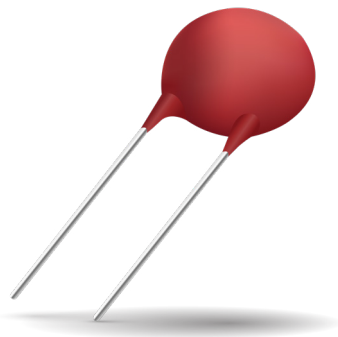


# NTC DISC THERMISTORS

ND 03/06/09 – NE 03/06/09 – NV 06/09



## APPLICATIONS

- ND or NE: Commercial, Industrial and Automotive Applications AEC-Q200 based Qual  
NV: Professional Applications
- Alarm and temperature measurement application
- Temperature regulation application
- Level detection application
- Compensation application and more

## TECHNOLOGY

- ND: epoxy-phenolic resin coating  
NE: epoxy resin coating (recommended for severe mounting conditions)  
NV: epoxy varnish coating
- Leads: Radial copper wire tinned
- Marking: on package only for ND03 & NE03  
ND/NE 06/09: Nominal resistance and tolerance for  $\pm 5\%$ ,  $\pm 10\%$   
NV06/09: Nominal resistance and tolerance
- Delivery Mode: Bulk, reeled or ammopacked

## PERFORMANCE CHARACTERISTICS

| Types                       | General purpose                                                     |                               |                               | Professional            |                         |
|-----------------------------|---------------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------|-------------------------|
|                             | ND03 or NE03                                                        | ND06 or NE06                  | ND09 or NE09                  | NV06                    | NV09                    |
| Climatic category           |                                                                     |                               |                               | 55/125/56-434           | 55/125/56-434           |
| Operating Temperature       | -55 to +150°C                                                       | -55 to +150°C                 | -55 to +150°C                 | -55 to +150°C           | -55 to +150°C           |
| Tolerance on Rn (25°C)      | 330Ω to 1MΩ : $\pm 3^*$ , 5, 10, 20%<br>1500Ω to 150 kΩ : $\pm 3\%$ | $\pm 3^*$ , 5, 10, $\pm 20\%$ | $\pm 3^*$ , 5, 10, $\pm 20\%$ | $\pm 2, 3, 5, \pm 10\%$ | $\pm 2, 3, 5, \pm 10\%$ |
| Maximum dissipation at 25°C | 0.25 W                                                              | 0.71 W                        | 0.9 W                         | 0.69 W                  | 0.85 W                  |
| Thermal dissipation factor  | 5 mW/°C                                                             | 7.1 mW/°C                     | 9 mW/°C                       | 6.9 mW/°C               | 8.5 mW/°C               |
| Thermal time constant       | 10 s                                                                | 22 s                          | 30 s                          | 18 s                    | 30 s                    |
| Response time               | < 3s                                                                |                               |                               |                         |                         |

## STANDARDIZATION

NV range : approved by  
 NFC 93271  
 Type: TN115 A for NV06  
 TN116 for NV09  
 List: GAM-T1  
 List: LNZ

\* Optional tolerance, please contact factory

## OPTIONS

Consult factory for availability of options:

- other nominal resistance values
- other tolerances
- alternative lead materials or lengths
- controlled dimensions

# NTC DISC THERMISTORS

## ND/NE 03

### HOW TO ORDER

#### ND06

##### Type

ND03  
NE03  
ND06  
NE06  
NV06

ND09  
NE09  
NV09

#### P0

##### Material Code

P  
(See tables  
page 23-25)

#### 0103

##### Resistance

10 kΩ  
(See tables  
page 22-24)

#### K

##### Tolerance

G (±2%) for NV  
H (±3%)\*  
J (±5%)  
K (±10%)  
M (±20%)

#### --

##### Packaging

--: Bulk  
Ammopack  
(See table page 26)  
Tape and reel  
(See table page 26)

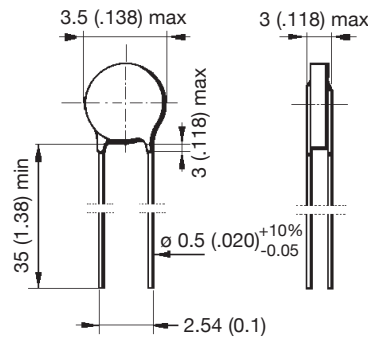
\* Optional tolerance, please contact factory

### TABLE OF VALUES

#### ND03/NE03 TYPE

| Part Number | Rn at 25°C (Ω) | Material Code | B (K)<br>(B/B <sup>(1)</sup> ± 5%<br>(2) ± 3%) | α at 25°C (%/°C) |
|-------------|----------------|---------------|------------------------------------------------|------------------|
| N_03J00681  | 680            | J             | 3480 (2)                                       | - 3.9            |
| N_03J00102  | 1,000          |               |                                                |                  |
| N_03K00152  | 1,500          | K             | 3630 (2)                                       | - 4.0            |
| N_03K00222  | 2,200          |               |                                                |                  |
| N_03L00272  | 2,700          | L             | 3790 (2)                                       | - 4.2            |
| N_03L00332  | 3,300          |               |                                                |                  |
| N_03M00472  | 4,700          | M             | 3950 (2)                                       | - 4.4            |
| N_03M00682  | 6,800          |               |                                                |                  |
| N_03N00103  | 10,000         | N             | 4080 (2)                                       | - 4.6            |
| N_03N00153  | 15,000         |               |                                                |                  |
| N_03P00223  | 22,000         | P             | 4220 (2)                                       | - 4.7            |
| N_03P00333  | 33,000         |               |                                                |                  |
| N_03Q00473  | 47,000         | Q             | 4300 (2)                                       | - 4.7            |
| N_03Q00683  | 68,000         |               |                                                |                  |
| N_03R00104  | 100,000        | R             | 4400 (2)                                       | - 4.8            |
| N_03R00154  | 150,000        |               |                                                |                  |
| N_03S00224  | 220,000        | S             | 4520 (2)                                       | - 5.0            |
| N_03T00334  | 330,000        |               |                                                |                  |
| N_03T00474  | 470,000        | T             | 4630 (2)                                       | - 5.1            |
| N_03U00105  | 1,000,000      |               |                                                |                  |
| N_03U00105  | 1,000,000      | U             | 4840 (2)                                       | - 5.3            |

