

Vapormatt | Tiger

Overview, technical specifications
and options



Vapormatt

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Overview

The Tiger is our highly efficient linear format wet blasting, rinsing and drying system. It is suitable for the most sophisticated and demanding of high-capacity production environments and provides maximum levels of process control and consistency. It combines several process steps into one automated system to significantly boost throughput.

Key features include:

- Fully automatic in-line wet blasting, cleaning and drying system optimised for tooling applications
- Simple to use and highly intuitive colour HMI for rapid set-up and operation, and suitable for Industry 4.0 connectivity
- Up to 20 component pallets (or 40kg (88.2 lbs) max. load) can be stored in the auto-load unit
- Automatically loads, wet blasts, multi-stage spray rinses, ultrasonic washes, dries and unloads components
- Sophisticated process control and monitoring
- Recipe driven parameter setting and post-process reporting
- Different processes and up to 999 blast recipes can be developed, stored and used when required for different component batches
- Extremely consistent and reproducible processing within $\pm 5\mu\text{m}$ (0.2 thou)
- Components are held in industry standard pallets and transported through the Tiger by conveyor belts
- High quality stainless steel cabinet, made from corrosion resistant high-grade stainless steel, offering a watertight enclosure
- Fully self-contained unit suitable for location in quiet, controlled environments
- Vapormatt 4.0 enabled for remote and predictive/preventative maintenance tasks - maximising production up-time

Industries and applications

Thanks to the robust and highly efficient build of the Tiger and its incredibly consistent reproducible processing, it is well suited for providing a range of applications to cutting tool inserts.

Industries

- Cutting tools

Applications

- Edge honing $70\mu\text{m}$ (2.8 thou) $\pm 10\%$ or $\pm 5\mu\text{m}$ (0.2 thou) whichever is larger*
- Surface cleaning/skin removal to enhance coating adhesion
- Polishing, pre and post coating
- Selective coating removal
- Peening for coating internal stress profile enhancement
- Suitable for replaceable inserts of varying 3D geometries
- Remove burrs without dimensional change

* This is dependent on:

1. Using Vapormatt gun crowns.
2. Pre-process inserts need to be of the following minimum standard:
 - a. No chips on cutting edges
 - b. Cutting edge radii tolerance $\pm 5\mu\text{m}$ (0.2 thou) of the average and at least $10\mu\text{m}$ (0.4 thou) below the required final radius.
Ideally pre-process radii to be $<8\mu\text{m}$ (0.3 thou)
 - c. Hardness to be uniform

Processing description

The Vapormatt Tiger successfully combines several process steps into one automated unit. The Tiger automatically loads, wet blasts, rinses, dries and unloads components. Each of the process steps can be varied so a series of recipes can be developed, stored and used at will so that different effects can be applied to component batches according to requirements.

Components are held in industry standard style pallets. These are transported by conveyor belts through the complete process cycle. Up to 20 (or 40kg (88.2lbs) max. load) component pallets can be stored in the auto-load unit to allow for unattended operation. Component pallets suitable for indexable inserts, or shank tools can be accommodated.

The machine can be specified with two semi-independent blast heads. Each blast crown can be fitted with an array of blast nozzles in either Vapormatt standard or customer specific arrangements.

The CNC blast nozzle arrays move together in the Y direction whilst the parts are moved in the X direction (inserts). The combination of these controlled movements ensures consistent processing of all components according to the part program selected. The nozzle height and angle on each of the blast heads can also be independently set to add further diversity to the available process effects.

After blasting, the parts enter the washing section where there is an option to spray wash them with detergent, spray rinsed with clean water, ultrasonically cleaned, spray rinsed with de-ionised water, and then dried. Water process temperatures, detergent levels, water quality in each of the rinses, ultrasonic action, and drying parameters are all carefully monitored and controlled via the main HMI control panel. The HMI allows the process to be paused at any time, the doors to be opened to allow operator intervention then the process can be restarted at the point where it was stopped.

