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Grit Blast & Surface Prep

A Technical Guide to Masking

Technical Application Series

Grit Blast & Surface Prep

A Technical Guide to Masking

Save Time and Money with the Right Materials and Methods

Tapes

GBI manufactures pressure sensitive thermal spray masking tapes. These materials must be smoothed with pressure to create a good bond of the masking tape to the component surface.



Applying 170-10s Green Masking Tape to a cylinder prior to grit blast and thermal spray coating. Quality tapes like this can stay in place for both grit blast and thermal spray coating.

Silicone adhesives are used for grit blast applications because silicone adhesive releases cleanly from most surfaces leaving no residual adhesive.

Thermal spray masking tapes are typically constructed from silicone rubber, woven fibreglass, metal foils, and silicone adhesive.



PTFE Group provides tapes, fabrics, compounds, and pre-cut or die-cut profiles for masking in various thermal spray coating applications.

centers whereby rolls of tape are generated with the die cut shapes (profiles) on the liner in roll form. As with the pre-cut advantages listed above, rotary die cutting is more economical for applications involving thousands of pieces. A proper cost study should be conducted by the customer before deciding which option is most appropriate for a given situation.

Masking Methods and Techniques for Best Results

First determine if the area to be masked is considered Primary or Secondary

Primary masking is the critical masking area in direct contact with the abrasive grit particles as they impact the component surface. Primary masking is crucial as this is the area where masking and exposed surface meet and most operators want well defined, clean coating lines. These perfect edges can be achieved by using GBI thermal spray masking products.



S/W 35 Masking Blanket is used as secondary masking to mask larger areas, and is re-usable.

Secondary masking is the non-critical masking area that does not come in direct contact with the grit particles as they impact on the component surface. The secondary masking area is usually furthest away from the targeted zone but operators still need to protect those areas as they can be impacted by bounced particles which could become a contaminant. Because these secondary areas are normally larger than the primary masking area a good masking solution would improve masking efficiency (save time and money).

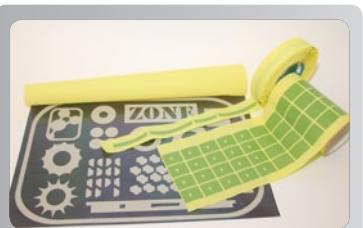
Compounds

GBI masking compounds are two part silicone putties. The compounds are provided in two parts, "A" and "B", so that they can remain stable and usable for long durations. Typical shelf life is 2 years. Once the two parts are mixed, a moulding putty has now been created that can be used to:

- Plug holes.
- Create moulded sleeves and caps

Fabrics

Thermal spray masking blankets, are constructed from silicone coated woven fibreglass fabric. Unlike tapes, these fabrics have no adhesive. The lack of adhesive is an important characteristic which allows for the material to be reusable. The material is also highly effective for masking large areas quickly in the form of secondary masking.



Pre-cut and die-cut profiles increase efficiency and safety in the workplace.

Pre-Cut or Die-Cut Pieces

Pre-cut or die-cut pieces are pressure sensitive tapes that have been pre-cut on release liners to simplify repetitive masking. Pre-cuts can be produced in sheets using PTFE Group's advanced plotter equipment. The profiles and drawings are stored in a

computer (for future use).

Pre-cuts are advantageous for:

- Faster masking leading to time and cost savings
- Creating a safer workplace with less razor blade handling.
- Improving accuracy and consistency of masking profiles.

Die-cut pieces, specifically rotary die cut pieces, are usually reserved for applications involving high volume repetitive masking. Rotary die cutting is accomplished at PTFE Group fabricating

Product Recommendations for Grit Blast Masking

Masking For Grit Blast and Thermal Spray Coating

The spectrum of PTFE Group solutions is well suited for the demands of both grit blast and application of thermal spray coating so savings can be achieved by masking for both processes just once, in a single step. Various weights, thickness, resistances and flexibility ensure the best available fit for the application. The following recommendations contemplate the best fit for different grit blast and thermal spray coating combinations.

