

Technical Construction File

EN 61984:2009

Connectors - Safety requirements and tests

Report reference No.....: TLGD22031537691

Compiled by (+ signature).....: Stephen Zhang / Test Engineer

Approved by (+ signature).....: Kosco Vent / Project Manager

Date of issue.....: March 22, 2022

Reviewing laboratory.....: Shanghai Global Testing Services Co., Ltd.

Reviewing location.....: Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District,
Shanghai, China.

Applicant.....: Mindian Electric Co., Ltd.

Address.....: MaLuJiao Industrial Park, Beibaixiang Town, Yueqing City, Zhejiang
Province, China

Manufacturer.....: Mindian Electric Co., Ltd.

Address.....: MaLuJiao Industrial Park, Beibaixiang Town, Yueqing City, Zhejiang
Province, China

Factory.....: The same as Manufacturer

Address.....: The same as Manufacturer

Standard.....: ☒ EN 61984:2009

Review Report Form No.....: 61984

TRF originator.....: GTS

Master TRF.....: Reference No. EN 61984:2009

Review procedure: GTS

Type of Review object.....: PV Connector

Trademark.....: YQPCT

Model/type reference.....: MD-MC4, MD-MC4-T, MD-MC4-Y

Main Model.....: MD-MC4

Rating.....: /



Possible review case verdicts:

- review case does not apply to the test object..... : N(.A.)
- review object does meet the requirement..... : P(ass)
- review object does not meet the requirement..... : F(ail)

General remarks:

"(see remark #)" refers to a remark appended to the report.

"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

The review results presented in this report relate only to the object reviewed.

This report shall not be reproduced except in full without the written approval of the third party.

Testing:

Date of receipt of review item:

March 08, 2022

Date(s) of performance of review:

March 08, 2022 to March 22, 2022

General product information:

PV Connector

Summary of reviewing:

This review report includes:

Annex I: 2 page(s) of photo documentation.

Copy of marking plate

PV Connector,
Model MD-MC4

Marking



Mindian Electric Co., Ltd.

6	Constructional requirements and performance		-
6.1	General		-
	Connectors shall be so designed and dimensioned that they can withstand the electrical, mechanical, thermal and corrosive stresses which occur in their intended use and present no danger to the user or the environment.		P
	<i>Compliance with this requirement is verified by the specified tests of this standard.</i>		P
6.2	Marking and identification		-
6.2.1	Identification		-
	Connectors shall be identified and characterised by the following markings:		P
	a) manufacturer's name, trademark or mark of origin;	Mindian Electric Co., Ltd.	P
	b) type identification;	MD-MC4	P
	NOTE The type identification may be a part number, catalogue number or IEC type designation.		-
	c) rated current in ampere (A);		P
	d) rated voltages or rated insulation voltages between line to earth and line to line in volt (V);		P
	e) rated impulse voltage in kilovolt (kV), if specified;		N
	f) pollution degree;		P
	g) degree of protection by enclosure according to IEC 60529, if applicable;		P
	h) temperature range (°C), (LLT – ULT);		P
	i) type of terminals;		P
	j) connectable conductors;		P
	k) reference to this standard or to the DS, if applicable.		P
6.2.2	Marking		-
	The marking shall be indelible and easily legible.		P
	The minimum marking on the connector shall be that of item a) of 6.2.1.		P
	Markings a) and b) of 6.2.1 shall be found on the smallest unit of packaging.		P
	All markings of 6.2.1 shall be given in the technical documentation or catalogue of the manufacturer; for the rated values, follow the examples given hereinafter.		P
	Examples of markings for rated current, rated voltages, rated impulse voltage and pollution degree:		P
	a) Example 1		-
	Marking of a connector with rated current 16 A, rated voltage 400 V, rated impulse voltage 6 kV and pollution degree 3, 2 and 1 for use in any system, preferably unearthed or deltaearthed		-

