

Submitted for recognition as an American National Standard

**GUIDELINES FOR USAGE OF STAINLESS STEEL AND
BIMETAL FOR EXTERIOR AUTOMOTIVE BRIGHT TRIM**

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

Stainless steel and bimetal have been used extensively for many years on automotive molding systems, as well as functional systems. These alloys provide an economical option for automotive trim systems. Bright moldings have allowed designers to both enhance the appearance and differentiate models of the same platform.

When choosing materials for moldings that are attached to the body, consider the whole system: component being attached, method of attachment, location of the molding on the vehicle, and panel or structure to which the molding is attached. All the materials must be compatible, to preclude galvanic corrosion or other destructive interactions.

1. **Scope**—The scope of this SAE Recommended Practice is to give guidelines for design, processing, and material selection for stainless steel and bimetal exterior automotive moldings.

2. **References**

2.1 **Applicable Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J405—Chemical Compositions of SAE Wrought Stainless Steels

2.1.2 ALUMINUM ASSOCIATION PUBLICATION—Available from the Aluminum Association, Inc., 900 19th Street, NW, Washington, DC 20006.

Aluminum Standards and Data

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3. Technical Requirements

3.1 General Design Considerations

- 3.1.1 CREVICE CORROSION—Avoid system designs that promote crevice corrosion, such as pockets or flat horizontal shelves that could collect corrosion promoting media. Crevice corrosion is intense localized corrosion that occurs in crevices or other shielded areas that are exposed to corrosive media. Stainless steel is susceptible to crevice corrosion. If possible, leave an open gap between the molding and the sheet metal to allow good air circulation. Eliminate rough edges and minimize the effects of cold work on the edges to help make the molding less susceptible to crevice corrosion.
- 3.1.2 CHROMIUM PLATING—Chromium plated moldings have special shape requirements. Sharp corners and projections are prone to excessive plating build-up and/or burning, and therefore should be avoided. Deep recesses, sharp radius concavities, and long return flanges tend to receive little or no plating, so those kinds of features should be avoided. To achieve uniform plating thickness, keep all appearance surfaces as close as possible to the major plane of the part. Parts to be plated may need a hole in them for mounting on racks.
- 3.1.3 GALVANIC CORROSION—Stainless steel will cause galvanic corrosion of mild steel (galvanized or bare) or aluminum panels which it touches in the presence of an electrolyte, such as salt water. Therefore, stainless steel should never be allowed to be grounded to the body. Do not count on the body paint to provide sufficient isolation. When stainless steel in the vicinity of a paint chip or scratch is connected to the exposed metal substrate via an electrolyte such as salt water, it will cause severe localized corrosion of the exposed metal.

The stainless steel can be isolated from the body by encapsulating the molding in plastic or using a foam or other nonconductive tape on the back. If the molding must be grounded to the body panel, then bimetal should be used. Bimetal consists of stainless steel on the front side, with aluminum clad on the back. The molding is formed of this sandwich material. The aluminum on the back provides sacrificial protection for the body. Note that when the aluminum corrodes, a white corrosion product forms which may bleed around onto the front of the molding. This is most prevalent when the molding edges are not curled around to the back.

3.2 Fastening Considerations

- 3.2.1 DESIGN—Do not put holes in any body panel after paint! Even when holes are put in body panels before paint, they should only be put in "wet" panels. Weld studs are preferred instead of fasteners that are inserted through holes.
- 3.2.2 FASTENER MATERIAL—The fastener material must be chosen carefully. Do not use stainless steel fasteners unless they touch only stainless steel, brass, and/or plastic. If the part is not too heavy, adhesives may be used. Plastic or coated aluminum fasteners may be used, depending on the molding material to which they are attached. Steel fasteners must have corrosion protective coatings that are designed to resist the exterior environment.

If the moldings are solid stainless, they should not have any metal fasteners touching them (except stainless steel¹). Plastic clips can be used to hold moldings to metal studs on the panel. Or adhesive foam tape may be possible. If the stainless steel is partly encapsulated in plastic, metal fasteners may be used only in the plastic, and only if they do not go through a stainless steel core.

1. If the screw goes into a brass or stainless steel nut that is isolated from the body, then it should be stainless or brass.

