Vapormatt

Wet blasting applications for aerospace manufacturers

Vapormatt | Aerospace

Vapormatt has a long-established heritage of supplying wet blasting solutions to the world's largest aerospace engine manufacturers.

Our association with the industry began with the invention of the first wet blasting machine, while exploring surface treatments with Sir Frank Whittle during the development of the jet engine.

To this day world leading aerospace engine manufacturers trust us and our well proven wet blasting technology for their finishing requirements, and wet blasting has numerous applications and benefits for a wide range of other aerospace components too.

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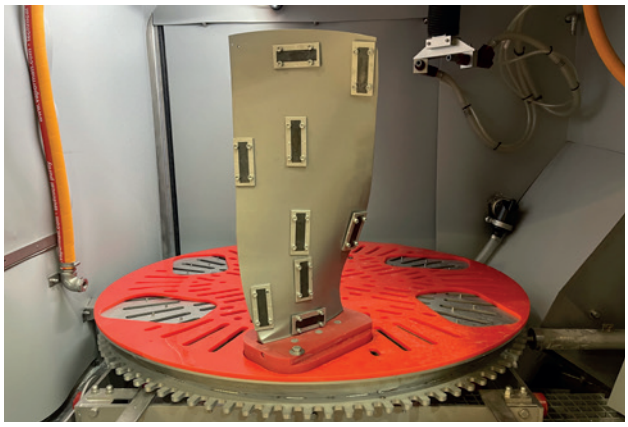
Wet shot peening fan and turbine blades, engine casings, and other components to the same intensity as dry shot peening

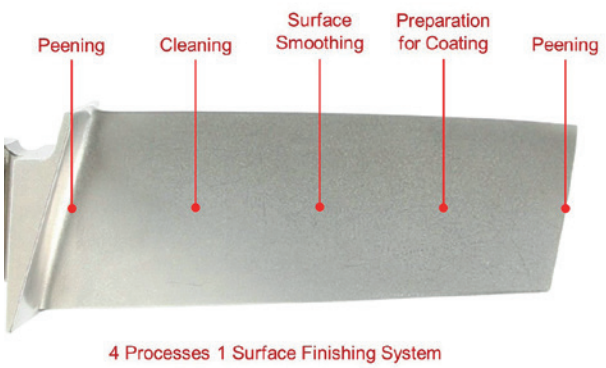


The lifespan of a turbine blade can be extended dramatically by wet shot peening – more than 1000%. The process involves projecting a mixture of water and small hard spherical media particles at turbine blades, fan blades, blisks, discs, driveshafts and any other engine components that need strengthening. It is a highly effective way to improve fatigue strength.

As well as peening to the same intensity as dry blasting, the flow of media over components ensures a smoother, more consistent, and higher quality finish compared with dry shot peening.

By bombarding the engine component with the peening blast media, the substrate is exposed to compressive stresses that improve strength by giving the grain structure a shallower depth with a more random texture pattern. This change to a surface's structure through peening makes it far less likely to fracture and crack.

Typically peening is used on components that are irregular in shape and that may be subject to twisting and bending stresses. Users of the wet peening process on components like these have recorded significantly increased product life and quality across a range of industries, including jet engine manufacturing.



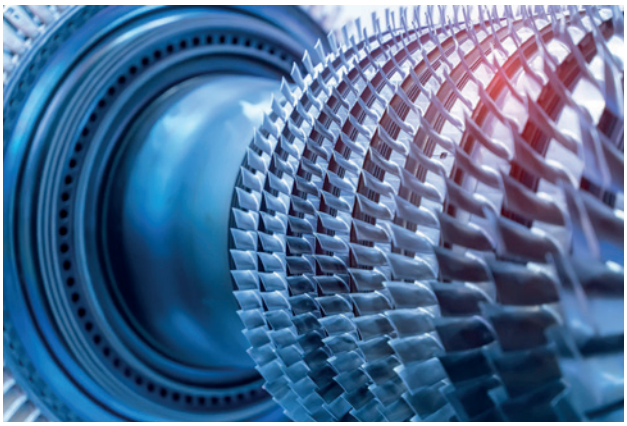
4 Processes 1 Surface Finishing System

As previously stated, wet shot peening peens to the same intensity as dry shot peening. We measure this using Almen strips, which are thin strips of SAE 1070 steel used to quantify the intensity of the shot peening process.