	systems:		
	16 / 400 / 6 / 3 or 16A 400V 6kV 3 or 16A/400V/6kV/3		-
	NOTE For reasons of space such marking may lay on two separate rows, i.e.: 16A 400V on one row and 6kV 3 on a subsequent row.		-
	b) Example 2		-
	Marking of a connector with rated current 16 A, rated insulation voltages line-to-earth 250 V, line-to-line 400 V, rated impulse voltage 4 kV and pollution degree 3, 2 and 1 for use in earthed systems, only:		-
	16 / 250 / 400 / 4 / 3 or 16A 250V 400V 4kV 3		-
6.2.3	Marking of position for contacts		-
	The positions for the contacts and protective earthing contacts shall be clearly indicated.		N
	Marking of the first contact and first row by a letter, number or another clear symbol is sufficient.		N
	This requirement does not apply to a connector in which contact identification is ensured in the end-use product.		N
	Relevant information shall be given in the technical documentation of the manufacturer.		N
	Marking of protective earthing contacts shall apply the symbol  or PE.		N
	This requirement is not necessary for non rewirable connectors.		N
	Marking shall not be applied to screws or other removable parts.		P
	Symbols are given in IEC 60417.		P
	The symbol  is reserved for end-use-equipment.		N
	The protection class of components is dependent upon the equipment in which they are used.		N
	Therefore, components shall not be marked with the symbol  .		N
	A connector without earth contact may be designated so as to read "Connector for class II equipment", if the connector itself meets the requirements of double and/or reinforced insulation.		P
6.3	Provision against incorrect mating (non-intermateable)		-
	A multipole connector shall be so designed that contact between protective earthing contacts and live contacts is not possible by engagement.		P
	<i>Compliance is checked by a polarisation test.</i>		P
6.4	Protection against electric shock		-
6.4.1	Non accessibility of live parts		-
	A connector shall be so designed that, after mounting, its live parts are not accessible by the		P

	IEC test finger in accordance with Clause 5 of IEC 60529:1989 using a test force of 20 N.		
	All parts which are necessary to ensure protection against electric shock shall only be removable by the aid of a tool.		P
	This requirement does not apply to a connector in which protection against electric shock is ensured by its mounting provisions or by the use of safety extra-low voltage (SELV, according to IEC 60364-4-41) in the end-use product.		P
	NOTE For an unenclosed connector, the protection against electric shock is provided by the enclosure of the equipment in which the connector is mounted, in accordance with the applicable product safety standard.		P
6.4.2	Non applicability of protection requirement to unenclosed connectors		-
6.4.2.1	General		-
	A connector intended for use inside an enclosure which ensures protection against electric shock is not required to have its own protection against electric shock.		P
	If protection is claimed by the manufacturer, the requirements of 6.4.2.2 or 6.4.2.3 apply.		P
6.4.2.2	Back of hand safety		-
	For a COC with protection against electric shock according to characteristic c2) of 5.4, protective provisions shall be tested by using the access probe – “50 mm sphere” – according to Clause 5 of IEC 60529:1989 with a test force of 20 N, without consideration of clearances and creepage distances.		P
6.4.2.3	Finger safety		-
	For a COC and a CBC with protection against electric shock respectively according to characteristic c3) and d) of 5.4, protective provision shall be tested according to Clause 5 of IEC 60529:1989 by using the test finger with a test force of 20 N without consideration of clearances and creepage distances.		P
6.4.3	Protection against electric shock during insertion and withdrawal		-
	For a CBC, protection against electric shock shall be ensured also during insertion and withdrawal.		P
	<i>Compliance is checked in accordance with Clause 5 of IEC 60529:1989 by the IEC test finger with a test force of 20 N with consideration of clearances and creepage distances according to the manufacturer specification.</i>		P
6.5	Provisions for earthing		-
6.5.1	First make, last break PE contact		-
	For a CBC with a protective earthing contact according to characteristic a) of 5.4, the earthing contact shall be a “first make, last break” contact.		P

6.5.2	PE contacts on connector for class II equipment		-
	A connector for class II equipment according to characteristic c) of 5.2 may be equipped with protective earthing contacts, provided that these contacts are considered as live parts and are equally protected against electric shock by double or reinforced insulation.		N
6.5.3	Reliability of connection to PE contacts		-
	Accessible metal parts of a connector with an earthing contact which may become live in the event of an insulation fault shall be reliably connected to the earthing contact. In no case shall the resistance of this connection exceed 0,1 Ω .		N
	NOTE If accessible metal parts are screened from live parts by metal parts which are connected to an earthing terminal or earthing contact, or if they are separated from live parts by double or reinforced insulation, they are not, for the purpose of this requirement, regarded as likely to become live in the event of an insulation fault.		N
	<i>Compliance is checked by the test of 7.3.13.</i>		N
6.5.4	Connection of the protective conductor		-
6.5.4.1	PE conductor terminal capacity		-
	The protective conductor terminal shall be able to accept a conductor with a minimum cross-sectional area as specified in Table 1, column 2.		N
6.5.4.2	Design of PE termination		-
	The design and type of construction of the protective conductor terminations shall be at least equivalent in performance to the types of termination given in 6.6.		N
6.6	Terminations and connection methods		-
6.6.1	General		-
	The terminations and connection methods listed in Table 2 meet the requirements of this standard.		P
	Electrical and thermal tests on terminations shall be carried out in conjunction with the test on the connector.		P
	Other terminations and connection methods have to be tested in accordance with the relevant standards.		P
6.6.2	Type and range of conductor cross-sectional areas		-
	Terminations shall be suitable for the type and range of conductor cross-sectional areas according to the DS or the manufacturer's information.		P
6.6.3	Design of electrical connections		-
	Electrical connections shall be so designed that the contact pressure is not transmitted through insulating material other than ceramic, pure mica or other material with characteristics not less suitable, unless there is sufficient resiliency in the		P

