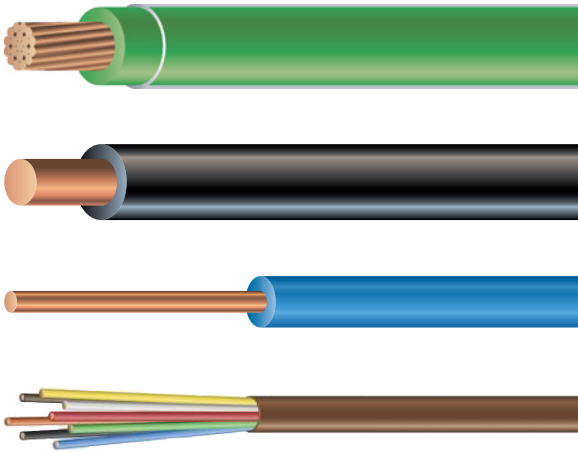
Southwire

CABLETECH SUPPORT™ Services

# LEAD WIRE

## MAXIMUM CURRENT CAPACITY (AMPACITY)

## LEAD WIRE



**The lead wire** product grouping at Southwire is made up of insulated single and multi-conductor low voltage wire and cable products used in a variety of applications including control panels, appliances, electronic equipment, automotive and industrial equipment harnesses, and specialty applications such as welding, HVAC, and pump & irrigation.

**Commonly referred to as:** motor lead wire, hook-up wire, automotive cable, battery cable, trailer cable, brake cable, welding cable, thermostat wire, pump cable, irrigation (sprinkler wire/tracer wire), or low voltage landscape lighting.

## CODE OR INDUSTRY STANDARD

Currently there is not a published code document and no industry standard that covers the maximum current capacity for hook-up and lead wires.

## CURRENT CARRYING CAPACITY (AMPACITY)

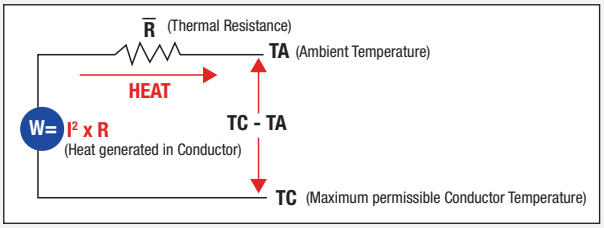
Current carrying capacity is defined as the continuous current which, when passed through a wire, will increase the temperature of the conductor from a specific ambient temperature to the maximum temperature rating of the insulation.

The maximum current capacity in the wire can be calculated using the heat-transfer formula developed by J.H Neher and M.H. McGrath. The formula is a series of heat-transfer calculations taking into account all heat sources and the thermal resistances.

$$I = \sqrt{\frac{TC - TA}{R \times RCA}}$$

Equation No. 1

Letting heat, IxIxR in this case, be represented by W and thermal resistance, RCA, by R with a line over it, we can draw a thermal circuit that is similar to an electrical circuit.




$$TC - TA = W \times \overline{R}$$

The selection of the cable size based in the current capacity depends on many variables like temperature, limitations of insulation, voltage drop, location or installation of the wires in free air or enclosed, single or bundle wires, etc.

Southwire has created the following ampacity tables for hook-up and lead wires based on the standard installation conditions indicated using the thermal method Neher-McGrath. However, it is important to highlight that these numbers were calculated assuming some variables and, in many cases, do not represent the installation conditions for the hook-up or lead wires.

The following tables are only applicable for hook-up and lead wire products and are valid for all voltage levels of these products.

| Date: | Spec No.: | Customer: |
|---|---|---|
| Prepared by: | Job Name: | |

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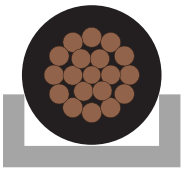

- **Table 1** - Maximum current capacity (Amperes) for a single copper conductor in free air with ambient temperature of 30°C (86°F). Shaded cables.

