

# 7. Electrical Continuity



To determine the electrical conductivity of each a sample of High Torque Fastener Systems formed helix and mating fastener.

## Test Procedure

At random a 4mm diameter High Torque Fastener Systems fixing was selected for electrical continuity analysis. Two 0.8mm thick coated steel plates were used during the tests and tightened to the recommended torque setting.

The experiment was carried out using a Fluke Multimeter (8840A), and involved clamping two steel sample plates together to its maximum torque setting of 1.1Nm using a Dial Torque Wrench (resolution 0.1Nm). Connecting the two positive leads to one plate and the two negative leads to the other and observe reading. The setup utilising 4 terminals eliminates errors introduced due to the resistance of the connecting leads.

A second test was applied using a 500V megger again connecting the leads to each plate and subjecting it to 500V, again recording results. This process was repeated six times for each sample, loosening and retightening to the specified torque.

## Test Plates 1

Tests	Megger ( $\Omega$ ) Res $\pm 0.1\Omega$ @ 500V	Resistance ( $\Omega$ ) Res $\pm 0.001\Omega$
1	0.0	0.032
2	0.0	0.023
3	0.0	0.013
4	0.0	0.004
5	0.0	0.001
6	0.0	0.000

## Observations

- ❖ Paint was stripped off on initial tightening.
- ❖ On second test a slither of paint and metal came off.

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## Test Plates 2

Tests	Megger ( $\Omega$ ) Res $\pm 0.1\Omega$ @ 500V	Resistance ( $\Omega$ ) Res $\pm 0.001\Omega$
1	0.0	0.002
2	0.0	0.005
3	0.0	0.001
4	0.0	0.002
5	0.0	0.004
6	0.0	0.005

## Observations

- ❖ Paint removed on initial first test.
- ❖ Metal removed while dismantling.
- ❖ Paint removed.

## Test Plates 3

Tests	Megger ( $\Omega$ ) Res $\pm 0.1\Omega$ @ 500V	Resistance ( $\Omega$ ) Res $\pm 0.001\Omega$
1	0.0	0.025
2	0.0	0.004
3	0.0	0.011
4	0.0	0.025
5	0.0	0.022
6	0.0	0.022

## Observations

- ❖ Paint removed on initial first test.

## Conclusion

The random variation between the 1<sup>st</sup> measurements of each of the three samples, we believe, is explained by the varying amount of surface paint removed during the initial engagement. The results of these initial experiments suggest that the contact resistance (a measure of continuity) between the components is undetectable by the industry-standard Megger measuring device. For scientific evaluation, the high precision Fluke meter indicates that the largest observed resistance value is typically  $0.03\Omega$ , an order of magnitude smaller than the Megger can detect. The above conclusions remain valid for repeated slackening and retightening. The measurements of the three samples indicate satisfactory electrical continuity for each individual fastener used in the application to the same specifications used in the samples. Use of multiple fasteners will improve the electrical bonding of the two plates.