



TEST REPORT

IEC 62477-1

Safety requirements for power electronic converter systems and equipment - Part 1: General

Report reference number : CGDY-ESH-P25010997

Date of issue..... : 2025-04-21

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Testing laboratory name..... : BUREAU VERITAS LCIE CHINA COMPANY LIMITED

Address : Building 4, No. 518, Xinzhuang Road, Caohejing Songjiang High-Tech Park, Shanghai, P.R.China (201612)

Accreditation..... :



Applicant's name : FOXESS CO., LTD.

Address : No.939, Jinhai Third Road, New Airport Industry Area, Longwan District, Wenzhou, Zhejiang, China

Test specification

Standard..... : IEC 62477-1:2022, EN 62477-1:2012+A11:2014+A1:2017+A12:2021

Test procedure..... : Certificate of compliance

Test report form number. : IEC62477-1_1

Master TRF..... : BUREAU VERITAS LCIE CHINA COMPANY LIMITED

Test item description : Rechargeable Li-ion Battery System

Trademark :



Model / Type : EP3 Plus, EP3 Plus (w), EP5 Plus, EP5 Plus (w), EP6 Plus, EP6 Plus (w), EK6 Plus, EK6 Plus (w)

Ratings : See below table

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Model	EP3 Plus	EP3 Plus (w)	EP5 Plus
Battery Type	Li-ion	Li-ion	Li-ion
Battery Voltage Range (Vd.c.)	174,0~219,0	174,0~219,0	174,0~219,0
Rated capacity (Ah)	17,2	17,2	27
Usable Energy (kWh)	3,3	3,3	5,18
Normal current (Ad.c)	15	15	15
Max. Charging/Discharging Current (Ad.c.)	30/30	30/30	30/30
Charging Temperature Range (°C)	0~55	0~55 (warm up function off) -25~55 (warm up function on)	0~55
Discharging Temperature Range (°C)	-10~55	-10~55 (warm up function off) -25~55 (warm up function on)	-10~55
Protective class	I	I	I

Model	EP5 Plus (w)	EP6 Plus	EP6 Plus (w)
Battery Type	Li-ion	Li-ion	Li-ion
Battery Voltage Range (Vd.c.)	174,0~219,0	174,0~219,0	174,0~219,0
Rated capacity (Ah)	27	30	30
Usable Energy (kWh)	5,18	5,76	5,76
Normal current (Ad.c)	15	15	15
Max. Charging/Discharging Current (Ad.c.)	30/30	30/30	30/30
Charging Temperature Range (°C)	0~55 (warm up function off) -25~55 (warm up function on)	0~55	0~55 (warm up function off) -25~55 (warm up function on)
Discharging Temperature Range (°C)	-10~55 (warm up function off) -25~55 (warm up function on)	-10~55	-10~55 (warm up function off) -25~55 (warm up function on)
Protective class	I	I	I

Model	EK6 Plus	EK6 Plus (w)
Battery Type	Li-ion	Li-ion
Battery Voltage Range (Vd.c.)	174,0~219,0	174,0~219,0
Rated capacity (Ah)	30	30
Usable Energy (kWh)	5,76	5,76
Normal current (Ad.c)	15	15
Max. Charging/Discharging Current (Ad.c.)	30/30	30/30
Charging Temperature Range (°C)	0~55	0~55 (warm up function off) -25~55 (warm up function on)
Discharging Temperature Range (°C)	-10~55	-10~55 (warm up function off) -25~55 (warm up function on)
Protective class	I	I

Testing Location	BUREAU VERITAS LCIE CHINA COMPANY LIMITED		
Address	Building 4, No. 518, Xinzhuan Road, Caohejing Songjiang High-Tech Park, Shanghai, P.R.China (201612)		
Tested by (name and signature)	Leon Yang Test Engineer		
Approved by (name and signature)	Jiaxin Tan Project reviewer		
Manufacturer's name	FOXESS CO., LTD.		
Manufacturer address	No.939, Jinhai Third Road, New Airport Industry Area, Longwan District, Wenzhou, Zhejiang, China		
Factory's name	FOXESS CO., LTD.		
Factory address	No.939, Jinhai Third Road, New Airport Industry Area, Longwan District, Wenzhou, Zhejiang, China		

Document History			
Date	Internal reference	Modification / Change / Status	Revision
2025-04-21	Leon Yang	Initial report was written	0
Supplementary information:			

Test item particulars	
Equipment mobility	☐ movable ☒ stationary ☐ for building-in ☒ fixed
Connection to the mains	☐ pluggable equipment ☐ direct plug-in ☐ permanent connection ☐ for building-in
Environmental category	☒ outdoor ☐ indoor ☒ unconditional ☐ conditional
Over voltage category Mains/AC	☐ OVC I ☐ OVC II ☐ OVC III ☐ OVC IV
Over voltage category PV/DC	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%)	N/A
Tested for power systems	N/A
IT testing, phase-phase voltage (V)	N/A
Class of equipment	☒ Class I ☐ Class II ☐ Class III
Pollution degree	☐ PD 1 ☒ PD 2 ☐ PD 3 (Reduction of table 5 is considered)
IP protection class	IP65
Elevation during operation (m)	Max. 3000m
Elevation of test laboratory (m)	≤2000m
Mass of equipment (kg)	51±2
For more information	See table 4
Possible test case verdicts	
- test case does not apply to the test object	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
Testing	
Date of receipt of test item	2025-01-20
Date (s) of performance of tests	2025-01-21 to 2025-03-15

General remarks

The test results presented in this report relate only to the object tested.
This report shall not be reproduced in part or in full without the written approval of the issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

This report consists of the following documents and/or enclosures

1. Test Report
2. Pictures of the unit – Annex No. 1
3. Equipment list – Annex No. 2

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

EP3 Plus



Rechargeable Li-ion Battery System

IFPr 47/163/[60S]M/-10+50/90

Model: Battery type: Rated capacity: Nominal energy: Nominal voltage: Voltage range: Max. charge/discharge current: Ingress protection: Protective class: Operating charge/discharge temperature:	EP3 Plus LFP (LiFePO₄) 17.2 Ah 3.30 kWh 192.0 V 174.0~219.0 V 30/30 A IP65 Class I 0~55/-10~55 °C
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CAUTION

- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

Emergency Situations

- * If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.
- * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.

Made in China

XX-XXX-XXXX-XX-X




















EP3 Plus (w)

FOX
ESS

Rechargeable Li-ion Battery System

IFPR47/163/[60S]M/-10+50/90

Model:	EP3 Plus (w)
Battery type:	LFP (LiFePO ₄)
Rated capacity:	17.2 Ah
Nominal energy:	3.30 kWh
Nominal voltage:	192.0 V
Voltage range:	174.0~219.0 V
Max. charge/discharge current:	30/30 A
Ingress protection:	IP65
Protective class:	Class I
Operating charge/discharge temperature:	0~55/-10~55 °C**
** warm up function off ** warm up function on	-25~55/-25~55 °C**

- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

CAUTION

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.

Emergency Situations * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.
Made in China
XX-XXXX-XXXXX-XX-X

EP5 Plus

FOX
ESS

Rechargeable Li-ion Battery System

IFPR 47/163/[60S]M/-10+50/90

Model: Battery type: Rated capacity: Nominal energy: Nominal voltage: Voltage range: Max. charge/discharge current: Ingress protection: Protective class: Operating charge/discharge temperature:	EP5 Plus LFP (LiFePO_4) 27 Ah 5.18 kWh 192.0 V 174.0~219.0 V 30/30 A IP65 Class I 0~55°/-10~55 °C
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CAUTION

- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.
 * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Emergency Situations

Manufacturer: FOXESS CO., LTD.
Made in China
XX-XXXX-XXXXX-XX-X

EP5 Plus (w)



Rechargeable Li-ion Battery System

IFPr47/163/[60S]M/-10+50/90

Model: Battery type: Rated capacity: Nominal energy: Nominal voltage: Voltage range: Max. charge/discharge current: Ingress protection: Protection class: Operating charge/discharge temperature:	EP5 Plus (w) LFP (LiFePO₄) 27 Ah 5.18 kWh 192.0 V 174.0~219.0 V 30/30 A IP65 Class I 0~55/-10~55 °C^{*1} -25~55/-25~55 °C^{*2}
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^{*1} warm up function off
^{*2} warm up function on



CAUTION

- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

Emergency Situations

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.

* Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.

Made in China

XX-XXX-XXXX-XX-X









EK6 Plus



Rechargeable Li-ion Battery System
IFPr47/163/[60S]M/-10+50/90

Model:	EK6 Plus
Battery type:	LFP (LiFePO ₄)
Rated capacity:	30 Ah
Nominal energy:	5.76 kWh
Nominal voltage:	192.0 V
Voltage range:	174.0~219.0 V
Max. charge/discharge current:	30/30 A
Ingress protection:	IP65
Protective class:	Class I
Operating charge/discharge temperature:	0~55/-10~55 °C



- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.

