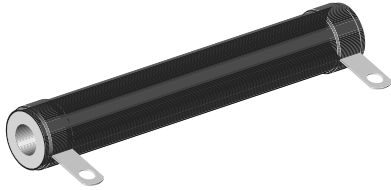


## Wirewound Resistors, Industrial Power, Tubular (HL), Non-Inductive Tubular (NHL)



**FEATURES**

- High temperature silicon coating
- Complete welded construction
- Available in non-inductive styles (model NHL) with Aryton-Perry winding
- Tight tolerance of 5 % for values above 1  $\Omega$
- Excellent stability in operation (< 3 % change in resistance)

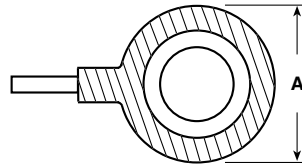


**RoHS\***  
COMPLIANT

| <b>STANDARD ELECTRICAL SPECIFICATIONS</b> |                   |  |                           |                            |                       |
|---|-------------------|--|---------------------------|----------------------------|-----------------------|
| GLOBAL MODEL                              | HISTORICAL MODEL  | POWER RATING $P_{25\text{ }^\circ\text{C}}$<br>W | RESISTANCE RANGE $\Omega$ |                            | WEIGHT (typical)<br>g |
|   |                   |  | $\pm 5\%$                 | $\pm 10\%$                 |                       |
| HL011<br>NHL011                           | HL-11<br>NHL-11   | 11   | 1.0 - 70K<br>1.0 - 4.7K   | 0.10 - 70K<br>1.0 - 4.7K   | 10.50                 |
| HL012<br>NHL012                           | HL-12<br>NHL-12   | 12   | 1.0 - 58K<br>1.0 - 3.9K   | 0.10 - 58K<br>1.0 - 3.9K   | 6.69                  |
| HL015<br>NHL015                           | HL-15<br>NHL-15   | 15   | 1.0 - 60K<br>1.0 - 4.3K   | 0.10 - 60K<br>1.0 - 4.3K   | 8.64                  |
| HL020<br>NHL020                           | HL-20<br>NHL-20   | 20   | 1.0 - 95K<br>1.0 - 6.8K   | 0.10 - 95K<br>1.0 - 6.8K   | 12.57                 |
| HL025<br>NHL025                           | HL-25<br>NHL-25   | 25   | 1.0 - 115K<br>1.0 - 8.8K  | 0.10 - 115K<br>1.0 - 8.8K  | 20.72                 |
| HL026<br>NHL026                           | HL-26<br>NHL-26   | 26   | 1.0 - 170K<br>1.0 - 11.8K | 0.10 - 170K<br>1.0 - 11.8K | 15.34                 |
| HL050<br>NHL050                           | HL-50<br>NHL-50   | 50   | 1.0 - 112K<br>1.0 - 21.5K | 0.10 - 112K<br>1.0 - 21.5K | 42.08                 |
| HL051<br>NHL051                           | HL-51<br>NHL-51   | 51   | 1.0 - 124K<br>1.0 - 22.9K | 0.10 - 124K<br>1.0 - 22.9K | 51.96                 |
| HL060<br>NHL060                           | HL-60<br>NHL-60   | 60   | 1.0 - 145K<br>1.0 - 27.2K | 0.10 - 145K<br>1.0 - 27.2K | 65.64                 |
| HL065<br>NHL065                           | HL-65<br>NHL-65   | 65   | 1.0 - 170K<br>1.0 - 31.4K | 0.10 - 170K<br>1.0 - 31.4K | 64.82                 |
| HL080<br>NHL080                           | HL-80<br>NHL-80   | 80   | 1.0 - 190K<br>1.0 - 38.3K | 0.10 - 190K<br>1.0 - 38.3K | 121.58                |
| HL100<br>NHL100                           | HL-100<br>NHL-100 | 100  | 1.0 - 260K<br>1.0 - 48.5K | 0.10 - 260K<br>1.0 - 48.5K | 91.37                 |
| HL120<br>NHL120                           | HL-120<br>NHL-120 | 120  | 1.0 - 330K<br>1.0 - 64.1K | 0.10 - 330K<br>1.0 - 64.1K | 183.82                |
| HL130<br>NHL130                           | HL-130<br>NHL-130 | 130  | 1.0 - 380K<br>1.0 - 70.2K | 0.10 - 380K<br>1.0 - 70.2K | 192.36                |
| HL160<br>NHL160                           | HL-160<br>NHL-160 | 160  | 1.0 - 470K<br>1.0 - 105K  | 0.10 - 470K<br>1.0 - 105K  | 245.86                |
| HL175<br>NHL175                           | HL-175<br>NHL-175 | 175  | 1.0 - 500K<br>1.0 - 112K  | 0.10 - 500K<br>1.0 - 112K  | 250.80                |
| HL225<br>NHL225                           | HL-225<br>NHL-225 | 225  | 1.0 - 645K<br>1.0 - 121K  | 0.10 - 645K<br>1.0 - 121K  | 309.97                |

