

# ALLOY DATA SHEET KHR45A LC

HEAT RESISTANT ALLOY

REVISION: 02/97

## DESCRIPTION

KHR45A LC is a modification of the popular KHR45A alloy, which is compositionally balanced to improve aged ductility properties. KHR45A LC has excellent carburization and oxidation resistance at elevated temperatures. It has been developed specifically for ethylene pyrolysis service as outlet tubes and fittings where the combination of high temperature carburization resistance and low temperature ductility are required. Modifications have been standardized to emphasize either ductility or carburization resistance. This material may be used at temperatures up to 2066 °F.

## 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>Other</u>
Min %	0.10			30	40	0.5	-	-	microalloy
Max %	0.15	2.0	2.0	35	46	1.8	0.03	0.03	additions.

## APPLICATIONS

Ethylene pyrolysis outlets and fittings, direct reduction furnace assemblies.

## PRODUCT FORMS

Horizontal and vertical centrifugal castings; static castings.

## PHYSICAL PROPERTIES

Density (lbs/in <sup>3</sup> )	0.297
Melting Solidus	2355 °F
Thermal Conductivity (Btu ft/ ft <sup>2</sup> hr °F)	9.0 @ 68 °F 13.3 @ 1112 °F 19.3 @ 2102 °F
Thermal Expansion (10 <sup>-6</sup> in/in °F)	8.61 @ 68-1472 °F 8.89 @ 68-1652 °F 9.11 @ 68-1832 °F 9.39 @ 68-2012 °F

## CARBURIZATION

### RESISTANCE

(816 hr cyclic 70-1560-2100 °F)	
ALLOY	CARBON
GRADE	Wt. Gain (%)
KHR35C Hi Si	22.7
KHR35CW	20.4
<b>KHR45A LC</b>	<b>7.5</b>

## MECHANICAL PROPERTIES (Centrifugally cast tube - low Si modification)

(Room temperature results after aging 100 hours at indicated temperature)

		70	1292	1472	1652	1832	°F
U.T.S.	ksi	87	104	118	97	89	
Y.S.	ksi	42					
Elongation	%	39.9	19.3	12.0	10.0	40.6	

## SERVICE TEMPERATURE

The alloy is suited for service in the temperature range from 1400 to 2066 °F.

## WELDABILITY

Procedures for welding KHR45A LC are available from Kubota Metal Corporation.

**CREEP-RUPTURE PROPERTIES**

Long term creep-rupture values were derived from Larson-Miller Parameter versus stress plots. Average values correspond to the best fit line through the data. Minimum values correspond to the lower 95% confidence interval on the average line.

HOURS		RUPTURE-STRESS-KSI							°F
		<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	<u>1900</u>	<u>2000</u>	
100	AVG	16.69	12.25	8.76	6.10	4.15	2.76	1.83	
	MIN	14.88	10.89	7.77	5.39	3.65	2.42	1.60	
1,000	AVG	12.87	9.10	6.25	4.18	2.73	1.78	1.16	
	MIN	11.45	8.07	5.52	3.68	2.40	1.55	1.01	
10,000	AVG	9.75	6.62	4.36	2.80	1.79	1.15	0.73	
	MIN	8.65	5.85	3.84	2.46	1.57	1.00	0.62	
100,000	AVG	7.24	4.72	2.99	1.87	1.18	0.73	0.34	
	MIN	6.41	4.16	2.62	1.64	1.03	0.63	0.27	

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

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