#### ND03/NE03



# NTC DISC THERMISTORS

## ND/NE/NV 06

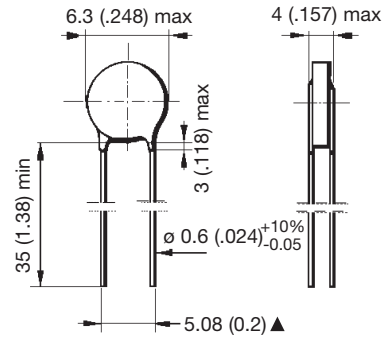
### TABLE OF VALUES

#### ND06/NE06/NV06

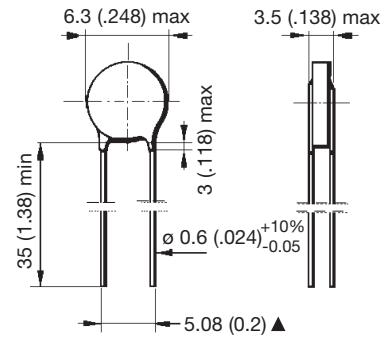
| Part Number | Rn at 25°C (Ω) | Material Code | B (K)<br>(B/B (1) ± 5%<br>(2) ± 3%) | α at 25°C (%/°C) |
|-------------|----------------|---------------|-------------------------------------|------------------|
| N_06J00151  | 150            | J             | 3480 (2)                            | - 3.9            |
| N_06J00221  | 220            |               |                                     |                  |
| N_06K00331  | 330            | K             | 3630 (2)                            | - 4.0            |
| N_06K00471  | 470            |               |                                     |                  |
| N_06L00681  | 680            | L             | 3790 (2)                            | - 4.2            |
| N_06L00102  | 1,000          |               |                                     |                  |
| N_06M00152  | 1,500          | M             | 3950 (2)                            | - 4.4            |
| N_06N00222  | 2,200          | N             | 4080 (2)                            | - 4.6            |
| N_06N00332  | 3,300          |               |                                     |                  |
| N_06P00472  | 4,700          | P             | 4220 (2)                            | - 4.7            |
| N_06P00682  | 6,800          |               |                                     |                  |
| N_06P00103  | 10,000         | Q             | 4300 (2)                            | - 4.7            |
| N_06Q00153  | 15,000         |               |                                     |                  |
| N_06Q00223  | 22,000         | R             | 4400 (2)                            | - 4.8            |
| N_06R00333  | 33,000         |               |                                     |                  |
| N_06S00473  | 47,000         | S             | 4520 (2)                            | - 5.0            |
| N_06S00683  | 68,000         |               |                                     |                  |
| N_06T00104  | 100,000        | T             | 4630 (2)                            | - 5.1            |
| N_06U00154  | 150,000        | U             | 4840 (2)                            | - 5.3            |
| N_06U00224  | 220,000        |               |                                     |                  |
| N_06U00334  | 330,000        |               |                                     |                  |

For other resistance values, please consult us.

