Vapormatt

Fast, clean and safe wet blasting applications for aerospace MRO

There are numerous applications for wet blasting in aerospace maintenance, repair and overhaul (MRO) operations including wet shot peening, cleaning and de-painting for NDT crack detection, and surface preparation for re-painting.

Our highly versatile wet blast finishing solutions deliver benefits over other finishing technologies too, like dry blasting and chemical cleaning. These benefits combined with our extensive experience of providing wet blasting solutions to the Aerospace industry means our machines can be found in leading MRO operations worldwide.

In fact, our relationship with aerospace can be traced right back to the development of the very first wet blasting machine during Sir Frank Whittles development of the jet engine in the 1940's.

Contents

Wet shot peening turbine and fan blades

The lifespan of a turbine blade can be extended more than a 1000% by wet shot peening. Peening by wet blasting involves projecting small hard spherical particles of media on to a component's surface and is a very effective way of improving fatigue strength.

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

Typically peening is used on components that are often 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.

There are several other benefits our customers have experienced when wet shot peening aerospace fan and turbine blades compared with their legacy dry shot peening systems.

Superior finishes: The flow of media over fan and turbine blades ensures a smoother, more consistent, and higher quality finish when compared with dry shot peening.

Elimination of contamination via better blast medias: Unlike dry shot peening a wet peening machine works best with ceramic or stainless-steel shot medias. 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 give you the option to change multiple variables. With live reports and automatic adjustments available Vapormatt wet blasting machines have become a preferred choice for several aerospace firms.

Reduced media consumption: Users of our wet shot peening machines have found that overall spend on peening blast media is drastically reduced. The cushioning effect of water and our patented filtration systems mean good media is recycled and stays in the system for much longer.

Dust free peening: Wet shot peening does not involve cleaning unwanted dust and media from the component after peening. The wet blast process avoids this as the media contained within the water flows through and off intricate shapes.

No degreasing: Wet shot peening means parts can be put into the wet blast machine uncleaned, still covered with oil, grease, and other contaminants. The wet blast process results in all surface contaminants being removed during peening and being quickly filtered away. In contrast, dry shot peening involves cleaning the component and drying it before the peening processing can begin.

Health and safety: Wet shot peening is preferred when potentially explosive materials are being treated, like titanium, removing the need for expensive ATEX filtration systems. The absence of dust also eliminates issues associated with dust inhalation.

Engines

In addition to wet shot peening engine turbine and fan blades, wet blasting has a broad range of other applications when it comes to MRO operations for jet engines, the highly versatile wet blasting process can:

- Thoroughly clean surfaces, removing oils, grease, heat scale, combustion deposits and other contaminants in one operation
- Prepare components for Non-Destructive Testing (NDT)
- Peen surfaces
- De-coat surfaces
- Prepare surfaces for coating
- Create technical surface finishes

Wet blasting is applicable to most engine components, including:

- Fan blades – including titanium forged fan blades
- Turbine blades and vanes
- Nozzle guide vanes
- Fan and turbine discs
- Engine seals
- Blisks
- Driveshafts
- Compressor blades and vanes
- Engine housings and casings
- Heat exchangers and cooling systems
- Fixings, e.g. screws and bolts

Surface preparation for coatings and the creation of technical surfaces

Wet blasting creates the perfect surface roughness (Ra) tolerance for coatings like paints, PVD and oils, ensuring excellent coverage and adhesion. It can also be used to create whatever technical surfaces are required for the component in question by using an appropriate blast media and suitable wet blast variables.

Wheels and brakes

The benefits of wet blasting for wheel and brake shop managers

Removing multiple coating layers, oils, grease, and all contaminants in one operation delivers significant time and cost savings for MRO wheel and brake shops compared with manual and chemical stripping processes. In fact, our wet blasting formula has been proven to be the fastest way to de-paint wheels and brakes.

Aircraft wheel and brake cleaning for MRO

Wheels and brakes are put under enormous stress when landing and require regular non-destructive testing (NDT) to ensure they remain safe.

To ensure accurate and safe inspection, wheels and brakes must be thoroughly clean for NDT methods like eddy current testing (ECT). However, the cleaning process can be time consuming and laborious, potentially tying up a skilled inspectors time.

Using our specially developed formula of plastic media, mild detergent, hot water and air, wet blasting thoroughly and rapidly cleans aircraft wheels and brakes, removing oils, grease, brake dust, rust, heat scale, and thanks to the flowing nature of the wet blast slurry, it can completely clean the most complex of wheel geometries.

With a blast formula set for cleaning, the process does not damage painted layers, it effectively simulates hand scrubbing without the laborious manual effort.

Wheels and brakes are rapidly and thoroughly cleaned leaving more time for inspection and in turn increasing the capacity of the wheel and brake shop operation.

As an added operator / environmental health benefit, brake dust, chromium particles in some primers, and other potentially harmful contaminants are held within the water of the wet blast slurry, so unlike dry blasting and some other finishing processes, there is no risk of inhalation.

