INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
COMMISSION ELECTROTECHNIQUE INTERNATIONALE (CEI)

Ref. Certif. No.
NL-4458

IEC SYSTEM FOR CONFORMITY TESTING AND CERTIFICATION OF ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

SYSTÈME CEI D'ESSAIS DE CONFORMITÉ ET DE CERTIFICATION DES EQUIPEMENTS ELECTRIQUES (IECEE) METHODE OC

CB TEST CERTIFICATE
CERTIFICAT D'ESSAI OC

Product *Produit*	switch for appliances
Name and address of the applicant *Nom et adresse du demandeur*	Marquardt GmbH, Schloß-Straße 16, 78604 Rietheim-Weilheim, Germany
Name and address of the manufacturer *Nom et adresse du fabricant*	Marquardt GmbH, Schloß-Straße 16, 78604 Rietheim-Weilheim, Germany
Name and address of the factory *Nom et adresse de l'usine*	see page 32 of the test report
Rating and principal characteristics *Valeurs nominales et caractéristiques principales*	10(8) A - 400 V~, 5E4, T105/55
Trade mark (if any) *Marque de fabrique (si elle existe)*	Marquardt
Model/type Ref. *Ref. de type*	1832., 1835.
Additional information (if necessary) *Information complémentaire (si nécessaire)*	rocker switches
A sample of the product was tested and found to be in conformity with *Un échantillon de ce produit a été essayé et a été considéré conforme à la*	IEC **PUBLICATION** 61058-1 **EDITION** 2 incl A1:1997
as shown in the Test Report Ref. No. which form part of this certificate *comme indiqué dans le Rapport d'essais numéro de référence qui constitue une partie de ce certificat*	2004680.02A (32 pages)

This CB Test Certificate is issued by the National Certification Body
Ce Certificat d'essai OC est établi par l'Organisme National de Certification

KEMA Registered Quality B.V.,
Utrechtseweg 310
6812 AR Arnhem, The Netherlands

Date
January 26, 2001

Signature
B.T.M. Holtus

KEMA

TEST REPORT
IEC 61058-1
Switches for appliances
Part 1: General requirements

Report

Reference No. ..... : 2004680.02A

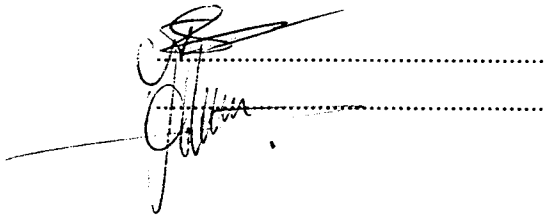
Tested by (+ signature) ..... : F.P. Swenne

Approved by (+ signature) ..... : J.C. Hendriksen

Date of issue ..... : 2001-01-26

Contents ..... : 32 pages

..... :



This report is based on a blank test report that was prepared by KEMA using information obtained from the TRF originator (see below).

Testing laboratory

Name ..... : KEMA Registered Quality B.V.

Address ..... : Utrechtseweg 310, 6812 AR Arnhem, The Netherlands

Testing location ..... : As above

..... :

Client

Name ..... : Marquardt GmbH

Address ..... : Schloß-Straße 16, 78604 RIETHEIM-WEILHEIM, Germany

..... :

Test specification

Standard ..... : IEC 61058-1:1996 + A1:1997

Test procedure ..... : CB-scheme

Procedure deviation ..... : N.A.

Non-standard test method ..... : N.A.

..... :

Test Report Form/blank test report

Test Report Form No. ..... : I1058-1A/97-02

Master TRF ..... : reference No. VDG-077/X-1993, dated 93-10

Test item	
Description	: rocker switches
Trademark	: Marquardt
Model and/or type reference	: 1832., 1835.
Manufacturer	: Marquardt GmbH, Rietheim-Weilheim, Germany
Rating(s)	: 10(8) A/400 V~, 5E4 T105/55
	:

Particulars: test item vs. test requirements		
Type reference	:	common type (C.T.)
Type of switch	:	rocker switch
Pattern number	:	1, 2
Type of switch	:	incorporated
Disconnection	:	full
Type of load	:	resistive and motor
Number of cycles	:	50.000 operating cycles
Ambient temperature, actuating member (°C)	:	0-55°C
Ambient temperature, other parts (°C)	:	0-105°C
Category	:	level 3
Degree of pollution	:	dirty
For appliance class	:	for class II appliances
IP number	:	IP40
PTI (V)	:	250 V
Type of terminals	:	tab terminals, (4,8 x 0,8 mm and 6,3 x 0,8 mm) solder terminals and PCB terminals

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

Testing		
Date of receipt of test item	:	2000-06-30
Date(s) of performance of test	:	2000-08-14
	:	

General remarks

This test report shall not be reproduced except in full without the written approval of the testing laboratory.

The test results presented in this report relate only to the item tested.

"(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.

This report is not valid as a CB Test Report unless appended to a CB Test Certificate issued by a NCB, in accordance with IECEE 02

Copy of marking plate:

Marquardt

10(8)/400~ 5E4

183.

