



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS



VALUE THROUGH TRUSTED PERFORMANCE

[www.thegundcompany.com](http://www.thegundcompany.com) | World HQ 314.492.4800





# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## STATOR RTDS

---

Resistance Temperature Detectors (RTDs)  
 RTD Single Element  
 RTD Dual Element  
 RTD Resistance vs. Temperature  
 RTD Embedding Materials

## GTH - RESISTANCE TEMPERATURE DETECTORS (RTDS)

---

GTH - RTD Overview

## FLEXIBLE RESISTANCE TEMPERATURE DETECTORS (RTDS)

---

Polyimide and Silicone Rubber RTDs  
 Installation Tips

## EMBEDDABLE BEARING SENSORS

---

Single and Dual Element Bearing RTD Sensors  
 Configuration Order Chart (RTD)  
 Configuration Order Chart (T/C)

## BEARING RESISTANCE TEMPERATURE DETECTORS (RTDS)

---

Isolated Single Element Bearing RTD Probes  
 Unisolated Single Element Bearing RTD Probes  
 Isolated Dual Element Bearing RTD Probes  
 Unisolated Dual Element Bearing RTD Probes

## RTD ACCESSORIES

---

RTD Probe Holder  
 RTD Probe Holder Installation Instructions  
 RTD Connection Head (Epoxy-Coated Cast Iron)  
 RTD Connection Head (Cast Aluminum)  
 RTD Terminal Block  
 RTD Shielded Cable  
 RTD Twisted Cable  
 GTH - RTD Shielded Cable

## RTD QUOTE FORM

---

Quote Form - Stator RTDs

## IEC SPECIFICATIONS OVERVIEW

---

IEC-60751 RTD Standards

## RTD TCR ELEMENT MATERIALS

---

TCR - Copper  
 TCR - Nickel  
 TCR - Platinum

## STANDARD TESTING

---

Resistance  
 Insulation Resistance  
 Hi-Pot / Dielectric Testing

## TGC OVERVIEW

---

For more information, visit [www.thegundcompany.com](http://www.thegundcompany.com)



# THE GUND COMPANY

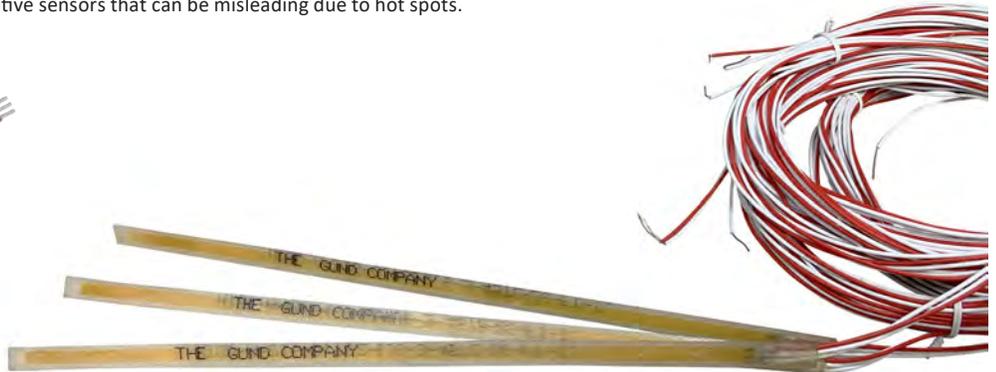
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Stator RTDs Resistance Temperature Detectors

Embedded temperature monitoring of motors and generators is a long-time industry-accepted practice. It allows for continuous assessment of equipment conditions. This embedded method of monitoring utilizes specially designed Resistance Temperature Detectors (RTDs) and Thermocouples (T/Cs) placed outside the major insulation - as specified in ANSI C50-10-1990 - the sensing element of RTDs in the stator winding slots. The extended length of our RTD sensor element design - sometimes exceeding 20 inches in body length - offers improved averaging of the measurement process over a wider area of the slot length. This benefit eliminates the problems related to tip-sensitive sensors that can be misleading due to hot spots.



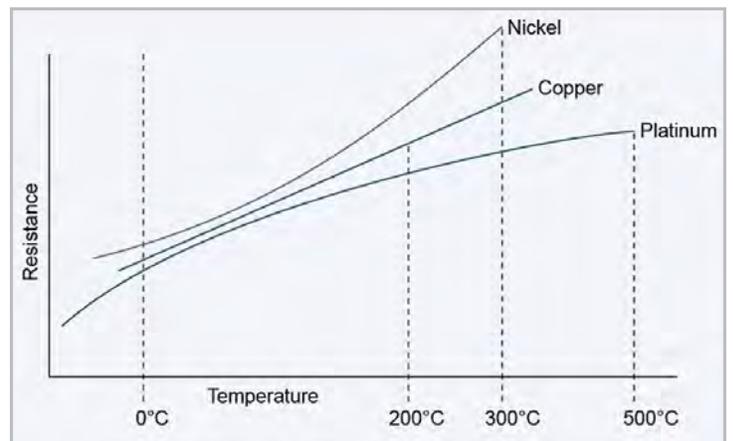
RTD Single Element Paddle



RTD Dual Element Paddles

PROPERTIES	PART ID	Dimensions	Rating	Element	Resistance	Number of Elements	Lead Wire Length	Number of Wires	Lead Wire Gauge	Lead Wire Coating
	RTD1A2540.7626.6P3457226PTS	10"L x 0.260"W x 0.030"T	Class H	Platinum	100 Ωm ± 0.5% @ 0°C	1	15 ft.	3	26 AWG	PTFE
	RTD1A2540.7626.6C3457226PTS	10"L x 0.260"W x 0.030"T	Class H	Copper	10 Ωm ± 0.5% @ 0°C	1	15 ft.	3	26 AWG	PTFE
	RTD1A2540.7626.6N3457226PTS	10"L x 0.260"W x 0.030"T	Class H	Nickel	120 Ωm ± 0.5% @ 0°C	1	15 ft.	3	26 AWG	PTFE
	RTD2A3050.76213.2P3457226PTS	12"L x 0.520"W x 0.030"T	Class H	Platinum	100 Ωm ± 0.5% @ 0°C	2	15 ft.	6	26 AWG	PTFE
	RTD2A4570.76213.2P3457226PTS	18"L x 0.520"W x 0.030"T	Class H	Platinum	100 Ωm ± 0.5% @ 0°C	2	15 ft.	6	26 AWG	PTFE

ELEMENT TYPE	Base Resistance	TCR (Ohm/Ohm/°C)
Platinum	100	0.00385
Nickel	120	0.00672
Copper	10	0.00427



RTD Resistance versus Temperature

The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type.

The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

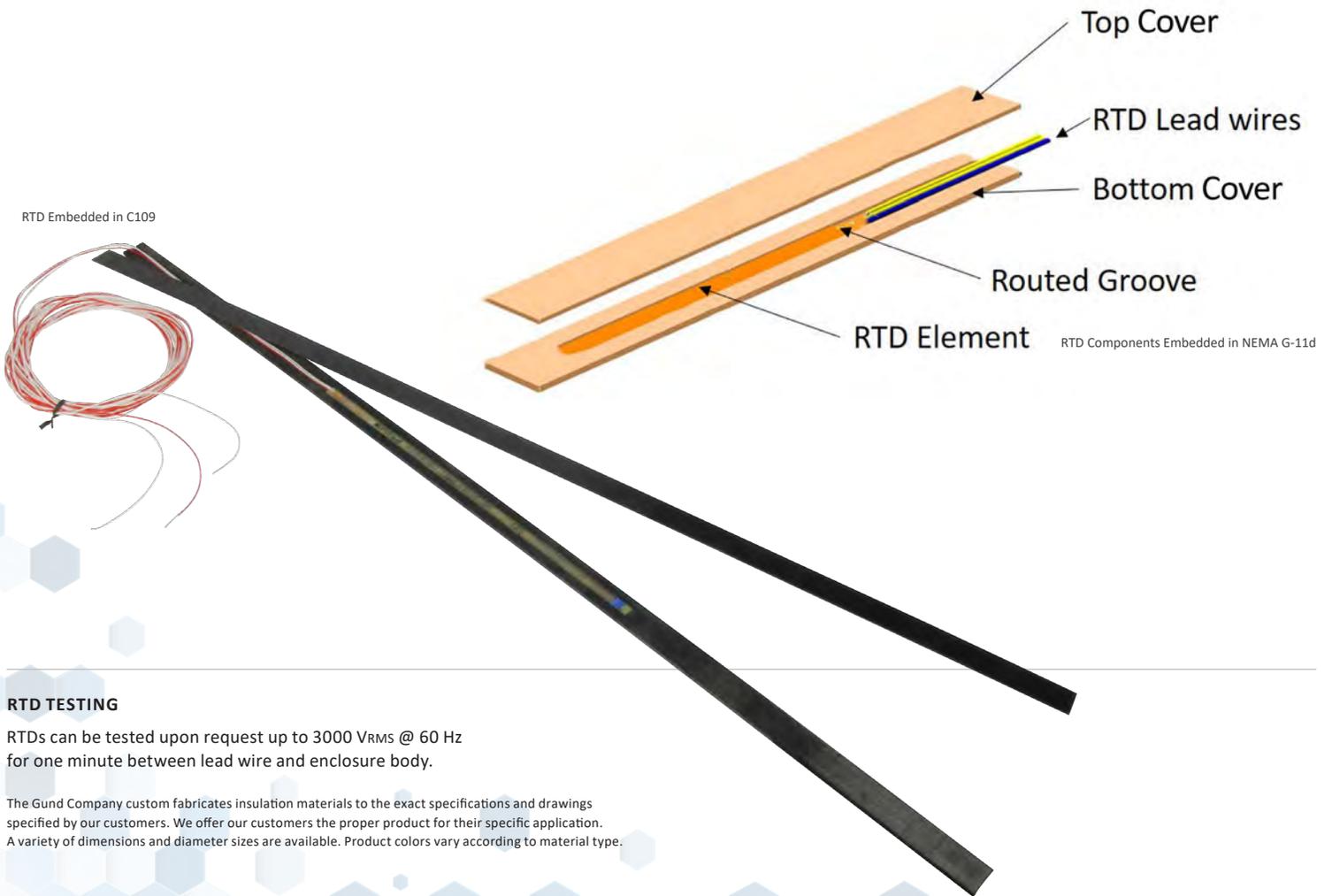
## Stator RTDs

### Resistance Temperature Detectors Enclosure Types

#### RTD EMBEDDING MATERIALS

RTDs can be embedded in either NEMA G-11 or The Gund Company's semi-conductive materials up to 109 inches for installation into the stator of your application. NEMA G-11 provides mechanical protection for the RTD during the installation phase and protects the RTD throughout its life span. The semi-conductive material offers the same mechanical protection with the added benefit of corona dissipation.

#### G-11 AND SEMI-CONDUCTIVE RIGID ENCLOSURE ELEMENTS



#### RTD TESTING

RTDs can be tested upon request up to 3000 V<sub>RMS</sub> @ 60 Hz for one minute between lead wire and enclosure body.

The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type.

The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

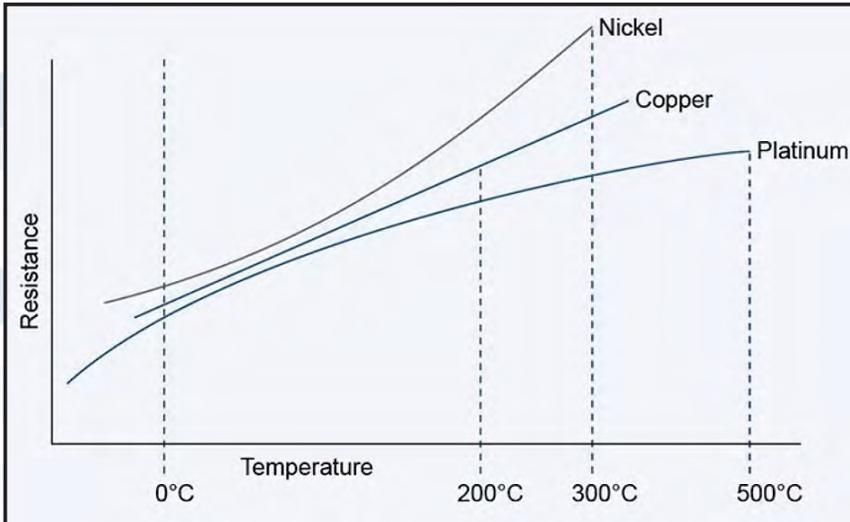
## GTH - Resistance Temperature Detectors (RTDs)

The Gund Company's embedded RTD sensors for turbo and hydro generators are used as part of the long-time industry accepted practice, allowing for continuous assessment of equipment condition. The GTH - Resistance Temperature Detectors (RTDs) are placed in the stator winding slots. The RTDs are produced and tested per the IEC 60751.

