

# NTC SMD Thermistors

## NB 12 - NB 20 (Ni Barrier/100% Sn Termination)



Chip thermistors are high quality and low cost devices especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits.

A nickel barrier metallization provides outstanding qualities of solderability and enables this chip to meet the requirements of the most severe soldering processes including lead free soldering with peak temperatures up to 270°C.

| Types                                      | NB 12<br>IEC SIZE : 0805 | NB 20<br>IEC SIZE : 1206 |
|--|--------------------------|--------------------------|
| <b>DIMENSIONS:</b><br>millimeters (inches) |                          |                          |
| Terminations                               | Nickel Barrier/100% Tin  |                          |
| Marking                                    | On packaging only        |                          |
| Climatic category                          | 40/125/56                |                          |
| Operating temperature                      | -55°C to +150°C          |                          |
| Tolerance on R <sub>n</sub> (25°C)         | ±3%*, ±5%, ±10%, ±20%    |                          |
| Maximum dissipation at 25°C                | 0.12 W                   | 0.24 W                   |
| Thermal dissipation factor                 | 2 mW/°C                  | 4 mW/°C                  |
| Thermal time constant                      | 5 s                      | 7s                       |

Resistance - Temperature characteristics: pages 29 to 33.

### FEATURES

- Fast thermal response
- Commercial, Industrial and Automotive Applications
- Ni Barrier/100% Sn Termination
- Suitable for lead free reflow or wave soldering
- AEC-Q200 qualified

### APPLICATIONS

- LCD compensation
- Battery packs
- Mobile phones
- CD players
- Heating systems
- Air-conditioning systems
- Refrigeration
- Temperature control of Switch Mode Power Supplies
- Compensation of pressure sensors
- Protection of power transistors in various electronic circuits and more



### HOW TO ORDER

|                            |                            |                                  |   |   |
|----------------------------|----------------------------|----------------------------------|---|---|
| <b>NB 20</b>               | <b>K 0</b>                 | <b>0103</b>                      | <b>M</b>                                    | <b>BA</b>   |
| <b>Type</b>                | <b>Material Code</b>       | <b>Resistance</b>                | <b>Tolerance</b>                            | <b>Suffix: Packaging</b>  |
| NB12 (0805)<br>NB20 (1206) | K<br>(See tables pages 13) | 10,000 Ω<br>(See tables page 13) | H (±3%*)<br>J (±5%)<br>K (±10%)<br>M (±20%) | --: Bulk (5000 pcs/bag)<br>NB20 BA: Plastic tape (180mm diam. reel, 3000 pcs/reel)<br>BE: Plastic tape (1/2 reel, 1500 pcs/reel)<br>BC: Plastic tape (330mm diam. reel, 10,000 pcs/reel)<br>NB12 BB: Cardboard tape (180mm diam. reel, 4000 pcs/reel)<br>BF: Cardboard tape (1/2 reel, 2000 pcs/reel)<br>BD: Cardboard tape (330mm diam. reel, 10,000 pcs/reel) |

\* Optional tolerance, please contact factory

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## NB 12 - NB 20 (Ni Barrier/100% Sn Termination)



### TABLE OF VALUES

| NB 12<br>IEC SIZE : 0805 |                   |                  |   |                            |
|--------------------------|-------------------|------------------|---|----------------------------|
| Types                    | Rn at 25°C<br>(Ω) | Material<br>Code | B (K)<br>( $\Delta B/B$ (1) $\pm$ 5%<br>(2) $\pm$ 3%) | $\alpha$ at 25°C<br>(%/°C) |
| NB 12 KC 0 180           | 18                | KC               | 3470 $\pm$ 5%   | - 3.9                      |
| NB 12 KC 0 220           | 22                |                  |   |                            |
| NB 12 KC 0 270           | 27                |                  |   |                            |
| NB 12 KC 0 330           | 33                |                  |   |                            |
| NB 12 KC 0 390           | 39                |                  |   |                            |
| NB 12 KC 0 470           | 47                |                  |   |                            |
| NB 12 KC 0 560           | 56                |                  |   |                            |
| NB 12 KC 0 680           | 68                |                  |   |                            |
| NB 12 KC 0 820           | 82                |                  |   |                            |
| NB 12 KC 0 101           | 100               |                  |   |                            |
| NB 12 MC 0 121           | 120               | MC               | 3910 $\pm$ 3%   | - 4.4                      |
| NB 12 MC 0 151           | 150               |                  |   |                            |
| NB 12 MC 0 181           | 180               |                  |   |                            |
| NB 12 MC 0 221           | 220               |                  |   |                            |
| NB 12 MC 0 271           | 270               |                  |   |                            |
| NB 12 MC 0 331           | 330               |                  |   |                            |
| NB 12 MC 0 391           | 390               |                  |   |                            |
| NB 12 MC 0 471           | 470               |                  |   |                            |
| NB 12 MC 0 561           | 560               |                  |   |                            |
| NB 12 MC 0 681           | 680               |                  |   |                            |
| NB 12 MC 0 821           | 820               |                  |   |                            |
| NB 12 MC 0 102           | 1,000             |                  |   |                            |
| NB 12 MC 0 122           | 1,200             |                  |   |                            |
| NB 12 MC 0 152           | 1,500             |                  |   |                            |
| NB 12 MC 0 182           | 1,800             |                  |   |                            |
| NB 12 MC 0 222           | 2,200             |                  |   |                            |
| NB 12 MC 0 272           | 2,700             |                  |   |                            |
| NB 12 MC 0 332           | 3,300             |                  |   |                            |
| NB 12 J 0 0332           | 3,300             | J                | 3480 $\pm$ 3%   | - 3.9                      |
| NB 12 J 0 0392           | 3,900             |                  |   |                            |
| NB 12 J 0 0472           | 4,700             |                  |   |                            |
| NB 12 J 0 0562           | 5,600             |                  |   |                            |
| NB 12 K 0 0682           | 6,800             | K                | 3630 $\pm$ 3%   | - 4.0                      |
| NB 12 K 0 0822           | 8,200             |                  |   |                            |
| NB 12 K 0 0103           | 10,000            |                  |   |                            |
| NB 12 L 0 0123           | 12,000            | L                | 3790 $\pm$ 3%   | - 4.2                      |
| NB 12 L 0 0153           | 15,000            |                  |   |                            |
| NB 12 M 0 0183           | 18,000            | M                | 3950 $\pm$ 3%   | - 4.4                      |
| NB 12 M 0 0223           | 22,000            |                  |   |                            |
| NB 12 M 0 0273           | 27,000            |                  |   |                            |
| NB 12 M 0 0333           | 33,000            |                  |   |                            |
| NB 12 N 0 0393           | 39,000            | N                | 4080 $\pm$ 3%   | - 4.6                      |
| NB 12 N 0 0473           | 47,000            |                  |   |                            |
| NB 12 N 0 0563           | 56,000            |                  |   |                            |
| NB 12 L 2 0683           | 68,000            | L2               | 3805 $\pm$ 3%   | - 4.1                      |
| NB 12 N 5 0683           | 68,000            | N5               | 4160 $\pm$ 3%   | - 4.7                      |
| NB 12 N 5 0823           | 82,000            |                  |   |                            |
| NB 12 P 0 0104           | 100,000           | P                | 4220 $\pm$ 3%   | - 4.7                      |
| NB 12 SC 0104            | 100,000           | SC               | 4500 $\pm$ 3%   | - 4.8                      |
| NB 12 P 0 0124           | 120,000           | P                | 4220 $\pm$ 3%   | - 4.7                      |
| NB 12 P 0 0154           | 150,000           |                  |   |                            |
| NB 12 P 0 0184           | 180,000           |                  |   |                            |
| NB 12 Q 0 0224           | 220,000           | Q                | 4300 $\pm$ 3%   | - 4.7                      |
| NB 12 Q 0 0274           | 270,000           |                  |   |                            |
| NB 12 R 0 0105           | 1,000,000         | R                | 4400 $\pm$ 3%   | - 4.8                      |

| NB 20<br>IEC SIZE : 1206 |                   |                  |   |                            |
|--------------------------|-------------------|------------------|---|----------------------------|
| Types                    | Rn at 25°C<br>(Ω) | Material<br>Code | B (K)<br>( $\Delta B/B$ (1) $\pm$ 5%<br>(2) $\pm$ 3%) | $\alpha$ at 25°C<br>(%/°C) |
| NB 20 MC 0 221           | 220               | MC               | 3910 $\pm$ 3%   | - 4.4                      |
| NB 20 MC 0 102           | 1,000             |                  |   |                            |
| NB 20 J 0 0472           | 4,700             | J                | 3480 $\pm$ 3%   | - 3.9                      |
| NB 20 J 0 0562           | 5,600             |                  |   |                            |
| NB 20 J 0 0682           | 6,800             |                  |   |                            |
| NB 20 J 5 0822           | 8,200             | J5               | 3480 $\pm$ 3%   | - 3.9                      |
| NB 20 K 0 0103           | 10,000            | K                | 3630 $\pm$ 3%   | - 4.0                      |
| NB 20 K 0 0123           | 12,000            |                  |   |                            |
| NB 20 L 0 0153           | 15,000            | L                | 3790 $\pm$ 3%   | - 4.2                      |
| NB 20 L 0 0183           | 18,000            |                  |   |                            |
| NB 20 L 0 0223           | 22,000            |                  |   |                            |
| NB 20 M 0 0273           | 27,000            | M                | 3950 $\pm$ 3%   | - 4.4                      |
| NB 20 M 0 0333           | 33,000            |                  |   |                            |
| NB 20 M 0 0393           | 39,000            |                  |   |                            |
| NB 20 M 0 0473           | 47,000            |                  |   |                            |
| NB 20 N 0 0563           | 56,000            | N                | 4080 $\pm$ 3%   | - 4.6                      |
| NB 20 N 0 0683           | 68,000            |                  |   |                            |
| NB 20 N 0 0823           | 82,000            |                  |   |                            |
| NB 20 N 5 0104           | 100,000           | N5               | 4160 $\pm$ 3%   | - 4.7                      |
| NB 20 P 0 0124           | 120,000           | P                | 4220 $\pm$ 3%   | - 4.7                      |
| NB 20 P 0 0154           | 150,000           |                  |   |                            |
| NB 20 P 0 0184           | 180,000           |                  |   |                            |
| NB 20 P 0 0224           | 220,000           |                  |   |                            |
| NB 20 Q 0 0274           | 270,000           | Q                | 4300 $\pm$ 3%   | - 4.7                      |
| NB 20 Q 0 0334           | 330,000           |                  |   |                            |
| NB 20 Q 0 0394           | 390,000           |                  |   |                            |
| NB 20 Q 0 0474           | 470,000           |                  |   |                            |
| NB 20 Q 0 0564           | 560,000           |                  |   |                            |
| NB 20 R 0 0684           | 680,000           | R                | 4400 $\pm$ 3%   | - 4.8                      |
| NB 20 R 0 0824           | 820,000           |                  |   |                            |
| NB 20 R 0 0105           | 1,000,000         |                  |   |                            |

