Technical Datasheet

CarTech® AerMet® 310 Alloy

Identification

U.S. Patent Number

• 5,866,066

Type Analysis

Single figures are nominal except where noted.

Carbon	0.25 %	**Chromium**	2.40 %
Nickel	11.00 %	**Molybdenum**	1.40 %
Cobalt	15.00 %	**Iron**	Balance

General Information

Description

CarTech AerMet 310 alloy possesses higher hardness and strength than CarTech AerMet 100 alloy while exhibiting exceptional ductility and toughness. At a 310 ksi (2137 MPa) ultimate tensile strength, CarTech AerMet 310 alloy exhibits toughness values equivalent to alloys 20 ksi (138 MPa) lower in strength. The alloy should be considered as a candidate for use in components requiring high strength, high fracture toughness and exceptional resistance to stress corrosion cracking and fatigue.

Applications

CarTech AerMet 310 alloy should be considered as a candidate for use in applications such as:

Armor
Landing gear
Actuators
Ordnance
Structural tubing
Ballistic tolerant components
Jet engine shafts
Structural members
Drive shafts

Corrosion Resistance

AerMet 310 alloy possesses environmental resistance similar to AerMet 100 alloy.

Important Note: *The following 4-level rating scale is intended for comparative purposes only. Corrosion testing is recommended; factors which affect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish and dissimilar metal contact.*

Humidity	Restricted	

Properties

Typical Mechanical Properties

Typical Mechanical Properties—AerMet 310 Alloy
Heat treatment— 1675°F +/- 25°F (913°C +/- 14°C) 1 hour, air cooled, -100°F (-73°C) 1 hour, 900°F +/- 10°F (482°C +/- 6°C) 6 hours, air cool.

Yield Strength		Ultimate Tensile Strength		% Elongation	% Reduction of Area	Charpy V-Notch Impact Energy
ksi	MPa	ksi	MPa			ft-lbs
Longitudinal Orientation						
275	1896	315	2172	14.5	63	20
Transverse Orientation						
275	1896	315	2172	13	53	17

Typical Room Temperature vs. Elevated Temperature (400°F [204°C]) Longitudinal Mechanical Properties—AerMet 310 Alloy
Heat treatment— 1675°F (913°C) 1 hour, air cooled, -100°F (-73°C) 1hour, air warmed, 900°F (482°C) 5 hours, air cool.

Test Temperature		Yield Strength		Ultimate Tensile Strength		% Elongation	% Reduction of Area
°F	°C	ksi	MPa	ksi	MPa		
Room Temperature		269	1852	311	2145	15.2	66.4
400	204	252	1737	283	1948	16.0	66.2

Heat Treatment

Decarburization

Like other carbon bearing high strength alloys, AerMet 310 alloy is subject to decarburization during hardening. Heat treatment should take place in a neutral atmosphere furnace, salt bath or vacuum. Decarburization should be determined by comparing the surface and internal hardness of a small test cube for proper response. Metallographic determination of decarburization is not recommended for this alloy.

Normalizing

AerMet 310 alloy can be normalized by heating to 1775°F (968°C), holding for one hour and air cooling to room temperature. Optimum softening for machining is obtained by following the 1775°F (968°C) normalize with a 16 hour 1250°F (677°C) overage anneal.

Annealing

AerMet 310 alloy is softened by using a 1250°F (677°C) overage anneal for 16 hours. The optimum annealed hardness of 40 HRC maximum is obtained following this anneal.

Solution Treatment

The solution treatment temperature range is 1675°F +/- 25°F (913°C +/- 14°C) for 1 hour. The solution treatment temperature must be monitored by a thermocouple attached to the load.

Quenching

Water quenching is not recommended.

Proper quenching practice is essential for AerMet 310 alloy. The alloy should be cooled from the solution treatment temperature to 150°F (66°C) in 1 to 2 hours to develop optimum properties. Individual sections larger than 2" diameter or 1" thick (plate) must be quenched with oil in order to obtain 150°F (66°C) in 1 to 2 hours. Individual sections up to 2" diameter or 1" thick (plate) will air cool to 150°F (66°C) in 1 to 2 hours. The cooling rate of the furnace load must be monitored by a thermocouple attached to the hottest spot in the load to insure that the 2 hour cool to 150°F (66°C) is obtained.