T105/55

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
8	**MARKING AND DOCUMENTATION**		
8.1	Information provided by marking (Ma) or by documentation (Do)		
	Switch with Common Type Reference (C.T.) or switch with Unique Type Reference (U.T.) ..... :	C.T.	P
8.1; 1.	Switch identification:		
	- Ma: manufacturer's name or trademark ..... :	Marquardt	P
	- Ma: type reference ..... :	1832., 1835.	P
8.1; 2.	Switch environment/mounting:		
	- Do: degree of protection ..... :	IP40	P
	- Do: degree of protection against electric shock ..... :	class II	P
	- Do: method of mounting ..... :	incorporated	P
8.1; 3.	Temperature:		
	- Ma (C.T.), Do (U.T.): ambient temperature limits (°C) ..... :	T105/55	P
8.1; 4.	Electrical load:		
	- Ma (C.T.), Do (U.T.): rated voltage or rated voltage range (V) ..... :	400 V	P
	- Ma (C.T.), Do (U.T.): nature of supply ..... :	~	P
	- Ma (C.T.), Do (U.T.): rated frequency (Hz) .. :		N
	- Ma (C.T.), Do (U.T.): rated current: Ir; Im; Ic; Il (A) ..... :	10(8) A	P
	- Do (U.T.): relevant details for declared specific loads ..... :		N
	- Ma/Do (C.T.), Do (U.T.): for switches for more than one circuit, the current (A) applicable to each circuit and to each terminal :		N

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
8.1; 5.	Terminals/conductors:		
	- Ma: all terminals identified ..... :	1, 1a, 1b	P
	- Ma: terminals for earthing conductors, earth symbol ..... :		N
	- Do: information for terminal for prepared conductors or the use of a special tool ..... :		P
	- Do: method of connection and disconnection for screwless terminals ..... :		N
	- Do: type of conductor to be connected to the terminal ..... :	rigid and flexible	P
	- Do: suitability for interconnection of two or more conductors ..... :		N
	- Do: type of solder terminal ..... :		P
	- Do: suitability for connection of unprepared supply conductors ..... :		N
	- Do: suitability for connection of prepared supply conductors ..... :		P
	- Do: cord switch non-rewirable documented . :		N
	- Do: cord switch suitable only for flat cords ... :		N
8.1; 6.	Operating cycles/sequence:		
	- Ma (C.T.), Do (U.T.): number of operating cycles ..... :	5E4	P
	- Do: operating sequence for switch with more than one circuit ..... :		N
8.1; 7.	Signal indicator:		
	- Ma: max. power of tungsten filament signal lamps (W) ..... :		N
	- Do: function of the illuminated indicator ..... :	neon lamp	P
8.1; 8.	Circuit disconnection:		
	- Ma (C.T.), Do (U.T.): micro-disconnection ... :		N
8.1; 9.	Insulating material:		
	- Do: proof tracking index, PTI ..... :	250 V	P

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
8.1; 10.	Switch category:		
	- Do: category of appliance ..... :	level 3	P
	- Do: category or type of luminaire according to IEC 598-1 ..... :		N
8.4	Information about rated current and rated voltage ..... :	10(8)/400~	P
8.5	Information about rated ambient temperature :	T105/55	P
8.6	Symbol for Class II not used ..... :		P
8.7	Information about rated operating cycles ..... :	5E4	P
8.8	Required marking shall preferably be on the body of the switch		P
	Not on screws, removable washers or other parts removable during installation of the switch		P
8.9	Marking shall be legible and durable:		
	- water		P
	- hexane		P
8.10	Enclosed switches, direction of actuation shall be clearly indicated, "O" ..... :		N
8.101	Cord switches for luminaires, no OFF marking		N
9	**PROTECTION AGAINST ELECTRIC SHOCK**		
9.1	Live parts not accessible when switches fixed and connected (except lamps with caps)		P
	Switches for Class II, metal parts not accessible if separated from live parts by basic insulation only		N
	Compliance is checked by inspection and with the standard test finger (IEC 529)		P
	Lacquer, enamel, paper, cotton or similar not used for protection against contact with live parts (if soften in heat)		P

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
9.2	Actuating member shall be fixed adequately (if soften in heat)		P
9.3	Accessible parts of actuating members shall be of insulating material or accessible metal parts separated from live parts by double or reinforced insulation		P
9.4	Capacitors shall not be connected to unearthed metal parts		N
	Metal casing of capacitors shall be separated by supplementary insulation from accessible unearthed metal parts		N
9.101	Non-rewirable cord switches tested as delivered		N
10	**PROVISION FOR EARTHING**		
10.1	Switches for Class II appliances shall have no provision for earthing the switch		P
	Terminals for earthing continuity only if separated from live parts by basic insulation or supplementary insulation for accessible parts		N
10.2	Earthing terminals and terminations shall not be connected electrically to neutral terminal		N
10.4	Connection of earthing terminal or termination shall be of low resistance; current (A), 1,5 times In or 25 A; resistance not exceeding 0,05 Ω ..... :		N