Emergency Situations * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.
 Made in China
 XX-XXX-XXXXX-XX-X







EK6 Plus (w)



Rechargeable Li-ion Battery System
IFPr47/163/[60S]M/-10+50/90

Model:	EK6 Plus (w)
Battery type:	LFP (LiFePO ₄)
Rated capacity:	30 Ah
Nominal energy:	5.76 kWh
Nominal voltage:	192.0 V
Voltage range:	174.0~219.0 V
Max. charge/discharge current:	30/30 A
Ingress protection:	IP65
Protective class:	Class I
Operating charge/discharge temperature:	0~55/-10~55 °C ^{*1}
	^{*1} warm up function off ^{*2} warm up function on -25~55/-25~55 °C ^{*2}



- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.

Emergency Situations * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.
 Made in China
 XX-XXX-XXXXX-XX-X







EP6 Plus



Rechargeable Li-ion Battery System
IFPr47/163/[60S]M/-10+50/90

Model:	EP6 Plus
Battery type:	LFP (LiFePO ₄)
Rated capacity:	30 Ah
Nominal energy:	5.76 kWh
Nominal voltage:	192.0 V
Voltage range:	174.0~219.0 V
Max. charge/discharge current:	30/30 A
Ingress protection:	IP65
Protective class:	Class I
Operating charge/discharge temperature:	0~55/-10~55 °C



- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.

Emergency Situations * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.
 Made in China
 99-200-00145-00-X







EP6 Plus (w)



Rechargeable Li-ion Battery System
IFPr47/163/[60S]M/-10+50/90

Model:	EP6 Plus (w)
Battery type:	LFP (LiFePO ₄)
Rated capacity:	30 Ah
Nominal energy:	5.76 kWh
Nominal voltage:	192.0 V
Voltage range:	174.0~219.0 V
Max. charge/discharge current:	30/30 A
Ingress protection:	IP65
Protective class:	Class I
Operating charge/discharge temperature:	0~55/-10~55 °C ^{*1}
	^{*1} warm up function off ^{*2} warm up function on -25~55/-25~55 °C ^{*2}



- Do not disassemble the battery.
- Do not immerse the battery in water.
- Do not short-circuit the battery.
- Do not leave the battery near fire.

* If leaking, on fire, wet or damaged, switch off the DC Switch and move away from the battery.

Emergency Situations * Do not touch any leaking liquid. Do not use water or sand. Dry powder fire extinguishers should be used.

Manufacturer: FOXESS CO., LTD.
 Made in China
 99-200-00153-01-X







SN: XX XXXXXX X XXX X XXX

工厂代码

产品型号代码

产品梯次

生产日期代码

产线代码

流水号

年度代码		月份代码		日期代码	
年度	代码	月份	代码	日期	代码
2020 年	0	1 月	1	1 日	1
2021 年	1	2 月	2	2 日	2
2022 年	2	3 月	3	3 日	3
2023 年	3	4 月	4	4 日	4
2024 年	4	5 月	5	5 日	5
2025 年	5	6 月	6	6 日	6
2026 年	6	7 月	7	7 日	7
2027 年	7	8 月	8	8 日	8
2028 年	8	9 月	9	9 日	9
2029 年	9	10 月	A	10 日	A
2030 年	A	11 月	B	11 日	B
2031 年	B	12 月	C	12 日	C
2032 年	C			13 日	D
2033 年	D			14 日	E
2034 年	E			15 日	F
2035 年	F			16 日	G
2036 年	G			17 日	H
2037 年	H			18 日	W
2038 年	J			19 日	J
2039 年	K			20 日	K
				21 日	L
				22 日	M
				23 日	N
				24 日	X
				25 日	P
				26 日	Q
				27 日	R
				28 日	Y
				29 日	T
				30 日	U
				31 日	V

Remark: SN: XX XXXXX X YMD X XXX represent the manufacture date, Y denote year, M denote month, D denote days.

General product information:

Dimension of EUT: 380*185*640mm

The products are Rechargeable Li-ion Battery system with a nominal voltage of 192,0V which is used in energy storage applications.

The battery system consists of 60 Lithium Iron Phosphate cells connected in 60S, the cell model No. LFR46160-30Ah.

The differences between the battery system models are as follows:

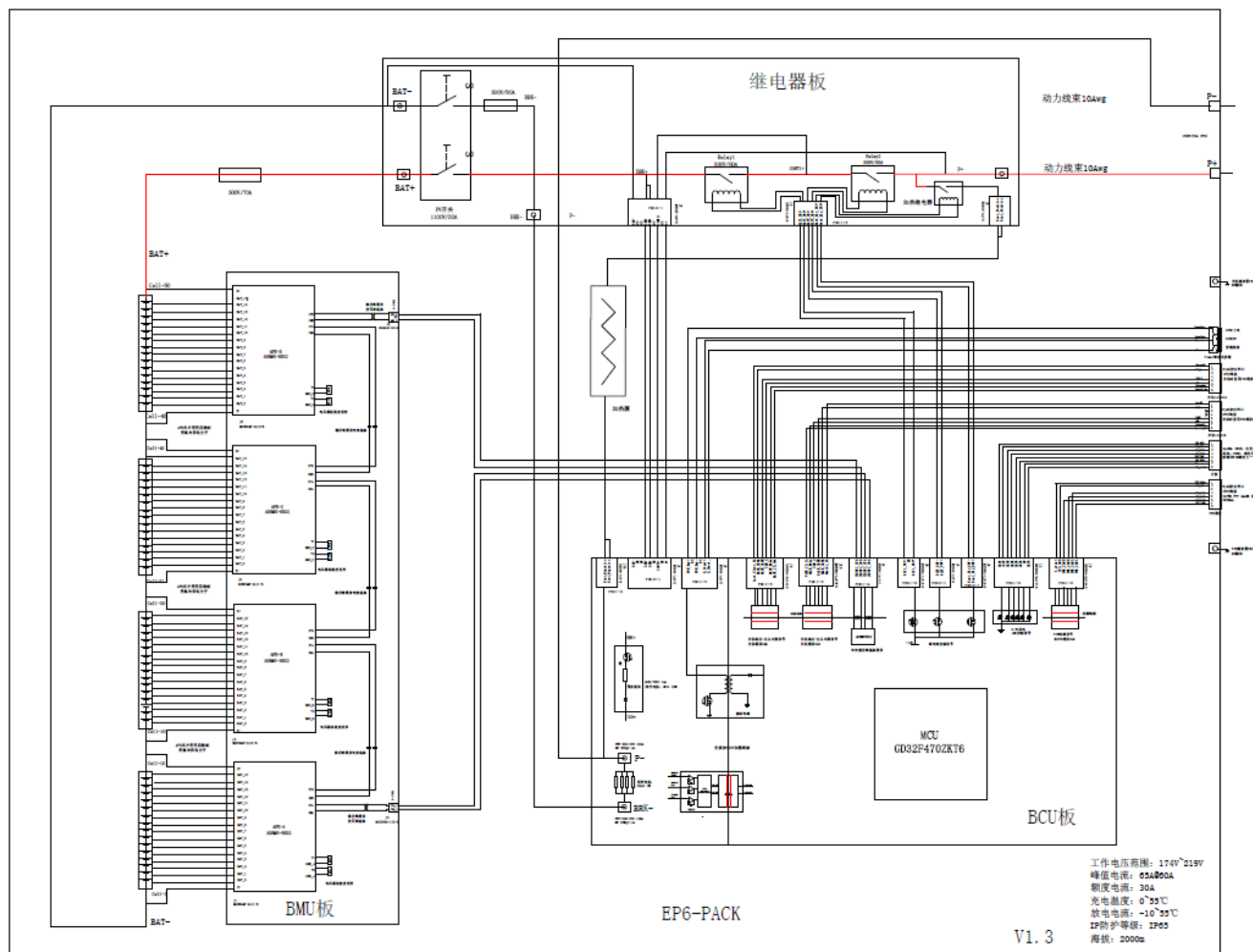
1. The hardware configuration and BMS of EP3 Plus, EP5 Plus, EP6 Plus and EK6 Plus are identical. The different part is that the energy release of the battery system will be limited through the software function, so that the energy released by the system is EP3 Plus: 3,30kWh, EP5 Plus: 5,18kWh, EP6 Plus: 5,76 kwh, EK6 Plus: 5,76 kwh.
2. The hardware configuration and BMS of EP3 Plus (w), EP5 Plus (w), EP6 Plus (w) and EK6 Plus (w) are identical. The different part is that the energy release of the battery system will be limited through the software function, so that the energy released by the system is EP3 Plus (w): 3,30kWh, EP5 Plus (w): 5,18kWh, EP6 Plus (w): 5,76 kwh, EK6 Plus (w): 5,76 kwh.
3. EP Plus (w) series adds a heating unit to the EP Plus series product base.
4. The EP6 Plus is identical to the EK6 Plus except for the model's name.
5. The EP6 Plus (w) is identical to the EK6 Plus (w) except for the model's name.

