



# Cumulus Quality Insulation Resistance Testing User Guide

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# Contents

Insulation Resistance Testing Overview .....	4
Setting Up a Workflow .....	5
Insulation Resistance Testing in the Mobile App .....	6
Connecting to a Tool.....	6
Stages of the Test.....	7
Ending a Test Segment (IR Mode or IR(t) Mode) .....	8
Completing the Test.....	9
Passing a Test .....	10
Failing a Test .....	11
Reviewing Tests in the Control Center.....	12
Tables of Test Data.....	12
Insulation Resistance Tickets .....	15
Recommended Details for Implementation.....	16
Support and Contact .....	18



# Insulation Resistance Testing Overview

Insulation Resistance (IR) testing – often called Megger testing – measures the integrity of electrical insulation by applying a high DC voltage and reading the resistance (in megohms) between conductors or between a conductor and ground. A good insulation will show very high resistance (typically in the megohm range or higher), whereas deteriorated or contaminated insulation yields lower resistance readings. This test is non-destructive and does not harm healthy insulation, yet it can reveal hidden weaknesses or moisture in the insulation that could lead to failures. With regular testing, Insulation Resistance values can be tracked over time to detect downward trends (deterioration) before a catastrophic failure occurs.

**Industry Standards:** The Cumulus platform is designed to help you perform Insulation Resistance tests in compliance with industry standards, such as ANSI/NETA ATS Table 100.1. This standard provides recommended minimum insulation resistance values for various equipment ratings. For example, NETA ATS 2017 recommends that a 600 V-rated cable or apparatus, tested at 1,000 V DC, should have at least 100 M $\Omega$  insulation resistance. Higher-voltage equipment requires correspondingly higher minimum readings (e.g. a 15 kV system should read 5,000 M $\Omega$  or more). Adhering to these benchmarks ensures that your test results meet accepted safety and quality criteria. Always consult the latest NETA ATS/MTS tables, or refer to your project requirements, for the appropriate minimum values based on equipment type and rating.

**Factors Affecting Test Results:** Be aware that readings are influenced by environmental conditions and test duration. Elevated *humidity* and temperature can drastically reduce insulation resistance readings even if the insulation is in good condition. For instance, laboratory tests on circuit breakers show that at 75% relative humidity the Insulation Resistance value can drop to around 10 M $\Omega$  (versus 500+ M $\Omega$  at 40% humidity). These values may still be considered functional, but they underscore the importance of testing under controlled conditions whenever possible. Industry guidelines (e.g. IEC 60947) suggest performing Insulation Resistance tests below 50% humidity and investigating any readings below 1 M $\Omega$  for new equipment. Temperature also impacts results – a common rule of thumb is that Insulation Resistance doubles for every 10°C drop in temperature (and halves for each 10°C rise). Always record the ambient temperature and humidity with each test if possible or use correction factors to normalize readings to a standard temperature. The Cumulus platform allows entry of environmental conditions as part of the test record (if your workflow is configured for it), aiding in the interpretation of results over time.

**Purpose and Safety:** The primary purpose of Insulation Resistance testing is to prevent electrical insulation failures that could lead to outages, fires, or safety hazards. It helps verify that cables, motors, transformers, busways, and other components are safe to energize. Always follow proper safety precautions: ensure the equipment under test is fully de-energized and discharged before connecting the tester, and never connect an Insulation Resistance tester to live circuits. Use appropriately rated test voltages as per standards (e.g., 500 V, 1,000 V, 2,500 V, etc., depending on equipment rating) – higher voltages will stress insulation more and can detect subtle weaknesses but must be chosen within equipment limits.

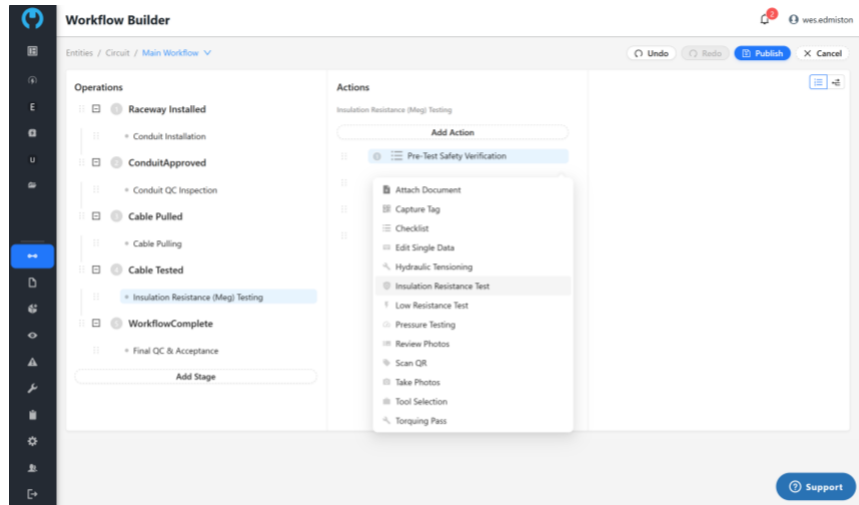
**Traceability and Compliance:** Using Cumulus for Insulation Resistance testing ensures that every test is digitally documented for full traceability. Each test record can include the date/time, the specific asset, the person who performed it, and even the tool used and its calibration status. The platform's connected workflow captures readings directly from the megohmmeter (when using a supported device), producing an "audit-ready" digital record for internal QA or external regulators. This defensible record of each insulation test demonstrates adherence to procedures and standards, helping organizations align field work with NETA requirements, manufacturer specs, and client criteria. The following sections provide step-by-step guidance on setting up and executing Insulation Resistance tests in Cumulus, reviewing the results, and handling any issues (tickets) that arise, all in a way that maximizes compliance, data integrity, and efficiency.



