

Standard Mill Finishes Applied by steel mills during the rolling process:

1. 2B Finish

- **Characteristics:** Cold-rolled, heat-treated, acid-pickled, and lightly skin-passed. Smooth, uniform surface with a slight sheen; no distinct grain.
- **Applications:** Most common finish for precision strips. Used for electronic components, medical device substrates, and parts requiring deep drawing or machining.

2. BA Finish (Bright Annealed)

- **Characteristics:** Annealed in a reducing atmosphere (e.g., dry H₂/N₂ mix) without pickling. Highly reflective, low roughness ($R_a \leq 0.2 \mu\text{m}$).
- **Applications:** High-end electronics, precision instruments, food processing equipment (where cleanliness and gloss are critical).

3. 2D Finish

- **Characteristics:** Acid-pickled and dull-rolled (using textured rolls). Matte appearance, higher roughness ($R_a 0.2 \sim 0.4 \mu\text{m}$), retains lubricants well.
- **Applications:** Parts requiring severe forming (e.g., automotive springs, stampings).

Specialized Finishes

Further processing for enhanced function or aesthetics:

Textured Finishes

1. Brushed (HL Finish)

- **Process:** Directional grinding with abrasive belts to create linear ("hairline"), random, or snowflake patterns.
- **Characteristics:** Scratch-resistant, low glare, tactile feel.
- **Applications:** Elevator cladding, appliance panels (range hoods, refrigerators).

2. Bead Blasted / Sandblasted

- **Process:** Bombarding surface with fine media (glass beads, ceramic grit).
- **Characteristics:** Uniform matte texture, increases coating adhesion.
- **Applications:** Architectural accents, industrial machinery housings.

Specialized Finishes

Coloring & Coating

1. PVD Coating (e.g., Titanium Coating)

- **Process:** Depositing thin, colored metal films (gold, rose gold) via Physical Vapor Deposition.
- **Characteristics:** Decorative, wear/corrosion-resistant, colorfast.
- **Applications:** Luxury architecture (façades), high-end accessories.

2. Nano/Anti-Fingerprint (AF) Coating

- **Process:** Applying a thin ceramic/fluorocarbon layer or protective film.
- **Characteristics:** Repels stains/fingerprints, easy to clean, maintains metallic look.
- **Applications:** Cookware, consumer electronics (phone frames, watch bands).

High-Gloss & Mirror Finishes

1. 8K Mirror Finish

- **Process:** Progressive mechanical or chemical polishing to achieve $Ra \leq 0.1 \mu m$; produces flawless reflectivity.
- **Applications:** Luxury décor, instrument panels, optical reflectors.

2. Electropolishing (EP)

- **Process:** Electrochemically dissolving surface peaks to enhance flatness and passive layer.
- **Characteristics:** Ultra-smooth, stress-free, maximizes corrosion resistance/cleanliness.
- **Applications:** Medical implants, semiconductor tools, food/beverage pipelines.

Etching & Embossing

1. Chemical Etching

- **Process:** Acid-etching through a mask to create custom patterns/textures.
- **Characteristics:** Combines with brushing/PVD for 3D effects.
- **Applications:** Decorative panels, signage.

2. Embossing

- **Process:** Pressing patterns (e.g., wood grain, geometric designs) with engraved rolls/dies.
- **Applications:** Architectural interiors, furniture surfaces.

Selection Guide

- **Corrosion Resistance:** EP, mirror, and BA finishes ($R_a < 0.5 \mu\text{m}$) perform best.
- **Aesthetics:** PVD, etching, and brushing enhance visual appeal.
- **Cleanability:** AF coating and EP suit hygienic environments (medical/food).
- **Formability:** 2D/2B finishes facilitate stamping/forming.

Surface Finish Comparison & Applications

Finish Type	Key Properties	Ideal Use Cases	Typical Applications
2B Finish	Smooth, matte sheen, formable	Parts needing post-processing	Electronic contacts, device chassis
BA Finish	High gloss, ultra-clean, smooth	Visual appeal + hygiene	Sensors, food-grade components
2D Finish	Matte, rough (retains lubricant)	Severe forming operations	Automotive parts, springs
Brushed (HL)	Directional grain, scratch-resistant	Decorative + durable surfaces	Appliance exteriors, elevators
Bead Blasted	Uniform matte, non-directional	Coating prep, low-reflectivity	Tools, architectural trim
PVD Coating	Decorative colors, wear-resistant	Premium visual/haptic surfaces	Luxury items, building cladding
AF Coating	Fingerprint/stain-resistant, easy-clean	High-touch surfaces	Electronics, kitchenware
8K Mirror	Near-perfect reflectivity	Decorative/mirror functions	Display trim, optical systems
Electropolishing	Ultra-smooth, corrosion-optimized	Critical hygiene/corrosion zones	Medical tools, pharma equipment
Chemical Etching	Custom patterns/textures	Branding, visual differentiation	Nameplates, artistic panels
Embossing	Tactile 3D patterns	Decorative/textured surfaces	Furniture, interior design elements