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FIRST IN SERVICE SSA®

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AerMet® 100 ALLOY
DATA SHEET

CHEMISTRY

Nominal Analysis%	C	Co	Ni	Cr	Mo	Ti	Fe
	0.23	13.40	11.10	3.10	1.20	.05 MAX	BAL

GENERAL CHARACTERISTICS

AerMet® 100 is an ultra-high strength type of martenistic (a very hard form of steel crystalline structure) steel alloy. Is was developed in response to a need for a stronger and tougher material with superior fracture toughness and ductility. The alloy possesses a minimum tensile strength of 280 ksi (1930 MPa) and a minimum fracture toughness of 100 Ksi√ in. AerMet is weldable requiring no preheating. Since it is not a corrosion resistant alloy, it must be sealed if used in a moist environment. The exceptional properties of hardness, FTT, tensile strength and ductility make this alloy a candidate for application such as landing gear, armor, fasteners, actuators, ordnance, jet engine shafts, drive shafts and structural tubing. AerMet 100 may be considered for use up to about 800° F (427° C).

SPECIFICATIONS

AMS 6532
MIL HDBK-5
McDonnell Douglas MMS 217

PHYSICAL PROPERTIES

Density, lb /in^3	.285	
Modulus of Elasticity	28.2 x 10^3 ksi	
Electrical Resistivity	70.0° F	259.0 ohm-cir-mil/ft
Critical Temperature	AC1 - 1065° F	AC3 - 1525° F
Mean Co of Thermal Expansion	Annealed	Heat Treated
600.0° F	6.01 x 10^{-6} in/in/° F	6.08 x 10^{-6} in/in/° F

HEAT TREATMENT

Decarburization
Like other carbon bearing high strength alloys, AerMet 100 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 100 alloy can be normalized by heating to 1650° F (899° C) holding for one hour and air cooling to room temperature. Optimum softening for machining is obtained by following the 1650° F (899° C) normalize with a 16 hour 1250° F (677° C) overage anneal.

Annealing
AerMet 100 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 1625° F+/-25° F (885° 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 100 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 to 1” thick (plate) must b 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.

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

Straightening
AerMet 100 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 (482/204° 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 100 alloy is 900° F +/- 10° F (482° C +/- 6° C) for 5 hours. Parts made from AerMet 100 alloy should never be aged at a temperature below 875° (468° C).

Aging Temperature	HRC
As hardened	51.0/53.0
875° F (468° C) 5 hrs	54.5/55.5
900° F (482° C) 5 hrs	53.0/54.0
925° F (496° C) 5 hrs	51.0/52.5

WORKABILITY

Forging
Primary break down forging of AerMet 100 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 treat 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 100 is somewhat more difficult to machine than 4340 at HRC 38. Hence, carbide tools are recommended at 280 to 350 SFM.

Following rough machining, stress relieve at 800° F (427° C) for 1-3 hours if a stress relief is desired.

TYPICAL MECHANICAL PROPERTIES - Longitudinal Orientation

Heat treatment - 1625° F (885° C) 1 hour, air cooled, -100° F (-73° C) 1 hour, aged 900° F (482° C) 5 hours.

Rc	UTS(ksi)	% Elongation	% Reduction of Area	Charpy V-Notch Impact Energy ft-lbs	FTT K_{1c} ksi$\sqrt{in}$
53.0/54.0	285	14	65	30	115

AVAILABILITY

Forms manufactured include bar-rounds, hollow bar, sheet, weld wire, billet, plate, strip and wire.

ADVANTAGES OF AerMet 100 ALLOY

EXCELLENT MECHANICAL PROPERTIES
- harness and strength
- exceptional ductility and toughness
- high fracture toughness
- excellent fatigue and stress corrosion cracking resistance
- high fatigue strength

EXCELLENT WORKABILITY
- good weldability requiring no preheating
- excellent polishability
- readily formed

ADVANTAGES DURING APPLICATION
- highest combination of strength and toughness vs. other steels
- designed for overstressed application

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