9336 AND 9337 SERIES

PRECISION HIGH VALUE "AIR" RESISTANCE STANDARDS

High to Ultra-High Value Precision Laboratory Air Resistance Standards



FEATURES

- Unique Multi-Element Design
- 12 Month Stabilities Low as 10 ppm
- Wide Operating Range 18 ^{0}C to 28 ^{0}C
- Resistance Range 10 MΩ to 100 GΩ
- Hermetically Sealed
- ISO/IEC 17025 Calibrations Available
- Compact and Ruggedized
- Nominal Initial Accuracy < 2 ppm
- Low Temperature Coefficients
- Voltage Hysteresis < 0.1 ppm
- Rated to 1000V
- Suitable for Calibration of Teraohmmeters Meggers, Long Scale DMM's, and More…



For The Ultimate In A High or Ultra High Value Resistance Standard Check Out The **6636 TEMPERATURE STABILIZED RESISTANCE STANDARD!**

GUILDLINE INSTRUMENTS 9336 & 9337 SERIES of Resistance Standards are designed as very high stability calibration laboratory standards for accurate resistance calibration in air, between 10 MΩ and 10 PΩ. These new resistors complement the 9334A Resistance Standards available from 1 Ω to 100 GΩ. Custom values are available for special applications.

THE 9336 OR 9337 SERIES OF PRECISION RESISTANCE STANDARDS ARE EXCELLENT SOLUTIONS AS HIGH TO ULTRA HIGH LABORATORY RESISTANCE STANDARDS OR FOR PORTABLE APPLICATIONS REQUIRING HIGH ACCURACY WITH RESISTANCE VALUES FROM 10 MΩ TO 10 PΩ.

These resistors are also suitable for use as calibration standards for the Guildline Series of Teraohmmeters including the following models: latest Series of 6530 TeraOhm Bridge-Meters, 6520 and 6500(A) Digital Teraohmmeters, and 9520 Teraohmmeter. They are also an excellent choice for the calibration of other high to ultra high ohms measuring instruments and standards including Electrometers, Long Scale DMMs, Pico and Micro Ammeters, Meggers, Dielectric Testers and much more.

With a wide laboratory environment from 18^{0}C to 28^{0}C, they can be used as working standards or reliable, ruggedized, transfer standards. They are extremely useful for the calibration of resistance ranges of multi-function calibrators and high accuracy digital multimeters, as well as being used in more classical standards and calibration laboratory applications where the need for high accuracy high ohms values are required.

Guildline standards are the best by design and by manufacture. One key advantage of Guildline Resistance Standards is that the main Resistance Value is made up from multiple resistance elements with ultra-stable trim resistors employed; not just a single element with multiple low cost trim resistors which is the technique used by most manufacturers.

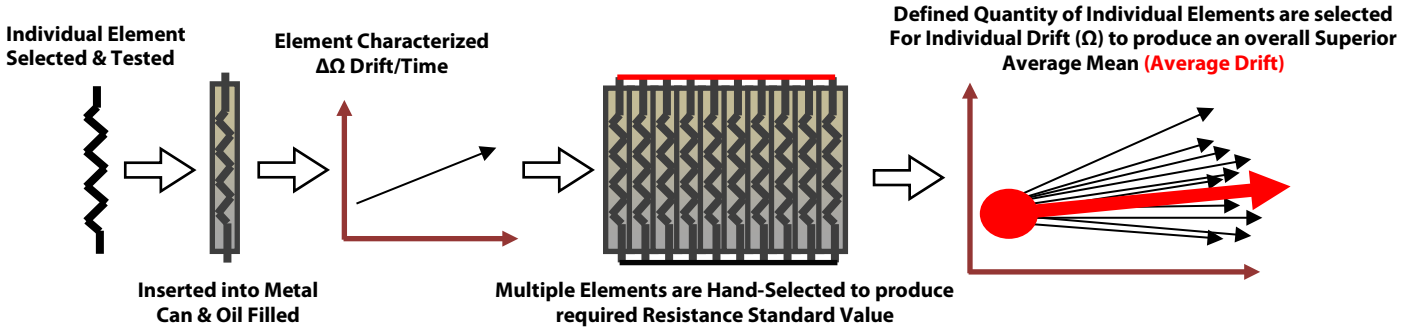
The 9336 & 9337 Series Resistance Standards are the world's most accurate and stable high ohmic value resistance standards available. The unique design of these resistance standards ensures that they meet the stringent published specifications over their entire operating range.

The design of Guildline's 9336 & 9337 Series Resistance Standards is based on extensive innovation, design knowledge, and manufacturing experience in building resistance standards since 1957. Guildline Resistance Standards are made with multiple elements in parallel or series rather than using a single element as per competitive products.

