

DC RESISTANCE STANDARDS

4015-B	4025-B	4035-B	4045-B
4020-B	4030-B	4040-B	4050-B

1. GENERAL INFORMATION

These standards are manufactured using U. S. Bureau of Standards type design and find application in industrial and educational precision electrical measuring laboratories for purpose of resistor comparison. Each standard, except the 4050-B, is made of selected Mn-Ni alloy wire, stress relieved and aged to ensure accuracy. The 4050-B is essentially the same as the other standards except for the resistance element which utilizes Evanohm* wire. Assembly of the standard is completed by placing the resistance element in a metal container which is filled with moisture-free oil and then sealed. The construction of the finished standard is such that the whole unit may be immersed in an oil bath for the purpose of better temperature equalization and increased current rating. Table I presents a list of the stocked standards. Intermediate values are also available by simply sending a request to Leeds & Northrup Company for the value desired.

2. SPECIFICATIONS

TERMINALS: Four (2 current and 2 potential).

NOMINAL VALUES: See Table I.

AMBIENT TEMPERATURE: To maintain maximum stability, the unit should not normally be used at temperatures below 20 C or above 35 C.

CURRENT RATINGS: See Table I.

SIZE: 4" W x 7" H x 1-7/8" OD of housing.

WEIGHT: Approximately 1 pound.

LIMIT OF ERROR: Limit of error for the nominal values listed in Table I apply under conditions of normal use. Each standard is supplied with an L&N Report of Calibration**, giving the temperature coefficient data and the measured value at 25 C to one part per million ($\pm 0.0001\%$), and is accurate to 10 parts per million ($\pm 0.001\%$) for all values except the 4015-B and 4050-B.

The 4015-B Standard is supplied with an L&N Report giving the measured value at 25 C to the nearest 0.01% (100 parts per million), and the stated value is accurate to $\pm 0.05\%$ (500 parts per million) for direct currents up to 3 amperes (1 watt).

The 4050-B standard is supplied with an L&N Report giving the measured value at 25 C to the nearest 0.0001% (1 part per million), and the stated value is accurate to 0.002% (20 parts per million) for direct currents up to 0.3 mA (0.1 watt).

The Report of Calibration states the 4-terminal resistance of the 0.1, 1, and 10 ohm standards, and the 2-terminal resistance for the higher value standards, measured at 25 C. If the 0.1, 1, or 10 ohm standards are used as 2-terminal resistors, the resistance value is 0.00004 ohm higher than the Report value. This difference should be taken into account where it becomes significant.

The resistance value at any temperature other than 25 C can be calculated by using the data on the L&N Report of Calibration.

TABLE I - CURRENT RATINGS OF LISTED NOMINAL VALUE STANDARDS

Nominal Values (Ohms)	Current Rating In Amperes				L&N Part Number
	$\pm 0.001\%$ Limit Of Error	$\pm 0.002\%$ Limit Of Error	$\pm 0.02\%$ Limit Of Error	$\pm 0.05\%$ Limit Of Error	
0.1	—	—	—	3	4015-B
1	0.3	—	1.0	—	4020-B
10	0.1	—	0.3	—	4025-B
100	0.03	—	0.1	—	4030-B
1,000	0.01	—	0.03	—	4035-B
10,000	0.003	—	0.01	—	4040-B
100,000	0.001	—	0.003	—	4045-B
1,000,000	—	0.0003	—	—	4050-B

*Wilbur B. Driver Co.

**The value of resistance given is in terms of the U. S. legal 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 recertified regularly by the N.B.S. for over 25 years.

3. AMALGAMATE ENDS OF TERMINALS

To eliminate the possibility of having a high resistance contact surface at the ends of the terminals, they should have a clean bright coating of chemically pure mercury.

To accomplish amalgamation, thoroughly clean the contact surfaces with fine grain sandpaper and 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 a small piece (about 1/8 inch cube) 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 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.

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

4. CONNECTIONS

4A. Used as Two-Terminal Resistor

Under this condition the connections are made to the two amalgamated ends of the terminals (used with mercury cups), or to the two screws on the sides of the terminal arms.

4B. Used as Four-Terminal Resistor

Under this condition the current connections can be made to either the amalgamated ends of the terminals (used with mercury-cups) or the two side thumbscrews. The potential connections are made to the two top thumbscrews.

On the 4020-B Resistance Standards, special Weaver-Shafer adaptors are mounted in the two top thumbscrew holes to provide permanent location of potential points. Use of these adaptors assures repeatability of readings in the order of a 0.1 part per million. In values higher than 1 ohm this uncertainty is negligible.

5. USE OF THERMOMETER

The hole in the head of the standard is a well for inserting a suitable thermometer to check the temperature of the unit.

6. ACCESSORY COMPONENTS

L&N 127287 Adjustable Mercury-Cup Stand.

L&N 128436 Connecting Link. This link is used to short-circuit the mercury-cups and permits the continuity of an electrical circuit from which a resistance standard has been removed.

L&N 128488 Amalgamated Binding Post Terminal.

L&N Cat. 4001 N.B.S. type Mercury Stand.



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