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
10.5	Earthing terminals shall be of a size at least equal to corresponding current-carrying terminal; terminal size ..... :		N
	No loosening without a tool		N
	Clamping means locked against accidental loosening		N
10.6	Thread-cutting and thread-forming screws, at least two screws are used for each connection		N
10.7	No risk of corrosion between earthing terminal and the copper of the earthing conductor or any other metal		N
10.8	Body of an earthing terminal: brass or other metal no less resistant to corrosion		N
10.9	If the body is part of a frame or enclosure of aluminium or aluminium alloy, precautions to prevent corrosion with copper		N
11	**TERMINALS AND TERMINATIONS**		
11.1.1	Terminals for unprepared copper conductors and not requiring the use of a special purpose tool:		
11.1.1.1.1	Terminals shall be such that connection is made by screws, nuts, springs or other equally effective means		N
	No special purpose tool for connection or disconnection necessary		N
11.1.1.1.2	Terminals shall be fixed so that they do not work loose when the clamping means are tightened or loosened		N
	Floating terminals are permitted if they do not impair the correct operation		N

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
	Compliance: 10 times fastening and loosening; max. cross-sectional area (mm²); torque (Nm) :		N
11.1.1.1.3	Conductors cannot slip out from terminals while being connected or while the switch is being operated as intended:		
	type of conductor		—
	max. cross-sectional area (mm²) ..... :		—
	min. cross-sectional area (mm²) ..... :		—
	number of conductors ..... :		—
	torque (Nm) ..... :		—
	After the test, conductor shall not have escaped from gap between the clamping means and retaining device		N
11.1.1.1.4	Terminals for flexible conductor located so that there is no risk of contact between live parts and accessible metal parts		N
	For Class II, between live parts and metal parts separated by supplementary insulation only from accessible metal parts		N
	Furthermore, no risk of short-circuiting those terminals electrically connected together by switch action		N
11.1.1.1.5	Terminals clamp the conductor without undue damage to the conductors		N
11.1.1.1.6	Insertion of the conductor is prevented by a stop, if further insertion may reduce creepage distances and/or clearance or influence the mechanism of the switch		N
11.1.1.2	Screw-type terminals for unprepared copper conductors:		
	Screw-type terminal ..... :		—

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
11.1.1.2.1	Terminals shall allow the connection of conductors:		
	flexible: cross-sectional area (mm²): required; measured ..... :		N
	rigid: cross-sectional area (mm²): required; measured ..... :		N
11.1.1.2.2	Terminals clamp the conductor reliably and between metal surfaces:		
	type of conductor		—
	size ..... :		—
	min. cross-sectional area (mm²) ..... :		—
	max. cross-sectional area (mm²) ..... :		—
	torque (Nm) ..... :		—
	pull (N) for 1 min ..... :		—
	During the test, the conductor shall not move noticeably in the terminal		N
11.1.1.2.3	Screws and nuts for clamping the conductors shall not serve to fix any other parts		N
11.1.1.3	Screwless terminals for unprepared copper conductors		
11.1.1.3.1	Screwless terminal shall allow the connection of conductor up to and including 2,5 mm² for flexible conductors:		
	size ..... :		—
	It shall be obvious how the insertion and disconnection of conductors are intended		N
	Disconnection of a conductor shall require an operation, other than a pull at the conductor		N
	Disconnection manually with or without the help of a tool		N
	Opening for the use of a tool clearly distinguishable from the opening for the conductor		N

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
11.1.1.3.2	Screwless terminals withstand mechanical stress occurring in normal use		N
	Conductor clamped reliably and between metal surfaces (if the current does not exceed 0,2 A)		N
	Flexible: five insertions and disconnections		N
	Size ..... :		—
	Number of conductors ..... :		—
	Pull (N) for 1 min ..... :		—
	During the test, the conductor shall not come out of the terminal		N
	After the test, terminals and clamping means have not worked loose		N
11.1.1.3.3	Screwless terminals for interconnection of more than one conductor:		
	- after insertion, operation of one clamping means is independent of the other		N
	- during the disconnection, conductors can be disconnected either simultaneously or separately		N
11.1.1.3.4	Screwless terminals withstand thermal stress occurring in normal use (this test is carried out for switch with number of operating cycles < 10 000 or when the clamping means forms part of the conductive path through the switch):		
	Ambient temperature (°C) ..... :		—
	Rated current (A) ..... :		—
	After the 192 test cycles (duration 1 h), the temperature rise does not exceed 55 K ..... :	1) 2) 3)	N
11.1.1.4	Insulation piercing terminals for insulated unprepared copper conductors:		
	Requirements and tests under consideration		N
11.1.2	Terminals for prepared copper conductor and/or requiring the use of a special purpose tool:		

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Clause	Requirement – Test	Result - Remark	Verdict
11.1.2.1.1	Terminals shall allow the connection is made as declared (checked during the tests of Cl. 16 and 19)		P
11.1.2.1.2	Terminals shall allow connection of conductors as declared; cross-sectional areas (mm²): required; measured ..... :		P
11.1.2.1.3	Connection reliably between metal surfaces, without undue damage to the conductor (checked during the tests of Cl. 16 and 19)		P
11.1.2.1.4	Insertion of the conductor limited by a stop, if further insertion may reduce creepage distance and/or clearance or influence the mechanism of the switch		P
11.1.2.2	Screw-type terminals for prepared copper conductors:		
	No further specific requirements		N
11.1.2.3	Screwless terminals for prepared copper conductors:		
11.1.2.3.1	Terminals clamp the conductor between metal surfaces (except terminals for current ≤ 0,2 A)		N
11.1.2.3.2	Screwless terminals withstand thermal stress occurring in normal use (checked by test according to 11.1.1.3.4)		N
11.1.2.4	Tabs of flat quick-connect terminations		

