

# ALLOY DATA SHEET HP

HEAT RESISTANT ALLOY

REVISION: 04/91

## DESCRIPTION

HP alloy is a fully austenitic iron-nickel-chromium heat resisting steel. It has much higher creep-rupture strength, carburization resistance and oxidation resistance than HK 40 alloy and consequently is used at higher service temperatures. This alloy also forms the base of an extensive family of Kubota alloys which are modified by single or multiple additions of cobalt, molybdenum, niobium, titanium and tungsten. These higher strength alloys are extensively used in reformer and pyrolysis furnaces in the petrochemical industry.

## 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			24	33	-	-
Max %	0.75	2.0	2.0	28	37	0.03	0.03

## APPLICATIONS

Ammonia, methanol and hydrogen reformers; ethylene pyrolysis coils and fittings; steam superheaters; tube supports and hangers; tube sheets.

## PRODUCT FORMS

Horizontal and vertical centrifugal castings; static castings; formed fittings and sweeps.

## PHYSICAL PROPERTIES

Density (lbs/in <sup>3</sup> )	0.284
Melting Point(°F)	2450
Thermal Conductivity (Btu/h/ft <sup>2</sup> /ft/°F)	7.5 @ 212°F
	14.5 @ 1600°F
	15.7 @ 1800°F
Thermal Expansion (10 <sup>-6</sup> in/in °F)	10.0 @ 70-1600°F
	10.3 @ 70-1800°F
	10.6 @ 70-2000°F

## CARBURIZATION

### RESISTANCE

(Gas-1064 hours @ 1760°F)

ALLOY	WEIGHT GAIN
GRADE	mg/mm <sup>2</sup>
HK	0.56
HN	0.43
<b>HP</b>	<b>0.20</b>
HT	0.38

## MECHANICAL PROPERTIES (Typical Values)

		Centrifugal Castings				Static Castings
		70	1600	1800	2000 °F	70 °F
U.T.S.	K.S.I.	71	26	15	7.5	66
Y.S.	K.S.I.	38	18	11	6	36
El.	%	11	27	46	69	11

## SERVICE TEMPERATURE

The alloy is suitable for long term service at temperatures up to 2050°F.

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

GRADE	1832	1922	2012	2102 °F
HH	<0.1	0.22	0.92	3.9
HK	<0.1	0.22	0.95	3.5
<b>HP</b>	<b>&lt;0.1</b>	<b>0.25</b>	<b>0.64</b>	<b>1.5</b>

**WELDABILITY**

HP alloy has good weldability by the SMAW, GTAW and GMAW processes.

**CREEP-RUPTURE PROPERTIES**

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

<u>HOURS</u>		<u>RUPTURE-STRESS-KSI</u>								°F
		<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	<u>2000</u>	<u>2100</u>	
100.	AVG.			9.5	7.0	5.15	3.8	2.75	1.25	
	MIN.			9.0	6.6	4.9	3.6	2.6	1.1	
1,000.	AVG.		9.8	7.05	5.05	3.65	2.6	1.09	0.77	
	MIN.		9.2	6.6	4.8	3.5	2.4	0.98	0.68	
10,000.	AVG.	10.4	7.28	5.15	3.63	2.55	1.38	0.70		
	MIN.	9.5	6.9	4.9	3.45	2.4	1.25	0.62		
100,000	AVG.	7.63	5.38	3.74	2.63	1.38	0.68	0.33		
	MIN.	7.25	5.1	3.57	2.5	1.25	0.62	0.30		

<u>%/HOUR</u>		<u>CREEP-STRESS-KSI</u>								°F
		<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	<u>2000</u>	<u>2100</u>	
0.01	AVG.		11.7	8.55	6.65	4.95	3.7	2.08	1.67	
0.001	AVG.	12.8	8.8	6.2	4.5	3.6	2.05	1.6	0.92	
0.0001	AVG.	9.7	7.05	5.2	3.78	2.45	1.56	0.90	0.53	

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

**RELATED SPECIFICATIONS**

ASTM: A 297 (HP).

Nearest wrought grade: None

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