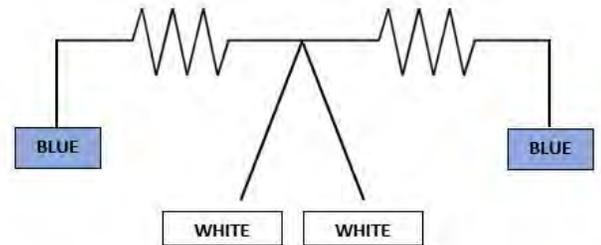
The longer length of the GTH-RTD sensors element designs allows for averaging the measurement process over a greater portion of the slot length. This eliminates the problems related to tip sensitive sensors that can be misleading when 'hot spots' are present. Since stator RTD sensors sometimes exceed 20 inches in body length, this is a useful characteristic the RTD brings to monitoring the health of your generator.

Part ID	Dimensions	Rating	Element	Resistance	Number of Elements	Lead Wire Length	Number of Wires	Lead Wire Gauge	Lead Wire Coating
RTD2A4570.76213.46P412395222RT	18"L x 0.530W x 0.030T	Class H	Platinum	100 $\Omega$ $\pm$ 0.5% @ 0C	2	40 ft	4	22 AWG	PTFE/ Shielded

Element Type	Base Resistance	TCR (Ohm/Ohm/C)
Platinum	100	0.00385
Nickel	120	0.00672
Copper	10	0.00427



RTD Resistance versus Temperature



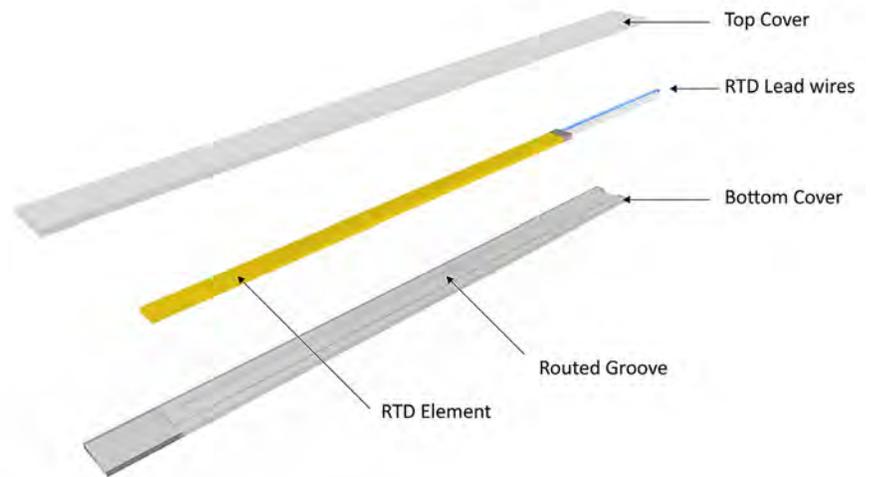


# THE GUND COMPANY

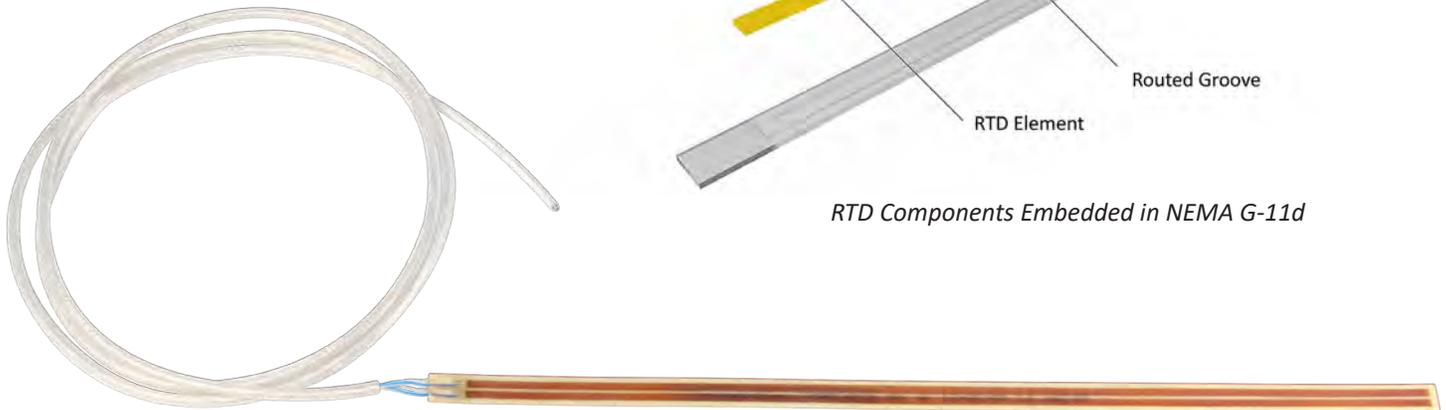
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## GTH - Resistance Temperature Detectors (RTDs)

Enclosure types include G-11 and Semi-Conductive rigid enclosure of the elements.



RTD Components Embedded in NEMA G-11d



### RTD Embedding Materials

The RTD can be embedded in either NEMA G-11 or The Gund Company's Semi-Conductive materials up to 109 inches for installation into the stator of your application. NEMA G-11 provides a mechanical protection for the RTD during the installation phase and protects the RTD throughout its life span. The Semi-Conductive material provides the same mechanical protection with the added benefit of corona dissipation.

### RTD Testing

RTDs can be tested upon request up-to 3000 V<sub>RMS</sub> @60Hz for 1 minute between lead wire and enclosure body.

Data supplied above are typical values and are not to be considered specification values. All of the information, suggestions and recommendations pertaining to the properties and uses of the products herein are based upon tests and data believed to be accurate; however, the final determination regarding suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty, expressed or implied, including, without limitation warranty of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

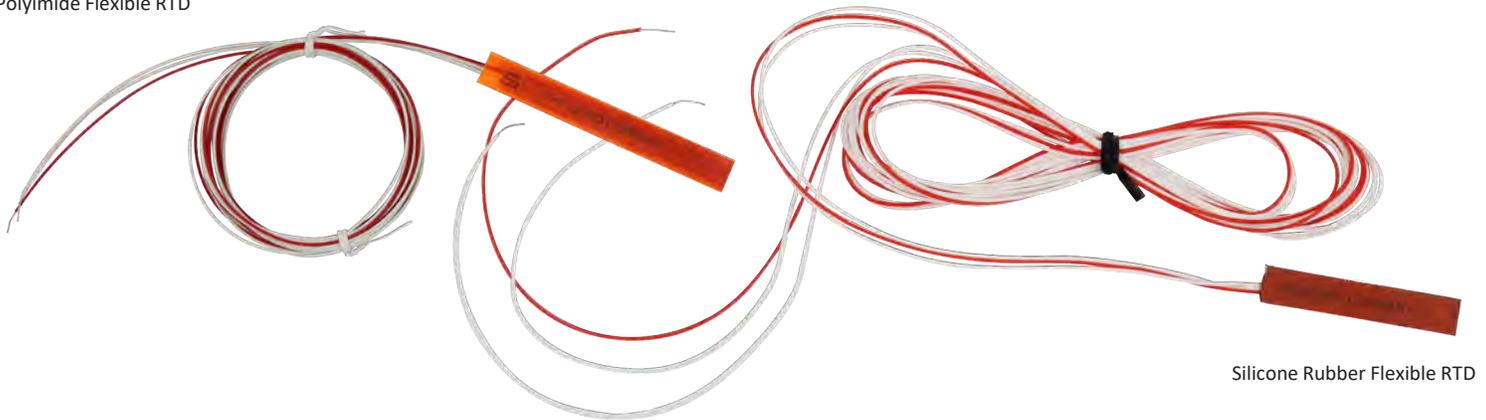
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Flexible Resistance Temperature Detectors (RTDs) Polyimide or Silicone Rubber

Embedded temperature monitoring of motors and generators is an industry-accepted practice that allows for continuous equipment condition assessment. Typically, this is done with RTD embedded in the stator windings or bearing. For some applications, the surface temperature needs to be monitored to measure the overall health of the motor or generator.

The Gund Company produces a flexible RTD in either Polyimide or Silicone Rubber that meets or exceeds industry standards.

Polyimide Flexible RTD



Silicone Rubber Flexible RTD

THE GUND COMPANY		Dimensions	Coating	Rating	Resistance	Element	Number of Elements	Wires	Gauge (Lead Wire)	Length (Lead Wire)	Coating (Lead Wire)
PART ID	RTDFA31.750.76212.7C3457226PFT	1.20" x 0.50" x 0.03"	Silicon	Class H	10 Ohm ±0.5% @ 0°C	Copper	1	3	26 AWG	15 ft.	PTFE
	RTDFA31.750.76212.7P3457226PFT	1.20" x 0.50" x 0.03"	Silicon	Class H	100 Ohm ±0.5% @ 0°C	Platinum	1	3	26 AWG	15 ft.	PTFE
	RTDFA511.659.5C3243826PTT	2.00" x 0.375" x 0.125"	Polyimide	Class H	10 Ohm ±0.5% @ 0°C	Copper	1	3	26 AWG	15 ft.	PTFE
	RTDFA511.659.5N3243826PTT	2.00" x 0.375" x 0.125"	Polyimide	Class H	120 Ohm ±0.5% @ 0°C	Nickel	1	3	26 AWG	15 ft.	PTFE
	RTDFA511.659.5P3243826PTT	2.00" x 0.375" x 0.125"	Polyimide	Class H	100 Ohm ±0.5% @ 0°C	Platinum	1	3	26 AWG	15 ft.	PTFE

The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type.



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Flexible Resistance Temperature Detectors (RTDs) Installation Tips

Flexible RTDs lend themselves to a variety of installation methods. Avoid repeated bending during the installation process. Flexible RTDs will bend in use, but should be installed carefully to avoid excess stress.

Secure lead wires so they do not pull against sensor bodies. Lead wires should be routed along the sensed surface a short distance so that they do not sink heat away from the sensing element. Listed below are some standard installation methods.

### PRESSURE-SENSITIVE ADHESIVE (PSA)

PSA is the simplest mounting method, but it is restricted to flat surfaces and temperatures below 177°C (350°F). During installation, PSA is usually applied to the mounting surface of the Flexible RTD. TGC does not offer this product (yet) but it can be acquired from your local industrial distributor.

### #20 STRETCH TAPE

Use high-temperature silicone rubber tape for mounting to pipes or other cylinders (shown above). Tape typically comes in one-inch wide rolls and six or 36 feet long. This product is available at any industrial distributor.

### #6 RTV CEMENT

Use room-temperature, vulcanizing cement to mount silicone rubber Flexible RTDs to flat or curved surfaces. This product is available at any industrial distributor.

**IT IS NOT RECOMMENDED to put RTDs between windings or under tie cords at the end of winding bundles.  
This installation method adds stress to the element and may break the element wire - causing the RTD to fail at installation.**

### FLEXIBLE RTDS FOR PIPE SENSING

Flexible RTDs make a practical, economical alternative to traditional immersed sensors for sensing fluid temperatures in pipes or tanks. They mount directly on pipe surfaces, so there is no need to tap and drain systems to install thermowells. If the Flexible RTD is installed correctly, tests show that the thermal response is as quick and accurate as traditional invasive sensors. We suggest using either #20 Stretch Tape or #6 RTC Cement (noted above).

The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type.

The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

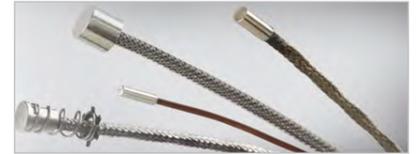
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Embeddable Bearing Sensors

### Single and Dual Element Bearing RTD Sensors



Embeddable bearing sensors are designed for areas with limitations on size and space. Typically, RTDs (Resistance Temperature Detectors) or thermocouples are installed within the bearing housing to monitor the bearing's temperature. These sensors provide a direct measurement of the bearing's temperature allowing for early detection of potential issues such as overheating, which can lead to bearing failure. Early potential failure detection allows for timely maintenance and prevents costly downtime. These sensors are small and compact, allowing for installation in tight spaces within the bearing housing.



