

ALLOY DATA SHEET HK

HEAT RESISTANT ALLOY

REVISION: 04/91

DESCRIPTION

HK alloy, more well known as HK 40, is an austenitic Fe-Cr-Ni alloy that has been a standard heat resistant material for over four decades. With moderately high temperature strength, oxidation resistance and carburization resistance the alloy is used in a wide variety of industrial applications.

COMPOSITION

	<u>C</u>	<u>Mn</u>	<u>Si</u>	<u>Cr</u>	<u>Ni</u>	<u>P</u>	<u>S</u>
Min %	0.35	0.4	0.5	23	19	-	-
Max %	0.45	1.5	1.5	27	22	0.03	0.03

APPLICATIONS

Ammonia, methanol and hydrogen reformers; ethylene pyrolysis coils and fittings; steam superheater tubes and fittings; tube supports and hangers; tube sheets; heat treatment fixtures and trays; refractory supports; furnace skids; furnace rolls; rabble arms.

PRODUCT FORMS

Horizontal and vertical centrifugal castings; static castings.

PHYSICAL PROPERTIES

Density (lbs/in ³)	0.280
Melting Point(°F)	2540
Thermal Conductivity (Btu/h/ft ² /ft/°F)	7.9 @ 212°F
	15.7 @ 1600°F
	17.1 @ 1800°F
Thermal Expansion (10 ⁻⁶ in/in °F)	9.8 @ 70-1400°F
	10.0 @ 70-1600°F
	10.2 @ 70-1800°F

CARBURIZATION RESISTANCE

(Gas-1064 hours @ 1760°F)

ALLOY	WEIGHT GAIN
GRADE	mg/mm ²
H F	0.81
H H	0.58
H K	0.56
H P	0.20

MECHANICAL PROPERTIES (Typical Values)

		Centrifugal Castings					Static Castings
		70	1400	1600	1800	2000 °F	70 °F
U.T.S.	K.S.I.	84	38	24	15	5.6	74
Y.S.	K.S.I.	44	24	16	9	5	45
El.	%	20	13	16	42	55	17

SERVICE TEMPERATURE

The alloy is suitable for service at temperatures up to approximately 2000°F.

COMPARATIVE OXIDATION RATES (mm / year) (500 hour cyclic tests)

GRADE	1832	1922	2012	2102	2204 °F
H H	<0.1	0.22	0.92	3.9	
H K	<0.1	0.22	0.95	3.5	12.7
H T	0.20	0.54	1.4	3.2	7.2

WELDABILITY

HK40 alloy has good weldability by the SMAW, GTAW and GMAW processes using filler metal of matching composition.

CREEP-RUPTURE PROPERTIES

Long term creep-rupture properties were extrapolated from Larson-Miller Parameter versus stress plots.

		<u>RUPTURE-STRESS-KSI</u>						
<u>HOURS</u>		<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	°F
1,000.	AVG.	11.9	8.75	6.18	4.34	3.05	2.09	
	MIN.	9.39	6.97	4.98	3.48	2.35	1.54	
10,000.	AVG.	8.75	6.04	4.10	2.67	1.74	1.05	
	MIN.	6.96	4.84	3.27	2.10	1.34	0.85	
100,000	AVG.	6.11	4.12	2.58	1.59	0.96		
	MIN.	4.84	3.20	2.06	1.28	0.78		
		<u>CREEP-STRESS-KSI</u>						
<u>%/HOUR</u>		<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	°F
0.01	AVG.	-	11.8	9.9	8.0	6.35	4.75	
0.001	AVG.	11.6	9.5	7.4	5.7	3.93	2.68	
0.0001	AVG.	9.0	6.85	5.0	3.35	2.05	1.05	

Note: Creep and rupture stresses are subject to periodic revisions as the results from long term tests become available.

RELATED SPECIFICATIONS

ASTM: A 297 (HK); A 351(HK30 and HK40); A 567 (HK40 and HK50 - specification discontinued in 1987); A608 (HK30 and HK40)

Nearest wrought grade: AISI 310. The composition of the wrought grade differs from that of the cast alloy and has different properties. The cast alloy designation should always be used to identify castings.

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