

1. Product Overview

1.1 Product Identifier

Product Name: Ballesta® Perforated Wall Panels

Product Code: [Customizable, e.g., PWP-AL-1500x600x1.5]

Description: Ballesta perforated wall panels combine functional acoustic performance with creative aesthetic expression. Manufactured using turret punch press, single-station punch, CNC engraving, or fiber laser cutting, our panels support unlimited hole patterns—from precision staggered arrays to custom graphic perforations. When combined with acoustic fleece backing, they deliver NRC ratings up to 0.80 while adding visual depth through light interaction. Available in aluminum (AA1100, AA3003) and stainless steel (304, 316), with panel thickness from 1.0mm to 2.0mm and hole diameters from 0.4mm to 10mm.

2. Technical Specifications

Item	Specification	Test Standard
Aluminum Substrate Material	Indoor: AA1100, AA3003 (H24 Temper) Outdoor: AA3003/5005 (H24 Temper) AA3003 Mn:1.0%-1.5%; AA5005 Mg:0.5%-1.1% Stainless Steel: 304, 316	ASTM B209, GB/T3190-2020
Panel Dimension	Customizable per project requirements Standard widths up to 1500mm, lengths up to 6000mm Tolerance: Length $\pm$ 2mm, Width $\pm$ 1mm	ISO 128, Project specification
Panel Thickness	Aluminum: 1.0mm, 1.5mm, 2.0mm	ASTM D7091, YS/T429.2

	Stainless Steel: 0.8mm, 1.0mm Thickness Error: $\pm 0.05\text{mm}$	
Surface Treatment	Powder coating (standard/textured) PVDF fluorocarbon (Kynar 500®) Anodized (natural or colored) Mill finish Gloss: 15–60° (customizable)	Professional Gloss Meter, AAMA 2604/2605
Coating Thickness	Powder coating: $\geq 60\mu\text{m}$ PVDF coating: $\geq 25\mu\text{m}$ Anodized: $\geq 10\mu\text{m}$	ASTM D7091
Perforation Parameters	Hole diameter: 0.4mm–10mm Open area: 10%–60% Patterns: Straight row, staggered, gradient, custom graphic Min hole diam $\geq$ material thickness	Per project specification
Acoustic Performance	NRC up to 0.80 (with acoustic fleece) Micro-perforation: 0.4–0.6mm holes Ultra-micro: 300,000–500,000 holes/m²	ASTM C423
Installation Method	Standard wall fixing brackets Hook-on suspension system Visible screw system (optional) Concealed clip system	AAMA 501.6

	(optional)	
Color Performance	Multi-color optional (RAL/ Pantone® matching) Monochrome color difference: $\Delta E^*_{ab} \leq 1.5$ Metallic/effect finishes available	ISO 7724-1
Adhesion Strength	Cross-cut: Class 0–1 (no peeling) Pull-off: ≥ 5 MPa	ASTM D3359
Hardness	Pencil Hardness: HB (minimum) Panel surface resists minor scratches and impacts	ASTM D3363
Fire Resistance Rating	Grade A (non-combustible) per EN 13501-1 Class A per ASTM E84 (Flame Spread ≤ 25 , Smoke Developed ≤ 450)	EN 13501-1, ASTM E84
Flatness	≤ 1.5 mm/m for standard panels ≤ 0.5 mm/m with honeycomb backing (premium)	YS/T429.1
Corrosion Resistance	Salt spray: ≥ 1000 h (ASTM B117) with appropriate coating High temp resistance: $\leq 70^\circ\text{C}$ High humidity: RH $\geq 95\%$	ASTM B117
Tensile Strength	AA1100: 90–110MPa AA3003: 145–180MPa SS304: ≥ 520 MPa	ASTM E8, GB/T3880

Density	Aluminum: 2.70 g/cm ³ Stainless Steel: 7.93 g/cm ³	ASTM D792
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3. Manufacturing Process

3.1 Perforation Pattern Design & Programming:

Engineers translate architectural drawings, custom graphics, logos, or text into CNC perforation maps. Hole diameter, pitch, arrangement (straight row, staggered, gradient, fade, or custom graphic) are programmed into the turret punch or laser controller. The pattern layout ensures compliance with structural constraints: minimum hole diameter $\geq$ material thickness, minimum edge distance $\geq$ material thickness, and open area limits per panel gauge. A digital prototype is generated for client approval before production.

3.2 Material Selection & Preparation:

Aluminum alloy sheets (AA1100, AA3003) in specified gauges (1.0mm, 1.5mm, 2.0mm) or stainless steel (304, 316) are cut to panel size with dimensional tolerance of ± 1 mm. The substrate undergoes degreasing and dust removal to ensure clean perforation edges and optimal adhesion for subsequent surface finishing. Protective film is applied to the top surface prior to perforation to minimize tool marking.