Aircraft wheel coating removal for MRO

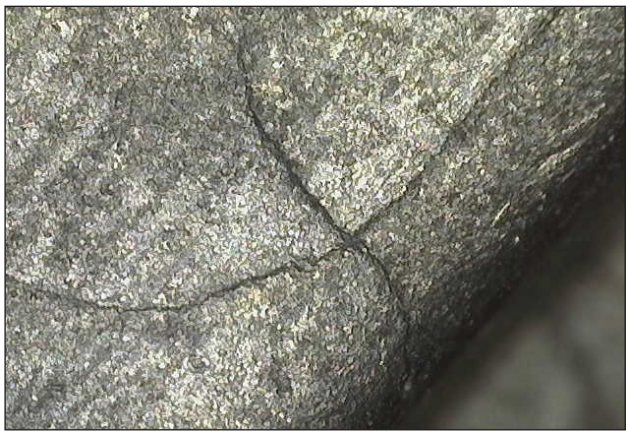
After a certain amount of use, wheels and brakes need more rigorous NDT which requires coatings like paints, primers, sealants, thermal barrier coatings and other coatings to be removed.

Using the same specially developed formula described above for wheel and brake cleaning, and at the touch of a button, a higher pressure can be used to rapidly remove multiple layers of coatings along with oils, grease, brake dust and all other contaminants in one operation and without damaging the wheel or Alodine layer. It is even possible to remove specific layers of paint.

Aircraft wheel before and after wet blasting

The highly controllable process is operator friendly and requires no hand scrubbing or harmful chemicals.

Crack before and after wet blasting



An additional benefit over dry blasting methods is the elimination of the separate wheel and brake cleaning and drying stages that must be carried out prior to dry blasting.

Dry media blasting tends to be slower, creates more dust and does not always protect operators from the harmful paint dust being removed. With the need to degrease wheels before dry blasting and the risk of concealing cracks through over peening, dry blasting can negatively affect NDT and safety.

With our wet blasting formula there is no risk of peening the surface. The flowing nature of wet blasting exposes cracks by cleaning them rather than concealing them, making them more visible during NDT, improving inspection accuracy, speed and subsequent safety.

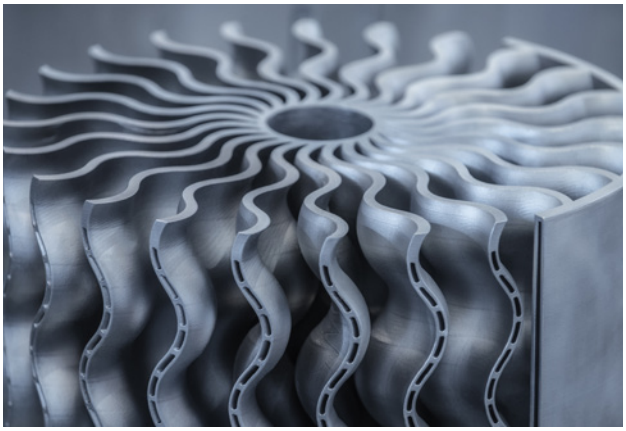
Composite and additive manufactured components

Composite aerospace components

The combination of strength and light weight makes composites ideal for use in aerospace. Wet blasting can clean and strip coatings from composite surfaces just as effectively as it can from metal surfaces and perfectly prepares composite surfaces for bonding and coatings like paint and lacquer, without damaging composite fibres.

When it comes to bonding, the 'wet out' surface wet blasting creates ensures optimal coverage of coatings and adhesives and in turn maximum bond strength and safety.

Wet blasting is therefore highly relevant to MRO operations working with composite fan and turbine blades, propellers, helicopter rotor blades and other composite aerospace components.



Additive manufactured (AM) aerospace components

Thanks to advances in additive manufacturing, a significant number of aerospace components are now manufactured using AM technologies. Wet blasting is highly suited to cleaning, de-painting 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. In contrast, it is not only difficult to tell if a channel is clear with dry blasting, the process could even compound issues by adding additional blast media to blocked channels.

Propeller and helicopter blades

As with other aerospace components, propeller blades need to be thoroughly cleaned and often de-coated / de-painted prior to NDT testing. Traditionally, this has either been done by hand, chemicals, or dry blasting, all of which have significant disadvantages when compared with wet blasting.

Cleaning by hand is time consuming and laborious, chemicals can be harmful, difficult to dispose of and slow to clean or de-coat propellers, especially if multiple stages are required. Dry blasting involves cleaning the propeller first, removing all oils, grease, and other contaminants, drying before blasting and then removing residual dust and blast media after processing, making the process lengthy and with significant health and safety issues. In addition, dry blasting can result in an uneven finish when compared with wet blasting.

Our specially developed wet blasting formula of plastic media, mild detergent, hot water and air, rapidly cleans and de-paints propeller and helicopter blades. Blades can be cleaned only, removing corrosion, grease, oils and other contaminants, or, at a press of a button, the air pressure can be increased to simultaneously clean and de-paint blades.

