HOW TO AVOID COSTLY MANUFACTURING MISSTEPS

VALENCE

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The 5 Steps of Manufacturing

01 **The Concept + Scope**
Identify potential problems.

02 **The Design**
Understand the purpose of the product.

03 **Bill of Materials**
Make sure you have what you need.

04 **The Prototype**
Prevent design mistakes.

05 **Production + Delivery**
Consider the requirements.

It means an obsession with detail and how the final piece will work so the end result is innovative and flawless.

"Scientists study the world as it is; engineers create the world that has never been."

—Theodore von Karman, Hungarian-American mathematician, aerospace engineer, and physicist

reduction in project timelines and cost when mega projects are done well [1]

[1] Industrial MegaProjects

01

THE CONCEPT + SCOPE

Are you proactively problem solving or avoiding problems throughout?

The Concept + Scope:

How are people using the part day-to-day?

Reminder: Do a full walk-through. Interview all individuals who interact or use the piece throughout the day to identify potential pain points.

The Design:

How precise do measurements need to be? Have you confirmed the measurements with your manufacturer to eliminate the need for guess work?

Reminder: Ensure you've allowed for time to test or prototype the product.

Bill of Materials:

Have you asked your manufacturing partner about foundational costs, upgrades and add-ons?

Reminder: Keep in mind durability, length of time used, appearance, and load bearing capabilities.

Prototype:

Have you made allowances in time and cost to test it properly?

Reminder: Prototypes can save you from unnecessary costs incurred from incorrect material purchases.

Production + Delivery:

Who needs to approve the piece and what are the deadlines?

Reminder: Outsourced processes and multiple delivery locations extend timing.

02

THE DESIGN

Keep your project on track by avoiding 7 common design mistakes.

Take a step back. Optimize your project.

Mistake #1: Not engineering for the basics first

Making sure to engineer a solution based on requirements rather than nice-to-haves.

Example: Designing a 2000 lb. rack when the end product really only requires 100 lbs. Requiring 1/2-inch steel when 3/16-inch steel would work.

Impact: Cost | Time

IF YOU'RE REFURBISHING:

- Is it possible to update the modifications?
- Is it going to be more expensive rather than creating something new?
- Metal and plastic deteriorate over time. Is the product still structurally sound?
- What are the risks to the employees of old materials being cut and updated?

Mistake #2: Not understanding the use case

Durability, length of time, appearance, and load bearing capabilities are all considerations when choosing the right material for your product.

Example: Using stainless steel because it was more attractive. It was three times more expensive than hot rolled steel, and when it was shipped overseas, it was scratched up within days.

Impact: Re-Engineering | Time | Cost

Mistake #4: Not considering machinability

Be less prescriptive upfront. Consider what materials will work best with the use-case at-hand.

Example: This has to do with how we drill the holes and stamp, or basically, how all the pieces come together. Harder steels can take up to three hours to drill holes while others can take 30 minutes. That's because it's the difference between drilling into a ½ inch of steel vs. ¼ inch, which doubles the time.

Impact: Time

Mistake #3: Not understanding materials

Customers will select materials because they are aesthetically pleasing. However, even if the product looks great it's possible the materials selected don't align with end requirements.

Example: Customers request powder coating because of the finish. However, the powder-coating adds significant cost while basic paint would have been just fine for an item that would ultimately become dirty and discolored when used.

Impact: Time | Use | Cost

Mistake #5: Not double-checking accessories and add-ons

Ensure that your project will be done right the first time by understanding the impact of accessories.

Example: In most industrial applications, casters are installed onto equipment in sets of two and four. To achieve the best balance between maneuverability and stability, the two rear casters are designed to swivel, while the two front casters are fixed. Some engineers come back and request mid-process reengineering because they didn't realize the cart needed to be walked around a machine instead of to and from.

Impact: Cost | Time

Mistake #6: Not confirming dimensions

You can never have too much information on the print, in both lengths and degrees. This ensures non-engineers, like welding & cutting production specialists, can understand your end goal.

Example: When welding two parts that have been cut together, radius is important. Prints can look like a 45-degree radius but in reality, its 80 degrees. With an incorrect guess, production can come to a grinding halt and the process will stall for a week or more as parts are re-ordered.

- How important are the tolerances (e.g. a mezzanine fitting over a piece of equipment)?
- Are radiuses included in addition to lengths for welding?

