BACK TO BASICS

ESTIMATING SHEET METAL FABRICATION COSTS



A Step-By-Step Guide to Understanding How Fabricated Parts Are Estimated





IS THIS EBOOK RIGHT FOR ME?

Not quite sure if this ebook is right for you? See the below description to determine if your level matches the content you are about to read.

INTRODUCTORY



Introductory content is for practitioners who are new to the subject. This content typically includes step-by-step instructions on how to get started with estimating sheet metal parts. After reading it, you will be able to execute basic cost models with your supply chain.

INTERMEDIATE

Intermediate content is for leaders who are familiar with the subject but have only basic experience in executing strategies and tactics on the topic. This content typically covers the fundamentals and moves on to reveal more complex functions and examples. After reading it, you will feel comfortable building cost models for all your metal parts.

ADVANCED

Advanced content is for leaders who are, or want to be, experts on the subject. In it, we walk you through advanced features of global metal part sourcing and help you develop complete mastery of the subject. After reading it, you will feel ready not only to execute strategies and tactics, but also to teach others how to be successful.









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LEAN MANUFACTURING



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INVENTORY OPTIMIZATION



FLEXIBLE ASSEMBLY



FLOW STABILIZATION









ESTIMATING SHEET METAL FABRICATED PARTS

by Rob Olney

Rob is president of ETM Manufacturing and has been applying the principles of open book management since his first day on the job.

Previously, Rob was the Director of Sourcing and Product Development at Staples where he worked on 100+ new product launches with 50+ suppliers located around the world.

Rob is passionate about helping improve customers' competitiveness as a key to keeping jobs local and improving our communities. He blogs regularly about controlling product costs and the supply chain at www.ETMmfg/blog.



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Why should you care about your suppliers' costs?

Let's face it, we all have too much to do with too little time. With the time we have available, most is spent in meetings or troubleshooting issues. Why does it help to understand sheet metal fabrication costs? We have found that some of the meetings and issues can be avoided once we understand the drivers behind sheet metal fabrication costs. Lot charges can be avoided if order quantities vary slightly. Non-recurring engineering (NRE) charges can be minimized with small deviations from the drawing. Lead times can be shortened once material grades are taken into consideration. The more we know about fabrication costs, the more we can provide lower cost designs.

In some cases, we have strategic sources that are valuable to the project, yet additional costs savings are required. Working together with our suppliers, we can identify areas that have the biggest effect on costs and go to work as a supply chain team to reduce lead times and lower costs. Transportation costs between companies and inside each company can be as much as 50% of the product costs and lead time. Once costs are understood throughout the supply chain, new ways of coordinating work can be developed that save everyone time and money. These changes can be implemented on one project, then easily transferred between projects.

Our mission is to help our customers improve their competitiveness. Sometimes this is a lower piece price, but often it involves solving long established supply chain redundancies to uncover deep savings and significant lead time reductions.



Our experience has shown us that by working together, we can challenge long held assumptions about how an assembly is designed as well as how it is manufactured.

One customer came to ETM to help reduce costs by 10%. We took one look at the design and new we could save even more by redesigning the assembly to eliminate parts. The end result was fewer parts, but also less assembly time and improve ease of use.

Another customer needed help meeting their cost target. After reviewing the total costs of the assembly, we noticed that almost 20% of the part cost was transportation. Instead of shipping heavy metal parts to the contract assembler, the customer re-configured the supply chain to ship the lighter parts to ETM, where we assembled the unit, and then shipped directly to their customer from ETM.

Every day we share our sheet metal estimating knowledge with our customers so we all make informed decisions to improve competitiveness together. We believe ETM can be a competitive weapon instead of a reluctant cost on your bill of materials.





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Just How are Sheet Metal Fabrications Estimated?

Most original equipment manufacturers (OEMs) request quotes from two to five suppliers for their sheet metal fabrication requirements. Pricing between suppliers can differ by as much as 50%. Why does the pricing fluctuate so much? More importantly, will sourcing to the lowest cost supplier really cost the company the least? Understanding the costs of a sheet metal part will help you evaluate the choices each supplier is making to provide their price.

First, let's take a look at some of the key components of a sheet metal fabrication quote. Typically they include four important areas: materials, labor, services and overhead. You will see in this eBook that costs can be transferred between categories depending on the cost, quality and lead time targets required for the project.

Materials

In this case, the materials included in this category are raw materials like sheet stock, bar stock and rod stock. Most sheet metal fabricators also include purchased materials such as hardware, gasketing, other components purchased for the product that is shipped to the customer. Some might include packaging, particularly unique packaging, in the materials category although most include packaging materials in the overhead category. Other materials such as punch tooling or press brake tooling as well as general shop supplies like oils, towels, and coolant are typically categorized as overhead costs.

One "hidden" materials cost is the in-bound freight costs. Sometimes this cost is included in the price of the material. In other cases, it is added as an additional cost on the invoice, but the buyer is never aware of the costs. In other cases, the material is shipped in on our account and shows up in a monthly bill. When all of these costs are









clear each cost is assigned to the product cost. If the "hidden" costs are not clear, then the costs are spread over the entire customer base or a portion of the customer base. Depending on the effectiveness of the sheet metal fabricator's accounting system, you could be paying more (or less) than your fair share of these in-bound freight costs.

Labor

There are several ways to look at the labor category. Direct labor is the labor cost assigned to make the products. Indirect labor is the cost assigned to run the business. Every supplier needs both types of cost and every supplier may take a slightly different approach to what labor cost is assigned to each category. For example, one company might assign engineering labor as a direct (part) cost and another supplier might assign engineering labor as an in-direct (overhead) cost. Here again, depending on how each supplier assigns these costs in their accounting system, you could be paying more (or less) for your fair share of indirect costs.

Here is a simple example to illustrate the point:

	Supplier A	Supplier B
Materials	\$100.00	\$100.00
Direct Labor	\$100.00	\$100.00
Engineering	\$100.00 (direct)	20% (indirect)
Total	\$300.00	\$240.00

In this case, Supplier B will provide a lower price than Supplier A only because Supplier B chose engineering to be an indirect cost using a 20% charge across all products. Supplier A might have a more accurate cost, but higher. Note that the opposite outcome will result on a less complex part where the direct engineering cost is \$20.

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The point here is that "accurate" costs are not always the "right" costs in the eyes of the customer. Sometimes pricing differences like the one in the example can be evened out in services costs or overhead costs.

Services

In most product companies, there is a decision to be made on whether to "make" or "buy" a particular component. Sheet metal fabricators also have these same choices. The most significant choice involves coatings such as plating or powder coating. In many cases, the cost of the equipment is simply too much given the small amount of customer requirements for the coating. In other cases, the EPA requirements or the plant space required for the coatings makes in-house coating difficult. In these cases, the choice is to source the service from an outside company. When these services are outsourced, the piece price is assigned directly to the sheet metal fabrication quote.

