Vapormatt | Sabre

Overview, technical specifications and options

Vapormatt

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Overview

The Vapormatt Sabre is our highly flexible and efficient edge preparation, surface conditioning and cleaning system made for a range of processing. It can be supplied in three versions for cutting inserts, aerospace components or for both inserts and round shank tools in a "hybrid" system that incorporates both blast heads.

Key features include:

- High quality stainless steel blast cabinet sits within an additional cabinet that houses the filtration, pumps, abrasive hopper, drain pump and large maintenance door for easy access
- The ultimate, automatic wet blasting system for pre-treatment, post treatment and edge honing
- This system can produce controlled, consistent edge hones up to 70 µm (2.75 thou) for inserts(+/- 10% or +/- 5 µm (0.2 thou) whichever is the larger) and hone radii of up to 30 µm (1.18 thou) +/- 3µm (0.12 thou) for round shank tools*
- Component surfaces are well prepared for subsequent PVD and CVD coating processes, typically leading to HF-1 adhesion levels according to the Rockwell-based coating adherence standard
- The configurable door provides easy access to the turntable for ease of loading and unloading
- Multiple different processes and blast recipes can be developed, stored and used when required for different component batches
- For jet engine and turbine components, the turntable can hold a maximum load of 100kg (220lb) with a maximum ø800mm (31.5") and maximum height of 360mm (14")
- Efficient rinse stage removes a majority of the process media prior to a separate drying stage
- Simple to use and highly intuitive colour HMI for rapid set-up and operation
- Recipe driven parameter setting and post process reporting for very accurate control which yields continuous monitoring and feedback for the more accurate processing
- Fully self-contained unit suitable for location in quiet, controlled environments
- Vapormatt 4.0 enabled for remote diagnostics - maximising production up-time

Industries and applications

Thanks to the versatility in application configuration, the Sabre offers sophisticated process control and monitoring that yields extremely consistent and reproducible processing results across a number of industries.

Industries

- Cutting tool inserts
- Round shank tools
- Jet engine components

Applications

- Deburring
- Edge preparation
- Surface improvement after casting
- Wet blasting of turbine components
- Surface activation for PVD/CVD coatings

* By adjusting angles and pressures a range of edge hones and shapes can be achieved to within +/-5 micron (0.2 thou) of specification. Aerospace components can be loaded on the turntable using jigs and/or component mats as necessary.

Processing description

The Vapormatt Sabre system brings the ultimate edge preparation, surface conditioning and cleaning technologies to 3 specific user groups. Designed to give better control to research and development facilities as well as manufacturers with medium to high volume production, the "hybrid" design accepts both round shank tools (drills, end mills, hobs, etc.) and cutting inserts. Taking Vapormatt's established monitoring and control technology, the Sabre offers high process control in an extremely compact footprint.

The use of servo motors allows for fast and highly accurate positioning with turntable speeds of up to 40 rpm. With the rinse stage as standard, the majority of the process media is removed, leaving the parts clean. Chemical additives in the process water can be automatically monitored and controlled to limit cobalt leaching and prevent oxidisation.

Constructed from stainless steel, the Sabre provides a robust, non-corrosive and quiet structure (80dBA) for the sophisticated processing controls. Using the integrated HMI screen to develop recipes, programming becomes easy and transferring between Vapormatt systems effortless. With watchdog monitoring, the Sabre becomes self-reliant with ensuring consistent results with minimal supervision.

With its main turntable, up to 4 insert pallets can be processed using the gun crown on the Y-axis. Additionally, 12 satellites allow round shank tools from 60 - 305mm (2.4 - 12") in length and ø 3 - 30mm (0.1 -1.18") to be processed by 2 targeted blast nozzles on the Y-Z axis.*

The Sabre's fully integrated software program allows for the control of; soap and abrasive concentrations, to slurry and air pressures as well as axis speed and positions to thermal controls. All these variables are displayed on trend screens which provide reliable feedback and, with the inbuilt password protection, accountability.