When it comes to metal propeller blades, the fast and clean wet blasting process leaves blades clean and de-painted ready for Alodine or anodised layers to be chemically removed in preparation for NDT dye penetrant testing for cracks. The main benefit here is the removal of harmful chemical or laborious hand cleaning and paint stripping processes.

Crucially the wet blasting process, even when de-painting, does not remove material from the propeller or helicopter blade itself.

Wet blasting can also be used to create the perfect surface for re-painting or bonding, e.g. bonding of de-icing pads.

As well as processing metal blades, wet blasting can replace time consuming manual sanding when it comes to preparing composite propeller blades for NDT crack detection. As with metal blades surfaces can be perfectly prepared for coatings like paint and lacquer or adhesives for bonding, especially important if the leading edge must be replaced due to damage. Composite fibres are not damaged during wet blasting thanks to the cushioning effect of water in the wet blasting process.

Propeller hubs, governors and other propeller components can be cleaned and prepared for NDT in the same way as blades, including smaller items.

Undercarriages

In addition to aircraft wheels and brakes (see the section on wheel and brake MRO above), wet blasting can be applied to other undercarriage components too, like landing gear struts, shock absorbers, retraction mechanisms, locking mechanisms, doors and fairings, fixings and other smaller components.

Applications for wet blasting include cleaning - removing oils, grease and other contaminants in one operation without damaging underlaying painted layers, de-painting and preparation for various NDT methods including eddy current testing (ECT) and dye penetrant testing.

Toilets

Wet blasting offers the opportunity for hygienic and safe toilet component cleaning. In one operation it cleans fixed and smearable contamination and creates surfaces that are harder for ‘dirt’ to adhere to. In addition, the process creates surfaces that are easier to clean, look better and are more hygienic. Components that can usually be wet blasted include pans, pipework, pumps, and tanks.

General benefits of wet blasting for MRO operations

Automation: Most of our wet blasting machines installed in jet engine MRO operations are automatic. That is because they deliver a highly consistent result every time and of course, there are significant productivity improvements too. In such a regulated industry, consistent results are essential. Consistency coupled with improved productivity ensures rapid ROI on our automatic machines.

Process control: The use of water in wet blasting helps control the surface finish more precisely compared to dry blasting methods. In fact, wet blasting is significantly more controllable than other surface finishing processes. Operators can adjust parameters such as blast pressure, water flow rate, and abrasive media type to achieve the desired surface roughness (Ra) and cleanliness levels, which is crucial for aerospace component performance and longevity.

Versatility: From cleaning wheels and fan blades to removing paint to wet shot peening, wet blasting is a highly versatile process. This allows MRO operations to use wet blasting for a multitude of different applications. It is a process that can be adapted easily, making it ideal for unskilled manual operation.

Gentle cleaning: Wet blasting utilises a combination of water, abrasive media, and compressed air to gently remove contaminants, coatings, and corrosion from delicate aerospace components without causing damage. This is particularly beneficial for sensitive parts like engine components, turbine blades, and intricate surfaces where other blasting methods might be too harsh. Composite fibres, Alodine and anodised layers are not damaged by the process.

Reduced dust and contamination: Wet blasting suppresses dust and airborne contaminants by trapping them in the water stream, resulting in a cleaner and safer working environment. This is especially important in aerospace MRO facilities where strict cleanliness standards are necessary to prevent foreign object debris (FOD) and to maintain component integrity.

Improved operator safety: In addition to reducing harmful airborne particles and abrasive dust, the use of water can mitigate the potential for static electricity buildup, which is important when working with flammable materials commonly found in aerospace applications.

Another safety benefit is the noise level of wet blasting which typically operates below 80 dBA vs. dry blasting at approx. 90 dBA and over. The US Occupational Safety and Health Administration (OSHA) requires employers to implement a hearing conservation program when noise exposure reaches 85 dBA averaged over 8 working hours, or an 8-hour time-weighted average (TWA). This, in layman's terms, means ear defenders are not required when wet blasting.

Environmental friendliness: Wet blasting is a more environmentally friendly alternative to most other surface preparation methods. It typically generates less waste and reduces the need for harsh chemicals, making it a greener option for aerospace MRO operations. Effluent from the machine is processed through a filtration system, enabling solid waste to be separated out for safe, non toxic, disposal, and for the water to be recycled.

Fixings and other small component cleaning: We have several wet blasting machines with barrel options for smaller components, removing the need to clean individual parts by hand, which is prohibitively costly.

Fixings like bolts, screws and other small components, e.g. smaller gear parts, are loaded into the barrel, blasted on a set program, rinsed, and dried ready for inspection and re-use. Crucially, wet blasting, unlike dry blasting, preserves delicate edges, threads, and plated surfaces. It also preserves the cadmium plating that prevents oxidation of some fixings.

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With so many applications for MRO, it is no surprise that our wet blasting technology can be found in many of the world's leading MRO operations.

You can find more information, including videos, case studies and white papers on our dedicated aerospace MRO landing page:
vapormatt.com/industries/aerospace-mro

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