#### EMBEDDED BEARING APPLICATIONS

- Motor Bearings
- Motor Windings
- Shafts
- Thrust bearings and plates
- Small areas requiring temperature sensing



#### TECHNICAL CAPABILITIES OF EMBEDDED BEARING RTDS AND THERMOCOUPLES

- RTD Platinum and Nickel elements of 100, 120, and 1000 ohms
- T/C Type E, J, K, and T
- Case material stainless steel and tin-plated copper alloys
- Wiring configuration based on Single or Dual elements
- Class A and Class B accuracy for RTDs
- Cables are stranded copper with PTFE insulation, optional stainless-steel shielding, and oil-resistant overcoating
- Insulation resistances of up to 10 megaohm at 100 Vdc from case to leads
- Optional calibration testing is provided at additional cost



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Embeddable Bearing Sensors

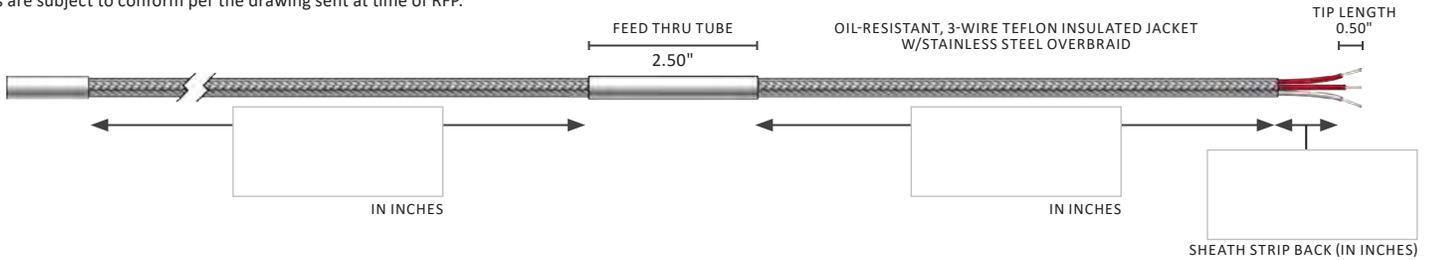
### Single and Dual Element Bearing RTD Sensors



LEAD WIRE SIZE (AWG)	2-Leads	3-Leads	4-Leads	6-Leads
Case Style A	24	24	24	24
Case Style B	24	24	28	28
Case Style C	24	26	30	30
Case Style D	30	30	34	NA

### BEARING SENSOR EXAMPLE

All parts are subject to conform per the drawing sent at time of RFP.



### CONFIGURATION ORDER CHART

Fill in the boxes with the corresponding codes per your requirements.

CASE STYLE	SENSOR (RTD or Thermocouple)	JUNCTION TYPE	SENSOR CONFIGURATION	WIRE GAUGE	COVERING	LEAD WIRE LENGTH
AC - Case A	P - Platinum RTD (100 Ohm)	X = RTD	S3 = Single, 3-Wire RTD	24 AWG*	SS = Stainless Steel (Overbraid Shielding)	In inches (Ex. 20.5)
BC - Case B			S4 = Single, 4-Wire RTD	26 AWG	Oil = Oil Resistant Wire	
CC - Case C	N - Nickel RTD (120 Ohm)		D2 = Dual, 2-Wire RTD	30 AWG	NO = None	
DC - Case D (RTD only)	P1 - Platinum RTD (1,000 Ohm)		D3 = Dual, 3-Wire RTD (not for Case D)			

\*T/C Sensors only use 24 AWG

### CASE SIZES

	Case A	Case B	Case C	Case D
<b>DIAM.</b>	0.275" (7.0 mm)	0.188" (4.8 mm)	0.125" (3.2 mm)	0.080" (2.0 mm)
<b>LENGTH</b>	0.250" (6.4 mm)	0.250" (6.4 mm)	0.300" (7.6 mm)	0.300" (7.6 mm)

### ADDITIONAL PARTS CONFIGURATION ORDER CHART

TYPE	Size	Your Requirements
Feed thru Length*	0.188" 0.215" 0.250" 0.375"	
Spring/Washer*	Small - 0.136" ID Large - 0.175" ID	

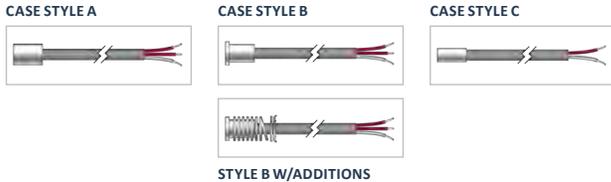
\*All orders ship with the (1) 2.5" Feed Thru Length and (2) small Spring/Washer size unless specified otherwise



# THE GUND COMPANY

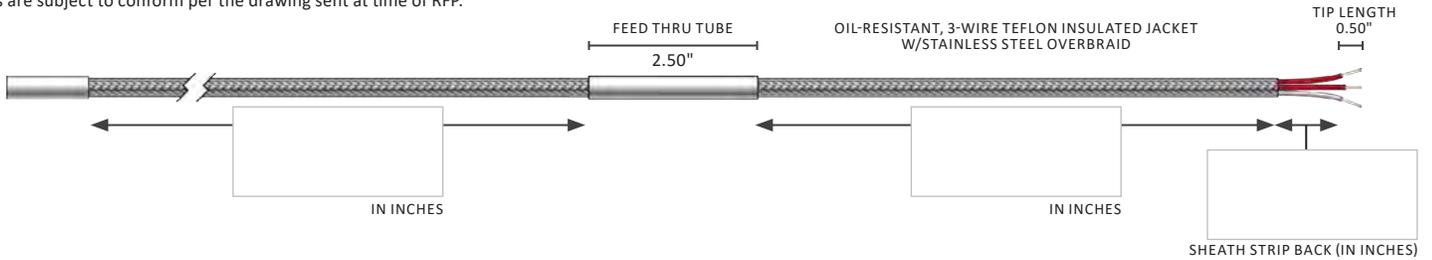
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Embeddable Bearing Sensors Single and Dual Element Bearing T/C Sensors



### BEARING SENSOR EXAMPLE

All parts are subject to conform per the drawing sent at time of RFP.



### CONFIGURATION ORDER CHART

Fill in the boxes with the corresponding codes per your requirements.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
CASE STYLE	SENSOR (RTD or Thermocouple)	JUNCTION TYPE	SENSOR CONFIGURATION	WIRE GAUGE	COVERING	LEAD WIRE LENGTH
AC - Case A	E - T/C Type E	G = Grounded (T/C only)	1TC = 1 Thermal Couple	24 AWG*	SS = Stainless Steel (Overbraid Shielding)	In inches (Ex. 20.5)
BC - Case B	J - T/C Type J	U = Ungrounded (T/C only)	2TC = 2 Thermal Couples		Oil = Oil Resistant Wire	
CC - Case C	K - T/C Type K				NO = None	
	T - T/C Type T					

\*T/C Sensors only use 24 AWG

### CASE SIZES

	Case A	Case B	Case C	Case D
DIAM.	0.275" (7.0 mm)	0.188" (4.8 mm)	0.125" (3.2 mm)	0.080" (2.0 mm)
LENGTH	0.250" (6.4 mm)	0.250" (6.4 mm)	0.300" (7.6 mm)	0.300" (7.6 mm)

### ADDITIONAL PARTS CONFIGURATION ORDER CHART

TYPE	Size	Your Requirements
Feed thru Length*	0.188"	<input type="text"/>
	0.215"	
	0.250"	
	0.375"	
Spring/Washer*	Small - 0.136" ID	<input type="text"/>
	Large - 0.175" ID	

\*All orders ship with the (1) 2.5" Feed Thru Length and (2) small Spring/Washer size unless specified otherwise



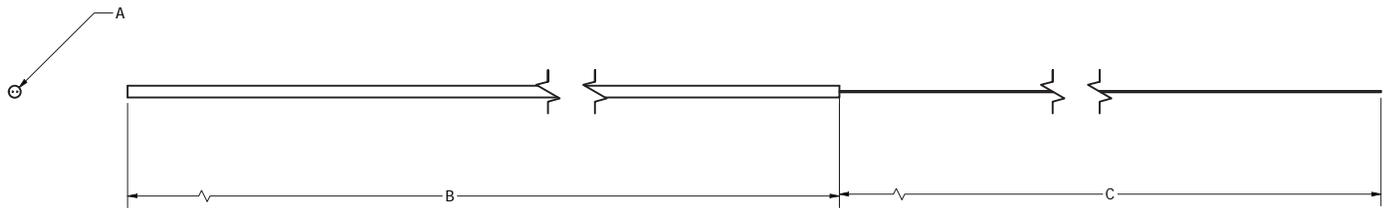
# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Bearing Resistance Temperature Detectors (RTDs)

### ISOLATED Single Element Bearing RTD Probes

THE GUND COMPANY	Probe Dia. (A)	Probe Dia. (B)	Wire Lgth. (C)	Wire Gauge	Element Type	Tube Material	Tip Material	
PART ID	RTDBPPu360.18822963G11Cu	0.188"	36"	96"	22	Platinum	G-11	Cu
	RTDBPPu360.21522963G11Cu	0.215"	36"	96"	22	Platinum	G-11	Cu
	RTDBPPu360.25022963G11Cu	0.250"	36"	96"	22	Platinum	G-11	Cu
	RTDBPPu360.1882296316SSCu	0.188"	36"	96"	22	Platinum	SS	Cu
	RTDBPPu360.2152296316SSCu	0.215"	36"	96"	22	Platinum	SS	Cu
	RTDBPPu360.2502296316SSCu	0.250"	36"	96"	22	Platinum	SS	Cu
	RTDBPCu360.18822963G11Cu	0.188"	36"	96"	22	Copper	G-11	Cu
	RTDBPCu360.21522963G11Cu	0.215"	36"	96"	22	Copper	G-11	Cu
	RTDBPCu360.25022963G11Cu	0.250"	36"	96"	22	Copper	G-11	Cu
	RTDBPCu360.1882296316SSCu	0.188"	36"	96"	22	Copper	SS	Cu
	RTDBPCu360.2152296316SSCu	0.215"	36"	96"	22	Copper	SS	Cu
	RTDBPCu360.2502296316SSCu	0.250"	36"	96"	22	Copper	SS	Cu



WIRE COLOR CODE	Color	Quantity
Three-Wire	White	2
	Red	1



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

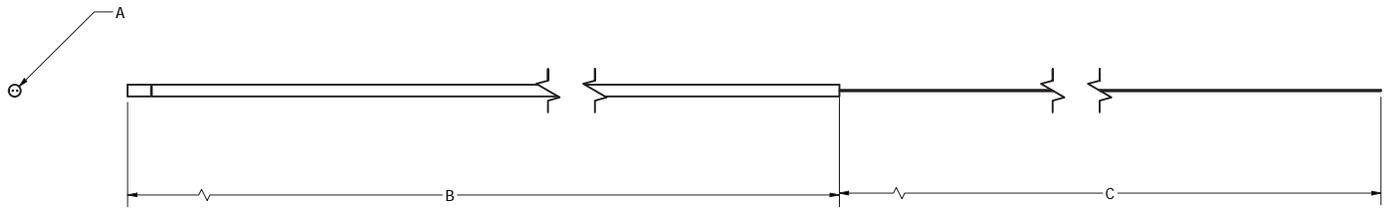


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Bearing Resistance Temperature Detectors (RTDs) UNISOLATED Single Element Bearing RTD Probes

THE GUND COMPANY	Probe Dia. (A)	Probe Dia. (B)	Wire Lgth. (C)	Wire Gauge (AWG)	Element Type	Tube Material	Tip Material	
PART ID	RTDBPPu240.1882236316SSCu-U	0.188"	24"	36"	22	Platinum	SS	Cu
	RTDBPPu240.2152236316SSCu-U	0.215"	24"	36"	22	Platinum	SS	Cu
	RTDBPPu240.2502236316SSCu-U	0.250"	24"	36"	22	Platinum	SS	Cu
	RTDBPCu240.1882236316SSCu-U	0.188"	24"	36"	22	Copper	SS	Cu
	RTDBPCu240.2152236316SSCu-U	0.215"	24"	36"	22	Copper	SS	Cu
	RTDBPCu240.2502236316SSCu-U	0.250"	24"	36"	22	Copper	SS	Cu



