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The True Cost of Dip-Spin

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Abstract

At face value, a dip-spin coating application price is attractive compared to a rack-spray coating application price. However, quality issues that accompany a dip-spin process on components that are not suited for such an application can quickly add up.

This white paper aims to address the true accumulated costs associated with a dip-spin coating process when directly compared to a rack-spray process, ultimately proving that a rack-spray coating application is more profitable to a manufacturer's bottom line in the long run.

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INTRODUCTION

A dip-spin, bulk application coating process is the ideal solution for a vast majority of small to mid-size fasteners or hardware and for numerous metal stamping geometries. In these cases, it would not make sense to pursue a rack-spray application as the benefit would not outweigh the cost.

However, many metal stamping geometries are not suited for a bulk coating application. Bends and pockets in the part can result in pooling of coating. Thinner gauged metal can bend and distort during processing. Certain geometries can tangle or nest and cause coating voids or inconsistent coverage. All said and done, a 100% sort could be required after the coating application. In many instances, the sort can yield upwards of 20% fallout, requiring parts to be scrapped or reworked.

Compare this to a rack-spray coating process. Parts are individually hung on a fixture and coated. They never touch during this process, ensuring complete coating coverage and no chance for damage. Parts are taken off the fixture, inspected, and packed. Fallout is less than one percent, if any. In most instances, they can be shipped directly to the end customer.

Regardless of whether it is a fit for bulk processing or not, the price for a dip-spin coating application is appealing. Priced per pound, the cost per piece can be a fraction of what a rack-spray application would be. However, when comparing a dip-spin price to a rack-spray price, the cost of poor quality must be considered.

This whitepaper's aim is to identify these extra costs and compare them to those of a rack-spray coating application to illustrate that although a dip-spin price looks better on paper, it is not necessarily the case in the grand scheme of things.

BACKGROUND/PROBLEM STATEMENT

As the automotive industry became more sophisticated and the necessity for better performing components became prevalent, new materials and metal treatments were developed to take normal stampings and hardware to the next level. In particular, one of the performance criteria that needed improvement was corrosion protection.

Prior to the 1970's, zinc electroplating was one of the only post metal treatments available to boost corrosion protection on small critical components, albeit not by much. Traditional zinc plating offered only about 250 hours salt-spray to red rust at the most. Due to the pre-treatment step necessary prior to plating, this process also introduced hydrogen embrittlement to components, which could ultimately alter their chemical makeup and structural integrity.

Enter zinc-flake coating in the 1970's. A mixture of zinc and aluminum flakes in an inorganic binder, zinc-flake coating offered a sacrificial, corrosion resistant barrier that allowed components to reach 1500 hours salt spray hours or more. Not requiring a dip in an acid tank prior to application, this coating method also eliminated the risk of hydrogen embrittlement.

With the advent of zinc-flake, the dip-spin method of applying coating grew in prevalence. In this method, a perforated basket is filled with parts and submerged into a vat of coating. The basket revolves in the coating to ensure every part has coverage. The basket is then lifted from the vat and rotated at a high rate of speed, effectively "spinning" the excess coating off. Lastly, parts are transferred to a bin or belt and cured in an oven. This process is repeated as needed to build the coating to a certain thickness or if the coating recipe requires different base and top coats.

The above method is an efficient and cost effective way to apply coating to small components, especially hardware like nuts, bolts, screws and springs. However, as the appealing performance characteristics of zinc-flake grew in popularity, the coating was specified on more and more alternative components, like metal stampings, assemblies, wire forms, etc.

Fast forward to today. As vehicle design has evolved, so has the design of its components. Parts are more complicated and more stressed. The byproduct of MPG legislation is lighter vehicles, which ultimately produces thinner and lighter components. And end-of-vehicle requirements means a much higher focus on the quality and longevity of components. More and more OEMs are requiring "soft handling" of components, but still want the performance characteristics of highly functional coatings.

All of the above should be steering automotive suppliers away from the bulk, dip-spin method of coating, most particularly on metal stampings, assemblies or wire forms with geometries that are not suited for bulk processing. Pooling of coating, part distortion, and bare metal or inconsistent coverage from nesting or tangling can all result in the necessity of a 100% sort after coating application, which can yield at least a 20% fallout, or greater, requiring parts to be scrapped or reworked.

As stated, even though the aforementioned should be steering suppliers away from dip-spin, it is not for one simple reason: price. Because it's priced per pound, the cost for a dip-spin coating application is usually a fraction of a rack-spray price would be.