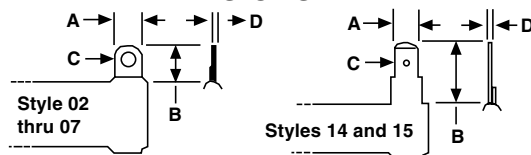
| <b>GLOBAL PART NUMBER INFORMATION</b>   |  |   |  |           |   |   |   |  |   |   |   |   |   |   |   |  |  |
|---|--|---|--|-----------|---|---|---|--|---|---|---|---|---|---|---|--|--|
| New Global Part Numbering: NHL10006Z10R00JJ (preferred part number format)                                  |  |   |  |           |   |   |   |  |   |   |   |   |   |   |   |  |  |
| N   | H  | L   | 1  | 0         | 0 | 0 | 6   | Z  | 1 | 0   | R | 0 | 0 | J | J |  |  |
| GLOBAL MODEL  | TERMINAL DESIGNATION   | TERMINAL FINISH   | RESISTANCE VALUE   |           |   |   | TOLERANCE   | PACKAGING CODE   |   | SPECIAL   |   |   |   |   |   |  |  |
| <b>NHL100</b><br><small>(See "Standard Electrical Specifications" table above for additional P/N's)</small> | <b>02</b><br><b>05</b><br><b>06</b><br><b>07</b><br><b>14</b><br><b>15</b> | <b>E</b> = Lead (Pb)-free<br><b>Z</b> = Tin/lead<br><b>N</b> = Nickel | <b>R</b> = Decimal<br><b>K</b> = Thousand<br><b>10R00</b> = 10.0 $\Omega$<br><b>1K000</b> = 1 k $\Omega$ |           |   |   | <b>J</b> = $\pm 5.0\%$<br><b>K</b> = $\pm 10.0\%$ | <b>E</b> = Lead (Pb)-free skin pack<br><b>J*</b> = Skin pack (J01) |   | (Dash Number) (up to 2 digits) From <b>1 - 99</b> as applicable |   |   |   |   |   |  |  |
| Historical Part Number Example: NHL-100-06Z 10 $\Omega$ 5 % J01 (will continue to be accepted)              |  |   |  |           |   |   |   |  |   |   |   |   |   |   |   |  |  |
| NHL-100   | 06Z  | 10 $\Omega$   | 5 %  | J01       |   |   |   |  |   |   |   |   |   |   |   |  |  |
| HISTORICAL MODEL  | TERMINAL/FINISH  | RESISTANCE VALUE  | TOLERANCE  | PACKAGING |   |   |   |  |   |   |   |   |   |   |   |  |  |

\* Pb containing terminations are not RoHS compliant, exemptions may apply

**DIMENSIONS**


(Includes Coating and Terminal Band)