- 37 Grit and Higher/ Wire Arc Spray: Green Belting 170-10s YL, 170-10s Green, 170-10s Red, S/W 35, and/or HVMC
- 36 Grit and Lower/ Wire Arc Spray: Green Belting 170-10s Green, S/W 35, and/or HVMC
- 37 Grit and Higher / Flame Spray: Green Belting 170-10s YL, 170-10s Green, 170-10s Red, 190-7s, and/or HVMC
- 36 Grit and Lower / Flame Spray: Green Belting 170-10s Green, 170-20s YL, and/or HVMC
- 37 Grit and Higher / Plasma Spray: Green Belting 170-10s YL, 170-10s Green, 170-10s Red, and/or HVMC
- 36 Grit and Lower / Plasma Spray: Green Belting 170-10s Green, 170-20s YL, and/or HVMC
- 37 Grit and Higher / Gas Fueled HVOF: Green Belting HVMT Orange and/or HVMC
- 36 Grit and Lower / Gas Fueled HVOF: Green Belting HVMT Orange and/or HVMC
- 37 Grit and Higher / Liquid fueled HVOF: Metal mask, Green Belting HVMT Orange, and/or HVMC
- 36 Grit and Lower / Liquid Fuel HVOF: Metal mask, Green Belting HVMT Orange, and/or HVMC

Masking For Grit Blast Only

Some metal fabricating facilities simply use grit blasting to clean industrial parts—there is no coating application that follows. In these cases, the high conformability of thermal spray masking materials is well-suited for detailed masking requirements.

The materials are also well suited to resist the abrasiveness of the grit spray. Most importantly, the thermal spray masking tapes leave no adhesive residue behind, so that no added clean-up is required. Recommendations include:

- 37 Grit or Higher: 170-10s Green for easy and quick application, flexibility and resistance to abrasive grit.
- 36 Grit or Lower: HVMT Orange or 179-25s – heavier tapes that protect against coarse grit and high pressure; a better option than plasma spray masking tapes

All Grit Media

HVMC is suitable for any grit blast situation as it withstands high pressure and high abrasion

- 36 Grit and Lower / Gas Fueled HVOF: HVMT Orange and/or HVMC
- 37 Grit and Higher / Liquid fueled HVOF: HVMT Orange and/or HVMC
- 36 Grit and Lower / Liquid Fuel HVOF: HVMT Orange and/or HVMC

*HVMC = High Velocity Masking Compound; HVMT = High Velocity Masking Tape

How to select the correct masking products for Primary Masking areas

To select the correct primary masking products, the operator needs to consider what factors will most affect the masking tapes, compounds, and fabrics. There are several factors to consider:

Is the profile of the component intricate or basic?

Basic profiles are easier to mask and all of the GBI tapes listed in the section above will work. In many cases, operators prefer to apply

two layers of masking tape to achieve a reliable primary mask. For example an operator may choose to apply two layers of 170-10s YL but to achieve time and cost savings a better option is to apply a single layer of 170-20s YL. This strategy can cut masking times by 50% and generate significant cost savings.



Close-up view of a turbine blade masked with 170-10s (Red) and 160 -5s (white) masking tapes as primary and secondary masking. The small cooling holes are filled with HVMC masking compound.

Intricate profiles are more challenging and require a good masking plan. Small, intricate parts and profiles will require a conformable (flexible) masking material; the most flexible is the 170-10s YL. This product is highly conformable and will survive moderate grit blast. If the operator requires more abrasion resistance, then 170-10s Green may be considered instead.

Does the grit blast or prep blast require coarse grit or fine grit?

All thermal spray coatings require a prep blast stage to etch the component surface so that the coating will form a strong bond. If the operator is using a fine grit of 60 or greater the abrasion will be somewhat mild. When finer grits are deployed all of the 170 series tapes, both compounds, and the silicone fabric are good to use.

If the operator is using coarse grits of 46 or less, we recommend using either 170-10s Green or HVMT Orange. Both of these tapes will survive intense grit blast and will maintain clean coating lines as they will resist fraying. GBI products are designed to be applied only once because they survive both the grit blast and the plasma spray coating.