The strips are placed on the component where the results are deemed critical. As you can see from the image opposite, that is in quite a few places when it comes to jet engine fan blades.

The peening process converts tensile stresses to compressive stresses causing strips to deform into an arch. The resulting arch is concave, the opposite to what you might counter intuitively think until you realise that the compressive stresses created cause the steel to bow upwards towards the direction of the arch.

The degree of arching is measured using a gauge and that is how we determine that wet shot peening has peened to the same intensity as dry shot peening.



Preparing composite fan, propeller and helicopter blades, and other composite components, for bonding and coating

Wet blasting is highly effective at cleaning and preparing composite fan blades, propeller blades, helicopter blades and other aerospace composite components for bonding and coating.

The wet blasting process thoroughly cleans components, removing waxy residues and other contaminants that might have a negative effect on adhesion. Simultaneously,

the process creates a consistent 'wet-out' surface that allows an even and complete coverage of adhesives or coatings like paint over the processed area.

Thorough cleaning and the creation of a 'wet-out' surface helps ensure bond strength is maximised - critical for bonding titanium leading edges to fan blades or heater mats to propeller and helicopter blades for example.

The cushioning effect of the water in wet blasting means composite fibres are not damaged during blasting. There is no material loss from the component either, so any potential compromise to the component's integrity is eliminated.

The improvement in bond strength is applicable to all coatings, not just adhesives, so the adhesion of paint, lacquers, and other coatings, is optimised too.

Preparing aerospace components for NDT crack detection

Wet blasting thoroughly cleans components, removing burrs, debris, and other contaminants in preparation for NDT crack detection. Crucially, there is no danger of peening over cracks during the cleaning operation, instead the flowing nature of the wet blast slurry exposes cracks by cleaning them rather than concealing them, making them more visible during NDT – improving inspection accuracy, speed, and subsequent safety.

Discs, driveshafts, turbine and fan blades, blisks, titanium engine casings, wheels, struts and a broad range of other aerospace components can be cleaned using wet blasting, with no risk of damage to the component or any risk of compromising the component's integrity.

Wet blasting for inspection differs to wet shot peening, see the section above, in terms of the wet blast recipe. The wet blast recipes associated with NDT crack detection consist of a blast medias and flow rates that will not peen.

Preparing aerospace components for coating, including CVD and PVD coating

PVD or CVD coating fan blades has two important affects. First, it maintains the surface finish of the blade for much longer by significantly reducing wear. Second, coatings make the surface finish smoother for better fuel efficiency.

Aerospace engine components operate in extreme conditions, so the bond strength of coatings like PVD and CVD needs to be maximised.

Wet blasting is highly effective at producing the perfect surface finish on blades and other aerospace components for coating. It does this by creating a specific Ra surface roughness for the best possible coverage and adhesion.

Wet blasting additive manufactured aerospace components

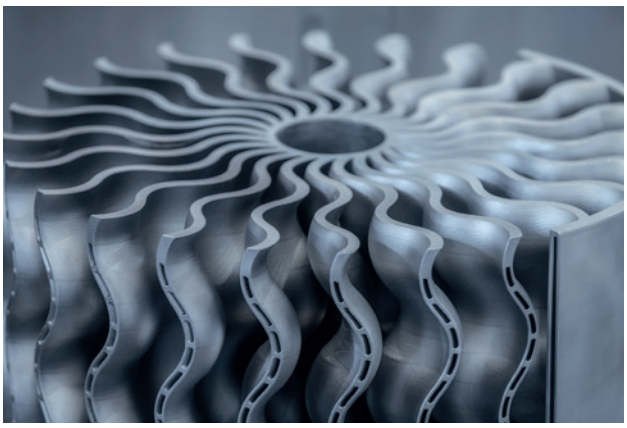
Thanks to advances in additive manufacturing (AM), a significant number of aerospace components are now manufactured using AM technologies. Wet blasting is highly suited to cleaning and preparing metal, composite, and polymer AM aerospace components for NDT or coatings like paints and oils.

It is also particularly effective at clearing powder, partially sintered powder, and other contaminants from the complex internal channels that are often a feature of AM components, giving a visual indication that the channel is clear when the blast media slurry appears at the end of the channel.