Based on the above differences, EP6 Plus (w) was a typical model for testing.

Software version: V1.0

Hardware version: V1.0

Block diagram



IEC 62477-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	PROTECTION AGAINST HAZARDS		P
4.1	General		P
4.2	Single fault conditions and abnormal operating conditions	See Table 4.2 to 4.3	P
	Components in 4.2 also include insulation systems, ports, etc (IEC 62477-1:2012/AMD1:2016)		P
4.3	Short-circuit and overcurrent protection		P
4.3.1	General		P
4.3.2	Input short-circuit withstand strength and output short-circuit current ability	See Table 4.2 to 4.3	P
4.3.2.1	General		P
	The interrupting capability of the overcurrent protective device shall be equal or greater than the prospective short-circuit current of the mains supply or non-mains supply.		P
	Protective devices provided or specified shall have adequate breaking capability to interrupt the maximum prospective short-circuit current specified for the port to which they are connected.		P
	If the result of one test is representative of the worst case, less severe combinations need not be tested.		P
4.3.2.2	Conditional short-circuit current (I_{cc}) on input ports		P
	In case where the PECS manufacturer selects the conditional short-circuit current (I_{cc}) rating according to 4.3.1, the following shall be specified:		P
	-conditional short-circuit current (I_{cc})		P
	-characteristics of the short-circuit protective device, and		P
	-minimum required prospective short-circuit current ($I_{cp,mr}$)		P
	Compliance is shown through evaluation according to 4.2, to determine the appropriate combination of testing according to 5.2.4.4, 5.2.4.6 and 5.2.3.11.3 in order to evaluate single fault conditions and abnormal operating conditions		P
4.3.2.3	Short-time withstand current (I_{cw}) on input ports		P
	When the PECS manufacturer selects the short-time withstand current (I_{cw}) rating according to 4.3.1, the following shall be specified:		P
	-short-time withstand current (I_{cw})		P
	-associated duration; and		P
	-peak withstand current (I_{pk})		P
	Compliance is shown through evaluation according to 4.2 to determine the appropriate combination of testing according to 5.2.3.11.3 and 5.2.4.4.3 in order to evaluate single fault conditions and abnormal operating conditions.		P
4.3.2.4	Output short-circuit current ability		P
	The ability of the PECS to deliver a current, in the event of a short-circuit at the output, defined in amperes and time.		P

IEC 62477-1			
Clause	Requirement + Test	Result - Remark	Verdict
4.3.2.5	Combined input and output ports		P
	For ports which are both input and output ports, the applicable requirements of both 4.3.2.1 and 4.3.2.4 apply.		P
4.3.3	Short-circuit coordination (backup protection)		P
	Protective devices provided or specified shall have adequate breaking capability to interrupt the prospective short-circuit current specified for the port to which they are connected.		P
	For PECS designed as pluggable equipment type A, either the PECS shall be designed so that the building installation provides short-circuit backup protection, or additional short-circuit backup protection shall be provided as part of the PECS.	No type A plug	N/A
	For PECS designed as pluggable equipment type B or permanently connected equipment, it is permitted for short-circuit backup protection to be in the building installation.	Permanently connected equipment	P
	If internal protection of the PECS is not rated for the prospective short-circuit current, the documentation shall specify an upstream protective device, rated for this prospective short-circuit current of that port. Analysis shall ensure the protection coordination so that the external protection opens before the internal protection.		P
	Compliance shall be checked by visual inspection in 5.2.1 and simulation or by the tests of 5.2.4.4 and 5.2.4.5.		P
4.3.4	Protection by several devices		P
	Where protective devices that require manual replacement or resetting are used in more than one pole of a supply to a given load, those devices located together. It is permitted to combine two or more protective devices in one component.		P
	Compliance shall be checked by visual inspection in 5.2.1.		P
4.4	Protection against electric shock		P
4.4.1	General		P
4.4.2	Decisive voltage class		P
4.4.2.1	General		P
4.4.2.2	DVC As		P
4.4.2.3	DVC B		N/A
4.4.2.4	DVC C		P
4.4.2.5	Interconnection of external SELV/PELV to DVC As circuits		P
4.4.2.6	Determination of the decisive voltage class (DVC)		P
4.4.2.7	Requirements for protection against electric shock		P
4.4.3	Means for basic protection		P
4.4.3.1	General		P
4.4.3.2	Protection by means of basic insulation of hazardous live parts		P

IEC 62477-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Basic insulation provided by means of		P
	-solid insulation; or		P
	-clearance and creepage distances in combination with means of enclosures or barriers according to 4.4.3.3.		P
	Not possible to remove the insulation without the use of a tool or key.		
	A conductive accessible part is considered to be conductive if its surface is bare or is covered by an insulating layer that does not comply with the requirements of at least basic insulation.		P
	Any conductive accessible part is considered to be a hazardous live part if not separated from the live parts by at least the minimum protective requirements		P
	The basic insulation designed and tested according to the impulse withstand voltages and temporary overvoltages for the circuits to which they are connected.		P
4.4.3.3	Protection by means of enclosures or barriers		P
	Hazardous live parts shall be arranged in enclosures or located behind enclosures or barriers, which meet at least the requirements of IP2X according to IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013.	IP65	P
	Hazardous live parts located at the top surfaces of enclosures or barriers which are accessible when the PECS is energized shall meet at least the requirements of type IP3X with regard to vertical access only.		N/A
	For PECS designed as movable equipment with no defined top and bottom, this requirement of IP3X applies to all sides.	Fixed equipment	N/A
	If the PECS is installed in a restricted access area, IPXXB instead of IP3X applies.		N/A
	Openings in the enclosure above 1,8 m comply with IPXXB.		N/A
	Only possible to open enclosures or remove barriers: • with the use of a tool or key; or • after de-energization of these live parts.		P
	Where the enclosure is required to be opened and the PECS energized during installation or maintenance: a) accessible live parts of voltage higher than DVC As shall be protected by at least IPXXA; b) live parts of voltage higher than DVC As that are likely to be touched when making adjustments shall be protected by at least IPXXB; c) be ensured that persons are aware that hazardous live parts are accessible, and marked per the requirements in 6.3.9.1 and		N/A

IEC 62477-1			
Clause	Requirement + Test	Result - Remark	Verdict
	6.5.1.		
	The protective means against access to hazardous live parts by means of enclosure and barriers according to 4.4.3.3 does not apply to open type sub-assemblies and PECS intended to be installed		N/A
	-inside a supplementary enclosure in the end application; or		N/A
	-in a restricted access area.		N/A
4.4.4	Means for fault protection		P
4.4.4.1	General		P
	Fault protection shall be provided by one or more of the following measures: • Protective equipotential bonding in 4.4.4.2 in combinations with the PE conductor in 4.4.4.3; • Automatic disconnection of supply in 4.4.4.4; • Supplementary insulation in 4.4.4.5; • Simple separation between circuits in 4.4.4.6; • Electrically protective screening in 4.4.4.7. Means used for fault protection independent and additional to those for basic protection. .		P
4.4.4.2	Protective equipotential bonding		P
4.4.4.2.1	General		P
	The protective equipotential bonding circuit consists of the interconnection of:		P
	-PE terminal(s) of the PECS (see 4.4.4.3.2);		P
	-the PE conductors (4.4.4.3) within and between the parts of the PECS including sliding contacts where they are part of the circuit; and		P
	-the conductive structural parts and conductive accessible parts of the PECS.		P
	Protective equipotential bonding suitably protected against mechanical damage, chemical or electrochemical degradation, electromagnetic and thermodynamic forces.		P
	The electrical connection points of the protective equipotential bonding shall be corrosion-resistant.		P
	Electrical connections of protective equipotential bonding circuit shall be designed so that contact pressure is not transmitted through insulating material		P
	Every connection (e.g. screwed, clamps) between protective equipotential bonding and other equipment provide durable electrical continuity and adequate mechanical strength and protection.		P
	Screws for connecting protective equipotential bonding shall not serve any other purpose except when the manufacturer specifies this in the documentation.		P
	Electrical contact to the means of connection of the PE conductor shall be achieved by one or more of the following means:		P
	-through direct metallic contact		P
	-through other conductive accessible parts or other metallic components which are not removed when the PECS is used as intended; or		P
	-through metal enclosures, walls or frames		P