Cutting inserts

After the operator places up to 4 Wendt or up to 3 Manz pallets of inserts onto the turntable and closes the door, a recipe is selected from the HMI unit.

The rotating table indexes to present the first pallet to the gun crown blast stream. Interpolation of 1 circular and 2 horizontal CNC servo axis allows linear processing of plastic pallets in addition to circular band motion according to recipe. The raster scan effect can replicate more accurate X-Y processing on a round table.

The machine is designed to process one side of inserts contained in the pallets at a rate of one pallet every 2 to 30 minutes (dependent on insert size, process type, and abrasive).

Jet engine and turbine components

After the operator manually loads the components onto the turntable using jigs and/or component mats as necessary closes the machine door, a recipe is selected from the HMI unit.

The component holding turntable is servo controlled and during normal operation this unit automatically processes components mounted on the turntable. The rotating table indexes to present the first pallet to the gun crown blast stream.

The Vapormatt Sabre has up to-5 axes of movement between the blast gun and the component. The blast gun is mounted on linear vertical (Z) and horizontal (Y) axes and optional rotary vertical (wrist, A) and rotary horizontal (twist, C) axes.

Like the process of cutting inserts, interpolation of 1 circular and 2 horizontal CNC servo axis allows linear processing of plastic pallets in addition to circular band motion according to recipe.

At the end of the blasting cycle, rinsing is carried out to remove the abrasive from the components, returning removed abrasive to blast sump.

Round shank tools

After the operator places up to 12 round shank tools into individual holders and closes the machine door, a recipe is selected from the HMI unit.

The rotating table indexes to present the first tool to the vertically mounted blast guns. The tool rotates as the guns traverse up and down to give full coverage to the area to be processed. The table then indexes to the next tool; the process is repeated until all 12 tools are processed.

Process speeds for round shank tools are very dependent on the material hardness however some indicative rates for edge honing on both lute and cutting edge using APA 320 are 10mm/sec (0.39 ips) for 10µm (0.39 thou) radius and 2mm/sec (0.08 ips) for 15µm (0.59 thou) radius.

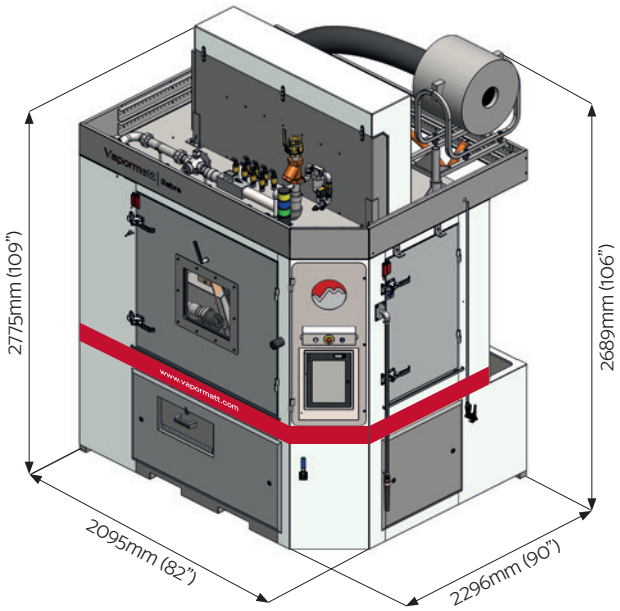
The process for any of the machine con igurations can be paused at any time, and the doors opened to allow operator intervention and then be restarted at the point where it was stopped.