	metallic parts to compensate for any shrinkage or yielding of the insulating material (see 25.3 of IEC 60309-1 or Clause 7 of IEC 60999-1 or IEC 60999-2).		
	On the basis of the tests according to IEC 60352-6 or IEC 60998-2-3 of Table 3, insulation piercing connections are excluded from the above requirement.		P
6.7	Interlock		-
	A connector with an interlock shall be so designed that it cannot be engaged or disengaged as long as the contacts are live.		P
	NOTE If pilot contacts (last make, first break contacts) are used for the electrical interlock, these can be live when disengaged if the pilot contacts are protected against indirect contact with live parts.		P
6.8	Resistance to ageing		-
	Parts which, due to ageing, might impair safety shall be so resistant that the specified characteristics such as dielectric strength, contact resistance or degree of protection are maintained.		P
6.9	General design		-
6.9.1	Polarisation		-
	Multipole connectors shall be so polarised that improper connection of mating parts is prevented. This requirement does not apply to connectors (for example two-part connectors for printed boards and rack-and-panel connectors) where mismating is prevented by their mounting provisions or by additional accessories, if necessary and available.		P
6.9.2	Fixing of live parts		-
	Mechanisms which are used for mounting the connector and/or termination of conductors shall not be used to fix live parts in the connector housing, if it may impair the proper function of the mechanism or reduce the clearance and creepage distances below the requirements according to 6.19.		P
6.9.3	Connection of conductors		-
	Connectors shall be so designed that connection of conductors of the type and crosssectional areas as specified by the DS or the manufacturer shall be possible.		P
	Besides the termination of the conductor, care shall be taken that no damage of the insulation is possible, e.g. by avoiding of sharp edges.		P
6.9.4	Design of non rewirable connectors		-
	Non-rewirable connectors shall be so designed that		P
	the flexible cable cannot be separated from the connector without making it permanently useless;		P

	NOTE 1 A connector becomes useless for further use when, for the re-mounting, other parts than the original ones are necessary.		P
	NOTE 2 Connectors with non-rewirable terminations (e.g. crimped connections) are considered as rewirable, if they can be reconstituted with correct replacement parts and, if so, with the tool designated by the manufacturer.		P
	the connector cannot be opened by hand or by using a general purpose tool, for example a screwdriver, as intended;		P
	means are provided to prevent live parts, e.g. free strands of a conductor, from reducing the minimum insulation distance between such live parts and all accessible external surfaces of the connector, with the exception of the engagement face of the male connector.		P
	If this cannot be granted by the design or manufacturing process itself, the in-process test schedule according to 7.4 or another test of the same safety level shall be carried out.		P
6.10	Design of a CBC		-
	A CBC shall have an adequate breaking capacity.		P
6.11	Design of a free connector		-
	In a free connector, the wires shall be protected against shear and tensile stress at the termination and be secured to prevent twisting.		P
	This requirement does not apply to		P
	a) free connectors for termination to cables in fixed mountings (plug connection in the sense of a detachable connection);		P
	b) free connectors in which the terminations are protected against pull and twisting by mounting provisions in the end-use product.		P
6.12	Degree of protection (IP Code)		-
	A connector shall have a degree of protection according to IEC 60529, if specified by the DS or the manufacturer's specification according to classification of 5.4 e).		P
6.13	Dielectric strength		-
	A connector shall withstand the specified test voltage, preferably the impulse withstand voltage (1,2/50 μ s) or the r.m.s. withstand voltage (50/60 Hz) alternatively. The connector shall withstand the test voltage specified in Table 8, in accordance with 7.3.12.		P
6.14	Mechanical and electrical durability		-
6.14.1	Mechanical endurance (COC and CBC)		-
	A connector, either COC or CBC, shall meet the mechanical operations without load as specified in the DS or in the manufacturer's specification (preferred numbers of operating cycles are given in Table 4a).		P