The final consideration for grit blast is the PSA of the grit blast nozzle. For PSA of 60 or less with relatively fine grits we expect that all of our 170 series tapes, compounds, and silicone fabrics

will survive. For PSA greater than 60 with relatively fine grits we recommend 170-10s Green (likely in two layers). Finally, for PSA greater than 60 with grit of 46 or more coarse, we recommend at least two layers of 170-10s Green or 170-14C. If the grit nears 16-24 grit other products should be considered such as HVMT Orange. 179-25 is also an option if flexibility is not a concern.

Will the grit blasting occur on a 90° angle?

Grit blasting technicians universally strive to clean and etch substrates on a 90° angle to achieve a consistent clean surface. For situations where grit blasting is done on a 90° angle, most of the above mentioned masking products should work well.

Unfortunately, the geometries of the components do not always allow for 90° angles for the grit blast nozzles. In fact, many profiles may be sprayed from 75-90° and in some severe instances, angles of 45° may occur. From a masking perspective, the further removed from a 90° angle of spray the greater the chance of the masking tape being lifted. This lifting could

potentially occur as the grit particles impact the edge of the tape which may create a lift of the material from the component surface. To combat the lifting scenario, operators are encouraged to use the 170 series tapes which have strong adhesion to metal and strong face-to-back adhesion. These tapes are pressure-sensitive so it is imperative that force (pressure) be applied in order that the strongest bond of the adhesive to the component surface is achieved. If grit blasting on a significant angle, we recommend 170-10s YL, 170-10s Green, or 170-10s Red. For the highest conformability, the best choice is 170-10s YL.



Manual application of grit-blast using a hand-held nozzle.

be applied in order that the strongest bond of the adhesive to the component surface is achieved. If grit blasting on a significant angle, we recommend 170-10s YL, 170-10s Green, or 170-10s Red. For the highest conformability, the best choice is 170-10s YL.

How to select the correct masking products for Secondary Masking areas

To select the correct secondary masking products, the operator needs to consider what factors will most affect the masking tapes, fabrics, and compounds. There are several factors to take into account:

What is the size of the secondary masking zone?

For large areas, use of the S/W 35 Silicone Coated Fibreglass (also known as a thermal spray masking blanket) is recommended. This material is a reusable form of masking that can be used to cover large areas quickly and will help to eliminate "excessive tape masking". Generally this fabric must be mechanically fastened. Large areas with difficult profiles should utilize fabric and tape together for the most cost effective solution.

Small areas should generally use a pressure sensitive plasma spray masking tape such as 170-10s Green.

Masking Strategies for Common Profiles and Components

Cylinders, Rollers, Shafts

Most rollers and cylinders have keyways which can be masked with HVMC. This compound is a very quick and reliable solution for masking keyways and repetitive masking can

often be created. Green Belting compounds easily withstand the high abrasion associated with all grit styles.

Journals can be masked quickly with a variety of plasma spray masking tapes or glass cloth tapes and often wider rolls are recommended for convenience. These silicone coated fibre-glass tapes will withstand most styles of grit. Note, you may need multiple layers of tape if using grit that is coarser than 46 grit.

Large surfaces of rollers or shafts can be protected by using S/W 35 silicone coated glass fabric as secondary masking with a good quality plasma spray masking tape close to the targeted zone or critical area.

Reliable masking always involves 170 series plasma spray masking tape or thicker double layer products. When a critical edge is needed, with no fraying from abrasion, then the correct product choice should be two layers of 170 series tape (10 mil) or a single layer of a 20 mil 170 series tape.

Cooling holes

Many aviation engine vanes and components found in the hot combustion zones of the engine contain very small holes on the surface to assist with controlling the temperature of that part while in service. Generally, operators try to protect cooling holes so that coating and grit does not penetrate and build up. Masking cooling holes is difficult and time consuming. The best solution for masking cooling holes is using High Velocity Masking Compound (HVMC). This masking technique involves mixing the compound to a 50:50 ratio then spreading and filling in the holes. The putty can be trimmed and the surface cleaned only after curing is complete (7 minutes). After the masking is cured, grit blast is required to etch and clean the surface of the component. The masking protects the hole from damage while preventing contamination from the grit particles.