# Packaging for Automatic Insertion

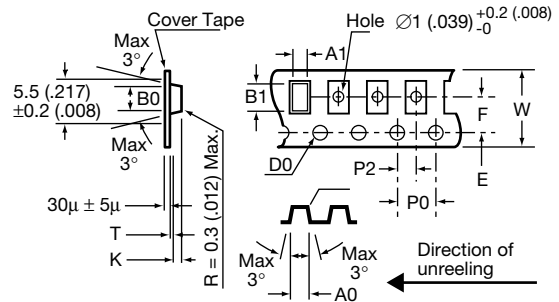
## NTC Chip Thermistors / NC/NB Series



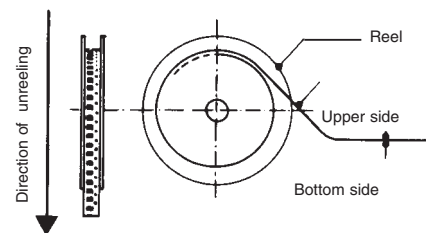
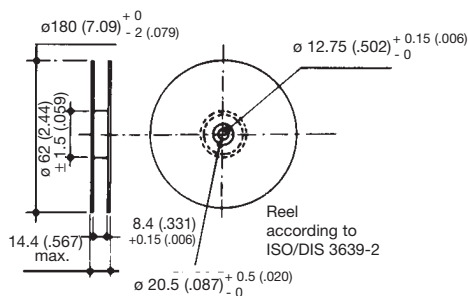
### AUTOMATIC INSERTION

#### Super 8 Plastic Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



| Designation                           | Symbol | Value     | Tolerance                                       |
|---------------------------------------|--------|-----------|---|
| Tape width                            | W      | 8         | ±0.2  |
| Tape thickness                        | T      | 0.4 max.  |   |
| Pitch of the sprocket holes           | P0     | 4         | ±0.1  |
| Diameter of the sprocket holes        | D0     | 1.5<br>-0 | ±0.1  |
| Distance                              | E      | 1.75      | ±0.1  |
| Distance (center to center)           | F      | 3.5       | ±0.05   |
| Distance (center to center)           | P2     | 2         | ±0.1  |
| Sizes of the cavities<br>NC 12 (0805) | A0     | 1.5       | ±0.1  |
|                                       | B0     | 2.4       | ±0.1  |
|                                       | K      | 1.4 max.  | K ±0.1<br>(size is adjustable)<br>(K = t1 +0.2) |
| NC 20 (1206)                          | A0     | 1.95      | ±0.1  |
|                                       | B0     | 3.55      | ±0.1  |
|                                       | K      | 1.5 max.  | K ±0.1<br>(size is adjustable)<br>(K = t1 +0.2) |



### QUANTITY PER REEL

| Type | Suffix | Description                     | Qty Per Reel |
|------|--------|---------------------------------|--------------|
| NB20 | BA     | Plastic tape (180mm diam. reel) | 3,000 pcs    |
|      | BE     | Plastic tape (1/2 reel)         | 1,500 pcs    |
| NC20 | BC     | Plastic tape (330mm diam. reel) | 10,000 pcs   |

# Packaging for Automatic Insertion

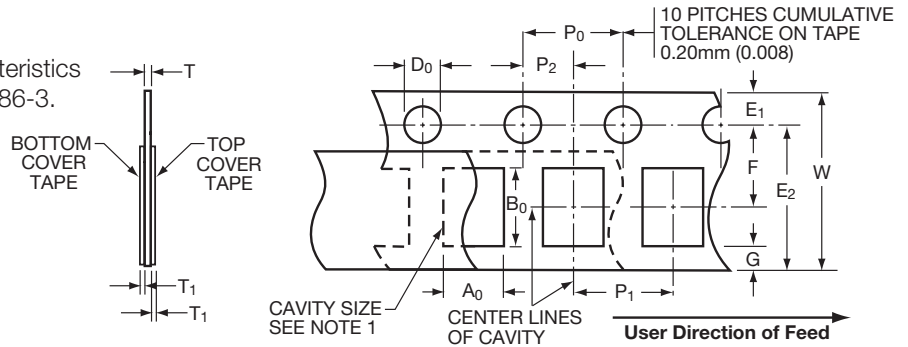
## NTC Chip Thermistors / NC/NB Series



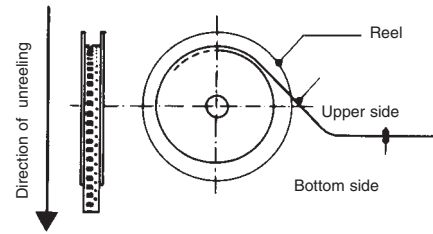
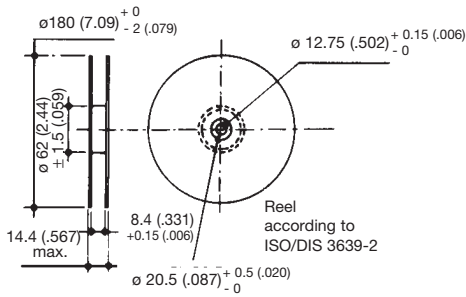
### AUTOMATIC INSERTION

#### 8mm Paper Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



| Designation                    | Symbol | Value     | Tolerance    |
|--------------------------------|--------|-----------|--------------|
| Tape width                     | W      | 8         | $-.0.1/+0.3$ |
| Tape thickness                 | T      | 1.1 max.  |              |
| Pitch of the sprocket holes    | $P_0$  | 4         | $\pm 0.1$    |
| Diameter of the sprocket holes | $D_0$  | $-0/+0.1$ | $\pm 0.1$    |
| Distance                       | $E_1$  | 1.75      | $\pm 0.1$    |
| Distance (center to center)    | F      | 3.5       | $\pm 0.05$   |
| Distance (center to center)    | $P_2$  | 2         | $\pm 0.05$   |
| Cover tape thickness           | $T_1$  | 0.10 max. |              |
| Distance                       | $E_2$  | 6.25 min. |              |
| Distance                       | G      | 0.75 min. |              |
| Component pitch                | $P_1$  | 0805/0603 | $\pm 0.1$    |
|                                |        | 0402      | $\pm 0.1$    |



### QUANTITY PER REEL

| Type | Suffix | Description                       | Qty Per Reel |
|------|--------|-----------------------------------|--------------|
| NB12 | BB     | Cardboard tape (180mm diam. reel) | 4,000 pcs    |
| NC12 | BF     | Cardboard tape (1/2 reel)         | 2,000 pcs    |
| NB21 | BD     | Cardboard tape (330mm diam. reel) | 10,000 pcs   |



# Surface Mounting Guide

## Chip Thermistor – Application Notes



### STORAGE

Good solderability is maintained for at least twelve months, provided the components are stored in their “as received” packaging at less than 40°C and 70% RH.

### SOLDERABILITY / LEACHING

Terminations to be well soldered after immersion in a 60/40 tin/lead solder bath at  $235 \pm 5^\circ\text{C}$  for  $2 \pm 1$  seconds.

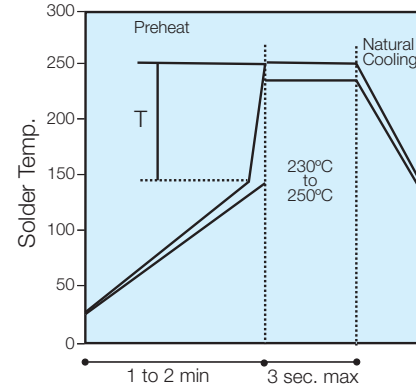
Terminations will resist leaching for at least the immersion times and conditions recommendations shown below.

| P/N | Termination Type | Solder Tin/Lead | Solder Temp °C | Immersion Time Seconds |
|-----|------------------|-----------------|----------------|------------------------|
| NC  | AgPdPt           | 60/40           | $260 \pm 5$    | 15 max                 |
| NB  | Nickel Barrier   | 60/40           | $260 \pm 5$    | $30 \pm 1$             |

NB products are compatible with a wide range of soldering conditions consistent with good manufacturing practice for surface mount components. This includes Pb free reflow processes with peak temperatures up to  $270^\circ\text{C}$ . Recommended profiles for reflow and wave soldering are shown below for reference.

NC products are recommended for lead soldering application or gluing techniques.

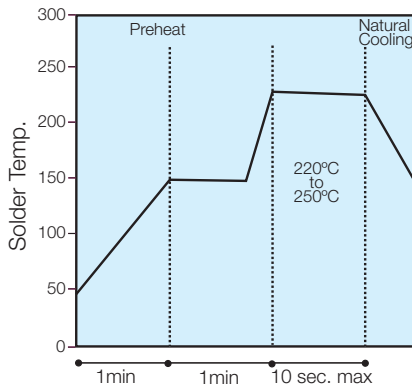
### Wave



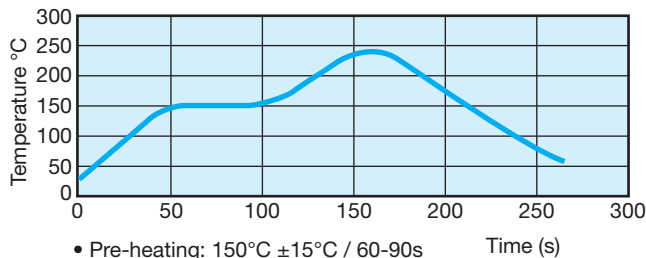
(Preheat chips before soldering)  
T/maximum  $150^\circ\text{C}$

- The visual standards used for evaluation of solder joints will need to be modified as lead free joints are not as bright as with tin-lead pastes and the fillet may not be as large.
- Resin color may darken slightly due to the increase in temperature required for the new pastes.
- Lead-free solder pastes do not allow the same self alignment as lead containing systems. Standard mounting pads are acceptable, but machine set up may need to be modified.

### Reflow



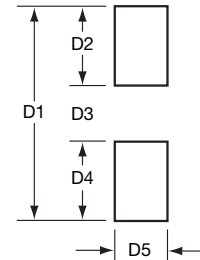
(Minimize soldering time)



- Pre-heating:  $150^\circ\text{C} \pm 15^\circ\text{C} / 60-90\text{s}$
- Max. Peak Gradient:  $2.5^\circ\text{C/s}$
- Peak Temperature:  $245^\circ\text{C} \pm 5^\circ\text{C}$
- Time at  $>230^\circ\text{C}$ : 40s Max.