| AWG/KCMIL | 60°C | 75°C | 90°C | 105°C | 125°C | 150°C | 200°C | 250°C |
|---|---|---|---|---|---|---|---|---|
| 22 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 17 |
| 20 | 9 | 11 | 13 | 14 | 16 | 18 | 20 | 22 |
| 18 | 12 | 14 | 17 | 19 | 22 | 23 | 26 | 29 |
| 16 | 15 | 19 | 22 | 24 | 28 | 31 | 34 | 37 |
| 14 | 21 | 25 | 30 | 33 | 38 | 41 | 46 | 51 |
| 12 | 27 | 33 | 39 | 43 | 49 | 54 | 60 | 66 |
| 10 | 36 | 45 | 52 | 59 | 67 | 74 | 81 | 90 |
| 8 | 50 | 63 | 74 | 83 | 93 | 104 | 113 | 125 |
| 6 | 71 | 88 | 103 | 115 | 129 | 143 | 156 | 173 |
| 4 | 95 | 118 | 138 | 154 | 173 | 192 | 210 | 233 |
| 2 | 129 | 160 | 186 | 209 | 234 | 261 | 286 | 316 |
| 1 | 152 | 190 | 221 | 247 | 277 | 309 | 338 | 374 |
| 1/0 | 167 | 209 | 243 | 272 | 297 | 331 | 348 | 385 |
| 2/0 | 200 | 249 | 289 | 323 | 355 | 394 | 415 | 459 |
| 3/0 | 234 | 292 | 338 | 379 | 414 | 462 | 486 | 538 |
| 4/0 | 274 | 341 | 396 | 443 | 486 | 540 | 570 | 630 |
| 250 | 308 | 383 | 446 | 498 | 546 | 607 | 639 | 706 |
| 350 | 380 | 473 | 551 | 616 | 674 | 751 | 791 | 874 |
| 400 | 419 | 522 | 607 | 679 | 743 | 827 | 872 | 963 |
| 500 | 486 | 607 | 705 | 788 | 864 | 963 | 1015 | 1122 |
| 750 | 626 | 781 | 909 | 1017 | 1115 | 1242 | 1310 | 1450 |

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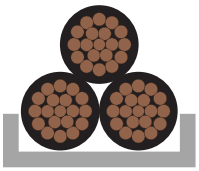

- **Table 2** - Maximum current capacity (Amperes) for not more than three (3) copper conductors in free air with ambient temperature of 30°C (86°F). Shaded cables.

| AWG/KCMIL | 60°C | 75°C | 90°C | 105°C | 125°C | 150°C | 200°C | 250°C |
|---|---|---|---|---|---|---|---|---|
| 22 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 20 | 6 | 8 | 9 | 10 | 12 | 13 | 14 | 15 |
| 18 | 8 | 11 | 13 | 14 | 15 | 17 | 19 | 21 |
| 16 | 12 | 14 | 16 | 18 | 20 | 23 | 25 | 27 |
| 14 | 14 | 18 | 22 | 24 | 27 | 30 | 33 | 37 |
| 12 | 19 | 24 | 28 | 32 | 35 | 40 | 43 | 48 |
| 10 | 27 | 32 | 38 | 43 | 48 | 54 | 60 | 65 |
| 8 | 38 | 47 | 55 | 61 | 68 | 77 | 84 | 94 |
| 6 | 53 | 67 | 77 | 86 | 97 | 108 | 119 | 132 |
| 4 | 71 | 89 | 104 | 116 | 131 | 146 | 160 | 178 |
| 2 | 96 | 121 | 141 | 158 | 177 | 198 | 218 | 241 |
| 1 | 114 | 144 | 167 | 188 | 211 | 236 | 259 | 287 |
| 1/0 | 128 | 160 | 186 | 209 | 230 | 256 | 270 | 300 |
| 2/0 | 153 | 191 | 222 | 249 | 274 | 305 | 323 | 358 |
| 3/0 | 179 | 223 | 261 | 292 | 320 | 357 | 378 | 419 |
| 4/0 | 209 | 262 | 305 | 342 | 376 | 419 | 443 | 492 |
| 250 | 238 | 297 | 346 | 388 | 426 | 475 | 502 | 557 |
| 350 | 293 | 365 | 427 | 478 | 525 | 587 | 620 | 689 |
| 400 | 320 | 401 | 469 | 526 | 578 | 646 | 684 | 759 |
| 500 | 370 | 464 | 542 | 608 | 670 | 749 | 794 | 882 |
| 750 | 471 | 592 | 692 | 779 | 858 | 962 | 1024 | 1140 |

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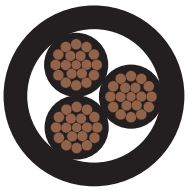

- **Table 3 -** Maximum current capacity (Amperes) for not more than three (3) copper conductors in a cable with ambient temperature of 30°C (86°F). Shaded cables.