#### ND06/NE06



#### NV06



# NTC DISC THERMISTORS

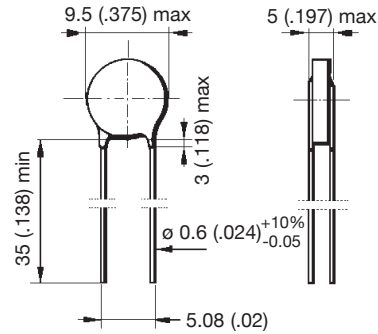
## ND/NE/NV 09

### TABLE OF VALUES

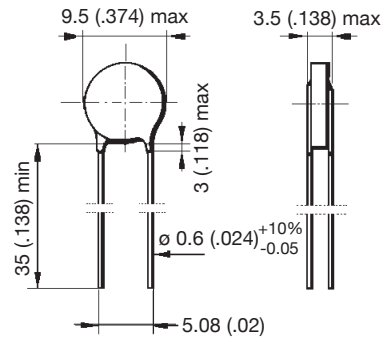
#### ND09/NE09/NV09

| Part Number | Rn at 25°C (Ω) | Material Code | B (K)<br>(B/B (1) ± 5%<br>(2) ± 3%) | α at 25°C (%/°C) |
|-------------|----------------|---------------|-------------------------------------|------------------|
| N_09J00680  | 68             | J             | 3480 (2)                            | - 3.9            |
| N_09J00101  | 100            |               |                                     |                  |
| N_09K00151  | 150            | K             | 3630 (2)                            | - 4.0            |
| N_09K00221  | 220            |               |                                     |                  |
| N_09L00331  | 330            | L             | 3790 (2)                            | - 4.2            |
| N_09M00471  | 470            | M             | 3950 (2)                            | - 4.4            |
| N_09M00681  | 680            |               |                                     |                  |
| N_09N00102  | 1,000          | N             | 4080 (2)                            | - 4.6            |
| N_09N00152  | 1,500          |               |                                     |                  |
| N_09P00222  | 2,200          | P             | 4220 (2)                            | - 4.7            |
| N_09P00332  | 3,300          |               |                                     |                  |
| N_09Q00472  | 4,700          | Q             | 4300 (2)                            | - 4.7            |
| N_09Q00682  | 6,800          |               |                                     |                  |
| N_09R00103  | 10,000         | R             | 4400 (2)                            | - 4.8            |
| N_09R00153  | 15,000         |               |                                     |                  |
| N_09S00223  | 22,000         | S             | 4520 (2)                            | - 5.0            |
| N_09T00333  | 33,000         | T             | 4630 (2)                            | - 5.1            |
| N_09T00473  | 47,000         |               |                                     |                  |
| N_09U00683  | 68,000         | U             | 4840 (2)                            | - 5.3            |
| N_09U00104  | 100,000        |               |                                     |                  |
| N_09U00154  | 150,000        |               |                                     |                  |

#### ND09/NE09



#### NV09



# NTC DISC THERMISTORS

## Packaging for Automatic Insertion

### PACKAGING AND KINK SUFFIXES

Tables below indicate the suffixes to specify when ordering to get the required kink and packaging. For devices on tape, it is necessary to specify the height (H or Ho) which is the distance between the tape axis (sprocket holes axis) and the seating plane on the printed circuit board. The following types can be ordered on tape either in AMMOPACK (fan folder) or on REEL in accordance with IEC 286-2.

– **Straight leads:**

H represents the distance between the sprocket holes axis and the bottom plane of component body (base of resin or base of stand off).

– **Kinked leads and flat leads:**

Ho represents the distance between the sprocket holes axis and the base on the knee (kinked leads) or the bottom of the flat part (flat leads).

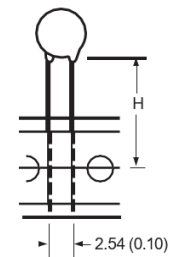
### • Reel & Ammopack

millimeters (inches)

| Types           | Suffix | H or Ho                       | Leads    | Quantity/Size | Packaging |
|-----------------|--------|-------------------------------|----------|---------------|-----------|
| ND/NE 03 & NJ28 | CA     | 16 ± 0.5<br>(0.630 ± 0.020)   | Straight | 3000          | AMMOPACK  |
|                 | CB     | 16 ± 0.5<br>(0.630 ± 0.020)   | Straight | 3000          | REEL      |
|                 | CC     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Straight | 3000          | AMMOPACK  |
|                 | CD     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Straight | 3000          | REEL      |
| NP30            | CA     | 16 ± 0.5<br>(0.630 ± 0.020)   | Straight | 2000          | AMMOPACK  |
|                 | CB     | 16 ± 0.5<br>(0.630 ± 0.020)   | Straight | 2000          | REEL      |
|                 | CC     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Straight | 2000          | AMMOPACK  |
|                 | CD     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Straight | 2000          | REEL      |
| ND/NE/NV 06/09  | DA     | 16 ± 0.5<br>(0.630 ± 0.020)   | Straight | 1500          | AMMOPACK  |
|                 | DB     | 16 ± 0.5<br>(0.630 ± 0.020)   | Straight | 1500          | REEL      |
|                 | DC     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Straight | 1500          | AMMOPACK  |
|                 | DD     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Straight | 1500          | REEL      |
|                 | DL     | 16 ± 0.5<br>(0.630 ± 0.020)   | Kinked   | 1500          | AMMOPACK  |
|                 | DM     | 16 ± 0.5<br>(0.630 ± 0.020)   | Kinked   | 1500          | REEL      |
|                 | DN     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Kinked   | 1500          | AMMOPACK  |
|                 | DP     | 19.5 ± 0.5<br>(0.768 ± 0.020) | Kinked   | 1500          | REEL      |

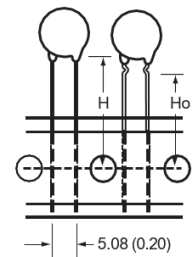
NTC

Type  
ND03  
NE03  
NJ28  
NP30



NTC

Types  
ND/NE/NV  
06/09

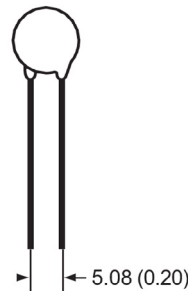
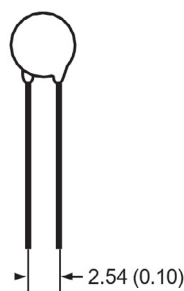


### • Bulk

| Type                         | Quantity/box |
|------------------------------|--------------|
| ND/NE03                      | 3000         |
| ND/NE06                      | 1500         |
| ND/NE09                      | 1500         |
| NV06                         | 100          |
| NV09                         | 100          |
| NI24<br>NJ28<br>NK20<br>NP30 | 1000         |

