915 MHz MICROWAVE TEMPERING TUNNEL

TMW 150

Multiple microwave inlets, crossed above & below
TEMPERING OF FROZEN BLOCKS
Capacity: 4000 to 6000 kg/h from -20 °C to -4 °C / -2 °C
Maximum microwave power 150 kW

ADVANTAGES

- ✓ **FAST**: **very short** time of treatment, high production flexibility;
- ✓ **ECONOMIC**: **product gain** from 5 to 10 %, working on a just in time basis, **minimum floor space**, fast return of investment;
- ✓ **HOMOGENEOUS**: big dimensions of the microwave cavity, microwave power inlets above and under the product, built-in proprietary structures for the uniform repartition of microwaves;
- ✓ **RELIABLE**: very good control of **final temperature**;
- ✓ **HYGIENIC**: no **bacteriological** growth, complies with all hygiene regulations and standards, keep taste and texture **qualities**;
- ✓ **FLEXIBLE**: can be used for tempering of meat, fish, fruits, vegetables and butter **packed** (carton without metallic staple or plastic film) **or not packed.**

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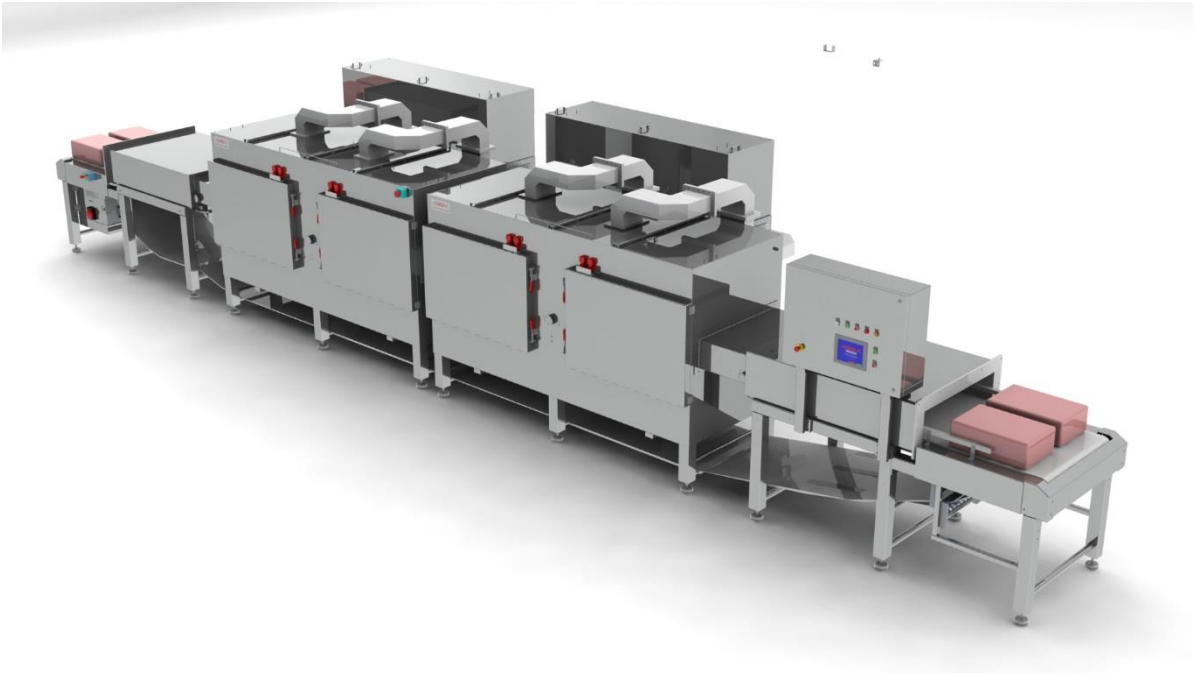
Tunnel TMW 150



The distinctive feature of the TMW 150 is the use of the microwave technology to achieve the best tempering homogeneity while maintaining a good microwave efficiency. The large size of the cavity, the length under microwaves and the crossed coupling of microwaves above and below the blocks are a few examples of the solutions used to conciliate capacity, efficiency and homogeneity.