6.14.2	Electrical endurance (CBC)		-
	A CBC shall meet the specified breaking capacity taking into account the severity as specified in the DS or in the manufacturer's specification (preferred numbers of operating cycles are given in Table 4a)		P
6.14.3	Bendings (non-rewirable connectors)		-
	A non-rewirable connector shall meet the numbers of bendings (flexings) specified in the relevant DS or in the manufacturer's specification (preferred numbers are given in Table 4b).		P
6.15	Temperature limits		-
	A connector shall comply with the upper and lower values of the temperature range as specified in the DS or in the manufacturer's specification (preferred values of temperature are given in Table 5a and Table 5b)		P
6.16	Temperature rise		-
	The sum of the ambient temperature and the temperature rise of a connector shall not exceed the upper limiting temperature given in Table 5b.		P
	<i>Compliance shall be checked by the test of 7.3.8.</i>		P
6.17	Cable clamp		-
	The cable clamp, if any, shall be suitable for the cable to be connected. The range of acceptable cable diameters shall be specified in the DS or by the manufacturer's specification.		P
	Tensile and torsion requirements shall be as specified in Table 6.		P
	Loose parts inserted to obtain clamping of the cable are permitted if they are fixed in the connector in the assembled state.		P
	The cable clamp can be made of insulating material or metal. If it consists of metal, it shall meet one of the following requirements:		P
	a) be provided with an insulating means so as to prevent any accessible metal part becoming live in case of a fault;		P
	b) no contact shall be possible with the test finger according to IEC 60529;		P
	c) be connected to the protective earth.		P
	If metric cable glands according to EN 50262 are used, the above mentioned tests shall not be performed.		P
6.18	Mechanical strength		-
6.18.1	Robustness of connectors		-
	A connector shall show no damage likely to impair safety after exposure to mechanical stress according to the test programme.		p
6.18.2	Retention of contacts		-
	In a connector assembled for final use, the contacts shall be securely retained in the contact		P

	insert.		
6.18.3	Integrity of internal insulation		-
	After exposure to the stresses according to the test schedule, the internal insulation shall show no damage which could impair normal use.		P
6.19	Clearances and creepage distances		-
	Clearances and creepage distances shall be dimensioned according to the following specifications, unless otherwise specified by the application or the manufacturer.		P
6.19.1	Clearances		-
6.19.1.1	General		-
	Clearances shall be in accordance with IEC 60664-1 and/or IEC 60664-5.		P
	Clearances through slots and openings in enclosures of insulating material shall meet the values of case A of Table F.2 of IEC 60664-1:2007 and/or Table 2 of IEC 60664-5:2007.		P
6.19.1.2	Rated impulse voltage		-
	The rated impulse voltage shall be selected according to the nominal voltage of the supply system and the overvoltage category, as specified in table B.2 of IEC 60664-1:2007.		P
6.19.1.3	Overvoltage category		-
	The assignment of connectors shall be carried out according to the rules as given in IEC 60664-1.		P
6.19.2	Creepage distances		-
6.19.2.1	General		-
	Creepage distances shall be dimensioned according to the rated voltage according to IEC 60664-1 and/or Table 4 of IEC 60664-5:2007, the pollution degree and insulating material as specified according to IEC 60664-1 and/or Table 4 of IEC 60664-5:2007.		P
	If the rated voltage is not derived from the nominal voltage of the supply system (see Table F.3a and Table F.3b of IEC 60664-1:2007) but from the working voltage, interpolation is permissible.		P
	For the relationship between creepage distance and clearances see 5.2.2.6 of IEC 60664-1:2007 and/or 5.3.2.6 of IEC 60664-5:2007.		P
	For a connector with a degree of protection IP54 or higher according to IEC 60529, the insulating parts inside the enclosure may be dimensioned for a lower pollution degree.		P
	This lower pollution degree also applies to mated connectors where the enclosure is ensured by the connector housing and which may only be disengaged for test and maintenance purposes.		P
6.19.2.2	Pollution degree		-
	The pollution degree shall be specified according to IEC 60664-1.		P