WIRE COLOR CODE	Color	Quantity
Three-Wire	White	2
	Red	1



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

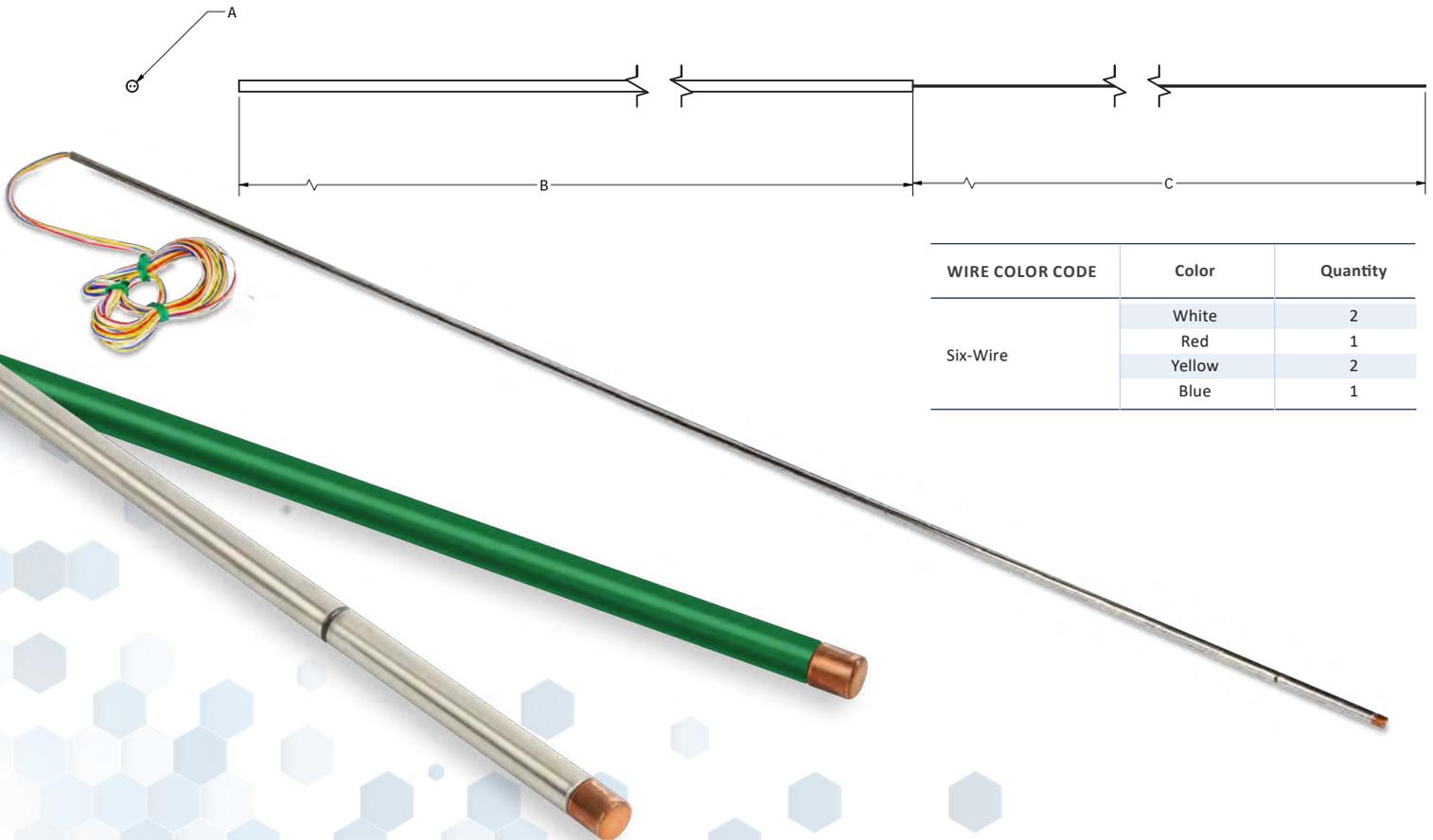


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Bearing Resistance Temperature Detectors (RTDs) ISOLATED Dual Element Bearing RTD Probes

THE GUND COMPANY	Probe Dia. (A)	Probe Dia. (B)	Wire Lgth. (C)	Wire Gauge	Element Type	Tube Material	Tip Material	
PART ID	RTD2BPPu360.18826966G11Cu	0.188"	36"	96"	26	Platinum	G-11	Cu
	RTD2BPPu360.21526966G11Cu	0.215"	36"	96"	26	Platinum	G-11	Cu
	RTD2BPPu360.25022966G11Cu	0.250"	36"	96"	22	Platinum	G-11	Cu
	RTD2BPPu360.18826966316SSCu	0.188"	36"	96"	26	Platinum	SS	Cu
	RTD2BPPu360.21526966316SSCu	0.215"	36"	96"	26	Platinum	SS	Cu
	RTD2BPPu360.25022966316SSCu	0.250"	36"	96"	22	Platinum	SS	Cu
	RTD2BPCu360.18826966G11Cu	0.188"	36"	96"	26	Copper	G-11	Cu
	RTD2BPCu360.21526966G11Cu	0.215"	36"	96"	26	Copper	G-11	Cu
	RTD2BPCu360.25022966G11Cu	0.250"	36"	96"	22	Copper	G-11	Cu
	RTD2BPCu360.18826966316SSCu	0.188"	36"	96"	26	Copper	SS	Cu
	RTD2BPCu360.21526966316SSCu	0.215"	36"	96"	26	Copper	SS	Cu
	RTD2BPCu360.25022966316SSCu	0.250"	36"	96"	22	Copper	SS	Cu



WIRE COLOR CODE	Color	Quantity
Six-Wire	White	2
	Red	1
	Yellow	2
	Blue	1

The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

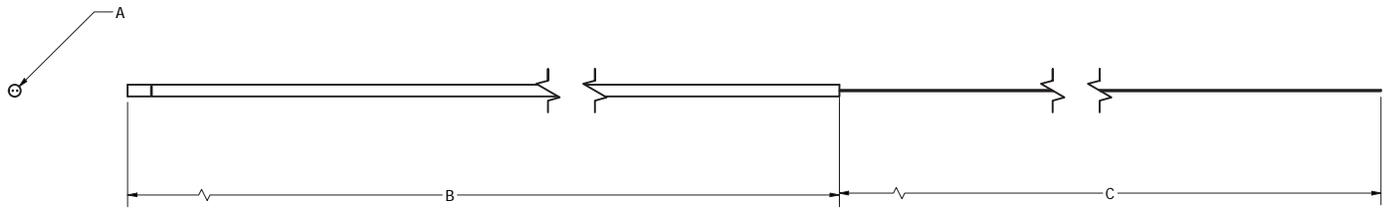


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Bearing Resistance Temperature Detectors (RTDs) UNISOLATED Dual Element Bearing RTD Probes

THE GUND COMPANY	Probe Dia. (A)	Probe Dia. (B)	Wire Lgth. (C)	Wire Gauge (AWG)	Element Type	Tube Material	Tip Material	
PART ID	RTD2BPPu240.18826366316SSCu-U	0.188"	24"	36"	26	Platinum	SS	Cu
	RTD2BPPu240.21526366316SSCu-U	0.215"	24"	36"	26	Platinum	SS	Cu
	RTD2BPPu240.25026366316SSCu-U	0.250"	24"	36"	26	Platinum	SS	Cu
	RTD2BPCu240.18826366316SSCu-U	0.188"	24"	36"	26	Copper	SS	Cu
	RTD2BPCu240.21526366316SSCu-U	0.215"	24"	36"	26	Copper	SS	Cu
	RTD2BPCu240.25026366316SSCu-U	0.250"	24"	36"	26	Copper	SS	Cu



WIRE COLOR CODE	Color	Quantity
Six-Wire	White	2
	Red	1
	Yellow	2
	Blue	1



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

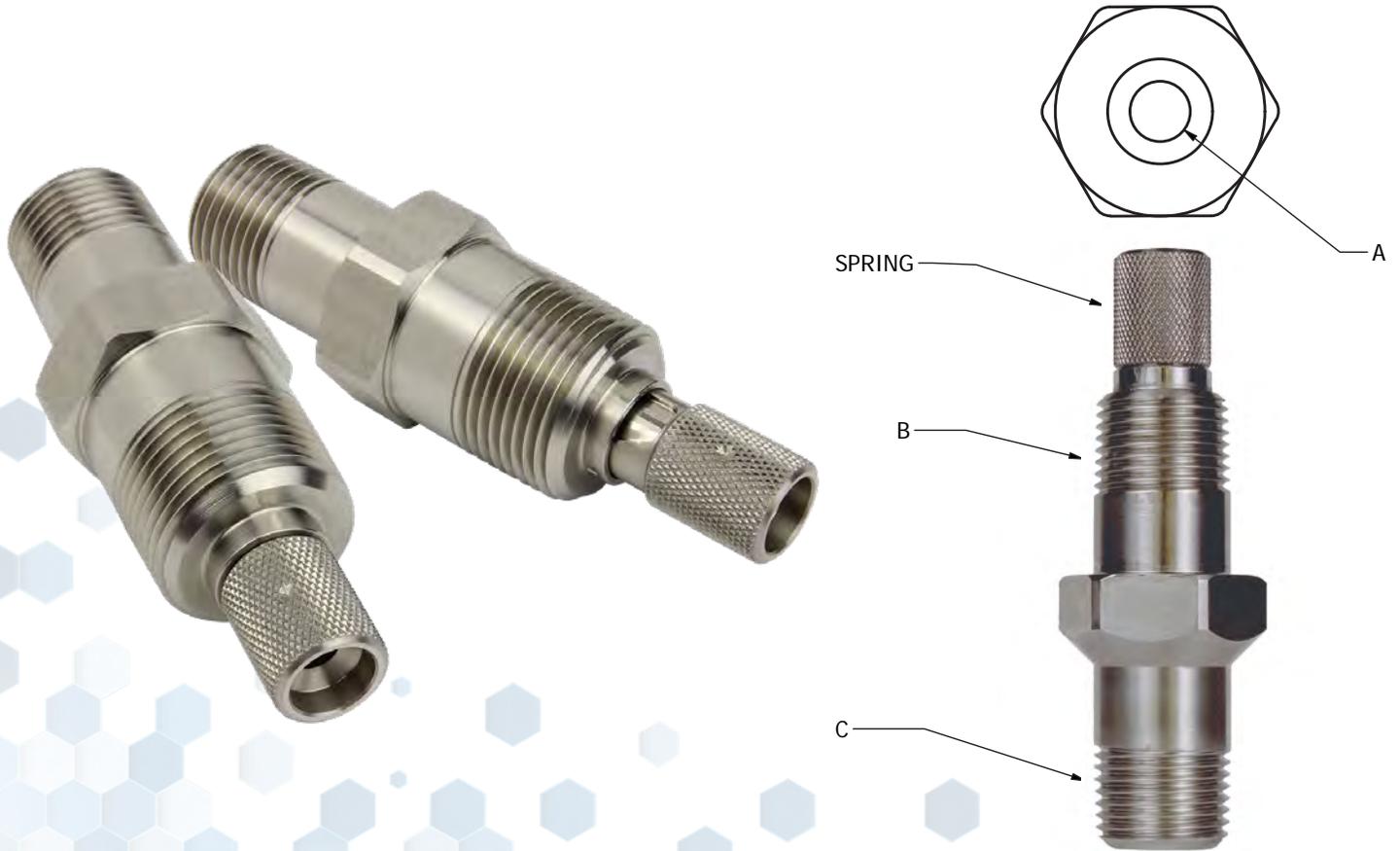


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Bearing Resistance Temperature Detectors (RTDs) RTD Probe Holder

