

Quality

EVALUATION FOR SHEET METAL: A CONTRACTORS GUIDE

This article is your comprehensive guide to understanding how to evaluate the quality of custom sheet metal. Quality sheet metal work is the linchpin of many industrial and construction projects. In essence, it's about ensuring that the material possesses the right tensile strength, malleability, and corrosion resistance to withstand external forces and environmental conditions.







A roll line is commonplace at fabrication shops like this one. Greater Wisconsin Sheet Metal has roughly 76,000 Sq Feet of working shop space.

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01

UNDERSTANDING THE BASICS OF SHEET METAL FABRICATION

Fabrication is the beating heart of custom sheet metal work, and it's a multi-step process that's far more complex than just bending a piece of metal into shape. At its core, sheet metal fabrication involves several essential steps, each requiring specialized skills and machinery.



Design and Prototyping

The process begins with an accurate design, often developed using CAD software, which serves as the blueprint for the entire project. Prototypes may be created to test the design before mass production.

Material Selection

The choice of metal—be it mild steel, aluminum, stainless steel, or copper—depends on various factors like tensile strength, corrosion resistance, and project requirements.

Cutting

Once the design is ready and materials are chosen, the metal sheet is cut into the required shape using techniques like plasma cutting or water jet cutting.

Forming

The cut sheet is then formed into specific shapes through processes like bending, rolling, or stamping. Hydraulic press brakes are commonly used for precision bending.

Welding and Joining

Parts are assembled and joined through welding, riveting, or using fasteners. The quality of a weld can be a significant factor in the structural integrity of the final product.





Post Fabrication

Post-fabrication, the metal often undergoes surface treatments such as powder coating, painting, or galvanizing to improve its appearance and durability.

Surface Treatment

Parts are assembled and joined through welding, riveting, or using fasteners. The quality of a weld can be a significant factor in the structural integrity of the final product.

Quality Control

Finally, the product undergoes rigorous quality checks to ensure it meets all specifications. This may include dimensional checks, material property tests, and visual inspections.