TEMPERING CAPACITIES

The TMW 150 offers a tempering capacity from 4 to 6t/h from - 20 °C to a final average temperature between - 4 °C and - 2 °C in 95 % of the block; the capacity is calculated to temper frozen blocks with standard dimensions 600 mm x 400 m x 200 mm and a weight of about 20 / 25 kg.

The tempering capacity is variable and depends on the final required temperature and on the product (meat, fish, vegetables, fruits, butter, etc.). Figures below show these variations.

The data in the charts are calculated for the TMW 150 operating at 120 kW power, with $\mathbf{t_{on}/t_{off}}$ optimum at 95 %, for blocks with regular size and weight 25 kg (600 mm x 400 mm x 200 mm) and for a starting temperature around -20 °C/-18 °C**.**

$\mathbf{t_{on}/t_{off}}$ is the microwave utilization within 1 hour including loading/unloading; the optimum is 95 %.

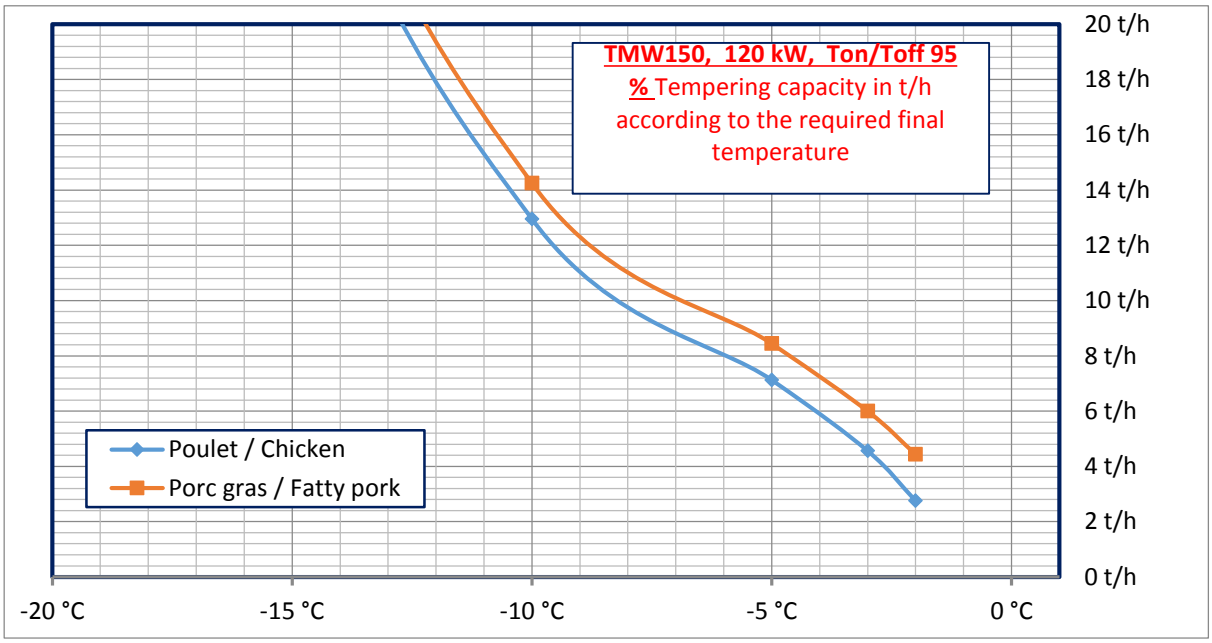
OBSERVATIONS

- If fatty products are to be processed, fat ought to be very homogeneously distributed in the block, otherwise the limit temperature for homogeneity is about -4 °C;

- At the final temperature of -4/-2°C the blocks are cold enough to be processed: dicing, grinding, slicing…

- The maximum microwave power which can be used in processing is limited by the products and not the tunnel. Recipes power vs. time must be chosen according to the compromise between capacity and homogeneity of heating.

