LIEBOVICH
STEEL & ALUMINUM

THE CHOICE OF QUALITY

Alloy Steels 4140

Specifications:	AISI 4140 AMS 6349 AMS 6381 AMS 6382 AMS 6390 AMS 6395 AMS 6529 ASTM A193 (B7, B7M) ASTM A194 (7, 7M) ASTM A29 (4140) ASTM A320 (L7, L7M, L7D) ASTM A322 (4140) ASTM A331 (4140) ASTM A506 (4140) ASTM A513 ASTM A513 (4140) ASTM A519 (4140) ASTM A646 (4140) ASTM A711 ASTM A752 (4140) ASTM A829 SAE J1397 (4140) SAE J404 (4140) SAE J412 (4140) UNS G41400

Chemistry Data

Carbon	0.38 - 0.43
Chromium	0.8 - 1.1
Iron	Balance
Manganese	0.75 - 1
Molybdenum	0.15 - 0.25
Phosphorus	0.035 max
Silicon	0.15 - 0.35
Sulphur	0.04 max

General Information

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Principal Design Features

This is one of the chromium, molybdenum, manganese low alloy steels noted for toughness, good torsional strength and good fatigue strength.

Applications

4140 is used in a tremendous variety of applications, too numerous to mention here.

Machinability

Machinability of this alloy is good in the annealed condition. In the heat treated and quenched condition machining is best limited to finish grinding.

Forming

As with all the low alloy steels forming may be done by conventional methods with the alloy in the annealed condition. These alloys have good ductility, but are tougher than plain carbon steel and thus usually require more force, or pressure, for forming.

Welding

Weldable by all of the conventional methods. Note that welding with the alloy in the heat treated condition will affect the mechanical properties and a post weld heat treatment may be needed.

Heat Treatment

This alloy is hardened by heating to 1550 F and quenching in oil. It is best to normalize the alloy by heating at 1675 F for a long enough time to permit thorough heating, followed by air cooling, prior to the hardening treatment.

Forging

4140 may be forged at 2200 F down to 1700 F.

Hot Working

Hot working, if required, may be done in the range of 1900 F to 1500 F.

Cold Working

The alloy readily cold works in the annealed condition by conventional methods.

Annealing

Annealing is done at 1600 F followed by slow furnace cooling.

Aging

Not applicable to this alloy.

Tempering

Tempering temperatures range from 400 F to 1200 F depending upon the hardness level desired. The lower the tempering temperature the greater the hardness of the alloy. For example tempering at 600 F gives a tensile strength of 225 ksi while tempering at 1000 F will give 130 ksi.

Hardening

Hardens by cold working, or heating and quenching - also see "Heat Treatment" and "Tempering".

Physical Data

Density (lb / cu. in.)	0.28
Specific Gravity	7.83
Specific Heat (Btu/lb/Deg F - [32-212 Deg F])	0.114
Melting Point (Deg F)	2580
Thermal Conductivity	23
Mean Coeff Thermal Expansion	7
Modulus of Elasticity Tension	33