However, compare the dip-spin, sort, and scrap/rework process to a rack spray process. Parts are individually hung on a fixture and coated. They never touch during this process, ensuring complete coating coverage and no chance for damage. Parts are taken off the fixture, inspected, and packed. Fallout is less than one percent, if any. In most instances, they can be shipped directly to the end customer from the coating applicator.

The dip-spin coating method is efficient, cost effective and produces a quality product, but only for the right part geometry. This is the case for not only zinc-flake coating, but any coating. It should also be noted that it is not the coating company or employees at said company that are producing questionable product…it is the PROCESS itself in which some components are simply not the right fit for a bulk application.

When comparing a dip-spin price on metal stampings, assemblies, wire forms, or any part with a complex geometry or thinner gauged metal to the price of a rack-spray application, the cost of poor quality must be considered. Dip-spin pricing does not take into account extra shipping, sorting labor, overhead associated with labor, expediting costs, rework costs, the cost of lost product, and the cost associated with quality defects making it to the customer.

This whitepaper's aim is to identify these extra costs and compare them to those of a rack-spray coating application to illustrate that although a dip-spin price looks better on paper, it is not necessarily the case in the grand scheme of things.

SOLUTION

As stated, the easiest solution to reduce the cost of poor quality is to transfer parts not suited for a bulk application to a rack-spray, "soft touch" coating method. Although the price for this process is higher up front, the overall cost is less when assessing the entire cycle of part processing.

Exempt Parts – These Are Not the Problem

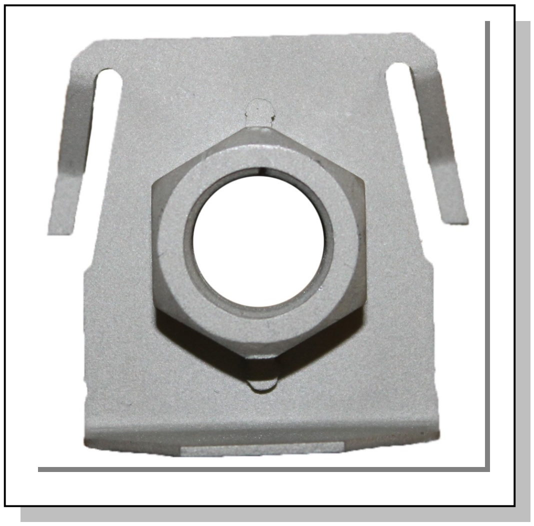
Below are some examples of parts that are very well suited for a dip-spin coating application:

With these components, sorting is not typically required after dip-spin. And if there needs to be a sort, some dip-spin applicators have vision systems or machines capable of performing the sort. In the same way these parts are suited for dip-spin, they are also suited for an automated type of sorting.

Also worth noting is that some small, durable metal stampings can be coated via the dip-spin method. This is especially the case if there is no visual finish requirement. A bulk application method produces an uneven and inconsistent finish from components touching and resting on each other during processing and can be a cause of rejection for some stampings. However, it is extremely difficult to automate sorting of complex stamping and assembly geometries after coating, resulting in the necessity of a manual sort post processing.

Real-World Examples

Following are real-world examples of components that started their production life with a dip-spin coating application and eventually transferred to a rack-spray, “soft touch” coating process.



The above stamping (roughly 1.75” x 1.75”) is used as a mounting bolt in a truck bed. The dip-spin application was bending and distorting the prongs on the edge of the component which resulted in the parts falling out of their position during truck assembly. As a result, the manufacturer had to 100% gauge every part after processing, resulting in more than 20% rejection. Of the rejected parts, over 80% could not be reworked and were scrapped. After switching to a rack-spray process, parts are no longer sorted and they are sent back to the manufacturer in labeled dunnage ready to ship to their customer.

The above stamping (roughly 4” x 1”) is a mounting bracket. The protrusions, bends and pockets caused inconsistent coating coverage and voids due to entanglement during the dip-spin coating application. For the same reason, the parts would also end up bent or distorted and required a 100% sort that resulted in over a 20% rejection rate. After switching to a rack-spray application, the sort was eliminated and parts were packed in dunnage ready to ship to the manufacturer’s end customer.

The above stamping (roughly .75” x 1.2”) is used in a rearview mirror assembly. The purpose of the coating is to create a controlled coefficient of friction for a consistent feel on a toggle-switch. To ensure each part had coating and that dimensional tolerances were maintained, the parts ran through a vision system at the manufacturer’s facility after dip-spin processing. Over 80% of the parts were rejected for being either out of dimension or for inconsistent coating coverage. They could also not be reworked. After switching to a rack-spray application, the post sort for coating coverage has been eliminated and the customer no longer lost the bulk of the parts they manufactured to scrap.

