

RA333® is a high chromium nickel base superalloy with outstanding resistance to high temperature oxidation and carburization. RA333 has an exceptional ability to withstand the repeated thermal shock of oil or water quenching. RA333 is one of the few materials that can withstand corrosive conditions ranging from aqueous to white heat. Upon shutdown, RA333 resists dew point corrosion by sulfuric acid and polythionic acid stress corrosion cracking.

Weld RA333 with matching composition N06333 bare wire or RA333-70-16 AC/DC coated electrodes. Do not preheat, keep interpass temperature below 212°F and use reinforced stringer beads. Machinability rating of RA333 is 12-15% of B1112; turn 20-25 sfm with high speed steel tools.

**Specifications**

UNS: N06333 W. Nr./EN: 2.4608 AMS: 5593, 5717 ASTM: B 718, B 719, B 722, B 723, B 726

**Chemical Composition, %**

	Cr	Ni	Mn	Si	Mo	Co	W	P	S	C	Fe
MIN	24.0	44.0	–	0.75	2.5	2.5	2.5	–	–	–	–
MAX	27.0	47.0	2.0	1.5	4.0	4.0	4.0	0.03	0.03	0.08	balance

**Features**

- Excellent carburization and metal dusting resistance
- Excellent long-term oxidation resistance through 2200°F
- Excellent thermal shock and fatigue resistance
- Resistant to chloride ion and polythionic acid stress corrosion cracking
- Useful resistance to sulfuric acid

**Applications**

- Carburizing furnace fixtures
- Radiant tubes, muffles, retorts
- Tube hangers for petroleum refining and power generation
- Boilers
- Calciner shells
- Flare tips
- Thermowells
- Gas turbine combustion chambers
- Molten glass process equipment
- Sour water stripper reboiler lining

**Physical Properties**

Density: 0.294 lb/in<sup>3</sup> Melting Range: 2375-2450°F

Temperature, °F	70	1000	1200	1400	1600	1800	2000
Coefficient of Thermal Expansion* in/in °F x 10 <sup>-6</sup>	–	8.6	9.0	9.3	9.4	9.7	–
Thermal Conductivity Btu • ft/ft <sup>2</sup> • hr • °F	6.41	11.3	12.4	13.5	14.5	15.6	16.7
Modulus of Elasticity, Dynamic psi x 10 <sup>6</sup>	29.2	24.6	23.4	22.1	20.2	18.2	–

\* 68°F to indicated temperature.

## Mechanical Properties

### Representative Tensile Properties

Temperature, °F	70	1600	1800	2000	2200
Ultimate Tensile Strength, ksi	107	27.5	15.7	7.4	4.0
0.2% Yield Strength, ksi	47	23.9	12.1	6.5	3.5
Elongation, Percent	48	75	64	25	106

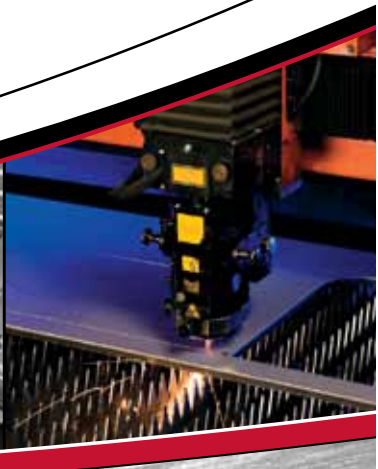
### Typical Creep-Rupture Properties

Temperature, °F	1400	1600	1800	2000	2200
Minimum Creep 0.0001%/Hour, ksi	6.4	2.7	0.88	—	—
10,000 Hour Rupture Strength, ksi	9.2	3.1	1.05	0.36	0.14

### Metal Dusting Comparison

RA333	Bright, no pits, 27,594 hr
RA333	preoxidized, light pits, 16,183 hr
RA330®	bright, pitted, 19,472 hr
N07214	bright, many pits, 19,472 hr
N07214	preoxidized, many pits, 19,472 hr
N08120	bright, pitted, 11,264 hr

*Atmosphere - endothermic with 0.7-0.8% Carbon potential metal dusting occurs at about 1100°F.*



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