

# materials information

## Mechanical Properties

|           |          | Tensile Strength<br>psi | Tensile Strength<br>MPa | Yield Strength<br>(0.2% offset)<br>psi | Yield Strength<br>(0.2% offset)<br>MPa | Impact Strength<br>ft. lb. | Impact Strength<br>J | Shear Strength<br>psi | Shear Strength<br>MPa | Hardness<br>Brinell | Elongation<br>% in<br>50 mm |
|-----------|----------|-------------------------|-------------------------|--|--|----------------------------|----------------------|-----------------------|-----------------------|---------------------|-----------------------------|
| Zinc      | ZAMAK 3  | 36-41000                | 248-283                 | 32000                                  | 221                                    | 43                         | 58                   | 31000                 | 214                   | 82                  | 10                          |
| Zinc      | ZAMAK 5  | 42-48000                | 289-331                 | 39000                                  | 269                                    | 48                         | 65                   | 38000                 | 262                   | 91                  | 7                           |
| Zinc      | ZA8      | 53-56000                | 365-386                 | 42000                                  | 290                                    | 24-35                      | 32-48                | 40000                 | 275                   | 103                 | 8                           |
| Zinc      | ZA27     | 61000                   | 425                     | 53000                                  | 371                                    | 9                          | 5                    | 47000                 | 325                   | 118                 | 1-3                         |
| Zinc      | ACuZinc5 | 59000                   | 407                     | 49000                                  | 338                                    | -                          | -                    | 40600                 | 280                   | 118                 | 5                           |
| Magnesium | AZ91D    | 34000                   | 230                     | 23000                                  | 159                                    | 2                          | 3                    | 20000                 | 138                   | 63                  | 0.5-3                       |
| Magnesium | AM60A    | 32000                   | 220                     | 19000                                  | 131                                    | 5                          | 6                    | -                     | -                     | 62                  | 8                           |
| Aluminum  | A380     | 47000                   | 325                     | 23000                                  | 159                                    | 2                          | 3                    | 28000                 | 195                   | 83                  | 4                           |
| Aluminum  | 383      | 43000                   | 300                     | 19000                                  | 131                                    | 2                          | 3                    | 29000                 | 200                   | 65-90               | 1-3                         |
| Aluminum  | B390     | 41000                   | 283                     | 35000                                  | 242                                    | 5                          | 6                    | 29000                 | 200                   | 120                 | 1                           |
| Brass     | C38500   | 62-77000                | 430-530                 | 33000                                  | 228                                    | 12                         | 17                   | -                     | -                     | 143                 | 15-25                       |
| Brass     | C38000   | 61-67000                | 420-460                 | 33000                                  | 228                                    | 12                         | 16                   | -                     | -                     | 133                 | 20-25                       |
| Steel     | SAE1020  | 65000                   | 448                     | 48000                                  | 331                                    | 64                         | 87                   | -                     | -                     | 143                 | 36                          |

## Physical Properties

|           |          | Density<br>lb/cu in | Density<br>g/cm <sup>3</sup> | Melting<br>Range °F | Melting<br>Range °C | Thermal<br>Conductivity<br>Btu-ft/h-ft <sup>2</sup> °F | Thermal<br>Conductivity<br>W/m °C | Thermal<br>Expansion<br>x10 <sup>-6</sup> °F <sup>-1</sup> | Thermal<br>Expansion<br>10 <sup>-6</sup> °C <sup>-1</sup> | Electrical<br>Conductivity<br>% IACS |
|-----------|----------|---------------------|------------------------------|---------------------|---------------------|--|-----------------------------------|--|---|--------------------------------------|
| Zinc      | ALLOY 3  | 0.24                | 6.7                          | 719-728             | 381-387             | 65.3   | 113                               | 15.2   | 27.4  | 27                                   |
| Zinc      | ALLOY 5  | 0.24                | 6.7                          | 717-727             | 380-386             | 62.9   | 109                               | 15.2   | 27.4  | 26                                   |
| Zinc      | ZA8      | 0.23                | 6.3                          | 707-759             | 375-404             | 66.3   | 115                               | 12.9   | 23.3  | 27.7                                 |
| Zinc      | ZA27     | 0.181               | 5                            | 708-903             | 376-484             | 72.5   | 125                               | 14.4   | 26  | 29.7                                 |
| Zinc      | ACuZinc5 | 0.25                | 6.85                         | 755-860             | 402-460             | 61.2   | 106                               | 13.3   | 24  | 26.9                                 |
| Magnesium | AZ91D    | 0.066               | 1.81                         | 875-1105            | 468-596             | 41.8   | 72                                | 15   | 27  | 11                                   |
| Magnesium | AM60A    | 0.065               | 1.8                          | 1005-1140           | 540-615             | 36   | 62                                | 14.4   | 26  | 12.4                                 |
| Aluminum  | A380     | 0.097               | 2.7                          | 1000-1100           | 537-593             | 55.6   | 96                                | 11.7   | 21  | 27                                   |
| Aluminum  | 383      | 0.097               | 2.7                          | 977-1058            | 525-570             | 57.9   | 100                               | 11.1   | 20  | 26                                   |
| Aluminum  | B390     | 0.099               | 2.75                         | 945-1200            | 507-649             | 77.5   | 134                               | 10   | 17.9  | 27                                   |
| Brass     | C38500   | 0.3                 | 8.4                          | 1616-1652           | 880-900             | 65.3   | 113                               | 14.4   | 26  | 26                                   |
| Brass     | C38000   | 0.3                 | 8.4                          | 1652-1688           | 900-920             | 62.9   | 109                               | 11.7   | 21  | 25                                   |
| Steel     | SAE1020  | 0.28                | 7.8                          | 2600                | 1426                | 28.9   | 50                                | 6.7  | 12.1  | 12                                   |