There are also hidden costs in out-sourcing services. In most cases there are transportation costs to the service provider and back again. Sometimes these costs are disclosed and easily assigned to the product. In other cases orders are grouped, making it difficult to accurately assign to each sheet metal fabrication. There are also a wide variety of fees depending on the supplier: lot charges, set-up fees, hazardous handling fees, storage rental fees, rare material surcharges, handling fees, packaging fees, sales taxes and financing fees can all be hidden or spelled out by the service provider. In most cases, these fees are part of a mark-up that is added on the service cost.

In some cases, it makes sense to "make" the service in-house. In that case, materials, labor, overhead are all separated into categories. Often this is assumed that the in-house costs are lower. Certainly the transportation costs are lower. Sometimes the coating costs are lower, but it will depend on the switch-over cost, the queue time and the idle time involved in the product mix of the sheet metal supplier.

Overhead

Overhead, also called SG&A (Sales, General & Administrative), costs are the costs required to run the business. Typically these are spread out over every item shipped equally as a percentage of the cost of the product. The "Big 5" overhead costs Follow us on







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for a sheet metal fabricator are:

- 1. Office wages
- 2. Sales wages
- 3. Payroll taxes
- 4. Employee health care
- 5. Rent

There are certainly other costs that are significant like marketing expenses, equipment maintenance, building repair, insurances, legal and accounting services as well as training expenses, but these grow (or shrink) with the business and work well when covered as a percentage of product cost.

According to the latest data from Financial Research Associates for Sheet Metal Fabricators with assets under \$2M, the following costs were reported:

General/Administrative Costs	27.23%	
Officer/Exec wages	8.63%	
Sales Wages & Other*	6.85%	*not reported, calculated
Payroll taxes (20% of labor)	5.08%	
Insurance (health, property, etc.)	3.71%	
Rent	2.96%	

The Big 5 expenses don't change as much as the business grows or shrinks. As a result, a sheet metal fabricator may have a certain "fixed" overhead costs that need to be paid regardless of the sales. Most sheet metal fabricators use a sales target and calculate the overhead percentage to cover the expenses and once the sales target is achieved, the overhead costs are covered. As we will discuss later, this can be helpful to know in your strategic sourcing decisions.









Where to Gather Data

Now that we've covered the basic components of sheet metal fabrication costs, it is important to understand the regional effects on costs. Material costs are lower nearer to the source. Labor costs fluctuate due to demand and skill level. Overhead costs – particularly health care costs – change dependent on the age of the employee population. The good news is that much of this information is available to you for free.

In this ebook, we will walk you through the process of locating the sources of the information available, building a cost model from this information and then evaluating the impact of your sourcing decisions based on this information.

From your local library and several important web-sites, there are some key costing data to help complete an accurate costing model. These include:

- Raw material costs, plus conversion costs for sheet, bar and rod stock
- Component and hardware costs
- Hourly labor rates for all key sheet metal positions including some overhead data
- Service cost calculators to estimate outside services
- Healthcare cost estimates
- Determining rent rates based on location and building age
- Payroll calculations and tax estimation
- Determining sales costs

Each chapter will go into greater detail to help you understand the costs, the assumptions and the impact on your sourcing decisions. Now let's get started!







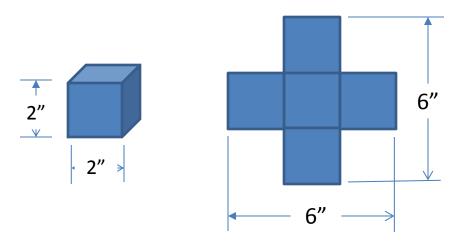


UNDERSTANDING MATERIAL COSTS



It All Starts with Your Lay-flat Dimensions

Every sheet metal fabrication starts with the sheet stock. To determine the sheet stock size, we start with the lay-flat. The lay-flat is the footprint of the part as it is unfolded and laid flat on the sheet stock. Take for instance, a five sided cube, 2" square. When you unfold it, the material is shaped like a cross, occupying a 6"x 6" inch piece of sheet stock.



This part lay-flat will now need to punched or laser cut from a sheet of material. What is the most efficient way to use the material? That depends on the part lay-flat.

All sheet stock is extruded at the mills, slit into 8' or 10' widths and then rolled into coils for transport. At distribution, the coils are flattened and cut into 3' or 4' widths. As a result, sheet stock typically comes in 3' x 8' sheets, 4' x 8' sheets or 4' x 10' sheets. Allowing for a 2" tool clearance between parts, the yield of this part would be 48 pieces per 3' x 8' sheet, or 72 pieces per 4' x 8' sheet, or 90 pieces per 4' x 10' sheet. In the example above, the 8" footprint does not divide equally in a 3' wide sheet, so it will be more cost effective to use a 4' wide sheet.

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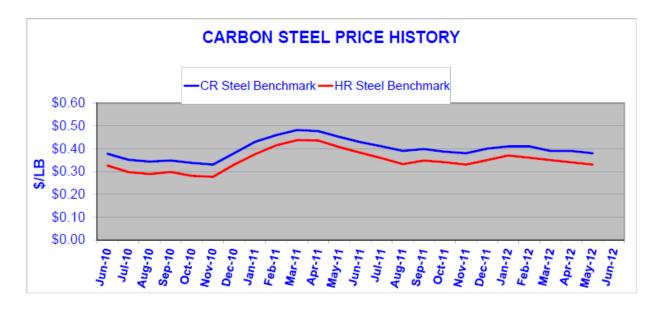






Carbon Steel Costs

Most raw material costs are listed by the London Metal Exchange (LME). These prices are commodity prices listed on the day of trading. To convert these spot prices to price paid by the sheet metal fabricator, first go back 30 days from today to when your material was purchased, then add a 20% conversion fee (raw ingot to sheet stock delivered to your fabricator). This will provide fairly accurate pricing. For example, current coiled rolled steel pricing from several distributors is \$0.54/lb. Go back a month to get the spot price of \$0.45/lb, multiply by 1.2 to get today's current price of \$0.54/lb.



Source: https://www.yarde.com/documents/carbonsteel.pdf

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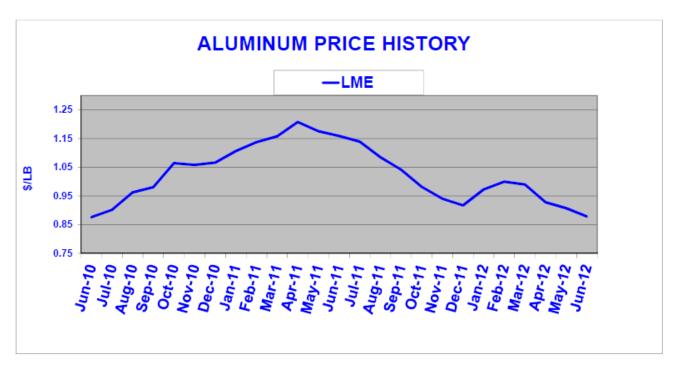


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Aluminum Costs

As you can see from the chart below, aluminum pricing varies considerably based on supply and demand. Last month's spot price is considerably different from this month's spot price. For large orders, sheet metal fabricators check pricing with their distributors. On small orders, most sheet metal fabricators use an average so that their price doesn't fluctuate too much for their customers. For aluminum, the conversion rate is about 1.8, so an LME price of \$1.00/lb is about \$1.80/lb from distribution.