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Clause	Requirement – Test	Result - Remark		Verdict
11.1.2.4.1	Tabs forming part of a switch comply with the dimensions according to fig. 7:			
	Nominal size (mm) ..... :	4,8 x 0,8	6,3 x 0,8	—
	A (mm): required (max.); measured ..... :	1,2 : 1,15	1,3 : 1,2	P
	B (mm): required (min.); measured ..... :	6,2 : 7,3	7,8 : 7,85	P
	C (mm): required (+0,04/-0,03); measured .... :	0,8 : 0,81	0,8 : 0,79	P
	D (mm): required (± 0,1); measured ..... :	4,7 : 4,74	6,3 : 6,27	P
	E (mm): required (max.); measured ..... :	4,2 : 4,0	5,7 : 5,2	P
	F (mm): required (max.); measured ..... :	1,6 : 1,55	2,0 : 1,75	P
	G (mm): required (min.); measured ..... :	1,2 : 1,8	1,2 : 1,2	P
	H2 (mm): required (min.); measured ..... :	3,0 : 4,74	4,0 : 4,67	P
	I (mm): required (max. diameter); measured . :			N
	Tabs with different dimensions are permitted to prevent any mating with female of fig. 8 and prescribed in IEC 760			N
11.1.2.4.2	Tabs may have an optional detent for latching (area EF, fig. 7)			N
11.1.2.4.3	Provision for non-reversible connections located in area EF			P
11.1.2.4.4	Material and plating of tabs shall be appropriate to the max. temperature:			
	Max. Temperature of tab (°C) ..... :	205°C		—
	Material and plating ..... :	silver plated copper alloy		P
11.1.2.4.5	Tabs allow application withdrawal of female without damage to the switch:			
	Tab size ..... :	4,8 x 0,8	6,3 x 0,8	—
	Push (N) ..... :	80 N	96 N	—
	Pull (N) ..... :	98 N	88 N	—
	No displacement or damage occurs			P
11.1.2.4.6	Tabs allow connection of the appropriate uninsulated female connectors (during the check no strain or distortion occurs to any of the tabs or adjacent parts)			P

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Clause	Requirement – Test	Result - Remark	Verdict
11.1.2.5	Insulation piercing terminals for prepared insulated copper conductors:		
	Requirements and tests are under consideration		N
11.1.2.6	Solder terminals		
11.1.2.6.1	Solder terminals shall have sufficient solderability, tests according to IEC 68-2-20, test Ta:		
	test method 1 (solder bath at 235 °C)		P
	test method 2 (soldering iron at 350 °C)		P
	soldering iron size B		P
	Final measurement: temperature rise according to Cl. 16		P
11.1.2.6.2	Solder terminals shall have sufficient resistance to soldering heat:		
	Type 1: checked during the tests of 11.1.2.6.1, after the tests the terminals shall not have worked loose or displaced in a manner impairing further use		P
	Type 2: tests according to IEC 68-2-20, test Tb: test method 1A (solder bath at 260 °C) test method 2 (soldering iron 350 °C) soldering iron size B		P
	After the tests the terminals shall not have worked loose or displaced in a manner impairing further use		P
11.1.2.6.3	Solder terminals (see 7.2.12) provided with means for mechanically securing the conductor:		
	- hole for hooking-in the conductors; or		P
	- edges shaped for wrapping-around; or		N
	- clamping means		N
11.1.3	Additional requirements for terminals for supply connection and the connection of external cords:		

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Clause	Requirement – Test	Result - Remark	Verdict
11.1.3.1	Terminal located near its corresponding terminal of different polarity, and to the earthing terminal		N
	According to IEC 335-1 type of attachment .... :		N
12	**CONSTRUCTION**		
12.1	Constructional requirements relating to protection against electric shock:		
12.1.1	Basic and supplementary insulation tested separately when double insulation is employed	reinforced	P
12.1.2	No reduction of creepage and clearance distances as a result of wear (see Cl. 20)		P
	If any conductive part becomes loose and moves out of position, creepage and clearance distances are not reduced to less than 50% (see Cl. 20)		P
12.1.3	Integrated conductors rigid, fixed or insulated so that creepage and clearance distances are not reduced (see Cl. 20)		N
12.1.101	Solder terminals according to 7.2.13, additional provision must be provided		N
12.2	Constructional requirements relating to safety during mounting and normal operation of the switch:		
12.2.1	Covers, cover plates, removable actuators and the like displaced or removed only by use of a tool		N
	Fixings for a cover or cover plate do not serve to fix any other parts except actuating member		N
	Not possible to mount removable parts such that indication of switch positions does not correspond with the actual switch position		N