	NOTE The pollution degree strongly influences the rated insulation voltage of a connector.		P
	Therefore, the rated insulation voltage for a connector with creepage distances fixed by design should be reconsidered for each pollution degree separately.		P
6.19.2.3	Dimensioning of creepage distances for connectors with IP54 or higher		-
	For a connector with a degree of protection IP54 or higher according to IEC 60529, the insulating parts inside the enclosure may be dimensioned for a lower pollution degree.		P
	This also applies to mated connectors where the enclosure is ensured by the connector housing and which may only be disengaged for test and maintenance purposes.		P
6.19.2.4	Shape of insulating surfaces		-
	Insulating surfaces may include transverse ridges and grooves to break the continuity of conductive layers.		P
	a) Ribs shall be dimensioned so that they withstand the mechanical stresses according to the test sequence without damage.		P
	If the height of the ribs is at least 2 mm the creepage distances may be dimensioned in accordance with one insulating material group level lower.		P
	b) In the case where there are grooves across the creepage distance, the groove walls shall be included in the creepage distance if the width X of the groove complies with 4.2 of IEC 60664-1:2007.		P
	If the associated clearance, measured on the component, is less than 3 mm, the minimum groove width may be reduced to one-third of this clearance.		P
	In all other cases, the groove walls shall not be taken into account.		P
	Methods of measuring clearances and creepage distances are given in 6.2 of IEC 60664-1:2007.		P
6.20	Insulation		-
6.20.1	Functional and basic insulation		-
	Functional and basic insulation shall be so designed that it withstands the impulse withstand voltage or the r.m.s. withstand voltage as specified in the DS or by the manufacturer's specification, as derived from the rated insulation voltage of the connector.		P
6.20.2	Supplementary insulation		-
	For the supplementary insulation, the same requirements are valid as for the basic insulation.		P
6.20.3	Double insulation		-
	Double insulation shall be so designed that the breakdown of one part (basic or supplementary insulation) does not impair the protective function of the other part.		P

	It shall not be possible to remove the supplementary insulation without using a tool.		P
	For double insulation, where basic and supplementary insulation cannot be tested separately, the insulation system shall be considered as reinforced insulation.		P
6.20.4	Reinforced insulation		P
	For the assessment of clearances for reinforced insulation, the rated impulse voltage shall be selected from the next higher overvoltage category in comparison to basic insulation.		P
	The creepage distances shall be doubled in comparison with the basic insulation. Insulation material of group IIIb ($100 \leq CTI < 175$) shall not be used at pollution degrees 3 and 4.		P
6.21	Protection against corrosion		-
	Metal parts shall be so designed that corrosion shall not impair safety with regard to electrical and mechanical characteristics.		P
	<i>Compliance is checked by the test of 7.3.14.</i>		P
7	Tests		-
7.1	General		-
7.1.1	Test sequence and number of specimens		-
	The tests shall be carried out in the sequence specified for each test group using the number of specimens as given in Table 9.		P
	For each test group, a separate set of new specimens shall be used.		P
	NOTE If designs of connectors require special tests or preparations, which are not explicitly indicated in this standard, they are chosen or carried out according to the manufacturer's specification, e.g. mechanical locking during IP-Code testing.		P
	If the testing has to be made on free contacts (e.g. crimp contacts), a minimum of three specimens shall be used.		P
7.1.2	Specimens condition		-
	Unless otherwise specified, the condition used in the test schedule is unmated.		P
7.1.3	Atmospheric conditions		-
	The tests shall be made under the standard atmospheric conditions of IEC 60068-1, unless otherwise specified in the test schedule.		P
7.1.4	Number of specimens for tests on terminations		-
	The tests on the terminations according to the relevant standard shall be made on three terminations per specimen, if available.		P
	NOTE See also 6.6.1.		P
7.1.5	Failure criteria		-
	The product is deemed not to comply with this standard if the product fails in more than one of the		P