Follow on stages after Sabre processing

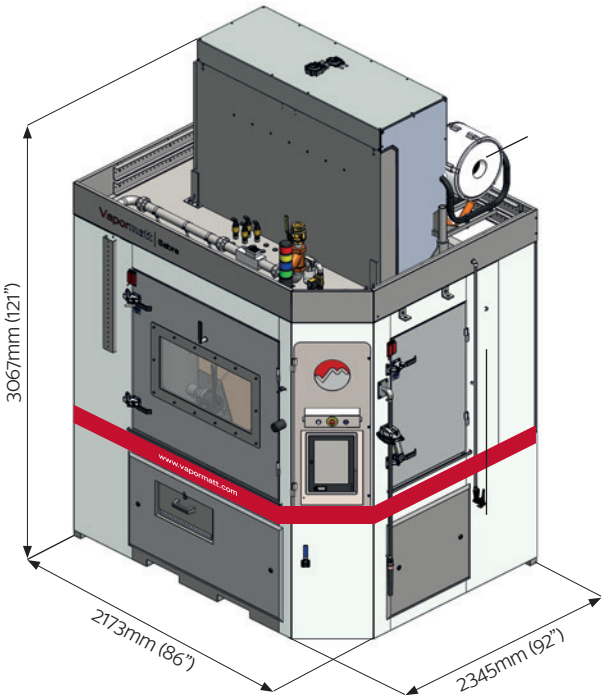
Following any of these processes, it will be necessary to carry out an additional rinse and drying operations in a separate washing and drying machine.

A full preventative maintenance programme is incorporated for all key components and service operations including slurry valve condition monitoring.

With several Vapormatt patented features such as continuous media classification by elutriation and slurry distribution using manifolds, the Sabre is a truly robust and controllable wet blasting system. With its customisable options and proven technologies, the Sabre offers greater edge and face preparation to a wide range of users.



Sabre configuration for cutting tools and inserts



Sabre configuration for jet engine and turbine components

Process stages and operation

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

	Stage	Heating	Chemical dosing	Purpose
1	Wet blast 1	O	✓	Micro/Macro blasting
2	Rinse	O	✓	Removal of most abrasive from inserts

O = dependent on options specified.

Please note:

- It will be necessary to carry out additional rinse and drying operations in a separate washing and drying machine.
- Process times are dependent on component size, process type, abrasive size and number of blast guns chosen to operate within the recipe (Times are non-contractual until confirmed by tests at Vapormatt R&D department)

* This is dependent on: Using appropriate Vapormatt gun crowns (some quoted options will be mandatory).

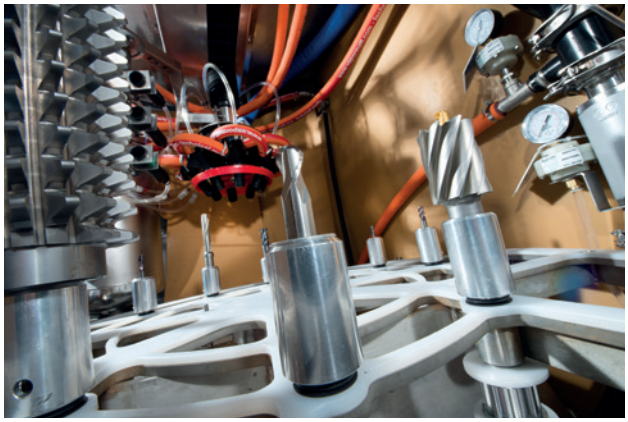
Pre-process inserts/tools need to be of the following minimum standard:

- No chips on cutting edges.
- Cutting edge radii tolerance +/- 5µm (0.2 thou) of the average and at least 10µm (0.4 thou) below the required final radius. Ideally pre-process radii to be < 8µm (0.31 thou) for inserts.
- Cutting edge radii tolerance +/- 2µm (0.08 thou) of the average and at least 5µm (0.2 thou) below the required final radius. Ideally pre-process radii to be <4µm (0.16 thou) for round shank tools.
- Hardness to be uniform.