# Setting Up a Workflow

Before field technicians can perform insulation resistance tests using the Cumulus Mobile App, a workflow must be configured in the Cumulus Control Center (web platform). This workflow defines how tests are to be carried out and what data is collected. As QA/QC managers or engineers, you'll set up the Insulation Resistance test workflow to match your project's requirements and industry best practices.

**Creating the Insulation Resistance Test Workflow:** In the Control Center, navigate to your asset workflow where the Insulation Resistance tests are needed. Create a new 'Insulation Resistance Test' Workflow Action. Give it a clear name (e.g. "Insulation Resistance Test – Medium Voltage Cables"). Within this workflow, you will define the steps that correspond to performing an Insulation Resistance test on an asset.



- **Define Test Parameters:** When setting up the Insulation Resistance test step, the user will name the action, define the acceptable test variance, and select if a minimum duration is required. If required, the user will be prompted to select which asset property will be used for the test duration. Otherwise, no further action is needed. The user can then save the action and proceed with configuring their workflow.
- **Automatic Property Creation:** Automatic Property Creation is a feature that saves you time here – when you select an “Insulation Resistance Test” action, Cumulus will automatically generate the standard data fields needed. For example, the system will auto-create fields for Minimum Required Resistance, Test Voltage, Number of Phases, Number of Neutrals, and Number of Grounds, within the asset type’s Properties list. Ensure these auto-created properties align with your site’s standard nomenclature. You can rename those properties and add custom properties if needed.

Position	Property Name	Description	Data Type	Unit	Precision	Actions
1	Test Voltage	The test voltage applied during the insulation resistance test	Voltage	Unit:V	Precision: 3	Delete
2	Required Resistance	The required resistance value for the insulation resistance test	Resistance	Unit:GOhm	Precision: 3	Delete
3	Test Duration	N/A	Time	Unit:min	Precision: 1	Delete
4	Number of Phases	The number of phases in the electrical system	Int			Delete
5	Number of Neutrals	The number of neutrals in the electrical system	Int			Delete
6	Number of Grounds	The number of grounds in the electrical system	Int			Delete

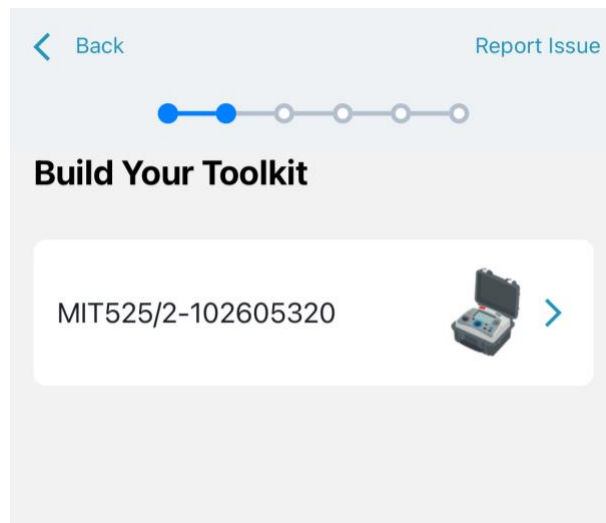


Once the workflow is fully defined with all steps and properties, publish it so that it becomes available to field users on the Cumulus mobile app. All the heavy lifting of configuration is done upfront in the Control Center, enabling a streamlined and guided experience for electricians in the field.

## Insulation Resistance Testing in the Mobile App

Field electricians will execute the Insulation Resistance testing workflow using the Cumulus Mobile App on a tablet or smartphone. This section describes the process from connecting the test instrument, through performing the test stages, to completing the test and recording results. Ensure that you have the latest version of the Cumulus mobile app installed (check for updates, as new versions often add support for more instruments or enhancements for testing workflows).

### Connecting to a Tool



Before starting a test, the mobile app user must connect the mobile app to the insulation resistance tester (megohmmeter). The Cumulus app supports specific digital Insulation Resistance testers via Bluetooth Low Energy (BLE).

#### Steps to Connect the Tool:

1. **Power On the Tester:** Turn on the insulation tester and enable its Bluetooth/wireless mode (refer to the tool’s manual or the Cumulus hardware guide for how to verify Bluetooth is on, if required). The tester should be calibrated and in good working order (ideally, ensure it has been uploaded into the site’s Control Center before use).
2. **Open the Cumulus App:** On the mobile app, navigate to the asset or work package you plan to test. Select Action button that corresponds to the insulation resistance test workflow that you set up earlier. The app will display the steps to follow. When you reach the step that requires instrument connection (labeled “Build Your Toolkit”), tap the option to connect a device.
3. **Select the Device:** The app will scan for supported devices nearby. Choose your Insulation Resistance tester from the list (it will show up with the model and serial number in the Bluetooth name). For example, if using a Megger MIT series, you might see “Megger MIT525/2-12345” in the list. Tap to connect. The app will indicate when the connection is successful and transition to the test execution screen.
4. **Lead Connections:** Now physically connect the tester’s leads to the equipment under test. Follow proper lead connection procedures for your site. The Cumulus app will show details for which conductors to connect during the test segment. **Ensure the circuit is de-energized and all personnel are clear, as you will be applying high voltage.**



*Safety Note: The workflow can be configured to display safety warnings where users must confirm on-screen that they have verified continuity and that it's safe to proceed. It is best practice to require users to confirm a Point-to-Point test has been completed and “Equipment de-energized – OK to test” before allowing the test to start.*

At this point, you have the instrument connected both physically (to the equipment) and digitally (to the app). You're ready to begin the actual testing sequence.