ND03 / NE03  
NJ28 / NP30

ND/NE/NV  
06/09



# AUTOMATIC INSERTION

## NTC Disc Thermistors

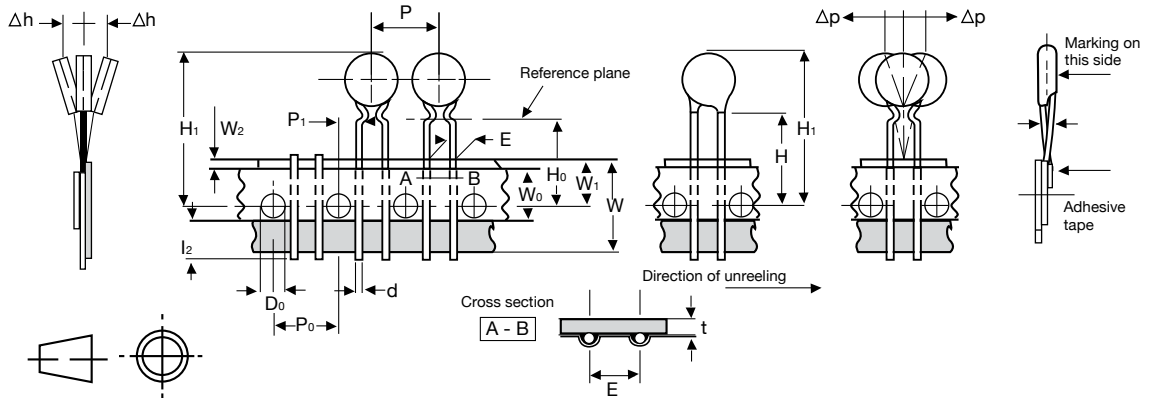
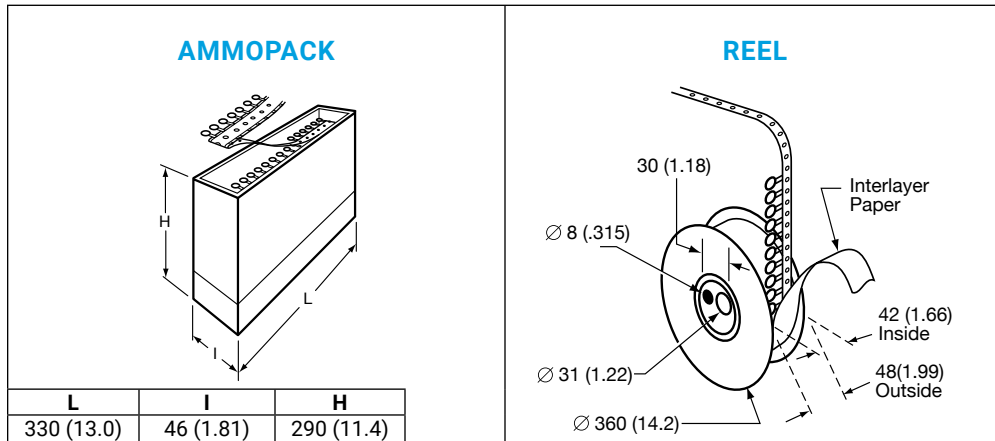
### TAPING CHARACTERISTICS

#### Missing components

A maximum of 3 consecutive components may be missing from the bandolier, surrounded by at least 6 filled positions. The number of missing components may not exceed 0.5% of the total per packing module.

The beginning and the end of tape exhibit 8 or 9 blank positions.

DIMENSIONS: millimeters (inches)

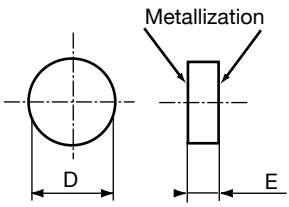


| Value   | Tolerance    | Dimensions Characteristics                                                           |
|---------|--------------|--------------------------------------------------------------------------------------|
| 18      | +1 / -0.5    | W Leading tape width                                                                 |
| 6       | ±0.3         | W <sub>0</sub> Adhesive tape width                                                   |
| 9       | +0.75 / -0.5 | W <sub>1</sub> Sprocket hole position                                                |
| 3 max.  |              | W <sub>2</sub> Distance between the top of the tape and the adhesive                 |
| 4       | ±0.2         | D <sub>0</sub> Diameter of sprocket hole                                             |
| 16/19.5 | ±0.5         | H <sub>0</sub> Distance between the tape axis and the seating plane of the component |
|         |              | H <sub>1</sub> Distance between the tape axis and the top of component body          |

| Value       | Tolerance    | Dimensions Characteristics                                               |
|-------------|--------------|--------------------------------------------------------------------------|
| 12.7        | ±0.2         | P <sub>0</sub> Sprocket holes pitch                                      |
| 254         | ±1           | - Distance between 21 consecutive holes 20 pitches                       |
| 0.7         | ±0.2         | t Total thickness of tape                                                |
| 2.54   5.08 | +0.6<br>-0.1 | E Lead spacing                                                           |
| 5.08   3.85 | ± 0.7        | P <sub>1</sub> Distance between the sprocket hole axis and the lead axis |
| 12.7        | ±1.0         | P Spacing of components                                                  |
| 0.5   0.6   | ±5%          | d Lead diameter                                                          |
| 0           | ±1.3         | <sup>3</sup> P Verticality of components                                 |
| 0           | ±2           | <sup>3</sup> h Alignment of components                                   |

# NTC LEADLESS DISC THERMISTORS

This type of product is widely used in automotive and consumer applications. They are assembled in custom-probes for sensing the temperature of liquids (water, oil, ...), gases or surface of any other component. The metallization covers completely the surfaces of the thermistor. The particularly flat and smooth surfaces ensure an excellent electrical and thermal contact under pressure.

| Types                      | NR                                                                                                                                                    |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical data (dim. in mm) |                                                                      |
| Marking                    | On package only / On parts upon request                                                                                                               |
| Operating temperature      | -40°C to +200°C                                                                                                                                       |
| Values and tolerances      | Custom - designed products defined with:<br>$D \pm D \quad R_1 \pm R_1/R_1 \text{ at } T_1$<br>$E \pm E \quad R_2 \pm R_2/R_2 \text{ at } T_2, \dots$ |

## DESIGN OF THE THERMISTOR

### Choice of the resistances

If the application is to measure the temperature around a defined point, a unique nominal resistance can be chosen (for example, among standard values of the ND range products presented on pages 20 to 24).