Source: https://www.yarde.com/documents/aluminum.pdf

Why not buy and hold? Just like your stock portfolio, it is very difficult to pick the low point for any given commodity. Weekly orders of similar size does that same as "dollar cost averaging" does for your portfolio. Although prices can fluctuate by 20%, buying low and holding ties up precious cash for the low-margin sheet metal fabricator.

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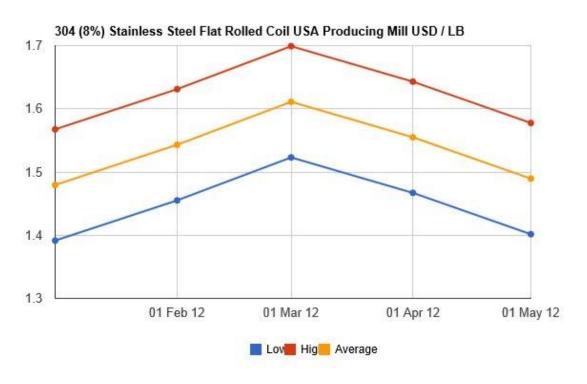






Stainless Steel Costs

Stainless pricing is harder to pinpoint only because several grades are used by sheet metal fabricators and several raw materials are used to create stainless steel alloys. There are several options for types of stainless as well as material formats. We use a conversion rate of 1.5 for stainless steel, but this can vary greatly based on material grade, finish and availability. Here is an historical example for 304 stainless:



Source: www.metalprices.com.

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Calculating Material Costs per Part

A common mistake made in calculating the material cost of a part is to take the weight of the part and multiply by the cost per pound of the material. In sheet metal fabrication, an entire sheet is ordered to make the parts. Material costs must include the extra material not used in the part, but included in the sheet.

Determine Your Sheet Stock Cost

A simple call to your local material distributor will help you determine the sheet stock price. Sometimes, volume purchases do lower the price. Other times, prices are lower if the material is in stock. Keep in mind the material price you are paying for now was actually purchased by the distributor almost 30 days ago! This is particularly important in inflationary (or deflationary) times.

Use Your Lay-flat To Calculate Sheet Yield

Take the part you are estimating and unfold it in your mind to have it lay flat on the sheet stock. Use your longest and widest dimension to establish a foot print. Add a 2" border to allow for tooling clearances. Plan out the footprint on the 3 different sizes of sheet stock to determine the best yield. Then, divide the sheet cost by the yield to get the true material cost per part.

One note about scrap costs. Unused material (aka scrap) is collected and sold to recycling companies. Typically scrap pricing is about 10% of the virgin material. So for example, if the sheet stock cost was \$20/sheet, and there was 20% scrap, then that means \$4 of virgin material was not used, with a total scrap value of \$0.40. We then add the labor cost to move the scrap sheet to a pallet (\$0.20), then the labor to load the scrap truck (\$0.05), then the carrying cost of the material (\$0.12) and total costs are \$0.37 for a net profit of \$0.03 per sheet on the scrap material.

There are exceptions. Sometimes the part creates an awkward lay-flat which in turn creates excessive scrap which needs to be included in your part cost. Other times, the cost to nest parts together can be recouped by the scrap savings.

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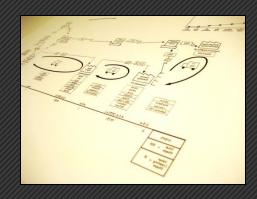






GET GREAT MATERIAL PRICING EVERY TIME

We provide industry best pricing for cold rolled steel and aluminum sheet stock to give you the competitive advantage you need. Lay-flats are optimized for maximum material yield to lower cost and improve throughput. Volume discounts for hardware.





Learn the latest raw material pricing and its effect on part costs



Easily compare the engineering costs to nest parts versus the scrap cost without nesting



Use ETM material calculators to better understand the cost of your material choices

Request a Quote

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Hardware Material Costs

The most common sheet metal hardware are PEM hardware designed by PENN Engineering (http://www.pemnet.com/) and distributed in New England by DB Roberts (http://www.dbroberts.com/). Almost every sheet metal fabricator in the region buys from the same distributor at very similar pricing. The actual costs are very small relative to the cost a sheet metal part. Here are some examples:



Nuts with load bearing threads for sheet metal. Price varies from \$0.05/pp to \$0.15/pp depending on size and length.



Blind threaded fasteners for sheet metal. Price varies from \$0.10/pp to \$0.35/pp depending on size and length.



Flush head threaded stand-offs for sheet metal. Price varies from \$0.05/pp to \$0.35/pp depending on size and length.



Blind threaded standoffs for sheet metal. Price varies from \$0.05/pp to \$0.35/pp depending on size and length.





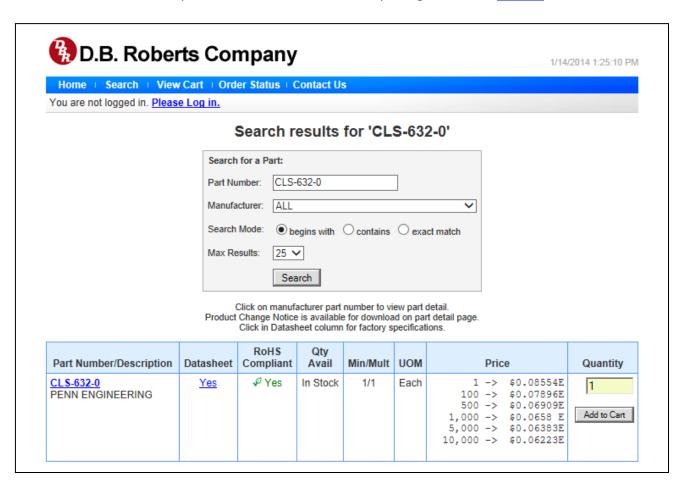




Specific Hardware Costs

Most hardware costs are sheet metal specific hardware, designed predominately by the <u>PENN Engineering</u> group. This hardware is commonly called "PEM fasteners." The only regional distributor for PEM hasteners is <u>DB Roberts</u> which controls the price of hardware for all sheet metal fabricators in New England. Typically no special pricing is provided except for volumes breaks, so there is little price advantage based on who your supplier is. Larger suppliers may have more inhouse inventory which may help.

Here is an example of PEM Fastener hardware pricing from their eStore:



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Finishing Costs

Unlike sheet metal hardware costs being controlled by one distributor in the region, painting and plating services vary greatly based on quality, speed, part size and quantity. Here are some examples:





Zinc Plating (for steel) to protect against rust. Shown here in clear zinc and yellow zinc. Pricing is typically \$0.20 - \$0.25 per sq. in.





Anodize Plating (for aluminum) to protect against oxidation. Shown here in black and clear although many colors are possible. Pricing is typically \$0.24 - \$0.27 per sq. in.