### RECOMMENDED SOLDERING PAD LAYOUT

Dimensions in mm (inches)



### REFLOW SOLDERING

| Case Size | P/N  | D1             | D2             | D3             | D4             | D5             |
|-----------|------|----------------|----------------|----------------|----------------|----------------|
| 0402      | NB23 | 1.70<br>(.067) | 0.60<br>(.024) | 0.50<br>(.020) | 0.60<br>(.024) | 0.50<br>(.020) |
| 0603      | NB21 | 2.30<br>(.091) | 0.80<br>(.031) | 0.70<br>(.028) | 0.80<br>(.031) | 0.75<br>(.030) |
| 0805      | NB12 | 3.00<br>(.118) | 1.00<br>(.039) | 1.00<br>(.039) | 1.00<br>(.039) | 1.25<br>(.049) |
| 1206      | NB20 | 4.00<br>(.157) | 1.00<br>(.039) | 2.00<br>(.079) | 1.00<br>(.039) | 2.50<br>(.098) |

### WAVE SOLDERING

| Case Size | P/N  | D1             | D2             | D3             | D4             | D5             |
|-----------|------|----------------|----------------|----------------|----------------|----------------|
| 0603      | NB21 | 3.10<br>(.122) | 1.20<br>(.047) | 0.70<br>(.028) | 1.20<br>(.047) | 0.75<br>(.030) |
| 0805      | NB12 | 4.00<br>(.157) | 1.50<br>(.059) | 1.00<br>(.039) | 1.50<br>(.059) | 1.25<br>(.049) |
| 1206      | NB20 | 5.00<br>(.197) | 1.50<br>(.059) | 2.00<br>(.079) | 1.50<br>(.059) | 1.60<br>(.063) |

# Tables of Resistance vs Temperature

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | I 3250        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 42.35         | 21.9   | -5.98    |
| -50       | 31.48         | 20.0   | -5.78    |
| -45       | 23.63         | 18.1   | -5.59    |
| -40       | 17.91         | 16.3   | -5.41    |
| -35       | 13.70         | 14.6   | -5.23    |
| -30       | 10.58         | 13.1   | -5.06    |
| -25       | 8.232         | 11.6   | -4.90    |
| -20       | 6.460         | 10.1   | -4.74    |
| -15       | 5.110         | 8.8    | -4.59    |
| -10       | 4.072         | 7.5    | -4.45    |
| -5        | 3.268         | 6.3    | -4.31    |
| 0         | 2.641         | 5.1    | -4.18    |
| 5         | 2.148         | 4.0    | -4.05    |
| 10        | 1.759         | 2.9    | -3.92    |
| 15        | 1.449         | 1.9    | -3.81    |
| 20        | 1.200         | 0.9    | -3.69    |
| 25        | 1.000         | 0.0    | -3.58    |
| 30        | 0.8377        | 0.9    | -3.48    |
| 35        | 0.7054        | 1.8    | -3.38    |
| 40        | 0.5969        | 2.6    | -3.28    |
| 45        | 0.5076        | 3.5    | -3.19    |
| 50        | 0.4336        | 4.3    | -3.10    |
| 55        | 0.3720        | 5.1    | -3.01    |
| 60        | 0.3206        | 5.9    | -2.93    |
| 65        | 0.2774        | 6.6    | -2.85    |
| 70        | 0.2410        | 7.4    | -2.77    |
| 75        | 0.2102        | 8.1    | -2.70    |
| 80        | 0.1839        | 8.8    | -2.63    |
| 85        | 0.1616        | 9.5    | -2.56    |
| 90        | 0.1424        | 10.2   | -2.49    |
| 95        | 0.1259        | 10.9   | -2.43    |
| 100       | 0.1117        | 11.5   | -2.36    |
| 105       | 0.09938       | 12.2   | -2.30    |
| 110       | 0.08869       | 12.8   | -2.25    |
| 115       | 0.07938       | 13.4   | -2.19    |
| 120       | 0.07124       | 14.0   | -2.14    |
| 125       | 0.06410       | 14.6   | -2.08    |
| 130       | 0.05783       | 15.2   | -2.03    |
| 135       | 0.05230       | 15.7   | -1.98    |
| 140       | 0.04741       | 16.3   | -1.94    |
| 145       | 0.04308       | 16.8   | -1.89    |
| 150       | 0.03924       | 17.4   | -1.85    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | J-5 3480      |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 51.75         | 20.5   | -6.23    |
| -50       | 37.98         | 17.7   | -6.03    |
| -45       | 28.15         | 15.2   | -5.84    |
| -40       | 21.07         | 13.0   | -5.65    |
| -35       | 15.91         | 11.0   | -5.48    |
| -30       | 12.13         | 9.3    | -5.31    |
| -25       | 9.321         | 7.8    | -5.15    |
| -20       | 7.222         | 6.4    | -4.99    |
| -15       | 5.640         | 5.2    | -4.84    |
| -10       | 4.438         | 4.2    | -4.69    |
| -5        | 3.517         | 3.3    | -4.55    |
| 0         | 2.807         | 2.5    | -4.42    |
| 5         | 2.255         | 1.8    | -4.29    |
| 10        | 1.824         | 1.2    | -4.17    |
| 15        | 1.484         | 0.7    | -4.05    |
| 20        | 1.215         | 0.3    | -3.93    |
| 25        | 1.0000        | 0.0    | -3.82    |
| 30        | 0.8278        | 0.3    | -3.71    |
| 35        | 0.6889        | 0.7    | -3.61    |
| 40        | 0.5763        | 1.1    | -3.51    |
| 45        | 0.4845        | 1.5    | -3.41    |
| 50        | 0.4092        | 2.0    | -3.32    |
| 55        | 0.3472        | 2.5    | -3.23    |
| 60        | 0.2960        | 3.0    | -3.15    |
| 65        | 0.2533        | 3.5    | -3.06    |
| 70        | 0.2177        | 4.1    | -2.98    |
| 75        | 0.1879        | 4.7    | -2.90    |
| 80        | 0.1628        | 5.3    | -2.83    |
| 85        | 0.1415        | 5.9    | -2.76    |
| 90        | 0.12349       | 6.5    | -2.69    |
| 95        | 0.10813       | 7.1    | -2.62    |
| 100       | 0.09499       | 7.7    | -2.55    |
| 105       | 0.08372       | 8.4    | -2.49    |
| 110       | 0.07402       | 9.0    | -2.43    |
| 115       | 0.06564       | 9.7    | -2.37    |
| 120       | 0.05837       | 10.3   | -2.31    |
| 125       | 0.05206       | 11.0   | -2.26    |
| 130       | 0.04656       | 11.6   | -2.21    |
| 135       | 0.04175       | 12.3   | -2.15    |
| 140       | 0.03753       | 13.0   | -2.10    |
| 145       | 0.03382       | 13.6   | -2.06    |
| 150       | 0.03055       | 14.3   | -2.01    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | K 3630        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 56.27         | 21.4   | -6.25    |
| -50       | 41.22         | 18.5   | -6.06    |
| -45       | 30.48         | 15.9   | -5.89    |
| -40       | 22.74         | 13.6   | -5.71    |
| -35       | 17.11         | 11.5   | -5.55    |
| -30       | 12.98         | 9.7    | -5.39    |
| -25       | 9.931         | 8.1    | -5.24    |
| -20       | 7.655         | 6.7    | -5.09    |
| -15       | 5.945         | 5.4    | -4.95    |
| -10       | 4.651         | 4.4    | -4.81    |
| -5        | 3.663         | 3.4    | -4.67    |
| 0         | 2.905         | 2.6    | -4.54    |
| 5         | 2.319         | 1.9    | -4.42    |
| 10        | 1.862         | 1.3    | -4.30    |
| 15        | 1.505         | 0.8    | -4.18    |
| 20        | 1.223         | 0.3    | -4.07    |
| 25        | 1.0000        | 0.0    | -3.96    |
| 30        | 0.8219        | 0.3    | -3.85    |
| 35        | 0.6792        | 0.7    | -3.75    |
| 40        | 0.5641        | 1.1    | -3.65    |
| 45        | 0.4708        | 1.6    | -3.55    |
| 50        | 0.3949        | 2.1    | -3.46    |
| 55        | 0.3327        | 2.6    | -3.37    |
| 60        | 0.2816        | 3.1    | -3.28    |
| 65        | 0.2393        | 3.7    | -3.20    |
| 70        | 0.2043        | 4.3    | -3.12    |
| 75        | 0.1751        | 4.9    | -3.04    |
| 80        | 0.1506        | 5.5    | -2.96    |
| 85        | 0.1301        | 6.1    | -2.89    |