When it is required to measure the temperature over selected ranges  $T_1 - T_2$ ,  $T_2 - T_3$ , ..., the corresponding resistance  $R_1$ ,  $R_2$ ,  $R_3$ , ..., must be such that they can be located on the  $R(T)$  characteristic of an existing NTC material (for example among standard materials whose  $R(T)$  are displayed on pages 29 to 33).

The resistances must also be compatible with the resistivity of the material and the dimensions of the thermistor.

### Choice of the tolerances

The precision of the temperature measurement determines the calculation of the tolerance on the resistance:

$$\Delta R/R = \alpha (\%/^{\circ}\text{C}) \cdot \Delta T (^{\circ}\text{C})$$

For example, the NTC NR55-3049-99, using "N5" material ( $R(T)$  characteristic displayed on page 31), requires a precision of 1°C over the temperature range 110°C - 120°C.

The tolerances can be calculated:

$$\Delta R_{110^{\circ}\text{C}}/R_{110^{\circ}\text{C}} = 1^{\circ}\text{C} \cdot 2.91\%/^{\circ}\text{C} = 2.91\%$$

$$\Delta R_{120^{\circ}\text{C}}/R_{120^{\circ}\text{C}} = 1^{\circ}\text{C} \cdot 2.76\%/^{\circ}\text{C} = 2.76\%$$

\*For your specific requirements, please consult us.

## HOW TO ORDER

**NR55 - - 3002 - 99**

Type

P/N Code

# NTC LEADLESS DISC THERMISTORS

We present below some examples of our custom - designed products as an illustration of the different ways to define products.

## DIMENSIONS: millimeters (inches)

| Types              | D                       | E                       | Material Code | B (k) | $R_1 \pm \Delta R_1$ at $T_1$ | $T_1$ (°C) | $R_2 \pm \Delta R_2$ at $T_2$ | $T_2$ (°C) | $R_3 \pm \Delta R_3$ at $T_3$ | $T_3$ (°C) |
|--------------------|-------------------------|-------------------------|---------------|-------|-------------------------------|------------|-------------------------------|------------|-------------------------------|------------|
| NR 55 -- 3002 - 99 | 5.5 (.217) ± 0.5 (.020) | 1.1 (.043) ± 0.4 (.016) | N5            | 4160  | 1230 Ω ± 7.5%                 | 40         | 160 Ω ± 5%                    | 96.5       | -                             | -          |
| NR 67 -- 3068 - 99 | 6.7 (.264) ± 0.5 (.020) | 1.7 (.067) ± 0.3 (.012) | N             | 4080  | 150 Ω ± 3.3%                  | 100        | 51 Ω ± 5.3%                   | 140        | -                             | -          |
| NR 55 -- 3049 - 99 | 5.5 (.217) ± 0.5 (.020) | 1.0 (.040) ± 0.2 (.008) | N5            | 4160  | 107 Ω ± 2.9%                  | 110        | 80.6 Ω ± 2.8%                 | 120        | -                             | -          |
| NR 55 -- 3046 - 99 | 5.5 (.217) ± 0.5 (.020) | 1.3 (.051) ± 0.4 (.016) | S             | 4520  | 48600 Ω ± 7.5%                | 25         | 3210 Ω ± 5%                   | 90         | -                             | -          |
| NR 49 -- 3119 - 99 | 4.9 (.193) ± 0.3 (.012) | 1.5 (.060) ± 0.4 (.016) | M             | 3950  | 840 Ω ± 10%                   | 37.8       | 84 Ω ± 5%                     | 104.4      | -                             | -          |
| NR 55 -- 3114 - 99 | 5.5 (.217) ± 0.4 (.016) | 1.0 (.040) ± 0.2 (.008) | P             | 4220  | 5000 Ω ± 10%                  | 25         | -                             | -          | -                             | -          |
| NR 70 -- 3121 - 99 | 7.0 (.275) ± 0.3 (.012) | 1.2 (.047) ± 0.2 (.008) | L             | 3790  | 210 Ω ± 10%                   | 40         | 40 Ω ± 7.5%                   | 90         | 30 Ω ± 6.7%                   | 100        |
| NR 29 -- 3107 - 99 | 2.9 (.014) ± 0.3 (.012) | 1.7 (.067) ± 0.3 (.012) | K             | 3630  | 2050 Ω ± 6%                   | 25         | 193 Ω ± 5.4%                  | 96.5       | -                             | -          |
| NR 55 -- 3122 - 99 | 5.5 (.217) ± 0.5 (.020) | 1.5 (.060) ± 0.4 (.016) | J             | 3480  | 210 Ω ± 5%                    | 25         | -                             | -          | -                             | -          |
| NR 55 -- 3126 - 99 | 5.5 (.217) ± 0.5 (.020) | 1.0 (.040) ± 0.2 (.008) | P             | 4220  | 3340 Ω ± 10%                  | 25         | 264 Ω ± 7%                    | 90         | 107 Ω ± 7%                    | 120        |
| NR 47 -- 3116 - 99 | 4.7 (.185) ± 0.4 (.016) | 1.2 (.047) ± 0.2 (.008) | R             | 4400  | 33000 Ω ± 2%                  | 25         | -                             | -          | -                             | -          |
| NR 49 -- 3113 - 99 | 4.9 (.193) ± 0.3 (.012) | 1.2 (.047) ± 0.2 (.008) | N             | 4080  | 1680 Ω ± 10%                  | 40         | 382 Ω ± 6.7%                  | 80         | 176 Ω ± 5%                    | 105        |
| NR 47 -- 3101 - 99 | 4.6 (.181) ± 0.3 (.012) | 1.4 (.055) ± 0.3 (.012) | J             | 3480  | 146 Ω ± 13%                   | 40         | 22 Ω ± 10%                    | 100        | -                             | -          |
| NR 55 -- 3071 - 99 | 5.8 (.228) ± 0.3 (.012) | 1.0 (.040) ± 0.2 (.008) | L             | 3790  | 262 Ω ± 8.7%                  | 40         | 120 Ω ± 10%                   | 60         | 35.5 Ω ± 7.8%                 | 100        |
| NR 61 -- 3063 - 99 | 6.1 (.240) ± 0.3 (.012) | 1.5 (.060) ± 0.3 (.012) | N             | 4080  | 760 Ω ± 9.2%                  | 50         | 130 Ω ± 8.5%                  | 100        | 56.6 Ω ± 8.5%                 | 130        |
| NR 67 -- 3053 - 99 | 6.7 (.264) ± 0.4 (.016) | 1.7 (.067) ± 0.3 (.012) | N             | 4080  | 540 Ω ± 11%                   | 60         | 144 Ω ± 7%                    | 100        | -                             | -          |
| NR 50 -- 3048 - 99 | 5.0 (.197) ± 0.5 (.020) | 1.5 (.060) ± 0.5 (.020) | J             | 3480  | 233 Ω ± 10%                   | 25         | 13.3 Ω ± 7%                   | 121        | -                             | -          |
| NR 60 -- 3021 - 99 | 6.0 (.236) ± 0.5 (.020) | 3.2 (.125) ± 0.3 (.012) | P             | 4220  | 3640 Ω ± 3%                   | 40         | 457 Ω ± 3%                    | 96.5       | -                             | -          |
| NR 55 -- 3016 - 99 | 5.5 (.217) ± 0.5 (.020) | 1.1 (.043) ± 0.4 (.016) | Q             | 4300  | 5500 Ω ± 9%                   | 40         | 650 Ω ± 7.7%                  | 96.5       | -                             | -          |

