

Insulation resistance testing

A complete solution—
for every application.



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CONNECT**



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Why perform insulation testing?



Safety

The most important reason for testing insulation is to ensure public and personal safety. By performing a high dc voltage test between de-energized current-carrying (hot), grounded, and grounding conductors, you can eliminate the possibility of having a life-threatening short circuit or short to ground which could lead to a fire.

Equipment uptime

In addition, insulation testing is important to protect and prolong the life of electrical systems and motors. Periodic maintenance tests can provide valuable information about the state of deterioration and will help in predicting possible failure of the system. Correcting problems will result not only in a trouble-free system, but will also extend the operating life for a variety of equipment.

Insulation resistance testers can be used to determine the integrity of windings or cables in motors, transformers, switchgear, and electrical installations. The test method is determined by the type of equipment being tested and the reason for testing. Spot-reading/short time resistance tests can be used for low-capacitance equipment, while trending tests such as step voltage or dielectric-absorption tests can be used for time-dependent currents that will last for hours.

Insulation regulations

The International Electrical Testing Association (NETA) provides representative and minimum insulation values for various voltage ratings of equipment for use when manufacturer's data is not available.

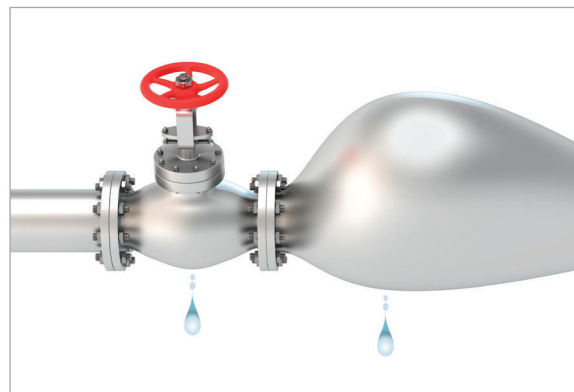
Insulation testers are essential in any electrical system for proper and safe equipment operation per industry standards, IEEE Std 43-2000 (Recommended Practice for Testing Insulation Resistance of Rotating Machines), and other recognized organizations.



The International Electrical Testing Association (NETA) also provides recommended test voltages when manufacturer's data is not available:

Nominal voltage rating of equipment	Minimum insulation resistance dc test voltage	Recommended minimum insulation resistance in megohms
250	500	25
600	1,000	100
1,000	1,000	100
5,000	2,500	1,000
15,000	2,500	5,000

Recommended test voltages and minimum insulation values. The International Electrical Testing Association (NETA) provides recommended representative test and minimum insulation values for various voltage ratings of equipment for use when manufacturer's data is not available.

