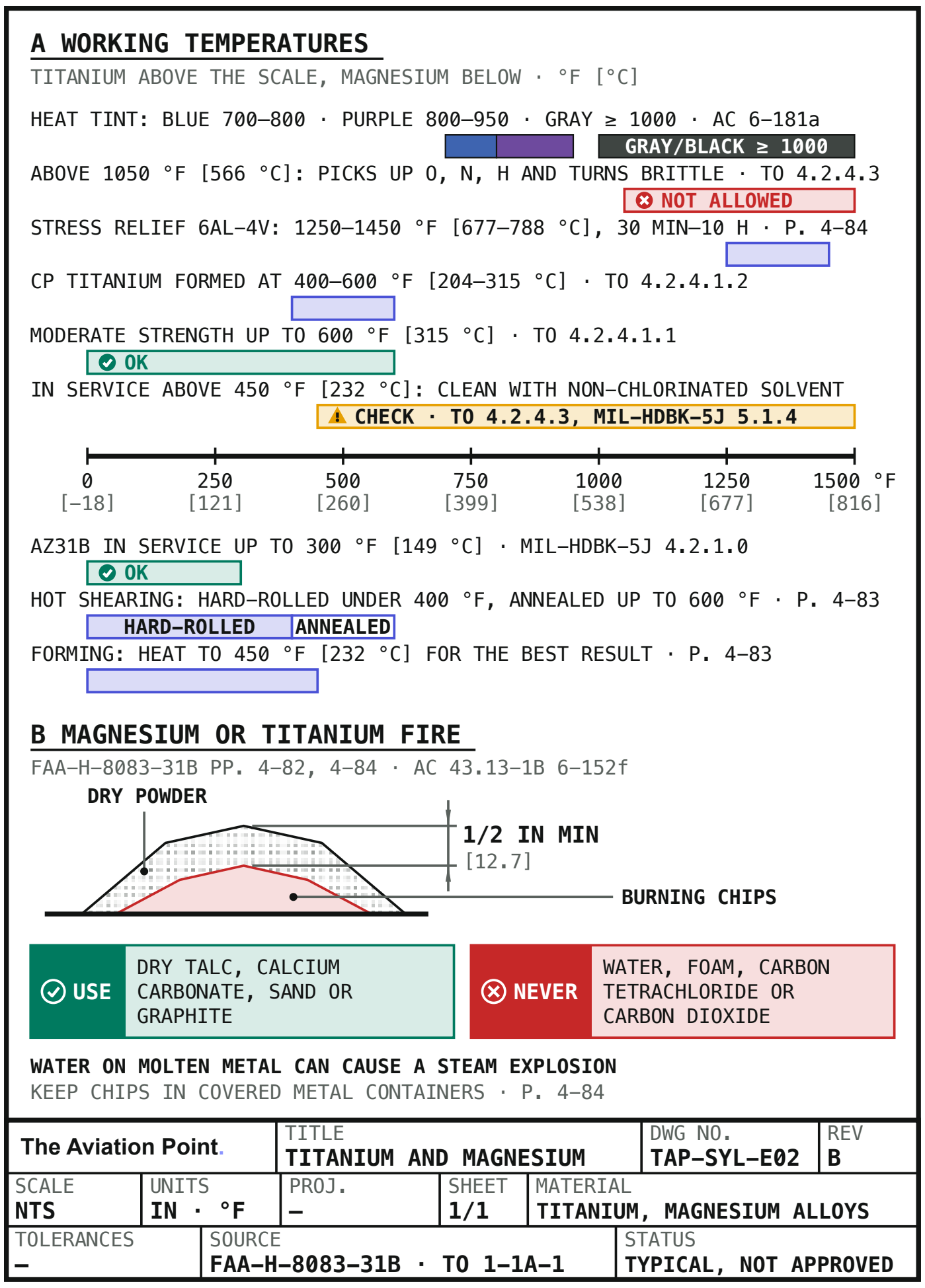
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Titanium and Magnesium Alloys: Identification, Limits, Shop Work, Corrosion and Fire

