

# ALLOY DATA SHEET

## KHR32C

HEAT RESISTANT ALLOY

REVISION: 11/01

### DESCRIPTION

KHR32C is a low carbon heat resistant alloy compositionally similar to Incoloy 800, except that niobium is used instead of titanium as a strengthening addition. It has outstanding creep-rupture strength, despite the low carbon content. Good creep ductility and retained ductility after service aging give a superior resistance to thermal fatigue and shock.

### COMPOSITION

	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>Cr</b>	<b>Ni</b>	<b>Nb</b>	<b>P</b>	<b>S</b>
Min %	0.07	-	-	19.0	31.0	0.6	-	-
Max %	0.16	1.50	1.2	22.0	35.0	1.6	0.03	0.03

### APPLICATIONS

Reformer and pyrolysis furnace manifolds, headers, transfer lines, outlet lines, reducers and wye fittings, decoking units, heat treatment furnace hardware.

### PRODUCT FORMS

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

### PHYSICAL PROPERTIES

Density (lbs/in <sup>3</sup> )	0.290		
Melting Solidus	2426 °F		
Thermal Conductivity (Btu ft/ ft <sup>2</sup> hr °F)	8.3	@ 212 °F	
	15.3	@ 1500 °F	
Thermal Expansion (x 10 <sup>-6</sup> in/in °F)	8.2	@ 70-212 °F	
	9.0	@ 70-1100 °F	
	9.5	@ 70-1500 °F	
	10.0	@ 70-1800 °F	

### CARBURIZATION

#### RESISTANCE

(Gas-100 hours @ 1922 °F)	
ALLOY	WEIGHT GAIN
GRADE	mg/mm <sup>2</sup>
H H	0.36
H K	0.33
<b>KHR32C</b>	<b>0.27</b>
KHR35CL	0.23

### MECHANICAL PROPERTIES (Typical Values - As Cast Condition, unless otherwise noted.)

Centrifugal Castings							Static Castings @ 70 °F		
	70	1400	1500	1600	1700 °F	Cast	Aged*	Aged**	
U.T.S. K.S.I.	76	38	31	22	15	72	75	70	
Y.S. K.S.I.	38	15	14	12	10	28	32	29	
El. %	33	30	32	40	46	29	21	25	

\*Aged 200h @ 1382 °F

\*\*Aged 1000h @ 1925 °F

### MODULUS OF ELASTICITY

RT	1112	1292	1472	1652	1832	°F
22.8	16.9	15.6	14.7	13.5	12.2	x 10 <sup>3</sup> ksi

### SERVICE TEMPERATURE

KHR32C is most commonly used at service temperatures in a range from 1300 °F to 1800 °F. Because of the niobium in the alloy, long term exposure to temperatures above this range may result in excessive rates of oxidation.

**WELDABILITY**

KHR32C 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.

HOURS		<b>RUPTURE-STRESS-KSI</b>								°F
		<u>1100</u>	<u>1200</u>	<u>1300</u>	<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	
100.	AVG.	37.17	27.99	21.08	15.88	11.96	9.01	6.79	5.11	
	MIN.	31.64	23.83	17.95	13.52	10.19	7.67	5.78	4.35	
1,000.	AVG.	29.07	21.55	15.98	11.85	8.78	6.51	4.83	3.58	
	MIN.	24.75	18.35	13.61	10.09	7.48	5.55	4.11	3.05	
10,000.	AVG.	22.74	16.60	12.11	8.84	6.45	4.71	3.44	2.51	
	MIN.	19.36	14.13	10.31	7.53	5.49	4.01	2.93	2.14	
100,000	AVG.	17.79	12.78	9.18	6.60	4.74	3.40	2.45	1.76	
	MIN.	15.15	10.88	7.82	5.62	4.04	2.90	2.08	1.50	

% / HOUR		<b>CREEP-STRESS-KSI</b>						°F
		<u>1300</u>	<u>1400</u>	<u>1500</u>	<u>1600</u>	<u>1700</u>	<u>1800</u>	
0.0001	AVG.	14.79	10.83	7.66	5.23	3.46	2.20	

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

**RELATED SPECIFICATIONS**

ASTM: A 351 (Grade CT 15C)

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