Chromate Plating (for steel) to protect against rust. Shown here in clear chromate and yellow chromate. Pricing is typically about \$0.20 per sq. in.





Powder Coating (for steel and aluminum) to protect and add color. Most colors and textures available. Pricing varies widely; however, pricing is typically \$0.20 - \$0.25 per sq. in.

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Packaging Costs

Smaller sheet metal fabricators are more likely to re-use their in-bound raw material packaging to ship product to their customers. It may not look uniform or pretty, but it saves you \$2 - \$4 per box. This can add up if your part is unusually shaped. Pallets can also be re-used; however, strapping cannot. Depending on the size and weight of your parts, 2 plastic straps (\$1.50) would work or 8 steel straps (\$2.00) might be needed.

Larger sheet metal shops receive more incoming freight on pallets and less in boxes. There just aren't enough boxes to re-use. As a result, boxes and packaging inside the boxes is purchased. Wrapping paper, bubble wrap, and tape also adds to your piece part costs. Progressive supply chains work on re-usable containers to avoid the extra packaging cost (and waste).



Using re-usable packaging signals your supplier to fill up just like your waitress fills up your empty coffee cup. No more, no less – just the right amount.

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Consigned Materials

Consigned materials are purchased by the OEM and shipped directly to the sheet metal fabricator. Sometimes OEMs with multiple suppliers can get better pricing directly with a mill. Sometimes the material risk is too high for the sheet metal fabricator (rare or shelf-life limited) and the OEM is required to purchase the material. Other times the OEM provides "left over" material from another source.

While the cost advantages may be clear, there are issues to watch out for. On the OEM side, realize you are paying for material for your product and the associated scrap. Under supply your fabricator and you run the risk of a very expensive end run. Sometimes there are unexpected handling and/or inventory costs. Work with your supplier to understand the total cost savings (lower material and higher handling costs may be zero-cost advantage).

Consigned materials do not mean no material costs. Your sheet metal supplier still needs to receive the material, move it, store it, protect it and inventory it until ready for use. Typically sheet metal suppliers add a mark-up percent to cover this cost which may or may not work to your advantage.







DETERMINING TRUE LABOR COSTS



"Hourly rate is just one part of the labor equation"

When we look at sheet metal fabrication labor rates, the first thing we consider is the hourly rate. Typically the hourly rate for more complex work centers are higher than less complex work centers. In addition to hourly rate, equipment costs, energy costs, and floor space requirements all roll up to the "shop rate" of a particular work center.

Here is a simplified example for a sheet metal mechanic fully loaded direct hourly rate.

Cost Component	Rate
Labor Rate	\$20/hr
Time Off Allowance	\$1/hr
Payroll Taxes	\$5/hr
Health Benefit	\$4/hr
Insurances	\$5/hr
Equipment	\$6/hr
Maintenance	\$2/hr
Supplies	\$2/hr
Utilities	\$2/hr
Floor Space	\$1/hr
Total Direct "Labor" Costs	\$48/hr
Assume 80% Efficiency	\$60/hr

Note - Keep in mind that some of these costs vary with the labor rate and other costs vary with the equipment.

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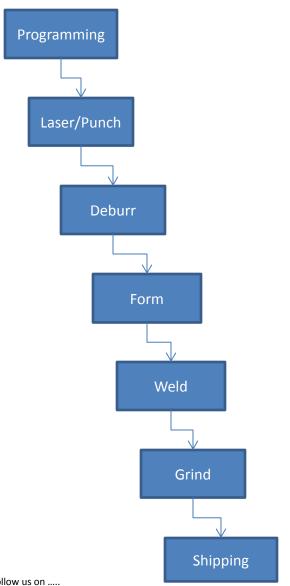






Understanding Workflow

Prior to calculating the total labor costs of your part, we need to understand the work flow for the particular part. Here is the typical work flow for a sheet metal fabrication:



Programming: If a solid model is provided, programming time is saved.

Piercing: Depending on the part, punching or laser cutting is more appropriate for the part.

Deburr: Also known as "timesaving" and can vary considerably depending on cosmetics.

Form: Sometimes an extra tooling charge saves considerable forming time.

Weld: Spot welding saves time over seam welding (MIG or TIG).

Grind: A better weld (aka more expensive) can save grinding time.

Shipping: More packaging time is needed if cosmetics are important.

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Programming Labor Costs

Any fabricated part that is new to your fabricator will need to be programed for the machines running in the shop. Two important variables in the programing costs are part complexity and programming queue time. Most programming costs involve labor and software.

Typical CNC Machine programmer	\$75,000
Employee benefits (health, payroll tax)	\$25,000
Solidworks site license	\$5,000
CNC Equipment software license	\$5,000
Training	\$5,000
Annual Hardware improvements	\$1,000
Total Annual Costs	\$116,000
Assuming 1,600 hrs billed	\$72.50/hr
Typical pricing with SG&A	\$90 - \$100/hr

It is important to remember that this cost does not assume that 100% of the engineer's working time is billable to production. In most cases, a constant flow of exactly the right amount of programming does not happen. Instead the work fluctuates from a few small jobs to a large package that take a whole week to program. And, unlike a production worker that may be use to fluctuating work hours, a CNC machine programmer expects to be paid for 40 hours regardless of the demand; any less and you risk losing a great programmer.

Sometimes spending more in programming will save you more over the life of the product. The most expensive parts to program are reverse-engineered projects. In this case, programing costs include disassembling the unit, measuring each part, creating a 3D model and then creating the CNC laser or CNC punching program. This takes longer, so it will cost more; however, if the scope of work is well defined, several cost savings opportunities can be identified and implemented.









Laser Labor Costs

The great appeal of laser cutting is the lack of set-up time. For most sheet metal part geometries, and most material thicknesses, laser cutting is the method of choice for low-volume, high-mix production. Programming is done off-line, so set up is typically less than 15 minutes. Here is a typical breakdown:

Typical CNC Machine operator	\$60/hr
Equipment Depreciation	\$34/hr
Rent, 100 SF	\$4/hr
Laser Gas	\$1/hr
Maintenance	\$2/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$102/hr
Typical pricing with SG&A	\$110 - \$120/hr

The key to laser cutting is a fast cut. Newer machines have faster cut times which is why equipment depreciation is included in the costs. A fully depreciated laser has a lower rate, but a slower cut. After about 5,000 hours (approximately 2.5 years) the resonator needs to be re-built, which keeps the equipment costs high. Oxygen or nitrogen gas helps with a faster, cleaner cut, but the costs breakeven with the faster cut time.

How can you keep your laser cost down? Help with making it easy to cut. Sharp corners make the laser head re-orient, causing a slight pause. Holes add pierce time which slows the cut time. Thick material, especially stainless steel, will slow the laser cut down. The least expensive laser part has sweeping curves and no holes.

A good sheet metal fabricator will spend more on the programming to save time on the laser (spend \$100/hr to save \$120/hr). Set-up time can be reduced further if the fabricator has enough product mix to run parts with similar materials together. When sourcing your sheet metal, consider splitting your RFQ packages by material type or thickness for best results.

