Maysteel

# A BUYER'S GUIDE TO

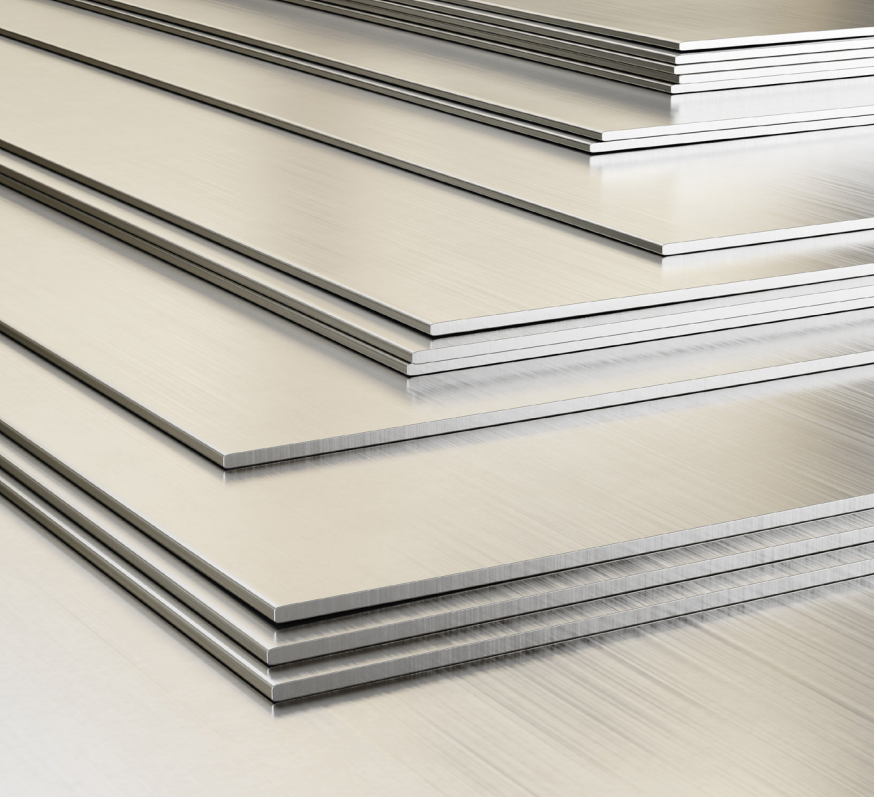
## Sheet Metal Fabrication


Are you new to procuring sheet metal enclosures, kiosks or hardware? Maybe you've been in the business for some time and are looking for a new sheet metal fabricator for your supply chain. This buyer's guide to sheet metal fabrication provides an overview of materials, processes and tolerances to help you make your supplier shortlist.

## This sheet metal fabrication guide will cover:

- Common types of metals used in sheet metal fabrication
- Sheet metal fabrication processes and capabilities
- Definition of sheet metal tolerances

**Our team is here to help with your next manufacturing project.**
**Contact us today at Info@Maysteel.com,**
**or give us a call at 262-251-1632.**



# Types of Metals Used in Sheet Metal Fabrication

Sheet metal comes in various materials. From the widely used carbon steel to the less common copper, when looking for a supplier for your fabricated metal products and parts, the first thing to look for is if they work with the types of sheet metal your drawings require.

**Here's a breakdown of metals commonly used in sheet metal fabrication:**

**Aluminum** is known for being a lightweight metal. It's a relatively strong material and can hold up to a NEMA 3 specification. It's more expensive than carbon steel, but not as expensive as copper. One disadvantage to aluminum is that it doesn't hold up to heat, and therefore must be TIG welded.

**Carbon steel** is one of the most widely used metals in sheet metal fabrication. It's a metal alloy made up of iron and typically no more than 2.1% carbon. Carbon steel is reasonably priced and easy to form, cut and weld. It can also hold up to NEMA 3 specifications.