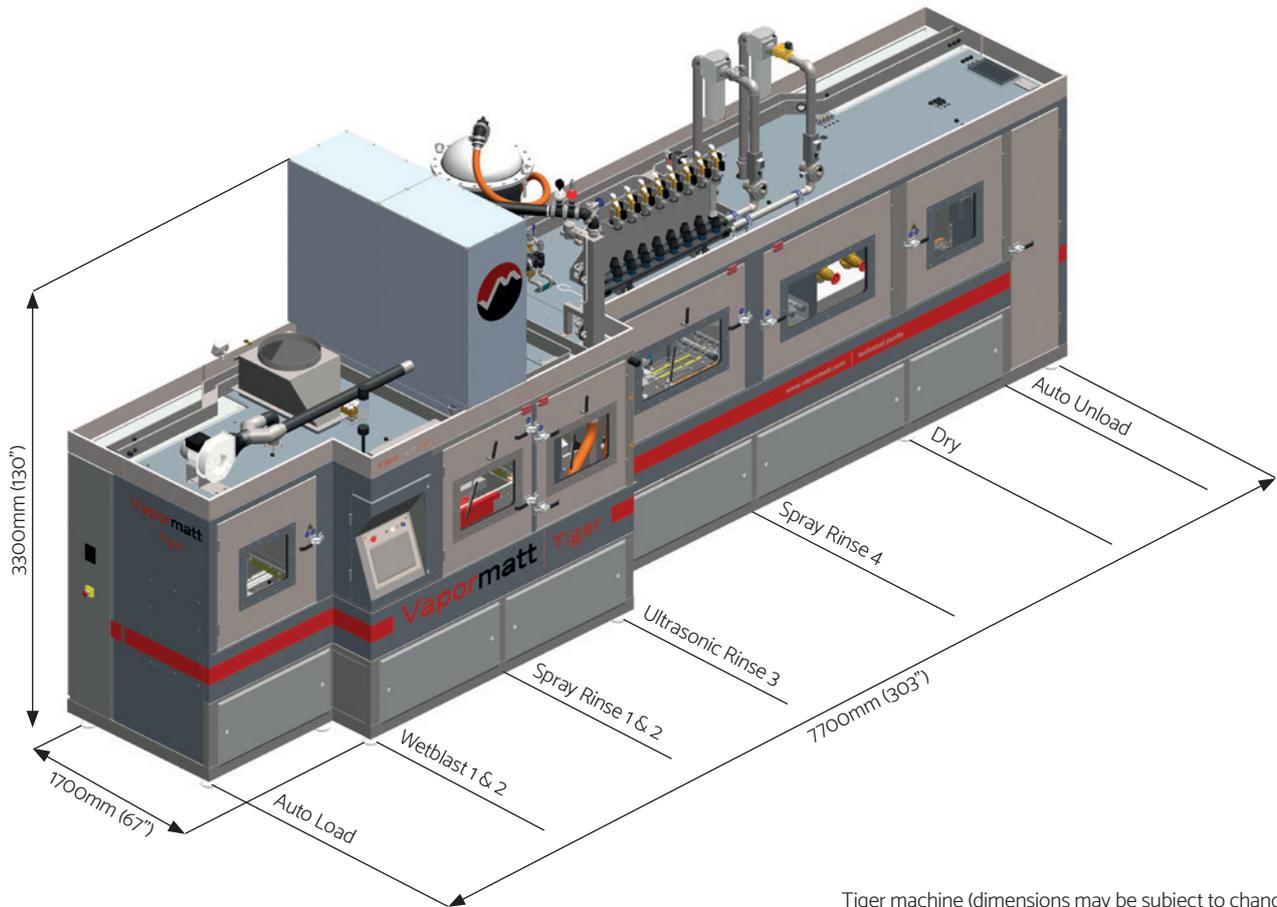
The dimensional and temporal proximity of the washing and drying stages to the wet blasting stage ensures consistent end surface quality (coating performance) as opportunities for inter-stage corrosion are limited and controlled. During the drying stage, the air is blown from below to "lift" the inserts out of the pockets/pins. This allows the drying air from above to flow around the whole insert leaving no surface wet or any staining from the pallet underneath the inserts.