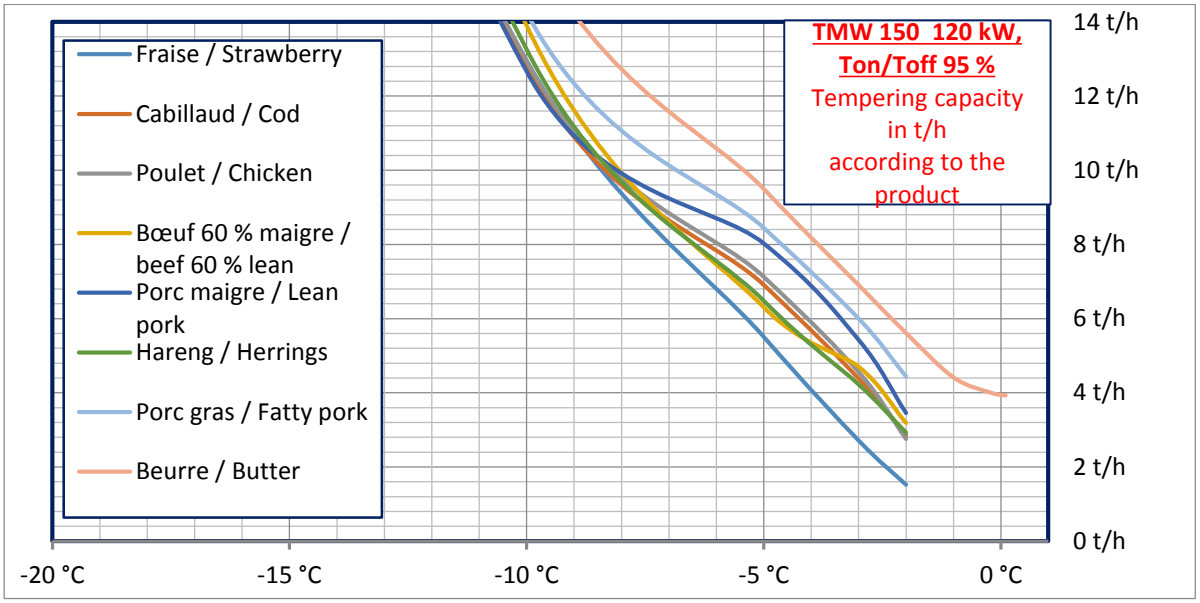
Fig.1. Tempering capacity vs. desired final temperature



Example: Chicken ~ 7.2 t/h from -18 °C to -5 °C or ~ 4.6 t/h from -18 °C to -3 °C.
Example: Fatty pork ~ 8.4 t/h from -18 °C to -5 °C or ~ 6 t/h from -18 °C to -3 °C.

It has to be noted that a starting temperature at -20 °C or -18 °C has almost no effect on the tunnel capacity if temperature is homogeneous in the whole product.

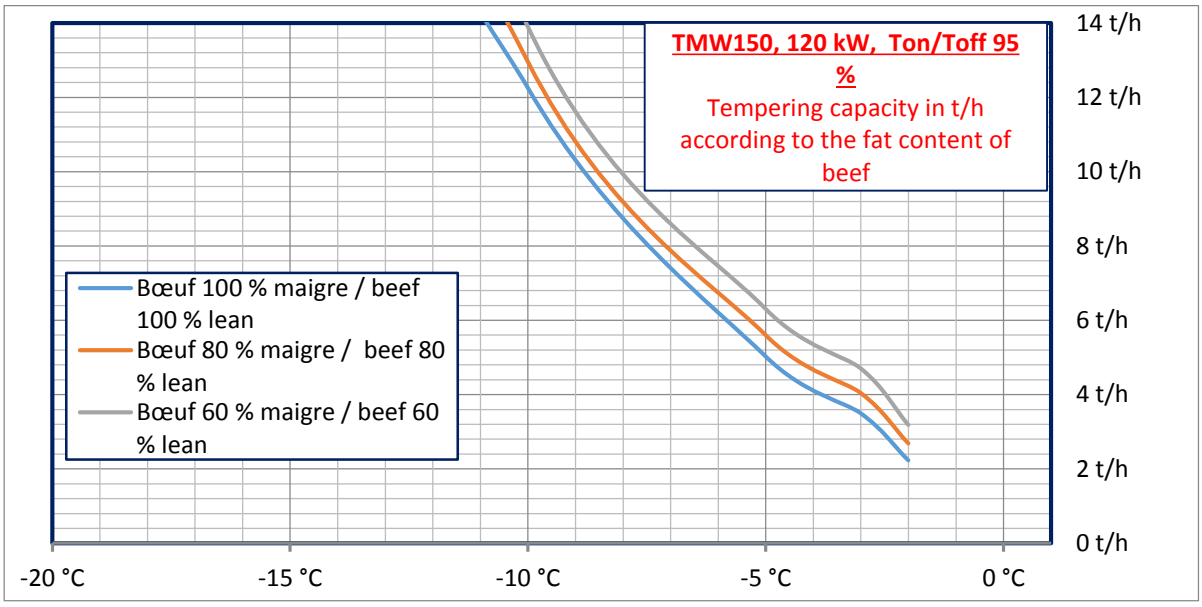
Fig.2. Tempering capacity vs. product type