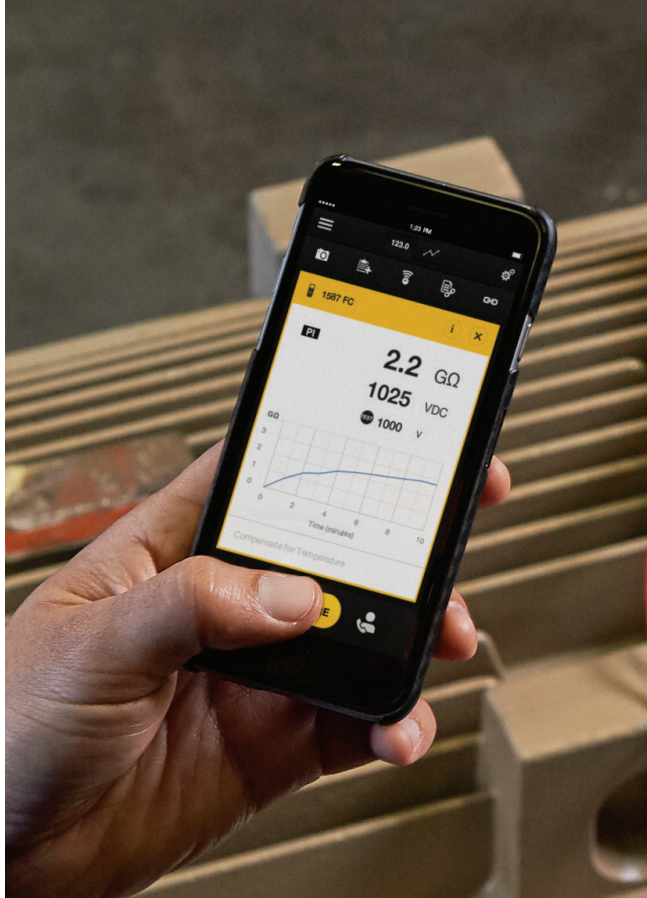


Insulation resistance basics

Insulation testing is a bit like pressure-checking a plumbing system. You can look for leaks in a plumbing system by forcing water through at a high pressure. The increased pressure makes the leaks easier to spot. The electrical version of pressure is voltage. In insulation testing we use a relatively high dc voltage to make leakage current more apparent. The instruments are designed to apply the test voltage in a "non-destructive" and very controlled way. Although they supply high voltage, the current they deliver is strictly limited. This helps prevent damage to systems with failing insulation and keeps the operator from receiving dangerous current levels from accidental contact.

All digital multimeters have a resistance measurement capability (Ohms). But this function uses just a few volts. For systems designed to work at more than a few volts, using the standard ohms function does not give us an accurate picture of the insulation integrity. We want to test the insulation at a voltage greater than working voltage. This will insure that any leakage will show up and if there is a potential for arcing, we will see it under the controlled test conditions.





Insulation spot test

This can be used to verify the condition of the insulation over the life of a motor by connecting Megohmmeter to measure resistance of each winding to ground while recording reading onto graph.

Insulation step voltage

Creates electrical stress on internal insulation cracks to reveal aging or damage not found during other motor insulation tests. This test is done by testing the insulation at two or more voltages and comparing the results.

Polarity index and dielectric absorption ratio

These are timed ratio tests that check the absorption characteristics of wet or contaminated insulation. The PI test is performed over a 10 minute period whereas the DAR ratio test is performed over a 60 second span. There are minimum acceptable polarization index values depending on the insulation class—IEEE Standard 43-2000 covers measurement of polarization index testing:

Insulation	Index value
Class A	1.5
Class B	2.0
Class F	2.0
Class H	2.0

6

Tips for effective insulation testing

- 1 Disconnect any electronic devices like motor drives, PLC's, transmitters, etc. before performing insulation testing. Electronics can be damaged by applying higher than normal voltage.
- 2 The effect of temperature should be considered—it is recommended that tests be performed at a standard conductor temperature of 20 °C (68 °F) or that a temperature baseline is established while compensating future readings by using a DMM with a probe or an infrared thermometer.
- 3 Select a test voltage appropriate for the insulation being tested. The objective is to stress the insulation but not to over-stress it. When in doubt, use a lower test voltage. It's usually appropriate to test insulation at twice the voltage it normally sees: for example 460 V to 600 V rated equipment is often tested at 1000 V.

- 4 When using an insulation tester, leave the leads connected when you stop the test. The insulation tester can discharge any residual test voltage.
- 5 Conductors that are close to each other have a normal capacitance. This will cause an insulation resistance reading to start low and increase steadily until it stabilizes. This type of increase is normal, but if the reading jumps violently down and up again this indicates arcing.
- 6 Although the current is tightly limited, an insulation tester can generate sparks and minor but painful burns. The unexpected surprise can cause an operator to jerk away. As always, work away from live systems and use safe work practices when working overhead.

Insulation resistance

The latest test tools from the testing experts.

***"You asked. We responded.
Now you have more insulation
testing choices than ever."***



Time and again, electrical workers tell us about the importance of testing insulation resistance. Insulation resistance tools are critical to a preventative maintenance program, and a staple for troubleshooting any number of utility, solar, industrial and commercial applications.

Now Fluke has **a tool for every budget and need**, from compact handhelds to portable 2.5, 5, and 10 kV models. We even offer a full-featured insulation tester with multimeter functions built right in—it's two products in one!

Every tester in the line is built to Fluke standards—in other words, beyond your expectations. These tools are all **rugged, reliable, accurate and easy to use**, for lower ownership costs over the long haul...less calibration costs, less repair and replacement costs and longer product lifetime.

For more about testing insulation, along with complete details on the growing family of Fluke insulation resistance testers, just visit **www.fluke.com/insulation**.



A digital insulation tester and full-featured multimeter — TWO TOOLS IN ONE!

Fluke 1587 FC/1577 Insulation Multimeters

The Fluke 1587 FC and 1577 combine the features of an insulation tester with a full featured true-rms digital multimeter in one, compact product.