Following processing, the parts are transported and stored in an enclosed unload magazine where they are protected from moisture and other forms of recontamination.

All services and support systems are enclosed behind doors within the main stainless steel machine enclosure. All process tanks and pipe work have secondary containment to avoid spillages in the event of failure. Connecting the machine to a factory extraction system provides ventilation to the entire machine and ensures the appropriate airflow within the equipment to avoid general atmospheric and component recontamination after processing.

Operational noise levels can be specified down to 75 dBA.

Patents and new patent applications cover several of the unique features of the Vapormatt Tiger automatic machine.



Tiger machine (dimensions may be subject to change)

Operations and process stages

	Stage	Media	Heating	Chemical dosing	Water purity (µS/cm)	Purpose
1	Wet blast	Blast media, water and pressurised air	○	✓		Micro/Macro blasting
2	Wet blast	Blast media, water and pressurised air	○	✓		Micro/Macro blasting
3	Rinse 1 (pre-rinse)	Filtered slurry and cyclone rinse	○	✓		Removal of most abrasive from inserts
4	Rinse 2 (drag rinse)	Clean water	○	✗	~20	Removal of abrasive from inserts
5	Ultrasonic dunk (optional)	Clean water	○	✗	~20	Deep cleaning of inserts and dislodgement of loose material
6	Final rinse	DI water	○	✗	~10	Polish rinse
7	Dry	Hot air	✓			Fast drying to avoid staining, corrosion or cobalt leaching

○ = dependent on recipe settings

Levels of automation

All levels of automation of the Tiger machine can be completed by either RFID readers/barcode scanners to enable the automatic loading of recipes and monitoring throughout the process line.

Infeed and outfeed conveyor system

The infeed conveyor is a roller conveyor, which loads pallets to the process conveyor via an integrated transfer table.

The outfeed conveyor is also a roller conveyor, which includes an integrated transfer table fed by the rinse-dry conveyor and returns the pallets toward the load end.

The infeed and outfeed conveyors can be linked with a linear roller conveyor making the system continuous. In this configuration, it incorporates a draw bridge to access the front of the Tiger machine.

Gantry Robot for pallet transfer

To integrate the Tiger machine in a fully automated production line, pallets can be transferred from another unit to a load magazine or conversely out of the unload magazine to the next production cell by a gantry robot and through roof hatches positioned above the load/unload zones.

The gantry robot is sized to cope with all transfers such that the system output rate is a minimum of 16 pallets per hour after the first pallet is completed (one pallet every 3 minutes 45 seconds).

Flipping unit

Pallets that need both sides processing can be identified in the Tiger machine unload magazines, collected, flipped over and replaced in the load magazine. Pallets that have been fully processed are transferred to the system outfeed magazine.

The system is sized to cope with all transfers and flipping such that the system output rate is a minimum of 16 pallets per hour after the first pallet is completed (one pallet every 3 minutes 45 seconds).