| GLOBAL MODEL | DIMENSIONS in inches [millimeters] |                         |         |                       |                                   |                                   |                      |          |                           |
|--------------|------------------------------------|-------------------------|---------|-----------------------|-----------------------------------|-----------------------------------|----------------------|----------|---------------------------|
|              | A (max.)                           | CORE DIMENSIONS         |         |                       | TERMINAL SETBACK ± 0.031 [± 0.79] | DISTANCE BETWEEN TERMINALS (REF.) | TERMINAL DESIGNATION |          | MOUNTING HARDWARE OPTIONS |
|              |                                    | LENGTH ± 0.062 [± 1.59] | O.D.    | I.D. ± 0.031 [± 0.79] |                                   |                                   | STANDARD             | OPTIONAL |                           |
| HL011        | 11.91                              | 1.750                   | 0.375   | 4.76                  | 0.094                             | 1.187                             | 02                   | -        | 101, 204, 301             |
| NHL011       | [0.469]                            | [44.45]                 | [9.53]  | [0.188]               | [2.38]                            |                                   |                      |          |                           |
| HL012        | 10.32                              | 1.750                   | 0.313   | 4.76                  | 0.094                             | 1.187                             | 05                   | 14       | 101, 204, 301             |
| NHL012       | [0.406]                            | [44.45]                 | [7.94]  | [0.188]               | [2.38]                            |                                   |                      |          |                           |
| HL015        | 0.563                              | 1.500                   | 0.438   | 0.313                 | 0.094                             | 0.937                             | 02                   | 14       | 101, 203, 301             |
| NHL015       | [14.29]                            | [38.10]                 | [11.11] | [7.94]                | [2.38]                            |                                   |                      |          |                           |
| HL020        | 0.563                              | 2.000                   | 0.438   | 0.313                 | 0.094                             | 1.437                             | 02                   | 14       | 101, 203, 301             |
| NHL020       | [14.29]                            | [50.8]                  | [11.11] | [7.94]                | [2.38]                            |                                   |                      |          |                           |
| HL025        | 0.688                              | 2.000                   | 0.563   | 0.313                 | 0.094                             | 1.312                             | 06                   | 15       | 101, 203, 301             |
| NHL025       | [17.46]                            | [50.8]                  | [14.29] | [7.94]                | [2.38]                            |                                   |                      |          |                           |
| HL026        | 0.563                              | 3.000                   | 0.438   | 0.313                 | 0.094                             | 2.437                             | 02                   | 14       | 101, 203, 301             |
| NHL026       | [14.29]                            | [76.2]                  | [11.11] | [7.94]                | [2.38]                            |                                   |                      |          |                           |
| HL050        | 0.688                              | 4.000                   | 0.563   | 0.313                 | 0.094                             | 3.312                             | 06                   | 15       | 101, 203, 301             |
| NHL050       | [17.46]                            | [101.6]                 | [14.29] | [7.94]                | [2.38]                            |                                   |                      |          |                           |
| HL051        | 0.906                              | 3.500                   | 0.750   | 0.500                 | 0.125                             | 2.75                              | 06                   | 15       | 102, 206, 303             |
| NHL051       | [23.02]                            | [88.9]                  | [19.05] | [12.70]               | [3.18]                            |                                   |                      |          |                           |
| HL060        | 0.906                              | 4.000                   | 0.750   | 0.500                 | 0.125                             | 3.250                             | 06                   | 15       | 102, 206, 303             |
| NHL060       | [23.02]                            | [101.6]                 | [19.05] | [12.70]               | [3.18]                            |                                   |                      |          |                           |
| HL065        | 0.906                              | 114.3                   | 0.750   | 0.500                 | 0.125                             | 3.750                             | 06                   | 15       | 102, 206, 303             |
| NHL065       | [23.02]                            | [4.500]                 | [19.05] | [12.70]               | [3.18]                            |                                   |                      |          |                           |
| HL080        | 1.313                              | 4.000                   | 1.125   | 0.500                 | 0.219                             | 2.812                             | 07                   | 15       | 103, 205, 303             |
| NHL080       | [33.34]                            | [101.6]                 | [28.58] | [12.70]               | [5.56]                            |                                   |                      |          |                           |
| HL100        | 0.906                              | 6.500                   | 0.750   | 0.500                 | 0.125                             | 5.750                             | 06                   | 15       | 102, 206, 303             |
| NHL100       | [23.02]                            | [165.1]                 | [19.05] | [12.70]               | [3.18]                            |                                   |                      |          |                           |
| HL120        | 1.313                              | 6.000                   | 1.125   | 0.750                 | 0.219                             | 4.812                             | 07                   | 15       | 103, 205, 303             |
| NHL120       | [33.34]                            | [152.4]                 | [28.58] | [19.05]               | [5.56]                            |                                   |                      |          |                           |
| HL130        | 1.313                              | 6.500                   | 1.125   | 0.750                 | 0.219                             | 5.312                             | 07                   | 15       | 103, 205, 303             |
| NHL130       | [33.34]                            | [165.1]                 | [28.58] | [19.05]               | [5.56]                            |                                   |                      |          |                           |
| HL160        | 1.313                              | 8.000                   | 1.125   | 0.750                 | 0.219                             | 6.812                             | 07                   | 15       | 103, 205, 303             |
| NHL160       | [33.34]                            | [203.2]                 | [28.58] | [19.05]               | [5.56]                            |                                   |                      |          |                           |
| HL175        | 1.313                              | 8.500                   | 1.125   | 0.750                 | 0.219                             | 7.312                             | 07                   | 15       | 103, 205, 303             |
| NHL175       | [33.34]                            | [215.9]                 | [28.58] | [19.05]               | [5.56]                            |                                   |                      |          |                           |
| HL225        | 1.313                              | 266.7                   | 1.125   | 0.750                 | 0.219                             | 9.312                             | 07                   | 15       | 103, 205, 303             |
| NHL225       | [33.34]                            | [10.500]                | [28.58] | [19.05]               | [5.56]                            |                                   |                      |          |                           |

