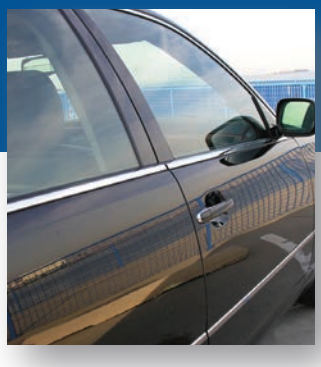
CLIFFS

# 434
## STAINLESS STEEL



- **Automotive Trim**
- **Dishwashers**
- **Gutters**
- **Range Hoods**
- **Roofing Equipment**

The most common applications for **TYPE 434** are automotive trim and molding. Additional consumer product applications include: furnace combustion chambers, dishwashers, range hoods, gas burners on heating units, gutters, down spouts and flatware. Commercial and industrial applications range from interior architectural uses to nitric acid plant equipment, oil refinery equipment, roofing and siding, and restaurant equipment.

# Product Description

Type 434 is a modification of Type 430, one of the most widely used of the non-hardenable, ferritic stainless steels. The addition of molybdenum (Mo) increases this alloy's corrosion resistance and its attack from many deicing chemicals. It also provides good heat and oxidation resistance up to 1500 °F (816 °C), as well as good mechanical properties. Heating above the critical austenite forming temperature leads to a room temperature microstructure of ferrite and fine martensite. As-annealed the alloy is ferritic. Maximum service temperature is 1500 °F (816 °C).

## AVAILABLE FORMS

Type 434 is available in thicknesses from 0.008 – 0.145 in. (0.20 mm – 3.68 mm) widths up to and including 48 in. (1219 mm).

Values shown in this bulletin were established in U.S. customary units. The metric equivalents of U.S. customary units may be approximate.

| Composition | | (wt %) |
|---|---|---|
| Carbon | (C) | 0.12 max. |
| Manganese | (Mn) | 1.00 max. |
| Phosphorus | (P) | 0.04 max. |
| Sulfur | (S) | 0.03 max. |
| Silicon | (Si) | 1.00 max. |
| Chromium | (Cr) | 16.0 – 18.0 |
| Molybdenum | (Mo) | 0.75 –1.25 |

## PHYSICAL PROPERTIES

| | |
|---|---|
| Density, lbs/in.$^3$ (g/cm$^2$) | 0.28 (7.74) |
| Electrical Resistivity, $\mu\Omega$•in. ($\mu\Omega$•cm)<br>70 °F (21 °C) | <br>23.68 (60) |
| Specific Heat, BTU/lb./°F (kJ/kg•K)<br>32 – 212 °F (0 – 100 °C) | <br>0.11 (0.46) |
| Thermal Conductivity, BTU/hr./ft./°F (W/m•K)<br>212 °F (100 °C)<br>932 °F (500 °C) | <br>15.1 (26.1)<br>15.2 (26.3) |
| Coefficient of Thermal Expansion, in./in./°F ($\mu$m/m•K)<br>32 – 212 °F (0 – 100 °C)<br>32 – 1000 °F (0 – 538 °C) | <br>5.8 x $10^{-6}$ (10.4)<br>6.3 x $10^{-6}$ (11.4) |
| Modulus of Elasticity, ksi. (MPa) | 29 x $10^3$ (200 x $10^3$) |
| Melting Range, °F (°C) | 2700 – 2790 (1482 – 1532) |
| Magnetic Characteristic | Ferro-magnetic |

# Properties

### TABLE 1 – TYPICAL MECHANICAL PROPERTIES

| UTS, ksi. (MPa) | 0.2% YS, ksi. (MPa) | Elongation % in 2 in. (50.8 mm) | Rockwell Hardness, B |
|---|---|---|---|
| 80 (552) | 50 (345) | 28 | 75 |

## CORROSION RESISTANCE

Type 434 has excellent corrosion resistance, including high resistance to nitric acid as well as to sulfur gases and many organic and food acids. This alloy does not provide the resistance to pitting by dilute-reducing acids that is provided by the chromium-nickel stainless steels, but does provide increased pitting resistance to deicing chemicals over Type 430. Because of its relatively high chromium content, the material provides good resistance to oxidation. Its maximum scaling temperature is 1500 °F (816 °C) for continuous service.

## FORMABILITY

Type 434 is readily drawn and formed. Its drawing characteristics are similar to those of low-carbon steel, although it is stronger in the annealed condition and will require stronger tooling and increased power. It is also adaptable to most hot-forming operations. It does have a slightly increased tendency to “rope” during forming than Type 430.

## WELDABILITY

The ferritic class of stainless steels is generally considered to be weldable by common fusion and resistance welding techniques. Special consideration is required to avoid brittle weld fractures during fabrication by minimizing discontinuities, maintaining low-weld heat input, and occasionally warming the part somewhat before forming. This particular alloy is generally considered to have poorer weldability than the most common alloy of this stainless class, Type 409. Major differences are the higher carbon content and the lack of stabilizing elements for this alloy which require post-weld annealing to restore optimum corrosion and forming characteristics. When a weld filler is needed, AWS E/ER 308L and 430 are most often specified. Type 434 is well known in reference literature and more information can be obtained in this way.

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## About Cleveland-Cliffs Inc.

Cleveland-Cliffs is the largest flat-rolled steel producer in North America. Founded in 1847 as a mine operator, Cliffs also is the largest manufacturer of iron ore pellets in North America. The Company is vertically integrated from mined raw materials and direct reduced iron to primary steelmaking and downstream finishing, stamping, tooling, and tubing. The Company serves a diverse range of markets due to its comprehensive offering of flat-rolled steel products and is the largest steel supplier to the automotive industry in North America. Headquartered in Cleveland, Ohio, Cleveland-Cliffs employs approximately 25,000 people across its mining, steel and downstream manufacturing operations in the United States and Canada.

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