

The True Cost of Thermal Spray Masking

A Technical Application Article

Disclaimer

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What is the True Cost of a Thermal Spray Masking Job?



170-10S Green applied to cylinder prior to grit blast and thermal spray coating.

It started as an innocent question, “How much does your masking job cost?” This is a question I asked the Purchasing Agent of a thermal spray coating company that will remain anonymous. After all, I work for a company that produces masking tapes, fabrics, and compounds. The question seemed innocent enough. The agent paused and said, “Well, the employee is paid \$9.00 per hour and your tape cost \$20.00 per roll so the job costs about \$30.00.” I found this to be interesting, but not accurate.

Later in my trip, I asked the same question to a shop supervisor of a different company. He confessed that calculating the exact cost of surface preparation was something that nobody at his company has ever undertaken accurately. In his case, it was time (with shop rate of \$45.00 per hour) plus the cost of masking material. Better, but still not perfect.

It is time to take a step backwards, and consider the cost of materials. Cost of raw materials can be deceiving.

Approximately two years ago, I visited a job shop in Asia specializing in the repair of industrial components. I met with the Managing Director whose first question for me was (upon knowing my focus), “How much does your masking tape cost?” I told him approximately US\$20.00 per roll. He laughed and thanked me for the visit, but told me I was wasting his and my time. After all, he currently used duct tape that was \$2.50 per roll and it did just fine! Before being pushed out the door I asked him for a favour. Could I see his process? He told me sure, and gave me a personal tour—probably to teach me a lesson.

Observing the Process

Sure enough I saw the Komatsu shafts they were resurfacing—in this case, the parts were to receive an arc spray coating. True to his word, his loyal employees masked the components using layer upon layer of duct tape.

After applying layer eight, I asked our host, “Is this normal?” I was told, yes of course this is normal, after all, the tape layers must survive grit blast and arc spray. Our next step was grit blasting. Upon observation, the edges of the tape had become frayed. The part was then subjected to the arc spray application where a significant coating thickness was applied. The duct tape, not being suited to a heat application distorted and frankly, we were left with a mess. My host was not dissuaded. He said this was fine, this was “normal.” I pointed out the edges which now resembled cooked bacon. My host was oblivious.

Masking for thermal spraying is often overlooked or simply seen as a necessary evil prior to the real job.



Flame spray coating applied to a component masked with 170-10S Green.

We then witnessed two operators removing the tape—this process took considerable time as the layers had melted into one another. Upon removal of all the tape layers, we saw “left over adhesive” or as we call it, adhesive residue. I pointed this out to our host who said “Oh well, this is normal, we can simply have an employee or two rub the residue off with solvent and/or abrasives.”



Ineffective masking tape can fail under the heat and abrasion of thermal spray coating processes.

I then pointed out the coating line, which again looked badly distorted. I showed my host who said, “Yeah, it would be great if the coating lines were straight but they never are but that is okay, because we have a machine shop that can now finish these areas properly.”



Plasma spray coating applied to a turbine blade component masked with 170-10S Red.

Later we had a meeting back in my host’s office. I pointed out that our “expensive” tape which is a plasma spray masking tape (silicone coated fiberglass) could be used in a single layer, it would leave no adhesive residue, it would not distort along the edges AND it would save a great deal of time, labour, opportunity cost, and ultimately money. Imagine: no extra labour for adhesive removal, no extra labour for reworking the edges, not to mention that the \$2.50 roll of tape was actually \$20.00 (\$2.50 x 8). He got the point.

The Lessons Learned

To follow up, my host also explained that he faces other challenges in his market dynamic. Not only are his customers demanding competitive pricing but they are also demanding faster and faster turnaround times. It became evident that his real driver was not necessarily cost, but rather efficiency— together, these factors mean he should focus on cost savings through improved efficiency. This was a good lesson: the cheap product is not always the most cost effective product—it is important to consider the entire coating process (including surface preparation).

So back to the original question, “What is the cost of thermal spray masking?” Obviously we have the following factors to consider: time, labour, and cost of masking material but what else? In the case of many OEM and tier-one support companies, we also need to consider the “gains of improved efficiency.” I recently met with an aviation engine repair facility that explained why they were seeking improvements to their masking process.

Ten years prior, this facility had exactly 14 days to receive, repair, and turnaround rebuilt commercial jet engines.