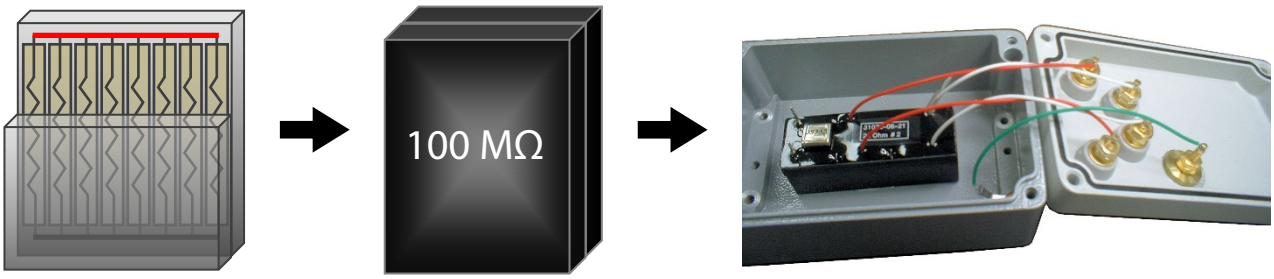
This approach lowers the drift that is seen with a single element and reduces the internal noise generated inside the reference resistor. The result is industry leading annual drift rates.

The design starts with every resistance element going through an exacting process that ensures quality and long term stability. This process is diagrammed as shown:

Resistance Element Build Up



The multiple elements are sealed in epoxy for protection against humidity, are bonded to a thermal block, and are placed into the provided EMI shielded outer case with high quality gold plated terminals attached.

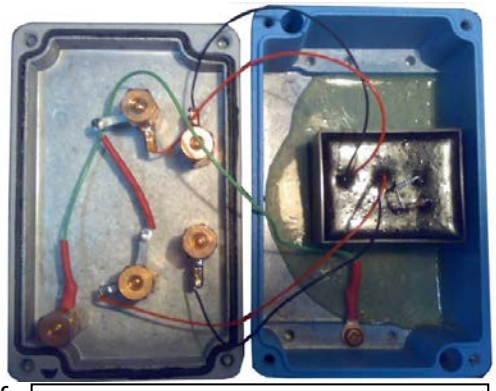


<u>This multi-element design and associated manufacturing techniques are unique to Guildline Resistance Standards</u>. Other manufactures say they also use a multi-resistor design, but they <u>use a single main element resistor</u> (e.g. 1 GΩ) <u>with multiple inexpensive TRIM resistors</u> used to get close to the nominal value. However, they (misleadingly) state that they use a multi-resistor design! Competitor's resistance standards also use cheaper components and multiple internal connections which results in a noisier resistor with poor secondary performance.

While anyone can state that their design is superior, a picture clearly shows the differences. On the left is an individual Guildline Resistance Element. Note that in this design you can see the spacing between the C1 and C2 Terminals showing that multiple elements are used in the MAIN element build up. In fact, the primary (1st) trim resistor used in any Guildline primary resistance standard is the same element that the competition uses as their main element. A picture of a competitive model is shown to the right. You can see how the wires go from a 4 wire down to a single 2 wire connection where the unit is sealed. This means a single resistor is used as the MAIN element. Also note all the cheap resistors in the competitive model that are used to trim the resistance value. This is because of excessive drift prior to shipment. In addition, the use of multiple internal connections, dissimilar metals, and overall poor build quality contribute to poor performance. The competition focuses on using an inexpensive design and quick build. In comparison Guildline's Standards use best design techniques and will perform for years as Primary Standards. Guildline is proud to describe our build process and to provide pictures showing the quality of our standards.



Inside View Guildline



Inside View Competitive Model

9336 Series of High Value Resistance Standards

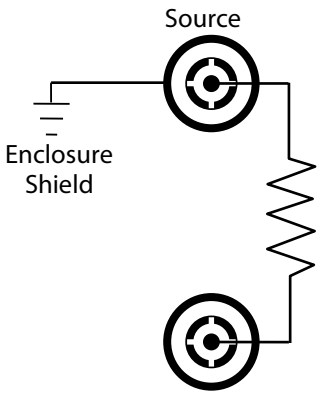
The 9336 Resistance Standards range from **10 MΩ to 100 GΩ** and use a pair of input/output Type N coaxial connectors to provide superior shielding. The resistance elements are direct reading which means that they **can be used on devices such as Active Arm Bridges**, long scale DMMs, Meggars, Dielectric Testers, Picoammeters, and more by simply connecting to the terminals. They are also an **excellent and recommended choice for verification with any Guildline Teraohmmeters** including the latest Series of 6530 TeraOhm Bridge-Meters, 6520 and 6500(A) Digital Teraohmmeters, and 9520 Teraohmmeter.