In contrast, it is not only difficult to tell if a channel is clear when dry blasting, it can compound the issue by adding additional blast media to blocked channels.

Removal of casting resist, burrs, heat scale, and debris, and applying a specific surface finish to cast aerospace components

Wet blasting is highly effective at removing casting resist, burrs, heat scale and other contaminants from the surfaces of fan and turbine blades, blisks, drive shafts, nozzle guide vanes, titanium engine casings, landing struts and other components manufactured by investment casting.



In addition to cleaning components, the process can also apply the final surface finish required or prepare the component for the next finishing stage, PVD coating for example.

The removal of casting resist and burrs, cleaning, and applying a surface finish is carried out in one efficient operation.

Removal of heat scale and oxidation from forged aerospace components and applying a specific surface finish

The forging process for components like landing gear struts and beams often results in the presence of heat scale and oxidation on the component's surface, this is also the case for components manufactured by other thermal processes.

In a single efficient operation, wet blasting removes all heat scale, oxidation, machining marks, and other contaminants, cleans the component, and applies the required uniform surface finish to meet stringent aerospace industry standards.

Wet blasting is also highly effective at reaching into small cavities and complex geometries, ensuring thorough cleaning.

The finish applied can either be the final surface finish or the finish required for the next surface finishing stage. For example, the process creates an ideal surface profile for subsequent coating applications, such as paint, anodizing, or thermal spray coatings, by promoting better adhesion and coating uniformity.

Finishing components for the rigours of space

The cutting tool inserts fitted to the Mars Rover's drill were finished in a Vapormatt Tiger wet blasting machine.

Exceptional levels of process control, highly uniform finishing, excellent repeatability and all the other benefits associated with wet blasting make it the ideal finishing process for components destined for space.

Our unrivalled expertise in maintaining a consistent blast flow coupled with automation ensures we can repeatedly deliver a highly consistent Ra surface roughness to component surfaces.

The Ra level of surface roughness can be set to a range, typically between 0.25 and 0.6 µm, that is perfect for sterilisation. Less than 0.25 µm Ra is suboptimal as microbes can effectively 'stick' to the surface and above 0.6µm Ra creates a larger surface area for microbes to populate.

Wet blasting is also ideal for preparing components for coatings, including adhesives and paint. This includes composite and additive manufactured components. The cushioning effect of water in the wet blast process ensures there is no material loss, so the integrity of the component is never compromised.

All of these factors contribute to the safety and reliability of components destined for space.

The essential blast consistency advantage of Vapormatt wet blasting

Controlling what comes out of the blast guns is essential for high quality consistent results. That applies to all applications, from cleaning and wet shot peening to surface preparation.

It is particularly important for automatic processes where the operator is not always there to visually check the consistency of blast flow and the results.

Vapormatt are second to none when it comes to controlling the consistency of output from blast guns.

The blast flow must always remain consistent and thanks to our world leading technical expertise and our patented technology we can achieve a consistent flow year in year out without change, even when components start to wear in the normal course of operation.

Our unrivalled ability to control the consistency of blast is present throughout our machine range.

Robotic automation for highly accurate and repeatable results

The accurate positioning of blast guns is another critical element associated with high quality consistent results. Our robotic automation can be programmed to accurately blast at multiple indexing points. If required, the blast guns can be moved by as little as 0.5mm.

This degree of accuracy is perfect for blasting highly complex components like the individual slots and angles associated with the 'fir trees' of a turbine disc.

Automation also ensures precisely the same blast recipe is delivered evenly to the entire surface of the component every time, making it ideal for finishing batches of the same component.

General benefits of wet shot peening for aerospace OEMs

There are several additional benefits our customers have experienced when wet shot peening aerospace fan and turbine blades compared with legacy dry shot peening systems, including:

- **Superior finishes** – As with all wet blast applications the flow of media over the fan and turbine blades ensures a smoother, more consistent, and higher quality finish compared with dry shot peening.
- **Eliminating contamination via better blast media** – Unlike dry shot peening a wet peening machine works best with ceramic or stainless-steel shot blast media. The benefit is that any risks of non-ferrous contamination is removed from the process.

