



Cambridge Instruments
& Engg. Co.

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TEST REPORT FORM

Motor Winding Test

Insulation, winding resistance and balance, and no-load current · one sheet per motor

01 Motor nameplate and job

Customer / plant		Motor ID / tag	Test date
Make and model		Serial no.	Year
Power (kW / HP)	Voltage (V)	Current (A)	Speed (rpm) / poles
Winding ☐ Copper ☐ Aluminium		Connection ☐ Star ☐ Delta	Thermal class ☐ B ☐ F ☐ H
Test instrument(s), serial no.		Tested by	Winding temperature (°C)
			Calibration due

02 Insulation resistance

MΩ with the motor disconnected from the supply and the cable. Apply the test voltage the specification gives

Connection winding to ...	Test voltage V DC	15 s	60 s	10 min	IR60 at 40 °C $IR_{60} \times K_t$	PI 10 min / 60 s	Result
U to earth							☐ Pass ☐ Fail
V to earth							☐ Pass ☐ Fail
W to earth							☐ Pass ☐ Fail
All windings to earth							☐ Pass ☐ Fail
Phase to phase (if open)							☐ Pass ☐ Fail

03 Winding resistance

Ω or mΩ between terminals, measured with a four-terminal or low-resistance ohmmeter

Terminals	Reading at test temperature Ω	Corrected to 75 °C $R \times (R_{75} / R_T)$	Factory or previous value Ω	Change %
U to V				
V to W				
W to U				

Highest (Ω)

Lowest (Ω)

Average (Ω)

Imbalance %
(high - low) / average × 100

04 No-load run (optional)

only where it is safe to run the motor uncoupled

	Phase U	Phase V	Phase W	Average	Nameplate	No-load as % of rated
Current (A)						
Voltage (V)						

05 Result and sign-off

Overall result
☐ SERVICEABLE ☐ WATCH ☐ REPAIR

Direction of rotation checked
☐ Yes ☐ N/A

Remarks and recommended action

Signature and date: tester

Signature and date: reviewer



Corrections, balance and method

Temperature correction of winding resistance, imbalance and what to look for

01 Formulas

Resistance at 75 °C, copper

$$R_{75} = R_T \times (235 + 75) / (235 + T)$$

Resistance at 75 °C, aluminium

$$R_{75} = R_T \times (225 + 75) / (225 + T)$$

Worked example

$$T = 30 \text{ °C}, R_T = 1.20: R_{75} = 1.20 \times 310 / 265 = 1.404$$

Resistance imbalance

$$(R_{\max} - R_{\min}) / R_{\text{avg}} \times 100$$

Polarization index

$$PI = IR_{10\text{min}} / IR_{60\text{s}}$$

Delta terminal reading

$$\text{each reading} = R_{\text{phase}} \times 2/3 \text{ (one phase in parallel with two)}$$

02 Copper correction factor R75 / RT

T is the winding temperature in °C when you measured

T (°C)	10	15	20	25	30	35	40	45
R75 / RT	1.265	1.240	1.216	1.192	1.170	1.148	1.127	1.107
T (°C)	50	55	60	65	70	75	80	85
R75 / RT	1.088	1.069	1.051	1.033	1.016	1.000	0.984	0.969

Constants 235 (copper) and 225 (aluminium) are the standard temperature constants. Let the motor rest long enough that the winding temperature is the same throughout, and note that the measuring current itself warms a small winding: take the reading quickly.

03 Guide values

no single value fits every machine: use the factory report, the standard or your site limit

Check	GUIDE	Common practice
Winding resistance imbalance		within about 2 %, compare with factory
Minimum IR (IEEE 43-2013)		kV + 1, or 100 MΩ form-wound, or 5 MΩ random-wound
Minimum PI, class B, F, H		2.0
No-load current		often 25 % to 50 % of rated; check the maker

Finding	May indicate
One phase resistance high	Loose or burnt connection, broken strand
One phase resistance low	Shorted turns
Low IR, PI near 1	Moisture, dirt or ageing insulation
No-load current unbalanced	Shorted turns, supply imbalance, rotor or bearing fault

The guide values are widely used rules of thumb. A change from the factory report or the last test counts for more than one reading. The motor must be isolated, locked off and proved dead before any winding test. A no-load run needs a safe, uncoupled motor with a permit.

CIE INSTRUMENTS FOR THIS TEST

MR-253A

Bench micro-ohm meter, 4-terminal, for winding resistance

DIT-2500

Digital insulation tester with DAR and PI

CIE/777

Motor-driven megger for steady voltage on the 10 minute test



Check it online

Scan for the motor minimum IR calculator. cieinstruments.in/tools