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Clause	Requirement + Test	Result - Remark	Verdict
	When painted surfaces (in particular powder painted surfaces) are joined together, masking of paint, paint piercing methods or a separate connection shall be made to ensure reliable contact.		P
4.4.4.2.2	Rating of protective equipotential bonding		P
	Protective equipotential bonding shall either be: a) sized in accordance with the requirements for the PE conductor in 4.4.4.3 and the means of connection for the PE conductor in 4.4.4.3.2 to ensure no voltage drop exceeding the values from 4.4.2.2.3 during a fault; or b) sized • to withstand the highest stresses that can occur to the PECS item(s) concerned when they are subjected to a fault connecting to accessible conductive parts; and • to remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part; and • to ensure no voltage drop exceeding the values from 4.4.2.2.3 during normal operation and during a fault. Compliance shall be checked with the type tests in 5.2.3.11		P
4.4.4.3	PE conductor		P
4.4.4.3.1	General		P
	A PE conductor shall be connected at all times when power is supplied to the PECS, unless the PECS complies with the requirements of protective class II (see 4.4.6.3) or protective class III. Unless local wiring regulations state otherwise, the PE conductor cross-sectional area shall be determined from Table 7 or by calculation according to 543.1 of IEC 60364-5-54:2011.		P
	If the PE conductor is routed through a plug and socket, or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		N/A
	The cross-sectional area of every PE conductor that does not form part of the supply cable or cable enclosure shall, in any case, be not less than: • 2,5 mm ² if mechanical protection is provided; or • 4 mm ² if mechanical protection is not provided.		P
	Provisions within cord-connected equipment shall be made so that the PE conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted. For special system topologies, the PECS designer verify the PE conductor cross-section required.		N/A
4.4.4.3.2	Means of connection for the PE conductor		P
	PECS shall have a means of connection for the PE conductor, located near the terminals for the respective phase conductors. The means of		P

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Clause	Requirement + Test	Result - Remark	Verdict
	connection shall be corrosion-resistant and suitable for the connection of conductors according to Table 4 and of cables in accordance with the wiring rules applicable at the installation (see 4.4.4.3.3, 4.11.10.2 and 4.11.10.3).		
	The means of connection for the PE conductor shall not be used as a part of the mechanical assembly of the PECS or for other connections.		P
	Connection and bonding points designed so that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences.		P
	Clamping screws and nuts for the PE conductor shall not serve to fix any other component although they may hold the terminals in place or prevent them from turning.		P
	Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.		P
	The marking shall not be placed on or fixed by screws, washers or other parts which removed when conductors are being connected.		P
4.4.4.3.3	Requirements for reinforced PE conductor		N/A
4.4.4.3.3.1	General		N/A
	The requirements of 4.4.4.3.3 satisfied to prevent conductive accessible parts to become hazardous in case of damage to or disconnection of the PE conductor thereby affecting the touch current. It also addresses issues with PECS having high leakage current.		N/A
4.4.4.3.3.2	PECS designed as pluggable equipment type A		N/A
	For pluggable equipment type A, the touch current shall not exceed the limits.	Non-mains supply	N/A
4.4.4.3.3.3	PECS designed as pluggable equipment type B and permanently connected equipment		N/A
	For pluggable equipment type B and permanently connected equipment,		N/A
	a) the touch current shall not exceed the limits specified in Table 5; or		N/A
	b) a pluggable equipment type B connection with a minimum PE conductor cross-sectional area of 2,5 mm ² as part of a multi-conductor power cable, and a strain relief according to 4.12.6 shall be used; or		N/A
	c) one of the following items shall be provided:		N/A
	-a cross-sectional area of the PE conductor of at least 10 mm ² Cu or 16 mm ² Al;		N/A
	-automatic disconnection of the supply in case of discontinuity of the PE conductor in 4.4.4.4;		N/A
	-an additional terminal for a second PE conductor of the same cross-sectional area as the original PE conductor in Table 4; or		N/A
	-the PE conductor according to Table 4 is completely enclosed within electrical equipment enclosures or otherwise protected throughout its length against mechanical damage (see 4.11.2.2).		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.4.3.3.4	High leakage current conditions for permanently connected PECS		N/A
	During normal operating conditions, the PE conductor current (RMS) not exceed 5 % of the rated input current of permanently connected PECS.		N/A
	If the above requirement is not achievable for functional or other reasons, the manufacturer provide information in the documentation about the required protective means such as:		N/A
	-an oversized PE conductor; or		N/A
	-protective equipotential bonding between the PECS and simultaneously accessible external conductive objects within 2,5 m such as the following:		N/A
	-metallic pipes		N/A
	-fences		N/A
	-fixed ladders		N/A
	-handrails		N/A
	-a connection to local earth		N/A
4.4.4.4	Automatic disconnection of supply		P
	For automatic disconnection of supply: • a protective equipotential bonding system shall be provided; and • a protective device operated by the fault current shall disconnect one or more of the line conductors supplying the equipment, system or installation, in case of a failure of basic insulation. The protective device shall interrupt the fault current within a time as specified in Figure 1, Figure 2 or Figure 3 in 4.4.2.2.3.		P
4.4.4.5	Supplementary insulation		P
4.4.4.6	Basic protection between circuits		N/A
	Basic protection between a circuit and other circuits or earth achieved by basic insulation throughout, rated for the highest voltage present.		N/A
	If any component is connected between the separated circuits, that component shall withstand the electric stresses specified for the insulation which it bridges (see 4.4.7.1.8).		N/A
	If any component is connected between a circuit and a circuit connected to earth, its impedance limit the current flow through the component to the steady-state touch current values indicated in 4.4.5.5.		N/A
	If one or more components are connected between circuits and a circuit connected to earth, their impedance shall limit the total current flow through the component(s) to the steady-state touch current values indicated in 4.4.5.5.		N/A
4.4.4.7	Electrically protective screening		N/A
	Electrically protective screening interposed between hazardous live parts of a PECS, shall consist of a conductive screen connected to the protective equipotential bonding of the PECS whereby the screen is separated from live parts by		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	at least simple separation. The protective screen and the connection to the protective equipotential bonding system of the PECS and that interconnection shall comply with the requirements of 4.4.4.2.		
4.4.5	Enhanced protection		P
4.4.5.1	General		P
	Subclause 4.4.5 describes the means of enhanced protection. Enhanced protection shall provide both basic protection and fault protection and can be achieved by means of: • double insulation in 4.4.5.2; • reinforced insulation in 4.4.5.3; • enhanced protection between circuits in 4.4.5.4; • protection by means of protective impedance in 4.4.5.5.		P
4.4.5.2	Double insulation		P
	Double insulation shall meet the requirement of basic insulation and supplementary insulation		P
4.4.5.3	Reinforced insulation		P
	Reinforced insulation so designed as to be able to withstand electric, thermal, mechanical and environmental stresses with the same reliability of protection as provided by double insulation		P
4.4.5.4	Enhanced protection between circuits		P
	Enhanced protection between a circuit and other circuits shall be achieved by one of the following means: • double insulation in 4.4.5.2 (basic insulation in 4.4.3.2 and supplementary insulation in 4.4.4.5); • reinforced insulation in 4.4.5.3; • electrically protective screening in 4.4.4.7 in combination with basic insulation in 4.4.3.2; or • a combination of these means.		P
	If any component is connected between the separated circuits, that component shall comply with the requirements for protective impedance devices		P
4.4.5.5	Protection by means of protective impedance		N/A
	To protect against a hazardous touch current when touching any conductive accessible part of the complete PECS, any impedances connected between hazardous live parts and conductive accessible parts or accessible circuits of DVC As shall comply with the requirements for protective impedances.		N/A
	Protective impedances shall be arranged so that, under normal operating conditions, abnormal operating conditions and single fault conditions, the available touch current shall be limited according to Table 5 and the discharge energy shall be limited to 0,5 mJ.		N/A
	Access to parts able to deliver touch currents above the limits of Table 5 shall be prevented under		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	normal operation, single fault conditions and abnormal operating conditions, except for conductive parts connected to PE according to 4.4.4.3.3.		
	A protective impedance designed according to 4.4.5.5 shall not be considered as a galvanic connection.		N/A
	When protective impedances are used to bridge any insulation, 4.4.7.1.8 applies.		N/A
	For compliance with the requirement for the limitation of touch currents, see 5.2.3.7.		N/A
	For compliance with the requirement for the limitation of touch currents for protective impedance, see 5.2.3.6.		N/A
	Compliance with the requirement for the discharge energy shall be checked by performing calculations and/or measurements to determine the voltage and capacitance.		N/A
4.4.6	Protective measures		P
4.4.6.1	General		P
4.4.6.2	Protective measures for protective class I equipment		P
	Protective class I equipment shall meet the requirements for: • basic protection in 4.4.3; and • fault protection in 4.4.4.2 and 4.4.4.3 with respect to equipotential bonding and PE conductor.		P
4.4.6.3	Protective measures for protective class II equipment		N/A
	Class II equipment shall meet the requirements for enhanced protection according to 4.4.5.1. In addition, the enclosure shall meet the requirement in 4.4.3.3 with respect to accessibility to hazardous live parts. See Figure 1, example 1, and Table A.1, row 4. Class II equipment shall not have means of connection for the PE conductor. This does not apply if a PE conductor is passed through the PECS to equipment series-connected beyond it. In the latter case, the PE conductor and its means for connection shall be separated from: • accessible surface of the PECS; and • circuits which employ enhanced protection with at least basic protection according to the requirement in 4.4.4.6. The basic protection shall be designed according to the rated voltage of the series-connected equipment. PECS designed as class II equipment may have means for the connection of an earthing conductor for functional reasons or for the damping of overvoltages. In this case, the functional earthing conductor shall be separated from: • accessible surface of the PECS; and • circuits which employ enhanced protection according to 4.4.5.4 with at least enhanced protection according to the	Class I	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	requirement in 4.4.5.4.		
4.4.6.4	Protective means for PECS designed as class III equipment		N/A
	Class III equipment shall be marked according to 6.3.9.2.4 and does not need basic protection or fault protection.	Class I	N/A
4.4.7	Insulation		P
4.4.7.1	Influencing factors		P
4.4.7.1.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Insulation selected after consideration of the following influences: • working voltage • pollution degree • overvoltage category • supply system earthing • impulse withstand voltage and temporary overvoltage • system voltage considering the specified supply system earthing • altitude and field homogeneity • location of insulation; • type of insulation; and • material characteristics		P
	Verification of insulation shall be made according to 5.2.3.1, 5.2.3.2, 5.2.3.3, 5.2.3.4 and 5.2.3.5, as applicable.		P
4.4.7.1.2	Working voltage		P
	The working voltage, including RMS, recurring peak and mean values, determined either by calculation, or simulation or by test taking into account the voltage within circuits, against adjacent circuits and against earth.	219Vmax.	P
4.4.7.1.3	Pollution degree		P
	Insulation, especially when provided by clearances and creepage distances, is affected by pollution which occurs during the expected life cycle of the PECS. The micro-environmental conditions for insulation shall be applied		P
	The pollution degree determined according to the environmental condition for which the product is specified. See Table 18 for selection of pollution degree according to environmental classification of the installation.		P
	The insulation may be determined according to pollution degree 2 if one of the following applies: a) instructions are provided with the PECS indicating that it shall be installed in a pollution degree 2 environment; or b) the specific installation application of the PECS is known to be a pollution degree 2 environment; or c) the PECS enclosure or coatings applied within the PECS according to 4.4.7.8.4.3 or 4.4.7.8.5 provide adequate protection against what is expected in pollution degree 3 and 4 (conductive		P