- **Controllability** - With wet shot peening you gain the highest levels of process control available. The integrated HMI and several monitoring parameters allow you to change multiple variables for the best possible results. With live reports and automatic adjustments available, Vapormatt wet blasting machines have become a preferred choice for numerous aerospace MRO companies.
- **Reduced media consumption** – Users of our wet shot peening machines have found overall spend on peening blast media is drastically reduced. The use of water and our patented filtration systems allow good media to be recycled and stay in the system for much longer. Water is also recycled through the system.
- **Dust-free peening** – Wet shot peening does not involve cleaning residual dust and media from the component after peening. The wet blast process avoids this as the blast media is contained within the water and flows through and off intricate shapes.
- **No pre-cleaning** – Wet shot peening allows parts to be placed in the wet blast machine uncleaned and still covered with oil, grease, and other contaminants. The wet blast process removes all surface contaminants during the peening process. Contaminants are quickly filtered away. In contrast, dry shot peening involves cleaning and drying components before processing can begin.
- **Health and safety** - Wet shot peening is preferred when potentially explosive materials are being processed such as titanium and certain alloys, removing the need for expensive ATEX filtration systems. The absence of dust also eliminates issues associated with dust inhalation.

To conclude...

Overall, wet blasting offers aerospace manufacturers a highly versatile and efficient solution for cleaning, surface preparation and peening, helping to ensure components are safe, reliable, and perform as well as they can do.

Why work with us?

Vapormatt isn't just the world leader in wet blasting. We invented the process and remain solely focused on it to this day.

Since Norman Ives Ashworth developed the first wet blasting machines in the 1940s, we've been developing, improving and refining wet blasting for edge radiusing, surface preparation and peening. And we're still led by the Ashworth family today, continuing to design and manufacture bespoke machinery and after-market services built to the specific requirements of your round shank tool manufacturing business.

Our expertise spans many different sectors: from carbide round shank tool manufacturing, to additive manufacturing. Our breadth of knowledge means we can explore a wider range of applications that benefit a business like yours.

Because at Vapormatt, while we might be pioneers of wet blasting technology, we never believe the job is done. We're constantly researching, developing our techniques and discovering new technological enhancements that we can apply to round shank tools. Consequently, we hold and have patent applications pending in significant areas of process control and repeatability.

When working with you, we'll build a long-term technical partnership, giving you access to our know-how and world-leading wet blasting services. As a result, we understand you may need us to develop methods and processes in confidence. You'll benefit from our discretion too – in fact, we have a long track record of doing just that with our key customers across a number of high-tech sectors.

What can you expect of us?

- **Integrity -** We always conduct business with you in a confidential, honest, open and ethical manner
- **Commitment -** Every member of our team aims to exceed your expectations at every level
- **Innovation -** We're at the forefront of wet blasting technology, implementing our technical expertise
- **Value -** You gain value from us through our high levels of service and technical excellence
- **Collaboration -** As a customer focused company, we work collaboratively to ensure you enjoy the best possible experience

The Vapormatt Promise

In designing and manufacturing specialist machines that meet your exact requirements, we're always improving. Always refining. Always pushing the boundaries. We build on the successes of the past, incorporating proven designs and approaches, and combine them with innovative thinking to meet the specific challenges we face together with you.

Throughout that collaborative process, we're also completely honest and discreet. And it's in this respect that we make a promise to you.

As we develop more efficient, more seamless and more effective ways to deliver the benefits of wet blasting to you, any off-the-shelf solution is unlikely to be suitable. So complete validation of every design detail is practically impossible, and some functions – software, for example – will inevitably need modification as they're integrated into your processes.

Equally, once the equipment is installed on your premises, things are unlikely to be up and running without a glitch from the first moment, in a plug-and-play manner. Performance will always improve as operators and maintenance teams become familiar with the machines and their operations.

Other manufacturers might shy away from such an honest admission. However, we accept that this is simply part of building and refining the right wet blasting machines for you. That's why we promise to make the entire Vapormatt team, including our engineers, designers and sales specialists, available to offer advice, guidance and practical assistance once the equipment is installed and integrated into your workplace.

And we won't be satisfied until it's working to its full potential and this promise is kept.

The four pillars of our promise:

- To continuously improve the design and manufacture of our equipment
- To provide you with machines of the highest possible quality
- To support you in achieving optimal performance from your machines
- To collaborate with honesty and discretion

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