## Stages of the Test

Insulation resistance tests may involve multiple stages or phases, depending on the number of conductors and the workflow design. Generally, a test will go through the following stages in the Cumulus app:

- **Initialization Stage:** After connecting, the app and instrument initialize the test. Start by selecting the test mode (steady Insulation Resistance or IR(t)), selecting the test voltage, and confirming the conductor pair under test. The app will display the Test Voltage, Test Duration (if required), and the Required Resistance. The mobile device will validate these properties throughout the test.
- **Charge/Ramp Stage:** To begin the test, press the “TEST” button on the instrument (**note:** for safety purposes, the test cannot be started nor ended via the mobile app). When the test begins, the instrument will ramp up to the specified voltage.
- **Measurement Stage:** This is the main testing period. During this stage, the mobile app will display warnings to indicate the system is energized. For a simple “spot-read” Insulation Resistance test, this stage may only last a few seconds – essentially until the reading stabilizes. For a timed test (denoted as IR(t) or as a test timed solely by the mobile app), this stage could run for a predetermined duration (e.g. 60 seconds). The app will show a live reading that updates as the test progresses. If configured, you will see a timer countdown indicating how much time remains in the test. The mobile app will display a test status denoting if the required resistance has been achieved or if it is below target. Once the test duration has been met (if required) and when the test is ended on the instrument, the app will end the measurement stage.





- **Discharge Stage:** Once a measurement is taken, the tested object's capacitance must be discharged safely. Many modern megohmmeters automatically discharge the circuit when the test is stopped – you will usually hear or see an indication on the tester. The app may explicitly prompt the user to ensure discharge (“Discharging... Do not disconnect leads until discharge complete”). This stage is critical for safety; the app's workflow enforces that the tester remains connected for the discharge duration.
- **Repeat Stage (if multiple segments):** If the workflow requires multiple segments (e.g. multiple conductor combinations), the app will loop back to the Initialization stage for the next segment. For instance, after completing “Phase A-B”, the next stage prompts “Connect leads to Phase A – Phase C” for the next measurement. The connection process might be repeated, or if you have multiple conductors, the app might instruct you to move one lead to the next conductor, etc. Each segment will then progress through the same charge and measure stages.

Throughout each stage, the app provides instructions and live feedback. Technicians should follow on-screen prompts closely. The Stages of the Test are clearly delineated in the UI to reduce confusion, so users know whether they are in the middle of a measurement or between measurements.

## Ending a Test Segment (IR Mode or IR(t) Mode)

Ending a test segment can happen automatically or manually depending on the mode:

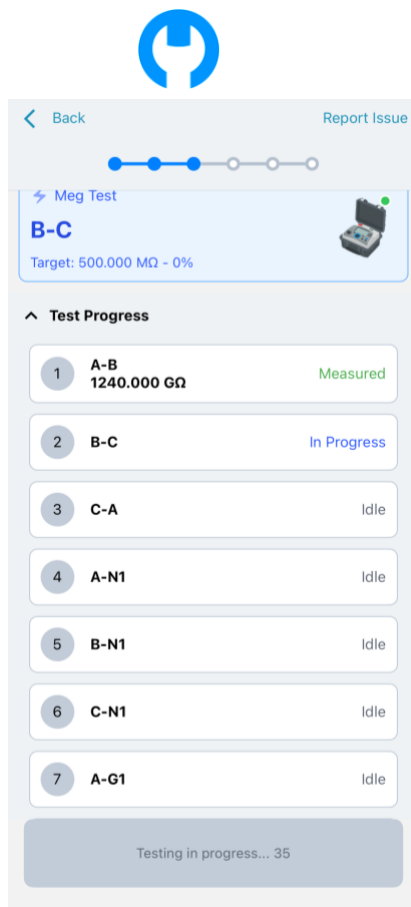
- **IR Mode (Spot Reading):** In a basic Insulation Resistance test mode, you might simply hold the test until the reading stabilizes (usually a few seconds to perhaps a minute). The user can decide to stop when a stable value is seen. Using Cumulus, this is done by pressing the “Test” button on the tool once the value has leveled off. Some workflows may specify a minimum time (e.g. “Run test for at least 60 seconds”). In those instances, the app will display a countdown of the remaining duration. Once the full duration has been met and the test is stopped from the device, the user will be able to progress to the next test phase or complete the test. When you tap Stop, the instrument will cease applying voltage and internally discharge the circuit. The final resistance value (at the moment of stopping) will be recorded by the app.
- **IR(t) Mode (Timed Test):** In a timed mode, the test runs for a preset duration (t). Common example: 60-second test (to get a one-minute reading, as required by NETA). In this cases, the tool and the app automatically end the test when the time expires. The user does not need to press “Test” to stop the test; rather, the tool will automatically end the test and the app will indicate the test is complete once the timer finishes.

When a segment ends (whether manually or automatically), the app will clearly show it. Typically, you will see the final measured resistance value logged on the screen. The instrument should also be discharging the system at this point – often indicated by a falling voltage reading or a message on the tester. Do not disconnect the test leads until the app/instrument confirm that discharge is complete. Only once that clears is it safe to handle the connections.