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Clause	Requirement + Test	Result - Remark	Verdict
	pollution and condensation).		
	The PECS manufacturer shall state in the documentation the pollution degree for which the PECS has been designed.		P
	If operation in a pollution degree 4 environment is required, protection against conductive pollution shall be provided by means of a suitable enclosure.		N/A
4.4.7.1.4	Overvoltage category (OVC)		P
	The OVC for non-mains supply is determined by taking into account whether control of overvoltages is provided or not, and whether the PECS is connected to outdoor lines or not, and if so, the length of the lines.		P
	Four categories are considered. • Equipment of overvoltage category IV (OVC IV) is for use at the origin of the installation. • Equipment of overvoltage category III (OVC III) is equipment in fixed installations and for cases where the reliability and the availability of the equipment are subject to special requirements. • Equipment of overvoltage category II (OVC II) is energy-consuming equipment to be supplied from the fixed installation. • Equipment of overvoltage category I (OVC I) is equipment for connection to circuits in which measures are taken to limit transient overvoltages to an appropriately low level.	OVC II	P
4.4.7.1.5	Supply earthing systems		N/A
	The following three basic types of system earthing are described in IEC 60364-1. • TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN system, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductors. • TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system. • IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the system earthing.		N/A
4.4.7.1.6	Determination of impulse withstand voltage and temporary overvoltage		P
	Table 7 uses the system voltage (see 4.4.7.1.7) and overvoltage category of the circuit under consideration to determine the impulse withstand voltage. The system voltage is also used to determine the temporary overvoltage. A PECS having more than one input or output shall be evaluated according to the input or output which gives the most severe requirements.		P
4.4.7.1.7	Determination of the system voltage for mains supply and non-mains supply		P

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.7.1.7.1	For mains supply		N/A
4.4.7.1.7.2	For non-main supply		P
	For PSCS supplied by non-mains a.c. or d.c., the system voltage is the r.m.s. value of the supply voltage between phases.	See page 2	P
4.4.7.1.8	Components bridging insulation		P
	Components bridging insulation shall comply with the requirements of the level of insulation (e.g. basic, reinforced, double) they are bridging.		P
4.4.7.2	Insulation to the surroundings		P
4.4.7.2.1	General		P
4.4.7.2.2	SPD monitoring		N/A
	If the PECS manufacturer bundles an external SPD with their product, this device shall have a monitoring circuit that enables the PECS to indicate when the device is damaged by an overvoltage. If the SPD is internal to a PECS, the test of 5.2.3.15 applies.		N/A
	The monitoring of an external SPD and the internal SPD monitoring test described above is not required on SPD circuits that are not part of a reduction of overvoltage category to allow for reduced clearances.		N/A
	Compliance is determined through visual inspection in 5.2.1 or test according to 5.2.3.15 as appropriate.		N/A
4.4.7.2.3	Circuits connected directly to mains supply		N/A
	Insulation between the surroundings and circuits which are connected directly to the mains supply shall be designed according to the impulse withstand voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement.		N/A
4.4.7.2.4	Circuits connected directly to non-mains supply		P
	Insulation between the surroundings and circuits supplied from a non-mains supply shall be designed according to: • the impulse withstand voltage determined from Table 7 using the system voltage; • the working voltage; • the temporary overvoltage if known to exist due to the nature of the supply; - whichever gives the more severe requirement.		P
	Temporary overvoltage on a non-mains supply shall be determined as follows: • Without detailed knowledge of the temporary overvoltage, it shall be according to Table 7. • If the temporary overvoltage is known this value shall be used.		P
	By the determination of temporary overvoltages on non-mains supply, following situations should be considered: • loss of the neutral in a non-mains low-voltage system; • accidental earthing of a non-mains low voltage IT		P

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Clause	Requirement + Test	Result - Remark	Verdict
	system; and • short circuit in the non-mains low voltage installation.		
4.4.7.2.5	PECS connected to both mains supply and non-mains supply		N/A
	For PECS with galvanic isolation between the mains supply and non-mains supply, the impulse voltage ratings of the mains supply and non-mains supply circuits are determined as in 4.4.7.2.3 and 4.4.7.2.4. Thereafter, the effect of reduction of the overvoltage categories (OVC) across the isolation is evaluated as follows.	Non-mains supply	N/A
	a) The magnitude of impulse voltages from the mains supply induced into the circuits connected to the non-mains supply is determined by reducing the OVC of the mains supply by one level, and determining the resulting impulse voltage rating based on mains supply system voltage.		N/A
	b) The rating to be used on the circuits connected to the non-mains supply is the higher of the value in 4.4.7.2.4 and the value determined in 4.4.7.2.5 a) above.		N/A
	c) The magnitude of impulse voltages from the non-mains supply induced into the circuits connected to the mains supply is determined by reducing the OVC of the non-mains supply by one level, and determining the resulting impulse voltage rating based on non-mains supply system voltage.		N/A
	d) The rating to be used on the circuits connected to the mains supply is the higher of the value in 4.4.7.2.3 and the value determined in 4.4.7.2.5 c)		N/A
	For PECS not providing galvanic isolation between circuits connected to the mains supply and circuits connected to the non-mains supply, the impulse withstand voltage ratings of the mains supply and non-mains supply circuits are determined as in 4.4.7.2.3 and 4.4.7.2.4. The higher of the two impulse withstand voltage ratings is used for the entire combined circuit.		N/A
	For circuits connected to the combined circuit without galvanic isolation, the impulse withstand voltage rating of the combined circuit applies.		N/A
4.4.7.2.6	DVC As or DVC B circuits supplied from mains supply or non-mains supply		N/A
	When circuits of DVC As or DVC B are supplied from the mains supply or non-mains supply through a transformer providing galvanic isolation working at a frequency of 10 kHz or more, the insulation between the circuit and the surroundings may be determined according to the working voltage of the circuit.	DVC C	N/A
	In that case, the transformer's ability to reduce the impulse voltages to values less than the impulse withstand voltage associated with the working voltage determined from Table 7 shown by test in 5.2.3.2, simulation or calculation.		N/A
4.4.7.2.7	Insulation between circuits		P
	Insulation between two circuits shall be designed according to the circuit having the more severe		P

