

# HAYNES® 75 alloy

## Principal Features

HAYNES® 75 alloy (UNS N06075) is a solution-strengthened nickel-chromium alloy with moderate strength to 1200 °F (650 °C). It is principally used in low stress elevated temperature application requiring reasonable oxidation resistance, and is approximately equivalent to alloy 600 in performance. Alloy 75 is used in a number of fabricated part applications in the gas turbine and aerospace industries in Europe, and is also employed in general industrial heating uses. The alloy is readily formed and fabricated using conventional techniques.

## Nominal Composition

### Weight, %

|                   |            |
|-------------------|------------|
| <b>Nickel:</b>    | 76 Balance |
| <b>Cobalt:</b>    | 1 max.     |
| <b>Chromium:</b>  | 20         |
| <b>Iron:</b>      | 5 max      |
| <b>Titanium:</b>  | 0.4        |
| <b>Manganese:</b> | 1 max.     |
| <b>Silicon:</b>   | 1 max.     |
| <b>Aluminum:</b>  | 0.4 max.   |
| <b>Titanium:</b>  | 0.4        |
| <b>Carbon:</b>    | 0.11       |

## Physical Properties

| Physical Property             | British Units |                                  | Metric Units |                        |
|-------------------------------|---------------|----------------------------------|--------------|------------------------|
|                               | RT            | 0.302 lb/in <sup>3</sup>         | RT           | 8.37 g/cm <sup>3</sup> |
| <b>Density</b>                | RT            | 0.302 lb/in <sup>3</sup>         | RT           | 8.37 g/cm <sup>3</sup> |
| <b>Melting Range</b>          | 2445-2515°F   | -                                | 1340-1380°C  | -                      |
| <b>Electrical Resistivity</b> | 400°F         | 44.1 μohm-in                     | 200°C        | 112 μohm-cm            |
|                               | 800°F         | 46.0 μohm-in                     | 400°C        | 117 μohm-cm            |
|                               | 1000°F        | 45.5 μohm-in                     | 600°C        | 115 μohm-cm            |
|                               | 1200°F        | 45.3 μohm-in                     | 700°C        | 115 μohm-cm            |
|                               | 1400°F        | 45.3 μohm-in                     | 800°C        | 115 μohm-cm            |
|                               | 1600°F        | 45.3 μohm-in                     | 900°C        | 115 μohm-cm            |
|                               | 1800°F        | 45.6 μohm-in                     | 1000°C       | 116 μohm-cm            |
| <b>Thermal Conductivity</b>   | 800°F         | 133 Btu-in/ft <sup>2</sup> -h-°F | 400°C        | 18.6 W/m-°C            |
|                               | 1000°F        | 149 Btu-in/ft <sup>2</sup> -h-°F | 600°C        | 22.7 W/m-°C            |
|                               | 1200°F        | 164 Btu-in/ft <sup>2</sup> -h-°F | 700°C        | 24.7 W/m-°C            |
|                               | 1400°F        | 179 Btu-in/ft <sup>2</sup> -h-°F | 800°C        | 26.5 W/m-°C            |
|                               | 1600°F        | 193 Btu-in/ft <sup>2</sup> -h-°F | 900°C        | 28.4 W/m-°C            |
|                               | 1800°F        | 207 Btu-in/ft <sup>2</sup> -h-°F | 1000°C       | 30.1 W/m-°C            |