3.3 Processing Considerations

- 3.3.1 SURFACE CONTAMINATION—Iron abrasion can lead to red rust and potentially pit corrosion. During forming or other manufacture, it is important to avoid tool wear or other abrasion that can contaminate the stainless surface. This is especially true if such tools have previously been used to process carbon steels or other material.

If such contamination is unavoidable, the stainless surface should be treated with diluted nitric acid or other suitable cleanser with subsequent careful rinsing with water in order to reestablish the noncorrosive character of the surface.

- 3.3.2 SURFACE SMOOTHNESS—The smoother a stainless surface is, the easier it is to keep it clean. Bright annealing or buffing achieve such smoothness. Note that dust or other particles may adhere more easily to a material's *horizontal* (buffing) lines and can be drained off more easily from *vertical* (buffing) lines.
- 3.3.3 SURFACE CLEANLINESS—A mild detergent should be used regularly to clean the stainless surface. Frequent cleaning enhances appearance and long-term corrosion resistance of the stainless.

- 3.4 **Material Selection**—Remember, only use stainless steel if it is insulated from the rest of the car! Bimetal (aluminum-backed stainless steel) is available for designs that cannot be isolated.

- 3.4.1 STAINLESS STEEL (SAE J405)—SAE 51434 is a chromium-molybdenum bearing alloy used where resistance to pitting and rusting is required. It is used when roping control is not required for the product application. Roping becomes a concern on parts stretched more than 3 to 5%. SAE 51436 is similar to SAE 51434 in corrosion resistance. The addition of columbium allows its use when roping control is required for the product application. SAE 51434 and SAE 51436 do not need chromium plating to attain an acceptable, attractive appearance. However, chromium flashing will increase the corrosion resistance of SAE 51434 and 51436. Note that those two alloys have had occurrences of pitting and red rust when used below the beltline. Generally, 0.10 to 0.12 μm of chromium is recommended for achieving the additional corrosion protection without causing a milky appearance. Buffing before chromium flashing may be needed to achieve the best appearance.

SAE 30201 is a chromium-manganese-nickel bearing alloy that is stronger, more ductile, and has better corrosion resistance than SAE 51434 and 51436, unless parts are chromium flashed. It is sometimes used for automotive trim fabrication where increased ductility is required for deep drawing or where increased atmospheric corrosion resistance is required. SAE 30301 is a chromium-nickel bearing alloy which has greater formability than the above alloys. It is used for trim parts requiring deep drawing or stretching operations or where increased atmospheric corrosion resistance is required. SAE 30201 and SAE 30301 will appear yellowish unless they are chromium flashed or chromium plated. The minimum thickness requirement for chromium flash is 0.12 μm for color match.

- 3.4.2 BIMETAL (SAE J405 FOR THE STAINLESS STEEL PORTION AND ALUMINUM STANDARDS AND DATA FOR THE ALUMINUM PORTION)—Bimetal as used for exterior automotive trim consists of cold rolled SAE 51434 or SAE 30201 stainless steel metallurgically bonded to either an AA1100 or AA3003 aluminum alloy or an AA5052 alclad with AA1100 series equivalent alloy. The stainless steel surface is intended to form the significant or visible side of fabricated parts. The bimetal is to be comparable in appearance to solid stainless steel and offer some corrosion protection to the vehicle due to the galvanic protection provided by the aluminum.

The selection of which bimetal to use will be based more on formability than appearance. The formability is affected by temper, aluminum alloy backing, and ratio of stainless steel thickness to aluminum thickness. The supplier who will be forming the part should be consulted to help determine which choice of bimetal would be most appropriate for a particular part.

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As noted previously, the SAE 51434 alloy is susceptible to pitting and red rust when used below the beltline. Therefore, chromium flash on the stainless steel side of the part may be needed for additional corrosion protection. Follow the same guidelines as previously mentioned for SAE 51434 with chromium flash. When chromium flashing bimetal, one should run high current densities, and very short times in order to not dissolve too much aluminum in the chrome tank.

- 3.4.3 NICKEL/CHROMIUM PLATING—For a deeper chromium plating appearance, nickel/chromium plating can be used on any of the previously mentioned alloys. Different processing is used for SAE 51434 and SAE 51436 than for SAE 30201 and SAE 30301.

PREPARED BY THE SAE STAINLESS STEEL AND BIMETAL SUBCOMMITTEE
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