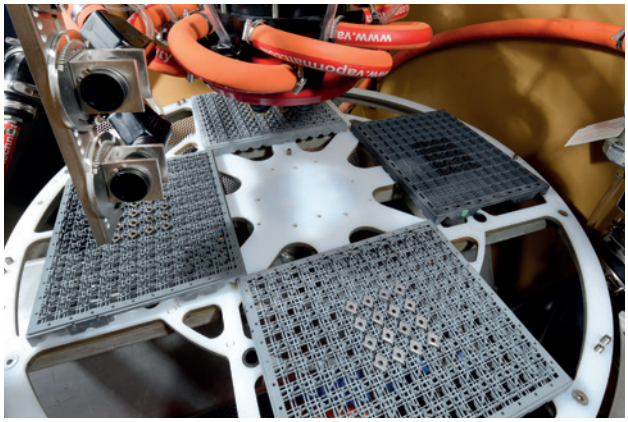
Technical specification

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

Feature	Description	Cutting inserts	Aerospace	Hybrid
1A	**Component pallets** The unit will be configured to operate with standard Wendt 246 x 296mm (10 x 12") or Manz 281 x 383mm (11 x 15") range style which are suitable for the majority of medium and large inserts. (Mesh covers may be required.)	●		●
1B	**Round shank tool holders** For round shank tools, the Sabre machine is fitted with 12 evenly space and automatically clamping satellites. These air controlled fixtures allow the operator to quickly change from large to small diameter tools.			●
2	**Blast cabinet** Constructed from welded stainless steel with abrasion-resistant lining. Large maintenance access doors are provided at the side and rear of the blast cabinet. The main blast enclosure door has a viewing window and a wash bar and manually operated wiper to allow observation of the equipment when in use.	●	●	●
3A	**Oscillation system** A horizontal oscillation system is mounted externally on the roof of the cabinet to prevent media and water encroachment into critical bearing areas.	●	●	
3B	**Oscillation system with Z axis adjustment** Allows blast gun height to be set as part of each recipe parameter. The vertical gun head manipulator has a 360mm (14") stroke.			●
4	**Component processing turntable** Made from cast aluminium, the 900mm (35") diameter turntable has a maximum balance load of 100kg (220lb) and can be programmed at speeds between 0 and 40 rpm and position accuracy of +/- 0.5°.	●	●	●
5	**Abrasive slurry system** Two Vapormatt vortex high efficiency abrasive pumps are provided. All pumping elements are made from solid polyurethane which gives exceptional abrasion-resistance. Pump one, a 50mm (2") 5.5kW pump, feeds the process nozzles and abrasive filtration. Pump two, a 25mm (1") 2.2kW pump, feeds the agitation system. Provisions of separate pumps for process slurry agitation / filtration and process gun feed facilitates a high level of control over the process slurry pressure and flow and hence improves control and repeatability.	●	●	●
6A	**8 Vapormatt blast guns** Each blast gun is made from solid polyurethane and incorporate standard high consistency long life 10 or 12mm (0.39 or 0.47") boron carbide nozzles, recessed air jets and air supply non-return valves. The blast guns are mounted to a configurable gun crown (80°, 60°, 55°, 45° and manually adjustable 45°/80°).	●		



Feature	Description	Cutting inserts	Aerospace	Hybrid
6B	**4 Vapormatt blast guns** Pinch valves enable fine features to be blasted by 1 nozzle instead of all 4. Position of nozzles shall be programmable allowing the distance between the nozzles and the blasting surface to be between 25 – 200mm (0.98 – 7.87"). Angle of nozzles shall be programmable allowing the angle between the nozzles and blasting surface to be between 0° – 60°. Nozzle movement shall be programmable.		●	
6C	**10 Vapormatt blast guns** Fitted into a Vapormatt standard gun crown, 8 for insert processing and 2 on a gun arm for round shank tool processing.			●
7	**Air pressure sensor and Tee mounted gauge** Provides information on the stability of the blasting process.	●	●	●
8	**Abrasive slurry conditioning** This continuous abrasive filtration system facilitates accurate and controlled media size which is essential for long-term consistent blasting performance. Particles of broken down abrasive and debris finer than the selected size are continually removed from the slurry circulation and collected in settling tanks at the rear of the machine. To compensate for lost abrasive due to breakdown, media level will need to be checked and replenished (Abrasive could be replenished by means of our Automatic abrasive dosing system – see optional items). The settling tanks are designed to allow their contents to be easily removed.	●	●	●
9	**Component washing** A set of pre-rinse nozzles remove the majority of abrasive as well as preventing abrasive leaving the blast cabinet.	●	●	●
10	**Electrical control system** The machine is provided with a sophisticated control system accessed via an Allen-Bradley HMI unit. All on-screen instructions will be in English. Units will be metric. Electrical equipment is mounted in an IP56 enclosure.	●	●	●
11	**Preventative maintenance** The control system monitors usage of key components such as blast guns, hoses, valves and pumps. Reminders are set to warn when maintenance is due.	●	●	●
12	**Drain** Excess water is directed to a reservoir. When the reservoir is full a diaphragm pump pumps the waste to the customer's drain.	●	●	●
13	**Cabinet exhaust system** The machine needs to be connected to an in-house forced extraction system to maintain a slight negative pressure within the cabinet when operating.	●	●	●