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Clause	Requirement + Test	Result - Remark	Verdict
	requirement. For the design of simple and protective separation between circuits the insulation shall be designed according to: • the circuit having the more severe requirement; or • the working voltage between the circuits; whichever gives the most severe requirement.		
4.4.7.3	Functional insulation		P
	Functional insulation shall satisfy one of the following requirements a) or b). a) It meet the clearance and creepage distance requirements for functional insulation according to 4.4.7.4 and 4.4.7.5. b) It comply with the decreased spacings requirements of 4.4.7.7. Where means are provided that reduce transient overvoltages within the circuit from OVC III to values of OVC II, or values of OVC II to values of OVC I, functional insulation may be designed for the reduced values.		P
	Where the circuit characteristics can be shown by testing (see 5.2.3.2) to reduce impulse voltages, functional insulation may be designed for the highest impulse voltage occurring in the circuit during the tests.		P
4.4.7.4	Clearance		P
4.4.7.4.1	General		P
	Clearances shall be determined for functional insulation, basic insulation or supplementary insulation directly from Table 8 for inhomogeneous fields.		P
	See 4.4.7.4.4 for reduced clearances due to homogeneous field conditions.	See Table 4.4.7.4	P
4.4.7.4.2	Clearances for reinforced insulation		P
	Clearances for reinforced insulation shall be dimensioned to withstand • an impulse withstand voltage one step higher in column 1 of Table 8; • 1,6 times the peak temporary overvoltage; or • 1,6 times the peak working voltage. than required for basic insulation in Table 8.		P
4.4.7.4.3	Clearances for use above 2 000 m and/or above 30 kHz		P
	Clearances for functional insulation, basic insulation or supplementary insulation and reinforced insulation for use in altitudes between 2 000 m and 20 000 m calculated using a correction factor according to IEC 60664-1:2020, Table A.2, which is reproduced as Table E.1.	3000m	P
	In the case of working voltage of frequency greater than 30 kHz, clearances for functional insulation, basic insulation or supplementary insulation and reinforced insulation due to working voltage shall be increased according to the requirements in Annex F. Clearances due to impulse withstand voltage and temporary overvoltage are still determined according to 4.4.7.4.		P

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.7.4.4	Clearances for homogeneous fields		N/A
	The dimensions in Table 8 correspond to the requirements of an inhomogeneous electric field distribution across the clearance, which are the conditions normally experienced in practice.		N/A
	If a homogeneous electric field distribution is known to exist, the clearance for basic insulation or supplementary insulation may be reduced to not less than that required by IEC 60664-1:2020, Table F.2 (case B). In this case, the impulse withstand voltage test of 5.2.3.2 shall be performed across the considered clearance.		N/A
	If working voltages (recurring peak) or temporary overvoltages according to Table 8 are used for the dimensioning of clearance and if these clearances are smaller than the values of Table 8, then an AC or DC voltage test performed.		N/A
	During the impulse withstand voltage test and AC or DC voltage test, any insulation layers not fulfilling at least basic insulation removed.		N/A
	Clearances for reinforced insulation not be reduced for homogeneous fields.		N/A
4.4.7.4.5	Clearance to conductive enclosures		P
	The clearance between any uninsulated hazardous live part and the walls of a metal enclosure in accordance with 4.4.7.4.		P
	During and following the deflection tests, clearance between any uninsulated hazardous live part and the walls of a metal enclosure in accordance with clearance requirements for basic insulation in 4.4.7.4.		P
	If the design clearance is at least 12,7 mm and the clearance required by Table 8 does not exceed 8 mm, the deflection tests may be omitted.		P
4.4.7.5	Creepage distance		P
4.4.7.5.1	Insulating material groups		P
	Insulating materials are classified into four groups corresponding to their comparative tracking index (CTI) when tested according to IEC 60112:2020, Clause 11: • Insulating material group I: $CTI \geq 600$; • Insulating material group II: $600 > CTI \geq 400$; • Insulating material group IIIa: $400 > CTI \geq 175$; • Insulating material group IIIb: $175 > CTI \geq 100$.		P
	Creepage distance requirements for PWBs exposed to pollution degree 3 environmental conditions shall be determined based on Table 9 pollution degree 3 under "Other insulators".		N/A
	If the creepage distance is ribbed, then the creepage distance of insulating material of group I applied using insulating material of group II and the creepage distance of insulating material of group II may be applied using insulating material of group III.		P
	The spacing of the ribs equal or exceed the dimension X in Table D.1. For pollution degree 2		P

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	and 3, the ribs at least 2 mm high.		
	For inorganic insulating materials, which do not track, for example glass or ceramic, the creepage distance may be equal to the associated clearance, as determined in 4.4.7.4.		P
4.4.7.5.2	Determination of creepage distances		P
	Creepage distances for functional insulation, basic insulation and supplementary insulation dimensioned according to Table 9.	See Table 4.4.7.5	P
	Creepage distances for reinforced insulation twice the distances required for basic insulation.		P
	For fundamental frequencies greater than 30 kHz, additional requirements apply in Clause F.3 and Table F.3.		P
	Compliance of creepage distances checked according to 5.2.2.1 and according to Annex F if applicable.		P
	In all cases, the associated creepage distance is not permitted to be smaller than the required clearance.		P
4.4.7.6	Coating		N/A
	A coating may be used to provide insulation, to protect a surface against pollution, and to allow a reduction in creepage and clearance distances (see 4.4.7.8.4.3 and 4.4.7.8.5)		N/A
4.4.7.7	Decreased spacings for functional insulation		P
	Spacings are permitted to be smaller than required in 4.4.7.3 a). In this case, an analysis performed according to 4.2.		P
	This decreased spacing short-circuited in accordance to 5.2.4.7, when the analysis of 4.2 shows that a short-circuit would cause:		P
	1) overheating of any material creating a risk of fire,		P
	2) thermal damage to basic insulation, supplementary insulation or reinforced insulation, thereby creating a risk of electric shock.		P
	Decreased spacings for functional insulation are only permitted:		P
	a) when all the following are satisfied for materials:		P
	• material has a flammability rating of V-0 or better (see IEC 60695-11-10:2013); and		P
	• material has a minimum CTI of 100.		P
	b) when all the following are satisfied for components:		P
	• pollution degree 1 or 2 environment; and		P
	• comply with the requirements of 4.6.2.2.		P
	In this case, the component manufacturer's specification used.		P
4.4.7.8	Solid insulation		P
4.4.7.8.1	General		P
	Materials selected for solid insulation shall be able to withstand the stresses occurring. These include mechanical, electrical, thermal, climatic and chemical stresses which are to be expected in normal use. Insulation materials shall also be		P

