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4340 ALLOY STEEL – AMS 6414 VAR – UNSG43406 DATA SHEET

GENERAL CHARACTERISTICS:

4340 VAR AMS 6414 is a low alloy Chromium-Nickel-Molybdenum steel capable of being heat treated to high strength levels. This specification is for a premium aircraft-quality, low-alloy steel in the form of bars, forgings, mechanical tubing, and forging stock. Service Steel Aerospace stocks Premium Aircraft Quality produced double melted in an Electric Furnace, followed by VAR, or Vacuum Arc Remelt (also known as CEVM, or Consumable Electrode Vacuum Arc Remelting). This results in a much cleaner steel meeting the magnetic particle test requirements of AMS-2300. It is a steel of the highest quality with excellent transverse ductility and toughness at high strength levels. It has good shock and impact resistance as well as wear and abrasion resistance in the hardened condition. Standard Aircraft Quality air-melted AMS 6414 Air Melt material is available on request. 4340 ESR, or Electroslag Remelted material is also available on request.

Service Steel Aerospace is one of the largest distributors / suppliers of 4340 Alloy Steel available in several forms including round bar, flat bar, and square bar as well as block, and billet. See below for product size ranges stocked.

4340 alloy steel applications:

4340 has been used typically for parts requiring a through-hardening capability up to 3.5 inches (89 mm) in nominal thickness at time of heat treatment and subject to rigid magnetic particle inspection standards, but usage is not limited to such applications. Premium Aircraft Quality is intended for use in the manufacturing of highly stressed parts at higher strength levels, such as 260/280,000 psi and where a much cleaner steel is desired.

Common Specifications:

- AMS 6414 VAR (CEVM)
- AMS 6414 ESR
- AMS 6415 (Air Melt)
- MIL-S-5000, AMS-S-5000 (Both are canceled and superseded by AMS 6415)
- MIL-S-8844
- 299-947-055 Bell Helicopter
- SS 9702 Sikorsky
- DMS 1555 Boeing (Previously McDonnell Douglas)





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Common Trade Names:

- Lescalloy 4340 Vac-Arc
- European Designation 36CrNiMo4

Common OEM

Approvals:

- Bell Helicopter
- Boeing
- Bombardier
- Pratt Whitney LCS
- Sikorsky

4340 VAR AMS 6414 Stocked Sizes:

- Rounds: 39 sizes 0.500" through 10.00" diameter
- Flats & Blocks: 12" x 23" block to cut-to-size" - Custom thicknesses & widths available saw-cut
- Billets: 7" and 14" billet for conversion to special sizes

Note: Stocked as Normalized and Tempered

4340 Air Melt AMS 6415 Stocked Sizes:

- Rounds: 35 sizes 0.500" through 8.500" diameter

Chemical Composition:

Symbol	Element	Min %	Max %
C	Carbon	0.38%	0.43%
Mn	Manganese	0.65%	0.90%
Si	Silicon	0.15%	0.35%
P	Phosphorus		0.01%
S	Sulfur		0.01%
Cr	Chromium	0.70%	0.90%
Ni	Nickel	1.65%	2.00%
Mo	Molybdenum	0.20%	0.30%
Cu	Copper		0.35%

Physical Properties:

- Density: 0.2836 #/in³
- Grain Size 5 or finer

Macrostructure limits:

Class	Condition	Severity
1	Freckles	A
2	White Spots	A
3	Radial Segregation	B
4	Ring Pattern	B



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Hardenability Requirements:

- Jominy: J 12/16 inch: 53 RC Hardness min
 - Jominy: J 20/16 inch: 32 RC Hardness min
- For Material Normalized 1600° F (871° C) with Test Specimen Austenitized 1550° F (843° C)

Heat Treatment:

Type	Process
Normalize	1600° - 1700° F (871° – 927° C), then air cool
Austenitize	1475° – 1575° F (802° – 857° C), then quench in oil
Temper	400° – 1200° F (204° – 649° C) depending on desired strength. For Ultimate Tensile Strength above 260ksi, temper between 400° – 500° F (204° – 260° C)

Tempering Data:

Temperature	Hardness (approx)
400° F (204° C)	52 HRC
500° F (260° C)	49 HRC
600° F (316° C)	47 HRC
700° F (371° C)	45 HRC
800° F (427° C)	41 HRC
900° F (482° C)	38 HRC
1000° F (538° C)	35 HRC
1100° F (593° C)	30 HRC
1200° F (649° C)	25 HRC

After Austenitized 1550° F (843° C), quenched in oil, Twice-tempered (2 hours each)

Fabrication:

Forging	Forge between 1950° – 2250° (1066° – 1232° C). Preheating or furnace cooling in ash or lime is recommended
Machinability	Normalize, then temper at approx. 1200° F (649° C) for optimum condition for machining
Welding	Can be welded by gas or arc fusion methods. Alloy is capable of air hardening, and should be either Annealed or Normalized and Tempered after welding

Min Longitudinal Tensile Properties:

Property	Value
Tensile Strength	260 ksi
Yield Strength 0.2% offset	217 ksi
Elongation	10%
Reduction of Area	30%

After heat treating specimens per paragraph 3.4.6



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Mechanical Properties:

Bar Size	Temperature *	Tensile Strength	Yield Strength	Elongation in 2"	Reduction of Area
3.5" Dia.	400° F (204° C)	276 ksi	222 ksi	11.0%	35.0%
7.5" Dia.	500° F (260° C)	265 ksi	222 ksi	8%	25.0%
10.5" Dia.	1100° F (593° C)	165 ksi	150 ksi	18%	60.0%

* After Normalized 1650°/1700° F, Austenized 1500°/1525° F, Oil quenched