

LANSING

# Electronic Enclosure Material Selection Guide

EVALUATING DIFFERENT ELECTRONIC ENCLOSURE MATERIALS:  
PROS, CONS, AND CHOOSING THE RIGHT ONE FOR YOUR NEEDS.



↙ Selecting an appropriate material for your electronic enclosure is essential to the protection and overall reliability of your equipment and technology systems. The right enclosure material can enhance product lifespan, reduce maintenance costs, and ensure compliance with industry standards.

This guide provides a comparative analysis of common enclosure materials, highlighting their advantages, limitations, and optimal applications to aid in informed decision-making. Additionally, use our key consideration checklist for a more holistic view of enclosure material selection to make the best choice for your specific application.

# Material Analysis

## ALUMINUM

Advantages	Limitations
High strength-to-weight ratio ideal for lightweight applications	Potential for higher material and processing costs compared to carbon steel and some plastics
Superior thermal conductivity aiding in heat dissipation	
Corrosion resistance, particularly when anodized or coated for enhanced durability	Susceptibility to surface abrasion and denting, requiring protective coatings
Intrinsic electromagnetic interference (EMI) shielding properties, crucial for sensitive electronics	
Easily machined and fabricated into complex shapes	Requires additional finishing processes to optimize corrosion resistance
Available in various configurations	

**Recommended Applications:** Aerospace, military, high-performance industrial enclosures, and applications requiring superior thermal management and EMI shielding.

## STAINLESS STEEL

Advantages	Limitations
Exceptional mechanical strength and impact resistance	Heavier than aluminum, which may impact portability and ease of installation
High resistance to oxidation, corrosion, and chemical exposure	Higher material costs relative to carbon steel and certain aluminum alloys
Suitable for sanitary applications	Inferior thermal conductivity compared to aluminum, making heat dissipation a challenge
Maintains structural integrity under extreme temperature variations	

**Recommended Applications:** Medical devices, food processing equipment, marine enclosures, and chemical processing applications where hygiene and corrosion resistance are critical.

# Material Analysis

## CARBON STEEL

Advantages	Limitations
High structural strength at a lower cost compared to stainless steel and aluminum	Prone to rusting
Can be galvanized or powder-coated to improve corrosion resistance	Heavier than aluminum, potentially affecting transport and handling
Versatile and widely available, making it an effective option for large-scale production	
Excellent machinability and weldability, allowing for custom fabrication	Requires regular maintenance, especially in high-moisture environments

**Recommended Applications:** Industrial control panels, heavy machinery enclosures, and cost-sensitive applications requiring durability and strength.

## PLASTICS (ABS, POLYCARBONATE, FIBERGLASS)

Advantages	Limitations
Lightweight, reducing overall system mass and easing transportation	Lower impact resistance compared to metals, though some reinforced plastics mitigate this issue
Intrinsic resistance to corrosion and environmental degradation	Susceptibility to UV degradation unless UV-stabilized or specially treated
Electrically insulating, mitigating conductivity concerns in sensitive applications	Limited effectiveness for EMI shielding without additional treatments or coatings
Available in various configurations	Can be flammable unless formulated with fire-retardant properties
Can be molded into complex shapes, making them versatile for different applications	Special configurations, such as molding, can be expensive in smaller quantities

**Recommended Applications:** Consumer electronics, indoor industrial enclosures, and applications requiring electrical insulation and lightweight solutions.

# Factors to Consider When Choosing a Material

To optimize material selection, evaluate the following factors:



1. **Environmental Resistance:** Will it be exposed to moisture, corrosive chemicals, or extreme temperatures?
2. **Strength Requirements:** How much impact resistance and durability does it need?
3. **Heat Management:** Does the material help dissipate heat effectively?
4. **EMI Protection:** Does it need to block electromagnetic interference?
5. **Manufacturing and Cost:** Is it affordable and easy to work with?
6. **Sustainability and Longevity:** Can it be recycled or maintained for long-term use?

By integrating material science principles with practical engineering considerations, you can ensure that your enclosure meets the rigorous demands of your industry. Understanding the nuances of each material type can lead to improved product reliability, better regulatory compliance, and overall enhanced performance in the field.

## PROVEN PROTECTION FROM ALUMINUM ENCLOSURES

While all materials have their strengths, aluminum stands out for its excellent combination of lightweight durability and configuration capability. Its versatility and long-term reliability make it one of the best all-around options for both standard and custom applications.

If you're looking for an enclosure solution that offers superior performance, aluminum should be at the top of your list.

For personalized guidance, expert recommendations, and high-quality aluminum enclosures, contact Lansing today.

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