The Fluke 1587 FC adds diagnostic functions through the Fluke Connect Measurements app including PI/DAR timed ratio tests, memory storage to eliminate needing to write down results, temperature compensation and historical tracking and trending with Fluke Connect® Assets (sold separately).

Fluke insulation multimeters are impressive all-in-one tools whether you work on motors, generators, cables or switch gear. They're rugged, reliable, and user-friendly - meeting the high standards expected from Fluke. This breakthrough solution eliminates the need for additional tools, saving you both time and money.

Recommended for:

Fluke 1587 FC: Industrial plant maintenance, industrial and utilities electricians, field service contractors and commercial HVAC/R technicians

Fluke 1577: Electrical contractors and commercial electricians



Key features

- Insulation test
1587 FC: 0.01 MΩ to 2 GΩ
1577: 0.1 MΩ to 600 MΩ
- Insulation test voltages
1587 FC: 50 V, 100 V, 250 V, 500 V, 1000 V
1577: 500 V, 1000 V
- PI/DAR timed ratio tests (1587 FC only) with enhanced FC TrendIt™ graphs identifies problems faster
- Memory storage through Fluke Connect eliminates writing down results, reduces errors and saves data for historical tracking over time
- Temperature Compensation for establishing accurate baselines and relevant historical comparisons
- Auto-discharge of capacitive voltage
- Measure ac/dc voltage, dc millivolts, ac/dc milliamps, resistance, and continuity beeper
- Fluke 1587 FC includes capacitance, diode test, temperature, min/max, and frequency
- VFD Low-pass filter for variable-speed motor drive measurements (1587 FC only)
- Live circuit detection prevents insulation test if voltage > 30 V is detected for added user protection
- Large display with backlight
- Auto Power Off to save battery life

Insulation resistance testing in the palm of your hand

Fluke 1507/1503 Insulation Resistance Testers

With their multiple test voltages, the compact Fluke 1507 and 1503 Insulation Testers are ideal for many troubleshooting, commissioning, and preventative maintenance applications. Additional features, like the remote probe on these tools, reduces the time needed to perform repetitive testing.

The Fluke 1507 is the best compact, lightweight, handheld insulation tester for advanced industrial and electrical insulation testing. Its full feature set offers the ability to easily and quickly perform advanced insulation resistance testing. Its handy size makes it easy to pack and use. And its reasonable price makes it an excellent value.

For basic electrical insulation testing, choose the compact Fluke 1503—a rugged, compact tool that handles the most common tests at a most affordable price.

Recommended for:

Fluke 1507: Electrical contractors, industrial and commercial electricians

Fluke 1503: Residential and commercial electricians



Key features

- Insulation test range
1507: 0.01 MΩ to 10 GΩ
1503: 0.1 MΩ to 2000 MΩ
- Insulation test voltages
1507: 50 V, 100 V, 250 V, 500 V, 1000 V
1503: 500 V, 1000 V
- Save both time and money with automatic calculation of Polarization Index and Dielectric Absorption Ratio (1507 only)
- Make repetitive tests simple and easy with the Compare (Pass/Fail) function (1507 only)
- Repetitive or hard-to-reach testing is easy with the remote test probe
- Live circuit detection prevents insulation test if voltage > 30 V is detected for added user protection
- Auto-discharge of capacitive voltage for added user protection
- AC/DC voltage: 0.1 V to 600 V
- Lo ohms/earth-bond continuity (200 mA)
- Resistance: 0.01 Ω to 20.00 KΩ
- Remote probe, test leads, probes and alligator clips included with each tester
- One-year warranty



Digital insulation testing up to 2.5 kV

Fluke 1535/1537 Insulation Resistance Testers

The Fluke 1535 and 1537 2,500 V Insulation Resistance Testers are engineered to simplify frontline troubleshooting whether you're on the factory floor or working in the field at a solar installation. With user selectable test voltages from 250 to 2,500 V and resistance measurements up to 500 GΩ these testers allow you to cover more workload with a single tool.

Equipped with an intuitive user interface, a short circuit current of up to 5 mA and a CAT IV 600 V rating these portable high-voltage insulation testers can deliver rapid and stable resistance measurements no matter where you take them.

The 1537 Insulation Resistance Tester also allows you to store measurements for later review or PC transfer, using the provided software to generate customizable reports.