Load infeed magazine and unload outfeed magazine

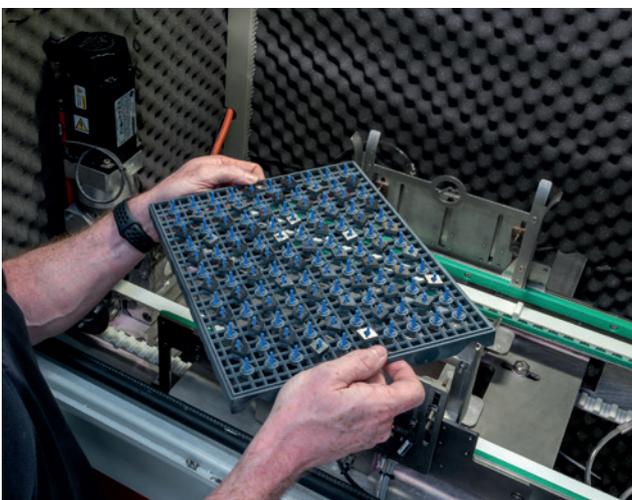
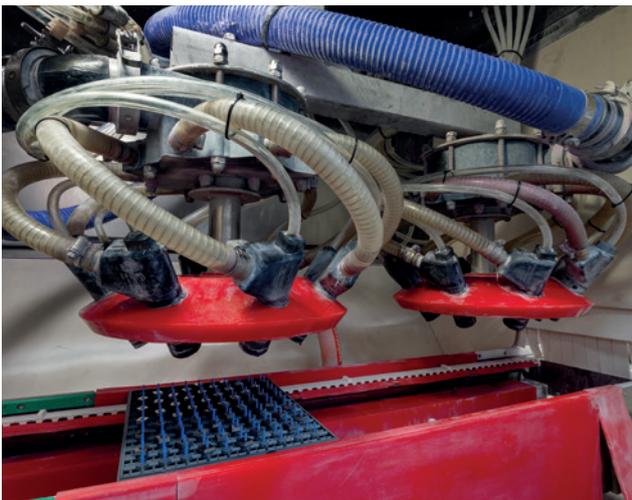
The load section allows loading from carts. Pallets will be individually lifted off the top of the incoming stack and dropped on the process conveyors with a pick-and-place unit, one pallet at a time.

The infeed magazine holds up to 30 pallets of inserts. It is used as a waiting bay to hold incoming pallets.

The unload section also allows unloading to carts where pallets are individually lifted off the top of two separate outgoing stacks. They are transferred to the outfeed magazines using a pick-and-place unit similar to the one in the load zone.

The outfeed magazine holds up to 30 pallets and the operator can pick the pallets directly from a completed stack.

Both cart docking stations are sub-mounted to extensions of the Tiger machines base frame and would accept AGV.



Technical specification

The following features are included within the machine's basic specification.

Feature	Description
1	<p>Design sizes*</p> <p>Installed dimensions: 7700 x 1720 x 3300 mm (303 x 68 x 130")</p> <p>Minimum installation space: 9300 x 3500 x 3500 mm high (366 x 138" x 138")</p> <p>*Dimensions may be subject to change.</p>
2	<p>Construction</p> <p>Stainless steel blast cabinet; painted in Vapormatt corporate colour scheme.</p> <p>Internally, the blast cabinet will be lined with abrasive-resistant curtains where necessary.</p> <p>There will be solid polyurethane abrasive resistant mats to protect the exposed sump surfaces. Maintenance access doors are provided at the front and rear of the blast cabinet.</p> <p>These have a double-glazed viewing window/wash bar/ manually operated wiper where necessary to allow observation of the equipment when in use.</p> <p>There are manually operated rinse nozzles located at the front and rear for wash-down/maintenance.</p>
3	<p>Component, pallet design and mesh covers</p> <p>Processes Wendt size pallets 296 x 246mm (12" x 10"), or Manz size pallets 383 x 281.3mm (15" x 11") with the maximum suitable pallet dimensions being 383mm x 296mm (15" x 12"). Mesh covers or specially designed pallets may be required in certain circumstances when the blast slurry blows some small carbide tool inserts out of the pallet in order to maximise retention.</p>
4	<p>Blast gun crowns</p> <p>The machine is provided with 16 x Mk3 Vapormatt blast guns made from solid polyurethane fitted with special, high-consistency boron carbide nozzles.</p> <p>Any of the standard Vapormatt 8-gun crowns (60°, 55°, 45°, 80° or manually adjustable 45°/80°) can be accommodated, having 2 separately controlled gun crowns allows pallets to be sequentially processed with two different blasting process recipes.</p>
5	<p>Blasting media</p> <p>Works with aluminium oxide from FEPA 60 to FEPA 320 mesh.</p> <p>Note: Changes to media specification will require changes to certain system components which may incur additional costs.</p>
6	<p>Conveyor system</p> <p>Polyurethane belt conveyors are provided and run through the load, blast, rinse, dry and unload sections of the machine.</p> <p>The conveyor guide system has sacrificial wear sections in the blast area. When using aggressive process recipes/media, these sacrificial shields will need to be frequently changed.</p> <p>The conveyors are driven by servo drives and inverter drives.</p>