Impact: Cost | Time

03

BILL OF MATERIALS

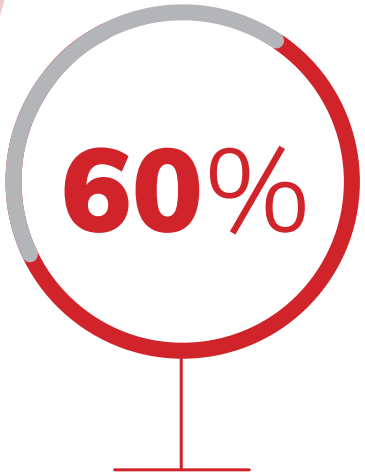
BENEFITS:	DRAWBACKS:
Bright + beautiful	Must be TIG welded
Light weight	Scratches easily
Heavy duty	More expensive
Less expensive	Soft
Easy to source	Less deductible
Ok to paint or powder coat	Less attractive
Retains shape	Small parcel quantities
High hardness	More time to machine
Conductivity + corrosion resistant	Less durable
Workability	Less size availability
Wide variety of color options	
Low friction	
Stress resistant	
Self-lubricating	
Strength	
High tension + bending	
Mechanical + electrical properties	

MATERIAL	APPLICATIONS	SHAPES	BENEFIT	DRAWBACK
Stainless steel	Thinner metals Smaller projects	Bars Pipe/tube Plate Sheet Structural Grating Expanded Metal Other	Bright + beautiful	Must be Tungsten Inert Gas (TIG) welded More easily scratched More expensive
Aluminum	Railway car components bridge components pipe fittings, wheels + transportation end uses	Bars Pipe/tube Plate Sheet Structural Grating Expanded Metal	Bright + beautiful Light weight	Softer
Carbon Steel	Structura Mezzanines	Bars, Pipe/Tube Plate Sheet Structural Grating Expanded metal Other	Heavy duty, less expensive Easy to source Ok to paint or powder coat Many sizes	Not as attractive Less deductible
Tool Steel	High-strength Wear-resistant	Bars Plate	High hardness Scratch resistant Retains shape	Small parcel quantities
Alloy	Precision machines Locating pins	Bars Pipe/tube Plate	Conductivity + corrosion resistant Good workability Bright + beautiful	Cost More time to machine
Copper	Domestic + industrial plumbing Contacts + switchgears Electrical wiring	Bars Plate Sheet	Bright + beautiful	Scratches easily Not as many sizes Softer durability
Brass	Pressing Deep drawing Rolling, Machining	Plate Sheet	Bright + beautiful Less expensive Corrosion resistant Good ductility Good strength	Cost Soft
PLASTICS				
Acetal Homopolymer	Color coded shims Color coded parts		High tensile + flexural properties High tension + bending Good strength + stiffness Low moisture absorption Fatigue endurance Good machinability	Less durable
UHMW	Material handling Food and beverage Agricultural Recreation Transportation		Less costly Variety of color Variety size + thickness Less expensive Impact strength, sliding material Resistant to chemical + stress cracking Self-lubricating	Less durable
Nylon 101	Bushings + bearings Gears + sprockets Wear rails, pads + strips Pulleys + sheaves Conveyor wheels + rollers Feed screws Star wheels		Size range Mechanical + electrical properties Strength + toughness	More expensive Less durable

04

THE PROTOTYPE

When evaluating your project, one of the most critical decisions is whether or not to create a prototype. The more complex, the better the chance that prototyping will cut cost and time.



of customers choose to do a prototype with projects **over $50k**

What does it mean to have a complex project?