**TERMINAL DIMENSIONS**

**TERMINAL FINISH**

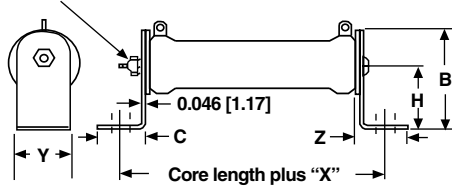
“E” Finish - 100 % Sn coated steel. “Z” Finish - 60/40 SnPb coated steel. “N” Finish - Nickel coated steel. Finish for terminal style 14 and 15 limited to nickel plated steel (N).

| DIMENSION | TERMINAL TYPE    |                  |                  |                  |                  |                  |
|-----------|------------------|------------------|------------------|------------------|------------------|------------------|
|           | 02               | 05               | 06               | 07               | 14               | 15               |
| A         | 0.188<br>[4.76]  | 0.188<br>[4.76]  | 0.250<br>[6.35]  | 0.375<br>[9.53]  | 0.188<br>[4.76]  | 0.250<br>[6.35]  |
| B         | 0.406<br>[10.32] | 0.438<br>[11.11] | 0.563<br>[14.29] | 0.625<br>[15.88] | 0.563<br>[14.29] | 0.594<br>[15.08] |
| C         | 0.093<br>[2.36]  | 0.104<br>[2.64]  | 0.166<br>[4.22]  | 0.173<br>[4.39]  | 0.050<br>[1.27]  | 0.065<br>[1.65]  |
| D         | 0.020<br>[0.51]  | 0.020<br>[0.51]  | 0.020<br>[0.51]  | 0.020<br>[0.51]  | 0.020<br>[0.51]  | 0.031<br>[0.79]  |

## MOUNTING HARDWARE DIMENSIONS in inches [millimeters]

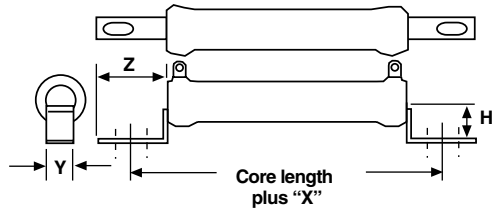
### Horizontal Thru-Bolt

(Threaded rod supplied as standard on HL050 thru HL225 sizes.)



| BRACKET TYPE | X                | Y                | Z                | H                | MOUNTING SLOT                   | C                | B                |
|--------------|------------------|------------------|------------------|------------------|---------------------------------|------------------|------------------|
| 101          | 1.063<br>[26.99] | 0.500<br>[12.70] | 0.859<br>[21.83] | 1.000<br>[25.40] | 0.219 x 0.438<br>[5.56 x 11.11] | 0.750<br>[19.05] | 1.375<br>[34.93] |
| 102          | 1.063<br>[26.99] | 0.750<br>[19.05] | 0.859<br>[21.83] | 1.250<br>[31.75] | 0.219 x 0.438<br>[5.56 x 11.11] | 0.750<br>[19.05] | 1.750<br>[44.45] |
| 103          | 1.063<br>[26.99] | 1.250<br>[31.75] | 1.000<br>[25.40] | 1.500<br>[38.10] | 0.281 x 0.563<br>[7.14 x 14.29] | 0.875<br>[22.23] | 2.125<br>[53.98] |

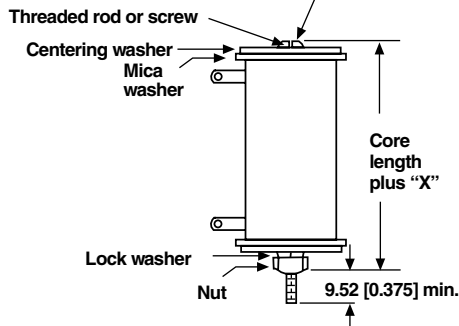
### Push-In



| BRACKET TYPE | X                | H                | Y                | Z                | HOLE (Dia.)                    |
|--------------|------------------|------------------|------------------|------------------|--------------------------------|
| 203          | 0.625<br>[15.88] | 0.672<br>[17.07] | 0.250<br>[6.35]  | 0.469<br>[11.91] | 0.161<br>[4.09]                |
| 204          | 0.375<br>[9.53]  | 0.281<br>[7.14]  | 0.250<br>[6.35]  | 0.344<br>[8.73]  | 0.144<br>[3.66]                |
| 205          | 0.813<br>[20.64] | 1.391<br>[35.32] | 0.500<br>[12.70] | 0.688<br>[17.46] | 0.196 x 0.260<br>[4.98 x 6.60] |
| 206          | 0.719<br>[18.26] | 0.969<br>[24.61] | 0.375<br>[9.53]  | 0.625<br>[15.88] | 0.196 x 0.260<br>[4.98 x 6.60] |

