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# ALLOY DATA SHEET
# HN

**HEAT RESISTANT ALLOY**

**REVISION**: 04/91

## DESCRIPTION

HN alloy is an austenitic Fe-Ni-Cr alloy with long term creep rupture properties that are intermediate between those of HK40 and HP40 alloys. Carburization resistance is better than that of HK40 but oxidation resistance is generally lower making the alloy suitable for long service at 2000 $^{o}$F

## COMPOSITION

| | C | Mn | Si | Cr | Ni | Mo | P | S |
|---|---|---|---|---|---|---|---|---|
| Min % | 0.2 | | | 19 | 23 | - | - | - |
| Max % | 0.5 | 2.0 | 2.0 | 23 | 27 | 0.5 | 0.03 | 0.03 |

## APPLICATIONS

Tube supports and hangers; heat treatment fixtures and trays; furnace skids; furnace rolls.

## PRODUCT FORMS

Horizontal and vertical centrifugal castings; static castings.

## PHYSICAL PROPERTIES

| | | |
|---|---|---|
| Density (lbs/in$^{3}$) | 0.283 | |
| Melting Point($^{o}$F) | 2500 | |
| Thermal Conductivity | 7.5 | @ 212$^{o}$F |
| (Btu/h/ft$^{2}$/ft/$^{o}$F) | 14.5 | @ 1600$^{o}$F |
| | 15.2 | @ 1800$^{o}$F |
| Thermal Expansion | 9.7 | @ 70-1400$^{o}$F |
| (10$^{-6}$in/in $^{o}$F) | 9.9 | @ 70-1600$^{o}$F |
| | 10.1 | @ 70-1800$^{o}$F |
| | 10.2 | @ 70-2000$^{o}$F |

## CARBURIZATION RESISTANCE

(Gas-1064 hours @ 1760$^{o}$F)

| ALLOY GRADE | WEIGHT GAIN mg/mm$^{2}$ |
|---|---|
| H H | 0.58 |
| H K | 0.56 |
| **H N** | **0.43** |
| H P | 0.20 |
| H T | 0.38 |

## MECHANICAL PROPERTIES (Typical Values)

| | | 70 | 1400 | 1600 | 1800 | 2000 $^{o}$F | ASTM Spec.A297 | |
|---|---|---|---|---|---|---|---|---|
| U.T.S. | K.S.I. | 68 | - | 20 | 12 | 6 | 63 | Min. |
| Y.S. | K.S.I. | 38 | - | 14 | 10 | 5 | | |
| El. | % | 13 | - | 37 | 51 | 55 | 8 | Min. |

## SERVICE TEMPERATURE

The alloy is suitable for service at temperatures up to approximately 2000 $^{o}$F.

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

| GRADE | 1832 | 1922 | 2012 | 2102 | 2204 $^{o}$F |
|---|---|---|---|---|---|
| H K | <0.1 | 0.22 | 0.95 | 3.5 | 12.7 |
| **H N** | **0.11** | **0.38** | **1.2** | **3.5** | **9.6** |
| H P | <0.1 | 0.25 | 0.64 | 1.5 | 3.4 |

## WELDABILITY

HN alloy has good weldability by the SMAW, GTAW and GMAW processes

## CREEP-RUPTURE PROPERTIES

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

**RUPTURE-STRESS-KSI**

| HOURS | | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | °F |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | AVG. | | | 10.9 | 8.0 | 5.8 | 4.35 | 2.6 | 1.55 | |
| 1,000 | AVG. | | 10.2 | 7.4 | 5.4 | 3.6 | 2.1 | 1.25 | 0.74 | |
| 10,000 | AVG. | 10.2 | 7.2 | 5.1 | 3.3 | 1.9 | 1.1 | | | |
| 100,000 | AVG. | 7.35 | 5.1 | 3.2 | 1.75 | 1.13 | 0.44 | 0.22 | | |

**CREEP-STRESS-KSI**

| %/HOUR | | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | °F |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0001 | AVG. | | | 6.3 | 3.8 | 2.4 | 1.6 | 1.04 | | |

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

**COMPARATIVE 100,000 HOUR RUPTURE STRESSES - K.S.I.**

| ALLOY | 1400 | 1500 | 1600 | 1700 | 1800 | °F |
|---|---|---|---|---|---|---|
| H K 40 | 6.11 | 4.12 | 2.58 | 1.59 | 0.96 | |
| **H N** | **7.35** | **5.1** | **3.2** | **1.75** | **1.13** | |
| H P | 7.63 | 5.38 | 3.74 | 2.63 | 1.38 | |

## RELATED SPECIFICATIONS

ASTM: A 297 (HN); A608 (HN40)
Nearest wrought grade: None.

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