THE GUND COMPANY	Style	Probe Diameter (A)	Connection Head Thread (B)	Process Thread (C)	Material	
PART ID	RTDPH.188.500.500SSS	Probe Holder With Spring	0.188"	0.50" - 14 NPT Male	0.50" - 14 NPT Male	Stainless Steel
	RTDPH.188.500.750SSS	Probe Holder With Spring	0.188"	0.50" - 14 NPT Male	0.75" - 14 NPT Male	Stainless Steel
	RTDPH.188.750.500SSS	Probe Holder With Spring	0.188"	0.75" - 14 NPT Male	0.50" - 14 NPT Male	Stainless Steel
	RTDPH.188.750.750SSS	Probe Holder With Spring	0.188"	0.75" - 14 NPT Male	0.75" - 14 NPT Male	Stainless Steel
	RTDPH.215.500.500SSS	Probe Holder With Spring	0.215"	0.50" - 14 NPT Male	0.50" - 14 NPT Male	Stainless Steel
	RTDPH.215.500.750SSS	Probe Holder With Spring	0.215"	0.50" - 14 NPT Male	0.75" - 14 NPT Male	Stainless Steel
	RTDPH.215.750.500SSS	Probe Holder With Spring	0.215"	0.75" - 14 NPT Male	0.50" - 14 NPT Male	Stainless Steel
	RTDPH.215.750.750SSS	Probe Holder With Spring	0.215"	0.75" - 14 NPT Male	0.75" - 14 NPT Male	Stainless Steel
	RTDPH.250.500.500SSS	Probe Holder With Spring	0.250"	0.50" - 14 NPT Male	0.50" - 14 NPT Male	Stainless Steel
	RTDPH.250.500.750SSS	Probe Holder With Spring	0.250"	0.50" - 14 NPT Male	0.75" - 14 NPT Male	Stainless Steel
	RTDPH.250.750.500SSS	Probe Holder With Spring	0.250"	0.75" - 14 NPT Male	0.50" - 14 NPT Male	Stainless Steel
	RTDPH.250.750.750SSS	Probe Holder With Spring	0.250"	0.75" - 14 NPT Male	0.75" - 14 NPT Male	Stainless Steel



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



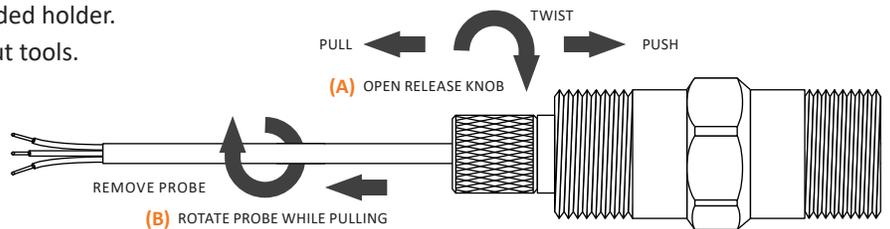
# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## RTD Spring-Loaded Sensor Assemblies Installation Instructions

### 1. REMOVE THE CONNECTION HEAD

- Unscrew the connection head from the spring-loaded holder.
- It should be hand-tight and easy to remove without tools.



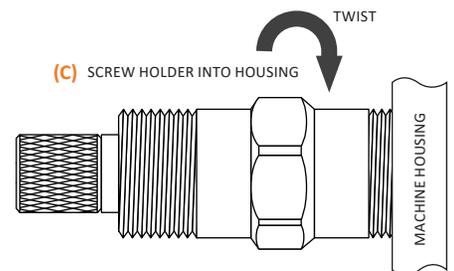
### 2. OPEN THE RELEASE KNOB

- Grasp the release knob, pull it outward, and twist it about ½ turn clockwise until it stops (A).
- Push it inward to lock it in the open position (A).
- If a probe is already installed, remove it by gently rotating the probe case clockwise while pulling it out (B).

**CAUTION: DO NOT PULL ON THE PROBE'S LEAD WIRES.**

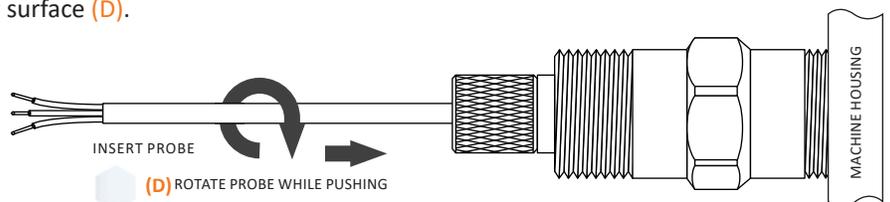
### 3. INSTALL THE HOLDER INTO THE HOUSING

- Apply Teflon tape or thread sealant to the process thread of the spring-loaded holder.
- Thread the holder into the female fitting of the machine housing, bearing block, thermowell, or other appropriate location (C).
- Tighten securely using an open-end or adjustable wrench.



### 4. INSERT THE PROBE

- Insert the probe tip-first through the hole in the release knob.
- Slowly rotate the probe clockwise while gently pushing it through the holder and O-ring seal until it contacts the sensing surface (D).



**TIP: IF THE PROBE DOESN'T SLIDE PAST THE O-RING EASILY, APPLY A SMALL AMOUNT OF SILICONE OIL TO THE PROBE TIP.**

**CAUTION: DO NOT INSERT THE PROBE WHILE THE RELEASE KNOB IS IN THE CLOSED POSITION.**



# THE GUND COMPANY

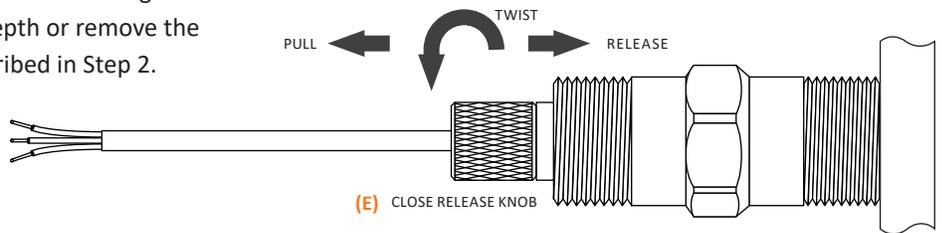
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## RTD Spring-Loaded Sensor Assemblies

### Installation Instructions (continued)

#### 5. CLOSE THE RELEASE KNOB

- Firmly grasp the release knob, pull it outward, and rotate it approximately half a turn counter-clockwise until it reaches the stop (E).
- Then release it. The knob will retract inward by about 1/8", locking in place and applying spring force to press the probe against the sensing surface.
- After installation, you can adjust the probe depth or remove the probe by reopening the release knob as described in Step 2.



**NOTE: IF THE PROBE IS NOT IN CONTACT WITH A SURFACE, THE KNOB WILL RETRACT FULLY—APPROXIMATELY 1/4".**

#### 6. ATTACH THE CONNECTION HEAD

- Screw the connection head onto the back of the spring-loaded holder and tighten securely.



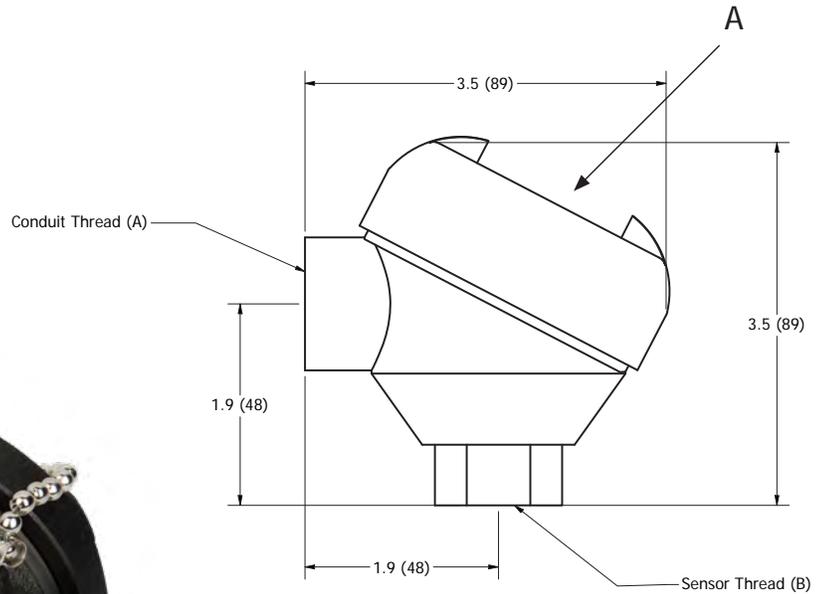
# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Resistance Temperature Detector (RTD) RTD Connection Head (Epoxy Coated Cast Iron)

THE GUND COMPANY	Style	Size (L x H)	Conduit Thread (A)	Conduit Thread (B)	Material	
<b>PART ID</b>	RTDCH3.500.500.750NIFE*	Connection Head	3.50"	0.50"	0.75"	Epoxy Coated Cast Iron
	RTDCH3.500.750.750NIFE	Connection Head	3.50"	0.75"	0.75"	Epoxy Coated Cast Iron
	RTDCH3.500.500.500NIFE	Connection Head	3.50"	0.50"	0.50"	Epoxy Coated Cast Iron
	RTDCH3.500.750.500NIFE	Connection Head	3.50"	0.75"	0.50"	Epoxy Coated Cast Iron

\* DISCONTINUED PART | Purchase option to achieve the same configuration: RTDCH3.500.750.750NIFE + RTDCHADAPT.



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

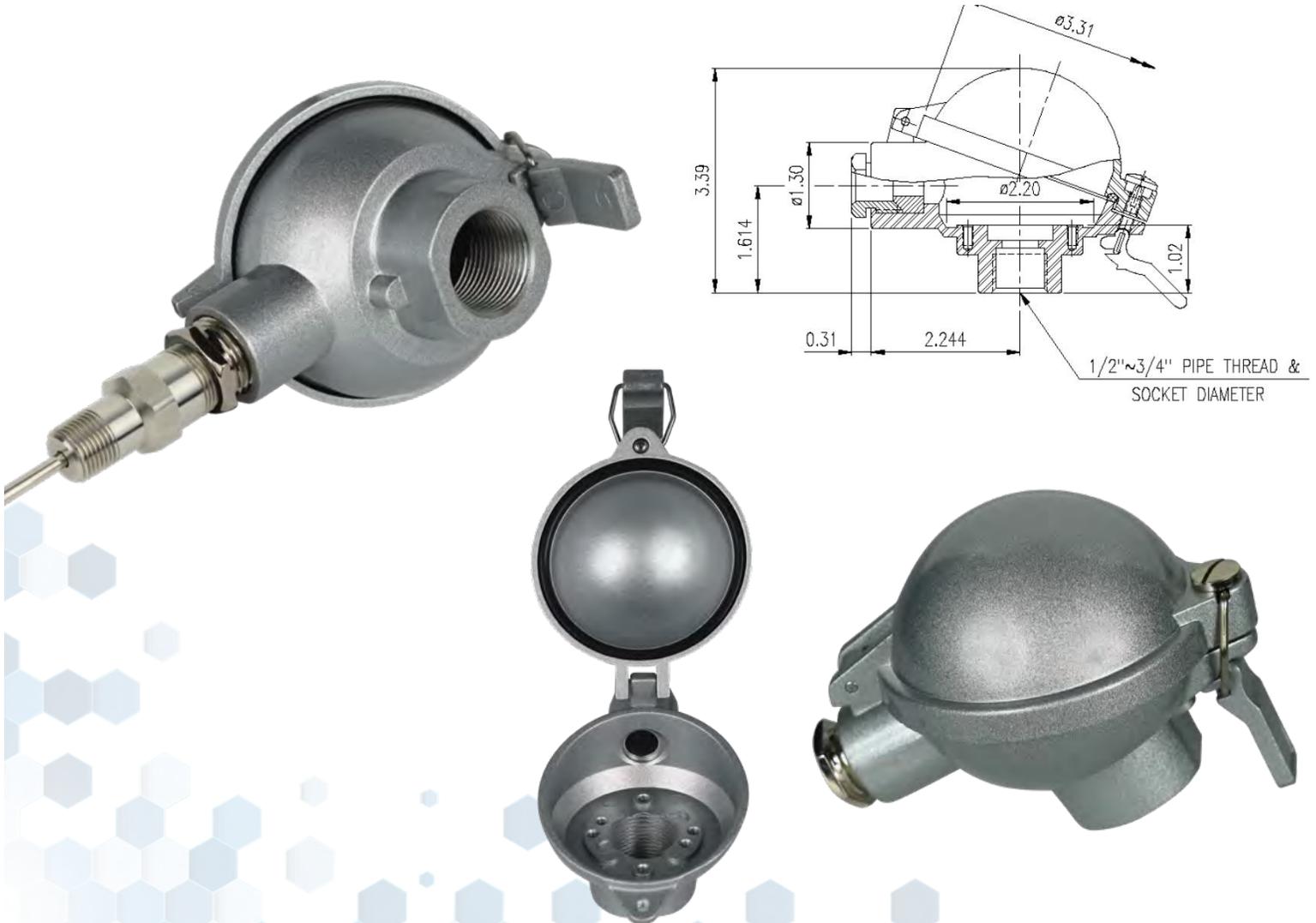


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Resistance Temperature Detector (RTD) RTD Connection Head (Cast Aluminum)

