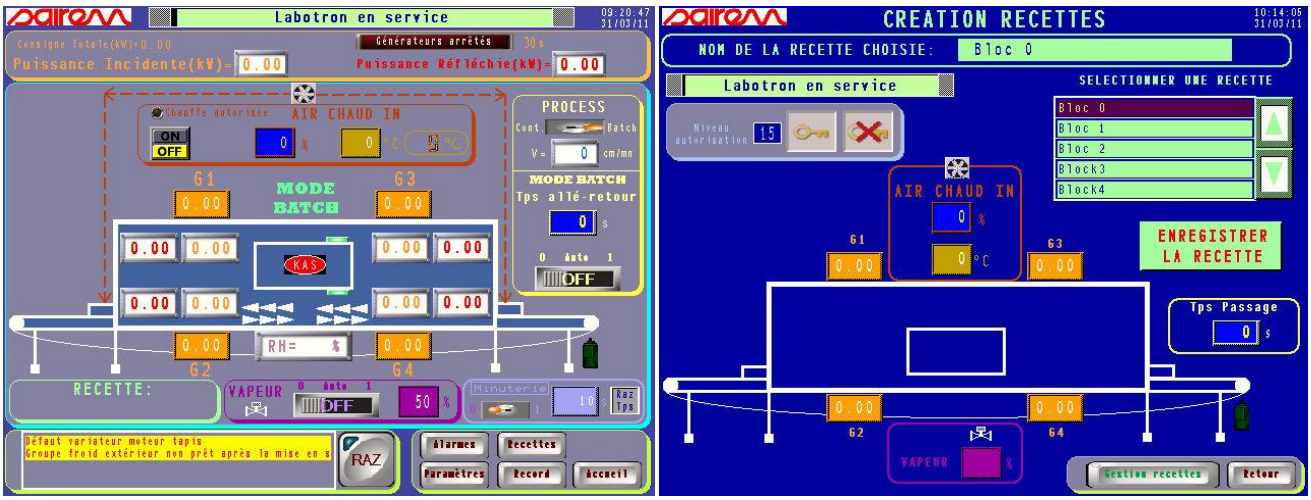
Reference	**Labotron TMW800AC60: 8 kW microwave power, 4 off x 2 kW generators** **Labotron TMW480AC60: 4.8 kW microwave power, 4 off x 1.2 kW generators**
Construction	1-block microwave cavity, stainless steel 304 L, door with ¼ wave choke. Air- & water-proof electrical cabinet at the rear of the tunnel containing all microwave generators, variators etc. Integrated PLC/HMI with 7" color touch screen located above the oven's access door. Tunnel mounted on wheels for easy moving; mains connections via socket, no-drip quick release connectors for cooling water
Microwave generators	4 microwave generators, 2450 MHz. Power level of each generator is adjustable separately or together with the other 3 generators from 100 W to 1200 W (TMW480 AC60) or from 200 W to 2000 W (TMW800 AC60) via the HMI. Reflected power is displayed for each generator. Total reflected power for all four generators is also displayed.
Microwave coupling	2 wave inputs at the top and 2 at the bottom of the microwave cavity, protection against no-load operation via isolator, measurement of reflected power for absorbed energy balance.
Forced air system with variable temperature and flow	Temperature adjustable up to 60 ^{0}C via the HMI, the air is not recycled, the air intake from atmosphere is filtered before heating. Air speed is adjustable up to 1.5 m/s via HMI by adjusting the speed of the fan. Air flow direction concurrent; max. hot air power 4 kW.
Conveyor belt	Intralox mesh, width 250 mm. Microwave heating time adjustable from 10 min to 40 s, i.e. conveyor belt speed from 0.1 m/min up to 1.5 m/min
Steam input	It is possible to diffuse steam alongside the oven via 2 nozzles. A solenoid valve controlled through HMI opens or closes to let steam enter the tunnel. Steam source not supplied.
Product input/output	Operating max. height 110 mm, width 250 mm, access for cleaning from the ends of the tunnel and through the access door. Adjustable shutters to reduce air flow and microwaves leakage with container shape. The microwave chokes are water-cooled.
Access door to the microwave cavity (oven)	The oven can be used as a batch system if long treatment time is required. Wide door allowing easy cleaning. Door with ¼ wave choke + silicone o-ring for hot air; sight window with LED lighting; 2 safety interlocks
HMI control & display	7" colour touch screen allows for control & reading of microwave power level, forced air speed and temperature, conveyor belt speed; up to 20 recipes can be stored. Oven status, faults status, etc. Emergency stop. Data transfer via USB and Ethernet ports.
Mains & consumption	3 x 400 V + earth, no neutral, 50/60 Hz, 20 kVA (TMW480AC60) or 27 kVA (TMW800AC60)
Cooling water	Min. 10 L/min, pressure 4 bars, water temperature between 18 ^{0}C and 22 ^{0}C, power to evacuate 5 kW (or 10 kW); water inlet/outlet 1" GF OPTIONAL: integrated air/water chiller.
Cleaning	Inside the tunnel: with pressured water, drain at the lower part of the oven, Outside the tunnel: with soft cloth, sponge
EC norms	89/392, 91/368, 73/23, 89/336, 92/31, 519-6 CEE/EWG EN55011 (specific)
Size, weight	See drawings on page 4, weight 950 kg