After ending a test segment, the Cumulus app will ask the user for additional input or provides some feedback:

- If the workflow requires multiple segments (multiple conductor pairs or repeated tests), the app may now prompt you to proceed to the next segment (e.g., “Continue to A-C”). Go through the Start and End process for each required segment in turn.
- If the segment was the last one for that asset, the app will move on to result evaluation and completion steps (discussed below). Sometimes, after a segment, the app will provide the option to pass or fail the test.

**Reviewing Segment Data:** You can tap on the chevron next to the “Test Progress” text above the test graph to review previously recorded values. This consistent feedback helps in deciding if a retest is needed or if the data is sound.



In summary, ending a test segment in Insulation Resistance mode involves manual intervention at the right time, whereas in IR(t) mode the tool and app coordinate to end the test at the prescribed duration. In both cases, Cumulus ensures the data is captured, that it meets specifications, and that the equipment is safely discharged before proceeding.

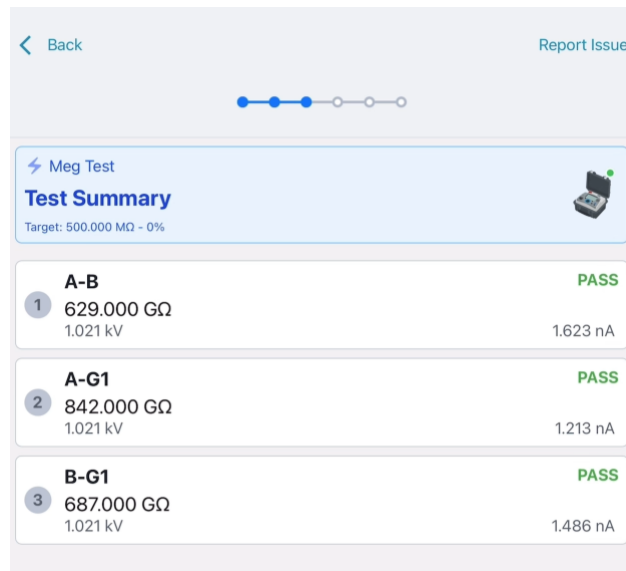
## Completing the Test

After all required test segments for an asset are finished, the workflow will guide the user through completing the test. “Completing” here means both finalizing the data recording and interpreting the overall result for that asset’s Insulation Resistance test. The Cumulus platform will aggregate the outcomes of each segment and determine if the asset passes or fails the insulation test criteria.

The user will then complete the remaining actions required for that operation in the workflow, provide any notes, and proceed to the next operation or asset.



## Passing a Test



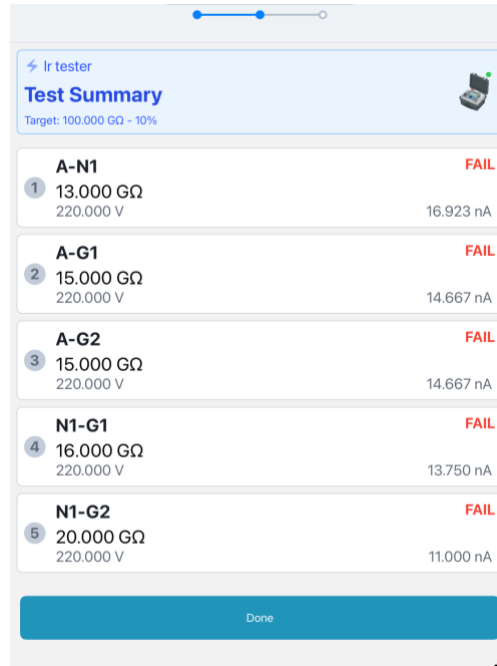
If all measured insulation resistance values meet or exceed the minimum acceptance criteria defined in the workflow, the test is considered a Pass. The app will typically display a green indicator or a message such as “Test Passed” once the last segment is done and the values are within spec.

- **Automatic Pass Evaluation:** Since you entered threshold criteria in the workflow setup, the app checks each result against those. For example, if the minimum was set to 100 MΩ and your lowest reading was 250 MΩ, the app knows this is a pass. In a multi-segment test, all segments must pass for the overall test to pass. The app might show a list of segments with checkmarks and their values, confirming each one met the standard.
- **User Confirmation:** In some cases, the workflow might ask the user to confirm the pass result. For instance, after automatic evaluation, it might present “Overall Result: PASS – Confirm to continue.” This gives the electrician a chance to agree that everything looks correct. Confirming will lock in the results and mark the workflow step as completed successfully.
- **Recording and Saving:** Cumulus automatically records the final readings in the asset’s test record. The platform also timestamps the completion and records the ID of the instrument used. All this data is synchronized to the cloud (once connectivity is available) so that managers can review it in real time.
- **Next Steps After Pass:** Once a test is passed and completed, the workflow might simply end, or it could guide the user to next steps like “Remove Lockout/Tagout and prepare to energize” – depending on how you designed it. The platform will automatically mark the asset as with the next workflow status across the system. Field users can then proceed to the next assigned test or task.

Passing a test typically requires no further immediate action. However, all stakeholders should be confident that a passing result is truly indicative of good insulation. Thanks to compliance with industry standards, procedural adherence enforcement by the Workflow Builder, and the captured evidence, these digital records give that confidence. The pass result will be visible in the Control Center’s Overview and Insulation Resistance pages, which we will discuss in a later section.



## Failing a Test



If one or more readings do not meet the acceptance criteria, the test is marked as a Fail. Cumulus will flag the result in red and prompt the user through additional steps to ensure this outcome is properly handled.