7	<p>Slurry system</p> <p>The slurry system incorporates 2 Vapormatt 50mm (2") 5.5kW vortex pumps (for a combined power of 11kW).</p> <p>The main slurry pump is fitted with a slurry pressure monitoring system with feedback to the pump motor which automatically alters pump pressure to facilitate recipe creation and to compensate for wear in conduits and nozzles.</p> <p>The slurry is pumped through a series of abrasion resistant hoses and solid polyurethane components from the unique Vapormatt slurry pipework system.</p>
8	<p>CNC servo drive gantry robot</p> <p>The blast gun gantry robot has a Y horizontal axis. The gantry robot is powered by servo motor drives for better positioning and accuracy of blasting. Y axis has a 700mm (27.5") stroke, max speed of 200mm/s (7.9ips) and an accuracy of better than +/- 0.5mm (19.7 thou).</p>
9	<p>Sump magnet</p> <p>A large removable magnet collects stray inserts.</p>
10	<p>Media conditioning system</p> <p>The machine is fitted with a continuous abrasive filtration system. Particles of broken-down abrasive are continually removed from the slurry circulation and collected in settling tanks at the rear of the machine.</p>
11	<p>Control system</p> <p>The HMI offers several levels of password-protected logins for process recipes to be stored. All on-screen instructions will be in English, units will be metrics. All on-screen instructions will be in English, units will be metrics.</p>
12	<p>Status beacon</p> <p>The machine is provided with an ANDON programmable status beacon to allow the progress of production / process of the unattended machine to be monitored at a distance from the unit itself.</p>
13	<p>Preventative maintenance</p> <p>The control system monitors the usage of key components such as blast guns, hoses, valves and pumps. Reminders are set to warn when maintenance is due.</p> <p>These are in addition to alarms that warn of specific faults or when monitored blasting parameters are out of tolerance.</p>
14	<p>Drain</p> <p>Excess water is directed to a reservoir. When the reservoir is full a diaphragm pump pumps the waste to the customer's drain.</p>
15	<p>Cabinet exhaust system</p> <p>The machine needs to be connected to an in-house forced extraction system to maintain a slight negative pressure within the cabinet when operating.</p> <p>A vacuum sensor will be fitted to provide a warning should the customer's extraction system fail.</p>

Optional items

The following features can be added to the machine's basic specification.

Feature	Cabinet enhancement
1	Translation of manuals, HMI screen and labels in non-English.
2	Roof hatches for robot loading Provision of opening hatches above the load and unload station to facilitate the integration of the handling system for loading and unloading of pallets.
3	Safety railing This can be fitted around the roof if required by local safety regulations for servicing roof-mounted equipment.
Feature	Slurry system enhancement
4	Sump immersion heater Is used to maintain a consistent sump water temperature. Elevated temperatures can allow chemicals to work more effectively and can promote faster drying of inserts.
5	Slurry concentration sensor Watchdog guards are provided to inhibit machine start and prevent blast processing should slurry concentration levels drift outside of predetermined control limits. A slurry concentration measuring unit is provided to measure concentration. Information from this unit is fed to the PLC, which in turn triggers the addition of new abrasive to the blast sump.
6	Automatic abrasive dosing system The automatic media feed compensates for the broken-down media removed by the separation system.
7	Chemical concentration control (sensor) An electronic sensor is provided to monitor Vacukleen™ concentration within the sump.
8	Automatic chemical dosing To maintain consistent chemical concentration within the blast process area; the chemical is fed directly from the storage barrel.
Feature	Filtration and re-circulation
9	Elutriation tower This patented slurry conditioning system offers a more consistent blast slurry quality which allows for more reliable and repeatable processing. Particles of broken-down abrasive and debris finer than the selected size are continually removed from the slurry circulation. *This option is recommended when the machine is used for edge honing.
10	Ultrasonic cleaning tank The lowering mechanism (dunk) can also vertically oscillate the pallets for improved cleaning action.
11	Rinse tank immersion heater (2 tanks) Are used to maintain a consistent rinse water temperature. Elevated temperatures can allow chemicals to work more effectively and can promote faster drying of inserts.
12	DI water generation unit If a DI supply is unavailable at the site, this option provides a filter and regeneration unit to purify the water supply to the required standard. The input water can either be from a mains water supply or water recirculated from the final rinse tank (this reduces overall water usage).