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Clause	Requirement + Test	Result - Remark	Verdict
	resistant to ageing during the expected lifetime of the PECS. Tests shall be performed on components and sub-assemblies using solid insulation, in order to ensure that the insulation performance has not been compromised by the design or manufacturing process.		
4.4.7.8.2	Material requirements		P
	The insulating material shall have a CTI of 100 or greater. The insulating material shall be suitable for the maximum temperature it attains as determined by the temperature rise test of 5.2.3.10. Consideration shall be given as to whether or not the insulating material additionally provides mechanical strength and whether or not the part can be subject to impact during use.		P
	The insulating material in contact with live parts higher than DVC As shall comply with: • the glow-wire test described in 5.2.5.3 at a test temperature of 850 °C; or • the glow-wire test described in 5.2.5.3, at a lower test temperature, but not less than 550 °C, depending on the classification of the use of the PECS, according to Table A.1 of IEC 60695-2-11:2011; or • the alternative hot wire ignition test of 5.2.5.4.		P
	Thermoplastic insulating materials used in contact with live parts higher than DVC As or used as part of the enclosure shall comply with the ball pressure test as abnormal heat test according to IEC 60695-10-2.		P
	Where an insulating material is used in a PECS that incorporates switching contacts, and is within 12,7 mm of the contacts, it shall comply with the high current arcing ignition test of 5.2.5.2.		P
	In case the manufacturer of the insulating material provides data to demonstrate compliance with the above requirements no further testing is required. No further evaluation is required when generic materials are used according to Table 12.		P
	Compliance is checked by inspection and by test of 5.2.3.10 and 5.2.5.3 or 5.2.5.2.		P
4.4.7.8.3	Thin sheet or tape material		P
4.4.7.8.3.1	General		P
	These requirements apply to the use of thin sheet or tape materials in assemblies such as wound components and bus-bars.	See Table 4.4.7.8.3.2	P
	Subclause 4.4.7.8.3 also applies to components providing insulation. See 4.13.1 for the use of component standards.		P
	Insulation less than 0,7 mm consisting of thin sheet or tape materials is permitted, provided that it is protected from damage and is not subject to mechanical stress under intended use.		P
	Where more than one layer of insulation is used, there is no requirement for all layers to be of the same material.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	One layer of insulation tape wound with more than 50 % overlap shall be considered as two layers.		P
4.4.7.8.3.2	Thin sheet material thickness and number of layers		P
	Table 11 specifies the required number of layers depending on the thickness of the thin sheet material and the type of insulation.		P
	When a component or sub-assembly makes use of thin sheet insulating materials, it is permitted to perform the tests on the component rather than on the material.		P
4.4.7.8.4	Printed wiring boards (PWBs)		P
4.4.7.8.4.1	General		P
	Printed wiring boards material have a flammability rating of V-2 or better and comply with the insulating material group IIIb or better according to 4.4.7.5.1.	V-0	P
	The requirements of 4.4.7.8.4 do not apply to printed wiring boards which contain only limited power sources according to 4.6.5.		P
	PWB shall meet the appropriate requirements of 4.4.7.10.1 and:		P
	• 4.4.7.10.2 for basic insulation or supplementary insulation;		P
	• 4.4.7.10.3 for double insulation or reinforced insulation; and		P
	• 4.4.7.7 for functional insulation.		P
4.4.7.8.4.2	Inner layers of multi-layer printed wiring boards		P
	Insulation (prepreg) between conductor layers in multi-layer PWBs and metal core PWBs is solid insulation according to IEC 60664-1:2020 and shall meet the applicable requirements of 4.4.7.8.1 and 4.4.7.8.4.1.		P
	The requirements in 4.4.7.8.3 for thin sheet or tape material are not applicable; however, a minimum overall material thickness of 0,4 mm for double insulation and reinforced insulation apply to the final PWB.		P
	Insulation between adjacent tracks on the same conductor layer shall be treated as either:		P
	a) a creepage distance for pollution degree 1 and a clearance as in air according to Table 8 and Table 9 (see Figure D.14); or		P
	b) solid insulation, in which case		P
	• it meet the applicable requirements of 4.4.7.8.4.1,		P
	• it shall meet the minimum distance from IEC 60664-3:2016, Table 1, for basic insulation, supplementary insulation and reinforced insulation,		P
	• the requirements for clearance and creepage distances according to Table 8 and Table 9 do not apply,		P
	• the PWB sample preconditioned according to 5.2.3.16 followed by a type test required by 4.4.7.8.4.1, and		P
	• no routine test for the PWB is required.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.7.8.4.3	Use of coating materials		N/A
	A coating material used to provide functional, basic, supplementary and reinforced insulation shall meet the requirement as specified below.		N/A
	Type 1 protection (as defined in IEC 60664-3:2016) improves the microenvironment of the parts under protection. The clearance and creepage distance of Table 8 and Table 9 for pollution degree 1 apply under the protection. Between two conductive parts, it is a requirement that one or both conductive parts, together with all the spacing between them, are covered by the protection.		N/A
	Type 2 protection is considered to be similar to solid insulation. Under the protection, the requirements for solid insulation specified in 4.4.7.8 are applicable, including the coating material itself, and spacings shall not be less than those specified in Table 1 of IEC 60664-3:2016. The requirements for clearance and creepage in Table 8 and Table 9 do not apply. Between two conductive parts, it is a requirement that both conductive parts, together with the spacing between them, are covered by the protection so that no air gap exists between the protective material, the conductive parts and the printed boards.		N/A
	The coating material used to provide Type 1 and Type 2 protection shall be designed to withstand the stresses anticipated to occur during the expected lifetime of the PECS. A type test on representative PWBs shall be conducted according to Clause 5 of IEC 60664-3:2003. For the cold test (5.7.1 of IEC 60664-3:2016), a temperature of - 25 °C shall be used, and for the rapid change of temperature test (5.7.3 of IEC 60664-3:2016): - 25 °C to +125 °C. No routine test is required.		N/A
4.4.7.8.5	Potting materials		N/A
	A potting material may be used to provide solid insulation or to act as a coating to protect against pollution.		N/A
	If used as solid insulation, it shall comply with the requirements of 4.4.7.8.1 and 4.4.7.10.		N/A
	If used to protect against pollution, the requirements for Type 1 protection in 4.4.7.8.4.3 apply.		N/A
4.4.7.9	Connection of parts of solid insulation (Cemented joints)		P
	The creepage and clearance path in the presence of a cemented joint between two insulating parts, are determined as follows. • Type 1 or type 2 protection as described in 4.4.7.8.4.3 apply. • A cemented joint that is not evaluated as providing protection of type 1 or type 2, is neither considered solid insulation nor to reduce pollution degree. The clearance and creepage distances of 4.4.7.4 and 4.4.7.5 apply for the pollution degree of the environment around the joint. See 5.2.5.7 for test.		P