Fan blades

Generally fan blades are masked at the bases of the blades but bases can have some complex geometries that require flexible masking. We recommend using rolls of 170 series tape for masking. Pre-cut pieces can be used for repetitive complex shapes to save time and money.



A turbine fan blade masked with 170-10s Red Plasma Spray Masking Tape.

Some operators may need to protect larger sections of the fan blade with a secondary masking application (away from the primary spray zone). For these applications we recommend using fabricated silicone fabric pouches constructed from S/W 35. This application is not only a fast masking option, but often a multi-use or reusable form of masking. This is a good option for protection against stray grit blast particles.

Pump and valve components

Pump components often used in the gas and oil industry are coated with wear resistant coatings. To apply these coatings, a significant etch is required with the substrate subjected to coarse grit. Given the difficult geometries or profiles, we often recommend two layers of 170-10s Green.

Note that some components may require heavy etching

which means intense grit blast with course grit. For the lower grit styles, we recommend two layers of plasma spray masking tape or possibly a single layer of stronger material such as HVMT Orange (High Velocity Masking Tape) or 179-25S (heavy thermal spray masking tape).

Recommendations for Abrasion and Conformability

High Abrasion

While 170-10s Green is usually sufficient for high abrasion environments, GBI produces other tapes which can survive extreme abrasion (such as aluminum oxide grit less than 24 grit size). For extreme abrasion, we recommend two materials:

- HVMT Orange, a highly conformable thermal spray masking tape which releases quickly and cleanly after use.
- GBI product 170-20s YL, a 20 mil double layered plasma spray masking tape which can take the place of the application of two layers of common plasma spray masking tape (resulting in time and cost savings).

A non-tape solution offered by GBI is our masking compound: HVMC (High Velocity Masking Compound). This two part silicone compound will withstand all forms of thermal spray along with surviving surface etching and grit blasting.

Conformability

One of the most significant challenges faced while masking for grit blast is the need to be strong, yet flexible. GBI has solutions for components that are difficult to mask due to challenging geometries and profiles. GBI products will conform to the challenging profiles and will not lift during grit blasting while removing completely clean (leaving no adhesive residue).

The most common solution is standard plasma spray masking tape, 170-10s YL. This material uses a flat glass style that is highly conformable. This conformability combined with GBI's strong adhesion makes this product the best choice for most challenging masking jobs involving difficult geometries and moderate abrasion. For higher abrasion applications GBI recommends 170-10s Green. This material is conformable yet has higher abrasion resistance.

In some cases, a non-tape solution is the best. Our HVMC can be used to make intricate reusable masking moulds that will take the shape of any profile. A component such as a complicated blade root would benefit from this type of masking solution.

Strategies to Maximize Grit Blast Masking Time and Cost Savings

Inspect the Component and Masking Prior to Spraying

Make sure proper pressure has been applied to the tape. The operator must remove all air-pockets and ripples to ensure that adhesive is fully engaged with the component surface.

If you are concerned about bridging of the coating, then we recommend prior to grit blast, using a second layer of tape (narrow strips) where the coating meets the masking. Upon completion of the grit blast, the narrow strips may be removed leaving a

smooth surface that will prevent any chance of bridging and cracking of the coating.

Eliminate any areas where tape is not in contact with the component, for example tape should not be used to cover holes (HVMT should be used instead).

Check for surface contaminants (oil, FPI oil using a black light, grease, paint, old coating etc.).



A part masked with 170-10s Red Masking Tape, and High Velocity Masking Compound (blue) is ready for inspection prior to receiving grit blast.

Ensure your Masking Department has the best tools for the job

Utility knives, razor blades, and/or scissors – Tapes and fabrics must be cut. Precision cuts are required as opposed to hand tearing. Hand tearing exposes glass filaments which are potential contaminants.

Masking tables with protective covers – will prevent parts from becoming scratched while also providing a surface where tape can be cut.

Lighting – All precision masking jobs require good lighting to be able to accurately mask with tapes, fabrics, and compounds.

Smoothing instrument – Most masking operators will utilize objects or tools for smoothing tape. Remember that thermal spray masking tapes are "pressure sensitive" thus they require sufficient pressure to bond well. Smoothing instruments can be fabricated plastic hand held tools but ideally have multiple surfaces to adapt to different profiles.