- **Immediate Indication:** The app will show an alert if a value is below the threshold. For example, “Resistance below target” may appear in the test status indicator when a low reading is recorded. The overall status for the asset will not, however, be “Failed”. Given the effects of humidity and temperature on insulation resistance readings, the app will allow you to test the remaining segments of the workflow. If, however, there are obvious signs of a greater defect, the user can fail the test at any time to close the test in the app and report the defect.
- **Data Recording:** All failing values are recorded just like passing ones. They will be highlighted in the system. Technicians should add any notes that could help in troubleshooting (e.g., “Failure possibly due to moisture observed in junction box” or “Cable insulation nicked – visible damage”). These notes become part of the test record.
- **Automatic Ticketing:** Cumulus has a built-in, automated non-conformance reporting system (see Section 5). In many configurations, a failed test will automatically generate a Ticket in the system, linking the test record to a corrective action workflow. For example, a ticket titled “Insulation Resistance Failure – Cable ID 1234” could be created.
- **Completing the Failed Test:** Even though the test itself failed, the workflow on the app may still be completed. The user can elect to mark the step as failed, which would abort the operation entirely, or they can allow the app to do this automatically and then complete the workflow steps. This might feel counterintuitive (completing a failed workflow), but this enables the full log of the state of the asset at time of test. The asset’s status in the system will now show “Test Failed” or the otherwise configured resulting status from the Workflow Builder.
- **Isolation and Safety after Fail:** If a test fails, it implies compromised insulation. It is best practice to configure the workflow to instruct the technician to keep the equipment de-energized and inform a supervisor or responsible engineer. Do not apply power to an asset that has failed Insulation Resistance testing.

After a failure, the asset will likely need troubleshooting and rework. The digital record in Cumulus provides traceability for this process. The failed reading, the person who performed the test, time stamps, and any photos (perhaps of the megger reading or the equipment condition) are all stored. This is invaluable for the QA/QC team to decide next steps – whether that’s drying out equipment, repairing insulation, or other corrective measures. Once the issue is resolved, a new Insulation Resistance test workflow run can be initiated on that asset to verify the fix, and all results will be logged again for full traceability and compliance.



# Reviewing Tests in the Control Center

All data captured during insulation resistance tests in the field is immediately available to office and QA personnel via the Cumulus Control Center web interface. This centralized dashboard allows for real-time monitoring of test progress, detailed review of results, and generation of reports. It is organized into various pages or tabs that present the information in useful formats. The key areas for Insulation Resistance testing are the Overview, History, and Insulation Resistance pages, along with the ability to produce Completion Reports. Each is discussed below.

## Tables of Test Data

The Control Center provides tabular views of test records to help QA/QC personnel and field supervisors quickly see status and drill down into details.

## Overview Page

The Overview page is the dedicated landing page for an individual asset record when you select it from the Asset Index. For assets with insulation resistance testing, you will see a summary table with the latest Insulation Resistance test results, as well as a summary of the history on the righthand side of the page.

This lets you quickly identify any failed tests (highlighted in red) and see where follow-up is needed. Passed tests will be indicated by a green test status.

## History Page

The History page provides a chronological log of activities and test results for an asset. This can be useful to see trends or repeat tests on the same asset, or for performing a root cause analysis after a failure or incident.



- **Details in History:** Clicking on a history entry opens the full test record. The History may show multiple entries for the same asset (if retested), whereas Overview will only show the latest test event.
- **Audit Trail:** The History page serves as an audit trail. It may log not just test completions but also events like “Ticket Approved” or any other workflow operations, depending on configuration. This gives a timeline of actions.

Using the History, QA managers can verify that no tests were missed and see the sequence of testing. It’s also helpful for auditing that proper procedure was followed – for instance, confirming that a failed test was indeed followed by a ticket and a subsequent retest entry.

## Insulation Resistance Page

The Insulation Resistance page provides detailed data and analytics specifically for Insulation Resistance tests. This is where you can dive into the actual readings and maybe see graphical data.

Target Resistance	Required Voltage	Overall Status
500.00 MΩ	1.00 kV	Pass

Test Voltage	Target Resistance Lower Limit	Minimum Duration Required
1.02 kV	500.00 MΩ	1m 0s

Measured Resistance	Status	Measurement	Minimum Duration Met	Timestamp
1330.00 GQ	Pass	A-B	(1m 0s)	January 15th 2026 3:24:40 pm
1670.00 GQ	Pass	B-C	(1m 0s)	January 15th 2026 3:26:18 pm
1840.00 GQ	Pass	C-A	(1m 0s)	January 15th 2026 3:27:26 pm

Measured Resistance	Status	Measurement	Minimum Duration Met	Timestamp
2000.00 GQ	Pass	A-N1	(1m 0s)	January 15th 2026 3:28:40 pm
2000.00 GQ	Pass	B-N1	(1m 0s)	January 15th 2026 3:30:26 pm
1550.00 GQ	Pass	C-N1	(1m 0s)	January 15th 2026 3:31:40 pm

- **Detailed Test Data:** When you select a particular asset record that contains a completed insulation Resistance test, the Insulation Resistance Table page will be available to show all of the recorded properties. For example, it will display:
  - **Test Voltage:** e.g. 1000 V DC.
  - **Measured Resistances:** e.g. Phase A-B: 500 MΩ, Phase B-C: 480 MΩ, Phase A-C: 505 MΩ, Phase A-G: >1000 MΩ (∞), etc., whatever combinations were tested.
  - **Test Durations:** e.g. 60 seconds for each measurement.
  - **Test Status ID:** e.g. Pass or Fail

The data is presented in a clear table layout. Out-of-spec values might be colored or flagged.

