MixSing FatMelt

for melting fat blocks

Purpose-Built

Integration into process lines

TPS

The power of simplicity

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Purpose-Built

Fat Melter

Design and Operation of Fat Melters

A fat melter transforms solid blocks of butter, lard, cocoa butter or shortening into a free-flowing liquid. Unlike drum melters, which handle semi-liquids, block melters must accept hard 10 – 25 kg rectangles, melt them fast, and feed a process line without lumps.

Key Features

How a fat melter handles fat blocks effectively.

Efficient Melting of Solid Blocks

- The melter is built to melt large, solid blocks evenly and quickly.
- It often includes heated grids, surfaces, or immersion heaters that make direct contact with the blocks to accelerate the melting process.

Precise Temperature Control

- It maintains exact temperatures to melt fats without overheating, preserving their quality. For example, butter melts at 32–35°C, while cocoa butter melts at 34–38°C.
- Indirect heating methods - such as hot water jackets, steam, or electric elements - are common to ensure consistent, controlled heating.

Even Heat Distribution

- Uniform melting is critical to avoid unmelted chunks or hot spots.
- Some melters feature agitators or recirculation systems to distribute heat evenly across the blocks.

Capacity for Various Block Sizes

- It accommodates blocks ranging from small (e.g. 10 kg) to large industrial sizes (e.g. 25 kg or more).
- The design scales to meet different production needs, from small batches to high-volume processing.

Ease of Loading and Unloading

- Heavy blocks are loaded using features such tilting mechanisms, hydraulic lifts, or conveyors.
- Once melted, the liquid fat is transferred via pumps for further use or storage.

Hygiene and Cleanability

- Made from food-grade stainless steel or similar materials to meet safety standards.
- Smooth surfaces and accessible designs simplify cleaning and prevent contamination.

Energy Efficiency

- Insulated tanks retain heat, reducing energy waste.
- Heating systems are optimized for efficiency while maintaining performance.

Safety Features

- Including temperature limits, overheat protection, and secure loading systems to ensure operator safety.
- Designed to handle the weight and size of solid blocks securely.

Potential Pitfalls

Various challenges can occur in the design, operation, and maintenance of industrial fat melters, and addressing these is key to ensuring safe and reliable performance.

Inadequate Temperature Control

- Overheating can degrade fats, leading to burnt residues that are difficult to clean and may compromise product quality. Insufficient heating can result in incomplete melting, causing blockages.

Poor Design of Melting Grid

- If the melting grid is poorly designed, it can cause uneven melting, where fat blocks fail to break down effectively - reducing throughput and raising energy use.

Blockages and Clogging

- Inadequate piping or grid design can cause fat to solidify, leading to blockages, especially in continuous operation systems, disrupting production.

Cleaning Challenges

- Complex designs with hard-to-reach areas can make cleaning difficult, potentially leading to residue buildup, contamination, and non-compliance with hygiene standards.

Material Corrosion

- Using inappropriate materials, such as soft metals, can lead to corrosion, especially when exposed to alkaline cleaners or acidic fats, reducing equipment lifespan.

Safety Hazards

- Handling hot fats poses risks, and poorly designed safety features, such as lack of insulation or emergency stops, can lead to operator injuries.

Energy Inefficiency

- Poor insulation or inefficient heating methods can increase operational costs, impacting the overall cost-effectiveness of the melter.

Cleaning Issues

Proper cleaning of industrial fat melters is essential for maintaining hygiene, preventing contamination, and meeting food safety standards.

Fat Residue Removal

- Fat-based residues, often present as emulsions, require a hot water rinse above their melting point to begin cleaning. More stubborn deposits may require alkaline cleaners with emulsifying or saponifying action - such as caustic soda (sodium hydroxide) - to effectively break down fats.

Cleaning Methods

- Depending on the system design, cleaning may involve Clean-In-Place (CIP) for piping and inaccessible areas or manual cleaning for systems that require full disassembly. CIP typically circulates detergent, hot water rinses, and a sanitising solution through the unit to ensure thorough cleaning.

Detergent and Sanitisation Approach

- Highly alkaline detergents are most effective for breaking down fats. Moderately alkaline alternatives, such as phosphates or silicates, can also be used, provided water hardness is controlled. Always ensure detergents are food-grade and compliant with environmental regulations.
- After cleaning, sanitisation is crucial. This can be achieved thermally (e.g. hot water at 77 °C for 5 minutes) or chemically (e.g. chlorine at 200 ppm, or iodophors at 12.5–25 ppm) to eliminate any remaining microbial contamination.