	tests of any test group.		
	If the product fails in only one of the tests, this test and the preceding tests which have affected the result shall be repeated on a new set of specimens.		P
	The new set of specimens shall pass the repeated tests, otherwise the product is deemed not to comply.		p
7.1.6	Visual examination tests		-
	All visual examination tests should be performed with the naked eye, unless otherwise specified.		P
7.2	Preparation of specimens		-
7.2.1	Pre-conditioning		-
	Specimens shall be pre-conditioned under standard conditions for testing, for a period of 24 h, in accordance with IEC 60512-1.		P
7.2.2	Conductors		-
	The tests shall be carried out with copper conductors unless otherwise specified by the manufacturer and with the type of conductor specified for the connector.		P
	If terminations are provided for all types of conductors, solid, stranded and flexible, the tests shall be carried out only with flexible conductors according to Class 5 of IEC 60228.		P
7.2.3	Torque for screw-type clamping units		-
	Screw-type clamping units shall be tightened with the value of the torque stipulated according to IEC 60999-1 and IEC 60999-2, unless otherwise specified by the manufacturer.		P
7.2.4	Assembly conditions		-
	Unless otherwise specified in the test schedule, all tests shall be made on the specimen completely assembled according to the manufacturer's instructions.		P
7.3	Performance of tests		-
7.3.1	General		P
	In accordance with the test schedule given in 7.5, the general test methods specified in Tables 10 to 14, columns 3 and 7, shall be applied according to IEC 60512. Other tests are indicated in column 4.		p
7.3.2	Durability of marking		-
	The test of the durability of marking shall be done as a wet test according to test Xb (abrasion of marking) of IEC 60068-2-70.		P
	For the test piston, size 1 shall be used and the test liquid shall be water.		P
	A force of 5 N shall be applied for a duration of 10 cycles.		P
	After the test, the marking shall be still readable.		P
	Markings made by impression, moulding, pressing or engraving or the like are not subjected to this		P

	test.		
7.3.3	“First make, last break” protective earthing contact		-
	The specimens shall be engaged and disengaged by hand in every possible position.		P
	To indicate contact, an electrical device (for example a lamp) shall be used.		P
	It shall be checked that the protective earthing contact will first make and last break relative to any other contact.		P
	For this test, all other contacts shall be wired in parallel.		P
7.3.4	Interlock		-
	The specimens are engaged by hand over their full engagement distance.		P
	The requirement that interlock contacts will make last and break first before any other contact shall be checked.		P
	An electric device, i.e. a lamp, shall be used to indicate contact. For this test, all other contacts shall be wired in series.		p
7.3.5	Breaking capacity of a CBC		-
	The specimens of a CBC shall be electrically operated at the indicated breaking capacity and at the rated voltage for a.c. with $\cos \Phi = (0,9 \pm 0,05)$ or for d.c. with a time constant of 1 ms $\pm 15\%$, depending on manufacturer's specifications.		P
	Any existing protective earthing contact shall not be loaded.		P
	The specimens shall be engaged and disengaged by means of a device simulating normal insertion and withdrawal.		P
	The number of operating cycles shall be specified by the DS or by the manufacturer, preferred values being given in Table 4a.		P
	The test position shall be horizontal or, if not possible, as in normal use.		P
	The specimen is inserted into and withdrawn from its counterpart at a rate of three to four cycles per minute.		P
	The speed of insertion and withdrawal of the specimen shall be $(0,8 \pm 0,1)$ m/s.		P
	Electrical contact shall be maintained for no more than 4 s and no less than 2 s.		P
	During the test, no sustained arcing shall occur.		P
	After the test, the samples shall show no damage impairing their further use and the entry holes for the plug contacts shall not show any serious damage.		P
7.3.6	Protection against electric shock		-
7.3.6.1	Unenclosed connectors		-
	For unenclosed connectors, with the exception of classification IP65, protection against electric shock shall be tested with the relevant test probe		p

	in accordance with the IP code claimed by the manufacturer.		
	Creepage and clearance distances are not taken into consideration for the test.		P
7.3.6.2	Enclosed connectors		-
	Enclosed connectors shall be tested with the IEC jointed test finger taking into consideration clearances and creepage distances between live parts and the test finger.		P
	This does not apply to the contact openings (lead-in) in the mating face:		P
	For a CBC, clearance and creepage distances according to IEC 60664-1 shall be measured through the openings between the live parts and the plane of the mating face.		P
	For a connector without breaking capacity (COC), clearance and creepage distances through the openings are disregarded.		P
7.3.6.3	Tests for connectors with IP Code higher than IP2X or IPXXB		-
	If the manufacturer claims a protection against access to hazardous parts higher than IP2X or IPXXB, the relevant tests shall be carried out according to IEC 60529.		P
7.3.7	Protection against solid foreign objects and against ingress of water		-
7.3.7.1	General		-
	IP code is measured in mated condition or according to the manufacturer's specification.		P
7.3.7.2	Protection against foreign solid objects		-
	If the manufacturer claims a degree of protection against ingress of foreign solid objects, the relevant tests shall be carried out according to IEC 60529.		p
	<i>Compliance is checked according to IEC 60529.</i>		P
7.3.7.3	Protection against harmful ingress of water		-
	If the manufacturer claims a degree of protection against harmful ingress of water, the relevant tests shall be carried out according to IEC 60529.		P
	<i>Compliance is checked according to IEC 60529. For numeral 3 and 4, unless otherwise specified in the detail specification or by the manufacturer, the oscillating tube, Figure 4 of IEC 60529:1989 is used.</i>		P
7.3.8	Temperature rise		-
	The object of this test is to assess the ability of a connector to continuously carry its rated current without exceeding the upper limiting temperature.		P
	The test shall be carried out according to test 5a of IEC 60512-5-1, unless otherwise specified, under the following test conditions.		P
	Any existing PE contact is not involved in the test.		N/A
	Test conditions: Maximum permissible conductor cross-sectional		N/A

