Corten A588 Weathering Steel – Technical Material Specification

1.0 Material Overview & Common Uses

Corten A588 is a high-strength low-alloy (HSLA) weathering steel conforming to ASTM A588/A588M. It is designed to form a stable, protective patina layer when exposed to atmospheric conditions, eliminating the need for painting in many structural applications. The alloy contains copper, chromium, nickel, and phosphorus to enhance corrosion resistance.

Common industrial uses include bridge girders, transmission towers, railcars, shipping containers, architectural cladding, and outdoor sculptures. It is widely specified in Canadian infrastructure projects where long-term durability and reduced maintenance are critical.

2.0 Core Technical Properties & Sizing

- Density: 7.85 g/cm³ (0.284 lb/in³)
- Minimum yield strength: 345 MPa (50 ksi) for thicknesses up to 100 mm (4 in)
- Tensile strength range: 485–620 MPa (70–90 ksi)
- Elongation in 200 mm: 18% minimum
- Melting point: approximately 1425–1540°C (2600–2800°F)
- Hardness: typically 140–180 HB (Brinell) in the as-rolled condition
- Standard plate thicknesses: 3/16 in (4.8 mm) to 4 in (101.6 mm)
- Standard plate widths: 48 in (1219 mm) to 120 in (3048 mm)
- Length tolerance: +0.25 in (6.4 mm) / -0.0 in for sheared plates
- Flatness tolerance: per ASTM A6, typically 0.25 in over 36 in (6.4 mm over 914 mm) for thicknesses under 0.5 in

3.0 Processing, Machinability & Application

Corten A588 is machinable with conventional tooling but work-hardens moderately. Carbide inserts are recommended for production runs. Plasma cutting and laser cutting are common for profiling; oxy-fuel cutting is suitable for thicker sections. Welding requires low-hydrogen practices and filler metals that match the corrosion resistance of the base metal.

- Machining: use C2 or C3 carbide inserts with a positive rake geometry for turning and milling.
- Recommended cutting speed for turning: 60–90 m/min (200–300 SFM) with carbide; reduce by 20% for high-speed steel.
- Feed rate: 0.15–0.30 mm/rev (0.006–0.012 in/rev) for roughing; 0.08–0.15 mm/rev for finishing.
- Plasma cutting: use nitrogen or compressed air at 60–80 psi; dross removal may require grinding.
- Welding: use AWS E7018-W (weathering steel electrode) or ER70S-6 with argon/CO_2 shielding gas for GMAW.
- Preheat: minimum 50°C (120°F) for thicknesses over 1 in (25 mm); maintain interpass temperature below 315°C (600°F).
- Post-weld: no heat treatment required; allow natural patina formation in outdoor exposure.
- Cold forming: acceptable with a minimum bend radius of 2x thickness for transverse bends; avoid sharp radii to prevent cracking.

4.0 Common Defects & Quality Control

- Reject if surface laminations or delaminations are visible on plate edges after cutting.
- Reject if surface pits exceed 0.5 mm (0.020 in) depth or 3 mm (0.125 in) diameter in any 1 m² area.
- Reject if out-of-flatness exceeds 6 mm over 1 m (0.25 in over 36 in) for thicknesses under 12.7 mm (0.5 in).
- Reject if weld cracks, porosity clusters, or lack of fusion are detected via visual inspection or dye penetrant testing.
- Reject if chemical composition deviates from ASTM A588 limits: Cu 0.25–0.40%, Cr 0.40–0.65%, Ni 0.20–0.40%, P ≤0.04%.
- Reject if tensile strength falls below 485 MPa (70 ksi) or yield below 345 MPa (50 ksi) per certified mill test report.
- Reject if elongation in 200 mm is less than 18% for thicknesses up to 20 mm (0.75 in).

5.0 Storage, Handling & WHMIS Guidelines

- Store indoors or under cover in a dry, well-ventilated area; avoid prolonged contact with moisture to prevent premature rust staining.
- Maintain relative humidity below 60% during storage; temperature range: -20°C to 40°C.
- Shelf life: indefinite if stored properly; inspect for surface corrosion every 6 months.
- FIFO protocol: rotate stock by date of receipt; use oldest material first to minimize surface oxidation.
- WHMIS classification: not classified as a hazardous product under WHMIS 2015 in solid form; dust and fume from grinding/welding are hazardous.
- Mandatory PPE during cutting/grinding: safety glasses with side shields, hearing protection, and leather gloves.
- Welding fume: use local exhaust ventilation or respirator with N95/P100 filters; avoid inhalation of chromium and nickel compounds.
- First aid: for dust/particle eye contact, flush with water for 15 minutes; for skin contact, wash with soap and water.