Thawing capacity is highly variable according to the product.

Examples: butter (7.2 t/h at -3°C) or beef 60 % lean (4.6 t/h at -3°C) for the same final temperature.

Fig.3. Tempering capacity vs. fat content



Example from -18 °C to -3 °C: capacity ~ 4.8 t/h for beef 60 % lean, or ~ 3.4 t/h for beef 100 % lean

Some examples of blocks processed with the TMW 150

Beef 25 % lean
Capacity: ~ 6000 kg/h from - 18 °C to - 4 °C

Turkey filets
Capacity: ~ 5000 kg/h from - 18 °C to - 4 °C / - 2 °C
or capacity: ~ 3000 kg/h from - 18 °C to - 3 °C / - 1.5 °C

Pork shoulder, 10 to 15 % fat
Capacity: ~ 4000 kg/h from - 18 °C to - 3 °C / - 1 °C

Chicken skin
Capacity: ~ 5000 kg/h from - 18 °C to - 3 °C / - 1 °C

Conclusions

Capacity is highly variable if final temperature is - 7 °C or - 3 °C or if meat is lean beef or fat pork. Such variations are linked to physical laws such as for example, latent heat of fusion.

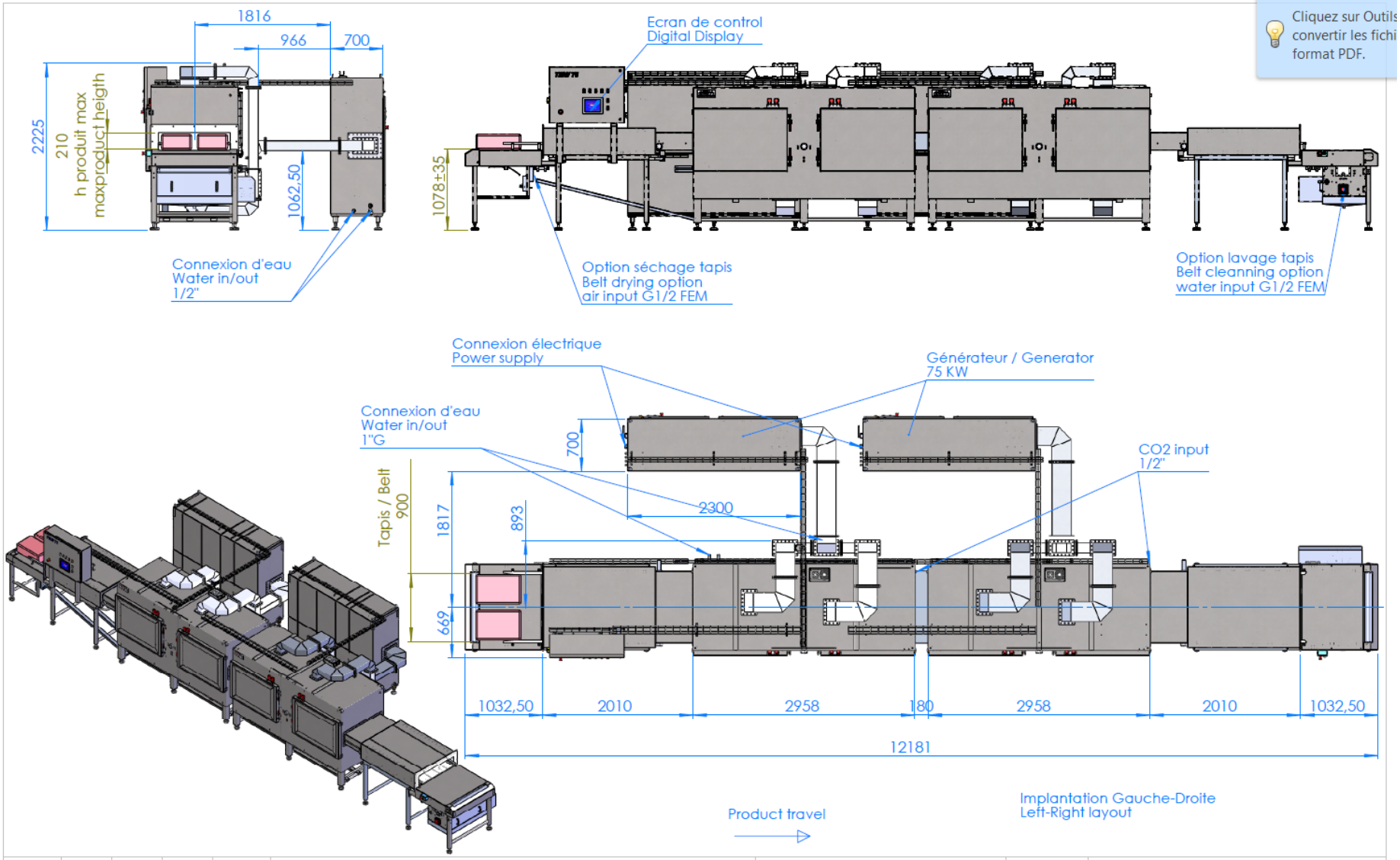
Capacity varies according to the processed product (lean beef, pork…), its fat content and the final required temperature.