- **Pass/Fail Criteria Display:** The page will usually indicate what the acceptance criteria were for context. For example, “Criteria:  $\geq 100 \text{ M}\Omega @ 1\text{kV}$  (per NETA ATS Table 100.1)” might be shown, justifying why a result was pass or fail. This is especially useful for report generation, to demonstrate compliance with industry standards in the documentation you might present to clients or auditors.

In summary, the Insulation Resistance detailed page is your go-to for any specific test’s in-depth information. It transforms raw data collected in the field into intelligible information, backed with context (criteria, instrument details, etc.). This ensures traceability – anyone reviewing later can see exactly how the test was done and what the outcomes were.



## Completion Reports

Cumulus allows you to generate Completion Reports to formally document the testing outcomes. These are PDF reports that compile the details of one or multiple tests, suitable for turnover packages, client documentation, or regulatory compliance records.

RECORD: PTC-0039 Page 1 of 4

**CIRCUIT DATA SHEET**

CLIENT DOCUMENT NUMBER: N/A ENTITY STATUS: Cable tested

RECORD	SYSTEM	ID	SUBSYSTEM	DATE CREATED/PTC
PTC-0039 Rev 000	N/A	PTC-0039	N/A	Jan 15th 2026 21:41:07

FROM LOCATION	TO LOCATION	PROJECT NAME	LOCATION	CABLE SIZE
PTX	BUSWAY	YOUR DATA CENTER	Hawaii	N/A

NUMBER OF PHASES	NUMBER OF NEUTRALS	NUMBER OF GROUNDS
2	N/A	1

TEST VOLTAGE	REQUIRED RESISTANCE	TEST DURATION
1000.000 V	0.500 GΩ	1.0 min

**COMMENTS**

FULL NAME	COMMENTS	TIME LTR
Justin Wolf		Jan 15th 2026 21:38:42

**TOOLS USED**

TOOL DESCRIPTION	SERIAL NUMBER	SET PRECISE	CALIBRATION DUE DATE
MIT525/2-102695325	102695325	-	N/A

**SIGNATURE**

ELECTRICIAN NAME (MMS TEST)	COMMENTS	DATE (DDMMYY)
Justin Wolf	N/A	January 15th 2026

RECORD: PTC-0039 Page 2 of 4

**INSULATION RESISTANCE TESTING**

FEEDER/CIRCUIT ID	MINIMUM DURATION	TARGET RESISTANCE	TARGET RESISTANCE LOWER LIMIT	TARGET VOLTAGE
PTC-0039	60s	500.00 MΩ	500.00 MΩ	1.00 kV

**PHASE MEASUREMENTS**

PHASE TO PHASE			PHASE TO NEUTRAL		
MEASUREMENT	RESISTANCE	TEST DURATION	MEASUREMENT	RESISTANCE	TEST DURATION
A-B	1330.00 GΩ	1m 0s	A-N1	2000.00 GΩ	1m 0s
B-C	1670.00 GΩ	1m 0s	B-N1	2000.00 GΩ	1m 0s
C-A	1840.00 GΩ	1m 0s	C-N1	1550.00 GΩ	1m 0s

PHASE TO GROUND			NEUTRAL TO GROUND		
MEASUREMENT	RESISTANCE	TEST DURATION	MEASUREMENT	RESISTANCE	TEST DURATION
A-G1	2000.00 GΩ	1m 0s	N1-G1	2000.00 GΩ	1m 0s
B-G1	2000.00 GΩ	1m 0s			
C-G1	2000.00 GΩ	1m 0s			

Key aspects of Completion Reports for Insulation Resistance testing:

- Individual Test Reports:** For each asset tested, you can output a formatted report containing all the pertinent data. This includes:
  - Header information:** Project name, location, date of test, tester name, asset ID, and asset property details.
  - The measured values vs. criteria:** in a table form listing each conductor combination, test voltage, duration, measured resistance, and whether it passed or failed.
  - Signatures or Approvals:** The workflow can be set such that QA/QC engineers must review and sign off on results. The report can include a field for an electronic signature or just a name/date stamp of who approved the results in the system.
  - Tool Traceability:** A completion report will also embed traceability info such as the instrument calibration details. For example: “Instrument: Megger MIT510, Serial 12345, calibration due 07-01-2026” will be included if the tool is tracked in the Cumulus Tools inventory. This provides confidence that the measurement was taken with a calibrated device.
- Batch or Summary Reports:** You can also produce summary reports covering multiple assets – for instance, an “IR Testing Summary for Building A – Floor 3”. This might list all cables tested on that floor with their results. It’s useful for showing overall completion status. Such a report will have one line per asset so quick review of many tests.