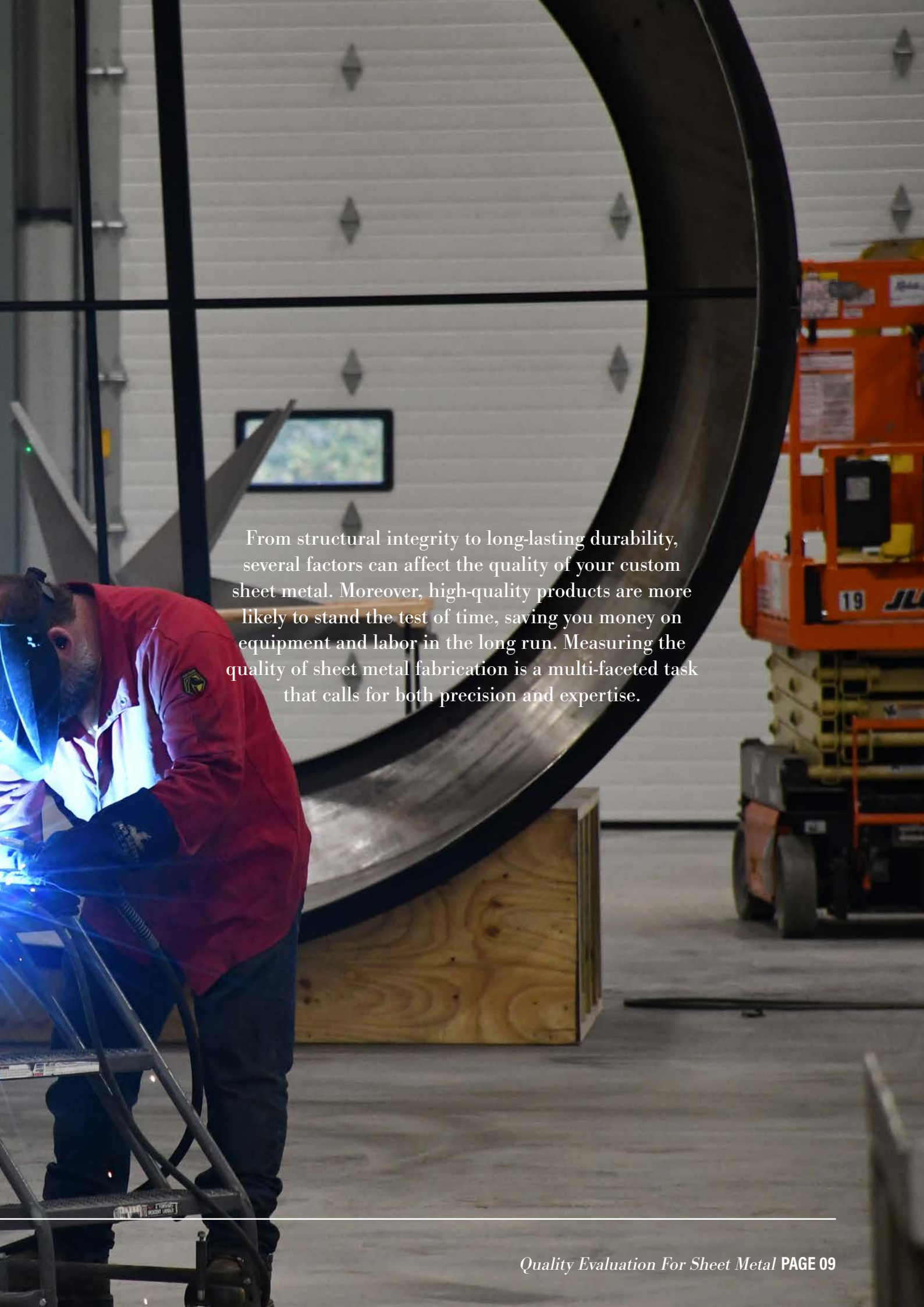
Assembly and Installation

The fabricated parts are then assembled, either as a part of larger structures or as standalone units and installed as per the project requirements.

Understanding these basic steps provides insights into the technical expertise that goes into creating high-quality custom sheet metal components. Quality starts with materials and ends with installation. Knowing what quality means is vital.

02

THE IMPORTANCE OF QUALITY EVALUATION



From structural integrity to long-lasting durability, several factors can affect the quality of your custom sheet metal. Moreover, high-quality products are more likely to stand the test of time, saving you money on equipment and labor in the long run. Measuring the quality of sheet metal fabrication is a multi-faceted task that calls for both precision and expertise.



Quality is Everything

High Quality Means Better Outcomes

The “best way” to evaluate quality involves a combination of techniques and tests to ensure that the fabricated item meets all specifications and quality standards. While not every job requires every step, here are some key methods to consider:

Material Certification, Dimensional Accuracy, Tensile Testing, NDT (Non-Destructive Testing), Weld Inspection, and Performance testing are all elements of maintaining a high-quality product. Making sure you have quality documentation from the metal supplier also helps to hedge against quality issues down the road. When ultra-high quality is desired, consider having a 3rd party inspect the finished product prior to installation to certify the product is top notch.

In the world of manufacturing and construction, the importance of sheet metal quality in fabrication can't be overstated. Sheet metal is the backbone of numerous industries—ranging from aerospace and automotive to HVAC and consumer appliances. Quality isn't just a buzzword; it's the linchpin that holds together functionality, durability, and safety in fabricated products. But why is quality in sheet metal so indispensable? Let's dig into this crucial topic.

Firstly, consider the role of sheet metal in structural integrity. Whether it's the fuselage of an airplane or the framework of a vehicle, the sheet metal used needs to withstand enormous stress and strain. Compromising on material quality can result in catastrophic failures, posing not just financial risks but also endangering lives. Material defects like cracks, porosity, or inclusions can significantly affect a metal's tensile strength and ductility, making it susceptible to premature failure under load.

Quality also has a direct impact on the fabrication process itself. High-quality sheet metal allows for more precise cuts, bends, and welds. In contrast, subpar quality metal can lead to issues like warping, tearing, and uneven edges, all of which affect the dimensional accuracy of the final product. Imagine assembling an intricate machine where the parts don't align correctly due to these errors—any efficiency gains from automation or high-speed production lines would be lost in the subsequent rework and delays.

Don't forget the cost implications. While it might be tempting to opt for lower-quality, cheaper materials, the long-term costs often outweigh the initial savings. Using low-quality sheet metal necessitates frequent repairs and replacements, driving up operational costs. In industries like aerospace and healthcare, where regulations are stringent, using inferior quality materials can also lead to hefty fines and legal repercussions.

In conclusion, the quality of sheet metal is an uncompromising requirement in the fabrication industry.

It affects everything from structural integrity and production efficiency to long-term costs and compliance with industry regulations.

High-quality sheet metal is easier to work with, lasts longer, performs better, and ultimately provides a safer, more reliable end product.

Skimping on quality is not just cutting a corner; it's cutting the very foundation on which the success and safety of a project rest.

Therefore, when it comes to sheet metal fabrication, quality isn't just important—it's absolutely vital.

A welder wearing a blue long-sleeved shirt, dark pants, a welding mask, and gloves is working on a large, curved metal structure. The welder is holding a welding torch and is positioned on a metal platform or scaffolding. The background shows a large, industrial metal tank or container with various pipes and structural elements. The number '03' is overlaid in a large, white, serif font in the upper center of the image.