9336 Values use a pair of input/output **Type N connectors** to provide the termination for the standard. The "SOURCE" terminal connects to the supply of the measurement system, while the "OUTPUT" terminal connects to the measurement/detector. This **layout schematic** is shown to the right.

In the case of the **6530 TeraOhm Bridge-Meters**, 6520 and 6500(A) Digital Teraohmmeters - the "SOURCE" terminal connects to the high voltage output connector and the "OUTPUT" terminal connects to the electrometer input. If necessary, the temperature of the enclosure may be monitored and a correction factor applied to the value of the resistance.

9336 Series Layout



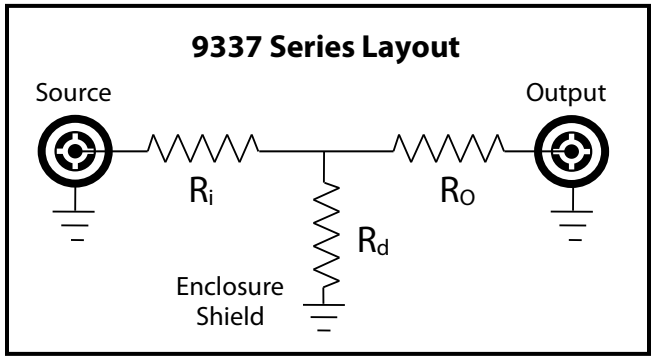
Guildline's 9337 Series of Ultra High Value Resistance Standards

The 9337 Series range from 1 TΩ to 10 PΩ and are **3 terminal devices** with a design that minimizes the effect of current leakages from the source and output connectors. The high stability is achieved by the **innovate use** of a resistance divider network. The Guildline 9337 Series of Ultra High Value Resistance Standards are **excellent as high stability calibration laboratory standards** for high accuracy resistance calibration between **1 TΩ and 10 PΩ.** The 9337s are also suitable for use as calibration standards for the Guildline Models 6530, 6520, 6500A and 6500 Digital Teraohmmeters, and the calibration of other high ohms measuring instruments.



The input and output terminals are still the same type of **"N" connectors** as the 9336 values, but the main element is configured with a different design. 1 TΩ and above elements use a 3 terminal design that **minimizes the effect of current leakages** from the source and output connectors. The **high stability** is achieved by use of a **resistance divider network**. Note in the diagram below, Resistor Values R_i (Input Resistor) and R_o (Output Resistor) are actually composed and built with multiple resistors as previously described.

The Divider Resistor (R_d) is a very high precision resistor used to adjust the values of the Input and Output Resistors (i.e. R_i and R_o) to give the desired nominal value. This design provides for a **very high quality and stable** standard and is **not as reactive to environmental** parasites as typically found in other high value resistance standards. This configuration (shown left) is also sometimes referred to as a delta-wye configuration.



This divider network design **produces excellent measurement and highly stable results** when **used with ultra-precise** High Resistance Measurement Standards such as **Teraohmmeters** and **Active Arm Bridges**.

Multiple Element Build - Element Sealing and Bonding - EMI Shielded - Excellent Performance! No other High Ohmic Value Resistance Standards can match the 9336 and 9337's performance when used with Electrometers, Teraohmmeters, TeraOhm Bridge-Meters, **Active Arm Bridge Systems** or other **High Resistance Measurement Instruments.** In addition to the performance of the 9336 and 9337 Series, Guildline provides the 6636 Temperature Stabilized High Resistance Standards with even lower uncertainties. Guildline also provides a 6564 High Resistance Scanner to make the measurement process automated and controlled!





Model 5032 Air Bath

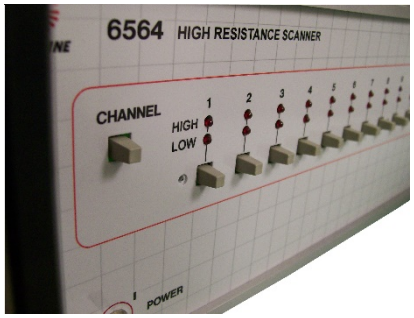


High to Ultra-High Resistance standards **cannot be placed in oil** (i.e. the isolative property of oil is too low) and for these values, the **Temperature Coefficient** of the resistance element can be as large an uncertainty contribution as the **annual drift**. Hence, you may wish to consider Guildline's 5030 Series of Programmable Precision Air Baths to **control of the temperature around the elements.** You can **virtually eliminate** the 9336 and 9337 Temperature Coefficient parameter when placed in a 5030 Air bath, even with a laboratory environmental temperature at **23 ˚C ± 5˚ C.**