THE GUND COMPANY		Style	Size (L x H)	Conduit Thread (A)	Conduit Thread (B)	Material
PART ID	RTDCH3.300.500.750ALH	Flip Top Conn. Head	3.10"	0.50"	0.50"	Cast Aluminum
	RTDCH3.300.750.750ALH	Flip Top Conn. Head	3.10"	0.50"	0.75"	Cast Aluminum



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

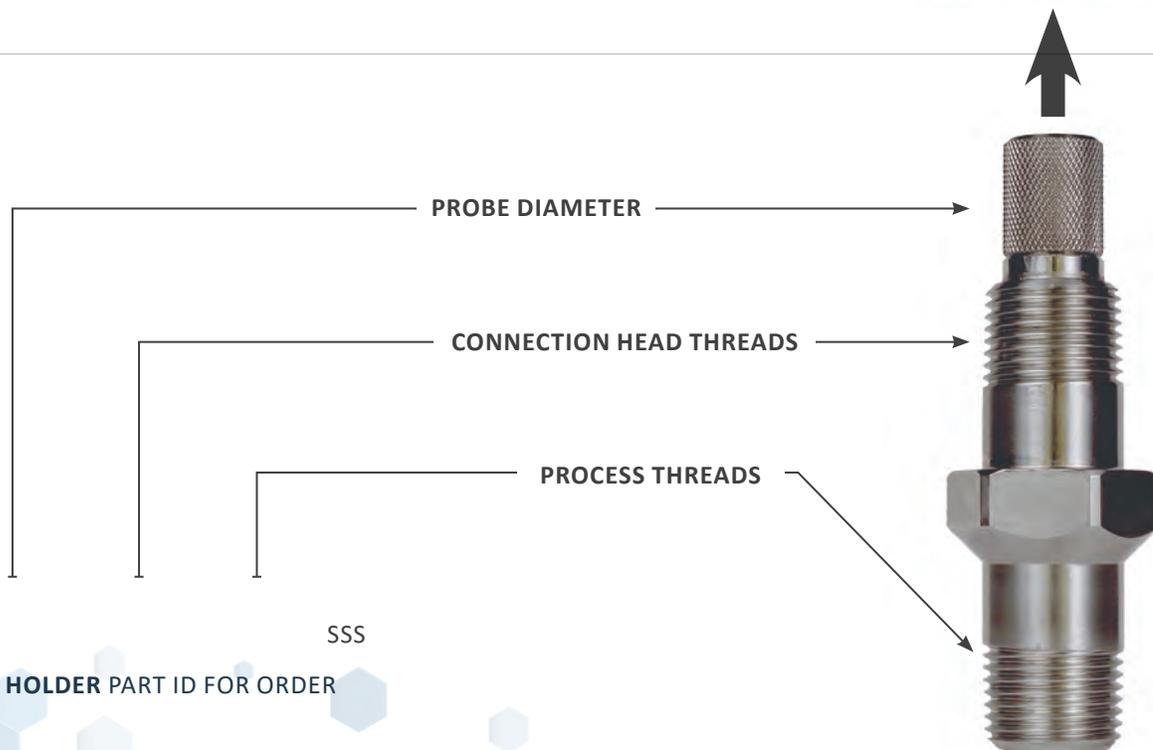


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Resistance Temperature Detector (RTD)

### RTD Connection Head and Probe Holder



The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type.

The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.

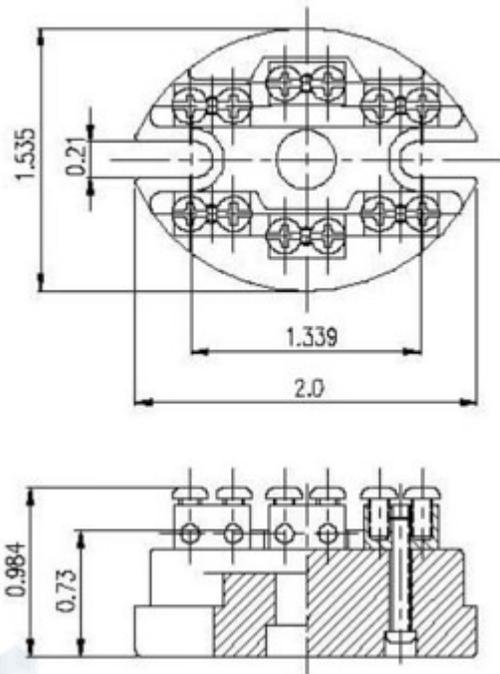


# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Resistance Temperature Detector (RTD) RTD Terminal Block

THE GUND COMPANY	Style	Size (L x W)	Material
RTDTERMINALBK6	Terminal Block	2.00" x 1.55"	92% Al203
<b>PART ID</b>			



The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



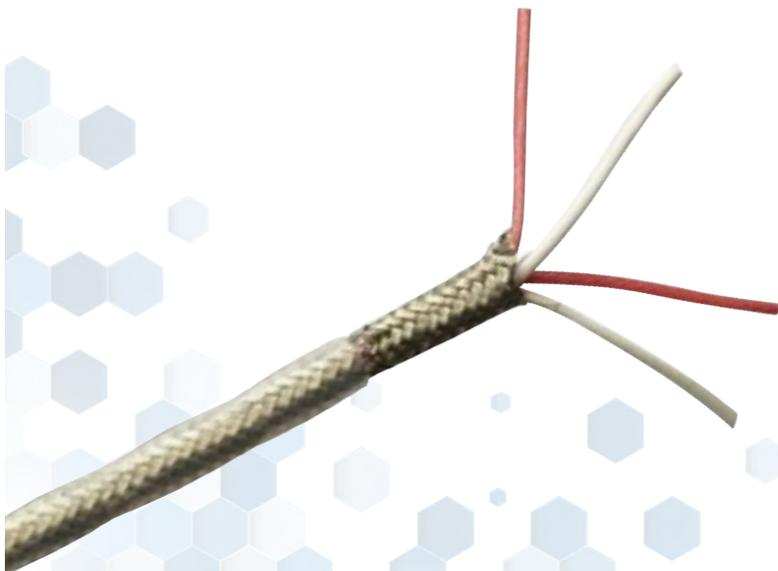
# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## RTD Shielded Cable

<b>Item:</b>	<b>RTD Shielded Cable</b>			
<b>Description:</b>	A shielded wire using a braided metal sheath over a grouping of 3 to 4 FEP coated stranded copper conductors with a clear FEP coating on the outside of the shielding to allow for visual inspection of the shielding.			
<b>Standards:</b>	AWG Wire size			
<b>Availability:</b>	<b>Core Wires:</b>		AWG	Number of Conductors
		Wire Sizes:	18, 20, 22, 24, 26*, 28	3 or 4
		Wire Coating:	FEP	Red and white color code
	<b>Metal Shielding Spec:</b>	Braided metal shielding coated with clear FEP overcoat. Braiding will be either Stainless Steel, Silver Plated Copper or Tin Plated Copper		

\*Indicated standard AWG utilized.



Data supplied above are typical values and are not to be considered specification values. All of the information, suggestions and recommendations pertaining to the properties and uses of the products herein are based upon tests and data believed to be accurate; however, the final determination regarding suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty, expressed or implied, including, without limitation warranty of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



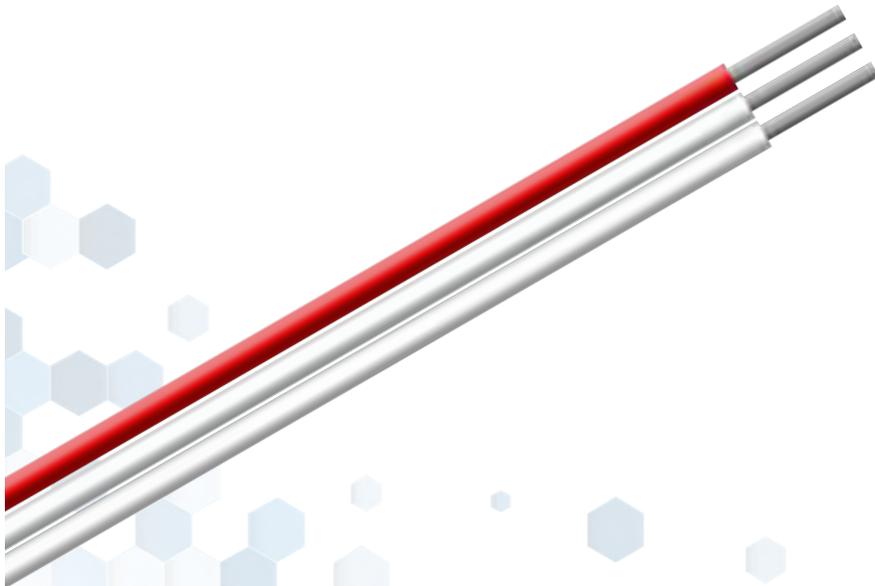
# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## RTD Twisted Cable

<b>Item:</b>	RTD Twisted Cable			
<b>Description:</b>	A twisted wire cable using a grouping of 3 to 4 FEP coated silver plated stranded copper conductors.			
<b>Standards:</b>	AWG wire size			
<b>Availability:</b>	<b>Core Wires:</b>		AWG	Number of Conductors
		Wire Sizes:	18, 20, 22, 24, 26*, 28	3 or 4
	Wire Coating:	FEP	Red and white color code	
	<b>Spool Size:</b>	1000 ft. standard spool size		

\*Indicated standard AWG utilized.



*Data supplied above are typical values and are not to be considered specification values. All of the information, suggestions and recommendations pertaining to the properties and uses of the products herein are based upon tests and data believed to be accurate; however, the final determination regarding suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty, expressed or implied, including, without limitation warranty of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.*



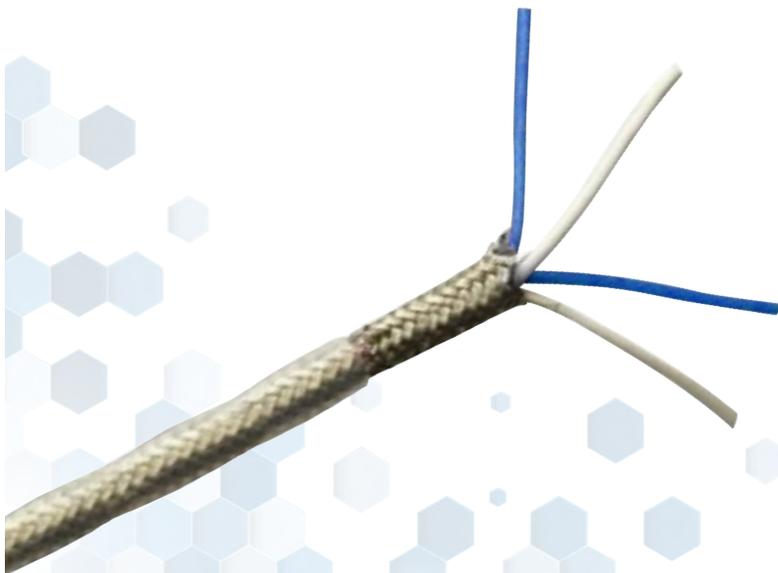
# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## GTH-RTD Shielded Cable

<b>Item:</b>	<b>GTH-RTD Shielded Cable</b>			
<b>Description:</b>	A shielded wire using a braided metal sheath over a grouping of 4 FEP coated tin plated stranded copper conductors with a clear Teflon coating on the outside of the shielding to allow for visual inspection of the shielding.			
<b>Standards:</b>	AWG Wire size, 1000 Ft Spools			
<b>Availability:</b>	<b>Core Wires:</b>		AWG	Number of Conductors
		Wire Sizes:	22*	4
		Wire Coating:	FEP	Blue and White Color code
	<b>Metal Shielding Spec:</b>	Braided metal shielding coated with Clear Teflon overcoat. Braiding Tin Plated Copper		

\*Others available upon request



Data supplied above are typical values and are not to be considered specification values. All of the information, suggestions and recommendations pertaining to the properties and uses of the products herein are based upon tests and data believed to be accurate; however, the final determination regarding suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty, expressed or implied, including, without limitation warranty of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Resistance Temperature Detectors (RTDs) Quote Form