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Punch Labor Costs

Once the workhorse of the sheet metal fabricator, turret punches are faster than lasers when the part profile is mostly straight lines, sharp angles and has many holes. Set-up times can be considerably longer since each punch & die has to be loaded into the machine. As a result, punching is typically used on parts purchased in larger quantities. Here is a typical cost breakdown:

Typical CNC Machine operator	\$60/hr
Equipment Depreciation	\$35/hr
Rent, 100 SF	\$4/hr
Punch Tooling	\$1/hr
Mantenance	\$1/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$102/hr
Typical pricing with SG&A	\$110 - \$120/hr

Punching technology has matured and now minor innovations bring incremental improvements. Automated tool grinding and tool changers help produce accurate parts incrementally faster. Automated loading/unloading is more effective with a punch since a punch is used with higher volumes.

Most job shop sheet metal fabricators have a wide variety of standard tooling that can be used to punch different geometries. Unique tooling is charged to the specific customer requiring that tooling. To gain additional punching efficiencies, talk with your sheet metal fabricator about custom tooling that could reduce the punch time even further (and lower costs).

Should you be impressed with automated sheet loaders? In high volume applications, many sheet metal fabricators purchase sheet loaders so the punch can operate unmanned 24/7. Using the breakdown above, they "remove" the labor cost, but "add" back additional equipment costs, rent, programming, maintenance, electricity, etc. The effective rate stays the same, but capacity is now 50% because a sheet loader is taking up the space where another punch could be operating.

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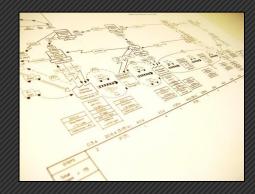






LASER CUT VERSUS PUNCHING — MORE THAN JUST COST DIFFERENCES

Both machines cost about the same amount, can be operated by the same level of operator and take up about the same amount of floor space. With the costs similar, the part geometry will tell us which method is right for your part. Shorter runs are typically best for laser cutting and longer runs are better for punching, but not always.





Use our checklist to evaluate which is better for your part – laser cutting or punching



Learn about set-up time differences and how they impact the part costs



Review your cosmetic requirements so you can impact edge finish

Request a Demo

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Deburring Labor Costs

When a part profile is either laser cut or punched, small tabs are added to the part to keep the part with the sheet as more parts are cut or punched. When the sheet is removed from the machine, the sheet is shaken and the tabs break to release the part. Is the sheet is well-programmed, the tabs can be hidden when the part is formed or easily removed with a hand deburring tool. Heavier parts require thicker or more tabs and the deburr costs go up. Here is a typical breakdown:

Typical deburring operator	\$40/hr
Equipment Depreciation	\$4/hr
Rent, 50 SF	\$2/hr
Disposable grinding material	\$1/hr
Mantenance	\$2/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$50/hr
Typical pricing with SG&A	\$60 - \$70/hr

Many parts have a cosmetic surface. One common method of producing a uniform surface is by belt sanding the entire part profile while it is still flat. The most popular supplier to solve this problem efficiently is a company called "<u>Timesavers</u>" and this process has come to be known as "timesaving." If done well, the belt sanding process also removes any sharp edges on the leading and exiting edges.









Forming Labor Costs

Forming costs can vary greatly depending on the skill of the operator and the complexity of the part. A quick look at salary.com and you can see that an entry level sheet metal mechanic's rate can be as low as \$12/hr and a senior level sheet metal mechanic can be as high as \$38/hr. Similarly, small used press brakes can be as little as \$50K and larger new semi-automated brakes can be as much as \$250K. Here is an average breakdown:

Typical CNC Machine operator	\$70/hr
Equipment Depreciation	\$11/hr
Rent, 100 SF	\$4/hr
Tooling	\$3/hr
Maintenance	\$1/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$90/hr
Typical pricing with SG&A	\$100 - \$110/hr

As with punching, set-up time can add substaintial costs to a sheet metal part. Forming technology has not changed considerably over the years, so punches and dies still have to be selected, fit to the machine and then test bends need to be made. Depending on the part geometry, there might be several set-ups to complete a finished parts. Good sheet metal fabricators reduce costs by using a very experienced sheet metal mechanic perform the set-up work and less expensive operator complete the forming.

One way to ensure the sheet metal fabricator is keeping costs down is how they control their set-up costs. Do they use set-up sheets for repeat orders? Do they keep the right tooling close to the right machine? Do they have enough tooling so jobs don't wait while another job needs to finish? Check the scrap bin to see how many set-ups are needed to get the job running.

Newer press brakes offer the option to engineer the forming off-line, so that set-up is reduced. This is only cost effective if the programming (\$100/hr) is less than the press brake time.

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Hardware Labor Costs

Hardware costs usually mean hardware insertion costs although some shops group this into assembly costs. Parts with few PEM inserts are hand loaded into the insert machine. Parts with several inserts (20+) are usually auto fed into the machine. Missing inserts (those that fallout during shipping) are a sheet metal fabricators worst quality issue, so inspection should be part of the hardware costs. Here is a typical breakdown:

Typical CNC Machine operator	\$50/hr
Equipment Depreciation	\$4/hr
Rent, 50 SF	\$2/hr
Maintenance	\$1/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$68/hr
Typical pricing with SG&A	\$75 - \$80/hr

Some parts are designed in a way that requires some forming to be done, then hardware to be inserted and then forming is completed. This can add to the cost since more travel/queue time is required. At other times, plating needs to be completed first, then hardware is inserted, which can be more expensive as well if this is not a typical process flow for the sheet metal fabricator.

One way to ensure that the fabricator is keeping costs down is to observe their practices for 100% correct hardware insertion every time. Do they keep their punch tooling sharpened so the holes are perfect and not oblong? Do they keep templates to check the parts for 100% hardware? Do they color code drawings so the right hardware goes in the right location? These are all best practices to make sure the right hardware goes in the right hole every time and stays there.









Welding Labor Costs

Welding costs not only include labor, but can also mean welding wire and fixturing depending on the job. There are three basic types of welding: spot, tungsten inert gas (TIG) and metal inert gas (MIG). Spot welding uses energy to fuse two faces of sheet metal together. TIG uses an electrode to apply energy to fuse two edges. MIG uses filler wire to fuse two edges together. Each as their own costs:

Typical welder	\$60/hr
Rent, 100 SF	\$4/hr
Maintenance	\$1/hr
Electricity	\$1/hr

For Spot Welding:

Equipment Depreciation \$4/hr

For TIG Welding:

Equipment Depreciation \$1/hr

For MIG Welding:

Equipment Depreciation \$1/hr Welding Wire (assuming 1" per min) \$3/hr

While the costs do vary, most sheet metal fabricators assume the costs are approximately the same and as a result, price welding as follows:

Assuming 1,600 hrs billed \$70/hr Typical pricing with SG&A \$80 - \$90/hr

With welding (and grinding), process time is governed mostly by the skill of the fabricator and not the speed of the equipment. A great welder can weld almost twice as fast as a new welder. Quality improves greatly with skill which in turn can reduce grinding time.