RT= Room Temperature

## Physical Properties Continued

|                                              |           |                                             |           |                                           |
|----------------------------------------------|-----------|---------------------------------------------|-----------|-------------------------------------------|
| <b>Mean Coefficient of Thermal Expansion</b> | 70-800°F  | 7.9 $\mu\text{in/in} \cdot ^\circ\text{F}$  | 20-500°C  | 14.3 $\mu\text{m/m} \cdot ^\circ\text{C}$ |
|                                              | 70-1000°F | 8.2 $\mu\text{in/in} \cdot ^\circ\text{F}$  | 20-600°C  | 15.0 $\mu\text{m/m} \cdot ^\circ\text{C}$ |
|                                              | 70-1200°F | 8.5 $\mu\text{in/in} \cdot ^\circ\text{F}$  | 20-700°C  | 15.4 $\mu\text{m/m} \cdot ^\circ\text{C}$ |
|                                              | 70-1400°F | 8.9 $\mu\text{in/in} \cdot ^\circ\text{F}$  | 20-800°C  | 16.5 $\mu\text{m/m} \cdot ^\circ\text{C}$ |
|                                              | 70-1600°F | 9.4 $\mu\text{in/in} \cdot ^\circ\text{F}$  | 20-900°C  | 17.1 $\mu\text{m/m} \cdot ^\circ\text{C}$ |
|                                              | 70-1800°F | 10.3 $\mu\text{in/in} \cdot ^\circ\text{F}$ | 20-1000°C | 18.2 $\mu\text{m/m} \cdot ^\circ\text{C}$ |
| <b>Dynamic Modulus of Elasticity</b>         | 70°F      | 32.0 x 10 <sup>6</sup> psi                  | 20°C      | 221 GPa                                   |
|                                              | 400°F     | 30.5 x 10 <sup>6</sup> psi                  | 200°C     | 210 GPa                                   |
|                                              | 800°F     | 28.2 x 10 <sup>6</sup> psi                  | 400°C     | 197 GPa                                   |
|                                              | 1000°F    | 27.0 x 10 <sup>6</sup> psi                  | 600°C     | 181 GPa                                   |
|                                              | 1200°F    | 25.5 x 10 <sup>6</sup> psi                  | 700°C     | 173 GPa                                   |
|                                              | 1400°F    | 24.6 x 10 <sup>6</sup> psi                  | 800°C     | 165 GPa                                   |
|                                              | 1600°F    | 22.6 x 10 <sup>6</sup> psi                  | 900°C     | 153 GPa                                   |
|                                              | 1800°F    | 20.5 x 10 <sup>6</sup> psi                  | 1000°C    | 140 GPa                                   |

RT= Room Temperature

## Heat Treatment, Sheet and Strip

1925°F (1050°C)/Bright Anneal

## Tensile Properties, Sheet

1925 °F (1050 °C)/Bright Anneal

| Form  | Test Temperature |     | 0.2% Offset Yield Strength |     | Ultimate Tensile Strength |     | Elongation |
|-------|------------------|-----|----------------------------|-----|---------------------------|-----|------------|
|       | °F               | °C  | ksi                        | MPa | ksi                       | MPa |            |
| Sheet | RT               | RT  | 59.4                       | 407 | 114.4                     | 792 | 31         |
|       | 1000             | 538 | 51.9                       | 363 | 105.6                     | 726 | 27         |
|       | 1200             | 649 | 40                         | 275 | 69.3                      | 473 | 32         |
|       | 1400             | 760 | 22                         | 152 | 41.4                      | 286 | 75         |
|       | 1600             | 871 | 9.9                        | 68  | 20.2                      | 139 | 90         |
|       | 1800             | 982 | 4.4                        | 31  | 9.7                       | 66  | 91         |

RT= Room Temperature

# Typical Stress-Rupture Strength, Sheet

1925 °F (1050 °C) Anneal

| Test Temperature |     | Approximate Initial Stress to Produce Rupture in: |     |       |     |        |     |
|------------------|-----|---------------------------------------------------|-----|-------|-----|--------|-----|
|                  |     | 10 h                                              |     | 100 h |     | 1000 h |     |
| °F               | °C  | ksi                                               | MPa | ksi   | MPa | ksi    | MPa |
| 1200             | 650 | 27                                                | 185 | 18.5  | 130 | 12     | 83  |
| 1300             | 705 | 16                                                | 110 | 10.2  | 70  | 6.8    | 47  |
| 1400             | 760 | 9.5                                               | 66  | 6     | 41  | 3.8    | 26  |
| 1500             | 815 | 5.8                                               | 40  | 3.7   | 26  | 2.2    | 15  |
| 1600             | 870 | 3.6                                               | 25  | 2     | 14  | 1.2    | 8.3 |

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