Resistance - Temperature characteristics: pages 29 to 33.



# 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-J5 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) |
| 1.4 pt    | 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    |

# TABLES OF RESISTANCE VS TEMPERATURE

| 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) |        |          |
|-----------|---------------|--------|----------|
|           | L0 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         | 15.6   | -7.42    |
| -50       | 68.97         | 14.3   | -7.16    |
| -45       | 48.40         | 12.9   | -6.91    |
| -40       | 34.38         | 11.7   | -6.67    |
| -35       | 24.71         | 10.5   | -6.45    |
| -30       | 17.97         | 9.4    | -6.23    |
| -25       | 13.20         | 8.3    | -6.02    |
| -20       | 9.804         | 7.3    | -5.82    |
| -15       | 7.352         | 6.3    | -5.63    |
| -10       | 5.565         | 5.4    | -5.45    |
| -5        | 4.251         | 4.5    | -5.28    |
| 0         | 3.275         | 3.7    | -5.11    |
| 5         | 2.544         | 2.9    | -4.95    |
| 10        | 1.992         | 2.1    | -4.80    |
| 15        | 1.572         | 1.4    | -4.65    |
| 20        | 1.249         | 0.7    | -4.51    |
| 25        | 1.0000        | 0.0    | -4.38    |
| 30        | 0.8057        | 0.7    | -4.25    |
| 35        | 0.6534        | 1.3    | -4.12    |
| 40        | 0.5331        | 1.9    | -4.00    |
| 45        | 0.4376        | 2.5    | -3.89    |
| 50        | 0.3612        | 3.1    | -3.77    |
| 55        | 0.2998        | 3.7    | -3.67    |
| 60        | 0.2501        | 4.3    | -3.57    |
| 65        | 0.2097        | 4.8    | -3.47    |
| 70        | 0.1767        | 5.3    | -3.37    |
| 75        | 0.1496        | 5.9    | -3.28    |
| 80        | 0.1272        | 6.4    | -3.19    |
| 85        | 0.1087        | 6.9    | -3.11    |
| 90        | 0.09320       | 7.4    | -3.03    |
| 95        | 0.08025       | 7.8    | -2.95    |
| 100       | 0.06937       | 8.3    | -2.87    |
| 105       | 0.06019       | 8.8    | -2.80    |
| 110       | 0.05242       | 9.2    | -2.73    |
| 115       | 0.04580       | 9.6    | -2.66    |
| 120       | 0.04016       | 10.1   | -2.60    |
| 125       | 0.03532       | 10.5   | -2.53    |
| 130       | 0.03117       | 10.9   | -2.47    |
| 135       | 0.02758       | 11.3   | -2.41    |
| 140       | 0.02448       | 11.7   | -2.36    |
| 145       | 0.02179       | 12.1   | -2.30    |
| 150       | 0.01945       | 12.4   | -2.25    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | MA 3965       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 101.09        | 2.47   | -7.49    |
| -50       | 69.81         | 2.26   | -7.22    |
| -45       | 48.87         | 2.06   | -6.96    |
| -40       | 34.65         | 1.87   | -6.71    |
| -35       | 24.87         | 1.69   | -6.48    |
| -30       | 18.06         | 1.52   | -6.26    |
| -25       | 13.259        | 1.35   | -6.05    |
| -20       | 9.837         | 1.19   | -5.84    |
| -15       | 7.372         | 1.04   | -5.65    |
| -10       | 5.578         | 0.89   | -5.47    |
| -5        | 4.259         | 0.75   | -5.29    |
| 0         | 3.280         | 0.61   | -5.12    |
| 5         | 2.548         | 0.48   | -4.96    |
| 10        | 1.994         | 0.35   | -4.81    |
| 15        | 1.573         | 0.23   | -4.66    |
| 20        | 1.250         | 0.11   | -4.52    |
| 25        | 1.0000        | 0.00   | -4.38    |
| 30        | 0.8054        | 0.11   | -4.25    |
| 35        | 0.6528        | 0.22   | -4.13    |
| 40        | 0.5324        | 0.32   | -4.01    |
| 45        | 0.4368        | 0.42   | -3.90    |
| 50        | 0.3603        | 0.52   | -3.79    |
| 55        | 0.2989        | 0.61   | -3.68    |
| 60        | 0.2492        | 0.70   | -3.58    |
| 65        | 0.2088        | 0.79   | -3.48    |
| 70        | 0.1758        | 0.88   | -3.39    |
| 75        | 0.1487        | 0.96   | -3.30    |
| 80        | 0.1263        | 1.04   | -3.21    |
| 85        | 0.1078        | 1.12   | -3.13    |
| 90        | 0.0923        | 1.20   | -3.05    |
| 95        | 0.0794        | 1.27   | -2.97    |
| 100       | 0.06857       | 1.35   | -2.90    |
| 105       | 0.05942       | 1.42   | -2.83    |
| 110       | 0.05167       | 1.49   | -2.76    |
| 115       | 0.04509       | 1.55   | -2.69    |
| 120       | 0.03948       | 1.62   | -2.62    |
| 125       | 0.03467       | 1.68   | -2.56    |
| 130       | 0.03055       | 1.75   | -2.50    |
| 135       | 0.02699       | 1.81   | -2.44    |
| 140       | 0.02392       | 1.87   | -2.39    |
| 145       | 0.02125       | 1.93   | -2.33    |
| 150       | 0.01894       | 1.98   | -2.28    |

