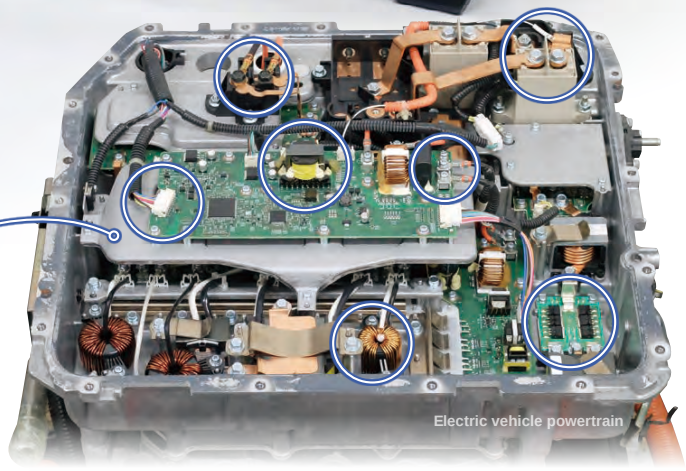
HIOKI

RESISTANCE METER RM3545A

Quality Inspection Solutions

NEW

Resistance meters are used to carry out an array of quality tests


Electric vehicle powertrain

What can be tested with the Resistance Meter RM3545A?

1 Checking metal weld quality

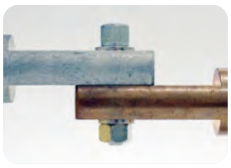
- Using resistance values to check weld condition
- Using resistance values to quantitatively express the performance of weld materials and welders
- Using resistance values to compare and choose optimal weld locations and methods

2 Testing the quality of components on high-current paths

- Testing the quality of high-current boards, boards with embedded busbars, and EV motors
- Testing the resistance values of fuses and shunt resistors
- Testing for internal cracking or crimp defects that can't be detected based on appearance

3 Testing the quality of connectors and cables

- Using resistance values to test the quality of high-current cables in EVs and other applications
- Testing for cable breaks, length, and diameter on production lines
- Testing the connection resistance of connectors



4 Checking busbar bolts for looseness

- Checking bolts for looseness caused by thermal expansion or vibration
- Preventing bolts from being inadvertently left untightened
- Checking whether bolts have been tightened to the designated torque and keeping a record of associated data

Why are resistance meters used to test quality?

A growing number of applications, for example electric vehicles, demand large currents. Since connectors and connection conditions have a significant impact on reliability and safety, it's becoming more and more important to test their quality.
Because resistance meters can accurately measure resistance values on the order of microohms and lower, the quality of connections can be judged in a quantitative manner using the resistance readings they provide. In addition, this approach is well suited to 100% inspections on production lines because it can be carried out in a non-destructive manner and at high speed.

Two models differentiated by measurement channel count

Single-channel model
Resistance Meter RM3545A-1

Model with a built-in multiplexer (up to 20 channels)
Resistance Meter RM3545A-2

High-precision, low-resistance measurement

Resistance measurement

Measurable range:
1 nΩ to 1200 MΩ
Maximum resolution:
1 nΩ (1000 μΩ range)
Minimum measurement range:
1000μΩ
Minimum measurement range accuracy:
0.045% rdg.
Maximum measurement current:
1 A

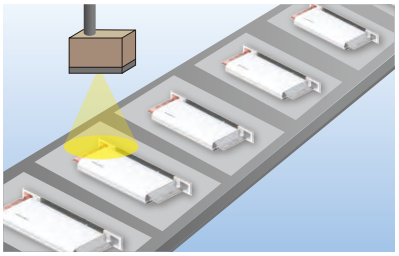
Applications

Testing quality for 100% of welds in a non-destructive manner

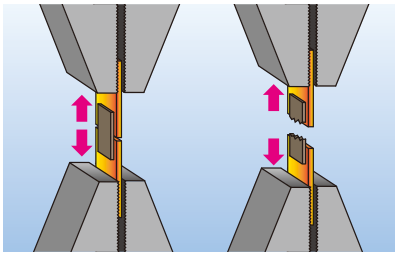
Weld quality testing methods and issues

There are multiple methods for testing weld quality, and each has its own issues. There are almost no non-destructive methods for detecting minuscule defects inside a weld. For automotive parts required to deliver high safety and reliability, a 100% inspection is preferable to a sampling inspection. This reality creates a need for testing methods that can accommodate production line automation.

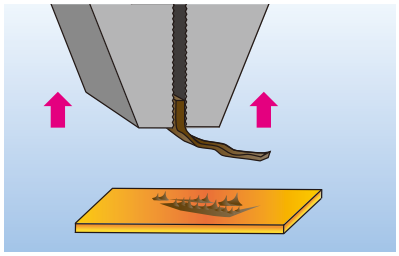
Testing method	Issues
Monitoring during welding work by means of optical coherence tomography (OCT) or observation of reflected waves, plasma waves, thermal waves, or oscillator current waveforms	Although these approaches allow manufacturers to check whether the welding process is being carried out properly, they are incapable of judging final weld quality
3D shape inspection using a laser displacement gauge or image analysis using cameras (visual inspection)	Cannot detect internal defects
Internal inspection by means of ultrasonic testing or electromagnetic testing	Testing is time-consuming
Destructive testing of sampled parts or tensile strength testing of sampled parts	Not all parts can be tested, and testing is time-consuming. Measured parts are damaged.



Visual inspection



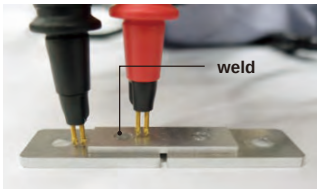
Tensile strength testing



Checking whether welds were made properly based on marks left after one side is peeled off

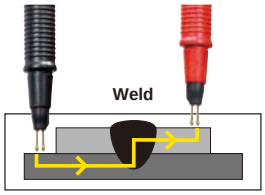
Ensuring traceability with non-destructive, high-precision weld quality testing using the Resistance Meter RM3545A

The solution is to apply an electric signal to welds, measure their electrical resistance, and sort parts into defective and non-defective categories based on the differences in resistance values. On the low end, weld resistance ranges from 10 μΩ to around 100 μΩ. With its 1000 μΩ range, the Resistance Meter RM3545A can measure low resistance with a high degree of precision at 1 nΩ resolution. Defective welds have resistance values that are higher than non-defective welds. Minuscule differences in the resistance values of defective and non-defective parts can be detected and used for pass/fail judgments. The welding quality of all parts on the production line can be managed numerically, and traceability assured.



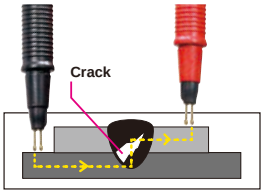
Measuring weld quality

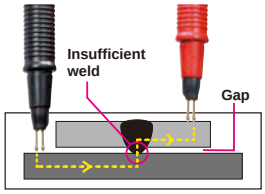
Battery pack busbar weld (laser welding)



Good weld

Resistance of weld is small enabling smooth flow of electricity





Defective weld

The resistance of the weld increases due to cracks or defects that occur during welding, insufficient melting, or gaps between parts, decreasing the flow of electricity

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