| 90        | 0.1128        | 6.8    | -2.82    |
| 95        | 0.09811       | 7.4    | -2.75    |
| 100       | 0.08564       | 8.1    | -2.68    |
| 105       | 0.07501       | 8.7    | -2.61    |
| 110       | 0.06591       | 9.4    | -2.55    |
| 115       | 0.05809       | 10.1   | -2.49    |
| 120       | 0.05136       | 10.8   | -2.43    |
| 125       | 0.04554       | 11.5   | -2.37    |
| 130       | 0.04049       | 12.2   | -2.32    |
| 135       | 0.03611       | 12.8   | -2.26    |
| 140       | 0.03228       | 13.5   | -2.21    |
| 145       | 0.02893       | 14.2   | -2.16    |
| 150       | 0.02600       | 14.9   | -2.11    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | KA 3625       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 61.22         | 7.1    | -6.55    |
| -50       | 44.25         | 6.1    | -6.33    |
| -45       | 32.34         | 5.3    | -6.12    |
| -40       | 23.88         | 4.5    | -5.92    |
| -35       | 17.81         | 3.8    | -5.73    |
| -30       | 13.41         | 3.2    | -5.54    |
| -25       | 10.19         | 2.7    | -5.37    |
| -20       | 7.815         | 2.2    | -5.20    |
| -15       | 6.041         | 1.8    | -5.04    |
| -10       | 4.707         | 1.5    | -4.89    |
| -5        | 3.696         | 1.1    | -4.74    |
| 0         | 2.923         | 0.9    | -4.60    |
| 5         | 2.329         | 0.6    | -4.46    |
| 10        | 1.867         | 0.4    | -4.33    |
| 15        | 1.507         | 0.3    | -4.21    |
| 20        | 1.224         | 0.1    | -4.09    |
| 25        | 1.0000        | 0.0    | -3.97    |
| 30        | 0.8217        | 0.1    | -3.86    |
| 35        | 0.6788        | 0.2    | -3.75    |
| 40        | 0.5638        | 0.4    | -3.65    |
| 45        | 0.4707        | 0.5    | -3.55    |
| 50        | 0.3948        | 0.7    | -3.46    |
| 55        | 0.3328        | 0.9    | -3.37    |
| 60        | 0.2817        | 1.0    | -3.28    |
| 65        | 0.2396        | 1.2    | -3.19    |
| 70        | 0.2046        | 1.4    | -3.11    |
| 75        | 0.1754        | 1.6    | -3.03    |
| 80        | 0.1510        | 1.8    | -2.96    |
| 85        | 0.1305        | 2.0    | -2.88    |
| 90        | 0.1131        | 2.3    | -2.81    |
| 95        | 0.09844       | 2.5    | -2.74    |
| 100       | 0.08596       | 2.7    | -2.68    |
| 105       | 0.07530       | 2.9    | -2.61    |
| 110       | 0.06618       | 3.1    | -2.55    |
| 115       | 0.05833       | 3.4    | -2.49    |
| 120       | 0.05157       | 3.6    | -2.43    |
| 125       | 0.04573       | 3.8    | -2.38    |
| 130       | 0.04065       | 4.0    | -2.32    |
| 135       | 0.03624       | 4.3    | -2.27    |
| 140       | 0.03239       | 4.5    | -2.22    |
| 145       | 0.02902       | 4.7    | -2.17    |
| 150       | 0.02607       | 5.0    | -2.12    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | KC 3470       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 60.08         | 34.0   | -7.00    |
| -50       | 43.19         | 29.4   | -6.71    |
| -45       | 31.42         | 25.3   | -6.44    |
| -40       | 23.13         | 21.6   | -6.18    |
| -35       | 17.22         | 18.4   | -5.94    |
| -30       | 12.95         | 15.5   | -5.71    |
| -25       | 9.842         | 12.9   | -5.49    |
| -20       | 7.550         | 10.7   | -5.29    |
| -15       | 5.845         | 8.7    | -5.10    |
| -10       | 4.564         | 6.9    | -4.91    |
| -5        | 3.594         | 5.4    | -4.74    |
| 0         | 2.853         | 4.1    | -4.58    |
| 5         | 2.281         | 3.0    | -4.42    |
| 10        | 1.838         | 2.0    | -4.27    |
| 15        | 1.491         | 1.2    | -4.13    |
| 20        | 1.217         | 0.5    | -4.00    |
| 25        | 1.0000        | 0.0    | -3.90    |
| 30        | 0.8267        | 0.5    | -3.74    |
| 35        | 0.6873        | 1.1    | -3.63    |
| 40        | 0.5747        | 1.8    | -3.52    |
| 45        | 0.4830        | 2.5    | -3.41    |
| 50        | 0.4081        | 3.3    | -3.31    |
| 55        | 0.3465        | 4.1    | -3.21    |
| 60        | 0.2955        | 5.0    | -3.12    |
| 65        | 0.2532        | 5.9    | -3.03    |
| 70        | 0.2179        | 6.8    | -2.94    |
| 75        | 0.1883        | 7.8    | -2.86    |
| 80        | 0.1634        | 8.7    | -2.78    |
| 85        | 0.1423        | 9.7    | -2.71    |
| 90        | 0.1244        | 10.8   | -2.63    |
| 95        | 0.10915       | 11.8   | -2.56    |
| 100       | 0.09608       | 12.9   | -2.50    |
| 105       | 0.08486       | 13.9   | -2.43    |
| 110       | 0.07519       | 15.0   | -2.37    |
| 115       | 0.06683       | 16.1   | -2.31    |
| 120       | 0.05957       | 17.2   | -2.25    |
| 125       | 0.05325       | 18.3   | -2.20    |
| 130       | 0.04774       | 19.4   | -2.14    |
| 135       | 0.04290       | 20.5   | -2.09    |
| 140       | 0.03866       | 21.6   | -2.04    |
| 145       | 0.03492       | 22.7   | -1.99    |
| 150       | 0.03162       | 23.8   | -1.95    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | L 3790        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 82.54         | 22.3   | -7.12    |
| -50       | 58.03         | 19.3   | -6.87    |
| -45       | 41.31         | 16.6   | -6.63    |
| -40       | 29.75         | 14.2   | -6.40    |
| -35       | 21.68         | 12.0   | -6.18    |
| -30       | 15.97         | 10.1   | -5.98    |
| -25       | 11.88         | 8.5    | -5.78    |
| -20       | 8.931         | 7.0    | -5.59    |
| -15       | 6.777         | 5.7    | -5.40    |
| -10       | 5.188         | 4.5    | -5.23    |
| -5        | 4.007         | 3.6    | -5.06    |
| 0         | 3.120         | 2.7    | -4.90    |
| 5         | 2.449         | 2.0    | -4.75    |
| 10        | 1.937         | 1.3    | -4.60    |
| 15        | 1.543         | 0.8    | -4.46    |
| 20        | 1.238         | 0.4    | -4.33    |
| 25        | 1.0000        | 0.0    | -4.20    |
| 30        | 0.8128        | 0.3    | -4.07    |
| 35        | 0.6648        | 0.7    | -3.95    |
| 40        | 0.5469        | 1.2    | -3.84    |
| 45        | 0.4525        | 1.6    | -3.73    |
| 50        | 0.3764        | 2.2    | -3.62    |
| 55        | 0.3148        | 2.7    | -3.52    |
| 60        | 0.2646        | 3.3    | -3.42    |
| 65        | 0.2235        | 3.8    | -3.33    |
| 70        | 0.1896        | 4.5    | -3.24    |
| 75        | 0.1616        | 5.1    | -3.15    |
| 80        | 0.1383        | 5.7    | -3.07    |
| 85        | 0.1189        | 6.4    | -2.98    |
| 90        | 0.1026        | 7.1    | -2.91    |
| 95        | 0.08888       | 7.7    | -2.83    |
| 100       | 0.07728       | 8.4    | -2.76    |
| 105       | 0.06744       | 9.1    | -2.69    |
| 110       | 0.05905       | 9.8    | -2.62    |
| 115       | 0.05188       | 10.5   | -2.56    |
| 120       | 0.04572       | 11.3   | -2.49    |
| 125       | 0.04042       | 12.0   | -2.43    |
| 130       | 0.03585       | 12.7   | -2.37    |
| 135       | 0.03188       | 13.4   | -2.32    |
| 140       | 0.02843       | 14.1   | -2.26    |
| 145       | 0.02542       | 14.8   | -2.21    |
| 150       | 0.02279       | 15.6   | -2.16    |

