

4221-B 4222-B 4223-B

D-C RESISTANCE STANDARDS

2-11-63



LEADS & M.C. PHILADELPHIA

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1. GENERAL INFORMATION

These resistors are used in the accurate measurement of current with a potentiometer, and as standards for comparison in low resistance measurements. The design of these resistors is based on those developed at the Reichsanstalt. In the 4221, the manganin resistor is bifilar wound. In the 4222 and 4223, a strip or sheet of manganin is supported between two terminal rods. The manganin elements are enameled after final adjustment. To obtain the current carrying capacities listed in the table, these resistors must be immersed in stirred oil baths and must be used only as four-terminal resistors.

2. SPECIFICATIONS

Terminals - Four, current/potential type.

Limits of Error - Limits of error for the nominal values listed in table below apply when resistors are immersed in oil bath at 25 C. Each standard is supplied with an L&N[®] Certificate* giving (1) temperature coefficient data and (2) measured value at 25 C to 10 parts per million ($\pm 0.001\%$) is accurate to 100 parts per million ($\pm 0.01\%$).

The value of resistance stated on the certificate is the value when used as a four-terminal resistor at 25 C.

The resistance value at any temperature other than 25 C can be calculated by using the formula on the L&N Certificate.

To maintain maximum stability, the unit should not be exposed to temperatures below 20 C or above 35 C.

Further details are given on the back of the L&N Certificate.

Current Rating - See TABLE I.

Size - 4221, 4222, 7" x 6" x 3-5/8"; 4223, 7" x 7-1/2" x 3-1/2"

Weight - 4221, 4222, approximately 2 pounds
4223, approximately 3 pounds

*The value of resistance given is in terms of the absolute ohm and is based on reference standards maintained by L&N and certified at regular intervals by the N.B.S. Some of these reference standards have been re-certified regularly by the N.B.S. for over 25 years.

TABLE I - CURRENT RATINGS

Resistance Ohms	Current Rating Amperes		L&N No.
	For Certificate Limit of Error	For $\pm 0.05\%$ Limit of Error	
0.1	3.0	10.0	4221-B
0.01	10.0	30.0	4222-B
0.001	30.0	100.0	4223-B

3. AMALGAMATE ENDS OF TERMINALS

To eliminate the possibility of having a high resistance contact surface at the ends of the bent current terminals, they should have a clean bright ~~amalgamated~~ coating of chemically pure mercury. *as small pieces (about 1/8 inch cubes)*

To accomplish amalgamation, thoroughly clean the contact surfaces with fine grain sandpaper and carefully wipe each contact surface with a clean cloth. Fill a one-half fluid ounce bottle about one-half full with chemically pure mercury and add approximately $1/8$ -cubic-inch of metallic sodium. Shake the bottle gently until the mercury flashes.

WARNING: Keep face away from the open end of bottle while shaking.

Turn the resistor up-side down. Moisten the contact surfaces with a drop of water and using an eye-dropper, place a drop of sodium prepared mercury on each contact surface. When contact surfaces are thoroughly amalgamated, thoroughly wash with water; otherwise, the amalgam will turn green to form high resistance contact surfaces. To finish the process, empty the contents of the eye-dropper into the bottle containing the sodium prepared mercury. Wash out the dropper with water and refill with chemically pure mercury. Place a drop of chemically pure mercury on each contact surface. The mercury will now adhere to the ends of the terminals to form low resistance contact surfaces with high conductivity characteristics.

The procedure outlined above should be repeated as often as the ends of the terminals require it.

4. CONNECTIONS

These units must always be used as four-terminal resistors. The current connections can be made to either the amalgamated ends of the bent terminals (used with mercury-cups) or the thumbscrews in these terminals. The potential connections are made to the two vertical terminals.

5. USE OF THERMOMETER

The plug in the center of the head of the case is in the opening of a well for inserting a suitable thermometer to check the temperature of the unit. Simply remove the plug and insert the thermometer in the well.

6. ACCESSORY COMPONENT

L&N 127287 Adjustable Mercury-Cup Stand.