Recommended for:

Fluke 1535 and 1537: Maintenance technicians, Electrical Engineers, Field service engineers, industrial electricians, solar technicians, utility troubleshooters, engineers and technicians



Key features

- Test voltages up to 2.5 kV cover both industrial and solar installation applications
- CAT IV 600 V safety rating
- Selectable test voltages of 250 V, 500 V, 1000 V, and 2500 V for the 1535 and from 250 V to 2500 V in 100 V steps for the 1537
- Resistance measurements up to 500 GΩ
- Voltage breakdown detection alerts the user that voltage is present and gives the voltage reading up to 600 V ac or dc for increased user safety (1537 only)
- Measurements can be stored in up to 99 memory locations, with each location assigned a unique, user defined, label for easy recall (1537 only)
- Up to 1,300 measurements at 2,500 V or 6,500 measurements at 250 V
- Automatic calculation of Dielectric Absorption (DAR) and Polarization Index (PI) with no additional setup
- Guard system eliminates the effect of surface leakage current on high-resistance measurements
- Large digital/analog LCD for easy viewing
- Capacitance and leakage current measurement
- Ramp function for breakdown testing (1537 only)
- Automatically calculate the dielectric discharge rate (DD) to aid in identifying elusive insulation issues (1537 only)
- One-year warranty (1535) / Three-year warranty (1537)

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Digital insulation testing up to 10 kV

Fluke 1555 and 1550C Insulation Resistance Testers

Perform preventive maintenance tasks faster, easier and safer using Fluke Connect and Fluke's market leading insulation testers. Preventive maintenance programs require data to compare present day information with historical readings. Fluke Connect offers three main benefits in data collection for preventive maintenance programs:

Remote configuration and operation

Insulation tests must always be performed with the equipment under test being de-energized, but there are still many safety concerns. Other powered equipment may be operating nearby, and the less time spent around this equipment, the better. The Fluke Connect app lets you setup and run tests through your smartphone.

Real time trending

You can also view results in progress, safely on your smartphone or tablet, through Fluke Connect real-time trending. You get easy-to-see visual cues and graphs, rather than hard to read rapidly changing values. Your smartphone will display the measured value continuously (in real time) and display a trend line for easier interpretation of results.

Simple report creation

Data from your insulation tests are transferred by the ir3000 FC Connector to the Fluke Connect app on your smartphone, tablet or PC, where reports can be generated to make the data easier to understand. No more hand-written data transfers, transcription errors or illegible notes. Report data can include the setup data you entered as part of the remote configuration, plus details such as location, technician's name, serial number for the unit under test and ambient test conditions. Tests can be compared to previous results and stored for future reference.



Key features

- Test voltages up to 10 kV provides solutions for all applications
- CAT III 1000 V, CAT IV 600 V safety rating
- Voltage breakdown detection alerts the user that voltage is present and gives the voltage reading up to 600 V ac or dc for increased user safety
- Selectable test voltages in 50 V steps from 250 V to 1000 V, and 100 V steps above 1000 V
- Measurements can be stored in up to 99 memory locations, with each location assigned a unique, user defined, label for easy recall
- Long battery life gives the user over 750 tests between charges
- Automatic calculation of Dielectric Absorption (DAR) and Polarization Index (PI) with no additional setup
- Guard system eliminates the effect of surface leakage current on high-resistance measurements
- Large digital/analog LCD for easy viewing
- Capacitance and leakage current measurement
- Ramp function for breakdown testing
- Resistance measurements up to 2 TΩ
- Timer settings up to 99 minutes for timed tests
- Three-year warranty

Recommended for:

Fluke 1555 and 1550C: Industrial electricians, utility troubleshooters, engineers and technicians



Fluke combo kits

Fluke has created combo kits to help maximize your productivity and help you solve problems faster and reduce downtime, all with significant savings over buying each product individually.

The products in each kit have been specifically selected for both troubleshooting and preventative maintenance applications.

Establishing preventative maintenance programs are becoming critical to maintaining the uptime of electrical equipment and can significantly reduce both planned and unplanned downtime. Unplanned downtime costs are difficult to calculate, but often significant. For some industries, it can represent 1 % to 3 % of revenue (potentially 30 % to 40 % of profits) annually.