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Clause	Requirement – Test	Result - Remark	Verdict
12.2.2	Fixing screws of covers or cover plates captive		N
12.2.3	When the actuating member is removed switch not damaged (checked by tests of 18.4)		N
12.2.4	Pull-cord insulated from live parts		N
	Possibility to fit or to replace without removing parts causing accessibility to live parts		N
12.2.5	Illuminated indicator incorporated in a switch provides the correct indication as declared; marked voltage (V) ..... :	same as rated voltage	P
12.3	Constructional requirements relating to the mounting of switches and to the attachment of cords:		
12.3.1	Method of mounting of switches does not adversely affect compliance with this standard		P
12.3.1.1	Switch cannot rotate or be displaced, cannot be removed from an appliance without the aid of a tool		P
	If the removal of a part is necessary during the normal use, requirements of Cl. 9, 15 and 20 are satisfied before and after the removal		N
12.3.101	Cord anchorages, conductors relieved from strain and twisting, sheath of the cord protected from abrasion and kept in position		N
12.3.102	Clear how relief from strain and twisting is effected		N
12.3.103	Makeshift method not used		N
12.3.104	Cord anchorages shall be of insulating material or if of metal, insulated from accessible metal parts and insulating surfaces by supplementary insulation		N

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Clause	Requirement – Test	Result - Remark	Verdict
12.3.105	Cord anchorages of rewirable cord switches do not fall out when the cover is removed		N
12.3.106	Cord anchorages so designed that:		
	- cord is not fixed by penetration of its insulation		N
	- cord cannot touch clamping screws of the cord anchorage (if accessible)		N
	- cord is not clamped by a screw (if of metal)		N
	Rewirable switches:		
	- at least one part securely fixed to the switch		N
	- replacement of the cord does not use a special tool		N
	- suitable for different types of cords		N
12.3.107	Rewirable switches: replacement of cord easy; compliance checked by pull and torque tests		N
	Non-rewirable:		
	- type of cord ..... :		—
	- nominal cross-sectional area (mm²) ..... :		—
	Rewirable:		
	- round cord: nominal cross-sectional area (mm²) ..... :		N
	- flat cord: nominal cross-sectional area (mm²) ..... :		N
	Clamping screws of cord anchorage:		
	- insulating type; torque (2/3): torque (Nm) .... :		N
	- metal type; torque (2/3): torque (Nm) ..... :		N
	Pull test: pull 100 times at 60 N		N
	Torque test: torque (Nm) for 1 min ..... :	0,15 Nm / 0,25 Nm	—
	During the test, cord not damaged		N

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
	After the test, displacement ≤ 2 mm ..... :		N
	no strain at the connection		N
	creepage distances and clearances not reduced		N
	no break in the electrical connections (non-rewirable switch)		N
12.3.108	Non-rewirable switches: cord complying with IEC 227 or IEC 245 ..... :	IEC 227 / IEC 245	N
12.3.109	Screws do not serve to fix any other component, unless		N
	switch is rendered inoperable or manifestly incomplete		N
	Component cannot be removed without a tool		N
12.3.110	Cords are capable of withstanding the bending		N
	Inlet or bushing no sharp edges		N
	Cord-guard not integral with the cord, except		N
	switches classified according to 7.2.3		N
	Flexing test (5000 flexings, weight: 1 kg):		
	- rated current (A) ..... :		—
	- type of cord; cross-sectional area (mm²) ..... :		—
	- type of cord; cross-sectional area (mm²) ..... :		—
	During the test:		
	- no interruption of the test current		N
	- no short-circuit between conductors		N
	After the test, no damage		N
12.3.111	Rewirable switches: adequate space for external conductors		N
	Possibility to check correct connection		N
12.3.112	Rewirable single-pole switch: additional terminal(s) for non-switched conductor(s)		N
	Terminals allow the connection of both incoming and outgoing ends		N

IEC 61058-1			
Clause	Requirement – Test	Result - Remark	Verdict
12.3.113	Non-rewirable switches shall have soldered, welded or crimped terminations ..... :		N
12.3.114	Prewired switch: current rating of the cord compatible with the current of table 102; rated current (A); nominal cross-sectional area (mm^2): required; measured ..... :		N
12.3.115	Rewirable switches provided for earthing continuity: ample space for slack protective earth conductor		N
	Test: protective earth conductor led to its terminals and cut off 8 mm longer than necessary; possibility to house the loop freely without squeezing or pressing the core		N
12.3.116	Switches with means for suspension shall have adequate mechanical strength		N
	Test (barrier): cylindrical steel rod pushed with a force of 75 N for 10 s; the rod shall not pierce the barrier		N
	Pull test: pull 60 N for 10 s to supply flexible cord; during the test, means for suspension shall not break, or		N
	if broken live parts shall not become accessible to test finger		N
12.3.117	Pull test with a round head screw: pull 50 N for 10 s; during the test, means for suspension shall not break, or		N
	if broken live parts shall not become accessible to test finger		N

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Clause	Requirement – Test	Result - Remark	Verdict
13	**MECHANISM**		
13.1	For d.c. switches, speed of contacts independent of the speed of actuating except switches ≤ 28 V or ≤ 0,1 A		N
13.2	Moving contacts rest only in ON and OFF position (intermediate position permitted)		P
	ON position if contact pressure is sufficient (checked by tests of Cl. 16)		P
	OFF position if separation of the contact is adequate, checked by tests of Cl. 15 and 20		P
	Intermediate position checked by test of Cl. 15 for OFF position		N
13.3	Rest position, automatic return to one of them after release (except only one rest position)		P
13.4	Cord operated switch after actuating, parts of mechanism are in position to allow the next cycle of actuation; pull 45 N vertically downwards, or		N
	70 N at 45° to the vertical		N
13.5	Multi-pole switch, all poles make and break simultaneously		N
	Neutral makes before and breaks after the other poles		N
14	**PROTECTION AGAINST INGRESS OF SOLID OBJECTS, DUST AND WATER AND PROTECTION AGAINST HUMID CONDITIONS**		
14.1	Protection against ingress of solid objects: degree of protection ..... :	IP00	N
14.2	Protection against ingress of dust: IP number, first numeral; no deposit of dust inside (IP6X) :	IP0X	N