# TABLES OF RESISTANCE VS TEMPERATURE

| 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) |        |          |
|-----------|---------------|--------|----------|
|           | ME 3975       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 103.9         | 2.47   | -7.56    |
| -50       | 71.53         | 2.26   | -7.28    |
| -45       | 49.94         | 2.06   | -7.01    |
| -40       | 35.32         | 1.87   | -6.76    |
| -35       | 25.29         | 1.69   | -6.53    |
| -30       | 18.32         | 1.52   | -6.30    |
| -25       | 13.43         | 1.35   | -6.08    |
| -20       | 9.945         | 1.19   | -5.88    |
| -15       | 7.440         | 1.04   | -5.68    |
| -10       | 5.621         | 0.89   | -5.50    |
| -5        | 4.286         | 0.75   | -5.32    |
| 0         | 3.297         | 0.61   | -5.15    |
| 5         | 2.557         | 0.48   | -4.98    |
| 10        | 2.000         | 0.35   | -4.83    |
| 15        | 1.576         | 0.23   | -4.68    |
| 20        | 1.251         | 0.11   | -4.54    |
| 25        | 1.0000        | 0.00   | -4.40    |
| 30        | 0.8048        | 0.11   | -4.27    |
| 35        | 0.6519        | 0.22   | -4.14    |
| 40        | 0.5313        | 0.32   | -4.02    |
| 45        | 0.4356        | 0.42   | -3.91    |
| 50        | 0.3591        | 0.52   | -3.80    |
| 55        | 0.2977        | 0.61   | -3.69    |
| 60        | 0.2481        | 0.70   | -3.59    |
| 65        | 0.2078        | 0.79   | -3.49    |
| 70        | 0.1749        | 0.88   | -3.40    |
| 75        | 0.1479        | 0.96   | -3.31    |
| 80        | 0.1256        | 1.04   | -3.22    |
| 85        | 0.1071        | 1.12   | -3.14    |
| 90        | 0.09175       | 1.20   | -3.06    |
| 95        | 0.07890       | 1.27   | -2.98    |
| 100       | 0.06810       | 1.35   | -2.90    |
| 105       | 0.05900       | 1.42   | -2.83    |
| 110       | 0.05130       | 1.49   | -2.76    |
| 115       | 0.04476       | 1.55   | -2.69    |
| 120       | 0.03918       | 1.62   | -2.63    |
| 125       | 0.03441       | 1.68   | -2.57    |
| 130       | 0.03031       | 1.75   | -2.50    |
| 135       | 0.02678       | 1.81   | -2.45    |
| 140       | 0.02373       | 1.87   | -2.39    |
| 145       | 0.02108       | 1.93   | -2.34    |
| 150       | 0.01878       | 1.98   | -2.28    |