Customer: \_\_\_\_\_ PO Number: \_\_\_\_\_

Ship To Address: \_\_\_\_\_ Date Ordered: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Postal Code: \_\_\_\_\_ Date Required: \_\_\_\_\_

Contact: \_\_\_\_\_ Email Address: \_\_\_\_\_ Phone #: \_\_\_\_\_

### Standard Stock RTDs

- 10" Single Element - (See Specifications Below)  Quantity: \_\_\_\_\_ Platinum  Nickel  Copper
- 12" Dual Element - (See Specifications Below)  Quantity: \_\_\_\_\_
- 18" Dual Element - (See Specifications Below)  Quantity: \_\_\_\_\_

Part ID	Dimensions	Rating	Element	Resistance	Number of Elements	Lead Wire Length	Number of Wires	Lead Wire Gauge	Lead Wire Coating
RTD1A2540.7626.6P3457226PTS	10"L x 0.260"W x 0.030"T	Class H	Platinum	100 Ωm ± 0.5% @ 0C	1	15 ft	3	26 AWG	PTFE
RTD1A2540.7626.6C3457226PTS	10"L x 0.260"W x 0.030"T	Class H	Copper	10 Ωm ± 0.5% @ 0C	1	15 ft	3	26 AWG	PTFE
RTD1A2540.7626.6N3457226PTS	10"L x 0.260"W x 0.030"T	Class H	Nickel	120 Ωm ± 0.5% @ 0C	1	15 ft	3	26 AWG	PTFE
RTD2A3050.76213.5P3457226PTV	12"L x 0.520"W x 0.030"T	Class H	Platinum	100 Ωm ± 0.5% @ 0C	2	15 ft	6	26 AWG	PTFE
RTD2A4570.76213.5P3457226PTV	18"L x 0.520"W x 0.030"T	Class H	Platinum	100 Ωm ± 0.5% @ 0C	2	15 ft	6	26 AWG	PTFE

Note: Standard Stock RTDs are insulation tested at 1kV, resistance tested and hi-pot test to 1.5kV. Additional testing is custom.

### Custom RTD Characteristics

Quantity: \_\_\_\_\_ Number of Elements: Single  Dual

Element Type: Platinum  Nickel  Copper

Resistance Class: A  B  C  Length of Element (mm): \_\_\_\_\_

Thickness of the Element (mm): \_\_\_\_\_ Width of the Element (mm): \_\_\_\_\_

Number of Wires per Element: 2  3  4  Lead Length of Wire (mm): \_\_\_\_\_

Wire Gauge (22 to 28AWG): 22  24  26  28

Lead Wire Insulation: PTFE  Other

Lead Wire Construction: Twisted  Flat  Twisted w/Sheath  Flat w/Sheath  Shield w/Sheath

Testing Required: No  Yes  Yes requires test requirements in detail.

Hi-Pot  Resistance at Multiple Temperatures



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## High Level Overview of IEC 60751

### The international standard defined

IEC 60751 is the international standard that defines the performance, characteristics, and requirements for **industrial platinum resistance thermometers (PRTs)** and **platinum resistance temperature sensors (RTDs)**. These devices measure temperature based on the predictable change in electrical resistance of platinum with temperature.

#### PURPOSE OF THE STANDARD

IEC 60751 establishes consistent rules so platinum RTDs from different manufacturers behave predictably and interchangeably. It covers:

- The **resistance versus temperature relationship** (based on ITS 90)
- **Accuracy/tolerance classes** and allowable deviations
- **Performance and calibration requirements** for industrial use

#### WHAT DEVICES IT APPLIES TO

IEC 60751 applies to the complete platinum RTD/thermometer assembly, which includes:

- The platinum sensing element
- Sheath and insulation materials
- Internal lead wires and terminals
- Connection heads and mounting hardware (if supplied as part of the device)

This is important because since the 2008 and 2022 revisions, the **entire assembled thermometer**, not just the sensing element, must meet accuracy classifications.

#### TEMPERATURE RANGE AND NOMINAL RESISTANCES

The standard supports measurement ranges up to **-200°C to +850°C**, depending on construction. Typical nominal resistances include:

- **Pt100** (100  $\Omega$  at 0°C)
- **Pt500**
- **Pt1000**

with platinum temperature coefficient  $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$ .

#### RESISTANCE TEMPERATURE RELATIONSHIP

Historically, numerical tables were used, but the **2022 revision** makes the **mathematical formula** the official definition of the resistance temperature relationship. Tables are now only for guidance.

#### IN SUMMARY

IEC 60751 ensures that platinum RTDs used across industries are accurate, stable, and interchangeable. It defines the resistance temperature relationship, tolerance classes, environmental performance requirements, and calibration procedures. The 2022 update modernizes the standard by emphasizing formula based temperature conversion and applying accuracy criteria to the full sensor assembly.

#### TOLERANCE CLASSES

The standard defines accuracy using two primary tolerance classes:

CLASS	DEVIATION AT 0°C	APPROX. TEMP ERROR	NOTES
Class A	$\pm 0.06 \Omega$	$\pm 0.15^\circ\text{C}$	Higher precision; not valid for 2 wire configurations
Class B	$\pm 0.12 \Omega$	$\pm 0.3^\circ\text{C}$	Widely used in industrial settings

These tolerances describe the allowable deviation from the ideal RTD curve.

#### PERFORMANCE AND ENVIRONMENTAL REQUIREMENTS

IEC 60751 lays out how an RTD must perform under real industrial conditions, including:

- Insulation resistance
- Thermal response time
- Self heating effects
- Mechanical durability (vibration, pressure, thermal cycling)
- Long term stability and drift limits
- Compatibility with AC and DC measurement systems up to 500 Hz

#### CALIBRATION REQUIREMENTS

The standard specifies acceptable calibration methods such as:

- Comparison with reference standards
- Curve fitting and coefficient calculation
- Interpolation between calibration points

It also defines accuracy, uncertainty, and temperature range requirements for calibration labs.

#### LATEST EDITION (2022)

The current edition, IEC 60751:2022 (Edition 3.0):

- Updates tolerance concepts
- Improves definitions of resistance temperature formulas
- Clarifies test methods and acceptance criteria
- Reinforces applying accuracy to the complete thermometer

Source: IEC 60751 Edition 3.0 2022-01

The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type. Additional data and samples are available on request.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## Defining TCR

### Temperature Coefficient of Resistance

The **Temperature Coefficient of Resistance (TCR)** describes **how much electrical resistance of a material changes per degree of temperature change**. It quantifies the rate at which resistance increases or decreases with temperature.

Formally:

**TCR is the fractional change in resistance per degree Celsius (or Kelvin).**

It is often expressed in **1/°C**, **ppm/°C**, or sometimes as **α** (alpha).

Mathematically (general form):

$$TCR = \frac{R_2 - R_1}{R_1 (T_2 - T_1)}$$

This is often scaled to **ppm/°C** by multiplying by 10<sup>6</sup>.

#### WHAT TCR INDICATES

- **POSITIVE TCR** → resistance **increases** with temperature (typical for metals like platinum, copper, nickel).
- **NEGATIVE TCR** → resistance **decreases** with temperature (common in semiconductors and NTC thermistors).
- **NEAR ZERO TCR** → resistance is very stable with temperature (e.g., manganin, constantan).

#### TCR IN RTDS (E.G., PT100)

For industrial platinum RTDs, TCR is defined as:

$$\alpha = \frac{R_{100} - R_0}{R_0 \cdot 100}$$

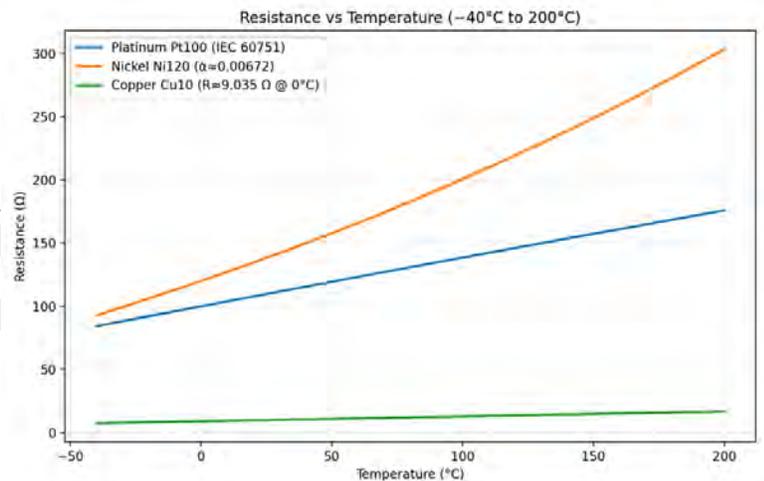
For example, a Pt100 has:

$$\alpha = 0.00385^\circ\text{C}^{-1}$$

which means the resistance increases by 0.385 Ω per °C near 0 °C.

#### SUMMARY TABLE OF TCR

MATERIAL	TYPICAL RTD TYPE	STANDARD TCR (Ω/Ω/°C)
Platinum	Pt100	0.00385
Nickel	Ni120	0.00672
Copper	Cu10	0.00427



The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type. Additional data and samples are available on request.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## How to Properly Measure the Resistance of an RTD

### RTDs are resistant devices

RTDs do not output a voltage like thermocouples, they are resistive devices. To measure temperature accurately, you must measure the **true resistance** of the sensing element while minimizing errors from wiring, excitation current, and the measurement method.

#### HOW AN RTD RESISTANCE MEASUREMENT WORKS

Resistance is not measured directly. A meter or transmitter applies a **precise, known excitation current** through the RTD, then **measures the voltage** drop across it. Using Ohm's law:

$$R = \frac{V}{I}$$

Because the instrument knows the exact current it sources, it can compute the resistance.

This is why stable, low excitation current is critical to avoid **self heating** – where the RTD warms itself due to current flow, corrupting the reading.

#### THE ROLE OF WIRING CONFIGURATION (2-, 3-, OR 4-WIRE)

Lead wires add resistance. This must be eliminated or compensated; otherwise, the measurement reads **too high**.

##### 2-WIRE RTD MEASUREMENT (Least Accurate)

- The simplest form: one wire on each end of the element.
- Measured resistance = RTD + two lead wires.  
Error grows with cable length (e.g., 1 m = ~0.1 Ω ≈ 0.27 °C error on a Pt100).
- Acceptable only for **short leads** or low accuracy applications.

##### 3-WIRE RTD MEASUREMENT (Industrial Standard)

- Adds a third wire so a Wheatstone bridge can **compensate the lead resistance**, assuming matched lead wires.
- Greatly reduces error; widely used in PLCs, DCS, and transmitters.

##### 4-WIRE RTD MEASUREMENT (Highest Accuracy)

- Two excitation wires + two separate sense wires.
- The sense wires carry no current, so they see only the RTD's resistance – **no lead wire error whatsoever**.
- Used in labs, calibration rigs, and precision processes.

#### ACCURATE RTD RESISTANCE MEASUREMENT KEY REQUIREMENTS

##### A. USE THE PROPER EXCITATION CURRENT

- Typically, **0.1–1 mA** for Pt100.
- Too high → RTD self heating → temperature reads artificially high.

##### B. ENSURE GOOD LEAD WIRE COMPENSATION

- 3-wire needs **equal lead resistance** on the paired legs.  
If mismatched, residual error remains.
- 4-wire eliminates this concern entirely.

##### C. MAINTAIN PROPER CONNECTIONS

- Sense wires must go directly to the RTD element – **never jumper sense wires at the transmitter**, or the measurement will include lead resistance.

##### D. AVOID ELECTRICAL NOISE & GROUND LOOPS

- Use shielded cables if necessary.
- Avoid running RTD wiring parallel to high voltage conductors.

##### E. ENSURE CORRECT LINEARIZATION

- The instrument must use the correct **Callendar–Van Dusen** coefficients for platinum (IEC 60751).

#### SUMMARY – CORRECT MEASUREMENT PROCEDURE

- 1) **Choose wiring scheme** based on required accuracy:
  - 2-wire = low accuracy
  - 3-wire = standard industrial
  - 4-wire = high precision
- 2) **Apply a known, stable, low excitation current** from the measurement instrument.
- 3) **Measure the voltage drop** across the RTD element.
  - Use  $V/I$  to compute resistance.
- 4) **Compensate lead resistance** (automatic 3- and 4-wire systems).
- 5) **Convert resistance to temperature** using the correct RTD model (IEC 60751, DIN 43760, etc.).