Surface Material Considerations

- Use stainless steel with a smooth, cleanable finish to support hygiene and ease of maintenance.

Cleaning Frequency

- Safe and efficient operation relies on regular cleaning and inspection. Flush with hot water after each batch to prevent congealing. Run a full CIP cycle daily or after product changes to maintain hygiene and avoid cross-contamination. Perform weekly visual checks and monthly seal inspections to catch wear early. Schedule quarterly deep cleans and annual validations to ensure long-term compliance and reliability.

Operational Observations

Operational factors play a key role in ensuring the efficiency and long-term performance of industrial fat melters.

Temperature Management

- Maintain the fat at the correct temperature to prevent solidification, which can cause blockages, or degradation, which affects quality. Dual heating systems can help, with one temperature for melting and another for holding.

Quality Monitoring

- Regularly monitor the melted fat for impurities, such as burnt residues or contaminants, to ensure it meets product specifications.

Integration with Production Lines

- Ensure that the melter integrates seamlessly with production lines, with appropriate piping, valves, and pumps for transferring melted fat. Consider mobility if the unit needs to be repositioned for different processes.

Energy Efficiency

- Design for energy efficiency, such as using insulated jackets to reduce heat loss, and select heating methods that minimize energy consumption, impacting operational costs.

Maintenance Schedules

- Implement regular maintenance schedules to check heaters, agitators, pumps, and control systems, preventing breakdowns and extending equipment lifespan. Address charring or residue buildup promptly to avoid clogging.

Operator Training

- Train operators on proper use, cleaning, and safety procedures to minimize errors, such as overheating or improper cleaning, which can lead to operational issues.

Compliance with Regulations

- Ensure the design and operation comply with food safety standards.

How to Size Your Fat Melter

Fats, being blends of various triglycerides, do not melt at a single point but over a temperature range. For practical calculations, an average melting point is typically used (see Table 1). In Example 1, a theoretical power requirement (kW) is calculated for melting butter. For real-world applications, it is recommended to add a safety margin of minimum 25%. This accounts for factors such as higher-than-average melting points, lower initial temperatures of the fat blocks, or heating media performing below expected levels - all of which can affect melting efficiency.

Fat Type	Melting Point T_m - (°C)	Enthalpy of Fusion ΔH_f - (kJ/kg)	Specific Heat Capacity (Solid) $C_{p,s}$ - (kJ/kg °C)	Specific Heat Capacity (Liquid) $C_{p,l}$ - (kJ/kg °C)
Butter	33.5	105	1.6	2.0
Margarine	35	110	1.7	2.1
Cocoa Butter	36	157	1.5	2.0
Lard	40	120	1.7	2.1
Shortening	47	140	1.6	2.0

Table 1: Average thermodynamic properties for melting different fats

$$P = \frac{m\left[C_{p,s} \cdot (T_m - T_i) + \Delta H_f + C_{p,l} \cdot (T_f - T_m)\right]}{t}$$

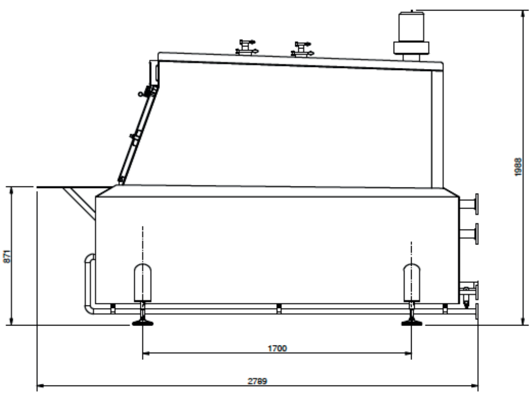
Formula 1: Power (kW) required to melt fat and heat liquid fat to the processing temperature

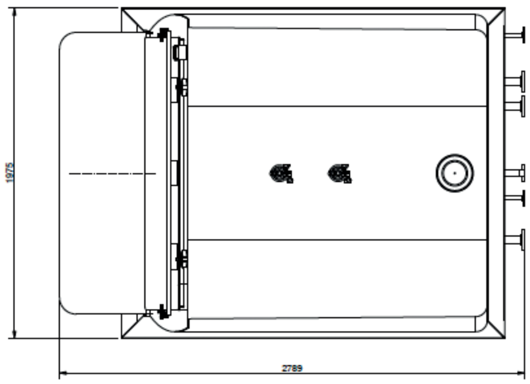
- P is the power in kilowatts (kW). 1 kW = 1 kJ/s.
- m is the mass of the fat in kilograms (kg).
- $C_{p,s}$ is the specific heat capacity of the solid fat in kJ/(kg·°C). The energy needed to raise the temperature of 1 kg of solid fat by 1°C.
- $C_{p,l}$ is the specific heat capacity of the liquid fat in kJ/(kg·°C). The energy needed to raise the temperature of 1 kg of liquid fat by 1°C.
- T_m is the melting point of the fat in °C (transition from solid to liquid).
- T_i is the initial temperature of the fat in °C.
- T_f is the final temperature of the liquid fat required for processing in °C.
- ΔH_f is the enthalpy of fusion in kJ/kg. The energy needed to melt the fat at its melting point.
- t is the time in seconds (s).