# Tables of Resistance vs Temperature



| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | L2 3805       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 62.45         | 22.4   | -6.41    |
| -50       | 45.40         | 19.3   | -6.22    |
| -45       | 33.33         | 16.6   | -6.03    |
| -40       | 24.70         | 14.2   | -5.85    |
| -35       | 18.47         | 12.1   | -5.68    |
| -30       | 13.92         | 10.2   | -5.52    |
| -25       | 10.58         | 8.5    | -5.36    |
| -20       | 8.110         | 7.0    | -5.21    |
| -15       | 6.260         | 5.7    | -5.07    |
| -10       | 4.867         | 4.6    | -4.93    |
| -5        | 3.810         | 3.6    | -4.80    |
| 0         | 3.003         | 2.7    | -4.67    |
| 5         | 2.382         | 2.0    | -4.55    |
| 10        | 1.901         | 1.3    | -4.43    |
| 15        | 1.526         | 0.8    | -4.31    |
| 20        | 1.232         | 0.4    | -4.20    |
| 25        | 1.0000        | 0.0    | -4.10    |
| 30        | 0.8161        | 0.3    | -4.00    |
| 35        | 0.6694        | 0.7    | -3.90    |
| 40        | 0.5518        | 1.2    | -3.80    |
| 45        | 0.4570        | 1.7    | -3.71    |
| 50        | 0.3802        | 2.2    | -3.62    |
| 55        | 0.3178        | 2.7    | -3.53    |
| 60        | 0.2667        | 3.3    | -3.45    |
| 65        | 0.2248        | 3.9    | -3.37    |
| 70        | 0.1902        | 4.5    | -3.29    |
| 75        | 0.1615        | 5.1    | -3.22    |
| 80        | 0.1377        | 5.8    | -3.14    |
| 85        | 0.1179        | 6.4    | -3.07    |
| 90        | 0.1012        | 7.1    | -3.00    |
| 95        | 0.08721       | 7.8    | -2.94    |
| 100       | 0.07539       | 8.5    | -2.87    |
| 105       | 0.06538       | 9.2    | -2.81    |
| 110       | 0.05688       | 9.9    | -2.75    |
| 115       | 0.04963       | 10.6   | -2.69    |
| 120       | 0.04343       | 11.3   | -2.63    |
| 125       | 0.03812       | 12.0   | -2.58    |
| 130       | 0.03354       | 12.7   | -2.53    |
| 135       | 0.02960       | 13.5   | -2.47    |
| 140       | 0.02618       | 14.2   | -2.42    |
| 145       | 0.02322       | 14.9   | -2.37    |
| 150       | 0.02064       | 15.6   | -2.33    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | M 3950        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 99.59         | 23.2   | -7.42    |
| -50       | 68.97         | 20.1   | -7.16    |
| -45       | 48.40         | 17.3   | -6.91    |
| -40       | 34.38         | 14.8   | -6.67    |
| -35       | 24.71         | 12.5   | -6.45    |
| -30       | 17.97         | 10.6   | -6.23    |
| -25       | 13.20         | 8.8    | -6.02    |
| -20       | 9.804         | 7.3    | -5.82    |
| -15       | 7.352         | 5.9    | -5.63    |
| -10       | 5.565         | 4.7    | -5.45    |
| -5        | 4.251         | 3.7    | -5.28    |
| 0         | 3.275         | 2.8    | -5.11    |
| 5         | 2.544         | 2.0    | -4.95    |
| 10        | 1.992         | 1.4    | -4.80    |
| 15        | 1.572         | 0.8    | -4.65    |
| 20        | 1.249         | 0.4    | -4.51    |
| 25        | 1.0000        | 0.0    | -4.38    |
| 30        | 0.8057        | 0.4    | -4.25    |
| 35        | 0.6534        | 0.8    | -4.12    |
| 40        | 0.5331        | 1.2    | -4.00    |
| 45        | 0.4376        | 1.7    | -3.89    |
| 50        | 0.3612        | 2.2    | -3.77    |
| 55        | 0.2998        | 2.8    | -3.67    |
| 60        | 0.2501        | 3.4    | -3.57    |
| 65        | 0.2097        | 4.0    | -3.47    |
| 70        | 0.1767        | 4.6    | -3.37    |
| 75        | 0.1496        | 5.3    | -3.28    |
| 80        | 0.1272        | 6.0    | -3.19    |
| 85        | 0.1087        | 6.7    | -3.11    |
| 90        | 0.09320       | 7.4    | -3.03    |
| 95        | 0.08025       | 8.1    | -2.95    |
| 100       | 0.06937       | 8.8    | -2.87    |
| 105       | 0.06019       | 9.5    | -2.80    |
| 110       | 0.05242       | 10.2   | -2.73    |
| 115       | 0.04580       | 11.0   | -2.66    |
| 120       | 0.04016       | 11.7   | -2.60    |
| 125       | 0.03532       | 12.5   | -2.53    |
| 130       | 0.03117       | 13.2   | -2.47    |
| 135       | 0.02758       | 14.0   | -2.41    |
| 140       | 0.02448       | 14.7   | -2.36    |
| 145       | 0.02179       | 15.5   | -2.30    |
| 150       | 0.01945       | 16.2   | -2.25    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | MA 3965       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 101.1         | 3.9    | -7.49    |
| -50       | 69.81         | 3.4    | -7.22    |
| -45       | 48.87         | 2.9    | -6.96    |
| -40       | 34.65         | 2.5    | -6.71    |
| -35       | 24.87         | 2.1    | -6.48    |
| -30       | 18.06         | 1.8    | -6.26    |
| -25       | 13.26         | 1.5    | -6.05    |
| -20       | 9.837         | 1.2    | -5.84    |
| -15       | 7.372         | 1.0    | -5.65    |
| -10       | 5.578         | 0.8    | -5.47    |
| -5        | 4.259         | 0.6    | -5.29    |
| 0         | 3.280         | 0.5    | -5.12    |
| 5         | 2.548         | 0.3    | -4.96    |
| 10        | 1.994         | 0.2    | -4.81    |
| 15        | 1.573         | 0.1    | -4.66    |
| 20        | 1.250         | 0.1    | -4.52    |
| 25        | 1.0000        | 0.0    | -4.38    |
| 30        | 0.8054        | 0.1    | -4.25    |
| 35        | 0.6528        | 0.1    | -4.13    |
| 40        | 0.5324        | 0.2    | -4.01    |
| 45        | 0.4368        | 0.3    | -3.90    |
| 50        | 0.3603        | 0.4    | -3.79    |
| 55        | 0.2989        | 0.5    | -3.68    |
| 60        | 0.2492        | 0.6    | -3.58    |
| 65        | 0.2088        | 0.7    | -3.48    |
| 70        | 0.1758        | 0.8    | -3.39    |
| 75        | 0.1487        | 0.9    | -3.30    |
| 80        | 0.1263        | 1.0    | -3.21    |
| 85        | 0.1078        | 1.1    | -3.13    |
| 90        | 0.09233       | 1.2    | -3.05    |
| 95        | 0.07941       | 1.3    | -2.97    |
| 100       | 0.06857       | 1.5    | -2.90    |
| 105       | 0.05942       | 1.6    | -2.83    |
| 110       | 0.05167       | 1.7    | -2.76    |
| 115       | 0.04509       | 1.8    | -2.69    |
| 120       | 0.03948       | 2.0    | -2.62    |
| 125       | 0.03467       | 2.1    | -2.56    |
| 130       | 0.03055       | 2.2    | -2.50    |
| 135       | 0.02699       | 2.3    | -2.44    |
| 140       | 0.02392       | 2.5    | -2.39    |
| 145       | 0.02125       | 2.6    | -2.33    |
| 150       | 0.01894       | 2.7    | -2.28    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | MC 3910       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 100.6         | 23.0   | -7.56    |
| -50       | 69.29         | 19.9   | -7.27    |
| -45       | 48.40         | 17.1   | -7.00    |
| -40       | 34.27         | 14.6   | -6.75    |
| -35       | 24.57         | 12.4   | -6.50    |
| -30       | 17.83         | 10.5   | -6.27    |
| -25       | 13.09         | 8.7    | -6.05    |
| -20       | 9.71          | 7.2    | -5.84    |
| -15       | 7.282         | 5.9    | -5.64    |
| -10       | 5.514         | 4.7    | -5.45    |
| -5        | 4.215         | 3.7    | -5.27    |
| 0         | 3.250         | 2.8    | -5.10    |
| 5         | 2.528         | 2.0    | -4.93    |
| 10        | 1.982         | 1.4    | -4.77    |
| 15        | 1.567         | 0.8    | -4.62    |
| 20        | 1.247         | 0.4    | -4.48    |
| 25        | 1.0000        | 0.0    | -4.34    |
| 30        | 0.8072        | 0.4    | -4.21    |
| 35        | 0.6559        | 0.8    | -4.08    |
| 40        | 0.5362        | 1.2    | -3.96    |
| 45        | 0.4410        | 1.7    | -3.85    |
| 50        | 0.3647        | 2.2    | -3.74    |
| 55        | 0.3033        | 2.8    | -3.63    |
| 60        | 0.2535        | 3.4    | -3.53    |
| 65        | 0.2130        | 4.0    | -3.43    |
| 70        | 0.1798        | 4.6    | -3.34    |
| 75        | 0.1525        | 5.2    | -3.25    |
| 80        | 0.1300        | 5.9    | -3.16    |
| 85        | 0.1112        | 6.6    | -3.08    |
| 90        | 0.09552       | 7.3    | -2.99    |
| 95        | 0.08239       | 8.0    | -2.92    |
| 100       | 0.07133       | 8.7    | -2.84    |
| 105       | 0.06199       | 9.4    | -2.77    |
| 110       | 0.05406       | 10.1   | -2.70    |
| 115       | 0.04731       | 10.9   | -2.63    |
| 120       | 0.04153       | 11.6   | -2.57    |
| 125       | 0.03658       | 12.3   | -2.51    |
| 130       | 0.03231       | 13.1   | -2.45    |
| 135       | 0.02863       | 13.8   | -2.39    |
| 140       | 0.02544       | 14.6   | -2.33    |
| 145       | 0.02267       | 15.3   | -2.28    |
| 150       | 0.02025       | 16.1   | -2.23    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | N 4080        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 110.1         | 24.0   | -7.50    |
| -50       | 75.89         | 20.7   | -7.25    |
| -45       | 52.97         | 17.8   | -7.01    |
| -40       | 37.42         | 15.2   | -6.78    |
| -35       | 26.75         | 12.9   | -6.56    |
| -30       | 19.33         | 10.9   | -6.35    |
| -25       | 14.11         | 9.1    | -6.14    |
| -20       | 10.41         | 7.5    | -5.95    |
| -15       | 7.758         | 6.1    | -5.76    |
| -10       | 5.834         | 4.9    | -5.58    |
| -5        | 4.426         | 3.8    | -5.41    |
| 0         | 3.387         | 2.9    | -5.24    |
| 5         | 2.614         | 2.1    | -5.08    |
| 10        | 2.033         | 1.4    | -4.93    |
| 15        | 1.593         | 0.9    | -4.78    |
| 20        | 1.258         | 0.4    | -4.64    |
| 25        | 1.0000        | 0.0    | -4.51    |
| 30        | 0.8004        | 0.4    | -4.37    |
| 35        | 0.6449        | 0.8    | -4.25    |
| 40        | 0.5228        | 1.3    | -4.13    |
| 45        | 0.4264        | 1.8    | -4.01    |
| 50        | 0.3497        | 2.3    | -3.90    |
| 55        | 0.2885        | 2.9    | -3.79    |
| 60        | 0.2392        | 3.5    | -3.68    |
| 65        | 0.1994        | 4.1    | -3.58    |
| 70        | 0.1671        | 4.8    | -3.49    |
| 75        | 0.1406        | 5.5    | -3.39    |
| 80        | 0.1189        | 6.2    | -3.30    |
| 85        | 0.1010        | 6.9    | -3.22    |
| 90        | 0.08616       | 7.6    | -3.13    |
| 95        | 0.07381       | 8.3    | -3.05    |
| 100       | 0.06347       | 9.1    | -2.97    |
| 105       | 0.05480       | 9.8    | -2.90    |
| 110       | 0.04748       | 10.6   | -2.83    |
| 115       | 0.04129       | 11.3   | -2.76    |
| 120       | 0.03603       | 12.1   | -2.69    |
| 125       | 0.03155       | 12.9   | -2.62    |
| 130       | 0.02771       | 13.7   | -2.56    |
| 135       | 0.02442       | 14.4   | -2.50    |
| 140       | 0.02158       | 15.2   | -2.44    |
| 145       | 0.01913       | 16.0   | -2.38    |
| 150       | 0.01700       | 16.8   | -2.33    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | NA 4100       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 109.5         | 8.0    | -7.53    |
| -50       | 75.44         | 6.9    | -7.27    |
| -45       | 52.64         | 6.0    | -7.02    |
| -40       | 37.19         | 5.1    | -6.78    |
| -35       | 26.59         | 4.3    | -6.56    |
| -30       | 19.22         | 3.7    | -6.34    |
| -25       | 14.05         | 3.1    | -6.14    |
| -20       | 10.37         | 2.5    | -5.94    |
| -15       | 7.730         | 2.1    | -5.75    |
| -10       | 5.817         | 1.6    | -5.57    |
| -5        | 4.417         | 1.3    | -5.40    |
| 0         | 3.382         | 1.0    | -5.23    |
| 5         | 2.611         | 0.7    | -5.08    |
| 10        | 2.032         | 0.5    | -4.92    |
| 15        | 1.593         | 0.3    | -4.78    |
| 20        | 1.258         | 0.1    | -4.64    |
| 25        | 1.0000        | 0.0    | -4.51    |
| 30        | 0.8003        | 0.1    | -4.38    |
| 35        | 0.6446        | 0.3    | -4.25    |
| 40        | 0.5224        | 0.4    | -4.14    |
| 45        | 0.4258        | 0.6    | -4.02    |
| 50        | 0.3490        | 0.8    | -3.91    |
| 55        | 0.2877        | 1.0    | -3.81    |
| 60        | 0.2383        | 1.2    | -3.71    |
| 65        | 0.1984        | 1.4    | -3.61    |
| 70        | 0.1660        | 1.6    | -3.51    |
| 75        | 0.1395        | 1.8    | -3.42    |
| 80        | 0.1178        | 2.1    | -3.34    |
| 85        | 0.09989       | 2.3    | -3.25    |
| 90        | 0.08506       | 2.5    | -3.17    |
| 95        | 0.07271       | 2.8    | -3.09    |
| 100       | 0.06240       | 3.0    | -3.02    |
| 105       | 0.05375       | 3.3    | -2.94    |
| 110       | 0.04647       | 3.5    | -2.87    |
| 115       | 0.04032       | 3.8    | -2.81    |
| 120       | 0.03509       | 4.1    | -2.74    |
| 125       | 0.03065       | 4.3    | -2.68    |
| 130       | 0.02685       | 4.6    | -2.61    |
| 135       | 0.02359       | 4.8    | -2.55    |
| 140       | 0.02079       | 5.1    | -2.50    |
| 145       | 0.01837       | 5.4    | -2.44    |
| 150       | 0.01628       | 5.6    | -2.39    |