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Clause	Requirement – Test	Result - Remark	Verdict
14.3	Protection against harmful ingress of water: IP number ..... :	IPX0	N
	Gasket, screwed glands, membranes or similar of rubber or thermoplastic material aged (240 h):		
	at 70 °C, (T + 30) °C or temperature (°C) ..... :		—
	Glands: torque (Nm) ..... :		—
	Fixing screws for enclosures: torque (Nm) ..... :		—
	After test switch withstands electric test specified in 15.3		N
	No trace of water or reduction of creepage and clearance distances (see Cl. 20)		N
14.4	Protection against humid conditions:		
	Duration: 48 h for IPX0, 168 h for other switches ..... :	48 h	—
	Switch does not show any damage		P
15	**INSULATION RESISTANCE AND DIELECTRIC STRENGTH**		
15.2	Insulation resistance (500 V d.c. for 1 min):		
	- operational insulation: ≥ 2 MΩ ..... :	> 2 MΩ	P
	- basic insulation: ≥ 2 MΩ ..... :		N
	- supplementary insulation: ≥ 5 MΩ ..... :		N
	- reinforced insulation: ≥ 7 MΩ ..... :	> 7 MΩ	P
15.3	Dielectric strength:		
	Rated voltage (V) ..... :	400 V~	—
	- operational insulation, test voltage (V) ..... :	1500 V	P
	- basic insulation, test voltage (V) ..... :		N
	- supplementary insulation, test voltage (V) ... :		N
	- reinforced insulation, test voltage (V) ..... :	4250 V	P
	- across full disconnection, test voltage (V) .... :	1500 V	P
	- across micro-disconnection, test voltage (V) :		N
	No flashover or breakdown shall occur		P

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Clause	Requirement – Test	Result - Remark	Verdict
16	**HEATING**		
16.2	Contacts and terminals:		
	Ambient temperature of actuating member (° C) ..... :	22°C	—
	Ambient temperature of other parts (°C) ..... :	105°C	—
	Rated current (A) ..... :	10(8) A	—
	Rated voltage (V) ..... :	400 V~	—
	Test current (A), 1,06 times max. rated current ..... :	10,6 A	—
	Test voltage (V) ..... :	400 V	—
	cross-sectional area (mm²) ..... :	1,0 mm²	—
	terminals, torque (Nm) ..... :		—
	Temperature rise at the terminals not exceeding 45 K (supplementary test: samples 4, 5, 6) ..... :	1) < 6 K 2) < 6 K 3) < 6 K 4) 5) 6)	P
16.3	Other parts of switches do not attain excessive temperatures during the normal use:		
	Test current, 1,06 times max. rated current (A) ..... :	10,6 A	—
	Ambient temperature (°C) ..... :	T105/55	—
	Other heating sources: max. declared power (W) ..... :		—
	Test voltage (V) ..... :	400 V~	—
	Temperature rise of rubber or polyvinyl chloride insulation of non-detachable cables and cords:		
	- without T-marking ≤ 75 °C ..... :		N
	- with T-marking ≤ T °C ..... :		N
	Temperature rise of cord sheaths used as supplementary insulation ≤ 60 °C ..... :		N

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Clause	Requirement – Test	Result - Remark	Verdict
	Temperature rise of rubber, other than synthetic, used for gasket or other parts:		
	- when used as supplementary insulation or as reinforced insulation ≤ 65 °C ..... :		N
	- in other cases ≤ 75 °C ..... :		N
	Temperature rise of material used as insulation other than that specified for wires:		
	- thermosetting materials ..... :		N
	- thermoplastic materials ..... :	133 °C	P
	Temperature rise of outer surface of capacitors:		
	- with marking of maximum operating temperature (T) ≤ (T - 10) °C ..... :		N
	- without marking of maximum operating temperature, small ceramic capacitors for radio and television interference suppression ≤ 75 °C ..... :		N
	- without marking of maximum operating temperature, other capacitors ≤ 45 °C ..... :		N
	Temperature rise of all accessible surfaces except those of actuating members or handles ≤ 85 °C ..... :		N
	Temperature rise of accessible surfaces of actuating members or handles which are held for short periods only:		
	- of metal ≤ 60 °C ..... :		N
	- of porcelain or vitreous material ≤ 70 °C ..... :		N
	- of moulded material or rubber ≤ 85 °C ..... :	< 60 °C	P

17	**ENDURANCE**		
	Rated voltage (V) ..... :	400 V~	—
	Rated current (A a.c. or d.c.) ..... :	10(8) A a.c.	—
	Ambient temperature (°C) ..... :	T105/55	—
	Operations per min ..... :	30	—

