

ALLOY DATA SHEET HH II

HEAT RESISTANT ALLOY

REVISION: 10/95

DESCRIPTION

Grade HH type II is an Fe-Cr-Ni alloy for moderately high temperatures and loading. With 25% chromium and 12% nickel it resists scaling at temperatures up to 2000°F, provides long term strength up to 1750°F while retaining resistance to hot sulphur bearing gases

COMPOSITION

	<u>C</u>	<u>Mn</u>	<u>Si</u>	<u>Cr</u>	<u>Ni</u>	<u>P</u>	<u>S</u>
Min %	0.20	-	-	24	11	-	-
Max %	0.50	2.0	2.0	28	14	0.04	0.04

APPLICATIONS

Rabble arms and blades; grate bars; cement kiln cooling chain and shackles; tuyeres; furnace burner nozzles; radiant heater tubes and fittings; tube supports and hangers; tube sheets; heat treatment furnace hardware; furnace retorts and muffles, indurizing sidewalls.

PRODUCT FORMS

Horizontal and vertical centrifugal castings; static castings.

PHYSICAL PROPERTIES

Density (lbs/in ³)	0.279
Melting Point(°F)	2500
Thermal Conductivity (Btu/h/ft ² /ft/°F)	8.2 @ 212°F
	15.3 @ 1600°F
	16.3 @ 1800°F
Thermal Expansion (10 ⁻⁶ in/in °F)	10.2 @ 70-1600°F
	10.5 @ 70-1800°F
	10.7 @ 70-2000°F

CARBURIZATION

RESISTANCE

(Gas-1064 hours @ 1760°F)	
ALLOY	WEIGHT GAIN
GRADE	mg/mm ²
H D	0.60
H F	0.81
H H	0.58
H T	0.56

MECHANICAL PROPERTIES (Typical Values)

		C.C.	Static Castings				
		70	70	1400	1600	1800	2000 °F
U.T.S.	K.S.I.	84	90	37	22	11	5.5
Y.S.	K.S.I.	49	57	20	16	7	-
EI.	%	21	7	16	18	31	-
Modulus - psi x 10 ⁶			27	16	12	5	-

SERVICE TEMPERATURE

The alloy is suitable for service at temperatures up to 2025°F.

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

GRADE	1832	1922	2012	2102 °F
H F	0.86	1.8	3.6	6.7
H H	<0.1	0.22	0.92	3.9
H K	<0.1	0.22	0.95	3.5

WELDABILITY

HH II 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>	<u>2000</u>	<u>2100</u>	<u>2200</u>	<u>OF</u>
100	AVG.			9.74	7.22	5.20	3.61	2.37	1.43	0.71	
	MIN.			9.46	6.99	5.01	3.46	2.25	1.34	0.64	
1,000	AVG.			6.87	4.83	3.24	2.04	1.13	0.45		
	MIN.			6.50	4.53	3.01	1.86	1.00	0.34		
10,000	AVG.	9.49	6.77	4.66	3.04	1.83	0.94				
	MIN.	9.04	6.41	4.36	2.81	1.66	0.81				
100,000	AVG.	6.92	4.67	2.98	1.74	0.83					
	MIN.	6.55	4.38	2.76	1.57	0.71					
		<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>	<u>2000</u>	<u>2100</u>	<u>2200</u>	<u>OF</u>
0.01	AVG.		11.9	9.15	6.8	4.95	3.33	2.1	1.1	0.5	
0.001	AVG.	11.7	8.7	6.4	4.35	2.85	1.63	0.75			
0.0001	AVG.	8.3	6.0	4.2	2.6	1.35	0.58				

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

RELATED SPECIFICATIONS

ASTM: A 297 (H H); A 447 (H H I and H H II); A 608 (H H 30 and H H 33)

Nearest wrought grade: AISI 309 (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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