### Vertical Thru-Bolt

(Threaded rod supplied as standard on HL050 thru HL225 sizes.)



| BRACKET TYPE | X (Approximate)  | THREAD |
|--------------|------------------|--------|
| 301          | 0.438<br>[11.11] | 8-32   |
| 303          | 0.500<br>[12.70] | 10-32  |

| TECHNICAL SPECIFICATIONS        |                 |  |
|---------------------------------|-----------------|--|
| PARAMETER                       | UNIT            | HL, NHL RESISTOR CHARACTERISTICS   |
| Temperature Coefficient         | ppm/°C          | ± 90 for 0.1 Ω to 0.99 Ω; ± 50 for 1 Ω to 9.9 Ω; ± 30 for 10 Ω and above |
| Dielectric Withstanding Voltage | V <sub>AC</sub> | 1000, from terminal to mounting hardware                                 |
| Short Time Overload             | -               | 10 × rated power for 5 s   |
| Maximum Working Voltage         | V               | (P × R) <sup>1/2</sup>   |
| Insulation Resistance           | Ω               | 1000 MΩ minimum dry, 100 MΩ minimum after moisture test                  |
| Operating Temperature Range     | °C              | - 55 to + 350  |



**MATERIAL SPECIFICATIONS**

**Element:** Copper-nickel alloy of nickel-chrome alloy, depending on resistance value

**Core:** Ceramic, steatite

**Coating:** Special high temperature silicone

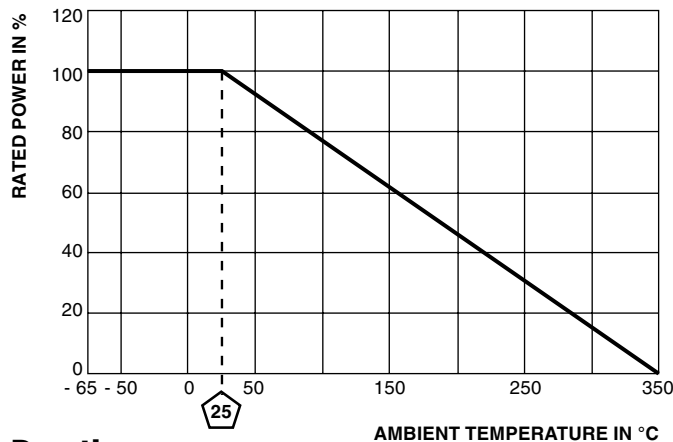
**Standard Terminals:** Model "Z" terminals are tinned steel

**Terminal Bands:** Steel

**Part Marking:** DALE, model, wattage, value, tolerance, date code

**NHL NON-INDUCTIVE**

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by adding the letter N to the front of the HL type designation (NHL-225 for example). For NHL models maximum resistance values are lower, see STANDARD ELECTRICAL SPECIFICATIONS table.



**Derating**

| PERFORMANCE                     |   |                       |
|---------------------------------|---|-----------------------|
| TEST                            | CONDITIONS OF TEST  | TEST LIMITS           |
| Thermal Shock                   | Rated power applied until thermally stable, then a minimum of 15 min at - 55 °C | ± (2.0 % + 0.05 Ω) ΔR |
| Short Time Overload             | 10 x rated power for 5 s  | ± (2.0 % + 0.05 Ω) ΔR |
| Dielectric Withstanding Voltage | 1000 V <sub>rms</sub> , 1 min   | ± (0.1 % + 0.05 Ω) ΔR |
| Low Temperature Storage         | - 55 °C for 24 h  | ± (2.0 % + 0.05 Ω) ΔR |
| High Temperature Exposure       | 250 h at + 350 °C   | ± (2.0 % + 0.05 Ω) ΔR |
| Moisture Resistance             | MIL-STD-202 Method 106, 7b not applicable                                       | ± (2.0 % + 0.05 Ω) ΔR |
| Shock, Specified Pulse          | MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks                             | ± (0.2 % + 0.05 Ω) ΔR |
| Vibration, High Frequency       | Frequency varied 10 to 2000 Hz, 20 g peak, 2 directions 6 h each                | ± (0.2 % + 0.05 Ω) ΔR |
| Load Life                       | 1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"                         | ± (3.0 % + 0.05 Ω) ΔR |



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