Example 1:

- 500 kg butter
- T_i = 2°C
- T_f = 60°C
- t = 2700 s (45 minutes)

$$P = \frac{500\left[1.6 \cdot (33.5 - 2) + 105 + 2.0 \cdot (60 - 33.5)\right]}{2700} = 38.6\text{kW}$$





Drawing: MixSing FatMelt

MixSing FatMelt

Function, not frills

Every Decision Follows Three Rules

- Operator-centred handling: One person can load, start, and clean the unit safely.
- Uniform, controllable heat: Every fat block sees the same temperature profile.
- Hygienic, future-proof build: EHEDG-level cleanability with premium materials.

Key Features

Feature	Why it matters
Lay-down loading door doubles as a stainless table	Blocks slide straight in - no dropped packs, less strain on staff
Single-header hot-water grid	Identical water temperature in every pipe; no hot-cold gradient, no recirculation balancing
Separate sump jacket (second water circuit)	Melts blocks at ~35 °C, then lifts liquid fat to 50–60 °C in the sump - perfect for downstream processing
Optional circulation - loop nozzle	Angled jet stirs the sump: in many recipes the agitator becomes unnecessary, cutting capex, utilities and maintenance
Compact skid for hot - water generation	Plug-and-play package with Alfa Laval heat exchanger, Grundfos pumps, IFM instrumentation; fully 3-D modelled for perfect alignment
Minimal internals + twin Alfa Laval jet cleaners + CIP spray balls	Full coverage above and below the grid.
316L product contact / 304 non-contact steel	Corrosion resistance where it counts, cost efficiency where it doesn't
2B surface finish as standard; optional 0.6 µm Ra or 0.3 µm Ra polish	Matches customer hygiene specs

How the Process Works

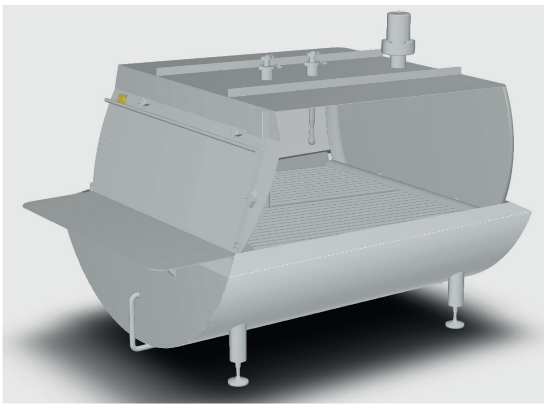
1. Block loading. The door folds down to waist height, forming a stable platform. Operators place 25 kg blocks on the door and slide them effortlessly onto the heated grid.
2. Even melting. Hot water (circuit 1) enters a single header that feeds every grid pipe in parallel, ensuring each pipe starts at the same temperature. Blocks melt from below without scorching.
3. Thermal lift in the sump. Melted fat drips into the sump, jacketed with hot water from circuit 2 at a lower set-point. This raises the fat to the exact process temperature - typically 55 °C - before discharge.
4. Optional agitation via nozzle. For easy-to-melt fats, the circulation pump drives oil through a angled nozzle that sweeps the sump, removing cold spots while saving the energy of a mechanical agitator.
5. Cleaning. At the end of each batch, one rotary jet cleaner above the grid and another below ensure thorough cleaning of all grid surfaces. Additional spray balls are positioned to reach areas beyond the jet coverage.

Operator Benefits

- Faster turn-around: Melt and reach process temperature in one vessel; no transfer losses.
- Lower labour risk: Waist-height loading removes awkward lifts; single-person operation.
- Simple controls: PLC with recipe presets; clear HMI for temperature, level, and alarms.
- Future flexibility: Agitator, load cells or higher-polish finish can be added if the process evolves.

Hygiene and Compliance

- All welds ground and passivated; no crevices, no threaded connections in the product zone.
- Documentation pack includes material certificates.