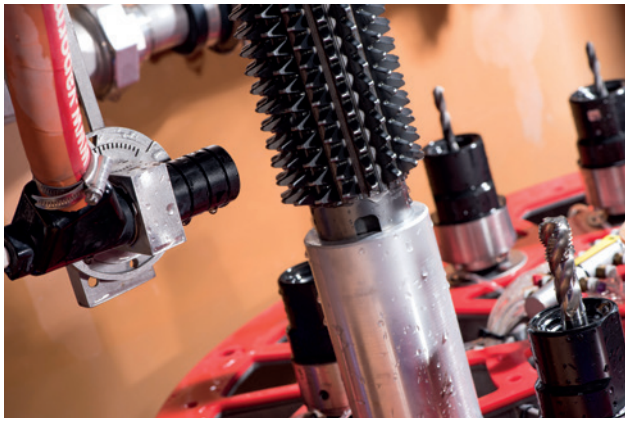
Optional items

The following features can be added on to the machines basic specification.

Feature	Cabinet enhancement	Cutting inserts	Aerospace	Hybrid
1	**Translation of operation manual, HMI screen and labels in non-English**	●	●	●
2	**Vertical sliding door** To allow automatic loading/unloading of the machine.	●	●	●
3	**Programmable ANDON status beacon** Allows the progress of production / process of unattended machine to be monitored at a distance from the unit itself.	●	●	●

Feature	Loading and component handling	Cutting inserts	Aerospace	Hybrid
4	**Component polyurethane holding mats**		●	
5	**Component fixtures and masking blocks** Polyurethane fixtures and masking blocks that can be used for components that don't require complete wet blasting.		●	
6	**Pallet manipulator** For improved processing with gun crowns with steep blast angles, or when guns don't focus on one point, a pallet will be mounted on a single satellite to keep it parallel with the oscillation axis, to obtain even processing.	●		●

Feature	Slurry system enhancement	Cutting inserts	Aerospace	Hybrid
7	**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.	●	●	●
8	**Automatic abrasive dosing system** The automatic media feed compensates for the broken-down media removed by the separation system. Avoiding the need for the operator to manually add abrasive on demand.	●	●	●
9	**Auto concentration measurement and dosing of Vacukleen** An electronic sensor is provided to monitor Vacukleen concentration within the sump.	●	●	●
10	**Automatic chemical dosing system**	●	●	●
11	**Sump immersion heater** Maintains consistent sump water temperature that can promote faster drying of components and improve performance of any added chemicals.	●	●	●



Feature	Filtration and re-circulation	Cutting inserts	Aerospace	Hybrid
12	**Sump magnet** A large removable magnet collects stray inserts.	●		●
13	**Elutriation tower** Upgrade options to utilise elutriation tower technology are available for use of media finer or equal to 280# and up to 320# or where a high level of abrasive consistency is required then an elutriation tower is fitted to obtain a high media size accuracy. Note: This option is required when the machine is used for edge honing.	●	●	●
14	**Slurry removal system for quick change of abrasive** This secondary tank is connected to the machine and a "purge" valve can be selected to quickly pump the slurry within the machine through the buckets and tanks to quickly empty the system.	●	●	●
15	**Exhaust extractor** Forced centrifugal extraction unit to maintain a negative pressure within the machine. Exhaust needs ducting to the external atmosphere.	●	●	●
16	**Exhaust extractor and mist eliminator** Forced extraction unit to maintain a negative pressure within the machine. The filter unit removes mist and dust and allows exhaust to workshop atmosphere. Will include an additive dosing system.	●	●	●
17	**Wet and dry vacuum cleaner** Allows for easy emptying of sediment filter tanks and other areas of the machine during cleaning and maintenance.	●	●	●

