

Multi-Contact Essen GmbH

Resistance to ammonia

Plug connector "MC4"

DLG Test Report 6076F



Applicant

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Evaluation – short version

Test results (comparison before/after ammonia climate exposure) **Assessment***

Contact resistance

Value	0.44 mΩ/0.56 mΩ	+
Alteration	25.2%	○

Dielectric strength

Requirements are satisfied.

Evaluation scale

The following evaluation scale is applied in the DLG FokusTest "Ammonia resistance – PV plug connector":

Evaluation*	Contact resistance test result	
	Value after the test	Alteration through the test
++	≤ 0.50 mΩ	≤ 10%
+	> 0.50 mΩ to ≤ 0.75 mΩ	> 10% to ≤ 25%
○	> 0.75 mΩ to ≤ 1.00 mΩ	> 25% to 50%
-	> 1.00 mΩ	> 50%

The DLG-FokusTest "Ammonia resistance – PV plug connector" is considered passed if the dielectric strength requirements are fulfilled, the test criteria "contact resistance" was at least rated with "standard" and no significant abnormalities are ascertained during the "visual inspection".

* Evaluation range: ++/+/○/-/-- (○ = standard)

Main technical data (according to the manufacturer)

Construction

Connector for photovoltaic applications without preassembled solar cable; with plug and socket, detachable locking

Connection

Type of contact Crimped

Cable cross-section 4.0 mm²

Materials

Insulation PC/PA

Seal TPE

Electrical properties

Rated voltage 1000 V DC

Rated current 30 A at 90 °C

39 A at 85 °C

Test voltage 6 kV

Protection class II

Contact resistance of the plug connector 0.5 mΩ

Overvoltage category CAT III

Dimensions (connected state)

Length/Width/Height 90 mm/20 mm/20 mm

General data

Protection mode IP2X (unplugged)/IP68 (plugged)

Temperature range -40 °C to +90 °C

Upper temperature limit 105 °C

Degree of pollution 2

Test results

The PV plug connector type "MC4" has passed the DLG Fokus-Test "Resistance to ammonia". Based on this result, one can assume that this PV plug connector is resistant to animal house air containing ammonia and that the aging process to be expected under normal circumstances is not accelerated.

Contact resistance

The results of the contact resistance measurement for the MC4 plug connector (cable cross-section: 2.5 mm²) before and after the climate test are compiled in Table 1.

With a value of 0.56 mΩ after the climate test, the connector has a good contact resistance (DLG evaluation: +).

Through the testing the contact resistance has increased by 25.2 % on average. This alteration is considered to be normal (DLG evaluation: ○).

Notes

The standard "Connectors for photovoltaic systems – Safety requirements and tests" DIN EN 50521 (VDE 0126-3) requires that the resistance may increase to no more than 50 % of the reference value or ≤ 5mΩ. The higher value is allowed.

Dielectric strength

The requirements regarding the dielectric strength were fulfilled. All test items passed the tests with an impulse test voltage of 12.3 V and a power-frequency test voltage of 6 kV, without a disruptive discharge or flashover occurring.

Visual inspection

During the visual inspection after the climate test, no alteration of the connectors could be detected. Ammonia deposits could only be detected on the cable glands and in the seal area.



Figure 2:
Before



Figure 3:
After

Table 1:
Contact resistance with a test current of 1 A.

Test item No.	Contact resistance R [mΩ]		Alteration of R after the climate test	
	new	after climate test	absolute [mΩ]	percentage [%]
1	0.45	0.52	0.07	15.81
2	0.46	0.56	0.11	23.68
3	0.44	0.55	0.11	25.11
4	0.42	0.45	0.03	8.43
5	0.47	0.57	0.10	22.32
6	0.40	0.46	0.06	15.25
7	0.45	0.61	0.15	33.92
8	0.46	0.66	0.20	44.44
9	0.45	0.57	0.13	28.25
10	0.45	0.61	0.16	34.36
Average	0.44	0.56	0.11	25.16
Standard deviation	0.02	0.07	0.05	10.64

Test conditions and performance of the test

The DLG FokusTest "Ammonia resistance" was carried out as a laboratory test according to the patented "DLG test standard for solar modules and PV components in agricultural use". This laboratory test is intended to determine the ability of the PV plug connector to withstand the effects of animal house air over a usage period of at least 20 years.

11 connector pairs with a standard pre-assembled connecting cable were available for the test. The cable on each plug connector had a wire cross section of 2.5 mm² and a total line length of 1000 mm.

The ammonia test was carried out with 10 paired plug connector test items, in a gassing chamber under the following climate conditions:

Duration of test	1500 h
Air temperature	70 °C
Rel. atmospheric humidity	70 %
Ammonia concentration	750 ppm

One test item served as a reference sample for the visual inspection conducted after the climate exposure test.

To assess the ammonia resistance, every plug connector was subjected to a contact resistance measurement both before and after the

climate test according to DIN EN 60512*, item 2b, with a test current of 1 A.

After the climate test, the dielectric strength* was tested, item 6.3.8, with the test steps

- a) Impulse withstand voltage test
- b) Power frequency withstand voltage test

and a visual inspection conducted.

* Test step in accordance with DIN EN 50521:2009-10 "Connectors for photovoltaic systems – Safety requirements and tests"

Test

The FokusTest included a climate exposure test under laboratory conditions.

Based on the available results, the plug connector type "MC4" fulfills the requirements with regard to the test criterion "ammonia resistance" (evaluation "o" or better) for the award of the DLG-FokusTest label.

Other criteria were not tested.

Realization of the test

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12-00091
June 2012
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