All the above charts are calculated for a TMW 150 operating under following conditions:

- Power of microwave generator at 120 kW
- T_{on}/T_{off} at 95 %
- Blocks or products with regular mass and shape
- Blocks or products regularly placed on the belt
- Starting temperature between -20°C and -18°C homogeneous in all the blocks or products

TECHNICAL CARACTERISTICS

Reference	**TMW 150**
Construction	**Tunnel**: 304 L stainless steel, microwave door with ¼ λ choke, chain conveyor in polyethylene, water-cooled input and output zones, touch screen, microwave inlet above and below, automatic loading and unloading. **Two microwave generators**: separate, IP55, can be placed at a distance from the tunnel, electronic system and cards without adjustment to make maintenance easier, high reliability.
Tempering capacity	Depends on final temperature, product and fat content, see above charts.
Conveyor belt	Flat top Intralox principle, width 900 mm for 2 blocks side by side. Adjustable belt speed, operating height 1080 mm. Belt direction has to be indicated on ordering: from the right to the left or conversely.
Max. size of blocks	600 x 400 x 210 mm, 30 kg maximum per block. **Option**: maximum height 260 mm.
Microwave frequency	915 MHz (other frequencies are available according to specific regulations of each country)
Microwave power	150 kW maximum, adjustable from 30 kW to 150 kW.
HMI (Human Machine interface)	10" touch screen, multi-lingual, control of microwave power and belt speed, 50 programmable recipes, tunnel status, faults history, etc. Microwave start, emergency stop, etc.
Specific safety	**Option**: a leakage detector ref. DFM signals any accidental leakage. It is a security for the operators. A smoke sensor detects a fire in the tunnel (for example a meat box blocked in the tunnel that could create a fire) and stops microwaves before injecting water via nozzles.
Voltage & consumption	400 V, 3-phase + earth (no neutral), 50/60 Hz, 200 kVA at full power.
Cooling water	**MW generators**: min. 100 L/min with differential pressure min. 3.5 bar, inlet water temperature 18 °C to 22 °C, power to dissipate 50 kW ; ES 1.5" gas female. **MW tunnel**: min. 6 L/min, max. pressure 1.5 bar. **Option:** air/water chiller.
Option belt washing/drying	System for belt washing/drying located near the tunnel output
Cleaning	Water jet inside the tunnel, evacuation under the tunnel
EC standards	CE norms 'machines' (2006/42/CE) CE norms 'low voltage' (BT 2006/95/CE) CE norms 'electromagnetic wave' (CEM 2004/108/CE) and EN 55011. CE norms 'installations safety' (CEI60519-6: 2011).
Size, weight	See drawing below, weight 6000 kg with the generators



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