**Fluke 1587 FC ET
Advanced Electrical
Troubleshooting Kit**

Includes:

- Fluke 1587 FC: Perform insulation tests, plus a wide range of DMM tasks with confidence and ease
- Fluke i400: Use with your 1587 FC to accurately measure AC current without breaking the circuit
- Fluke 62 Max +: Check for hot spots and measure temperature with the 62 Max + non-contact thermometer



**MDT Advanced
Motor and Drive
Troubleshooting Kit**

Includes:

- Fluke 1587 FC: Perform insulation tests, plus a wide range of DMM tasks with confidence and ease
- Fluke i400: Use with your 1587 FC to accurately measure ac current without breaking the circuit
- Fluke 9040: Check the rotation of three-phase motors easily and safely



**Fluke 1555 FC
Insulation
Resistance
Tester Kit**

Includes:

- Fluke 1555 Insulation Resistance Tester
- Fluke IP67 Hard Case
- Ruggedized Alligator Clips
- Fluke ir3000 FC Connector
- NIST Traceable Certificate of Calibration



**Fluke 1550C FC
Insulation
Resistance
Tester Kit**

Includes:

- Fluke 1550C Insulation Resistance Tester
- Fluke IP67 Hard Case
- Ruggedized Alligator Clips
- Fluke ir3000 FC Connector
- NIST Traceable Certificate of Calibration

Choose the best fit

FLUKE®

	Two in one tools		Stand-alone tools					
Insulation test features	1587 FC	1577	1503	1507	1535	1537	1550C	1555
Test voltages	50 V, 100 V, 250 V, 500 V, 1000 V	500 V, 1000 V	500 V, 1000 V	50 V, 100 V, 250 V, 500 V, 1000 V	250 V, 500 V, 1000 V, 2500 V	250 V to 2500 V	250 V to 5000 V	250 V to 10,000 V
Insulation resistance range	0.01 MΩ to 2 GΩ	0.01 MΩ to 600 GΩ	0.01 MΩ to 2000 GΩ	0.01 MΩ to 10 GΩ	200 kΩ to 500 GΩ	250 kΩ to 500 GΩ	250 k to 1 TΩ	250 k to 2 TΩ
PI/DAR	•			•	•	• + DD Test	•	•
Auto discharge	•	•	•	•	•	•	•	•
Timed ramp test (Breakdown)						•	•	•
Pass/fail comparison				•	•	•	•	•
Est. # of IRT tests	1000	1000	2000	2000	1300	1300	Various	Various
Voltage > 30 V warning	•	•	•	•	•	•	•	•
Memory	With Fluke Connect™ App					•	•	•
Remote test probe	•	•	•	•				
Lo ohms/earth-bond continuity ¹			200 mA source (10 mΩ resolution)	200 mA source (10 mΩ resolution)				
Fluke Connect™ compatible	•						• ³	• ³
Display	Digital LCD	Digital LCD	Digital LCD	Digital LCD	Digital/analog LCD	Digital/analog LCD	Digital LCD/analog display	Digital LCD/analog display
Hold/lock	•	•	•	•			•	•
Multimeter features								
AC/DC volts	•	•				•		
Current	•	•						
Resistance	•	•				•		
Continuity beeper	•	•				•		
Temperature (contact)	•							
Lo-pass filter ²	•							
Capacitance	•							
Diode test	•							
Frequency	•							
MIN/MAX	•							
Other features								
Backlight	•	•	•	•	•	•		
Software	Fluke Connect compatible					Fluke 1537 Data Management PC Software	Fluke Connect Desktop	Fluke Connect Desktop
Warranty	Three-years*	Three-years	One-year	One-year	One-year	Three-years	Three-years	Three-years
Battery	4 AA (NEDA 15A or IEC LR6)	4 AA (NEDA 15A or IEC LR6)	4 AA (NEDA 15A or IEC LR6)	4 AA (NEDA 15A or IEC LR6)	8 AA (NEDA 15A or IEC LR6)	8 AA (NEDA 15A or IEC LR6)	Rechargeable	Rechargeable

*Extendable to five years with if registered within 45 days of purchase.

Footnotes:

¹ Function useful for checking connections and motor windings. Also useful for users who are required to perform earth-bond continuity measurements during installation testing.

² Filter for variable-speed motor drive measurements.

³ Requires Fluke ir3000 FC Connector.

1.888.610.7664



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Insulation resistance support

Fluke not only has a full line of insulation resistance products to cover every application, we also provide application notes, online webinars, case studies, and expert technical support to help you stay up and running. From “how-to” guides to industry and product specific case studies, Fluke is dedicated to providing you with technical support.

Fluke. *Keeping your world up and running.™*

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