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Grinding Labor Costs

Grinding costs can vary considerably with the skill of the operator and the requirements of the customer. "Free of burrs and scratches" can mean removing punch/laser tabs and one pass on the "timesaver". It can also mean blending the corners of each edge and several passes through the "timesaver". The customers' cosmetic requirements determine the grinding costs as much as anything. Here is a typical cost breakdown:

Typical operator	\$45/hr
Equipment Depreciation	\$2/hr
Rent, 100 SF	\$2/hr
Punch Tooling	\$1/hr
Maintenance	\$1/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$52/hr
Typical pricing with SG&A	\$60 - \$70/hr

Below are some common drawing notes and the process costs to meet these standards:

"Break all edges": sometimes means "timesave "both sides in the flat, other times it means grinding the edges of the formed part.

"Free of burrs and scratches": deburr the tabs and "timesave" the outside surface

"Mill finish": "timesave" both sides in the flat

"Class A finish": blend all outside welded corners and orbital sand outer surfaces

"Mirror finish": sequentially "timesave" in finer increments, grind corners and edges in the same way to achieve a reflective surface (typically for chroming).

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Packing Labor Costs

Packing costs (vs. packaging costs) can vary significantly based on the size of the part, the distance to be transported and the size of the order. Heavy parts usually require more, smaller boxes and are shipped via a pallet. Lightweight parts can be shipped UPS. For ETM Manufacturing, all quotes are "freight on board" (FOB) our factory, so more packing expense can save you transportation costs or part damage.

Typical shipping clerk	\$45/hr
Equipment Depreciation	\$1/hr
Rent, 50 SF	\$2/hr
Maintenance	\$1/hr
Electricity	\$1/hr
Assuming 1,600 hrs billed	\$50/hr
Typical pricing with SG&A	\$60 - \$65/hr

Part of the packing cost is also the packaging cost. Delicate or cosmetic parts require more packaging, and large parts may be strapped to a pallet. Here are some general guidelines:

Small box	\$1.00/box
Medium Box	\$1.50/box
Large Box	\$2.00/box
Strapping	\$2.00/yd
Pallets	\$20.00/pallet
Foam Inserts	\$5.00/ft ³
Wrapping Paper	\$20/roll

So, for example, let's say there is an order for 100 assemblies. If five pieces fit in a medium box, then the packaging cost would be \$30.00 (boxes), plus \$5.00 (paper), plus \$20.00 (pallet), plus \$2.00 (strapping) for a total of \$57.00 or \$0.57 per assembly not including labor. Returnable packaging might cost \$1 per assembly the first time, but eliminate future packaging costs.

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THE BIG 5 OVERHEAD COSTS



"The Big 5 control over 80% of overhead costs"

Every manufacturing business has five major overhead costs associated with running a plant: office wages, sales wages, payroll taxes, health care and rent.



In most manufacturing companies, the biggest impact on overhead costs are ranked as follows: #1 office wages, #2 health care, #3 sales wages, #4 rent and #5 payroll taxes. Most can be controlled with the right productivity programs, although rent and sales wages are based on utilization.

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"Good" vs. "Bad" Sales and Administrative Costs

Every business needs sales and administrative costs to keep running; however, some costs are wasted and the customer bears the cost of that waste. Eliminating the waste reduces the costs and as a result prices can be lowered.

Sales, Marketing & Advertising Wages

Considered by many a "necessary evil", our sales team only exists to provide a steady stream of business for our factory. As customers reduce forecasts and shorten lot sizes, more risk is introduced to the production schedule. To mitigate that risk, new customers need to be added to the production schedule to ensure that all costs are covered. Steady forecasts reduce the risk and therefore reduce the sales costs.

Inside Sales, Estimating & Quoting Wages

Multiple bidding situations mean that more quoting will be done than orders received. In general, if a new customer is quoting to three suppliers, a sheet metal fabricator would expect to receive 33% of the parts quoted. That's a 33% efficiency rate. The frustrating part is that the cost of quoting the other 66% is passed on to the customer purchasing the 33%. Once more, the customer is actually paying 100% of three quoting groups to quote the package. Sounds wasteful, plus none of the three fabricators get the efficiency of full production and so that cost is passed on to the customer as well.

Accounting & Finance Wages

Every business needs to order material, receive material, enter the material invoice, pay the material invoice and file the paperwork. Or do they? Internet businesses have shown us that if we can reduce the variability, then these processes can be automated.

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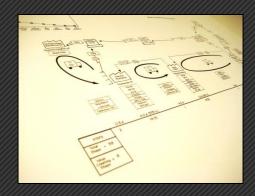




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SAVE MONEY BY TACKLING THE INFORMATION INEFFICIENCY

If you truly believe that time is money, then how we communicate can cost or save our companies thousands of dollars. Together we can process map the information flow between the companies to identify and eliminate wasted time in quoting, issuing POs, confirming POs, and confirming deliveries.





Create standard ordering processes to eliminate missed orders



Establish communication procedures for push-ins and pull-out



Create seamless visibility throughout the supply chain to react quickly to customer changes

Request a Demo

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Payroll Taxes

One significant contributor to overhead costs is payroll taxes. As we add labor or increase wages, this expense goes up. If we increase productivity, these costs can go down. Here is a monthly breakdown for a typical 25 person sheet metal fabricator:

TOTAL	21.09%	\$4876
Payroll management costs	0.51%	\$120
State Unemployment Insurance	12.33%	\$2901
Federal Unemployment	0.60%	\$135
Social Security/Medicare	7.65%	\$1720

If customer and supplier work together to even out demand, then layoffs are reduced and the state unemployment insurance costs will go down.

Why not use contract labor? Some sheet metal fabricators have significant fluctuation in demand. In those cases, they may consider adding temporary labor or "1099" contract labor. Unfortunately temporary staffing firms charge more than 21% by including their profit, so this solution is only effective if they have quick access to the right labor pool. "1099" contractors shift the payroll costs from the employer to the employee, but the total cost stays the same, so there is usually no cost advantage.

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The Impact of Health Care Inflation on Part Costs

In the United States, employers are required to pay for at least 50% of the health care costs of an individual and 33% of a family plan. All companies with less than 50 employees are required to go through a broker and incur that additional expense. For companies in Massachusetts, the law prohibits employers from forming a collective group to negotiate a lower rate for their group. Rates vary from \$700/month for an high-deductible individual plan to \$3,000/month for a full service family plan.

For example, a typical sheet metal fabrication shop of 25 employees might have 15 employees that will require coverage and mostly the older employees will sign-up for coverage. An average plan costs \$1,400/month per person so with the company paying 50%, the health care cost is \$10,500 per month. A 25 person shop might ship 5000 parts per month, so \$2.10 of every part shipped is for health care costs.

As the manufacturing workforce ages, the health care costs increase. For the past five years, our health care costs have increased 20% - doubling every 5 years. This means the heath care portion in the example above would grow to \$4.20 in 5 years. Health care inflation is cited as the #1 cost concern with sheet metal fabricators.