The above weld assembly (roughly 3” x 5”) is an O2 sensor bracket harness. The dip-spin process yielded over 25% scrap/rework after sorting post coating due to pooled coating and parts being bent out of tolerance. Because of the volume and complexity of the part, multiple people were required for sorting. After switching to a rack-spray application, parts were packed in dunnage ready to ship to the manufacturer’s customer and the sorting process was eliminated.

The above stamping (roughly 3” x 5”) is a mounting bracket. The dip-spin process produced blisters and pooled coating in the corner of the deep pocket that would flake off during handling, leaving bare metal exposed. Sorting was required and although it did not result in the need for scrapping the part, it did necessitate reworking the rejected components, ultimately resulting in double processing. Once the rack-spray process was implemented, the need for sorting and reworking was eliminated.

In the various real-world examples above, one can conclude that part rejection, scrapping, reworking and sorting all incur extra costs. But how much cost when doing a direct comparison with a dip-spin piece price versus a rack-spray piece price? Figure 1 and the accompanying data demonstrate how the cost of a process that does not yield quality parts can add up. However, there must be some assumptions made in order to demonstrate comparative data. Those assumptions are below, including the assumption that parts are shipped directly to the manufacturer’s end customer from the rack-spray coating facility:

Processing Lot Size: 5400pcs
Weight of Component: 0.24lbs
Dip-spin price per LB: $0.20
Dip-spin price per piece: $0.052
Rack-Spray Price: $0.133 – based on a current production part of equal size
Shipping Cost: LTL Rate of $109, assumes 1300lb shipment sent 200 miles
Labor Rate: $12.00 an hour – does not include benefits
Sorting Rate: 1500pcs an hour – based on current time study averages
Packing Rate: 4000pcs an hour – based on current time study averages
Scrap Rate: 20%, which is the low bar of the above real world examples