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | M4 3995       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 98.22         | 23.5   | -7.38    |
| -50       | 68.17         | 20.3   | -7.12    |
| -45       | 47.92         | 17.5   | -6.88    |
| -40       | 34.11         | 14.9   | -6.64    |
| -35       | 24.57         | 12.7   | -6.42    |
| -30       | 17.89         | 10.7   | -6.20    |
| -25       | 13.17         | 8.9    | -6.00    |
| -20       | 9.790         | 7.4    | -5.80    |
| -15       | 7.349         | 6.0    | -5.62    |
| -10       | 5.568         | 4.8    | -5.44    |
| -5        | 4.256         | 3.8    | -5.27    |
| 0         | 3.280         | 2.8    | -5.11    |
| 5         | 2.549         | 2.1    | -4.95    |
| 10        | 1.996         | 1.4    | -4.80    |
| 15        | 1.574         | 0.8    | -4.66    |
| 20        | 1.250         | 0.4    | -4.52    |
| 25        | 1.0000        | 0.0    | -4.39    |
| 30        | 0.8049        | 0.4    | -4.27    |
| 35        | 0.6519        | 0.8    | -4.15    |
| 40        | 0.5311        | 1.2    | -4.03    |
| 45        | 0.4352        | 1.7    | -3.92    |
| 50        | 0.3586        | 2.3    | -3.81    |
| 55        | 0.2970        | 2.8    | -3.71    |
| 60        | 0.2472        | 3.4    | -3.61    |
| 65        | 0.2068        | 4.1    | -3.52    |
| 70        | 0.1738        | 4.7    | -3.42    |
| 75        | 0.1468        | 5.4    | -3.34    |
| 80        | 0.1245        | 6.0    | -3.25    |
| 85        | 0.1060        | 6.7    | -3.17    |
| 90        | 0.09060       | 7.4    | -3.09    |
| 95        | 0.07776       | 8.2    | -3.01    |
| 100       | 0.06700       | 8.9    | -2.94    |
| 105       | 0.05793       | 9.6    | -2.87    |
| 110       | 0.05026       | 10.4   | -2.80    |
| 115       | 0.04376       | 11.1   | -2.74    |
| 120       | 0.03822       | 11.9   | -2.67    |
| 125       | 0.03349       | 12.6   | -2.61    |
| 130       | 0.02944       | 13.4   | -2.55    |
| 135       | 0.02595       | 14.1   | -2.49    |
| 140       | 0.02294       | 14.9   | -2.44    |
| 145       | 0.02033       | 15.6   | -2.38    |
| 150       | 0.01807       | 16.4   | -2.33    |

# TABLES OF RESISTANCE VS TEMPERATURE

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | MN 4077       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 103.6         | 2.54   | -7.39    |
| -50       | 71.79         | 2.32   | -7.14    |
| -45       | 50.39         | 2.12   | -6.90    |
| -40       | 35.79         | 1.92   | -6.68    |
| -35       | 25.71         | 1.74   | -6.46    |
| -30       | 18.67         | 1.56   | -6.25    |
| -25       | 13.70         | 1.39   | -6.06    |
| -20       | 10.15         | 1.22   | -5.87    |
| -15       | 7.591         | 1.06   | -5.68    |
| -10       | 5.730         | 0.91   | -5.51    |
| -5        | 4.362         | 0.77   | -5.34    |
| 0         | 3.349         | 0.63   | -5.18    |
| 5         | 2.592         | 0.49   | -5.03    |
| 10        | 2.021         | 0.36   | -4.88    |
| 15        | 1.587         | 0.24   | -4.74    |
| 20        | 1.256         | 0.12   | -4.60    |
| 25        | 1.0000        | 0.00   | -4.47    |
| 30        | 0.8016        | 0.11   | -4.35    |
| 35        | 0.6465        | 0.22   | -4.23    |
| 40        | 0.5246        | 0.33   | -4.11    |
| 45        | 0.4281        | 0.43   | -4.00    |
| 50        | 0.3514        | 0.53   | -3.89    |
| 55        | 0.2899        | 0.63   | -3.79    |
| 60        | 0.2404        | 0.72   | -3.69    |
| 65        | 0.2004        | 0.81   | -3.59    |
| 70        | 0.1678        | 0.90   | -3.50    |
| 75        | 0.1411        | 0.99   | -3.41    |
| 80        | 0.1193        | 1.07   | -3.32    |
| 85        | 0.1012        | 1.15   | -3.24    |
| 90        | 0.08624       | 1.23   | -3.16    |
| 95        | 0.07378       | 1.31   | -3.08    |
| 100       | 0.06336       | 1.38   | -3.00    |
| 105       | 0.05462       | 1.46   | -2.93    |
| 110       | 0.04725       | 1.53   | -2.86    |
| 115       | 0.04101       | 1.60   | -2.79    |
| 120       | 0.03572       | 1.67   | -2.73    |
| 125       | 0.03122       | 1.73   | -2.66    |
| 130       | 0.02736       | 1.80   | -2.60    |
| 135       | 0.02406       | 1.86   | -2.54    |
| 140       | 0.02121       | 1.92   | -2.49    |
| 145       | 0.01876       | 1.98   | -2.43    |
| 150       | 0.01663       | 2.04   | -2.38    |

| 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        | 1.0000        | 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        | 1.0000        | 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        | 1.0000        | 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    |

# TABLES OF RESISTANCE VS TEMPERATURE

| 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        | 1.0000        | 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       | 123.40        | 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        | 1.0000        | 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        | 1.0000        | 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       | 113.90        | 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       | 110.80        | 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    |



# TABLES OF RESISTANCE VS TEMPERATURE

| T<br>(°C) | Material B(K) |        |          |
|-----------|---------------|--------|----------|
|           | RC 4340       |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 105.70        | 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) |        |          |
|-----------|---------------|--------|----------|
|           | T 4630        |        |          |
|           | R(T) / R25    | TF (%) | α (%/°C) |
| -55       | 137.10        | 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 (%) | α (%/°C) |
| -55       | 173.70        | 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    |