**Stainless steel** is another metal alloy. Stainless steel is made up of iron and around 11% chromium, making it durable and resistant to heat and rust. Chromium gives stainless steel a better surface finish, which is excellent for highly aesthetic products. Stainless steel can be used for NEMA 4x enclosures because it is resistant to corrosive acids. One of the biggest concerns with stainless is the reaction that can occur when it comes into contact with other materials, specifically aluminum. This reaction causes pitting or discoloration and can eat away at the stainless steel.

**Copper** is an excellent electricity and heat conductor. It is a soft and malleable metal, making it great for construction and transportation uses. Because of its price point, copper is not typically used for sheet metal enclosures, unless the project requires conductivity.

**Titanium** is a costly, but incredibly durable material with low density. Because of its strength, however, titanium can be difficult to machine. Titanium is perfect for cases where precision, durability and weight are key. The medical and aerospace fields might consider titanium as an option.

Once you have qualified that a potential supplier can work the metals your designs require, it's important to see if they have the in-house machinery/processes to fabricate your products and parts.

# Sheet Metal Fabrication Processes/Capabilities

Sheet metal fabrication typically begins with raw material such as metal sheets. Through the fabrication process, those sheets are bent, formed and finished into kiosks, enclosures, cabinets more. Here are common sheet metal fabrication capabilities.

**Cutting** is a process where you cut sheet metal into smaller shapes that will be used later in the fabrication process. Equipment used for cutting may include a fiber laser, a plasma cutter, turrets, or a water jet cutting machine.

The **drawing** process uses a mold or a die and pulls the sheet metal to form the desired shape. Drawing works well with thicker materials.

During the **folding** process, sheet metal is bent to certain angles using equipment such as a brake press. A brake press can easily fold panels and multiple shapes on a piece of sheet metal.

The **extrusion** process uses molds or dies to form shapes into the sheet metal. Turret punches used during the extrusion process can improve product manufacturability by reducing the need for fastener hardware.

**Sheet metal punching** uses a turret and die to force material out of a working piece or part. In layman's terms, this process creates holes. Punch press turrets come in different sizes and styles to create different shaped openings.

**Sheet metal shearing** cuts sheet metal in a long, straight line. Usually, this process trims metal into a smaller size by using two blades. The top blade pushes the metal into the stationary bottom blade to cut through the metal.

**Sheet metal stamping** is similar to extrusion and punching, but it doesn't completely cut through the metal. Instead, stamping uses a die to mold shapes and create indents. You will see this process often used in the automotive industry for various vehicle parts and components.

**Sheet metal welding** is a staple in complex metal fabrication and includes MIG, TIG, arc and spot welding. Each method requires varying capabilities and expertise in the trade.

**Roll forming** turns sheet metal over rollers at room temperature to form round parts. Roll forming is essential for products and applications that require a rounded shape. Thomasnet explains the roll forming process as, "The material is fed into the machine where it continuously makes its way through the stages of each operation, ending with the completion of a final product."

You won't typically find **machining** in a fabrication facility, but it can be advantageous to have a supplier with fabrication and machining capabilities for tight tolerance requirements. Machining covers a wide variety of processes that remove metal from a part or piece using a coordinate system, which allows for improved accuracy over other processes such as punching and folding. Most machining processes fall into three categories: turning (also known as lathing), drilling and milling.

Speaking of sheet metal tolerances, what exactly are sheet metal tolerances?

## What are Sheet Metal Fabrication Tolerances?

A tolerance controls part and feature sizes. They are an acceptable range of variation from a design file, which is represented by +/-. The tighter the tolerance, the more precision required.

Machining is commonly used for tight tolerances because it uses a coordinate system which, as discussed earlier, is vastly different from other fabrication processes.

Let's use a real-world example. Engine blocks on your vehicle are machined because they require tight tolerances. On the other hand, sheet metal kiosks are cut on a turret and folded on a brake press, where tolerances are more variable.

