

ALLOY DATA SHEET KHR20T

HEAT RESISTANT ALLOY

REVISION: 12/96

DESCRIPTION

KHR20T is one of the family of Kubota alloys in which micro-alloying is used to raise the long term high temperature strength, without significantly increasing total alloy content. Average 100,000 hour rupture stresses at 1600 to 1800°F are raised by a factor of 1.6 to 1.8 compared with those of the standard HK40 grade. KHR20T was primarily developed for use in reformer tube assemblies.

COMPOSITION

	<u>C</u>	<u>Mn</u>	<u>Si</u>	<u>Cr</u>	<u>Ni</u>	<u>Nb</u>	<u>P</u>	<u>S</u>	<u>Ti</u>
Min %	0.35			23	19		-	-	Addition
Max %	0.50	2.0	1.5	27	25	0.5	0.030	0.030	

APPLICATIONS

Reformer tube assemblies and fittings

PRODUCT FORMS

Horizontal and vertical centrifugal castings; static castings.

PHYSICAL PROPERTIES

Density (lbs/in ³)	0.285
Melting Solidus	2372 °F
Thermal Expansion	6.3 @ 68-392°F
(10 ⁻⁶ in/in °F)	7.7 @ 68-572°F
	8.8 @ 68-752°F
	9.1 @ 68-932°F
	9.4 @ 68-1112°F
	9.8 @ 68-1292°F
	10.1 @ 68-1492°F
	10.3 @ 68-1652°F
	10.6 @ 68-1832°F
	11.0 @ 68-2012°F
Hardness	170 BHN

OXIDATION LOSS

(1832 °F, 500 hours)	
mm/year	
HK40	0.11
KHR20T	0.17

CARBURIZATION

(Pack - 100 hrs @ 2012 °F)	
Alloy	Carbon Increase*
HH	1.70
KHR12C	1.45
KHR20T	1.41

*Average wt% in 3.0 mm layer.

MECHANICAL PROPERTIES

		Typical Values					Minimum Values
		70	1400	1600	1800	2000 °F	70° F
U.T.S.	K.S.I.	83	47	27	15.5	8.8	64
Y.S.	K.S.I.	42	20.5	15	10	7.5	34
El.	%	20	21	27	33	35	10(cc), 8 (st)
Modulus	(psi x 10 ⁶)	14.2	13.3				

SERVICE TEMPERATURE

The alloy is particularly suited for long term service at temperatures in the range from 1300 to 1850 °F.

WELDABILITY

KHR20T has good weldability by the GTAW process with 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>1300</u>	<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	°F
100	AVG.	-	-	10.81	9.74	7.96	6.26	4.48	
	MIN.	-	-	9.39	8.32	6.90	5.33	3.80	
1000	AVG.	-	10.88	9.81	8.10	6.19	4.34	2.77	
	MIN.	-	9.39	8.46	6.97	5.33	3.73	2.35	
10,000	AVG.	11.02	9.96	8.25	6.40	4.34	2.77	1.56	
	MIN.	9.53	8.53	7.11	5.43	3.73	2.35	1.34	
100,000	AVG.	10.24	8.60	6.68	4.59	2.80	1.56	0.80	
	MIN.	8.85	7.40	5.69	3.87	2.39	1.38	0.68	

		<u>CREEP-STRESS-KSI</u>							
<u>%/HOUR</u>		<u>1300</u>	<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	°F
0.0001	AVG.	-	9.81	7.82	6.07	4.56	3.29	2.27	

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

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