

Photovoltaic combiner box housing material



Overview

The string combiner boxes form subsystems that can be standardized according to the number of strings, voltage and rated current.

Key Takeaways

PV combiner boxes are typically housed in materials such as aluminum, stainless steel, UV-stabilized polycarbonate, and fiber-reinforced polyester, chosen for thermal management, UV resistance, and environmental durability. Common Housing Materials



Aluminum: Aluminum enclosures are widely used due to their excellent thermal conductivity, which helps dissipate heat generated by high DC currents inside the combiner box. Field tests show aluminum can maintain internal hotspots around 58°C under 45°C ambient conditions, making it suitable for high-temperature environments like deserts. Aluminum is also lightweight and corrosion-resistant when properly treated, but dark-colored finishes can absorb solar heat, increasing surface temperatures significantly .

Stainless Steel: Stainless steel offers superior corrosion resistance, making it ideal for coastal or humid environments. It is mechanically robust and can withstand physical impacts, but its thermal conductivity is lower than aluminum, so internal heat management may require careful design or passive cooling features .

UV-Stabilized Polycarbonate: Polycarbonate enclosures are lightweight, impact-resistant, and UV-stabilized, which prevents material degradation under prolonged sun exposure. They are often used with transparent windows for monitoring internal components. Polycarbonate is suitable for tropical and sub-tropical climates and can be molded with integrated cooling fins to reduce internal temperatures by 12–15°C .

Fiber-Reinforced Polyester (FRP/GRP): Glass or fiber-reinforced polyester enclosures provide high electrical insulation, UV resistance, and chemical durability. They are commonly used in IP65/IP54 rated combiner boxes for outdoor installations, offering protection against dust, water ingress, and extreme weather conditions .

Painted Steel: Painted or powder-coated steel enclosures are cost-effective and provide moderate corrosion protection. They are suitable for less extreme environments but may require additional UV or corrosion-resistant coatings for long-term outdoor use .

Material Selection Considerations

- **Thermal Management:** PV combiner boxes generate continuous heat (150–220W for 200A systems), so materials with good heat dissipation, like aluminum, are preferred in high-current applications .
- **UV and Weather Resistance:** UV-stabilized polycarbonate and FRP/GRP prevent degradation in sunny or tropical climates, extending the lifespan of the enclosure .
- **Environmental Conditions:** Stainless steel is ideal for coastal or corrosive environments, while polycarbonate and FRP are suitable for humid or tropical regions .
- **Mechanical Protection:** Stainless steel and FRP provide robust protection against physical impacts, while polycarbonate offers moderate impact resistance with lighter weight .

- Customization and Monitoring: Modern enclosures can include transparent windows, integrated cooling fins, and sensor ports for real-time monitoring, which may influence material choice . In summary, aluminum, stainless steel, UV-stabilized polycarbonate, and fiber-reinforced polyester are the primary materials used for PV combiner box housings, each selected based on thermal performance, UV resistance, environmental durability, and mechanical protection requirements. Proper material selection ensures long-term reliability, safety, and reduced maintenance costs for solar installations .

Article Content

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Housing: The physical box that houses the combiner components, usually made of PV or ABS materials, with an IP65

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Learn how a PV combiner box works, what components it contains, how solar combiner

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