Titanium and magnesium · designations · limits · drilling · forming · isolation · fire

1 Identification



Titanium and magnesium temperatures from AC 43.13-1B par. 6-181a, TO 1-1A-1 pars. 4.2.4.1.1, 4.2.4.1.2 and 4.2.4.3, MIL-HDBK-5J pars. 4.2.1.0 and 5.1.4 and FAA-H-8083-31B pp. 4-83 and 4-84; the fire from FAA-H-8083-31B pp. 4-82 and 4-84 and AC 43.13-1B par. 6-152f.

2 Allowable damage

Titanium: limits that matter in repair

Limit	Value
Strength in service	Moderate strength up to 600 °F (315 °C)
Upper temperature	Below 1050 °F (566 °C)
Heat tint	Blue 700 to 800 °F (371 to 427 °C); purple 800 to 950 °F (427 to 510 °C); gray or black 1000 °F (538 °C) and higher
Hot salt	Stress corrosion by dry sodium chloride, seen in laboratory tests at 450 to 500 °F (232 to 260 °C) and higher; no service failure reported
Other media	Methyl alcohol, chloride salt solutions, hydrogen, liquid metals, also at lower temperatures
Cadmium, silver, mercury	Contact, under certain conditions
Oxygen	No contact with liquid oxygen, or gaseous oxygen at cryogenic temperature; about 50 psi (345 kPa) partial pressure ignites a fresh surface from –250 °F (–157 °C) to room temperature or higher
Creep at room temperature	Can be significant above about 50 % of Fty for unalloyed titanium and about 75 % of Fty for the standard alloys
Cracks in water	Some alloys grow fatigue cracks faster in water or salt water; thin sheet is not susceptible, thicker sections become so
Damage on the part	—

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3 Repair

Working magnesium

Job	Rule
Cutting sheet	Blade shears, blanking dies, routers or saws; never conventional shears or nibblers (rough, cracked edge); clearance 3 to 5 % of the thickness
Cold shearing	Not on hard-rolled sheet over 0.064 in (1.63 mm) or annealed sheet over 1/8 in (3.18 mm); shave about 1/32 in (0.79 mm) off a rough edge
Hot shearing	Annealed sheet up to 600 °F (316 °C), hard-rolled under 400 °F (204 °C); allow for shrinkage
Sawing	The only method for plate over 1/2 in (12.7 mm); bandsaw 4 to 6 tooth pitch, nonsparking blade guides
Bending	Cold: radius at least 7 t for soft and 12 t for hard sheet; heated: 2 to 3 t; best results heated to 450 °F (232 °C)
Heating	Watch the temperature: it burns or forms molten pools and is ruined; a sulfur dioxide atmosphere protects it
Layout and edges	Soft carpenter's pencil only: a scribed mark can start a fatigue crack; sharp corners and burrs off near the bend line
Rivets and repair metal	5056 rivets (see Where the documents differ); clad 2024-T3 is often the repair material, insulated from the magnesium
Dissimilar metals	Protect both, separate them, plate the magnesium or film the other metal; faying surfaces get epoxy primer and sealant; on patches two coats of epoxy primer on doubler and skin, vinyl tape and sealed edges
Machining	Sharp tools, high speeds, heavy cuts; chips, filings and shavings in covered metal containers

1. Identify the metal.
2. Read the SRM limits.
3. Fire kit ready for magnesium.
4. Right tools and speeds.
5. Keep contaminants off titanium.
6. Isolate, seal, record.

Key points

- **Titanium:** below 1050 °F; no chlorides when hot; no cadmium, silver, mercury.
- **Magnesium:** insulate every joint and keep the coating whole.
- **Fire:** dry talc, calcium carbonate, sand or graphite, 1/2 in deep; never water.
- **The SRM governs** every damage limit.

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

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