Guildline's NEW **6530 Series of TeraOhm Bridge-Meters** are the World's New Standard to **accurately measure high resistance** from 10^5 ~ 10^{16} Ω (100 kΩ to 10 PΩ). The new 6530-XP and 6530-XPR Models provide the **highest level** of **measurement performance**, with the widest range of options, available from any manufacturer today. **This unique series** of instruments is based on over **30 years of experience** designing and building Teraohmmeters; and substantially **improves the performance, functionality** and **stability** developed in previous generations. The **6530 Series provides functionality** and analysis options based on Metrologist's inputs and accreditation requirements. The 6530 TeraOhm Bridge-Meter will incorporate a **ratio capability** allowing laddering up from 100MΩ or a lower valued resistance standard. The laddering functionality for the **6530 TeraOhm Bridge-Meter is more robust** than a commercial dual source bridge and provides much **better uncertainties**.



Check out **Guildline's 6564 High to Ultra-High Resistance Scanners!** These Scanners are the first commercial scanners capable of **operating with measurement capabilities** to 10 PΩ (10^{16}) and at voltages to 1000 Vdc. This capability has never previously been commercially available, and will greatly improve the measurement and calibration throughput of high and ultra-high ohm resistors now that standard laboratories can easily and quickly **automate single and multiple** high to ultra-high resistance measurements. The 6564 Series Scanners provides **>10^{17} isolation**, measurements to 10 PΩ, and with voltages up to 1000 V with no guarding required!



Guildline **provides other Series of Air Resistance Standards** besides the 9336 and 9337. Each of the datasheets can be found on the web at **www.guildline.com**. These Series include the **9334A Series** of Precision Air Resistors which range from 1μΩ to 100GΩ, the **9333 Series** of Secondary Standards which range from 1 mΩ to 1 GΩ, the new **7330 Series** of Oil Resistors which range from 1 Ω to 10 kΩ, the **7334 Series** of AC/DC Resistance Standards which range from 1 Ω to 10 kΩ, our **6634A and 6636 Temperature Stabilized Resistance Standards** from 1 mΩ to 100 TΩ. For High Currents, our 9230A DC Shunts, 7340 and 7350 AC & DC Shunts also provide stable resistance values for these currents. **Values, performance and quality** that nobody else can provide!



1 Year Specifications

Model	Nominal Resistance Value (Ω)	Intial[1] Tolerance ± ppm	Calibration[2] Uncertainty ± ppm	12 Month Stability[3] (+/- ppm)	Temperature Coefficient ± ppm/°C	Voltage Coefficient ± ppm/V_{dc}
9336-10M	10 M	25	15	10	<5	0.1
9336-100M	100 M	50	25	25	<5	0.5
9336-1G	1 G	100	80	35	<6	0.5
9336-10G	10 G	200	100	100	<25	1
9336-100G	100 G	500	500	200	<250	1
9336-X	Customer Specified Value		Specifications Provided Upon Request			
9337-1T	1T	1000	1000	500	<300	<2
9337-10T	10T	3000	4500	750	<500	<2
9337-100T	100T	5000	5500	1000	<800	<2
9337-1P	1P	2%	1%	2000	<1000	<2
9337-10P	10P	30%	25%	2%	<5000	<5
9337-X	Customer Specified Value		Specifications Provided Upon Request			

Note 1: Initial Tolerance is the maximum variation of resistance mean value as adjusted initially at the point of sale.

Note 2: Calibrated in air at 23 °C traceable to the SI unit of electric resistance. Calibration uncertainties expanded and expressed at the 95% level of confidence. An ISO/IEC 17025 accredited certificate and report of calibration stating the calibrated value and estimated uncertainty is provided with each resistor.

Note 3: Maximum Voltage Rating: 1000 volts

Note 4: Special Values available on request

General Specifications - All Models

Environmental	Temperature		Humidity	
Operating	18 °C to 28 °C		<50% RH non-condensing	
Storage	-20 °C to 60 °C		15% to 80% RH	
Dimensions	Height	Width	Depth	Weight
mm	82 mm	124 mm	79 mm	0.63 kg
inches	3.8″	4.9″	3.1″	1.4 lbs

Ordering Information

9336-Model	Resistance Standard (10M to 100G : List Ohmic Value For Model)
9337-Model	Resistance Standard (1T to 10T : List Ohmic Value For Model)
9336-X	Customer Specified Value (State Value)
9337-X	Customer Specified Value (State Value)
/TM	Technical Manual Included
	ISO/IEC 17025 Accredited Calibration Certificate Included
/Temp	Additional Customer Specified Temperature Point (Charge)
/Voltage	Additional Customer Specified Voltage Point (Charge)
/Current	Additional Customer Specified Current Point (Charge)
*Other Precision Leads Are Available – Call and tell us your requirements	

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