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## Zinc Alloy Composition

| %             | ZAMAK 3   | ZAMAK 5   | ZA8        | ZA27      | ACuZinc5   |
|---------------|-----------|-----------|------------|-----------|------------|
| Aluminum      | 3.5-4.3   | 3.5-4.3   | 8.0-8.8    | 25.0-28.0 | 2.8-3.3    |
| Copper        | 0.25 max  | 0.75-1.25 | 0.8-1.3    | 2.0-2.5   | 5.0-6.0    |
| Magnesium     | 0.02-0.05 | 0.03-0.08 | 0.015-0.03 | 0.01-0.02 | 0.025-0.05 |
| Iron (max)    | 0.1       | 0.1       | 0.075      | 0.075     | 0.075      |
| Lead (max)    | 0.005     | 0.005     | 0.006      | 0.006     | 0.005      |
| Cadmium (max) | 0.004     | 0.004     | 0.006      | 0.006     | 0.004      |
| Tin (max)     | 0.003     | 0.003     | 0.003      | 0.003     | 0.003      |
| Nickel        | -         | -         | -          | -         | -          |
| Others        | -         | -         | -          | -         | -          |
| Zinc          | Remainder | Remainder | Remainder  | Remainder | Remainder  |

## Magnesium Alloy Composition

| %                         | AZ91D     | AM60A     |
|---------------------------|-----------|-----------|
| Aluminum                  | 8.3-9.7   | 5.5-6.5   |
| Manganese                 | 0.15-0.5  | 0.13-0.6  |
| Zinc                      | 0.35-1.0  | 0.22 max  |
| Silicon (max)             | 0.1       | 0.5       |
| Copper (max)              | 0.03      | 0.35      |
| Nickel (max)              | 0.002     | 0.03      |
| Iron (max)                | 0.005     | -         |
| Other Metallic (max each) | 0.02      | -         |
| Magnesium                 | Remainder | Remainder |

## Designations & Standards Cross Reference

|           |         |              |          |
|-----------|---------|--------------|----------|
| Zinc      | ZAMAK 3 | ASTM B86     | SAE 903  |
|           | ZAMAK 5 | ASTM B86     | SAE 925  |
|           | ZA8     | ASTM B791-45 | -        |
|           | ZA27    | ASTM B791-96 | -        |
| Aluminum  | A380    | ASTM B85     | SAE 306  |
|           | 383     | ASTM B85     | SAE383   |
|           | B390    | ASTM B85     | -        |
| Magnesium | AZ91D   | ASTM B94     | SAE 501A |
|           | AM60A   | ASTM B94     | -        |

## Aluminum Alloy Composition

| %            | A380      | 383       | B390      |
|--------------|-----------|-----------|-----------|
| Beryllium    | -         | -         | -         |
| Copper       | 3.0-4.0   | 2.0-3.0   | 4.0-5.0   |
| Iron (max)   | 1.3       | 1.3       | 1.3       |
| Magnesium    | 0.1 max   | 0.1 max   | 0.45-0.65 |
| Manganese    | 0.5 max   | 0.5 max   | 0.5 max   |
| Phosphorus   | -         | -         | 0.01 min  |
| Silicon      | 7.5-9.5   | 9.5-11.5  | 16.0-18.0 |
| Zinc (max)   | 3.0       | 3.0       | 1.5       |
| Nickel (max) | 0.5       | 0.3       | 0.1       |
| Tin          | 0.35 max  | 0.15 max  | -         |
| Titanium     | -         | -         | 0.1 max   |
| Others       | 0.5 total | 0.5 total | 0.2 total |
| Aluminum     | Remainder | Remainder | Remainder |

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