# Tables of Resistance vs Temperature



| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | NC 4080       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 105.4         | 24.0   | -7.45    |
| -50       | 72.89         | 20.7   | -7.20    |
| -45       | 51.04         | 17.8   | -6.95    |
| -40       | 36.18         | 15.2   | -6.72    |
| -35       | 25.94         | 12.9   | -6.50    |
| -30       | 18.81         | 10.9   | -6.29    |
| -25       | 13.78         | 9.1    | -6.08    |
| -20       | 10.20         | 7.5    | -5.89    |
| -15       | 7.621         | 6.1    | -5.71    |
| -10       | 5.748         | 4.9    | -5.53    |
| -5        | 4.373         | 3.8    | -5.36    |
| 0         | 3.355         | 2.9    | -5.20    |
| 5         | 2.595         | 2.1    | -5.04    |
| 10        | 2.023         | 1.4    | -4.89    |
| 15        | 1.588         | 0.9    | -4.75    |
| 20        | 1.256         | 0.4    | -4.61    |
| 25        | 1.000         | 0.0    | -4.48    |
| 30        | 0.8014        | 0.4    | -4.35    |
| 35        | 0.6463        | 0.8    | -4.23    |
| 40        | 0.5243        | 1.3    | -4.11    |
| 45        | 0.4278        | 1.8    | -4.00    |
| 50        | 0.3510        | 2.3    | -3.89    |
| 55        | 0.2896        | 2.9    | -3.79    |
| 60        | 0.2401        | 3.5    | -3.69    |
| 65        | 0.2001        | 4.1    | -3.59    |
| 70        | 0.1675        | 4.8    | -3.50    |
| 75        | 0.1409        | 5.5    | -3.41    |
| 80        | 0.1190        | 6.2    | -3.32    |
| 85        | 0.1010        | 6.9    | -3.24    |
| 90        | 0.08605       | 7.6    | -3.16    |
| 95        | 0.07360       | 8.3    | -3.08    |
| 100       | 0.06319       | 9.1    | -3.01    |
| 105       | 0.05446       | 9.8    | -2.94    |
| 110       | 0.04710       | 10.6   | -2.87    |
| 115       | 0.04087       | 11.3   | -2.80    |
| 120       | 0.03559       | 12.1   | -2.73    |
| 125       | 0.03109       | 12.9   | -2.67    |
| 130       | 0.02724       | 13.7   | -2.61    |
| 135       | 0.02394       | 14.4   | -2.55    |
| 140       | 0.02111       | 15.2   | -2.49    |
| 145       | 0.01866       | 16.0   | -2.44    |
| 150       | 0.01654       | 16.8   | -2.38    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | NE 4100       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 97.27         | 24.1   | -7.2     |
| -50       | 67.99         | 20.8   | -7.0     |
| -45       | 48.08         | 17.9   | -6.8     |
| -40       | 34.39         | 15.3   | -6.5     |
| -35       | 24.85         | 13.0   | -6.3     |
| -30       | 18.15         | 11.0   | -6.1     |
| -25       | 13.38         | 9.2    | -6.0     |
| -20       | 9.960         | 7.6    | -5.8     |
| -15       | 7.479         | 6.2    | -5.6     |
| -10       | 5.664         | 4.9    | -5.4     |
| -5        | 4.325         | 3.8    | -5.3     |
| 0         | 3.328         | 2.9    | -5.1     |
| 5         | 2.581         | 2.1    | -5.0     |
| 10        | 2.016         | 1.4    | -4.9     |
| 15        | 1.585         | 0.9    | -4.7     |
| 20        | 1.255         | 0.4    | -4.6     |
| 25        | 1.000         | 0.0    | -4.5     |
| 30        | 0.8017        | 0.4    | -4.3     |
| 35        | 0.6466        | 0.8    | -4.2     |
| 40        | 0.5245        | 1.3    | -4.1     |
| 45        | 0.4278        | 1.8    | -4.0     |
| 50        | 0.3508        | 2.3    | -3.9     |
| 55        | 0.2891        | 2.9    | -3.8     |
| 60        | 0.2394        | 3.5    | -3.7     |
| 65        | 0.1992        | 4.2    | -3.6     |
| 70        | 0.1666        | 4.8    | -3.5     |
| 75        | 0.1399        | 5.5    | -3.4     |
| 80        | 0.11794       | 6.2    | -3.4     |
| 85        | 0.09987       | 6.9    | -3.3     |
| 90        | 0.08491       | 7.6    | -3.2     |
| 95        | 0.07246       | 8.4    | -3.1     |
| 100       | 0.06207       | 9.1    | -3.1     |
| 105       | 0.05336       | 9.9    | -3.0     |
| 110       | 0.04604       | 10.6   | -2.9     |
| 115       | 0.03985       | 11.4   | -2.8     |
| 120       | 0.03461       | 12.2   | -2.8     |
| 125       | 0.03015       | 12.9   | -2.7     |
| 130       | 0.02635       | 13.7   | -2.7     |
| 135       | 0.02309       | 14.5   | -2.6     |
| 140       | 0.0203        | 15.3   | -2.5     |
| 145       | 0.01789       | 16.1   | -2.5     |
| 150       | 0.01581       | 16.8   | -2.4     |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | N5 4160       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 115.8         | 16.3   | -7.52    |
| -50       | 79.72         | 14.1   | -7.28    |
| -45       | 55.54         | 12.1   | -7.04    |
| -40       | 39.15         | 10.4   | -6.82    |
| -35       | 27.91         | 8.8    | -6.61    |
| -30       | 20.11         | 7.4    | -6.40    |
| -25       | 14.64         | 6.2    | -6.20    |
| -20       | 10.77         | 5.1    | -6.01    |
| -15       | 7.996         | 4.2    | -5.83    |
| -10       | 5.991         | 3.3    | -5.65    |
| -5        | 4.529         | 2.6    | -5.48    |
| 0         | 3.454         | 2.0    | -5.31    |
| 5         | 2.655         | 1.4    | -5.16    |
| 10        | 2.057         | 1.0    | -5.00    |
| 15        | 1.606         | 0.6    | -4.86    |
| 20        | 1.263         | 0.3    | -4.72    |
| 25        | 1.000         | 0.0    | -4.58    |
| 30        | 0.7973        | 0.3    | -4.45    |
| 35        | 0.6398        | 0.5    | -4.32    |
| 40        | 0.5167        | 0.9    | -4.20    |
| 45        | 0.4198        | 1.2    | -4.09    |
| 50        | 0.3430        | 1.6    | -3.97    |
| 55        | 0.2819        | 2.0    | -3.86    |
| 60        | 0.2329        | 2.4    | -3.76    |
| 65        | 0.1934        | 2.8    | -3.66    |
| 70        | 0.1614        | 3.3    | -3.56    |
| 75        | 0.1354        | 3.7    | -3.46    |
| 80        | 0.1141        | 4.2    | -3.37    |
| 85        | 0.09658       | 4.7    | -3.29    |
| 90        | 0.08211       | 5.2    | -3.20    |
| 95        | 0.07010       | 5.7    | -3.12    |
| 100       | 0.06009       | 6.2    | -3.04    |
| 105       | 0.05171       | 6.7    | -2.96    |
| 110       | 0.04467       | 7.2    | -2.89    |
| 115       | 0.03872       | 7.7    | -2.82    |
| 120       | 0.03369       | 8.2    | -2.75    |
| 125       | 0.02941       | 8.8    | -2.68    |
| 130       | 0.02576       | 9.3    | -2.62    |
| 135       | 0.02263       | 9.8    | -2.55    |
| 140       | 0.01995       | 10.3   | -2.49    |
| 145       | 0.01763       | 10.9   | -2.44    |
| 150       | 0.01563       | 11.4   | -2.38    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | P 4220        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 121.4         | 24.8   | -7.56    |
| -50       | 83.35         | 21.5   | -7.32    |
| -45       | 57.92         | 18.4   | -7.09    |
| -40       | 40.72         | 15.8   | -6.87    |
| -35       | 28.95         | 13.4   | -6.66    |
| -30       | 20.80         | 11.3   | -6.45    |
| -25       | 15.10         | 9.4    | -6.26    |
| -20       | 11.07         | 7.8    | -6.07    |
| -15       | 8.197         | 6.3    | -5.89    |
| -10       | 6.123         | 5.1    | -5.71    |
| -5        | 4.615         | 4.0    | -5.54    |
| 0         | 3.508         | 3.0    | -5.38    |
| 5         | 2.688         | 2.2    | -5.22    |
| 10        | 2.076         | 1.5    | -5.07    |
| 15        | 1.616         | 0.9    | -4.92    |
| 20        | 1.267         | 0.4    | -4.78    |
| 25        | 1.000         | 0.0    | -4.64    |
| 30        | 0.7949        | 0.4    | -4.51    |
| 35        | 0.6359        | 0.8    | -4.38    |
| 40        | 0.5120        | 1.3    | -4.26    |
| 45        | 0.4148        | 1.8    | -4.14    |
| 50        | 0.3379        | 2.4    | -4.03    |
| 55        | 0.2769        | 3.0    | -3.92    |
| 60        | 0.2281        | 3.6    | -3.81    |
| 65        | 0.1890        | 4.3    | -3.71    |
| 70        | 0.1573        | 5.0    | -3.61    |
| 75        | 0.1316        | 5.7    | -3.52    |
| 80        | 0.1106        | 6.4    | -3.42    |
| 85        | 0.09337       | 7.1    | -3.34    |
| 90        | 0.07918       | 7.9    | -3.25    |
| 95        | 0.06743       | 8.6    | -3.17    |
| 100       | 0.05766       | 9.4    | -3.09    |
| 105       | 0.04950       | 10.2   | -3.01    |
| 110       | 0.04266       | 10.9   | -2.93    |
| 115       | 0.03691       | 11.7   | -2.86    |
| 120       | 0.03204       | 12.5   | -2.79    |
| 125       | 0.02791       | 13.3   | -2.72    |
| 130       | 0.02439       | 14.1   | -2.66    |
| 135       | 0.02139       | 14.9   | -2.59    |
| 140       | 0.01881       | 15.7   | -2.53    |
| 145       | 0.01660       | 16.5   | -2.47    |
| 150       | 0.01469       | 17.3   | -2.42    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | PA 4235       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 123.39        | 8.3    | -7.68    |
| -50       | 84.33         | 7.2    | -7.42    |
| -45       | 58.39         | 6.2    | -7.17    |
| -40       | 40.93         | 5.3    | -6.93    |
| -35       | 29.04         | 4.5    | -6.71    |
| -30       | 20.83         | 3.8    | -6.49    |
| -25       | 15.11         | 3.2    | -6.29    |
| -20       | 11.07         | 2.6    | -6.09    |
| -15       | 8.190         | 2.1    | -5.90    |
| -10       | 6.117         | 1.7    | -5.72    |
| -5        | 4.610         | 1.3    | -5.54    |
| 0         | 3.505         | 1.0    | -5.38    |
| 5         | 2.686         | 0.7    | -5.22    |
| 10        | 2.075         | 0.5    | -5.07    |
| 15        | 1.615         | 0.3    | -4.92    |
| 20        | 1.267         | 0.1    | -4.78    |
| 25        | 1.000         | 0.0    | -4.64    |
| 30        | 0.7949        | 0.1    | -4.51    |
| 35        | 0.6359        | 0.3    | -4.39    |
| 40        | 0.5119        | 0.4    | -4.27    |
| 45        | 0.4145        | 0.6    | -4.15    |
| 50        | 0.3376        | 0.8    | -4.04    |
| 55        | 0.2764        | 1.0    | -3.93    |
| 60        | 0.2276        | 1.2    | -3.83    |
| 65        | 0.1883        | 1.4    | -3.73    |
| 70        | 0.1566        | 1.7    | -3.63    |
| 75        | 0.1308        | 1.9    | -3.54    |
| 80        | 0.1098        | 2.1    | -3.45    |
| 85        | 0.09257       | 2.4    | -3.37    |
| 90        | 0.07836       | 2.6    | -3.28    |
| 95        | 0.06661       | 2.9    | -3.20    |
| 100       | 0.05685       | 3.1    | -3.13    |
| 105       | 0.04870       | 3.4    | -3.05    |
| 110       | 0.04188       | 3.7    | -2.98    |
| 115       | 0.03614       | 3.9    | -2.91    |
| 120       | 0.03129       | 4.2    | -2.84    |
| 125       | 0.02719       | 4.5    | -2.78    |
| 130       | 0.02370       | 4.7    | -2.71    |
| 135       | 0.02072       | 5.0    | -2.65    |
| 140       | 0.01817       | 5.3    | -2.59    |
| 145       | 0.01598       | 5.5    | -2.54    |
| 150       | 0.01409       | 5.8    | -2.48    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | Q 4300        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 98.04         | 25.3   | -6.87    |
| -50       | 69.53         | 21.9   | -6.70    |
| -45       | 49.73         | 18.8   | -6.53    |
| -40       | 35.87         | 16.1   | -6.37    |
| -35       | 26.08         | 13.6   | -6.22    |
| -30       | 19.12         | 11.5   | -6.07    |
| -25       | 14.12         | 9.6    | -5.92    |
| -20       | 10.51         | 7.9    | -5.78    |
| -15       | 7.877         | 6.5    | -5.64    |
| -10       | 5.947         | 5.2    | -5.50    |
| -5        | 4.521         | 4.0    | -5.37    |
| 0         | 3.460         | 3.1    | -5.24    |
| 5         | 2.666         | 2.2    | -5.11    |
| 10        | 2.067         | 1.5    | -4.99    |
| 15        | 1.613         | 0.9    | -4.87    |
| 20        | 1.266         | 0.4    | -4.75    |
| 25        | 1.000         | 0.0    | -4.63    |
| 30        | 0.7944        | 0.4    | -4.52    |
| 35        | 0.6347        | 0.8    | -4.41    |
| 40        | 0.5099        | 1.3    | -4.30    |
| 45        | 0.4119        | 1.9    | -4.20    |
| 50        | 0.3344        | 2.4    | -4.09    |
| 55        | 0.2730        | 3.1    | -3.99    |
| 60        | 0.2239        | 3.7    | -3.90    |
| 65        | 0.1846        | 4.4    | -3.80    |
| 70        | 0.1529        | 5.1    | -3.71    |
| 75        | 0.1272        | 5.8    | -3.62    |
| 80        | 0.1063        | 6.5    | -3.53    |
| 85        | 0.08927       | 7.2    | -3.44    |
| 90        | 0.07526       | 8.0    | -3.36    |
| 95        | 0.06372       | 8.8    | -3.28    |
| 100       | 0.05417       | 9.6    | -3.20    |
| 105       | 0.04622       | 10.4   | -3.13    |
| 110       | 0.03960       | 11.2   | -3.05    |
| 115       | 0.03405       | 12.0   | -2.98    |
| 120       | 0.02938       | 12.8   | -2.91    |
| 125       | 0.02545       | 13.6   | -2.84    |
| 130       | 0.02211       | 14.4   | -2.77    |
| 135       | 0.01928       | 15.2   | -2.71    |
| 140       | 0.01686       | 16.0   | -2.64    |
| 145       | 0.01479       | 16.8   | -2.58    |
| 150       | 0.01302       | 17.7   | -2.52    |