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Clause	Requirement – Test	Result - Remark	Verdict
	Type of circuit ..... :	resistive and motor	—
17.2.4	Increased voltage test at accelerated speed:		
	Test voltage, 1,15 Vn (V) ..... :	460 V~	—
	Test current, making (A); cos phi ..... :	55,2 A; cosφ 0,6	—
	Test current, breaking (A); cos phi ..... :	11,5 A; cosφ > 0,95	—
	Number of cycles: 100; time constant (ms) .... :	100; 25	—
	Samples 1, 2, 3 ..... :	1) 2) 3)	P
	Supplementary test: samples 4, 5, 6 ..... :	4) 5) 6)	N
17.2.5	Test at low speed:		
	Test voltage (V) ..... :	400 V~	—
	Test current, making (A); cos phi ..... :	48 A; cosφ 0,6	—
	Test current, breaking (A); cos phi ..... :	10 A; cosφ > 0,95	—
	Number of cycles: 100; time constant (ms) .... :	100; 5	—
	Samples 1, 2, 3 ..... :	1) 2) 3)	P
	Supplementary test: samples 4, 5, 6 ..... :	4) 5) 6)	N
17.2.6	Test at high speed (only for switches with more than one pole):		
	Test voltage (V) ..... :		—
	Test current, making (A); cos phi ..... :		—
	Test current, breaking (A); cos phi ..... :		—
	Number of cycles: 100; time constant (ms) .... :		—

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Clause	Requirement – Test	Result - Remark	Verdict
	Samples 1, 2, 3 ..... :	1) 2) 3)	N
	Supplementary test: samples 4, 5, 6 ..... :	4) 5) 6)	N
17.2.7	Test at accelerated speed:		
	Test voltage (V) ..... :	400 V~	—
	Test current, making (A); cos phi ..... :	48 A; cosφ 0,6	—
	Test current, breaking (A); cos phi ..... :	10 A; cosφ > 0,95	—
	Number of cycles; time constant (ms) ..... :	49 800; 25	—
	Samples 1, 2, 3 ..... :	1) 2) 3)	P
	Supplementary test: samples 4, 5, 6 ..... :	4) 5) 6)	N
17.3	After all tests, switch is deemed to comply if:		
	- all actions function as declared		P
	- temperature rise at the terminals does not exceed 55 K (supplementary test: samples 4, 5, 6) ..... :	1) 40 K 2) 38 K 3) 46 K 4) 5) 6)	P
	- reduced (75%) dielectric strength requirement is met, test voltage (V) ..... :	1125 V 3187 V	P
	- no fault between live parts and earth metal, accessible metal part, or actuating member has occurred		P

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Clause	Requirement – Test	Result - Remark	Verdict
18	**MECHANICAL STRENGTH**		
18.1	Switches have adequate mechanical strength		P
18.1.1	Accessible parts of actuating members have adequate mechanical strength or adequate protection if the actuating member is broken		P
	Checked by tests of 18.2, 18.3, 18.4 as appropriate		P
18.2	Impact test, three blows of:		
	0,5 Nm for all accessible surfaces		P
	1,0 Nm for foot-actuated switches		N
	Foot-operated switches, in addition, subjected to a force of 750 N for 1 min		N
	After the tests, switches comply with the requirements of Cl. 9, 13, 15 and 20		P
	Insulating lining, barriers have not worked loose		P
	Possibility to remove and to replace detachable and other external parts		N
18.3	Cord-operated switches: no damage after pull test; pull (N), normal direction for 1 min; pull (N), 45° from normal direction for 1 min ..... :		N
18.4	Actuating member:		
	- pull test to try to pull off: pull (N) for 1 min .... :	15 N	P
	- push test: 30 N for 1 min for all actuating members		N
	After the tests specimen shows no damage		N
	Pull and push of 30 N applied to the actuating means if without actuating member		N

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Clause	Requirement – Test	Result - Remark	Verdict
18.101	Tumbling barrel (other than foot-operated switches):		
	- rewirable: cord type; cross-sectional area (mm²) ..... :		N
	- non-rewirable as delivered		N
	- number of falls ..... :	1000 / 500 / 100	—
	- during the test: connection shall not become loose		N
	- after the test, no damage		N
18.102	Compression test (only for foot-operated switches): 3 compressions in three different positions; force of 250 N increased to 750 N and maintained for 1 min; after the test, no damage		N
19	**SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS**		
19.1	General requirements for electrical connections: contact pressure is not transmitted through insulating material other than ceramic or like, unless there is sufficient resiliency (not applicable for connections with current ≤ 20 mA)		P
19.2	Screwed connections:		
19.2.1	Screwed connections, electrical or other withstand mechanical stresses		N
19.2.2	Screws transmitting contact pressure in engagement with a metal thread		N
	Screws not of soft metal or metal liable to creep, such as zinc or aluminium		N
19.2.3	Screws operated during the mounting of switches not of the thread-cutting type		N