	area used for the test shall be in accordance with the detail specification DS or manufacturer's information.		
	The length of the connecting cable and conductor loops (see Figures 1a, 1b and 1c) is given in Table		N/A
	The test shall be carried out with a rated current selected from the current-carrying capacity curve according to IEC 60512-5-2, test 5b depending on the ambient temperature.		N/A
	For this purpose, the test arrangement according to IEC 60512-5-2 shall be used.		N/A
	NOTE The reduction factor for ascertaining the derating curve is 0,8. In case of deviation, the used factor shall be indicated in the technical documentation.		N/A
	The test shall be continued until a constant temperature is obtained.		N/A
	For two-part printed board connectors, the connection on the printed board side is made by wire jumpers corresponding to the cross sectional area of the connecting cable of the connector.		N/A
	According to the agreement with the manufacturer, a printed board can be used for fixing (Figure 1b). For edge-socket connectors, the wire jumpers are soldered as close to the contact zone of the printed board as possible corresponding to the cross sectional area of the connecting cables (Figure 1c).		N/A
	For both conductor versions, the wire jumpers shall be produced as short as possible, i.e. in pitch dimension.		N/A
7.3.9	Mechanical operation		-
	The object of this test is to assess the mechanical operational endurance of a connector either CBC or COC in the normal operational mode without electrical load.		P
	The test shall be carried out according to test 9a of IEC 60512, under the following conditions, unless otherwise specified.		P
	Test conditions:		P
	The specimens shall be engaged and disengaged by means of a device simulating normal operating conditions.		P
	The preparation and mounting of the specimen shall be as in normal use.		P
	The type and cross sectional area of the cable/wire bundle to be used shall be specified by the manufacturer or by the DS.		p
	The number of operating cycles shall be specified by the manufacturer or by the DS.		P
	Preferred values are indicated in Table 4a.		P
	The speed of insertion and withdrawal shall be approximately 0,01 m/s with a rest in the unmated position of approximately 30 s.		P
7.3.10	Bending (flexing) test		-
	Non-rewirable connectors shall be subjected to a		P

	bending test in an apparatus similar to that shown in Figure 2.		
	The specimen is fixed to the oscillating member of the apparatus so that, when this is at the midpoint of its travel, the axis of the flexible cable, where it enters the specimen, is vertical and passes through the axis of oscillation.		P
	The oscillating member is, by variation of distance d shown in Figure 2, so positioned that the flexible cable makes a minimum lateral movement when the oscillating member of the test apparatus is moved over its full travel.		P
	The cable is loaded with a weight such that the force applied is		P
	20 N for non-rewirable connectors with a conductor cross-sectional area $> 0,75 \text{ mm}^2$;		N
	10 N for non-rewirable connectors with a conductor cross-sectional area $\leq 0,75 \text{ mm}^2$.		P
	A current equal to the rated current of the connector is passed through the conductors, the voltage between them being the rated voltage.		P
	The protective conductor, if any, shall be loaded with a sufficient current to perform the continuity test.		P
	The oscillating member is moved backwards and forwards through an angle of 90° (45° on either side of the vertical).		P
	The number of bendings shall be specified by the DS or the manufacturer's specification.		P
	Preferred values are given in Table 4b.		P
	The rate of bendings shall be 60 per minute.		P
	One bending is one movement, either backwards or forwards.		P
	Specimens with cables of circular cross-sectional area shall be rotated approximately 90° around the vertical axis within the oscillating part after 50 % of flexings; specimens with flat flexible cables are only bent in a direction perpendicular to the plane containing the axis of the conductor.		P
	During this test, there shall be no interruption of the test current and no short-circuit between the conductors, including the protective conductor, if any.		P
	After the test there shall be no damage; the cable support sleeve shall not be loosened from the body and the insulation shall show no signs of abrasion or of wear and tear.		P
	Broken strands shall not pierce the insulation.		P
7.3.11	Measurement of clearances and creepage distances		-
	Clearances and creepage distances shall be measured according to IEC 60664-1 with the following additional requirements.		P
	For connectors without breaking capacity (COC), clearances and creepage distances to the accessible surface shall be measured only in the mated position.		P