Health care costs are controlled in one of three ways. First, hire workers that do not need health care coverage. These are typically workers that have a spouse with coverage or they are offered coverage through the military reserves. Second, hire younger workers, who lower the risk pool and as a result, reducing the health care premiums. Lastly, grow the workforce to over 50 employees to negotiate directly with the healthcare providers.

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Determining Rent Costs

Estimating rent for manufacturers is relatively easy. Most manufacturers boast about the size of their facilities, otherwise it is listed in a D&B report. Similarly, rental rates per square foot can be easily determined at sites such as LoopNet.com. For example, we have a 43,000 SF building in Littleton, Mass. where the industrial lease rates are around \$7.50 NNN (not including taxes, insurance or utilities). Rent for a building such as ours would be calculated to be \$322,500/yr or \$26,875/mo. How does that factor into your piece part costs?

To understand the rent costs on a piece part basis, consider the square footage required to produce your part (i.e., 2,000 SF) and the time to produce your order (i.e., 20 hours). With this example, $$7.50/\text{SF} \times 2,000 \text{ SF} = $15,000/\text{year} \text{ or }$144.23 \text{ for } 20 \text{ hours}$. If manufacturing is done in a rural area with \$5/SF lease rates, the rental cost for that example would be \$96.15 or if the manufacturing is done in an urban location, with $$10/\text{SF} \times $10,000 \text{ job}$, the rental difference from rural to urban might be \$1%.

How do you help lower the cost impact for your parts? Help fill the capacity. If your sheet metal fabricator is working one shift, the rent cost is spread over that single shift. Add a second and third shift and that rental costs per part can be cut in half. Don't have enough work to fill up your sheet metal fabricators? Consider consolidating your warehouse space so the fabricator is keeping your stock at his location. You win by opening up more space in your warehouse and he wins because he can cover more of his overhead to keep your piece part cost low.

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BEWARE OF THE HIDDEN FREIGHT "TAX"



Transportation as a Hidden Tax that Robs Customers

Taiichi Ohno, executive vice president of Toyota Motors, famously remarked that he thought that there was 95% waste in everything Toyota made. In fact, lean methodology is based on the customer only paying for value produced, not for waste. Electronic communication has eliminated most transportation waste for information. How do we do this for material and product?

Raw Materials

Pick raw material suppliers that are close to the factory to reduce the inbound freight costs. Consider suppliers that can make several different components in the same location (i.e., sheet metal fabrications, machined parts, turned parts, etc.). For metal suppliers, do they buy direct from the converter or from distribution?

Components

Pick local distributors for reduced transport cost although sometime buying direct and paying for shipping can be less expensive. To my amazement, we can sometimes buy hardware from China and have it shipped direct at a lower cost than buying from a distributor. Consider setting up daily or bi-weekly "milk" runs to reduce variation and lower costs.

Hire Locally

If you can help an employee keep more money in their pocket, typically you will get better shop productivity. With gas prices going up, consider moving to a 4 day work week to reduce the commuting costs for each employee. Hiring locally also has an impact on employee's take-home pay. Employees that are friends can commute together, which not only lowers transport costs but can also help avoid tardiness.

CUSTOMERS

Local customers mean lower transport costs and faster deliveries. In some cases, we specify a painter or plater close to the customer to reduce transport costs. In other case, either we or our customer arrange for daily or bi-weekly "milk" runs.





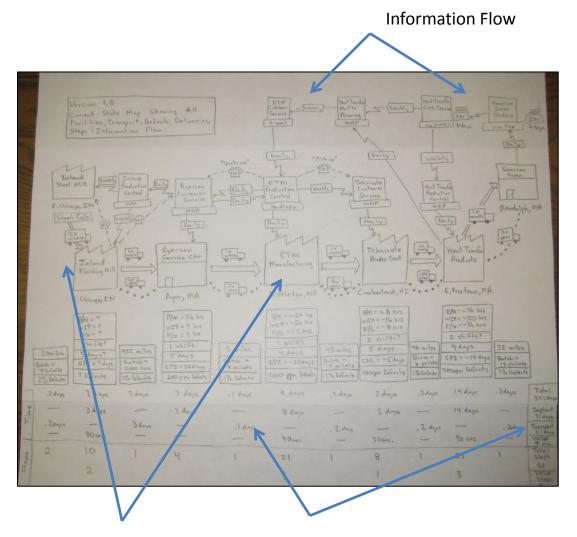


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Work Together to Lower Transport Time & Costs

One area that can be extremely helpful in lowering transportation time and costs is the use of value stream mapping. Within a day, a joint supplier-customer team can map out the entire information and material flow of the value chain. Value-added time can be identified and compared against the total time to uncover all the wasted time and costs.



Material Flow

Value Add Analysis

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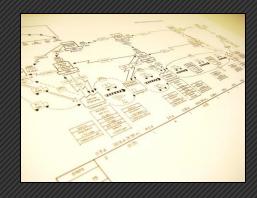




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GET FREE HELP IDENTIFYING TRANSPORTATION WASTE

Sometimes you can be too close to the problem to see how big it is. Sometimes you don't even see the problem because it is so ingrained in what you do every day. We offer a free assessment to understand the transportation waste throughout your supply chain.





Get a free assessment of the transportation waste throughout your supply chain



Use ETM Grant money to get the help you need to reduce transportation waste



Build a supply chain culture that rewards for lowering the total cost of the product

Request a Demo

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If Transportation is the Hidden Tax, then Inventory is the Visible Tax

Many years ago when I use to tour plants around the world, I would look at all the inventory and hear all the machines operating at full capacity and think the plant was doing well. Lean manufacturing has taught me that inventory is waste and only used after all else fails to level flow throughout production. In many cases, there is also inventory on both sides of the supply chain to lower risk.

RAW MATERIAL INVENTORY AT THE PRODUCER.

Raw material producers have high switch over costs, so based on forecasts, they may run more material than is actually needed. Unfortunately, the forecasts are provided by optimistic salespeople or unaffected customers so demand never matches the high forecast and inventory is created.

RAW MATERIAL INVENTORY AT THE DISTRIBUTOR

Sometimes raw material producers do not build to forecast, but build to historical averages. The distributor may lose an important customer if the raw material producer doesn't have enough capacity, so they over order in the hopes that they can win the new customer with available material.

RAW MATERIAL INVENTORY AT THE FABRICATOR

Unpredictable customer demand combined with isolated sheet stock shortages have the fabricator keep sheet stock on hand "just in case". For every five sheets of material kept in stock, it may only take one quick turn order to validate carrying the sheet stock inventory. Many times, unfortunately, the right stock is not available or not enough is available.

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Other Costs that Impact Price

Lean manufacturing experts have identified several other areas that can add cost and impact the final sheet metal fabrication price.