Drawing: MixSing FatMelt

Automated Process Lines

For plants that demand maximum throughput and repeatability, MixSing FatMelt integrates with the MixSing Vacuum high-shear system at the core of a fully automated recombination line. Controlled by a Siemens PLC and recipe-driven HMI, the line delivers smooth, air-free products with minimal operator input.

How It Works

1. Powder charging: Powder, sugar, and stabilisers are conveyed from silos to a vacuum hopper. The PLC meters each ingredient by load-cell weight and inducts it below the liquid surface, eliminating dust and clumping.
2. Liquid fat: Fat is pumped via a flowmeter into the supply line.
3. Flow diversion: A sanitary mix-proof valve block routes product through heating and circulation tanks, or to CIP, with every move logged for traceability. No manual plate swings or hose changes are required.
4. Heating: Product passes through a dedicated inline heat exchanger regulated by PID loops. The hot-water skid provides stable temperature with minimal product damage, and the circulation tanks are jacket-free, relying on insulation only.
5. CIP cycle: At batch end, the PLC executes a validated CIP cycle: Pre-rinse, alkaline wash, intermediate rinse, acid wash, and final rinse, all temperature and conductivity-verified. The system is ready for the next recipe without manual cleaning.

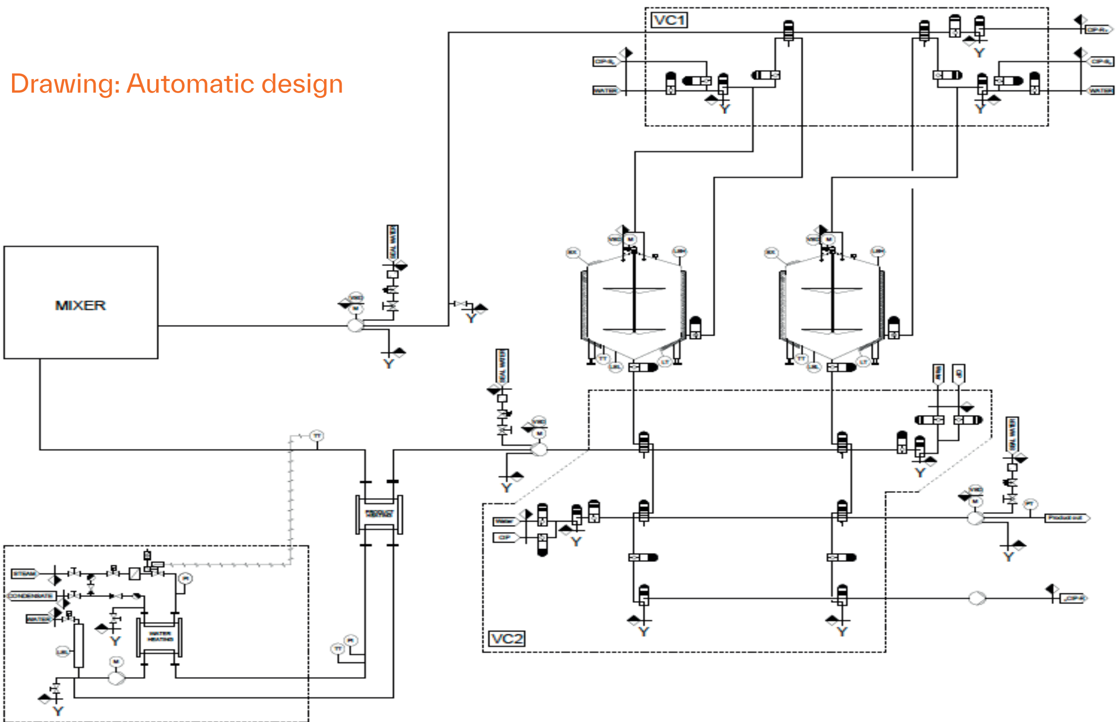
Why Choose MixSing Vacuum?

- Labour-lean operation: Operators can supervise multiple lines: Dosing, mixing, transfer, and cleaning on recipe schedules.
- Unmatched consistency: Automated ingredients-ratio control and high-shear dispersion give identical solids, viscosity, and fat-globule size in every batch.
- Full traceability: Time-stamped batch reports capture every valve position, temperature, and flow - ideal for audits and export compliance.
- Higher OEE: Rapid CIP and recipe change-over achieve high uptime, boosting daily output without extra tanks.
- Future-proof: Open-code software and remote connectivity enable fast support and seamless MES integration.

With MixSing FatMelt and MixSing Vacuum, TPS brings fully automated capability to recombined processing - delivering repeatable quality, lower labour costs, and real-time production insight.

