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ALLOY DATA SHEET
KHR 35C

HEAT RESISTANT ALLOY

REVISION: 06/99

DESCRIPTION

KHR35C is a modification of HP alloy in which niobium is used to increase the creep-rupture strength. The alloy is commonly used to upgrade components and assemblies previously produced from HK40 alloy and it's use can result in substantial weight and cost savings.

COMPOSITION

	C	Mn	Si	Cr	Ni	Nb	P	S
Min %	0.4			24	34	0.6	-	-
Max %	0.5	1.5	1.5	28	37	1.5	<.03	<.03

APPLICATIONS

Ammonia, methanol and hydrogen reformers; steam superheaters; tube supports; hangers and tube sheets. (For service in carburizing environments, such as ethylene pyrolysis coils, KMF recommend the use of a modified form of this alloy, KHR35C Hi Si. Information on this material is covered by a separate data sheet.)

PRODUCT FORMS

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

PHYSICAL PROPERTIES

Density (lbs/in^3)	0.291	
Melting Solidus (^{o}F)	2381 ^{o}F	
Thermal Conductivity	7.5	@ 68 ^{o}F
(Btu ft/ft^2 hr ^{o}F)	12.6	@ 1112 ^{o}F
	13.5	@ 1292 ^{o}F
	14.5	@ 1472 ^{o}F
	15.9	@ 1652 ^{o}F
	17.4	@ 1832 ^{o}F
Thermal Expansion	9.2	@ 70-1112 ^{o}F
(X 10^{-6}in/in ^{o}F)	9.5	@ 70-1292 ^{o}F
	9.7	@ 70-1472 ^{o}F
	10.2	@ 70-1652 ^{o}F
	10.3	@ 70-1832 ^{o}F

CARBURIZATION RESISTANCE

(Gas-100 hours @ 1922 ^{o}F)

ALLOY GRADE	WEIGHT GAIN mg/mm^2
H K40	0.33
H N	0.31
KHR35C	**0.23**
KHR48N HiSi	0.18

MECHANICAL PROPERTIES

(Typical Values)

		Centrifugal Castings					Statics	Min. Values
		70	1400	1600	1800	2000 ^{o}F	70 ^{o}F	70 ^{o}F
U.T.S.	K.S.I.	75	45	28	16	10	68	64
Y.S.	K.S.I.	40	20	14	9.5	6	37	32.5
El.	%	12	22	36	48	55	10	8 (c.c), 6 (st)
M odulus psi.10^6		23	15.5	14.4	13.9	13.5		

SERVICE TEMPERATURE

The alloy is suitable for long term service at temperatures up to 1975 ^{o}F, but because of the detrimental effect of niobium on oxidation resistance, it should be used with caution at higher temperatures.

WELDABILITY

Good with all conventional processes; bare wire and flux coated electrodes of matching composition are commercially available

CREEP-RUPTURE PROPERTIES

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

RUPTURE-STRESS-KSI

HOURS		1400	1500	1600	1700	1800	1900	2000	2100	°F
100	AVG.	-	-	10.5	8.24	6.24	4.55	3.15	2.05	
	MIN.	-	-	9.11	7.14	5.42	3.96	2.75	1.79	
1,000	AVG.	-	10.79	8.37	6.28	4.51	3.06	1.94	1.14	
	MIN.	-	9.34	7.26	5.45	3.92	2.67	1.69	0.99	
10,000	AVG	-	8.71	6.48	4.61	3.08	1.91	1.10	-	
	MIN	-	7.55	5.63	4.01	2.69	1.67	0.95	-	
100,000	AVG.	9.26	6.86	4.85	3.22	1.97	1.11	0.63	-	
	MIN.	8.02	5.96	4.22	2.81	1.72	0.96	0.52	-	

CREEP-STRESS-KSI

%/HOUR		1700	1800	1900	1922	2012	°F
0.0001	AVG.	4.12	2.77	1.76	1.45	0.90	

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

MODULUS OF ELASTICITY

R.T.	1112	1202	1292	1382	1472	1562	1652	1742	1832	°F
23.0	17.9	17.0	16.2	15.5	14.9	14.6	14.2	14.0	13.9	(x 10^3 ksi)

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