# Tables of Resistance vs Temperature

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | QA 4250       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 99.06         | 8.3    | -7.09    |
| -50       | 69.60         | 7.2    | -6.88    |
| -45       | 49.42         | 6.2    | -6.68    |
| -40       | 35.45         | 5.3    | -6.49    |
| -35       | 25.67         | 4.5    | -6.30    |
| -30       | 18.77         | 3.8    | -6.13    |
| -25       | 13.84         | 3.2    | -5.96    |
| -20       | 10.29         | 2.6    | -5.79    |
| -15       | 7.719         | 2.1    | -5.64    |
| -10       | 5.834         | 1.7    | -5.49    |
| -5        | 4.442         | 1.3    | -5.34    |
| 0         | 3.407         | 1.0    | -5.20    |
| 5         | 2.632         | 0.7    | -5.07    |
| 10        | 2.047         | 0.5    | -4.94    |
| 15        | 1.602         | 0.3    | -4.81    |
| 20        | 1.262         | 0.1    | -4.69    |
| 25        | 1.0000        | 0.0    | -4.57    |
| 30        | 0.7971        | 0.1    | -4.46    |
| 35        | 0.6389        | 0.3    | -4.35    |
| 40        | 0.5149        | 0.4    | -4.24    |
| 45        | 0.4172        | 0.6    | -4.14    |
| 50        | 0.3397        | 0.8    | -4.04    |
| 55        | 0.2780        | 1.0    | -3.95    |
| 60        | 0.2286        | 1.2    | -3.85    |
| 65        | 0.1888        | 1.4    | -3.76    |
| 70        | 0.1567        | 1.7    | -3.68    |
| 75        | 0.1306        | 1.9    | -3.59    |
| 80        | 0.1093        | 2.1    | -3.51    |
| 85        | 0.09179       | 2.4    | -3.43    |
| 90        | 0.07743       | 2.6    | -3.36    |
| 95        | 0.06556       | 2.9    | -3.28    |
| 100       | 0.05571       | 3.2    | -3.21    |
| 105       | 0.04752       | 3.4    | -3.14    |
| 110       | 0.04067       | 3.7    | -3.07    |
| 115       | 0.03492       | 3.9    | -3.01    |
| 120       | 0.03008       | 4.2    | -2.94    |
| 125       | 0.02600       | 4.5    | -2.88    |
| 130       | 0.02254       | 4.7    | -2.82    |
| 135       | 0.01960       | 5.0    | -2.76    |
| 140       | 0.01709       | 5.3    | -2.71    |
| 145       | 0.01495       | 5.5    | -2.65    |
| 150       | 0.01311       | 5.8    | -2.60    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | R 4400        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 113.9         | 25.9   | -7.13    |
| -50       | 79.71         | 22.4   | -6.95    |
| -45       | 56.30         | 19.2   | -6.77    |
| -40       | 40.13         | 16.4   | -6.60    |
| -35       | 28.85         | 14.0   | -6.44    |
| -30       | 20.92         | 11.8   | -6.28    |
| -25       | 15.29         | 9.8    | -6.12    |
| -20       | 11.27         | 8.1    | -5.97    |
| -15       | 8.368         | 6.6    | -5.82    |
| -10       | 6.261         | 5.3    | -5.68    |
| -5        | 4.719         | 4.1    | -5.53    |
| 0         | 3.583         | 3.1    | -5.40    |
| 5         | 2.739         | 2.3    | -5.26    |
| 10        | 2.108         | 1.5    | -5.13    |
| 15        | 1.634         | 0.9    | -5.00    |
| 20        | 1.274         | 0.4    | -4.88    |
| 25        | 1.0000        | 0.0    | -4.75    |
| 30        | 0.7897        | 0.4    | -4.64    |
| 35        | 0.6273        | 0.9    | -4.52    |
| 40        | 0.5012        | 1.4    | -4.41    |
| 45        | 0.4028        | 1.9    | -4.30    |
| 50        | 0.3255        | 2.5    | -4.19    |
| 55        | 0.2644        | 3.1    | -4.09    |
| 60        | 0.2159        | 3.8    | -3.98    |
| 65        | 0.1772        | 4.5    | -3.89    |
| 70        | 0.1462        | 5.2    | -3.79    |
| 75        | 0.1212        | 5.9    | -3.70    |
| 80        | 0.1009        | 6.7    | -3.60    |
| 85        | 0.08440       | 7.4    | -3.52    |
| 90        | 0.07092       | 8.2    | -3.43    |
| 95        | 0.05984       | 9.0    | -3.35    |
| 100       | 0.05071       | 9.8    | -3.26    |
| 105       | 0.04314       | 10.6   | -3.19    |
| 110       | 0.03685       | 11.4   | -3.11    |
| 115       | 0.03160       | 12.2   | -3.03    |
| 120       | 0.02719       | 13.1   | -2.96    |
| 125       | 0.02349       | 13.9   | -2.89    |
| 130       | 0.02036       | 14.7   | -2.82    |
| 135       | 0.01770       | 15.6   | -2.76    |
| 140       | 0.01545       | 16.4   | -2.69    |
| 145       | 0.01352       | 17.2   | -2.63    |
| 150       | 0.01187       | 18.1   | -2.57    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | RA 4380       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 110.76        | 8.6    | -7.24    |
| -50       | 77.24         | 7.4    | -7.03    |
| -45       | 54.44         | 6.4    | -6.83    |
| -40       | 38.76         | 5.5    | -6.63    |
| -35       | 27.87         | 4.6    | -6.45    |
| -30       | 20.22         | 3.9    | -6.27    |
| -25       | 14.81         | 3.3    | -6.10    |
| -20       | 10.94         | 2.7    | -5.93    |
| -15       | 8.144         | 2.2    | -5.78    |
| -10       | 6.112         | 1.8    | -5.62    |
| -5        | 4.623         | 1.4    | -5.48    |
| 0         | 3.522         | 1.0    | -5.34    |
| 5         | 2.702         | 0.8    | -5.20    |
| 10        | 2.087         | 0.5    | -5.07    |
| 15        | 1.623         | 0.3    | -4.94    |
| 20        | 1.270         | 0.1    | -4.82    |
| 25        | 1.0000        | 0.0    | -4.70    |
| 30        | 0.7920        | 0.1    | -4.59    |
| 35        | 0.6308        | 0.3    | -4.47    |
| 40        | 0.5052        | 0.5    | -4.37    |
| 45        | 0.4068        | 0.6    | -4.26    |
| 50        | 0.3292        | 0.8    | -4.16    |
| 55        | 0.2678        | 1.0    | -4.07    |
| 60        | 0.2189        | 1.3    | -3.97    |
| 65        | 0.1797        | 1.5    | -3.88    |
| 70        | 0.1482        | 1.7    | -3.79    |
| 75        | 0.1228        | 2.0    | -3.71    |
| 80        | 0.1022        | 2.2    | -3.63    |
| 85        | 0.08536       | 2.5    | -3.55    |
| 90        | 0.07159       | 2.7    | -3.47    |
| 95        | 0.06028       | 3.0    | -3.39    |
| 100       | 0.05095       | 3.2    | -3.32    |
| 105       | 0.04322       | 3.5    | -3.25    |
| 110       | 0.03679       | 3.8    | -3.18    |
| 115       | 0.03142       | 4.1    | -3.11    |
| 120       | 0.02693       | 4.3    | -3.05    |
| 125       | 0.02315       | 4.6    | -2.98    |
| 130       | 0.01997       | 4.9    | -2.92    |
| 135       | 0.01728       | 5.2    | -2.86    |
| 140       | 0.01499       | 5.4    | -2.80    |
| 145       | 0.01304       | 5.7    | -2.75    |
| 150       | 0.01138       | 6.0    | -2.69    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | RC 4340       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 105.88        | 25.5   | -7.15    |
| -50       | 74.01         | 22.1   | -6.95    |
| -45       | 52.37         | 19.0   | -6.75    |
| -40       | 37.43         | 16.2   | -6.56    |
| -35       | 27.01         | 13.8   | -6.38    |
| -30       | 19.66         | 11.6   | -6.20    |
| -25       | 14.44         | 9.7    | -6.04    |
| -20       | 10.70         | 8.0    | -5.87    |
| -15       | 7.990         | 6.5    | -5.72    |
| -10       | 6.013         | 5.2    | -5.57    |
| -5        | 4.559         | 4.1    | -5.42    |
| 0         | 3.482         | 3.1    | -5.29    |
| 5         | 2.678         | 2.2    | -5.15    |
| 10        | 2.074         | 1.5    | -5.02    |
| 15        | 1.616         | 0.9    | -4.90    |
| 20        | 1.267         | 0.4    | -4.77    |
| 25        | 1.0000        | 0.0    | -4.66    |
| 30        | 0.7936        | 0.4    | -4.54    |
| 35        | 0.6334        | 0.8    | -4.43    |
| 40        | 0.5083        | 1.3    | -4.33    |
| 45        | 0.4100        | 1.9    | -4.23    |
| 50        | 0.3325        | 2.5    | -4.13    |
| 55        | 0.2709        | 3.1    | -4.03    |
| 60        | 0.2218        | 3.7    | -3.94    |
| 65        | 0.1825        | 4.4    | -3.85    |
| 70        | 0.1508        | 5.1    | -3.76    |
| 75        | 0.1251        | 5.8    | -3.67    |
| 80        | 0.1043        | 6.6    | -3.59    |
| 85        | 0.08727       | 7.3    | -3.51    |
| 90        | 0.07332       | 8.1    | -3.43    |
| 95        | 0.06184       | 8.9    | -3.36    |
| 100       | 0.05235       | 9.7    | -3.29    |
| 105       | 0.04448       | 10.5   | -3.22    |
| 110       | 0.03793       | 11.3   | -3.15    |
| 115       | 0.03245       | 12.1   | -3.08    |
| 120       | 0.02785       | 12.9   | -3.01    |
| 125       | 0.02399       | 13.7   | -2.95    |
| 130       | 0.02072       | 14.5   | -2.89    |
| 135       | 0.01796       | 15.4   | -2.83    |
| 140       | 0.01561       | 16.2   | -2.77    |
| 145       | 0.01360       | 17.0   | -2.72    |
| 150       | 0.01189       | 17.8   | -2.66    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | S 4520        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 126.1         | 26.6   | -7.25    |
| -50       | 87.75         | 23.0   | -7.07    |
| -45       | 61.60         | 19.8   | -6.90    |
| -40       | 43.63         | 16.9   | -6.73    |
| -35       | 31.17         | 14.3   | -6.56    |
| -30       | 22.46         | 12.1   | -6.40    |
| -25       | 16.31         | 10.1   | -6.25    |
| -20       | 11.94         | 8.3    | -6.10    |
| -15       | 8.809         | 6.8    | -5.95    |
| -10       | 6.549         | 5.4    | -5.80    |
| -5        | 4.904         | 4.2    | -5.66    |
| 0         | 3.699         | 3.2    | -5.52    |
| 5         | 2.810         | 2.3    | -5.39    |
| 10        | 2.149         | 1.6    | -5.26    |
| 15        | 1.654         | 1.0    | -5.13    |
| 20        | 1.282         | 0.4    | -5.00    |
| 25        | 1.0000        | 0.0    | -4.88    |
| 30        | 0.7848        | 0.4    | -4.76    |
| 35        | 0.6196        | 0.9    | -4.64    |
| 40        | 0.4921        | 1.4    | -4.52    |
| 45        | 0.3931        | 2.0    | -4.41    |
| 50        | 0.3158        | 2.6    | -4.30    |
| 55        | 0.2551        | 3.2    | -4.20    |
| 60        | 0.2072        | 3.9    | -4.09    |
| 65        | 0.1691        | 4.6    | -3.99    |
| 70        | 0.1387        | 5.3    | -3.89    |
| 75        | 0.1144        | 6.1    | -3.80    |
| 80        | 0.0948        | 6.8    | -3.71    |
| 85        | 0.0789        | 7.6    | -3.61    |
| 90        | 0.06594       | 8.4    | -3.53    |
| 95        | 0.05538       | 9.2    | -3.44    |
| 100       | 0.04671       | 10.1   | -3.36    |
| 105       | 0.03956       | 10.9   | -3.28    |
| 110       | 0.03364       | 11.7   | -3.20    |
| 115       | 0.02872       | 12.6   | -3.12    |
| 120       | 0.02461       | 13.4   | -3.04    |
| 125       | 0.02117       | 14.3   | -2.97    |
| 130       | 0.01827       | 15.1   | -2.90    |
| 135       | 0.01583       | 16.0   | -2.83    |
| 140       | 0.01376       | 16.8   | -2.77    |
| 145       | 0.01200       | 17.7   | -2.70    |
| 150       | 0.01050       | 18.6   | -2.64    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | SC 4500       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 129.77        | 26.5   | -7.51    |
| -50       | 89.31         | 22.9   | -7.29    |
| -45       | 62.15         | 19.7   | -7.07    |
| -40       | 43.72         | 16.8   | -6.87    |
| -35       | 31.07         | 14.3   | -6.68    |
| -30       | 22.29         | 12.0   | -6.49    |
| -25       | 16.15         | 10.0   | -6.31    |
| -20       | 11.80         | 8.3    | -6.14    |
| -15       | 8.703         | 6.8    | -5.97    |
| -10       | 6.470         | 5.4    | -5.81    |
| -5        | 4.849         | 4.2    | -5.66    |
| 0         | 3.662         | 3.2    | -5.51    |
| 5         | 2.786         | 2.3    | -5.36    |
| 10        | 2.135         | 1.6    | -5.23    |
| 15        | 1.647         | 0.9    | -5.09    |
| 20        | 1.279         | 0.4    | -4.96    |
| 25        | 1.0000        | 0.0    | -4.84    |
| 30        | 0.7865        | 0.4    | -4.72    |
| 35        | 0.6223        | 0.9    | -4.60    |
| 40        | 0.4953        | 1.4    | -4.49    |
| 45        | 0.3963        | 2.0    | -4.38    |
| 50        | 0.3189        | 2.6    | -4.28    |
| 55        | 0.2579        | 3.2    | -4.18    |
| 60        | 0.2096        | 3.9    | -4.08    |
| 65        | 0.1712        | 4.6    | -3.99    |
| 70        | 0.1405        | 5.3    | -3.89    |
| 75        | 0.1159        | 6.0    | -3.80    |
| 80        | 0.09595       | 6.8    | -3.72    |
| 85        | 0.07980       | 7.6    | -3.63    |
| 90        | 0.06664       | 8.4    | -3.55    |
| 95        | 0.05588       | 9.2    | -3.47    |
| 100       | 0.04704       | 10.0   | -3.40    |
| 105       | 0.03975       | 10.8   | -3.32    |
| 110       | 0.03371       | 11.7   | -3.25    |
| 115       | 0.02869       | 12.5   | -3.18    |
| 120       | 0.02450       | 13.4   | -3.12    |
| 125       | 0.02100       | 14.2   | -3.05    |
| 130       | 0.01805       | 15.1   | -2.99    |
| 135       | 0.01557       | 15.9   | -2.92    |
| 140       | 0.01347       | 16.8   | -2.86    |
| 145       | 0.01169       | 17.6   | -2.80    |
| 150       | 0.01017       | 18.5   | -2.75    |

