

Haynes Hastelloy® S alloy, gas tungsten arc welded plate 12.7 mm (1/2 in.) thick, aged 4000 hours

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

Material Notes:

Nickel-based, high temperature alloy. Excellent thermal stability, low thermal expansion, excellent oxidation resistance to 1093°C, good high temperature and thermal fatigue strength. Applications include seal rings in gas turbine engines, and severe cyclical heating conditions where it retains strength, ductility, and integrity. Data provided by the manufacturer, Haynes International, Inc.

Order this product through the following link:

http://www.lookpolymers.com/polymer_Haynes-Hastelloy-S-alloy-gas-tungsten-arc-welded-plate-127-mm-12-in-thick-aged-4000-hours.php

| Physical Properties | Metric | English | Comments |
|---------------------|-----------|--------------------------|----------|
| Density | 8.75 g/cc | 0.316 lb/in ³ | |

| Mechanical Properties | Metric | English | Comments |
|----------------------------|---------------------------------|-----------------------------------|------------------------------------|
| Hardness, Rockwell A | 57 | 57 | |
| Tensile Strength, Ultimate | 847 MPa | 123000 psi | |
| Tensile Strength, Yield | 416 MPa @Strain 0.200 % | 60300 psi @Strain 0.200 % | |
| Reduction of Area | 32 % | 32 % | |
| Modulus of Elasticity | 132 GPa @Temperature 1093 °C | 19100 ksi @Temperature 1999 °F | Heat treated at 1066°C, air cooled |
| | 151 GPa @Temperature 927 °C | 21900 ksi @Temperature 1700 °F | Heat treated at 1066°C, air cooled |
| | 161 GPa @Temperature 813 °C | 23400 ksi @Temperature 1500 °F | Heat treated at 1066°C, air cooled |
| | 166 GPa @Temperature 760 °C | 24100 ksi @Temperature 1400 °F | Heat treated at 1066°C, air cooled |
| | 174 GPa @Temperature 649 °C | 25200 ksi @Temperature 1200 °F | Heat treated at 1066°C, air cooled |
| | 182 GPa @Temperature 538 °C | 26400 ksi @Temperature 1000 °F | Heat treated at 1066°C, air cooled |
| | 194 GPa | 28100 ksi | Heat treated at 1066°C, air cooled |

| Mechanical Properties | @Temperature 357 °C Metric | @Temperature 675 °F English | Comments |
|-----------------------|-------------------------------|--------------------------------|----------|
| | 212 GPa | 30700 ksi | |
| | @Temperature 24.0 °C | @Temperature 75.2 °F | |

| Thermal Properties | Metric | English | Comments |
|---|---|---|----------|
| CTE, linear | 11.5 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 6.39 $\mu\text{in}/\text{in}\cdot\text{°F}$ | |
| | @Temperature 20.0 - 93.0 °C | @Temperature 68.0 - 199 °F | |
| | 12.2 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 6.78 $\mu\text{in}/\text{in}\cdot\text{°F}$ | |
| | @Temperature 20.0 - 204 °C | @Temperature 68.0 - 399 °F | |
| | 12.8 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.11 $\mu\text{in}/\text{in}\cdot\text{°F}$ | |
| | @Temperature 20.0 - 316 °C | @Temperature 68.0 - 601 °F | |
| | 13.1 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.28 $\mu\text{in}/\text{in}\cdot\text{°F}$ | |
| | @Temperature 20.0 - 427 °C | @Temperature 68.0 - 801 °F | |
| | 13.3 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.39 $\mu\text{in}/\text{in}\cdot\text{°F}$ | |
| | @Temperature 20.0 - 538 °C | @Temperature 68.0 - 1000 °F | |
| 14.4 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.00 $\mu\text{in}/\text{in}\cdot\text{°F}$ | | |
| @Temperature 20.0 - 760 °C | @Temperature 68.0 - 1400 °F | | |
| 14.9 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.28 $\mu\text{in}/\text{in}\cdot\text{°F}$ | | |
| @Temperature 20.0 - 871 °C | @Temperature 68.0 - 1600 °F | | |
| 15.5 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.61 $\mu\text{in}/\text{in}\cdot\text{°F}$ | | |
| @Temperature 20.0 - 982 °C | @Temperature 68.0 - 1800 °F | | |
| 16.0 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.89 $\mu\text{in}/\text{in}\cdot\text{°F}$ | | |
| @Temperature 20.0 - 1093 °C | @Temperature 68.0 - 1999 °F | | |
| Specific Heat Capacity | 0.398 J/g-°C | 0.0951 BTU/lb-°F | |
| | @Temperature 0.000 °C | @Temperature 32.0 °F | |
| | 0.414 J/g-°C | 0.0989 BTU/lb-°F | |
| @Temperature 50.0 °C | @Temperature 122 °F | | |
| | 0.440 J/g-°C | 0.105 BTU/lb-°F | |