03

TYPES OF METALS USED IN CUSTOM FABRICATION

Whether you're dealing with mild steel, aluminum, stainless steel, or copper, the type of metal used can dramatically impact the project's success. The choice of metal is influenced by several factors, such as the application, budget, and required mechanical properties like strength and corrosion resistance.



Common Metals Used

Lightweight and highly malleable, aluminum is often used for its excellent corrosion resistance and electrical conductivity. It's especially popular in automotive and aerospace applications.

Known for its robustness and corrosion resistance, stainless steel is a go-to for food processing, medical equipment, and outdoor installations. It comes in various grades, each with unique properties tailored for specific applications. Highly polished stainless steel is popular in custom or high-end kitchen applications.

Carbon Steel is probably the most common in indoor mechanicals and is a versatile choice. It is commonly used for its ease of fabrication and high tensile strength. Depending on the carbon content, it can range from being extremely soft to very hard. It's often seen in structural and engineering projects.

Some less common but interesting fabrication metals are Copper, Brass, Bronze, Nickel Alloys, Titanium, and Zinc galvanized. These tend to be not as common because of their physical properties and the cost of obtaining raw stock.

Items that live outside in the elements are typically stainless steel or aluminium. Like the large air scrubber pictured here. Welds are cleaned up and it's off to paint.

04

MEASURING QUALITY IN SHEET METALS

Ask for Certifications Everytime

Always start by checking the material certifications. These documents should comply with recognized standards like ASTM or ISO and will provide detailed information about the material's properties such as tensile strength, chemical composition, and hardness. There are several layers of reports and certifications that metal manufacturing firms go through. Then, Check the surface of the sheet for any visible defects such as cracks, corrosion, or other imperfections. These could affect both the appearance and integrity of the finished product.

Next, using precision measuring tools like calipers or micrometers, confirm that the thickness, length, and width of the sheet stock match the specifications. Variances in thickness can cause significant issues in later stages of fabrication. Flatness, Edge Quality, and Hardness testing can also be done to ensure the quality of your sheet stock. Finally, consider the reputation of your supplier. Well-established suppliers are more likely to provide high-quality sheet stock and will often have quality assurance protocols in place. At the end of the day, quality in means higher quality out so don't settle for less than the best metals in your fabrications.

Common Quality Issues

Being aware of common quality issues can help in early detection and remediation

Early detection of these issues is key. Proper quality control methods, including visual inspections, dimensional checks, and more advanced techniques like non-destructive testing, can go a long way in mitigating these common quality problems.

Frequent Quality Issues

Material Defects:

Inclusions: Foreign material trapped in the metal during the smelting process can compromise its structural integrity.

Porosity: Tiny holes or voids that occur due to trapped gas during the solidification of the metal.

Surface Imperfections:

Corrosion: Surface rust or oxidation that can weaken the metal.

Discoloration:

Usually due to poor surface treatment or exposure to corrosive elements.

Dimensional Inaccuracies:

Warping: The metal sheet doesn't lie flat, often due to residual stresses from manufacturing.

Undersized/oversized dimensions:

When the metal sheet doesn't meet the required specifications in terms of length, width, or thickness.

Structural Weaknesses:

Cracks: Usually found at corners or along edges, cracks are often due to poor material quality or excessive force during fabrication.

Thinning: Excessive material removal during processes like grinding can result in weak spots.

Welding Defects:

Incomplete Penetration: The weld does not fully extend through the metal pieces being joined.

Undercut: A groove melted into the base metal adjacent to the weld toe or weld root that wasn't filled by weld metal.

Porosity in Weld: Tiny holes in the weld bead due to gas entrapment, which can weaken the joint.

Edge Quality:

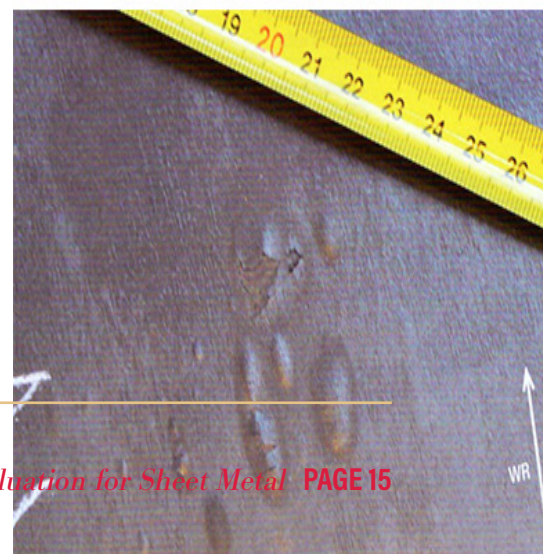
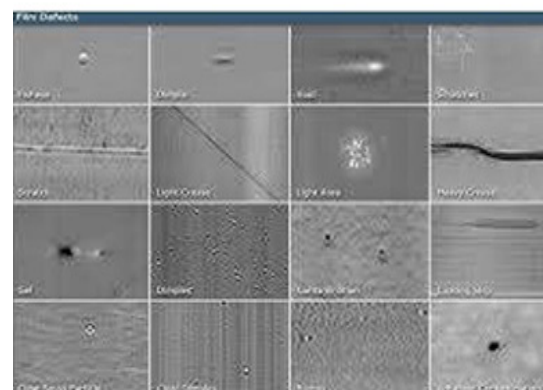
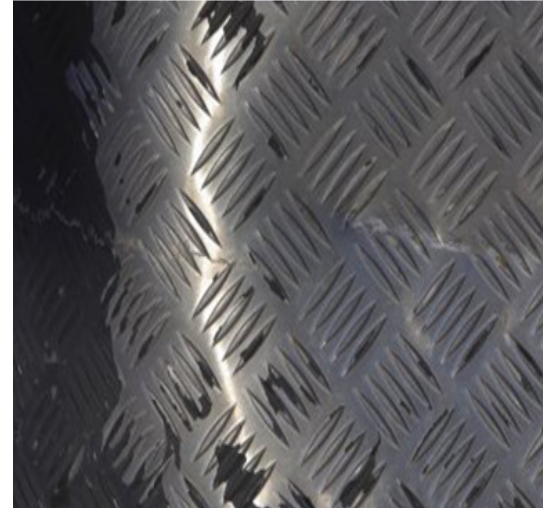
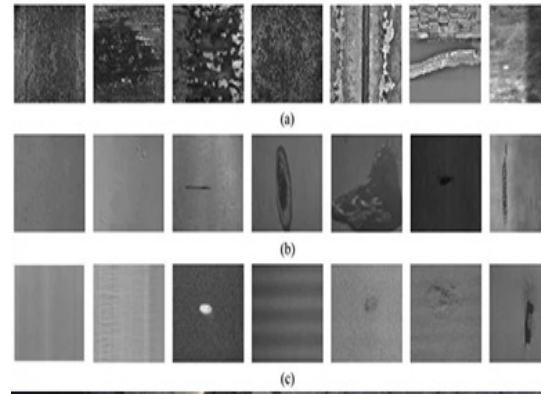
Burr Formation: Sharp or rough edges after cutting operations, posing a safety hazard and potentially affecting the fit and finish of assembled parts.

Tearing: Small, jagged ruptures often found along the edges of the sheet.

Forming Issues:

Springback: The material rebounds slightly after a bending operation, affecting the final dimensions.

Die Marks: Visible marks left on the sheet metal surface due to direct contact with forming dies.





05

CHOSING THE RIGHT CONTRACTOR

Look for expertise and examine their past projects.

Perhaps you know some of their customers, they'll typically be very honest about their experiences. Reviews and testimonials can offer a glimpse into their reliability and quality of work. Talk to them about your project and what the specifications are. Review their past projects to find similar production applications to your project and reach out to them. Choose a fabrication sheet metal shop that wants to build a relationship with you, that way you know that they will get your projects done in a timely manner with good quality workmanship. The better the relationship the more likely they are to work with you when you're in a pinch.

07

IN CONCLUSION

Understanding how to evaluate the quality of custom sheet metal is crucial for any contractor. Adopting the right quality assurance practices and choosing a reliable contractor can make all the difference.

Frequently Asked Questions

Custom sheet metal fabrication is a specialized process where sheet metal is transformed into specific shapes, sizes, and configurations according to customer requirements. Unlike mass-produced parts, custom fabrication is tailored to unique specifications, making it invaluable for projects that require a high level of precision or unique features. The process involves various operations like cutting, bending, forming, and joining, which are carried out using advanced machinery such as CNC laser cutters, press brakes, and TIG/MIG welding units.

The journey begins with a design, usually rendered in CAD software, which serves as a blueprint for the entire fabrication process. The chosen sheet metal—be it aluminum, steel, copper, or any other material—is then subjected to a series of carefully planned steps to bring that design to life. Whether it's a one-off prototype or a small production run, custom sheet metal fabrication offers unparalleled flexibility and precision.

01 What are the most common quality issues?

Warping and oxidation are common quality issues. These must be handled with the supplier to effectively correct.

02 What is tensile testing?

It measures the tensile strength of the material. This is critical because when parts fail due to tensile strength people can be injured.

03 What certifications should I look

AWS, API Certifications are reliable indicators of quality. ASME Certifications in all processes means quality as well.

04 How can quality issues be addressed?

Quality issues can be addressed either through short-term solutions like coatings or long-term adjustments in the fabrication process.





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