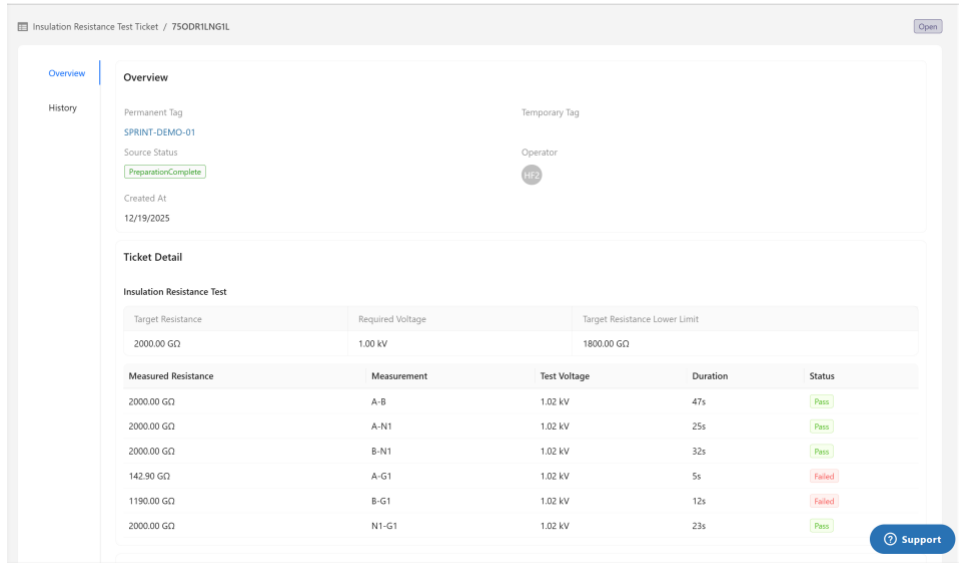
Once generated, these reports can be digitally signed if needed and then distributed. Cumulus also allows you to bulk-download all Insulation Resistance test reports for a project, which is useful for assembling turnover packages. Always review the report content before and all failures are accounted for with notes or tickets. The digital records in Cumulus mean you can always go back and audit the source data if any question arises about a report.

Completion reports serve as the formal evidence that testing was done correctly and that the installation is either ready for energization (if all passed) or that certain issues were found and addressed. When combined with the digital audit trail, they help achieve compliance with both client requirements and industry standards, while minimizing the chance of human error in transcription since the data flows directly from the field device to the report.



# Insulation Resistance Tickets

In the Cumulus platform, Tickets are a key mechanism for tracking issues, non-conformances, or work that needs follow-up. In the context of Insulation Resistance testing, tickets are typically used to manage any problems uncovered by the tests – most commonly failed tests, but also anomalies or things to revisit. This section will cover how tickets are integrated into the Insulation Resistance testing workflow and the best practices for using them.



**Automatic Ticket Generation:** Cumulus workflows can automatically generate tickets based on criteria. For Insulation Resistance tests, when the workflow outcome is “Fail,” the system creates a new ticket, populating it with:

- The asset ID and name.
- The reason (e.g., “Insulation resistance below acceptable limit”).
- The related test data (it might even attach the test record or reference it).
- The person responsible or group (could auto-assign to an Electrical Supervisor or QA Engineer role).

This automation is valuable for traceability. It ensures no failure is overlooked – there’s a formal item in the system that must be closed out. In the Control Center, you can view all open tickets in a ticket register, filterable by type (IR Test, etc.).

**Ticket Contents and Workflow:** A ticket generally has a description of the issue and may have fields like Category, Location, Date Raised, Raised By, Description, Attachments, and Status. Team members can update the ticket as they work on the issue:

- They might add notes (“Dried and re-sealed cable termination. Ready for retest.”).
- Change status from Open to Closed.

**Ensuring Traceability and Minimizing Rework:** Tickets play a crucial role in traceability. They create a documented link between a failed test and its resolution, which is evidence that due diligence was done. This helps minimize rework because issues are tracked methodically – nothing slips through the cracks to later require re-testing unexpectedly. It also helps root cause analysis: if certain patterns of failure emerge (e.g., “multiple cables failing due to the same installation practice”), the tickets can be analyzed to drive process



improvements. In short, tickets enforce the QA/QC feedback loop.

***Example:** Suppose during Insulation Resistance tests, five cables fail due to moisture. Five tickets are logged. QA notices the common thread and investigates – perhaps installers didn't cap the conduits in the rain. The resolution might not just be fixing those five cables, but also issuing a notice to prevent this in the future. The end result is better quality and less rework on subsequent installations.*

**Closing the Loop:** Once a ticket's issue is resolved, ensure to update the ticket status to Closed and reference the evidence. Often the closing note will say "Retested under Ticket – see Insulation Resistance Test record dated X, result Pass." Now the test cycle is fully traceable: initial fail record, ticket, and pass record all linked. An auditor or client can follow this chain and be assured that the failure was properly managed – a hallmark of a robust quality system.

In conclusion, tickets are your friend in managing test outcomes. Use them diligently. They provide a structured approach to handle failures and ensure every issue is accounted for, fixed, and verified. The Cumulus platform's integration of ticketing with test workflows makes this process seamless and transparent to all stakeholders.

## Recommended Details for Implementation

Organizing your assets and workflows in Cumulus effectively is essential for smooth execution and meaningful reporting of insulation resistance tests. This section provides recommendations on how to structure the hierarchy of assets and how to design workflows to fit different scenarios. By structuring things well, you ensure that tests are easy to perform for field crews and that data rolls up in a way that makes sense for analysis and compliance.

**Asset Hierarchy:** In Cumulus, assets can be arranged in parent-child relationships (e.g., System > Subsystem > Equipment > Component). For Insulation Resistance testing, consider the following:

- **Group by Electrical System:** It often makes sense to mirror the electrical single-line diagram. For example, you might have assets grouped under a switchboard or panel. Under a panel, list all outgoing cables/feeders as individual assets. Under a motor or transformer, have its winding/cable as asset (if separate).
- **Each Testable Item as an Asset:** If something will have its own Insulation Resistance test certificate or result, treat it as a distinct asset in the system. For instance, each power cable segment (between terminations) should be an asset with a unique ID. Each motor or generator would be an asset (the whole motor – Insulation Resistance is typically done on its windings).
- **Use Descriptive Names and IDs:** Name assets in a way that technicians can identify in the field. E.g., "Cable-Tag: 3L1-3L2 from Panel DP-1 to MCC-2" or "Motor-23 (Pump P-23)". This helps ensure they test the right item. If your project has tag numbers, load those into Cumulus asset names or alias fields.
- **Asset Properties for Voltage Class:** Include a property for each asset that indicates its nominal voltage (e.g., 600 V, 5 kV). This can be leveraged in the workflow to automatically set test voltage and criteria as mentioned earlier. Also include length for cables or kW for motors if that helps in evaluating results or applying the correct standards (for example, different test voltages for motors might depend on rated voltage).

