FLUKE®

Insulation resistance testing

A complete solution— for every application.

FLUKE CONNECT®







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.

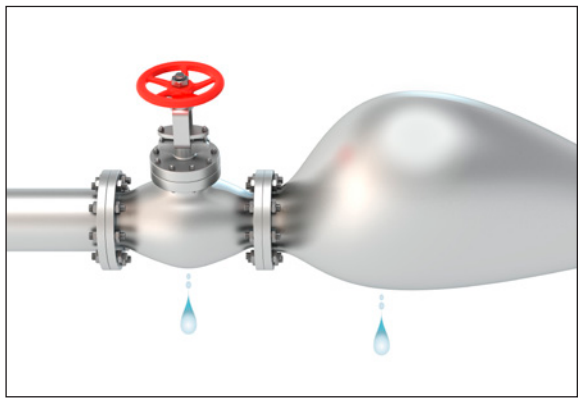


The International Electrical Testing Association (NETA) also provides recommended test voltages when manufacturer's data is not available:

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 Megohmeter 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, industrial and commercial applications.

Now Fluke has **a tool for every budget and need,** from compact handhelds to a portable 10 kV model. 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.

Each Fluke tester also provides you access to "how-to" application notes, selected case studies and expert technical support—FREE.

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 multimeter in one, compact product.

Both offer the "two tools in one" feature set, combining a digital insulation tester with a full-featured, true-rms digital multimeter in a single, compact, handheld unit. The result: maximum versatility for both troubleshooting and preventative maintenance.

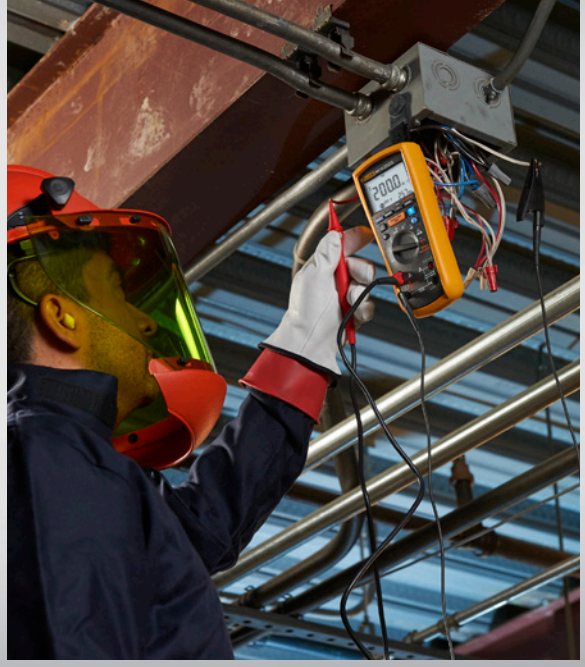
Whether you work on motors, generators, cables or switch gear, Fluke insulation multimeters deliver impressive capability in a single unit. No longer do you need to go back to the truck, shop, or tool crib to get the extra tool you need to get the job done. They are rugged, reliable and easy to use, just what you would expect from Fluke. It all adds up to a breakthrough solution that saves you time and money.

FLUKE CONNECT®

The Fluke 1587 FC adds diagnostic functions through the Fluke Connect Measurements app:

- PI/DAR timed ratio tests with TrendIt™ graphs
- Memory storage through Fluke Connect eliminates writing down results
- Temperature Compensation through app for establishing accurate baselines and relevant historical comparisons
- Historical tracking and trending of assets identifies degradation over time, allows real-time decisions to be made in the field with Fluke Connect® Assets (sold separately)

Product Comparison Charts on page 11.





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

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

Product Comparison Charts on page 11.





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

Product Comparison Charts on page 11.





Digital insulation testing up to 10 kV

Fluke 1555/1550C Insulation Resistance Testers

The new 1555 and redesigned Fluke 1550C insulation resistance testers, offer digital insulation testing up to 10 kV, making them ideal for testing a wide range of high voltage equipment including switchgear, motors, generators and cables. Fluke insulation testers can now conduct the entire range of test voltages specified in IEEE 43-2000 with a best in class, three-year warranty and CAT IV 600 V safety rating. With measurement storage and PC interface, the 1555 and 1550C are perfect tools for preventative or predictive maintenance programs designed to identify potential equipment failures before they occur.

Recommended for:

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

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

Product Comparison Charts on page 11.



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 combo kits



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 Insulation Resistance Tester Kit

Includes:
- Fluke 1555 Insulation Resistance Tester
- Fluke IP67 Hard Case
- Ruggedized Alligator Clips
- NIST Traceable Certificate of Calibration



Fluke 1550C Insulation Resistance Tester Kit

Includes:
- Fluke 1550C Insulation Resistance Tester
- Fluke IP67 Hard Case
- Ruggedized Alligator Clips
- 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**	**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 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	250 k to 1 TΩ	250 k to 2 TΩ
PI/DAR	•			•	•	•
Auto discharge	•	•	•	•	•	•
Timed ramp test (Breakdown)					•	•
Pass/fail comparison				•	•	•
Est. # of IRT tests	1000	1000	2000	2000	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)		
Display	Digital LCD	Digital LCD	Digital LCD	Digital 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				FlukeView® Forms Basic	Fluke View® Forms Basic
Warranty	Thee-years*	Thee-years	One-year	One-year	Thee-years	Thee-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)	Rechargeable	Rechargeable

Note: Not all product features and specifications are listed in this table. For more complete information, see individual product data sheets.

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.

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



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.

Visit www.fluke.com/insulation for a complete list of insulation testing support materials.

Every need—and every budget:

Learn about the entire range of Fluke insulation resistance testers. See your Fluke sales representative or visit **www.fluke.com/insulation**

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

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