3.3 Precision Perforation:

Perforation is executed using one of four technologies depending on pattern complexity and volume: (1) Turret punch press for high-volume standard patterns, up to 600 hits/min with multi-station tool change for mixed hole sizes on a single panel. (2) Dedicated single-station punch for extended runs of ultra-micro perforation (0.4–0.6mm holes). (3) CNC engraving for non-round openings and custom geometric patterns. (4) Fiber laser cutting for complex graphics, logos, and variable-size hole arrangements with kerf width of 0.1–0.2mm. Burr removal is performed on both faces.

3.4 Surface Finishing:

After perforation and deburring, panels receive specified surface treatment. Options include powder coating (standard or textured), PVDF fluorocarbon coating for exterior durability, anodized finish, or mill finish. Acoustic fleece backing is thermally bonded to the rear face for sound absorption applications. Fleece color (black, grey, or white) is selected to match back-visibility requirements. For double-sided visible installations, both front and back faces receive identical coating with matching color and gloss levels.

3.5 Stiffening & Structural Reinforcement:

For large-format panels or those exceeding recommended open area limits, structural reinforcement is applied to the non-visible back face. Options include: formed integral stiffening channels at panel edges, bonded aluminum L-profiles (20x20mm or 30x30mm) at 600–900mm centers, or 10–15mm aluminum honeycomb core bonding for maximum flatness in premium applications. All reinforcement is installed without interfering with the visible perforation pattern.

3.6 Installation Accessory Matching & Quality Inspection:

Standard wall fixing brackets or hook-on suspension systems are configured per project requirements. Each panel undergoes dimensional inspection, hole pattern verification, surface finish quality check, flatness measurement ($\leq 1.5\text{mm/m}$), and acoustic fleece adhesion testing. Packaging includes interleaving protective sheets and edge protectors for damage-free transit.

4. Application Scope

Ballesta perforated wall panels are widely used in architectural interior and exterior applications, including but not limited to:

- Auditoriums, concert halls, theaters and lecture halls requiring acoustic control
- Office lobbies, atriums and open-plan spaces with feature wall designs
- Airport terminals, railway stations and metro transit hubs where fire safety and acoustics are critical
- Corporate headquarters, hotel lobbies, retail boutiques and branded spaces with custom logo perforation
- Façade cladding and rainscreen applications requiring ventilated and visually striking panel surfaces

5. Compliance Standards

- **ASTM B209:** Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- **ASTM E84:** Standard Test Method for Surface Burning Characteristics of Building Materials (Class A)
- **EN 13501-1:** Fire Classification of Construction Products and Building Elements (Class A2)
- **ASTM C423:** Standard Test Method for Sound Absorption and NRC Ratings
- **ASTM D7091:** Standard Practice for Nondestructive Measurement of Dry Film Thickness
- **ASTM D3363:** Standard Test Method for Film Hardness by Pencil Test (HB minimum)
- **ISO 7724-1:** Paints and Varnishes – Colorimetry – Color Difference (ΔE^*_{ab})
- **ASTM B117:** Standard Practice for Operating Salt Spray (Fog) Apparatus ($\geq 1000\text{h}$)

6. Packaging & Storage

Packaging: Each perforated panel is interleaved with protective sheets to prevent surface contact, wrapped in PE film, then packed in wooden crates with foam padding at edges and corners to avoid deformation and perforation edge damage during transit.

Storage: · Store in a dry, ventilated and rainproof warehouse, avoid direct sunlight, high temperature ($>70^\circ\text{C}$) and high humidity ($\text{RH}>95\%$) environment.

- Avoid contact with sharp objects, chemicals and corrosive substances to prevent surface damage and substrate corrosion.
- Stacking height shall not exceed 3 layers to prevent flatness damage caused by excessive pressure.
- The storage site shall be far away from fire sources to meet the fire safety

requirements of Grade A fire-resistant materials.

7. Quality Assurance

All perforated wall panels undergo strict multi-item quality inspection before delivery, including dimensional tolerance, hole pattern verification (position, diameter, and open area percentage), surface finish quality, color difference ($\Delta E^*_{ab} \leq 1.5$), flatness ($\leq 1.5\text{mm/m}$), coating thickness, adhesion strength, and acoustic fleece integrity.

We provide a warranty period of not less than 15 years for the product (under normal use conditions and compliance with installation and storage requirements). Custom warranty terms are available upon negotiation for specific project requirements.