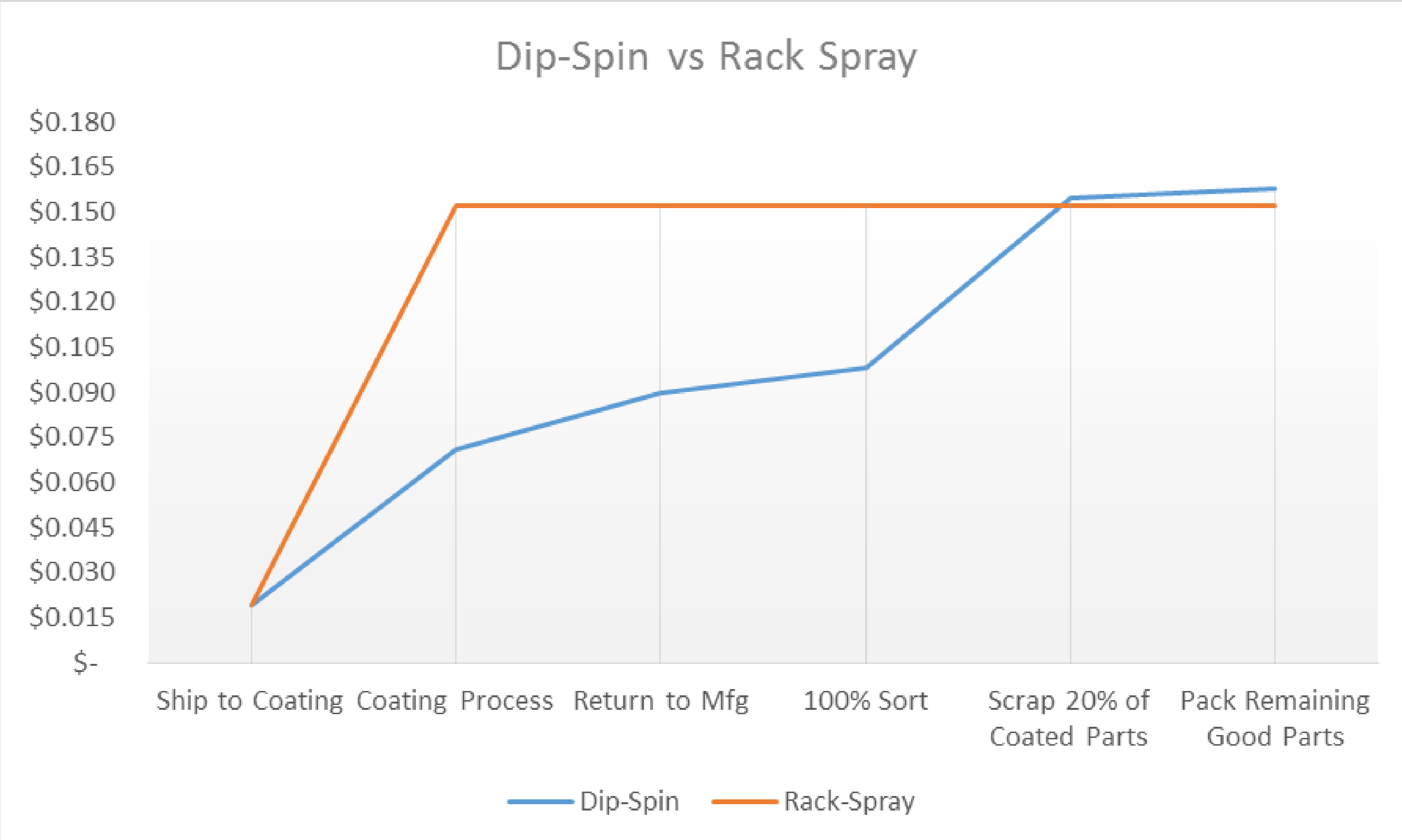


FIGURE 1

Accumulated Cost of Dip-Spin vs Rack-Spray Processing		Dip-Spin			Rack-Spray
	Cost	Accumulated Cost		Cost	Accumulated Cost
Ship to Coating	0.019	$ 0.019		0.019	$ 0.019
Coating Process	0.052	$ 0.071		0.133	$ 0.152
Return to Mfg for Sorting	0.019	$ 0.090		0	$ 0.152
100% Sort	0.008	$ 0.098		0	$ 0.152
Scrap 20% of Coated Parts	0.057	$ 0.155		0	$ 0.152
Pack Remaining Good Parts	0.003	$ 0.158		0	$ 0.152

As demonstrated above, additional steps in processing can quickly add up. However, it should be noted that this is a “bare bones” comparison. Not included in the manufacturer’s additional dip-spin costs are: benefits and overhead for staffed sort and pack labor, cost of reworking rejected parts (the above assumes parts will be scrapped and not reworked), expediting costs to recover lost product, excess inventory to compensate for potential lost product, potential late delivery fees, and any salaried labor for dealing with quality corrective actions or 8-D’s. Add any of the aforementioned costs to the dip-spin costs and it rises exponentially higher than the comparative rack-spray price. A link to a customizable spreadsheet to compare costs using actual rates and pricing is included in the Additional Resources section.

A note about the assumed costs: these are particular assumptions based on industry averages and market knowledge. They may be higher or lower from manufacturer to manufacturer and the dip-spin/rack-spray pricing may fluctuate up or down from coating company to coating company.

CONCLUSION

Through real world examples and comparative data it has been shown that, ***for certain part geometries,*** a dip-spin coating process is actually more costly in the long run than a rack-spray coating process.

It must be emphasized – the purpose of this white paper is not to slander the dip-spin coating process. Dip-spin, or any other bulk coating application, has its advantages and is a very efficient and cost effective way to apply coating to a vast array of certain components.

This white paper's purpose is to be a resource for manufacturers to reference during the upfront bidding process when trying to secure new work that requires a functional coating.

However, unless a spray process is specified on the print, an end customer considers only upfront pricing. This inevitably leads to work being sourced with a dip-spin price and process on certain part geometries of which it is not suited. One way to combat this endless cycle is for manufacturers to learn what is and is not suited for a dip-spin coating application, and for them to educate their end customers.

Automotive design and manufacturing is more advanced than ever. With those advancements comes a demand for better performing and higher quality components. Demanding the quality of a rack-spray component processed in a dip-spin method does not benefit anyone involved, from the coating company experiencing undue burden, to the manufacturer dealing with constant quality issues and their accompanying costs, to the end customer dealing with potential late shipments and deadlines. Addressing the challenge upfront and educating the end customer on the necessity of a rack-spray coating application ultimately benefits every party in the long term.

ADDITIONAL RESOURCES

- Visit http://www.decc.com/Dip-Spin_vs_Rack-Spray for a downloadable infographic that quickly illustrates the main points of this white paper, as well as a downloadable Excel template that can be populated with you actual costing, rates and pricing for comparative purposes

FOR MORE INFORMATION

For more information, please contact salesgroup@decc.com