Picture: Recombination in MixSing Vacuum

Drawing: Automatic design



Internal View of the MixSing Vacuum High-Shear Mixer

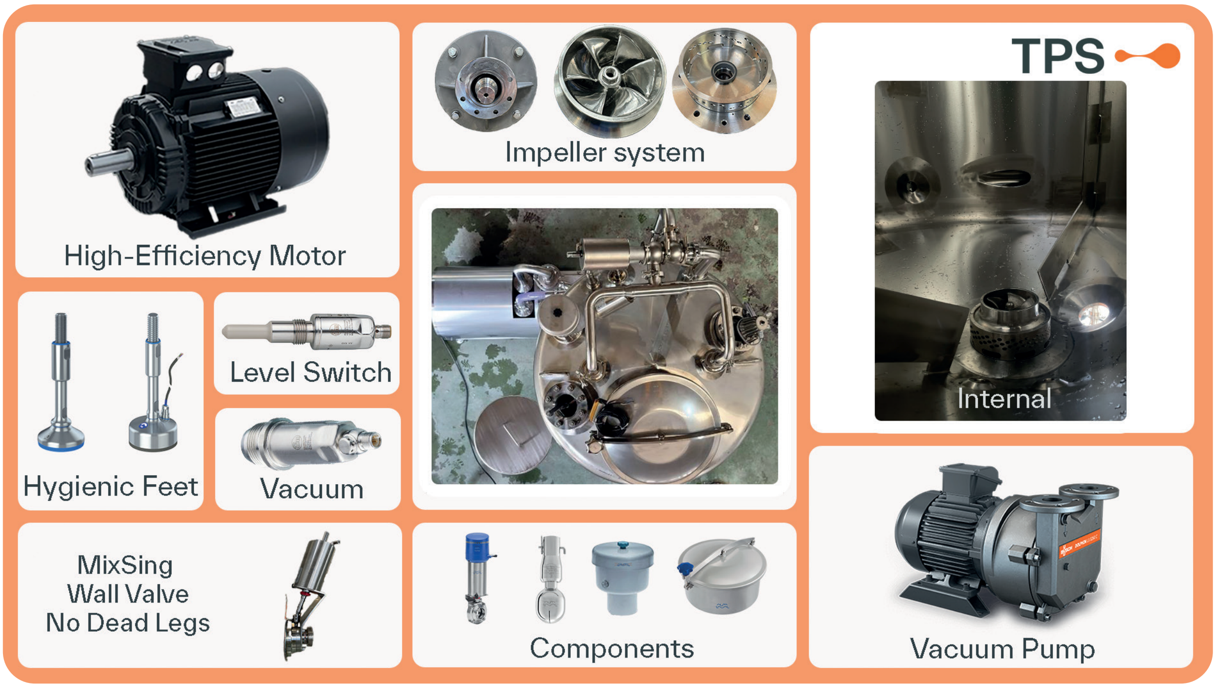
- MixSing Wall Valve: A specialised valve designed by TPS. It is built on the Alfa Laval sizing/parts structure, with moving parts integrated from an Alfa Laval valve. The design minimises dead legs in the valve integration and ensures proper drainage into the tank.
- Minor ingredients: A side-mounted MixSing Wall Valve allows for the addition of speciality ingredients, if required. If not needed, it can be removed from the design prior to manufacturing.
- Product outlet: A bottom-mounted MixSing Wall Valve enables complete emptying of the tank.
- Vortex breaker: Two stainless steel structures designed to break the vortex created by the bottom shear.
- Bottom shear: The impeller-stator high-shear unit, designed by TPS. The parts are cast and then CNC-machined to achieve a very narrow clearance between impeller and stator, significantly increasing shear rates.
- Tangential inlet: Allows for product recirculation over an external hydration tank.
- IFM instruments: Installed with sanitary welding parts.

The MixSing Vacuum High-Shear Mixer

is built using subcomponents from globally recognised OEM suppliers.

- Alfa Laval: SSV, butterfly valves, ThinkTop, SaniMidget, tank vents, and manways.
- Busch: Vacuum pump.
- Hoyer: High-efficiency motor with low vibration allowing for optimised clearance between impeller and stator.
- IFM: Instruments and sanitary weld-in parts.
- NGI: Hygienic tank feet and load cells.

All components are selected for their quality, durability, and global availability through supplier contact points.



TPS

The power of simplicity

Web
tps.ltd

Europe
Fugelhavevej 34
2750 Ballerup
Denmark

Rest of world
36 Robinson Rd
Singapore 068877
claus.siegaard@tps.ltd