Three years ago, this facility was tasked with the goal of complete turnaround in 12 days. Today, they face a new challenge—11 days. This facility is clearly under pressure to find the most cost effective and efficient solutions possible. Now consider that a thermal spray coating job is normally 90% surface preparation (a relatively small amount of time is dedicated to spraying). Masking is time consuming and labour intensive—put simply, masking can be expensive.



Surface preparation is typically 90% of the time consumed for a thermal spray job.

This is the reason why facilities must find the most cost effective methods for masking with the goal being to mask faster and more accurately. A variety of masking methods should be explored because often the best solutions may involve a variety of masking materials including: tape, metal masking, silicone rubber profiles and compounds—in some cases, all at the same time. In terms of thermal spray masking tapes, it is important to note that there are subtle differences (and not so subtle) between various masking tapes. Depending on the masking tape manufacturer and style, there can be a wide range of breaking strengths, adhesion properties (to stainless steel and Face-to-Back), heat resistance, abrasion resistance, and flexibility etc.

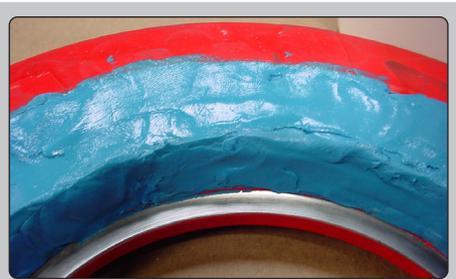
Always Choose Good Quality Masking Materials

Considering the variables from tape style to tape style, the correct selection of masking tape is crucial in terms of providing masking efficiency. Consider a standard plasma spray masking tape constructed of silicone coated fiberglass fabric complete with silicone adhesive. A standard tape uses a flat standard fiberglass weave. If you are the operator preparing for masking, you need to consider the abrasion of the prep blasting and spray particles. If you are using a relatively mild grit (for example 60-80 grit aluminum oxide), then the standard tape may work perfectly fine.

The operator may mask using 1-2 layers of tape. But if abrasion is going to be considerable, then 1-2 layers of standard tape may not be enough (the operator may experience frayed edges, adhesive transfer, erosion etc.). It is important to make the correct decision to purchase stronger tapes which are more abrasive resistant than standard plasma tapes.

Good quality products and opportunity go hand in hand.

This abrasion resistance allows for more precise masking and sometimes fewer layers of tape (reduced tape consumption). Now again consider the pressures facing companies today for quicker turnaround times. If the operator can mask a component in half the time, and avoid unnecessary clean up, then the result should be major cost savings and improved efficiency.



HVMC provides an effective thermal spray barrier in hard to reach places.

Don't Forget About the Opportunity Cost

The real measure of overall cost savings comes from a true application audit and product audit to determine the cost of various masking techniques. Opportunity cost should also be considered. For example, if a stronger thermal spray masking tape is selected, and considerable time is saved in the process, what can the operator and/or facility do with the gained improvement? Take on new jobs? Perform needed maintenance? Selectively take on higher margin projects?

Health & Safety In a Cost Savings Paper?

So far, we have discussed process efficiencies and cost savings. Another consideration with cost benefits is health and safety. Normally "health and safety" and "cost savings" are not contained in the same sentences, but in terms of thermal spray masking they can be! Consider the following scenario.

One of the most costly and frustrating situations surrounds repetitive masking—masking the same profile over and over (sometimes hundreds or thousands of times). Obviously, metal masking "jigs" would be a good solution—but unfortunately, not every profile lends itself to metal masking alone. Quite often, thermal spray coating operators find themselves using tape. It is not uncommon to cut out the same profile repeatedly. A good solution is rotary die-cut masking profiles or pre-cut plotter profiles all produced using plasma spray masking tape. If complex shapes are pre-cut, the operator can mask faster (peeling the profiles from rolls or sheets like a label pad). While this may be great for efficiency what does it have to do with health and safety? You need to consider the large amount of cutting done by operators with sharp razor blades and utility knives: cuts lead to time off for operators and expense to employers. Die-cuts or pre-cuts save time and money while improving employee safety. A win / win situation.

Improve cost, quality, and safety by using pre-cut & die-cut forms.

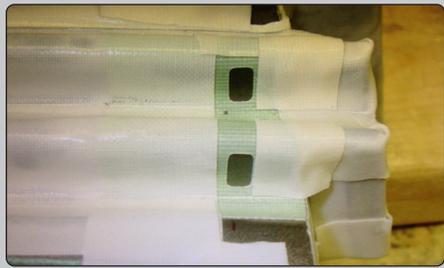
How Do We Calculate the Cost of a Thermal Spray Masking Job?