Feature	Process functionality	Cutting inserts	Aerospace	Hybrid
18	**Vertical gun head manipulator** Automatically operated Z axis adjustment allows blast gun height to be set as part of each recipe parameter with a 360mm (14") stroke.	●	●	
19	**A and C axes** The blast gun gantry robot will have rotary vertical (wrist, A) and rotary horizontal axes (twist, C) axes, allowing the nozzles to maintain their blasting angle across varying geometries.		●	
20	**Manually adjustable gun crown** A versatile gun crown that allows blast angles to be set at either 45° or 80°.	●		●
21	**Mk 9 guns** These latest Vapormatt blast guns are approximately 10% more efficient than the Mk3 blast guns.	●	●	●

Feature	Process monitoring	Cutting inserts	Aerospace	Hybrid
22	**Manufacturing execution system (MES)** Allows for data logging of machine status during the wet blasting process.	●	●	●
23	**Barcode scanner** This enables the reading of data from any batch card for automatically loading of recipes.	●	●	●
24	**Blast air flow monitoring system** If flow drifts outside pre-set limits, at any given pressure, due to air jet or hose failure, a signal appears on the HMI unit.	●	●	●

Services to be provided by the customer

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

Service	Requirement
Electrical supply	Operating voltage; 400/480V 3 phase frequency; 50/60Hz Basic specification 10.2kW, 18A at 400V 50Hz Options may require extra. (e.g. immersion heater = + 4.5kW) The supply should be fitted with an RCCD.
Air supply	Pressure 6 - 7 bar (90 – 100 psi) Cutting inserts/Hybrid: Consumption 0.7 Nm^3/min (25 SCFM) per blast gun at 4 bar (60 psi) (max 5.6 Nm^3/min (200 SCFM) for 8 guns at 4 bar (60 psi)) + 0.5 Nm^3/min (18 SCFM) for pumps Aerospace: Consumption 1.15 Nm^3/min per blast gun at 5.5 bar (4.6 Nm^3/min for 4 guns) + 0.5 Nm^3/min for pumps (higher blast pressures will require additional air) Connection: DN40 (1 ½" BSP) Quality DIN ISO 8573-1: class 4
Town water supply	For machine fill, top-up and rinsing Pressure 2 - 7 bar (30 - 100 psi) Volume; 13 L/min (3 gpm) intermittent flow; Connection: DN15 (½" BSP) Drinking quality required
Drain	Excess water is pumped from the machine. The diaphragm pump has a maximum flow of 125 L/min (33 gpm) within 10m (33') of machine (drain pump can pump to a head of 3m (10')). The drain must incorporate a grit trap.
Extraction	Ø150 mm (5.9") connection 62 Pa (¼" W.G.) vacuum level Flow = compressed air input + 10%
Foundations	A waterproof flat and level floor is required to take a point load of 500kg (1102lbs) Machine weight (empty) = 1800kg (3970lb) Total machine weight (with water but no components) = 2300kg (5070lb) 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.

Technical acceptance process

QA

The QA checks occur prior to the FAT and covers the handover of the operating system.

Process development

Process development will be undertaken to establish the recipes and the component holding system.

FAT

The Factory Acceptance Testing will be at the site of manufacture. Managed by the Project Manager in conjunction with the Commissioning Engineer.

Commissioning

The installation and commissioning of the machine will be undertaken by the Commissioning Engineer following delivery to site.

SAT

Following delivery and commissioning, the Site Acceptance Testing will happen and be managed by the same Commissioning Engineer.

Training

The training module will cover operation, every day maintenance and recipe fine tuning.

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 opposite, 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.

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