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Clause	Requirement – Test	Result - Remark	Verdict
19.2.4	Thread-forming screws not used for connection of current-carrying parts (unless they use a suitable means of locking)		N
	Thread-cutting screws not used for electrical connection of current-carrying parts (unless they generate ISO thread or equivalent)		N
	Provisionally SI, BA and UN are equivalent to ISO thread		N
	Screws or nuts tightened and loosened:		
	10 times for screws in engagement with a thread of insulating material		N
	5 times for all other cases		N
	Nuts concentric with the button: tightened and loosened 5 times:		
	0,8 Nm if insulating material		N
	1,8 Nm if metal		N
	Terminal screws: diameter (mm); torque (Nm) :		N
	Assembly screws: diameter (mm); torque (Nm) ..... :		N
	Cord anchorages: diameter (mm); torque (Nm) ..... :		N
	Other screws: diameter (mm); torque (Nm) ... :		N
	During the test, terminals do not work loose and no damage		N
19.2.5	Screwed glands: ..... :	metal / insulating	—
	Diameter metal rod (mm); torque (Nm) ..... :		N
	After the test, the glands and the enclosure show no damage		N
19.2.6	Correct introduction of the screws into the screw holes ensured		N
19.2.7	Screws and rivets locked against loosening		N

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Clause	Requirement – Test	Result - Remark	Verdict
19.2.8	Screws and nuts for clamping the conductors have ISO thread or equivalent		N
	Provisionally SI, BA, UN are comparable to ISO		N
	Checked by tests of 19.2		N
19.3	Current-carrying parts, material of current-carrying parts and earthing parts shall be:		
	- copper, or		N
	- 58% copper for parts worked cold, or	> 58%Cu	P
	- 50% for other parts		N
	- stainless steel, or		N
	- steel with coating of zinc (ISO 2081)		N
	- steel with coating of nickel and chromium (ISO 1456)		N
	- steel with coating of tin (ISO 2093)		N
	Parts subjected to arcs not of steel with an electroplated coating		P
19.101	Insulating material screws: diameter (mm); torque (Nm) ..... :		N
	Insulating material screws: diameter (mm); torque (Nm) ..... :		N
19.102	Not possible to replace screws of insulating material with metal screws (if impair safety)		N
20	**CLEARANCES, CREEPAGE DISTANCES AND DISTANCES THROUGH INSULATION**		
	Clearances and creepage distances	(see appended table)	
	Distance through insulation:		
	- basic insulation, ≥ 1,0 mm ..... :		N
	- reinforced insulation, ≥ 0,8 mm ..... :	> 2 mm	P
	- supplementary insulation, ≥ 0,4 mm ..... :		N

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Clause	Requirement – Test	Result - Remark	Verdict
21	**RESISTANCE TO HEAT, FIRE AND TRACKING**		
21.1.1	Resistance to heat and fire for accessible parts:		
	Ball-pressure test: test temperature (°C); diameter of impression ≤ 2 mm ..... :	75 °C / actuating member < 2 mm	P
	Glow-wire test at 650 °C: no visible flame or		P
	flame extinguishes within 30 s ..... :		N
21.1.2	Resistance to heat and fire for parts in contact with or support current-carrying parts:		
	Ball-pressure test: test temperature (°C); diameter of impression ≤ 2 mm ..... :	125 °C /	N
	Glow-wire test at 650 °C: no visible flame or		N
	flame extinguishes within 30 s ..... :		N
21.1.3	Resistance to heat and fire for parts in contact with, maintain, or retain in position electrical connections:		
	Ball-pressure test: test temperature (°C); diameter of impression ≤ 2 mm ..... :	125 °C / body < 2 mm	P
	Glow-wire test: test temperature (°C); no visible flame or ..... :	850 °C	P
	flame extinguishes within 30 s ..... :	< 3 sec.	P
21.1.4	Resistance to heat and fire for all other parts:		
	Glow-wire test at 650 °C: no visible flame or		N
	flames extinguish within 30 s ..... :		N
21.2	Resistance to tracking:		
	50 drops; test voltage (V); PTI (V) ..... :	250 V	P
	No flashover or breakdown (test not carried out for switches ≤ 50 V or for use in clean situations)		P

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Clause	Requirement – Test	Result - Remark	Verdict
22	**RESISTANCE TO RUSTING**		
	Ferrous parts adequately protected against rusting; no signs of rust after exposure to ammonium chloride and moisture treatment in saturated air		P

20	**TABLE: creepage distance and clearance measurements**				
	Working voltage (V) ..... :	400 V~			—
	Degree of pollution ..... :	dirty			—
creepage distance Cd and clearance Cl across:		**required Cd (mm)**	**Cd (mm)**	**required Cl (mm)**	**Cl (mm)**
Operational insulation, sealed or incapsulated		-	-	-	-
Operational insulation,		4,0	> 4,0	3,0	> 3,0
basic insulation		-	-	-	-
Supplementary insulation		-	-	-	-
Reinforced insulation *)		8,0	> 8,0	6,0	> 6,0
full disconnection		4,0	> 4,0	3,0	> 3,0
Micro-disconnection		-	-	-	-

*) The creepage distances and clearances for reinforced insulation shall be realized in the appliance.

Remarks

Body and actuating member of thermoplastic material.

Factory locations:

The switches may be manufactured in the following factory locations.

1) Marquardt GmbH,
Schloß-Straße 16, RIETHEIM-WEILHEIM, Germany

2) S.A.E.E.,
104 Av. L'Union Magreb Arab, 2036 LA SOUKRA - TUNIS, Tunisia

3) Marquardt Switches (Shanghai) Co. Ltd.,
No. 458 Qingda Road, Heqing, SHANGHAI 201201, China

4) Marquardt Switches Inc.,
Route 20 West, CAZENOVIA, NY 13035, United States of America

The maufacturer declares that the switches manufactured in the above mentioned factory locations are equal.