13-8Mo

Applicable designation: AMS 5629, ASTM A564

Associated specifications: BMS 7-332, BMS 7-349, DMS 2100, HMS 6-1105, RMS 150, STM05-602, STO 160 LB 0013, UNS S13800

Type analysis

Single figures are nominal except where noted.

Iron	Balance	**Chromium**	12.60 %	**Nickel**	8.30 %
Molybdenum	2.15 %	**Aluminum**	1.00 %	**Carbon**	0.04 %

Forms manufactured

Bar	**Forged Bar**	**Plate**	**Strip**	**Wire**

Description

13-8Mo is a precipitation hardening martensitic stainless steel offering excellent fracture toughness and transverse mechanical properties, coupled with the resistance to stress-corrosion cracking and high-strength characteristics common to the family of precipitation hardening steels.

A wide range of mechanical properties can be realized by selecting various single cycle low temperature aging treatments. The alloy is double vacuum melted (VIM-VAR: vacuum induction melting followed by vacuum arc remelting) to consistently ensure low gas content, improved homogeneity, and superior cleanliness.

Key Properties:

- Stress-corrosion resistance
- High strength
- Excellent fracture toughness

Markets:

- Aerospace
- Energy
- Defense
- Industrial

Applications:

- Semiconductor components
- Jet engine parts
- Aircraft and nuclear reactor components, fasteners, gears, valves

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Corrosion resistance

The general corrosion resistance of 13-8Mo approaches that of 304 in most media and is superior to the 400 series. Corrosion resistance of the alloy is greatest in the H950 condition and decreases slightly with increasing aging temperatures.

Physical properties

Following are the physical properties of 13-8Mo precipitation hardened to H1000 condition.

PROPERTY	At or From	English Units	Metric Units
DENSITY	—	0.279 lb/in^3	7.76 g/cm^3
MEAN COEFFICIENT OF THERMAL EXPANSION (CTE)	70 to 200°F (21 to 93°C)	5.8 x 10^{-6} in/in/°F	10.4 x 10^{-6} mm/mm/°C
	70 to 400°F (21 to 204°C)	6.0 x 10^{-6} in/in/°F	10.8 x 10^{-6} mm/mm/°C
	70 to 600°F (21 to 316°C)	6.2 x 10^{-6} in/in/°F	11.2 x 10^{-6} mm/mm/°C
	70 to 800°F (21 to 427°C)	6.3 x 10^{-6} in/in/°F	11.3 x 10^{-6} mm/mm/°C
POISSON'S RATIO	—	0.278	—
ELASTIC MODULUS	—	28.3 x 10^6 psi	195.1 GPa

A more extensive presentation of physical properties is available in the Aerospace Structural Metals Handbook and other industry reference publications.

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Typical mechanical properties

A convenient way to appreciate the tensile property capabilities of 13-8Mo is to consider the minimum guarantees of the popular AMS 5629 document. The following has been extracted from AMS 5659.

The solution treated product, 12 in. (300mm) and under in nominal diameter or maximum cross-sectional dimension, when precipitation heat treated for 4 hours ± 0.25 to a particular condition at the temperatures shown here and cooled in air, shall have the properties specified here for that particular condition.

0.625 IN. DIAMETER (15.9 MM) BAR PRODUCT

CONDITION	SPECIMEN ORIENTATION	TEMPERATURE		0.2% YIELD STRENGTH		TENSILE STRENGTH		ELONGATION IN 4D	REDUCTION OF AREA
		°F ±10	°C ±5	ksi	MPa	ksi	MPa	%	%
H950	Longitudinal	950	510	205	1415	220	1515	10	45
	Transverse	950	510	205	1415	220	1515	10	35
H1000	Longitudinal	1000	540	190	1310	205	1415	10	50
	Transverse	1000	540	190	1310	205	1415	10	40
H1025	Longitudinal	1025	550	175	1205	185	1275	11	50
	Transverse	1025	550	175	1205	185	1275	11	45
H1050	Longitudinal	1050	565	165	1140	175	1205	12	50
	Transverse	1050	565	165	1140	175	1205	12	45
H1100	Longitudinal	1100	595	135	931	150	1035	14	50
	Transverse	1100	595	135	931	150	1035	14	50
H1150	Longitudinal	1150	620	90	620	135	931	14	50
	Transverse	1150	620	90	620	135	931	14	50

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Heat treatment

13-8Mo is solution heat treated by heating to 1700°F (927°C) ±15°F (8°C), holding 15–30 minutes at temperature, followed by an air cool. The austenite to martensite transformation starts at about 250°F (121°C) and is completed for all practicality at approximately 60°F (16°C). Therefore, for optimum property response, it is important the alloy be cooled to below 60°F (16°C) following solution treatment.

Precipitation hardening (aging) is conducted at a variety of temperatures within the 950–1150°F (510–621°C) temperature range. See the tensile property section for details.

A dimensional change during aging can be anticipated. Shrinkage of approximately 0.0004–0.0006 in/in (mm/mm) is normal for the H950 condition. Up to 0.0030 in/in (mm/mm) can occur when aging to the H1150 condition.

HARDNESS

CONDITION	HARDNESS
	HBW
Solution treated	363 Max
H950	430 Min
H1000	400 Min
H1050	372 Min
H1100	313 Min
H1150	283 Min
H1150M*	302 Max

**Overaged for sawing and cold forming*

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Workability

Hot working	13-8Mo is readily forged from 2150–2200°F (1177–1204°C). To favorably control grain size, the final 50% of reduction should be completed below 1900°F (1038°C). This alloy should be air cooled to room temperature after forging.
Cold working	For severe cold forming operations, it is recommended the material be in the H1150 or H1150M (overaged) condition.
Welding	13-8Mo has excellent weldability. It requires no preheating or special cooling and can be welded using any of the usual electric arc or resistance welding techniques. Welding can be readily done in either the solution treated or any of the aged conditions. Smaller sections may be aged directly after welding; however, for optimum post weld properties, the component should be solution treated and precipitation hardened after welding.
Machining	This alloy can be machined in any of the several thermal conditions. Machining is easiest in the H1150M overaged condition, which involves the following thermal cycle: 1400°F (760°C), 2 hours, air cool 1150°F (621°C), 4 hours, air cool The rate of machining possible for the various thermal conditions relates to the hardness typical of each condition. See the Heat Treatment section for hardness information.

For additional information, please contact your nearest sales office:
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