| Thermal Properties | Metric | English | Comments |
|----------------------|----------------------|------------------------------------|----------|
| | @Temperature 150 °C | @Temperature 302 °F | |
| | 0.456 J/g-°C | 0.109 BTU/lb-°F | |
| | @Temperature 250 °C | @Temperature 482 °F | |
| | 0.473 J/g-°C | 0.113 BTU/lb-°F | |
| | @Temperature 350 °C | @Temperature 662 °F | |
| | 0.481 J/g-°C | 0.115 BTU/lb-°F | |
| | @Temperature 450 °C | @Temperature 842 °F | |
| | 0.494 J/g-°C | 0.118 BTU/lb-°F | |
| | @Temperature 550 °C | @Temperature 1020 °F | |
| | 0.502 J/g-°C | 0.120 BTU/lb-°F | |
| | @Temperature 650 °C | @Temperature 1200 °F | |
| | 0.590 J/g-°C | 0.141 BTU/lb-°F | |
| | @Temperature 800 °C | @Temperature 1470 °F | |
| | 0.594 J/g-°C | 0.142 BTU/lb-°F | |
| | @Temperature 850 °C | @Temperature 1560 °F | |
| | 0.594 J/g-°C | 0.142 BTU/lb-°F | |
| | @Temperature 900 °C | @Temperature 1650 °F | |
| | 0.594 J/g-°C | 0.142 BTU/lb-°F | |
| | @Temperature 700 °C | @Temperature 1290 °F | |
| | 0.594 J/g-°C | 0.142 BTU/lb-°F | |
| | @Temperature 750 °C | @Temperature 1380 °F | |
| | 0.598 J/g-°C | 0.143 BTU/lb-°F | |
| | @Temperature 950 °C | @Temperature 1740 °F | |
| | 0.598 J/g-°C | 0.143 BTU/lb-°F | |
| | @Temperature 1000 °C | @Temperature 1830 °F | |
| | 0.598 J/g-°C | 0.143 BTU/lb-°F | |
| | @Temperature 1050 °C | @Temperature 1920 °F | |
| | 0.603 J/g-°C | 0.144 BTU/lb-°F | |
| | @Temperature 1100 °C | @Temperature 2010 °F | |
| Thermal Conductivity | 14.0 W/m-K | 97.2 BTU-in/hr-ft ² -°F | |
| | @Temperature 200 °C | @Temperature 392 °F | |

| Thermal Properties | Metric | English | Comments |
|----------------------------------|----------------------|-----------------------------------|----------|
| | 16.1 W/m-K | 112 BTU-in/hr-ft ² -°F | |
| | @Temperature 300 °C | @Temperature 572 °F | |
| | 17.9 W/m-K | 124 BTU-in/hr-ft ² -°F | |
| | @Temperature 400 °C | @Temperature 752 °F | |
| | 19.5 W/m-K | 135 BTU-in/hr-ft ² -°F | |
| | @Temperature 500 °C | @Temperature 932 °F | |
| | 21.0 W/m-K | 146 BTU-in/hr-ft ² -°F | |
| | @Temperature 600 °C | @Temperature 1110 °F | |
| | 26.1 W/m-K | 181 BTU-in/hr-ft ² -°F | |
| | @Temperature 700 °C | @Temperature 1290 °F | |
| | 26.1 W/m-K | 181 BTU-in/hr-ft ² -°F | |
| | @Temperature 800 °C | @Temperature 1470 °F | |
| | 26.1 W/m-K | 181 BTU-in/hr-ft ² -°F | |
| | @Temperature 900 °C | @Temperature 1650 °F | |
| | 27.1 W/m-K | 188 BTU-in/hr-ft ² -°F | |
| | @Temperature 950 °C | @Temperature 1740 °F | |
| | 28.0 W/m-K | 194 BTU-in/hr-ft ² -°F | |
| | @Temperature 1000 °C | @Temperature 1830 °F | |
| Melting Point | 1335 - 1380 °C | 2435 - 2520 °F | |
| Solidus | 1335 °C | 2435 °F | |
| Liquidus | 1380 °C | 2520 °F | |
| Maximum Service Temperature, Air | 1093 °C | 1999 °F | |

| Component Elements Properties | Metric | English | Comments |
|-------------------------------|---------------|---------------|----------|
| Aluminum, Al | 0.10 - 0.50 % | 0.10 - 0.50 % | |
| Boron, B | <= 0.015 % | <= 0.015 % | |
| Carbon, C | <= 0.020 % | <= 0.020 % | |
| Chromium, Cr | 14.5 - 17 % | 14.5 - 17 % | |
| Cobalt, Co | <= 2.0 % | <= 2.0 % | |
| Copper, Cu | <= 0.35 % | <= 0.35 % | |

| Component Elements Properties | Metric | English | Comments |
|-------------------------------|----------------|----------------|----------|
| Lanthanum, La | 0.010 - 0.10 % | 0.010 - 0.10 % | |
| Manganese, Mn | 0.30 - 1.0 % | 0.30 - 1.0 % | |
| Molybdenum, Mo | 14 - 16.5 % | 14 - 16.5 % | |
| Nickel, Ni | 67 % | 67 % | |
| Phosphorous, P | <= 0.020 % | <= 0.020 % | |
| Silicon, Si | 0.20 - 0.75 % | 0.20 - 0.75 % | |
| Sulfur, S | <= 0.015 % | <= 0.015 % | |
| Tungsten, W | <= 1.0 % | <= 1.0 % | |

| Electrical Properties | Metric | English | Comments |
|------------------------|---|---|--|
| Electrical Resistivity | 0.000128 ohm-cm @Temperature 25.0 °C | 0.000128 ohm-cm @Temperature 77.0 °F | specimen aged 16000 hours at 650°C (1200°F) |

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