Rack/bar for holding tape rolls – In the interest of safety and efficiency, masking departments should have racks or bars to contain and dispense tape easily. This is the best way to store various sizes at each work station.

Don't forget these important Health and Safety considerations

Avoid cuts

Unfortunately, cuts to hands and fingers do occasionally occur. Cutting injuries result in down time (not to mention pain and possibly infection). Cuts can be reduced by employing the following:

- Pre-cut sheets of masking tape containing pre-cut profiles. Not only is this strategy safer, it also speeds up masking, ultimately generating time and cost savings.
- Kevlar gloves. Where possible, employees should consider using Kevlar gloves to avoid cuts from blades and also from sharp component areas.

Avoid repetitive motion disorders

Some companies perform masking of repetitive shapes. Peeling the liner off of thermal spray masking tapes can sometimes lead to repetitive motion injuries (particularly if breaks, rest periods, or job rotations do not occur). This problem is more often seen with operators who consistently use wider width rolls of

masking tape such as 4" and greater. To reduce the potential for injury, GBI recommends pre-cut masking profiles to minimize liner removal and avoid excess strain on wrists. Furthermore, most masking operators are moving towards narrower width rolls such as 2" wide to help reduce repetitive motion disorders.

Contain release liners to minimize trip and fall hazards

Masking departments should be kept clean, especially the floors. Unfortunately, many shops forget to immediately dispose of release liners (which are discarded after the tape is unwound). A good practice is to have several garbage containers beside the masking work space to prevent release liners ending up on the floor which can lead to slipping hazards. This potential hazard is especially common when customers use products with clear polyester release liners (they are very slippery and harder to see compared to yellow PVC release liners).

Additional tips for successful masking

Never hand tear thermal spray masking tapes

Avoid hand tearing even though some thermal spray tapes may have weaker breaking strengths. Tearing by hand will seriously damage the integrity of the product. Thermal spray masking tapes utilize a base of woven fibreglass and when torn by hand, the fibreglass is exposed as a potential contaminant to the coating. The frayed glass can also shadow the coating line, leading to rework.

Always apply firm pressure to ensure strong adhesion of the tape to the component.

Thermal spray masking tapes are pressure sensitive, meaning they require force to properly wet out and adhere. A smoothing tool or instrument (even fingers) should be used to create a good bond of the tape to the component.

Avoid the use of solvents

Where possible solvents should not be used on thermal spray masking tapes or the components to be masked. Strong solvents can break-down and liquefy the adhesives and silicone rubbers. For example, if a strong solvent is used and tape is immediately applied to that surface, the tape will not adhere well.

Mild solvents can be used to clean a surface prior to applying the tapes, however the operator should make sure that the solvent has flashed off.

Never allow for silicone adhesive tapes to freeze but refrigeration is okay

Freezing of silicone rubber tapes may interfere with the chemistry of the product, lead to poor adhesion values, and does NOT extend the life of the product.

Refrigeration of tapes will not have a negative effect on thermal spray masking tapes.

Best storage conditions are at room temperature, but avoid excessive humidity and excessively dry storage.

When using GBI tapes, take precautions to not leave the tapes in dirty areas because tape edges can pick up dirt and dust particles. These particles can reduce the tack and adhesion of the tapes as well as potentially contaminating the coating so a clean working environment is important.

Where possible, try to avoid narrow strips of masking tape less than ¼" wide.

Tapes can be manufactured in widths of less than ¼", however, operators risk tape lifting due to small surface coverage (adhesive coverage) versus the relative force of the spray. In other words, extremely narrow strips of tape have a better chance of lifting, tearing, or moving compared to strips of tape that are ¼" or greater in width.

Grit blast masking has varying degrees of challenge depending on factors such as the profile or geometry of the component, coarseness and style of the grit blast medium, and pressure of grit system. GBI produces many different options (not just tape) to solve a variety of masking challenges related to grit blast masking. The goal is to mask faster, safer, and more accurately thus leading to time and cost savings while avoiding fraying. The result is perfect edges produced in a timely and cost effective manner.

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