13	Industrial wet and dry vacuum cleaner This air-powered vacuum cleaner allows easy emptying of sediment filter tanks and other areas of the machine during cleaning and maintenance.
14	Wet and dry vacuum cleaner A small size vacuum cleaner for daily routine cleaning and maintenance.
Feature	Process functionality
15	Vertical gun head manipulator The vertical gun head manipulator adjusts Z axis blast range and has a 400 mm (16") stroke.
16	Manually adjustable gun crown A versatile gun crown that allows blast angles to be set at either 45° or 80°.
17	Mk 9 guns Vapormatt's latest blast guns are approximately 10% more efficient than the Mk3 blast guns.
Feature	Process monitoring
18	Blast airflow monitoring system Blast airflow sensors monitoring compressed air supply can be fitted to each bank of blast guns. If flow drifts outside pre-set limits, at any given pressure, on any blast gun bank due to air jet or hose failure, a signal appears on the HMI unit. This option can be extended to monitor airflow electronically on each gun. This is a particularly sensitive diagnostic that will immediately recognise the loss of harmony and/or inconsistent mixing of the 3 inputs (solid, liquid and gas) into the blast gun. Each gun is monitored with a rotameter gauge.
19	Blast airflow (electronic) monitoring per gun This option extends electronic airflow monitoring on each gun. The flow rate will be shown on the HMI screen and faulty guns will be individually alarmed.
20	MES Integration (excludes flights and accommodation) Manufacturing execution system between the Vapormatt wet blast machinery and the customer's network to allow data logging of machine status during the wet blasting process, for remote recipe handling and to allow backups of recipe and machine parameters.
21	Barcode scanner This enables the reading of data from any batch card for the automatic loading of recipes.
22	RFID readers and controller This enables the reading of each pallet of inserts and individual monitoring throughout the process line.
23	Process conveyor torque meter This will detect any pallet jamming in the process line and prevent the conveyor from moving forward and stops blasting.
24	Vapormatt 4.0 12 months access to Serval 4.0 IIoT data platform.

Services to be provided by the customer

The following services are required for the machine to be run correctly.