Over-production

When the fabricator has an unpredictable set-up process, there are always a few extra parts punched or laser cut just in case the yield is low. However, the yield might be low in punch, as well as forming, as well as welding, as well as coating, so several extra parts are run taking up precious production time and adding to Work In Process (WIP) costs. Look for set-up sheets in each work center or location-based improvement efforts to minimize or eliminate over production.

Waiting

If production flow is not well balanced, semi-finished goods (WIP) will sit for days or weeks until a particular work center is caught up. Even worse, mostly complete parts may be waiting for a final component (i.e., hardware) to arrive. A customer-driven push-out after the parts have been made is costly. The worst culprits are fabricators that build several months of inventory ahead of demand to spread set up costs over the larger number of parts.

Over-processing

Sometimes more work is done to a part than is required. This typically involves a timesaving process or edge de-burring process that is added but not required. In other cases there is packaging that is used, but not required by the customer. Overinspection should be included here as well.

Motion

If sheet metal parts are traveling more than 30 feet from raw sheet stock to finished parts, the customer is paying for excessive motion. Worse yet is the extra inventory that is moved several times before the product is shipped.

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Resolving Supplier Issues to Lower Costs

Most OEMs review quality, delivery and costs for supplier selection, but you can also use this information to lower your costs.

Poor Quality

With lower quality comes higher rework costs and expedite costs. One way to reduce that cost is to interview the supplier's quality assurance manager to understand the root cause. Does the root cause apply to your product? Can you invest resources to help fix the supplier's root cause? Another approach is to help your supplier with their biggest quality issue – even if it is not on your parts. Either way, less time/money wasted on fixing quality, the more cost savings are available to be shared with the company that helped.

Poor Delivery

Most sheet metal fabricators don't accept a purchase order thinking they will miss the delivery. In an effort to keep costs down, sheet metal fabricators need to take on enough business to spread costs out fairly among all customers. Unfortunately, customer demand fluctuates and if it fluctuates enough, the sheet metal fabricator cannot absorb the variation with overtime and will be late. A steady flow of business with an even mix of new/repeat orders allows any business to effectively capacity plan and significantly increase on-time delivery. To keep costs down, work with your sheet metal supplier to help balance the shop demand.

High Costs

Hopefully this eBook has helped you understand the cost drivers for sheet metal fabricated parts. If your supplier will allow, check to see if his costs are in-line with the industry averages provided here. If not, consider working together to improve the biggest cost driver. Maybe your company has a bigger buying advantage on costly components. Or perhaps your freight costs are considerably lower than his. Working together to help lower costs not only helps you, but help him become more profitable on all his other business as well.

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Building a Low-Cost Sourcing Model

Wondering what a good low-cost sourcing model might look like? The key is finding an open book partner that has continuous improvement processes in place. Here's some practical steps to setting up a low cost solution:

Locate a supplier who's purchases provide best in class raw materials pricing. Hint: ask your local distributor.



Find a sheet metal fabricator located in a low cost labor area.

Survey suppliers to understand their training programs. Do they grow low cost internal labor or hire expensive specialists?

Keep health costs in check. Do they have a young workforce? How do they measure productivity?

Find a sheet metal fabricator located in a low cost rent area or without real estate debt.

Does the fabricator understand the cost tradeoffs between using slower, older equipment and newer, faster equipment?

How big is the fabricator's key customers? Fewer new customers mean lower sales and administrative costs.

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Establish a quick quote model to lower quoting costs and speed time-to-market.

HOW TO USE SUPPLIER PROFIT TO YOUR ADVANTAGE



Better Understanding = Smarter Decisions

As a summary of what we have covered, a sheet metal fabricated part cost can be determined by calculating the materials costs, estimating the time to make the part, then calculating the labor costs, adding overhead costs and including profit. This should provide you a baseline for discussions in evaluating suppliers.

Calculate Material Costs

Create a lay-flat for the part and then calculate the yield per sheet of material. Use the LME or distributor pricing to determine the sheet cost and back-calculate the material cost per part. Add in any hardware or other material costs.

Calculate Labor Costs

Estimate the time for each step used to create your sheet metal fabricated part; laser or punch, "timesave" or deburr, form, hardware, weld, grind, anodize or plate, pack and ship. For each work center time, apply the fully loaded work center rate to determine the labor costs.

Account for Overhead Costs

Based on the information provided, calculate the office wages, payroll taxes, health insurance, rent and sales costs per hour and then multiply these costs by the total time to fabricate your order (from the times used in your labor cost estimate). Plan for some additional expenses to cover advertising, training, professional fees, other taxes, etc.

Include Fabricator Profit

Every business needs to make a profit to stay in business. The amount of profit depends on the risk involved are the rarity of that businesses' offer. Since the design and sales risk is borne by the OEM plus there are several competitors, fabricator profit is typically very low.

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Cost Estimating Example: A Typical Bracket

- 1. Determine quantity
- 2. Determine delivery date
- 3. Verify material type
- 4. Verify material thickness
- 5. Calculate lay-flat footprint
- Determine material used
- 7. Determine material cost
- 8. Create work flow
- Determine each labor rate
- 10. Calculate each labor cost
- 11. Add for total labor cost
- 12. Determine sales cost
- 13. Determine admin costs
- 14. Calculate payroll taxes
- 15. Determine health cost
- 16. Calculate rent
- 17. Estimate additional overhead
- 18. Determine transport cost
- Add total material, plus total labor, plus total overhead plus hidden transportation
- 20. Add profit
- 21. Determine total cost







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Our Take on Profits

The latest data published by Financial Research Associates for sheet metal fabricators with sales over \$1 million indicates that profits are very slim:

Net sales	\$1,000,000	
Cost of sales	<u>\$724,700</u>	
Gross Profit	\$275,300	
Overhead	<u>\$219,100</u>	
Operating Profit	\$56,200	5.6%
Interest	\$7,400	
Depreciation	<u>\$24,800</u>	
Profit Before Tax	\$24,000	2.4%

Profits Must Cover Debt Service or the Business Will Not Survive

Standard accounting rules record loan payments as a balance sheet line item, not as a cost on the income statement. A good sheet metal fabricator will account for these loan payments in hourly rates. Regardless of the product profitability, the fabricator still needs company profits to pay the equipment loans. The same is said for the fabricator that needs to borrow money to pay for materials and labor while waiting for the customer to pay their bills (aka cost of money, or cost of capital). If customers don't order steadily, the fabricator may also have to borrow money to cover overhead costs when orders are slow.

Sheet Metal Fabricators Want to Keep Profits Low

As a small business, most sheet metal fabricators get taxed on their profits. It is in their interest to keep profits as low as possible. This is accomplished either by hiding excessive benefits under overhead costs or through accelerated depreciation on new equipment.

More Profits Mean Better Employee Benefits

Another way to reduce profits (and lower taxes) is to provide employee raises, promotions, 401k matches, and other benefits – the things that attracted you to your employer. Happy employees make better products and will take better care of you.

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MAKE BETTER COST & SOURCING DECISIONS TODAY

With a better understanding of sheet metal costs, you can make better decisions with your supply chain.

See how ETM can help you with this.



http://ETMmfg.com/Lowest-Total-Cost

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