	The surface of an unenclosed connector to be incorporated into an equipment or a device shall not be regarded as accessible, unless otherwise claimed by the manufacturer.		P
7.3.12	Dielectric strength		-
	If the manufacturer or the DS specifies a value for the rated impulse voltage, test a) shall be conducted.		P
	Otherwise, test b) shall be conducted. For the verification of the solid insulation, test b) shall be used.		P
	a) Impulse withstand test		P
	The impulse withstand test shall be carried out with a voltage having a 1,2/50 μ s waveform according to IEC 60060-1 with three impulses of each polarity and an interval of at least 1 s between pulses.		P
	The output impedance of the impulse generator should not be higher than 500 Ω . The test voltage shall be taken from Table 8.		P
	b) Voltage proof (test 4a of IEC 60512)		P
	The voltage proof test shall be performed by applying a r.m.s. withstand voltage with values as specified in Table 8 according to test 4a of IEC 60512.		P
	The test duration shall be 1 min.		P
7.3.13	Resistance between accessible metal parts and the protective earthing contact		-
	A current of 1,5 times the rated current with a maximum of 25 A derived from a source having an open voltage not exceeding 12 V is passed through the protective earthing contact and each of the accessible metal parts in sequence.		N
	The voltage drop between the protective earthing contact and the accessible metal part is measured after steady conditions have been established and the resistance is calculated from the current and this voltage drop.		N
	This test shall be carried out on the engaged specimen only.		N
	In no case shall the resistance exceed the maximum value given in 6.5.3.		N
7.3.14	Corrosion test		-
	For testing the protection of contacts against the influence of a corrosion atmosphere, one of the two alternative tests shall be selected. In both cases, the specimens shall be mated.		P
	Test 1: Flowing mixed gas corrosion according to test 11g of IEC 60512, with a choice of method 1 or method 4 (see Table 1 of IEC 60512-11-7).		P
	The test duration shall be four days.		P
	Test 2: Sulfur dioxide test with general condensation of moisture according to ISO 6988.		P
	The test duration shall be 24 h (1 test cycle).		P

7.4	In-process test schedule (routine test) for non-rewirable free connectors		-
7.4.1	General		N
	For non-rewirable free connectors, it shall be verified that live parts, e.g. free strands, cannot become accessible.		N
	If this cannot be ensured by construction or by the production process, the following tests shall be made on 100 % of the production.		N
7.4.2	Impulse withstand voltage test		N
	The accessible external surface of the connector, with the exception of the engagement face of the male connector, shall be scanned by plane electrodes according to IEC 61032 and each time the specified impulse withstand voltage of the connector shall be applied between all live parts and these electrodes.		N
	Alternatively, the specified r.m.s. withstand voltage according to Table 8 shall be applied for a minimum of three full cycles (i.e. 60 ms at a frequency of 50 Hz).		N
	No breakdown or flashover shall occur.		N
7.4.3	Continuity of PE path test		-
	For connectors with protective earthing contacts, an electrical continuity test with Safety Extra-Low Voltage (SELV) shall not show any interruption or wrong connection of the protective earth.		N
7.4.4	AC power-frequency voltage withstand test		-
	A dielectric strength test using the test voltage according to Table 8, applied between all live contacts connected together and the protective earthing contact shall show no breakdown.		N

- End of Review Report -

Type of equipment, model: PV Connector,
MD-MC4, MD-MC4-T, MD-MC4-Y

Details of:

View:

☒ general

☐ front

☐ rear

☐ right

☐ left

☐ top

☐ bottom



Details of:

View:

☒ general

☐ front

☐ rear

☐ right

☐ left

☐ top

☐ bottom



Details of:

View:

☒ general

☐ front

☐ rear

☐ right

☐ left

☐ top

☐ bottom



Details of:

View:

☒ general

☐ front

☐ rear

☐ right

☐ left

☐ top

☐ bottom