| AWG/KCMIL | 60°C | 75°C | 90°C | 105°C | 125°C | 150°C | 200°C | 250°C |
|---|---|---|---|---|---|---|---|---|
| 22 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 20 | 6 | 8 | 9 | 10 | 12 | 13 | 14 | 15 |
| 18 | 8 | 11 | 13 | 14 | 15 | 17 | 19 | 21 |
| 16 | 11 | 14 | 15 | 17 | 19 | 22 | 24 | 27 |
| 14 | 14 | 18 | 21 | 23 | 26 | 29 | 32 | 36 |
| 12 | 19 | 23 | 27 | 30 | 33 | 37 | 41 | 46 |
| 10 | 26 | 32 | 37 | 40 | 44 | 50 | 54 | 61 |
| 8 | 35 | 44 | 50 | 53 | 59 | 67 | 74 | 82 |
| 6 | 48 | 59 | 68 | 72 | 81 | 91 | 100 | 112 |
| 4 | 62 | 76 | 88 | 94 | 105 | 118 | 131 | 147 |
| 2 | 81 | 101 | 117 | 124 | 140 | 156 | 173 | 195 |
| 1 | 93 | 115 | 134 | 142 | 159 | 179 | 199 | 222 |
| 1/0 | 112 | 139 | 161 | 170 | 187 | 209 | 224 | 250 |
| 2/0 | 131 | 162 | 188 | 199 | 219 | 245 | 262 | 294 |
| 3/0 | 151 | 187 | 218 | 230 | 253 | 283 | 304 | 341 |
| 4/0 | 173 | 215 | 249 | 265 | 291 | 326 | 350 | 392 |
| 250 | 202 | 251 | 292 | 310 | 341 | 381 | 408 | 458 |
| 350 | 244 | 303 | 352 | 374 | 412 | 461 | 494 | 556 |
| 400 | 264 | 329 | 383 | 407 | 448 | 502 | 539 | 606 |
| 500 | 299 | 372 | 434 | 462 | 510 | 572 | 614 | 691 |
| 750 | 364 | 455 | 531 | 566 | 627 | 706 | 761 | 858 |

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• **Table 4 -** Correction factors for other temperatures

| AMBIENT TEMP (°C) | INSULATION TEMPERATURE LEVEL | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 60°C | 75°C | 90°C | 105°C | 125°C | 150°C | 200°C | 250°C |
| 30 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 40 | 0.82 | 0.88 | 0.91 | 0.92 | 0.95 | 0.96 | 0.97 | 0.98 |
| 50 | 0.58 | 0.75 | 0.81 | 0.82 | 0.89 | 0.91 | 0.94 | 0.96 |
| 60 | - | 0.58 | 0.70 | 0.73 | 0.83 | 0.86 | 0.91 | 0.93 |
| 70 | - | 0.33 | 0.55 | 0.61 | 0.76 | 0.81 | 0.87 | 0.91 |
| 80 | - | - | 0.38 | 0.46 | 0.69 | 0.76 | 0.84 | 0.88 |
| 90 | - | - | - | 0.30 | 0.61 | 0.70 | 0.80 | 0.85 |
| 100 | - | - | - | - | 0.51 | 0.63 | 0.76 | 0.83 |
| 120 | - | - | - | - | - | 0.48 | 0.68 | 0.77 |
| 140 | - | - | - | - | - | 0.26 | 0.58 | 0.70 |
| 160 | - | - | - | - | - | - | 0.47 | 0.63 |
| 180 | - | - | - | - | - | - | 0.32 | 0.56 |
| 200 | - | - | - | - | - | - | - | 0.47 |

For ambient temperatures over 30°C, multiply the ampacities shown in Table 1, Table 2, or Table 3 by the appropriate correction factor to determine the maximum current capacity.

• **Table 5 -** Correction factors for more than three conductors in a cable

| NUMBER OF CONDUCTORS | REDUCTION FACTOR |
|---|---|
| 4 – 6 | 0.80 |
| 7 – 9 | 0.70 |
| 10 – 20 | 0.50 |
| 21 – 30 | 0.45 |
| 31 – 40 | 0.40 |
| 41 and above | 0.35 |

If more than three (3) conductors are in air or cable, the values given in Table 2 and Table 3 must be reduced using the correction factors.

Tables 4 and 5 are based on the NEC® 2020.

The above ampacity numbers are for reference only. For installation conditions other than those shown, please contact **CableTechSupport@southwire.com** or **IWCableTechsupport@southwire.com**.

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