**Workflow Design per Asset Type:** You might have separate Insulation Resistance workflows for different asset categories:

- A **Cable Insulation Resistance Test** workflow, which includes multiple conductor pair tests (phase-phase, phase-ground).
- A **Motor Insulation Resistance Test** workflow, which might involve testing each phase to ground and then performing a polarization index (PI) test (10-min test) per IEEE/NETA for large motors. It could also include steps like warming the motor or drying before test if needed.



- A **Bus Duct Insulation Resistance Test** workflow for busway sections, which might entail testing each bus phase-to-phase and phase-to-ground.
- A **Panel/Bus Insulation Resistance Test** workflow for switchgear bus sections, etc.

By separating workflows, you can tailor the steps and criteria to each situation. This prevents confusion (for example, a motor’s PI test might not apply to a cable, so you wouldn’t include those steps in the cable workflow).

**Conductor Pair Testing Example (Cables):** As an example of structuring a cable Insulation Resistance test:

- Step 1: Verify cable isolated (safety).
- Step 2: Connect Megger leads to Phase 1 and Phase 2. Perform Insulation Resistance test at specified voltage (e.g., 1000 V for 600 V cable) for 1 minute. Record resistance.
- Step 3: Connect leads to Phase 1 and Phase 3. Perform test, record.
- Step 4: Connect leads to Phase 2 and Phase 3. Test, record.
- Step 5: Connect Phase 1 to Ground. Test, record.
- Step 6: Phase 2 to Ground.
- Step 7: Phase 3 to Ground.
- Step 8: Complete – determine pass/fail.

While that seems like many steps, the app makes it straightforward by guiding the user. The advantage of listing each combination is thoroughness – you won’t miss a combination (which is important; a cable could have good phase-to-phase insulation but a problem to ground, for instance). According to Schneider Electric’s guidance for breaker testing, for example, one should test each phase-to-ground and phase-to-phase to cover all insulation paths. The same principle applies to cables and bus – test all ways the insulation separates conductors and ground.

If an asset has a neutral or shield, include those in combinations as well (phase-to-neutral, neutral-to-ground, etc., as applicable). Document in the workflow instructions what combinations are required so that even if an electrician is new, they know exactly what to do.

**Minimizing Rework via Structure:** A well-structured workflow reduces rework by making sure tests are done right the first time. By listing all required test points and embedding acceptance criteria, the app prevents technicians from accidentally skipping something or using wrong settings. This means fewer “oops, we have to go back and test that one missed phase” scenarios. Additionally, clear structure helps in training – field electricians quickly get the hang of the sequence since it’s logical and consistent across similar assets.

**Asset Relationships for Reporting:** Consider how you want your reports structured. If, for instance, a panel has 20 cables, do you want one report per cable or a combined report? Likely per cable. Therefore, each cable being its own asset with its own completed workflow (which generates a report) is the way to go. You might then have a higher-level report (maybe manually compiled or via summary function) for the panel that just references all 20 cable reports.

**Example of Good Structure:** Let’s say you have a data center project. You could structure:

- Data Center A (location)
  - Electrical System 1
    - Panel DP-1 (asset)
      - Cable DP1-Feeder1 (asset, workflow Insulation Resistance test)



- Cable DP1-Feeder2 (asset, workflow Insulation Resistance test)
- ... (and so on)
- Electrical System 2
  - Panel DP-2
    - Cables under it, etc.
- Generators
  - Generator #1 (asset, workflow Insulation Resistance test of windings)
  - Generator #2, etc.
- UPS System
  - UPS #1 (maybe test the output isolation)
  - etc.

This hierarchy allows filtering in Control Center. For example, you could filter to see all meg tests in “Electrical System 1” easily. It also makes sense to stakeholders (they often think in terms of systems).

**Guarding Against Mistakes:** In workflow steps, especially when multiple connections are involved, use the instruction fields to illustrate. A small diagram of the cable cores labeling Phase A, B, C and ground can go a long way to ensure the right connections each time. If a conductor must be temporarily grounded between tests (to discharge any charge left), mention that in the step instructions. The platform allows adding such notes which appear on the mobile app for each step.

Finally, always pilot your workflow with one or two assets and maybe one experienced field tech to see if the structure works well. You might find you need to tweak the order or wording for clarity. Once it’s refined, that structure will serve you across the whole project with consistent, reliable results, minimal rework, and maximum compliance.

**Conclusion:** A thoughtful combination of asset organization and workflow design in Cumulus ensures that insulation resistance testing is systematic and foolproof. It aligns with industry standards (like NETA and IEEE) by inherently guiding users to follow those procedures, and it creates a robust digital paper trail for every component tested – reinforcing quality and safety in your electrical installations.

## Support and Contact

For assistance, please contact our technical support team at [support@cumulusds.com](mailto:support@cumulusds.com), or reach out to your customer success representative.

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