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Aircraft Steels: Alloy and Corrosion-Resistant Steels, Heat Treatment, Corrosion and Inspection

SAE/AISI numbers · stainless series · heat treatment · exposure limits · corrosion · NDI

1 Identification

A READING THE NUMBER

SAE / AISI · AC 43.13-1B PAR. 4-2, TABLE 4-2

4130

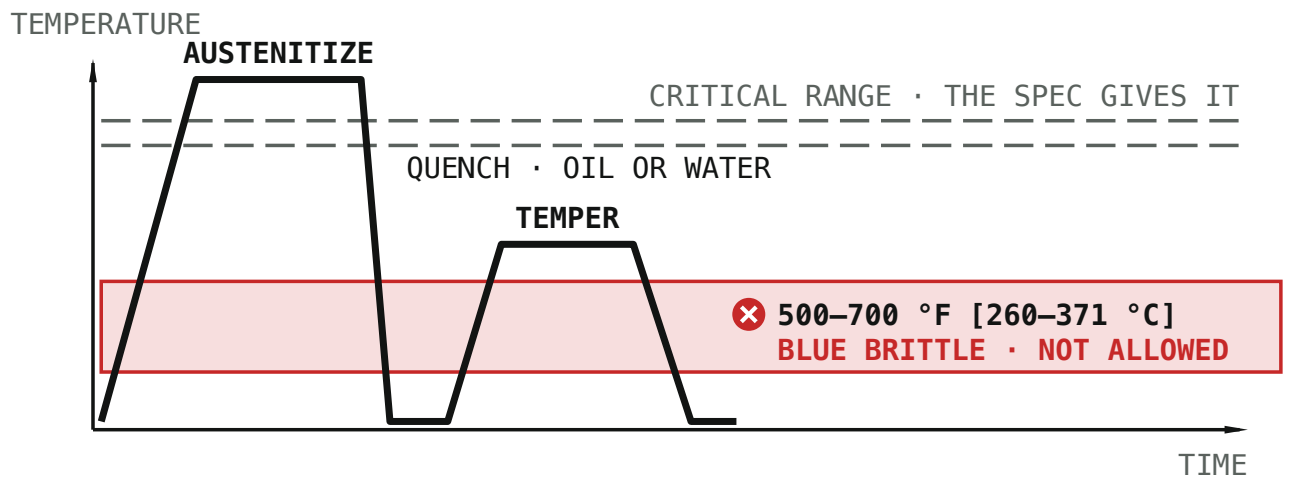
41XX · CHROMIUM-MOLYBDENUM
1 % CR · 0.25 % MO · TABLE 4-2

30 · CARBON, HUNDREDTHS OF 1 %
4130: 0.28 TO 0.33 %, MEAN 0.30 % · PAR. 4-2a

STAINLESS: 3XX AUSTENITIC, NON-MAGNETIC · 4XX MAGNETIC
AC 43.13-1B 6-166 · TABLE 4-3: 410 IS MARTENSITIC, MAGNETIC

B HARDEN AND TEMPER

SCHEMATIC: ONLY THE BAND HAS VALUES · MIL-HDBK-5J 2.1.2, 2.3.0.2



NORMALIZE: 150–225 °F [83–125 °C] ABOVE THE CRITICAL RANGE,
SOAK ≈ 1/4 H PER INCH, COOL IN STILL AIR · AC 43.13-1B 4-1c

C EXPOSURE LIMIT AFTER Q&T

MIL-HDBK-5J TABLE 2.3.0.3 · °F [°C] BY FTU

ALLOY	125 KSI	150 KSI	180 KSI	200 KSI
4130, 8630	925 [496]	775 [413]	575 [302]	–
4140, 8740	1025 [552]	875 [468]	725 [385]	625 [329]
4340	1100 [593]	950 [510]	800 [427]	700 [371]