Cold Treatment

Following cooling to room temperature, to obtain the full toughness capability, AerMet 310 alloy should be cooled to -100°F (-73°C) and held for 1 hour. The parts can then be air warmed.

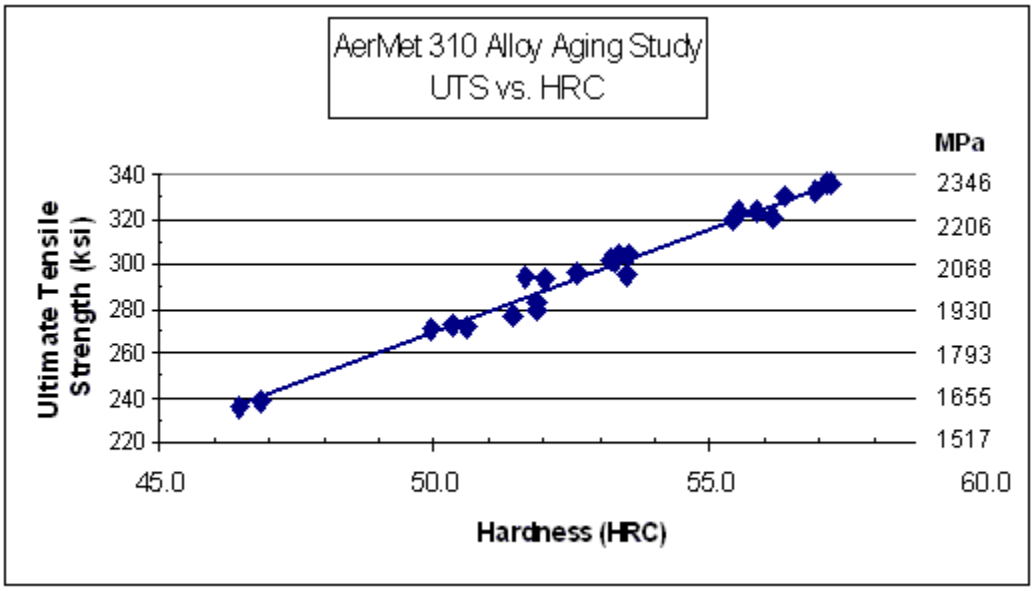
Straightening

AerMet 310 alloy exhibits minimal size change during heat treatment; however, for some parts, mechanical straightening to compensate for distortion during heat treatment is appropriate.

Prior to straightening, a low temperature stress relief at 350/400°F (177/204°C) for 5 hours following the refrigeration operation will provide an optimal combination of ductility and yield strength for the mechanical straightening operation.

Age

The standard aging treatment for AerMet 310 alloy is 900°F +/-10°F (482°C +/- 6°C) for 3-8 hours. Parts made from AerMet 310 alloy should never be aged at a temperature below 875°F (468°C).



Workability

Forging

Primary breakdown forging of AerMet 310 alloy should be done at a maximum starting temperature of 2250°F (1232°C). Finish forging should be done from 1800°F (982°C) with a finishing temperature below 1650°F (899°C) in order to optimize the final heat treated properties. Following forging, the parts should be air cooled to room temperature and then annealed. Following the anneal the forgings should be normalized in order to restore properties to the dead zone.

Machinability

AerMet 310 alloy is somewhat more difficult to machine than 4340 at Rockwell C 38. Carbide tools are recommended at 280 to 350 SFM. Following rough machining, if a stress relief is desired, stress relieve at 800°F (427°C) for 1 to 3 hours.

Other Information

Forms Manufactured

- Bar-Rounds
- Hollow Bar
- Sheet
- Wire
- Billet
- Plate
- Strip

Technical Articles

- A Designer's Manual On Specialty Alloys For Critical Automotive Components
- A Guide to Etching Specialty Alloys for Microstructural Evaluation
- New Requirements for Ferrous-Base Aerospace Alloys
- Selection of High Strength Stainless Steels for Aerospace, Military and Other Critical Applications
- Toughness Index for Alloy Comparisons

Edition Date: 9/20/07

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