



Cambridge Instruments
& Engg. Co.

EST. 1963 · HOWRAH, INDIA

TEST REPORT FORM

Insulation Resistance Test

Timed test · IEEE 43-2013 · temperature correction, DAR and polarization index

01 Job and machine details

Customer / site	Equipment ID / tag	Test date
Machine / cable description	Rated line voltage (kV)	Test voltage applied (V DC)
Winding class (sets minimum IR) ☐ Pre-1970, field, other (kV + 1) ☐ Form-wound, post-1970 (100 MΩ) ☐ Random-wound or form-wound below 1 kV (5 MΩ)		
Thermal class ☐ A ☐ B ☐ F ☐ H	Winding temperature (°C)	Ambient (°C) / humidity (%)
Calibration due	Tested by	Test instrument, serial no. Reviewed by

02 Timed readings

MΩ at each time, test voltage applied continuously

Connection tested e.g. U to E, V and W earthed	15 s	30 s	45 s	60 s	10 min	Kt see page 2	IR 60 s at 40 °C IR60 × Kt	DAR 60 s / 30 s	PI 10 min / 60 s

03 Evaluation against limits

limits on page 2

Connection	IR at 40 °C MΩ	Minimum IR MΩ	IR check	PI	Minimum PI	PI check	Result
			☐ Meets ☐ Below			☐ Meets ☐ Below ☐ N/A	☐ PASS ☐ BELOW
			☐ Meets ☐ Below			☐ Meets ☐ Below ☐ N/A	☐ PASS ☐ BELOW
			☐ Meets ☐ Below			☐ Meets ☐ Below ☐ N/A	☐ PASS ☐ BELOW
			☐ Meets ☐ Below			☐ Meets ☐ Below ☐ N/A	☐ PASS ☐ BELOW
			☐ Meets ☐ Below			☐ Meets ☐ Below ☐ N/A	☐ PASS ☐ BELOW
			☐ Meets ☐ Below			☐ Meets ☐ Below ☐ N/A	☐ PASS ☐ BELOW

PI is not meaningful when IR at 60 s is above about 5000 MΩ (tick N/A and judge on the absolute value and the trend). Use the stricter of these limits and your plant or customer specification.

04 Result and sign-off

Overall result	☐ PASS ☐ BELOW LIMIT	Test voltage within recommended range?	☐ Yes ☐ No
Remarks and recommended action			

Signature and date: tester	Signature and date: reviewer



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WORKSHEET AND REFERENCE

How to work out the results

Formulas, temperature factors and IEEE 43-2013 limits, for filling in the form by hand

01 Formulas

Temperature factor

$$K_t = 0.5^{((40 - T) / 10)}$$

IR at 40 °C

$$IR_{40} = IR_{60} \times K_t$$

Leakage at 60 s

$$I (\mu A) = V / IR (M\Omega)$$

Dielectric absorption ratio

$$DAR = IR_{60s} / IR_{30s}$$

Polarization index

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

Worked example

$$T = 32\text{ °C}, IR_{60} = 300: K_t = 0.574, IR_{40} = 172$$

02 Temperature factor Kt

T is the winding temperature in °C

T (°C)	0	5	10	15	20	25	30	35	40	45
Kt	0.0625	0.08839	0.125	0.1768	0.25	0.3536	0.5	0.7071	1	1.414

T (°C)	50	55	60	65	70	75	80	85	90
Kt	2	2.828	4	5.657	8	11.31	16	22.63	32

Kt is the usual field rule that insulation resistance halves for every 10 °C rise. It is an approximation, so test at a similar winding temperature each time for the best trend.

03 Limits

IEEE 43-2013 for rotating machines, as commonly quoted. Check your edition.

Winding class	Minimum IR60 at 40 °C
Pre-1970 windings, field windings, others	kV + 1 MΩ
Form-wound, built after about 1970, and DC armatures	100 MΩ
Random-wound stator coils, form-wound below 1 kV	5 MΩ

Thermal class	Minimum PI
A	1.5
B, F, H	2.0

DAR (60 s / 30 s) GUIDE	Reading
Below 1.0	Poor
1.0 to 1.25	Questionable
1.25 to 1.6	Acceptable
Above 1.6	Excellent

Rated line voltage	Test voltage (V DC)
Below 1 kV	500
1 kV to 2.5 kV	500 to 1000
Above 2.5 kV to 5 kV	1000 to 2500
Above 5 kV to 12 kV	2500 to 5000
Above 12 kV	5000 to 10000

PI (10 min / 60 s) GUIDE	Reading
Below 1.0	Dangerous
1.0 to 2.0	Questionable
2.0 to 4.0	Good
Above 4.0	Excellent

Guide bands are common rules of thumb used by CIE tools, not limits from the standard. Only the minimum IR and minimum PI above come from IEEE 43-2013.

04 Method notes

- Isolate and disconnect the winding or cable. Discharge it before the test and again after it, before touching the terminals.
- Apply the test voltage continuously for 10 minutes and note the readings at the times on the form. Hand-driven testers cannot hold voltage that long, so use a motor-driven or digital instrument for PI.
- Use the guard terminal where surface leakage could affect the reading, and keep leads clear of earth and of each other.

CIE INSTRUMENTS FOR THIS TEST

DIT-2500

Digital, 100, 250, 500, 1000 and 2500 V, up to 50 GΩ, with DAR and PI

DIT-5000

Digital, up to 5000 V and 200 GΩ, auto-ranging

CIE/777

Mains-motor-driven for sustained PI and dielectric absorption testing



Check it online

Scan for the free PI and DAR calculator.
cieinstruments.in/tools



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Page 2 of 2 · Calculation aid, not a substitute for the standard or your site procedure

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