≈ 100 °F [56 °C] BELOW THE TEMPER · ≤ 1 H PER INCH, 1/2 H UNDER 1/2 IN

The Aviation Point.	TITLE: AIRCRAFT STEELS	DWG NO.: TAP-SYL-E01	REV: A
SCALE: NTS	UNITS: °F [°C]	PROJ.: –	SHEET: 1/1
MATERIAL: LOW-ALLOY AND CRES	TOLERANCES: –	SOURCE: AC 43.13-1B · MIL-HDBK-5J	STATUS: TYPICAL, NOT APPROVED

Reading an SAE/AISI number (AC 43.13-1B par. 4-2, Table 4-2), the harden-and-temper cycle with the blue-brittle range (MIL-HDBK-5J pars. 2.1.2, 2.3.0.2) and the exposure limits after quench and temper (MIL-HDBK-5J Table 2.3.0.3).

Reading the SAE/AISI number

Number	What it says	Example
10XX	Plain carbon steel: no principal alloying element	1020: 0.20 % carbon mean (0.18 to 0.23 %)
2XXX	Nickel steel; 3.00 to 3.75 % nickel is the grade in common use	2330: about 3 % nickel (3.25 to 3.75 %), 0.30 % carbon; bolts, terminals, keys, clevises, pins
41XX	Chromium-molybdenum: 1 % chromium, 0.25 % molybdenum	4130: 0.80 to 1.10 % Cr, 0.15 to 0.25 % Mo, 0.28 to 0.33 % C
43XX	2 % nickel, 1 % chromium, 0.25 % molybdenum	4340: about 0.40 % carbon, from its last two digits
86XX, 87XX	0.5 % chromium, 0.5 % nickel, with 0.20 % (86XX) or 0.25 % (87XX) molybdenum	8630, 8740
11XX, leaded	Extra sulfur, or lead, for easy machining	Not for highly stressed aircraft parts: the transverse properties drop sharply
Three digits	Stainless and heat-resisting steels: AISI three-digit numbers or the producer's name; chromium is essential	302: 0.15 C, 18 Cr, 9 Ni, austenitic; 321 (titanium) and 347 (columbium): additions that cut intergranular corrosion in welded work; 410: 12.5 Cr, martensitic, magnetic

Educational reference only, not approved data. Always consult the applicable SRM, AMM, or AC 43.13-1B and your certifying authority.

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2 Allowable damage

The limits that come with the steel

Limit	Value
High-strength steel	Heat treated above Rockwell C40, 180,000 psi (1,241 MPa) tensile
Exposure after quench and temper	About 100 °F (56 °C) below the typical tempering temperature, for no longer than about 1 h per inch of thickness (1/2 h under 1/2 in); values in the drawing, part C
Blue-brittle range	About 500 to 700 °F (260 to 371 °C)
Low temperature	Below –100 °F (–73 °C)
PH stainless in service	Long exposure above 600 °F (316 °C) and below the tempering range
Cold-worked austenitic	Above about 900 °F (482 °C)
Electrolytic plating	Without a bake to remove the hydrogen
Humid air, water, salt water	On high-strength steel
Damage on the part	—

3 Repair

1. Identify the steel and its condition.
2. High-strength? Hand methods only.
3. No acid strippers or removers.
4. No power tools, no heat.
5. Measure against the SRM.
6. Protect, bake plating, record.

Key points

- **Know the heat-treated value** before any rework.
- **Above Rockwell C40 / 180 ksi:** hand methods only, no chemical removers.
- **300 series** non-magnetic, **400** magnetic: a magnet is not the final word.
- **Heat:** stay below the exposure limit of the condition.

MAIN SOURCES · AC 43.13-1B CHG 1, Acceptable Methods, Techniques, and Practices: Aircraft Inspection and Repair · MIL-HDBK-5J, Metallic Materials and Elements for Aerospace Vehicle Structures · FAA-H-8083-31B, Aviation Maintenance Technician Handbook – Airframe · TO 1-1A-1 / NAVAIR 01-1A-1, General Manual for Structural Repair · Specifications named by number

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