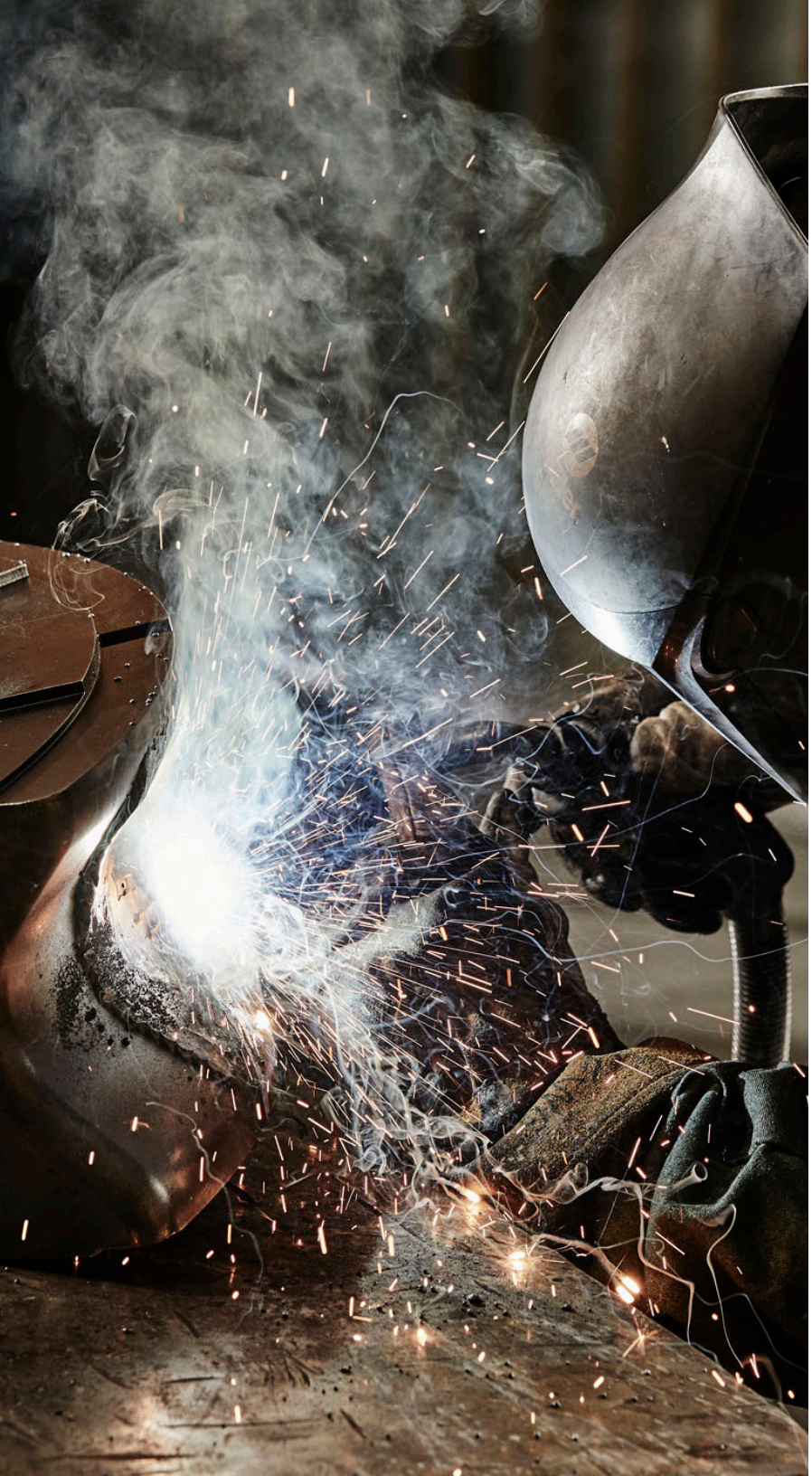
Moving parts. Tight tolerance. Needing an understanding of how it will withstand daily manufacturing rigors.

Why prototype?

Prototyping reduces cost, time, and risk

Because of the reduction of mis-measured or incorrectly developed components, projects are, on average, 2 weeks faster when prototyping.

Recently a customer ordered 20 pallets of product made of steel because that is the way they had been doing it for years. Because of the cost of the production run, they chose to first prototype a product made with aluminum. The aluminum prototype allowed them to discover that the same end result could be achieved with a lower cost product.



05

PRODUCTION + DELIVERY

Have you thought about each level's requirements?

- Project sponsor
- Process engineer
- Manufacturer
- Material & process vendor

7 Hidden Delays in Production

Project sponsor

After a first build, do production managers prefer to see the final piece?

Process engineer

What is your delivery schedule with multiple deliveries? Locations?

Manufacturer

What is your timeframe? What is the drop-dead date?

Material & process vendors

Are there samples that can be shared to ensure that they fit within the piece that is being transported?

HEAT TREATING

- Confirm parts are durable enough; they should not crack under constant banging.

PLATING

- Produces longer lasting pieces with more durability, allowing for connectivity and more attractive finishes.

COMPONENT PURCHASES

- Customizing fasteners and casters can add 4-6 weeks.

LOCATION

- Materials sent farther – especially internationally – can add time.

POWDER VS. PAINTING

- Painting on-site only takes days. Powder coating is heat-treated and necessitates packing up parts, transporting, and then returning.

AVAILABILITY OF METALS

- If there are rushes in the market, getting the metals can become cost prohibitive.

OUTSOURCING ADDITIONAL PROCESS FROM FACTORY TO VENDORS

- Customizing fasteners and casters can add 4-6 weeks.

THANK YOU.