So back to the original question, "How do we calculate the cost of a thermal spray masking job?" The answer will vary from company to company, but some constant themes will remain. The cost can be calculated by considering: time, labour, masking material consumption, opportunity cost, improved efficiency gains, and health and safety. To begin with the cost calculation, the easiest way may be to look at a production job while recording all of the costs related to that one specific job. Take into account the amount of masking material used as well as the cost of masking material per job.

Record the time involved in masking (in minutes or hours); the shop labour rate must be recorded here as well. Another consideration that must be taken into account is the clean-up time after the coating is complete. Is there adhesive residue that must be manually removed? Is there a coating line that must be machined away or otherwise physically eliminated? Combining all of this information will calculate the very basic costs of the masking job.

The next step is to confirm how many masking jobs the facility has per work shift and multiply that by the number of shifts in the facility per day. The subsequent consideration would be the number of work days per week in the shop.

From here it is simple to calculate the costs per month, quarter, and year.



A part is masked pre-cut tapes prior to the coating process.



The same part is shown above, after receiving the spray coating.

Die-cut tapes save time and reduce the risk of repetitive strain injuries that may occur when employees are cutting profiles by hand.

To take this approach one step further and determine an area for potential cost savings consider alternate masking processes, whether it be as simple as changing the tape used all the way up to different methods such as masking compounds and die-cuts. Using tape as our example, try comparing one manufacturer's product (the current process) versus another manufacturer's product (new potential process). Comparing the two costs side-by-side represents a very basic ROI calculation.

While cost savings may be discovered at this level, these numbers only tell a portion of the story. The time necessary to complete the job must be added into the equation. Again with side-by-side comparisons, track the time required to perform each masking and unmasking job (with the existing strategy versus the new potential strategy). The questions that need to be answered are: How much time was saved per job, work shift, day, week, month, quarter, and year?

Green Belting Industries is a leading manufacturer of specialty-coated performance fabrics, tapes and belts used in a wide range of manufacturing, packaging, maintenance and repair environments around the world. From the aviation industry to consumer products, we supply performance materials and technical expertise to 21 different industries for use in over 100 applications.

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Secondly, what is the time savings worth (could the facility take on more work)? What is the value of these additional jobs? This of course is the opportunity cost.

By considering all the factors above, it is now possible to define the true cost of masking. Masking is a critical process inherent to producing a thermal sprayed part to acceptable levels of cost and quality. By understanding its real cost a value added approach can be utilized to gain real improvement in margins, quality and delivery improvements and set the stage for increased capacity and capability, key factors in our globally competitive world. Often overlooked, masking is a costly time consuming business typified with repeating quality issues and time consuming use of labour. Green Belting has developed tools and resources to support understanding of the true cost of masking. Using a data driven approach leads to best product selection and establishment of best practice leading to lower cost of production, improved quality, delivery and capacity. Use the right tool for the job!

The purpose of this ROI Calculation is to evaluate current masking costs based on known conditions and evaluate cost savings generated by Green Belting product and value added. All information is strictly confidential between the Company and Green Belting Industries.

To calculate costs for a given job it is important to track:

- Prep time
- Tape usage and cut time
- Application time
- Clean up and rework

Compare methods, calculate time saved, and reduce job cost.

Reduce job cost means:

- Higher margin
- Faster throughput
- Better quality
- Increased capacity

	Cost Per Job	
	Current Process	Green Belting Process
Quantity (Rolls)	2	1
Cost per Roll	\$14.00	\$18.00
Masking Time per Job (minutes)	30.00	15.00
Clean-up Time per Job (minutes)	10.00	1.00
Number of Jobs per Work Shift	5	5
Number of Work Shifts per Day	2	2
Number of Work Days per Month	22	22
Labour Rate	\$20.00	\$20.00
Total Cost per Job	\$41.33	\$23.33
Total Cost per Work Shift	\$206.67	\$116.67
Total Cost per Work Day	\$413.33	\$233.33
Potential Cost Savings per Month		\$3,960.00
Potential Time Savings per Month (hours)		45.00
Potential Cost Savings per Quarter		\$17,146.80
Potential Time Savings per Quarter (hours)		189.90
Potential Time Savings per Year (hours)		759.60
Potential Cost Savings per Year		\$47,520.00

The ROI Calculator available from Green Belting can assist in more accurate and consistent tracking of the costs associated with thermal spray projects.