Tolerances are highly dependent on the type of project and materials, but there are standards that engineers follow. These are set by organizations like American National Standards Institute (ANSI) and Machinery's Handbook, which includes tolerances that are accepted worldwide.

Maysteel typically uses 4 Sigma quality standards, which gives a tolerance of +/-.006" / .15mm for standard feature sizes (hole, square, etc.). For a single hit, flat pattern relation, the tolerance is '+/-.010" / .25mm. Tolerances vary from project to project, and our machining capabilities allow us to meet even tighter tolerance requirements such as military, aerospace and defense products. See the chart below for more sample tolerance standards.

| | | | | | | |
|---|---|---|---|---|---|---|
| Maysteel | **QUALITY LEVEL** | | **3 Sigma** | **4 Sigma** | **6 Sigma** | **7 Sigma** |
| | **PPM DEFECTIVE** | | 3,700 | 63 | 3.40 | < 1 |
| | **CP VALUE** | | 1.00 | 1.33 | 2.00 | 2.33 |
| | **CPK VALUE** | | 1.00 | 1.33 | 2.00 | 2.33 |
| | | **Standard Deviation** | ⇩ | ⇩ | ⇩ | ⇩ |
| 1 | Standard feature sizes (hole, square, etc.) | .0011" | +/-.005" / .13mm | +/-.006" / .15mm | +/-.007" / .18mm | +/-.008" / .20mm |
| **2** | **Special features requiring multiple hits** | **.0018"** | **+/-.008" / .20mm** | **+/-.010" / .25mm** | **+/-.012" / .30mm** | +/-.014" / .36mm |
| 3 | Flat pattern relation (Single hit) (feature to feature, NO forms) | .0018" | +/-.008" / .20mm | +/-.010" / .25mm | +/-.012" / .30mm | +/-.014" / .36mm |
| 4 | Dimensions that locate features that are the consequence of a singe form from inside the material thickness. | .0027" | +/-.012" / .30mm | +/-.015" / .38mm | +/-.018" / .46mm | +/-.020" / .50mm |
| 5 | Dimensions that locate features that are the consequence of (2) separate forms from inside the material thickness. | .0044" | +/-.020" / .50mm | +/-.024" / .60mm | +/-.028" / .60mm | +/-.032" / .81mm |
| 6 | Dimensions that locate features that are the consequence of (3) separate forms from inside the material thickness. | .0067" | +/-.030" / .76mm | +/-.038" / .97mm | +/-.042" / 1.07mm | +/-.048" / 1.22mm |
| 7 | Dimensions that locate features that are the consequence of (4) separate forms from inside the material thickness. | .0089" | +/-.040" / 1.00mm | +/-.050" / 1.27mm | +/-.056" / 1.42mm | +/-.062" 1.57mm |
| 8 | Angularity tolerance on forms (in degrees) | +/- 22 min. | +/- 1 deg. | +/- 1 deg. 22 min. | +/- 1 deg. 33 min. | +/- 1 deg. 55 min |
| 9 | Dimensions that are located from a form are to be measured within .120 of the tangent of the form line. | | | | | |
| 10 | Assembly or Weldment tolerances are determined using the root sum squared method. Square root of the sum of the piece part tolerances squared plus an additional manufacturing tolerance of .5mm / .020" | | | | | |

## Ready to Make Your Supplier Shortlist?

This sheet metal fabrication guide for buyers and procurement professionals covered sheet metal materials, sheet metal fabrication processes and capabilities and tolerances. When searching for sheet metal fabrication partners, you will need to search their website for:

- Can they work with the required materials?
- Do they have in-house capabilities you need?
- Can they meet your required tolerances?


## About Maysteel:

Maysteel is a complex sheet metal fabricator with in-house machining capabilities. Our solutions include custom enclosures, kiosks, machined parts and more.

If you have a project that you'd like to review with our team, contact us to schedule a meeting!

262-251-1632

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