



Cambridge Instruments
& Engg. Co.

EST. 1963 · HOWRAH, INDIA

TEST REPORT FORM

Low Resistance (Micro-Ohm) Test

Four-wire Kelvin measurement of joints, busbars, lugs, contacts and bonds · with baseline comparison

01 Job and equipment details

Customer / site	Panel / equipment ID	Test date
Equipment description	Rated current (A)	Conductor material
Item tested ☐ Busbar joints ☐ Cable lugs ☐ Breaker contacts ☐ Earth bonds	Conductor temperature (°C)	Ambient (°C)
Test instrument, serial no.	Test current used (A)	Calibration due

02 Readings μΩ or mΩ, 4-terminal connection, same probe points every time

Joint / contact location or label	Measured μΩ	At 20 °C corrected	Baseline factory or last test	Change %	Maximum allowed μΩ	Result
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check
						☐ Pass ☐ Check

Write the maximum allowed from the manufacturer or your specification. Where there is no baseline, compare similar joints with each other using the phase comparison below.

03 Phase comparison three phases of the same device or run

R phase	Y phase	B phase	Deviation from lowest, % (highest - lowest) / lowest × 100

04 Result and sign-off

Overall result ☐ PASS ☐ INVESTIGATE	Joint re-torqued or cleaned ☐ No ☐ Yes, retested
Remarks and recommended action	
Signature and date: tester	Signature and date: reviewer



Formulas and method

Temperature correction, change against baseline and what to do about a high reading

01 Formulas

Correct to 20 °C (copper)

$$R_{20} = R_t / (1 + 0.00393 (T - 20))$$

Correct to 20 °C (aluminium)

$$R_{20} = R_t / (1 + 0.00403 (T - 20))$$

Change against baseline

$$\text{change \%} = (R - R_{\text{base}}) / R_{\text{base}} \times 100$$

Worked example, copper

$$T = 35\text{ °C}, 52\text{ }\mu\Omega: R_{20} = 49.1\text{ }\mu\Omega$$

Heat in a joint

$$P = I^2 \times R$$

Worked example, heating

$$1000\text{ A through }100\text{ }\mu\Omega = 100\text{ W}$$

Temperature coefficients are the usual figures for copper and aluminium near 20 °C. Measure at a steady temperature and correct only when comparing readings taken at different temperatures.

02 Guide values

commonly used by maintenance teams. Not limits from a standard

Comparison	GUIDE	Action
Up to about 25 % above baseline or lowest similar joint		Normal, record and trend
About 25 % to 50 % above		Re-clean, re-torque, retest
More than about 50 % above		Investigate before returning to service

Typical causes of a high reading
Loose or under-torqued bolts
Oxidised or dirty contact faces
Worn, pitted or misaligned breaker contacts
Wrong lug, plating or joint compound

The 50 % deviation idea is widely quoted in acceptance testing practice. Use the manufacturer value for breaker contacts, which is usually given in micro-ohms per pole.

03 Method notes

- **Four terminals.** Put the current leads outside the potential leads. The two inner clips must sit across only the joint, so lead and clip resistance is left out.
- **De-energise.** Isolate, test for dead and earth the item before connecting. Never connect to a live conductor.
- **Mind the test current.** Standards for circuit breaker contact tests normally call for a DC test current of 100 A or more. Low-current micro-ohm meters suit lugs, bolted joints, bonds, shunts and small contacts. Check your instrument range and the test current stated for the item you are testing.
- **Repeat.** Take each reading twice, with leads swapped, to cancel thermal offsets. Mark probe points so later tests are repeatable.

CIE INSTRUMENTS FOR THIS TEST

MR-253A

Bench micro-ohm meter, 4-terminal Kelvin, 1999 $\mu\Omega$ to 19.99 k Ω , 8 ranges

DET-2000

Digital earth resistance tester, 4-terminal

DIT-2500

Digital insulation tester with True-RMS multimeter



See the micro-ohm meter

Scan for CIE digital earth and micro-ohm instruments.
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