# Tables of Resistance vs Temperature

| T<br>(°C) | Material B(K) |        |                 |
|-----------|---------------|--------|-----------------|
|           | T 4630        |        |                 |
|           | R(T) / R25    | TF (%) | $\alpha$ (%/°C) |
| -55       | 137.06        | 27.2   | -7.33           |
| -50       | 94.94         | 23.5   | -7.15           |
| -45       | 66.35         | 20.2   | -6.98           |
| -40       | 46.78         | 17.3   | -6.82           |
| -35       | 33.25         | 14.7   | -6.66           |
| -30       | 23.84         | 12.4   | -6.50           |
| -25       | 17.23         | 10.3   | -6.35           |
| -20       | 12.54         | 8.5    | -6.20           |
| -15       | 9.206         | 6.9    | -6.05           |
| -10       | 6.807         | 5.6    | -5.91           |
| -5        | 5.070         | 4.3    | -5.77           |
| 0         | 3.803         | 3.3    | -5.63           |
| 5         | 2.873         | 2.4    | -5.50           |
| 10        | 2.185         | 1.6    | -5.36           |
| 15        | 1.673         | 1.0    | -5.23           |
| 20        | 1.289         | 0.4    | -5.11           |
| 25        | 1.0000        | 0.0    | -4.99           |
| 30        | 0.7805        | 0.4    | -4.86           |
| 35        | 0.6129        | 0.9    | -4.75           |
| 40        | 0.4841        | 1.4    | -4.63           |
| 45        | 0.3847        | 2.0    | -4.52           |
| 50        | 0.3074        | 2.6    | -4.41           |
| 55        | 0.2470        | 3.3    | -4.30           |
| 60        | 0.1996        | 4.0    | -4.19           |
| 65        | 0.1621        | 4.7    | -4.09           |
| 70        | 0.1323        | 5.4    | -3.99           |
| 75        | 0.1086        | 6.2    | -3.89           |
| 80        | 0.08951       | 7.0    | -3.80           |
| 85        | 0.07416       | 7.8    | -3.71           |
| 90        | 0.06172       | 8.6    | -3.62           |
| 95        | 0.05160       | 9.5    | -3.53           |
| 100       | 0.04333       | 10.3   | -3.44           |
| 105       | 0.03655       | 11.2   | -3.36           |
| 110       | 0.03095       | 12.0   | -3.28           |
| 115       | 0.02632       | 12.9   | -3.20           |
| 120       | 0.02246       | 13.7   | -3.12           |
| 125       | 0.01925       | 14.6   | -3.05           |
| 130       | 0.01656       | 15.5   | -2.97           |
| 135       | 0.01429       | 16.4   | -2.90           |
| 140       | 0.01238       | 17.3   | -2.83           |
| 145       | 0.01076       | 18.1   | -2.77           |
| 150       | 0.009383      | 19.0   | -2.70           |

| T<br>(°C) | Material B(K) |        |                 |
|-----------|---------------|--------|-----------------|
|           | U 4840        |        |                 |
|           | R(T) / R25    | TF (%) | $\alpha$ (%/°C) |
| -55       | 173.74        | 28.5   | -7.69           |
| -50       | 118.20        | 24.6   | -7.50           |
| -45       | 81.18         | 21.2   | -7.32           |
| -40       | 56.26         | 18.1   | -7.15           |
| -35       | 39.34         | 15.4   | -6.98           |
| -30       | 27.75         | 12.9   | -6.82           |
| -25       | 19.74         | 10.8   | -6.66           |
| -20       | 14.15         | 8.9    | -6.50           |
| -15       | 10.23         | 7.3    | -6.34           |
| -10       | 7.457         | 5.8    | -6.19           |
| -5        | 5.476         | 4.5    | -6.04           |
| 0         | 4.051         | 3.4    | -5.90           |
| 5         | 3.020         | 2.5    | -5.76           |
| 10        | 2.267         | 1.7    | -5.62           |
| 15        | 1.714         | 1.0    | -5.48           |
| 20        | 1.305         | 0.5    | -5.35           |
| 25        | 1.0000        | 0.0    | -5.22           |
| 30        | 0.7715        | 0.4    | -5.09           |
| 35        | 0.5991        | 0.9    | -4.97           |
| 40        | 0.4681        | 1.5    | -4.84           |
| 45        | 0.3680        | 2.1    | -4.72           |
| 50        | 0.2911        | 2.8    | -4.61           |
| 55        | 0.2316        | 3.4    | -4.49           |
| 60        | 0.1853        | 4.2    | -4.38           |
| 65        | 0.1491        | 4.9    | -4.28           |
| 70        | 0.1206        | 5.7    | -4.17           |
| 75        | 0.09812       | 6.5    | -4.07           |
| 80        | 0.08022       | 7.3    | -3.97           |
| 85        | 0.06591       | 8.2    | -3.87           |
| 90        | 0.05442       | 9.0    | -3.77           |
| 95        | 0.04515       | 9.9    | -3.68           |
| 100       | 0.03763       | 10.8   | -3.59           |
| 105       | 0.03150       | 11.7   | -3.50           |
| 110       | 0.02649       | 12.6   | -3.42           |
| 115       | 0.02237       | 13.5   | -3.33           |
| 120       | 0.01897       | 14.4   | -3.25           |
| 125       | 0.01615       | 15.3   | -3.17           |
| 130       | 0.01380       | 16.2   | -3.10           |
| 135       | 0.01184       | 17.1   | -3.02           |
| 140       | 0.01020       | 18.0   | -2.95           |
| 145       | 0.008814      | 19.0   | -2.88           |
| 150       | 0.007643      | 19.9   | -2.81           |

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