Service	Requirement
Electricity	Operating voltage; 400/480V 3 phase, 50Hz/60Hz load 47kW, (100A at 400V, 50Hz) Isolation switch is on the electrical cabinet.
Process air supply	Pressure 6 – 7 bar (90 – 100 psi) Max consumption 11.2 Nm ³ /min (400 SCFM) at 4 bar (58 psi) (higher blast pressures will require additional air) Connection 2 x Rp 2 (2" BSP) Air quality DIN ISO 8573-1: class 5.6.4 Isolation valve is provided.
Control air supply	Pressure 6 – 7 bar (90 – 100 psi) Max consumption 2.4 Nm ³ /min (85 SCFM); Connection Rp 1/2 (1/2" BSP) Quality DIN ISO 8573-1: class 4 Isolation valve is provided.
Water supply	For machine fill and top-up Clean water pressure 2 – 7 bar (30 – 100 psi) Volume 13 L/min (3 gpm) intermittent flow Connection Rp 1/2 (1/2" BSP) Drinking quality required Isolation valve is provided.
High-purity water supply	For first rinse, ultrasonic bath and final rinsing Pressure 2 – 7 bar (30 – 100 psi) Volume; 13 L/min (3 gpm) intermittent flow; connection; Rp 1/2 (1/2" BSP) Quality conductivity <4µS/cm Isolation valve is provided.
Drain	The diaphragm pump has a maximum flow of 125 L/min (33 gpm) within 10m (33') of the machine (drain pump can pump to a head of 3m (10')). The drain must incorporate a grit trap.
Vent or extraction	3500 m ³ /hour (2060 CFM) 62 Pa (1/4" W.G.) minimum vacuum level Ø400mm (16") connection at roof level.
Foundations	A waterproof flat and level floor is required to take a point load of 500 kg (1100 lbs) Machine weight (empty) = 4700 (17650 lbs) Total machine weight (with water and abrasive but no components) = 5650 kg (20950 lbs) The weight is approximate and will be confirmed at shipping time.
Networking	The machine runs on a closed Ethernet network, and connection to the internet is required prior to commissioning to allow program changes and machine diagnosis to be carried out. Vapormatt uses a dedicated platform for its remote access services, with connection methods being cellular, Wi-Fi and Ethernet. The machine is fitted with Vapormatt's preferred platform provider as standard.

Dedicated project management and the Vapormatt Promise

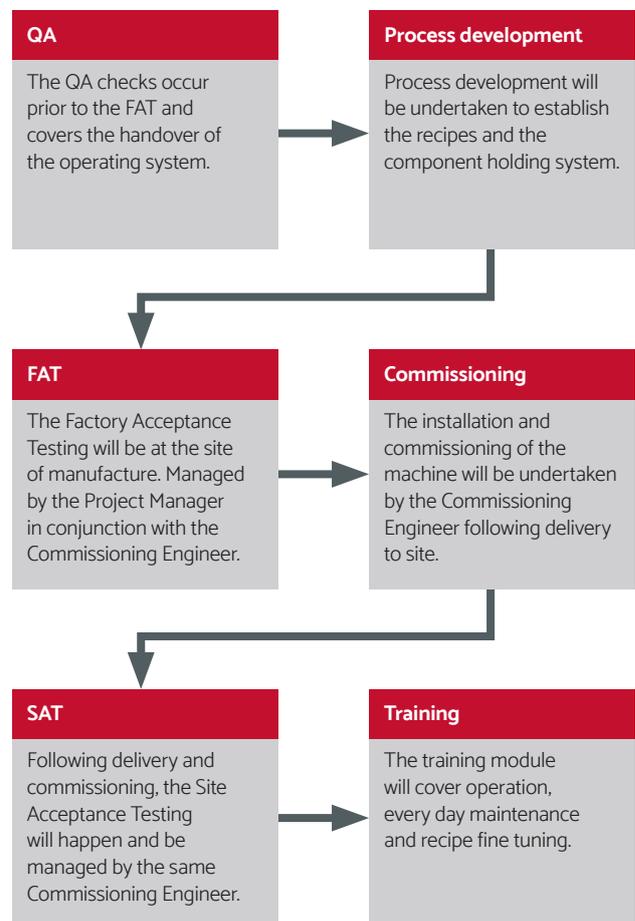
We always ensure our machines operate to the specification agreed with the customer, that's the Vapormatt Promise.

To achieve this every customer is assigned a dedicated project leader from order to installation.

Project management includes our detailed technical acceptance process, see below, a key part of which is our factory acceptance testing (FAT). This is where the customer's wet blasting system is extensively tested, often with the actual components the customer will be regularly processing, before it leaves us.

Vapormatt support doesn't end there, our aftermarket support includes spares, servicing and Vapormatt 4.0, our Industry 4.0 solution, to ensure maximum production up-time.

Technical acceptance process





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