

SAE 1040

Component Wt. %

C 0.37 - 0.44

Fe 98.6 - 99

Mn 0.6 - 0.9

P Max 0.04

S Max 0.05

Material Notes:

Typical uses include machine, plow, and carriage bolts, tie wire, cylinder head studs, and machined parts, U-bolts, concrete reinforcing rods, forgings, and non-critical springs.

Physical Properties Metric English Comments

Density 7.845 g/cc 0.283 lb/in³ Chemical composition of 0.435% C, 0.69% Mn, 0.20% Si, annealed at 860 °C (1580 °F).

Mechanical Properties

Hardness, Brinell 149 149

Hardness, Knoop 169 169 Converted from Brinell hardness.

Hardness, Rockwell B 80 80 Converted from Brinell hardness.

Hardness, Vickers 155 155 Converted from Brinell hardness.

Tensile Strength, Ultimate 525 MPa 76100 psi

Tensile Strength, Yield 290 MPa 42100 psi

Elongation at Break 18 % 18 % in 50 mm

Reduction of Area 40 % 40 %

Modulus of Elasticity 200 GPa 29000 ksi Typical for steel

Bulk Modulus 140 GPa 20300 ksi Typical for steels

Poisson's Ratio 0.29 0.29 Typical For Steel

Izod Impact 49 J 36.1 ft-lb as rolled, 45 J (33 ft-lb) annealed at 790 °C (1450 °F), 65 J (48 ft-lb) normalized at 900 °C (1650 °F)

Shear Modulus 80 GPa 11600 ksi Typical for steels

Electrical Properties

Electrical Resistivity 1.71e-005 ohm-cm 1.71e-005 ohm-cm 20 °C (68 °F)
Electrical Resistivity at Elevated Temperature 0.0001111 ohm-cm 0.0001111 ohm-cm 800 °C (1470 °F)
Electrical Resistivity at Elevated Temperature 0.0001149 ohm-cm 0.0001149 ohm-cm 900 °C (1650 °F)
Electrical Resistivity at Elevated Temperature 0.0001179 ohm-cm 0.0001179 ohm-cm 1000 °C
Electrical Resistivity at Elevated Temperature 2.21e-005 ohm-cm 2.21e-005 ohm-cm 100 °C (212 °F)
Electrical Resistivity at Elevated Temperature 2.96e-005 ohm-cm 2.96e-005 ohm-cm 200 °C (390 °F)
Electrical Resistivity at Elevated Temperature 4.93e-005 ohm-cm 4.93e-005 ohm-cm 400 °C (750 °F)
Electrical Resistivity at Elevated Temperature 7.63e-005 ohm-cm 7.63e-005 ohm-cm 600 °C (1110 °F)
Electrical Resistivity at Elevated Temperature 9.32e-005 ohm-cm 9.32e-005 ohm-cm 700 °C (1290 °F)

Thermal Properties

CTE, linear 20°C 11.3 $\mu\text{m}/\text{m}\cdot\text{°C}$ 6.28 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu.; 20-100 °C (68-212 °F)
CTE, linear 20°C 12.1 $\mu\text{m}/\text{m}\cdot\text{°C}$ 6.72 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu.; 20-200 °C (68-390 °F)
CTE, linear 250°C 12.2 $\mu\text{m}/\text{m}\cdot\text{°C}$ 6.78 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu; 20-300 °C (68-570 °F)
CTE, linear 250°C 13.3 $\mu\text{m}/\text{m}\cdot\text{°C}$ 7.39 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu; 20-400 °C (68-750 °F)
CTE, linear 500°C 13.9 $\mu\text{m}/\text{m}\cdot\text{°C}$ 7.72 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu; 20-500 °C (68-930 °F)
CTE, linear 500 °C 14.2 $\mu\text{m}/\text{m}\cdot\text{°C}$ 7.89 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu; 20-600 °C (68-1110 °F)
CTE, linear 500°C 14.8 $\mu\text{m}/\text{m}\cdot\text{°C}$ 8.22 $\mu\text{in}/\text{in}\cdot\text{°F}$ Composition of 0.40% C, 0.11% Mn, 0.01% P, 0.03% S, 0.03% Si, 0.03% Cu; 20-700 °C (68-1290 °F)
CTE, linear 1000°C 14.7 $\mu\text{m}/\text{m}\cdot\text{°C}$ 8.17 $\mu\text{in}/\text{in}\cdot\text{°F}$ Typical steel
Specific Heat Capacity 0.486 J/g- °C 0.116 BTU/lb- °F 50-100 °C (122-212 °F)
Specific Heat Capacity at Elevated Temperature 0.515 J/g- °C 0.123 BTU/lb- °F 150-200 °C (300-390 °F)
Specific Heat Capacity at Elevated Temperature 0.528 J/g- °C 0.126 BTU/lb- °F 200-250 °C (390-480 °F)
Specific Heat Capacity at Elevated Temperature 0.548 J/g- °C 0.131 BTU/lb- °F 250-300 °C (480-570 °F)
Specific Heat Capacity at Elevated Temperature 0.569 J/g- °C 0.136 BTU/lb- °F 300-350 °C (570-660 °F)

Specific Heat Capacity at Elevated Temperature 0.586 J/g- °C 0.14 BTU/lb- °F 350-400 °C (660-750 °F)

Specific Heat Capacity at Elevated Temperature 0.624 J/g- °C 0.149 BTU/lb- °F 750-800 °C (1380-1470 °F)

Specific Heat Capacity at Elevated Temperature 0.649 J/g- °C 0.155 BTU/lb- °F 450-500 °C (750-930 °F)

Specific Heat Capacity at Elevated Temperature 0.708 J/g- °C 0.169 BTU/lb- °F 550-600 °C (1020-1110 °F)

Specific Heat Capacity at Elevated Temperature 0.77 J/g- °C 0.184 BTU/lb- °F 650-700 °C (1200-1290 °F)

Specific Heat Capacity at Elevated Temperature 1.583 J/g- °C 0.378 BTU/lb- °F 700-750 °C (1290-1380 °F)

Thermal Conductivity 50.7 W/m-K 352 BTU-in/hr-ft²- °F 100 °C (212 °F)

Thermal Conductivity 51.9 W/m-K 360 BTU-in/hr-ft²- °F 0 °C

Thermal Conductivity at Elevated Temperature 24.7 W/m-K 171 BTU-in/hr-ft²- °F 800 °C

Thermal Conductivity at Elevated Temperature 29.8 W/m-K 207 BTU-in/hr-ft²- °F 1200 °C (2190 °F)

Thermal Conductivity at Elevated Temperature 30.1 W/m-K 209 BTU-in/hr-ft²- °F 700 °C (1290 °F)

Thermal Conductivity at Elevated Temperature 32.9 W/m-K 228 BTU-in/hr-ft²- °F 1000 °C (1830 °F)

Thermal Conductivity at Elevated Temperature 33.9 W/m-K 235 BTU-in/hr-ft²- °F 600 °C (1110 °F)

Thermal Conductivity at Elevated Temperature 38.2 W/m-K 265 BTU-in/hr-ft²- °F 500 °C (930 °F)

Thermal Conductivity at Elevated Temperature 41.7 W/m-K 289 BTU-in/hr-ft²- °F 400 °C (750 °F)

Thermal Conductivity at Elevated Temperature 45.7 W/m-K 317 BTU-in/hr-ft²- °F 300 °C (570 °F)

Thermal Conductivity at Elevated Temperature 48.1 W/m-K 334 BTU-in/hr-ft²- °F 200 °C (390 °F)