Examples of HMI screens

Calculation of maximum performance

The maximum performance of the oven can be calculated as follows:

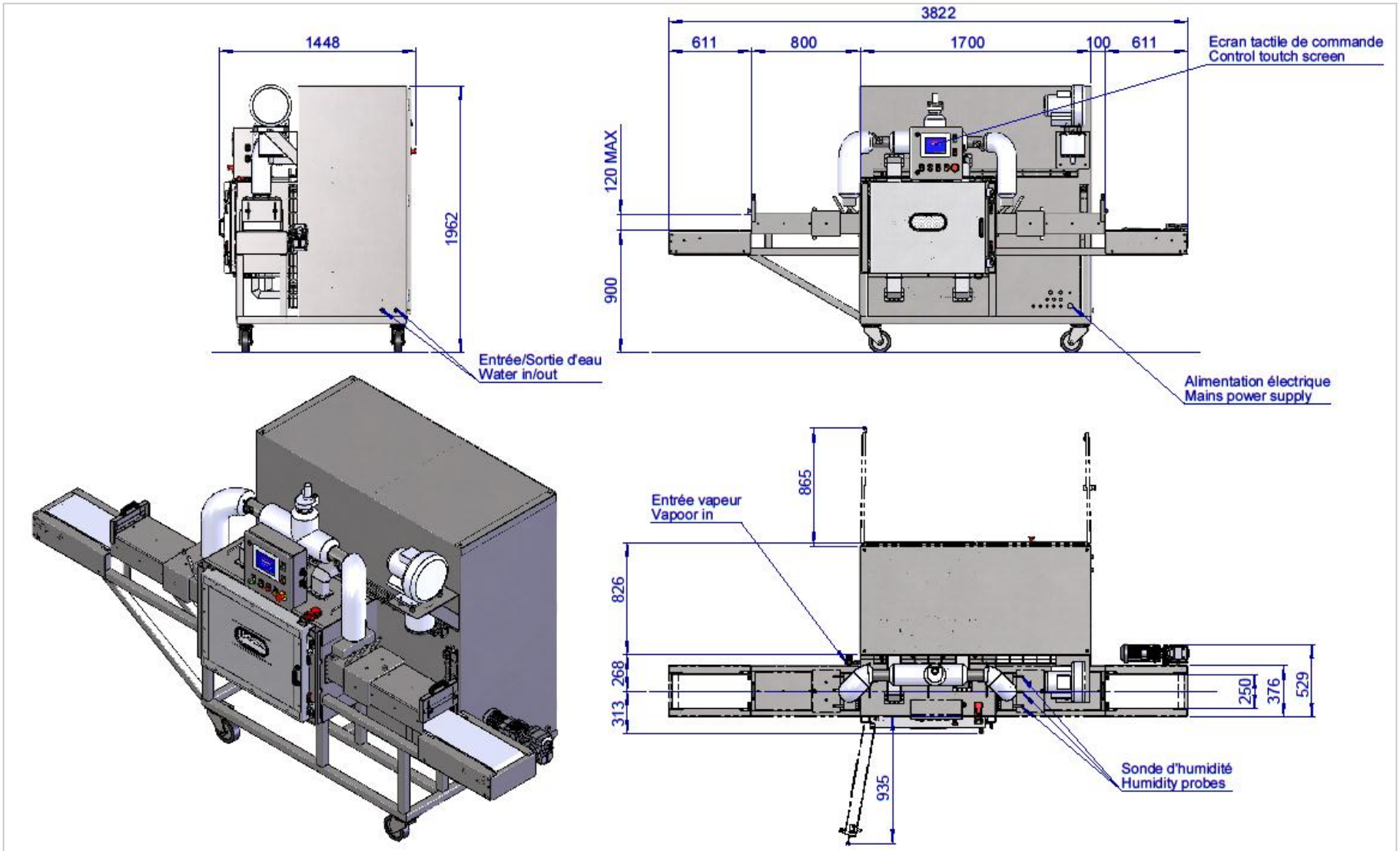
$$P(kW) = \frac{m(kg) \times Cp\ (J\ g^{-1}\ K^{-1}) \times \Delta T(°C)}{t(s)}$$

It follows that if we consider a microwave efficiency of 90 % the maximum production capacity is:

$$capacity\ (kg\ h^{-1}) = \frac{P(kW) \times 3600}{Cp\ (J\ g^{-1}\ K^{-1}) \times \Delta T(°C)} \times 0.9$$

Example TMW800 : power 8 kW, temperature difference 70 °C (ΔT) between input and output (15 °C to 85 °C), Cp = 3.7 J g^{-1} K^{-1}, the maximum production is 100 kg h^{-1} (kg/h).

If lower microwave power is used the production flow reduces proportionally.



INDICE	DATE	DESSINE	VERIFIE	APPROUVE	MODIFICATION DU DESIGN
A	22-03-11	BDE			EMISSION ORIGINALE

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