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## How Insulation Resistance of an RTD is Measured Run an Insulation Resistance (IR) Test

The **insulation resistance (IR)** test verifies that the RTD element and its internal wiring are properly insulated from the sensor sheath and from each other. Good insulation prevents **leakage currents**, which otherwise cause **temperature errors**, noise, or even sensor failure.

This test is typically required by manufacturers, calibration labs, and standards such as **IEC 751 / IEC 60751 / DIN 43760**.

### PURPOSE OF THE INSULATION RESISTANCE TEST

- Ensures **no electrical leakage** between:
  - RTD element and sheath
  - Wiring circuits inside the RTD
- Confirms RTD has not absorbed moisture, developed cracks, or suffered insulation breakdown.
- Prevents reading errors: low insulation resistance acts as a **parallel shunt path**, artificially lowering measured resistance (temperature reads too low).

### EQUIPMENT REQUIRED

- Insulation resistance tester (megohmmeter / megger)** – typically 100 V to 500 V depending on the test. For example:
  - 500 V DC for ambient IR test
  - 100 V DC for elevated temperature IR tests
- PPE (gloves, eyewear)
- Cleaners (isopropyl alcohol) for terminals

### TEST PREPARATION

#### 1) ISOLATE THE RTD

- Disconnect it completely from transmitters, PLCs, and wiring. ]

#### 2) CLEAN TERMINALS

- Remove moisture, dirt, oxidation.

#### 3) VERIFY MEGOHMMETER SETUP

- Confirm correct test voltage and battery condition.

### HOW THE INSULATION RESISTANCE TEST IS PERFORMED

#### A. IDENTIFY RTD WIRING

- For 2-wire: 2 leads
- For 3-wire: 3 leads
- For 4-wire: 4 leads (Wire count does not change IR test method; only the number of pairs you test.)

#### B. CONNECT THE MEGOHMMETER

You test insulation between the RTD's internal wiring and its metal sheath:

- Bundle all RTD lead wires together** → connect to **megger terminal #1**
- Connect megger terminal #2** → to **sensor sheath** (or body)

This checks for insulation breakdown between electrical conductors and the protective sheath.

For multi element or multi wire sensors (e.g., 6 wire Pt100), IR may also be checked **between individual wire pairs**.

#### C. APPLY TEST VOLTAGE

Typical test points:

TEST CONDITION REQUIREMENT	VOLTAGE	MINIMUM IR
Ambient temperature IR test	500 V DC	>100 MΩ
High temperature IR test (≈320 °C)	100 V DC	>2 MΩ (often >20 MΩ provided)
Autoclave / steam test	125 °C	>5 MΩ

The megger applies voltage and measures how much leakage current flows. Low leakage = high insulation resistance.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

How Insulation Resistance of an RTD is Measured (cont.)

## EVALUATING THE RESULTS

### AN RTD IS CONSIDERED IN GOOD CONDITION WHEN:

- IR is very high (hundreds of M $\Omega$  at ambient conditions)
- IR does not collapse rapidly when voltage is applied
- IR remains above minimum limits at elevated temperature tests (2 M $\Omega$  or more)

### LOW INSULATION RESISTANCE INDICATES:

- Moisture ingress
- Cracked mineral insulation
- Damaged sheath
- Contamination at terminals
- Internal conductor breakdown

These conditions cause **shunt leakage paths** that corrupt the RTD reading.

## WHY INSULATION RESISTANCE TESTING MATTERS

If insulation resistance drops to **~0.1 M $\Omega$** , the leakage path can create an error equal to **Class B RTD tolerance**, making the sensor unusable for precision applications.

Thus, insulation integrity is essential for accurate, stable temperature measurement.

## IN SUMMARY

To measure RTD insulation resistance:

1. Isolate RTD
2. Clean terminals
3. Connect megger between all RTD leads tied together and the sheath
4. Apply 100–500 V DC depending on test
5. Confirm IR meets minimum values (100 M $\Omega$  ambient,  $\geq 2$  M $\Omega$  hot test)
6. Investigate or replace the RTD if IR is low



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## What an RTD Hi-Pot Test Is Run an Insulation Resistance (IR) Test

A **Hi-Pot test** applies a **high voltage (AC or DC)** between the RTD's internal conductors and its metal sheath to verify that the insulation can withstand electrical stress **without breakdown or leakage**. It is essentially a high voltage version of an insulation resistance test.

For RTDs, this ensures:

- The insulation inside the sheath is intact
- No moisture or contamination is present
- No internal shorts exist between conductors and sheath

### WHERE THE HI-POT TEST IS APPLIED ON AN RTD

Voltage is applied between:

1. **All RTD leads tied together** (shorted)
2. **RTD sheath** (metal body)

This stresses the insulation that separates the sensing element and lead-wires from the protective sheath.

### EQUIPMENT REQUIRED

- **Hi-Pot tester** (AC or DC output)  
Must be able to ramp voltage, hold for a fixed time, and detect leakage/breakdown.
- High voltage test leads
- Sheath grounding clip
- PPE (gloves, eyewear)
- Isolation area with high voltage safety precautions

### STEP BY STEP HI-POT TEST PROCEDURE (RTD)

#### 1. PREPARE THE RTD

- Ensure the RTD is **fully disconnected** from transmitters, wiring, or any instrumentation.
- Clean the terminals to remove moisture/dirt.
- Tie all RTD lead wires **together** (short them).

#### 2. CONNECT THE HI-POT TESTER

- **High voltage output lead** → RTD lead bundle
- **Return/ground lead** → RTD sheath (this creates the insulation stress path)
  - i.e. Bearing RTD elements with metal body would use this method.
  - If testing an RTD with a composite body such as NEMA G-11 or IEC EPGC 308 it is recommended that a metal foil be wrapped around the RTD body to create the conductive connection point (i.e. Stator RTD elements).

#### 3. SET THE TEST VOLTAGE

Typical Hi-Pot levels used for sensors:

TEST TYPE	TEST VOLTAGE	PURPOSE
Insulated RTDs (standard)	<b>500–1000 V AC or 500–1500 V DC</b>	Verifies insulation withstand capability
Harsh duty or high temp RTDs	<b>Up to 2 kV AC</b>	For higher spec assemblies

**NOTE:** These levels follow typical dielectric withstand levels for insulation systems. Specific OEM or industry standards may define exact voltage.

Hi-Pot standards emphasize maintaining the test voltage long enough for leakage detection



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## What an RTD Hi-Pot Test Is (cont.)

### 4. RAMP THE VOLTAGE

- Slowly increase voltage from 0 → test level.
- Modern testers automatically ramp to prevent sudden stress.

### 5. HOLD THE VOLTAGE

- Hold for 1 to 60 seconds depending on standard or customer spec. (common RTD dwell time: 1 minute)
- During the dwell:
  - Monitor leakage current
  - The RTD must NOT arc or break down

Acceptable leakage is typically **very low (microamps)**.

Pass/Fail criteria:

- **PASS:** Leakage remains below the Hi-Pot tester limit (usually <1 mA).
- **FAIL:** Breakdown occurs (e.g., >20 mA current spike or insulation arc).

### 6. RAMP DOWN AND DISCHARGE

- Reduce voltage to zero.
- Allow tester's internal discharge circuit to remove stored energy.
- Disconnect test leads only after discharge. (high-voltage devices can retain charge)

## WHY HI-POT AN RTD?

A Hi-Pot test reveals defects that a normal insulation resistance test may miss:

- Cracked mineral insulation
- Moisture inside the sheath
- Lead wire insulation breakdown
- Manufacturing contamination
- Degraded insulation from high temperature cycling

## SAFETY PRECAUTIONS

Hi-Pot testing involves **dangerous voltages** and must be performed with strict controls:

- Use PPE.
- Only trained personnel should operate HV equipment.
- Work in an isolated HV test area with warning signage.
- Ensure no one touches the device under test during energization.

## SUMMARY

To perform a Hi-Pot test on an RTD:

1. Disconnect RTD and clean terminals.
2. Tie all RTD leads together.
3. Apply high voltage between lead bundle and sheath.
4. Ramp to 500–1500 V (typical), hold 1–60 seconds.
5. Monitor leakage—must stay low.
6. Ramp down, discharge, disconnect.

This verifies that the RTD's insulation can survive electrical stress without breakdown.

The Gund Company custom fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type. Additional data and samples are available on request.



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## OUR EXPERTISE IS OUR COMPETITIVE ADVANTAGE

At The Gund Company, we're not just about materials; we're about empowering our clients innovations with a diverse array of solutions, from resilient glass epoxy composites to high-performance silicone sponges. Our consultative approach ensures that we dive deep into their unique needs, collaborating closely with your engineers and buyers to identify the perfect materials that match your projects.

We understand that selecting the right material can be a daunting task, which is why our experienced Application Engineering Teams are here to help navigate these challenges. By focusing on the key material properties, we often uncover valuable opportunities for cost reduction, enhancing the overall success of your project.

Our Material Specialists are dedicated to reviewing customer specifications and providing insightful recommendations that could save you money while still meeting all your requirements. Together, we're not just solving problems; we're innovating for the future.

We believe that asking the right questions is the first step towards delivering tailored solutions. At The Gund Company, continuous improvement is at the core of our ethos. We are committed to optimizing production for material yield and fabrication efficiency, constantly adapting our capabilities based on what our customers need.

Today, we proudly stand as an industry-leading manufacturer and fabricator of engineered material solutions, and we're excited to evolve alongside our employees. Let's embark on this journey together and redefine what's possible for tomorrow!

**WE LISTEN, LEARN,  
RESPOND, AND SERVE.**

## OUR CURRENT FABRICATION FACILITIES



### LOS ANGELES - CALIFORNIA

- 80 employees
- 46,480 square feet



### CEDAR LAKE - INDIANA

- 30 employees
- 30,000 square feet



### MILWAUKEE - WISCONSIN

- 50 employees
- 75,000 square feet



### TORONTO - CANADA

- 45 employees
- 55,000 square feet



### DALLAS - TEXAS

- 30 employees
- 54,000 square feet



### QUERETARO - MEXICO

- 200 employees
- 55,000 square feet



### ST. LOUIS - MISSOURI

- 120 employees
- 62,000 square feet



### ALBANY - NEW YORK

- 150 employees
- 100,000 square feet



### XIAMEN - CHINA

- 70 employees
- 60,000 square feet



### HUZHOU - CHINA

- 100 employees
- 52,000 square feet

**1,000+**  
TEAM MEMBERS

**16**  
MANUFACTURING LOCATIONS\*

**8**  
COUNTRIES WITH OFFICES

\*10 of the 16 shown above

## GLOBALY-KNOWN AND GROWING

Established in 1951 | Fourth-generation family business | **One of the largest insulation component fabricators in North America**  
Unique supplier of thermoset composites specializing in rigid and flexible laminates | Vertical integration on key materials  
Partners with many major Electrical/Electronic OEMs



# THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

## MARKETS



*Switchgear*



*Electronics*



*Power Generators*



*Motor Applications*



*Transformers*



*Metals Processing*



*Electric Vehicles*



*Military/Aerospace*



*Oil & Gas*



*Medical*



*Space*

## OUR EXPERTISE IS YOUR COMPETITIVE ADVANTAGE

We manufacture and custom-fabricate a complete line of components for market-specific applications (left column). As TGC better understands these markets – we can expand into other applications for our products.

As an employer, we are one family, acting in accordance with our Core Values: respect, trust, growth, passion, connection, teamwork, integrity, and performance. Collectively, we recognize and serve others so that lives are transformed!

### Material Families:

- Thermoset Rigid Laminates & Composites
- Flexible Laminates, Papers, Films & Felts
- Thermoplastic Materials
- Elastomeric Materials

### Engineering Capabilities:

- Custom Material Development
- Resin Formulation
- Laboratory Testing
- Comparative Materials Evaluation

### Manufacturing Capabilities:

- Compression Molding
- Autoclave & Light RTM Molding
- Pultrusion / Extrusion of Rods & Shapes
- Filament, Convolute & Wet Winding Tubes
- Additive & Injection Molding
- Infusion & B-Stage Composites Lay-Up
- Hand Lay-Up & Spray-Up Molding

### Conversion Capabilities:

- Die, Laser & Knife Cutting
- Waterjet Cutting
- Rotary Die Cutting
- Slitting
- Thermoforming

### Fabrication Capabilities:

- 5-Axis Machining
- CNC Milling
- Routing
- Turning & Lathe Cutting
- Punching
- Bending



## THE GUND COMPANY GLOBAL FOOTPRINT

