

HASTELLOY® W alloy

CHEMISTRY: Weight %

Ni	Co	Fe	Cr	Mo	Mn	Si	V	C
63 ^a	2.5*	6	5	24	1*	1*	0.6*	0.12*

^a As Balance

*Maximum

ALLOY DESCRIPTION:

HASTELLOY W alloy is a solid-solution-strengthened superalloy that was developed primarily as a filler metal for welding of dissimilar alloys. It displays excellent dissimilar welding characteristics, and is widely used for that purpose in the gas turbine, aerospace, and chemical process industries. The properties of dissimilar weld joints made with alloy W are dependent upon the alloys joined, but are generally acceptable for a wide variety of combinations. Alloy W is also used as a wrought alloy for a limited number of ring-type applications in older gas turbine engines. HAYNES® 242® alloy is a more modern alloy, and should be considered as a substitute for alloy W in these ring applications (ask for publication H-3079).

PHYSICAL PROPERTIES:

	Temp., °F	British Units	Temp., °C	Metric Units
Density	Room	0.325 lb/in ³	Room	9.00 g/cm ³
Melting Range	2350-2510		1290-1375	
Mean Coefficient of Thermal Expansion	70-800	7.3 µin/in-°F	20-500	13.2 µm/m-°C
	70-1000	7.4 µin/in-°F	20-600	13.2 µm/m-°C
	70-1200	7.4 µin/in-°F	20-700	13.5 µm/m-°C
	70-1400	7.8 µin/in-°F	20-800	14.2 µm/m-°C
	70-1600	8.2 µin/in-°F	20-900	14.8 µm/m-°C
	70-1800	8.4 µin/in-°F	20-1000	15.3 µm/m-°C

HEAT TREATMENT, WELD DEPOSITS (A) AND WROUGHT BAR (B):

(A) None (B) 2165°F(1185°C)/15 minutes/WQ

APPLICABLE ALLOY SPECIFICATIONS:

Bare Wire: AMS 5786

AWS A5.14 & ASME SFA 5.14; (ERNiMo-3)

Coated Electrodes: AMS 5787

AWS A5.11 & ASME SFA 5.11; (ENiMo-3)

Bar, Rings and Forgings: AMS 5755

TYPICAL ALL-WELD METAL TENSILE PROPERTIES:

GAS TUNGSTEN ARC WELDS:

Condition	Test Temperature		Ultimate Tensile Strength		Yield Strength		Elongation %	Reduction of Area %
	°F	°C	Ksi	MPa	Ksi	MPa		
As-Welded	70	20	120	830	80	555	35	27
	1600	870	43	295	40	275	45	53
Aged 1000 Hrs. 1200°F (650°C)	70	20	160	1100	115	795	14	16
	1400	760	84	580	64	445	27	38

GAS METAL ARC WELDS:

Condition	Test Temperature		Ultimate Tensile Strength		Yield Strength		Elongation %	Reduction of Area %
	°F	°C	Ksi	MPa	Ksi	MPa		
As-Welded	70	20	127	870	80	555	38	32
	1600	870	45	310	42	285	41	42
Aged 1000 Hrs. 1200°F (650°C)	70	20	153	1055	110	755	15	16
	1400	760	82	565	58	400	30	47

SHIELDED METAL ARC WELDS:

Condition	Test Temperature		Ultimate Tensile Strength		Yield Strength		Elongation %	Reduction of Area %
	°F	°C	Ksi	MPa	Ksi	MPa		
As-Welded	70	20	110	760	76	525	25	22
	1600	870	38	265	36	250	14	15
Aged 1000 Hrs. 1200°F (650°C)	70	20	128	885	108	745	8	8
	1400	760	77	535	57	390	11	14

TYPICAL TRANSVERSE TENSILE PROPERTIES FOR 1/2 INCH (12.7mm) PLATE WELDMENTS (GTAW) USING ALLOY W FILLER*

Base Materials	Test Temperature		Ultimate Tensile Strength		Yield Strength		Elongation	Reduction of Area
	°F	°C	Ksi	MPa	Ksi	MPa	%	%
HASTELLOY® X alloy	70	20	113	780	58	395	52	55
	1600	870	42	290	33	230	39	65
HAYNES® 188 alloy	70	20	128	885	73	505	20 ¹	30 ¹
	1600	870	58	400	51	350	36 ¹	60 ¹
MULTIMET® alloy	70	20	116	800	62	425	49	65
	1600	870	42	290	32	215	28	42
HAYNES® 625 alloy	70	20	119	820	69	475	63	63
	1600	870	44	300	35	240	58	91
HAYNES 718 alloy	70	20	125	860	68	470	23 ¹	31 ¹
Type 304 stainless	70	20	90	620	48	330	62	69
Carbon Steel	70	20	72	500	60	415	14	50
Alloy 188/ MULTIMET®alloy	70	20	117	805	66	455	35	64
	1600	870	47	320	34	235	19	19
Alloy 625/ Alloy 718	70	20	131	905	62	430	43 ²	42 ²
	1600	870	48	330	39	270	51	95
Type 304/ Carbon Steel	70	20	71	490	51	355	17	51

*Failures in base metal unless otherwise indicated

¹Failures in weld

²Failures in weld and base metal

All values are averages of 2-4 tests

TYPICAL GUIDED BEND TEST RESULTS FOR 1/2 INCH (12.7mm) PLATE WELDMENTS (GTAW) USING ALLOY W FILLER

Base Materials	Bend Radius	Results
HAYNES® 188 alloy/MULTIMET® alloy	2t	No Cracks
HAYNES® 625 alloy/HAYNES 718® alloy	2t	No Cracks
Type 304 Stainless/Carbon Steel	2t	No Cracks

HASTELLOY® W alloy

TYPICAL TENSILE PROPERTIES, BAR (AMS 5755):

Test Temperature		Ultimate Tensile Strength		0.2% Yield Strength		Elongation in 2 in (51mm)
°F	°C	Ksi	MPa	Ksi	MPa	%
ROOM	ROOM	139.8	965	75.5	520	51.0
1000	540	120.8	835	54.0	370	52.5
1200	650	103.5	715	52.9	365	27.0
1400	760	88.5	610	55.5	385	20.3
1600	870	60.5	415	48.8	335	31.8
1800	980	32.4	225	23.6	160	47.5
2000	1095	17.4	120	10.6	73	79.0

TYPICAL STRESS-RUPTURE STRENGTH BAR (AMS 5755):

Test Temperature		Approximate Initial Stress, Ksi (MPa) to Produce Rupture in:					
°F	°C	10 Hours		100 Hours		1000 Hours	
1300	705	-	-	34.5	(240)	27.5	(190)
1400	760	33.0	(230)	26.0	(180)	19.0	(130)
1500	815	24.8	(170)	18.0	(125)	12.4	(85)
1600	870	17.4	(120)	12.0	(83)	8.0	(55)
1700	925	11.7	(81)	7.9	(54)	5.2	(36)
1800	980	7.9	(54)	5.2	(36)	3.2	(22)

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