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.7.10	Requirements for electrical withstand capability		—
4.4.7.10.1	General		P
	Where verification of insulation is impossible by visual inspection according to 5.2.2.1, test according to 4.4.7.10.2 or 4.4.7.10.3 applies between the considered circuits and for solid insulation on components and sub-assemblies.	See Table 4.4.7.10	P
4.4.7.10.2	Basic or supplementary insulation		P
	Test with impulse withstand voltage according to 5.2.3.2		P
	Test with AC or DC voltage according to 5.2.3.4		P
4.4.7.10.3	Double insulation or reinforced insulation		N/A
	Double or reinforced insulation shall be tested as follows: • Test with impulse withstand voltage according to 5.2.3.2; and • Test with AC or DC voltage according to 5.2.3.4.		N/A
	For solid insulation, the partial discharge test according to 5.2.3.5 shall be performed in addition to the above tests, if the recurring peak working voltage across the insulation is greater than 750 V and the voltage stress on the insulation is greater than 1 kV/mm. The partial discharge test shall be performed as a type test on all components, sub-assemblies and PWB. In addition, a sample test shall be performed if the insulation consists of a single layer of material.		N/A
	Double insulation shall be designed so that failure of the basic insulation or of the supplementary insulation will not result in reduction of the insulation capability of the remaining part of the insulation.		N/A
4.4.8	Compatibility with residual current-operated protective devices		N/A
	To ensure the intended work of an RCD provided by the installation PECS shall satisfy one of the following conditions. a) A Pluggable Type A single-phase PECS, shall be designed so that, under normal and fault conditions any resulting DC component of the current in the PE conductor does not exceed the DC current withstand requirements in IEC 60755:2017 for RCD of type A. b) For PECS that are Pluggable Type B or intended for permanent connection, d.c. current in the PE conductor is not limited if the information and marking requirements of 6.3.9.5 are complied with.		N/A
	Compliance with RCD provided by the installation shall be checked by simulation or calculation of current in the PE conductor under normal and single fault conditions according to the guideline provided in Annex H.		N/A
4.4.9	Capacitor discharge		N/A
	For protection against electric shock (see IEC 61140:2016, 8.3), all capacitors within a PECS discharged to a voltage less than DVC As, or to a residual charge		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	less than 0,5 mJ after the removal of power from the PECS and shall satisfy a) or b) as applicable, and c):		
	a) For pluggable equipment type A and pluggable equipment type B, the discharge time shall not exceed 1 s when unplugged, measured on the accessible plug pins (see Figure 12, key 7).		N/A
	b) For permanently connected equipment, the discharge time shall not exceed 5 s, measured on input ports and output ports.		N/A
	c) For all PECS, when the discharge time exceeds 5 s due to functional or other reasons, hazardous live parts shall be protected as described in 4.4.3.3, and the information and marking requirements of 6.5.2 apply.		N/A
4.5	Protection against electrical energy hazards		P
4.5.1	General access areas		P
4.5.1.1	General		P
	PECS designed that there is no risk of electrical energy hazard to ordinary persons in general access areas and skilled persons in service access areas from electrical accessible parts by fulfilling requirement of 4.2.		P
	A risk of injury due to an electrical energy hazard exists if it is likely that two or more bare parts (one of which may be earthed), between which a hazardous energy level exists, will be bridged by a metallic object.		P
	The likelihood of bridging the parts under consideration is determined by means of the test finger of Figure M.2 in any position. If it is possible to bridge the parts with this test finger, a hazardous energy level shall not exist.		P
	Barriers, guards, and similar means preventing unintentional contact may be provided as an alternative to limiting the energy.		P
	Compliance against unintentional contact is checked by visual inspection in 5.2.1 or test of 5.2.2.2.		P
4.5.1.2	Determination of hazardous electrical energy level		N/A
	A hazardous electrical energy level is considered to exist if the voltage is 2 V or more and • power available exceeds the limits of 4.6.5; or • the energy exceeds 20 J. Compliance shall be checked with the test in 5.2.3.8 or by calculation.		N/A
4.5.2	Service Access Areas		N/A
	Capacitors within a PECS shall be discharged to an energy level less than 20 J, as in 4.5.1.2, within 5 s after the removal of power from the PECS. If this requirement is not achievable for functional or other reasons, the information and marking requirements of 6.5.2 apply.		N/A
	Compliance is checked by visual inspection in 5.2.1 of the PECS and relevant circuit diagrams, taking into account the possibility of disconnection with any "ON/OFF" switch in either position and non-		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	operation of periodic power consuming devices or components within the PECS. If the capacitor discharge time cannot be accurately calculated, the discharge time shall be measured.		
4.6	Protection against fire and thermal hazards		P
4.6.1	Circuits representing a fire hazard		P
	The following types of circuits are considered a fire hazard: - circuits directly connected to the mains supply - circuits that are not directly connected to the mains but exceed the limits for limited power sources in 4.6.5 - components having unenclosed arcing parts		P
4.6.2	Components representing a fire hazard		P
4.6.2.1	General		P
	The risk of ignition due to high temperature minimized by the appropriate selection and use of components and by suitable construction.		P
	Electrical components shall be used in such a way that their maximum working temperature under normal operating conditions or single fault conditions is less than that necessary to cause ignition of the surrounding materials with which they are likely to come into contact. Under normal operating conditions, the limits in Table 14 shall not be exceeded for components or their surrounding material.		P
	Where it is not practical to protect components against overheating under single fault conditions, all materials in contact with such components shall be of flammability class V-1 or better.		P
	Compliance with 4.6.2 confirmed by visual inspection in 5.2.1 of component and material data sheets and, where necessary, by test.		P
4.6.2.2	Components within a circuit representing a fire hazard		P
	Inside fire enclosures, materials for components and other parts and all materials in contact with such parts shall comply with flammability class V-2, HF-2 or VTM-2 or better.		P
	When the manufacturer of components provides data to demonstrate compliance with the above requirements, no further testing is required.		P
	The above requirement does not apply to any of the following: • electrical components which do not present a fire hazard under abnormal operating conditions when tested according to 5.2.4.6; • materials and components within an enclosure of 0,06 m3 or less, consisting totally of metal and having no ventilation openings, or within a sealed unit containing an inert gas; • electronic components, such as integrated circuit packages, opto-coupler packages, capacitors and other small parts that are mounted on material of flammability class V-1 or VTM-1 or better;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- wiring, cables and connectors - insulated with PVC, TFE, PTFE, FEP, neoprene or polyimide; - rated VW-1 (UL/CSA C22.2 no. 2556) or FT-1 (CSA C22.2 no. 0.3), or - fulfilling the requirements of the test methods in IEC 60332-1-2, IEC 60332-1-3, IEC 60332-2-2; - the following parts, provided that they are separated from electrical parts (other than insulated wires and cables) which under single fault conditions are likely to produce a temperature that could cause ignition, by at least 13 mm of air or by a solid barrier of material of flammability class V-1 or better: - other small parts which would contribute negligible fuel to a fire, including, labels, mounting feet, key caps, knobs and the like; or - tubing for air or any fluid systems, containers for powders or liquids and foamed plastic parts, provided that they are of flammability class HB or better.		
4.6.2.3	Components within a circuit not representing a fire hazard		P
	For components within a circuit not representing a fire hazard 4.6.2 does not apply.		P
4.6.3	Fire enclosures		P
4.6.3.1	General		P
	Fire enclosures are used to reduce the spread of fire to the environment, independent of the location where they are installed. A fire enclosure provided for all PECS, unless: - it is an open type PECS and the documentation requires means against spread of fire according to 6.3.6.1, or - the PECS is intended to be used only in areas without combustible materials and is marked according to 6.3.9.7.		P
4.6.3.2	Flammability of enclosure materials		N/A
	Materials used for fire enclosures of PECS shall meet the flammability test requirements of 5.2.5.5, except for those portions of the enclosure that enclose only circuits not representing a fire hazard.	Metal enclosure	N/A
	Materials are considered to comply without test according to 5.2.5.5 if, in the minimum thickness used, the material is of flammability class 5VB or better.		N/A
	Materials for PECS designed as movable equipment comply without test if the material is of flammability class of V-1 or better for the minimum thickness which is used.		N/A
	Metals, ceramic materials, and glass which is heat-resistant tempered, wired or laminated, are considered to comply without test according to 5.2.5.5.		N/A
	Materials for components that fill an opening in a fire enclosure do not require to be tested		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	according 5.2.5.5 provided that these materials comply with at least one of the following: • V-1 class material and no larger than 100 mm in any dimension; or • V-2 class material and either – not larger than 25 mm in any dimension; – not larger than 100 mm in any dimension and located at least 100 mm from any part that is a source of fire hazard; • V-2 class material and there is a barrier or device(s) that forms a barrier made of a V-0 class material between the part and a source of fire hazard; or • comply with a relevant IEC component standard that includes flammability requirements for components that are intended to form part of, or fill openings in, a fire enclosure.		
	Polymeric materials that serve as fire enclosure and have surface area greater than 1 m ² or a single dimension larger than 2 m shall have a maximum flame spread index of 100 or better.		N/A
	The manufacturer may provide data from the fire enclosure material manufacturer to demonstrate compliance with the above requirements. In this case, no further testing is required.		N/A
4.6.3.3	Openings in fire enclosures		N/A
4.6.3.3.1	General		N/A
4.6.3.3.2	Openings in the top and the side of fire enclosures		N/A
	Openings in the top surfaces of fire enclosures shall be designed to prevent an external object falling vertically or at up to 5° from vertically from entering the enclosure in an area that could lead to a fire hazard. This requirement applies to all sides of moveable equipment with no defined top and bottom, unless top and bottom surfaces can be suitably demonstrated in the installation instructions. Compliance checked by test of 5.2.2.2.		N/A
	Openings in the top surfaces of fire enclosures not located vertically above or within 5° from vertical of a circuit representing a fire hazard as defined in 4.6.2 are not subject to the test of 5.2.2.2 and can be of any construction if the construction prevents access to parts greater than DVC As with the IP3X probe as detailed in 4.4.3.3. Where a portion of the side of a fire enclosure falls within the area traced out by the 5° angle in Figure 6, the limitations in 4.6.3.3.3 regarding openings in bottoms of fire enclosures also apply to this portion of the side. Compliance shall be checked by visual inspection.		N/A
4.6.3.3.3	Openings in the bottom of fire enclosures		N/A
	The following constructions are considered to satisfy the requirement without test: • products intended to be mounted on a non-combustible surface such as concrete. For marking,		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	see 6.3.5; • no opening in the bottom of a fire enclosure; • openings in the bottom of any size under an internal barrier, screen or the like, which itself complies with the requirements for a fire enclosure; • openings in the bottom, each not larger than 40 mm², under components and parts meeting the flammability requirements of V-1 or HF-1 or better or under small components that pass the needle-flame test of IEC 60695-11-5:2016 with the flame applied for a duration of 30 s; • baffle plate construction as illustrated in Figure 9; • metal bottoms of fire enclosures conforming to the dimensional limits of any line in Table 13; or • metal bottom screens having a mesh with nominal openings not greater than 2 mm between centre lines and with wire diameters of not less than 0,45 mm.		
4.6.3.3.4	Doors of covers in fire enclosures		N/A
	If part of a fire enclosure consists of a door or a cover leading to an general access area, it comply with one of the following requirements: • the door or cover shall be provided with a safety interlock; or • a door or cover, intended to be routinely opened by the user, shall comply with both of the following conditions: – it shall not be removable from other parts of the fire enclosure by the user; and – it shall be provided with a means to keep it closed during normal operation. A door or cover intended only for occasional use by an installer, such as for the installation of specified accessories, is permitted to be removable provided that the documentation include directions for correct removal and reinstallation of the door or cover.		N/A
4.6.4	Temperature limits		P
4.6.4.1	General		P
	Internal parts and external enclosure parts of the PECS shall not attain temperatures which can lead to a risk of fire, burn or electric shock due to high temperatures when the PECS is operated under normal operating condition and maximum ratings as determined by 5.2.3.12.	See table 4.6.4	P
	Other rated operating conditions, such as duty cycle operation, thermal derating, operation in altitude above 1 000 m and cooling control characteristic, shall be tested or calculated.		N/A
4.6.4.2	Internal parts		P
	PECS and its component parts not attain temperatures in excess of those in Table 14 when tested in accordance with the ratings of the PECS.		P
4.6.4.3	Accessible parts		P

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Clause	Requirement + Test	Result - Remark	Verdict
	In order to limit the touch temperatures of accessible parts of PECS, and to protect against long-term degradation of building materials, the maximum temperature for accessible parts of the PECS shall be in compliance with Table 15.		P
	When surface temperatures of the PECS, close to mounting surfaces, exceed the limit of Table 15, a warning according to 6.3.5 shall be provided.		P
	It is permitted that accessible parts that are required to get hot as part of their intended function (for example heatsinks including their cover) may have temperatures up to 100 °C, if the parts are not in contact with building materials upon installation, and are marked with the warning given in 6.4.4.		P
	For products only for use in a restricted access area, the temperature may exceed 100 °C.		P
4.6.5	Limited power sources		N/A
	Where a limited power source is required, the source shall comply with Table 16 or Table 17 as applicable.		N/A
	A limited power source shall comply with one of the following requirements: a) the output is inherently limited in compliance with Table 16; or b) a linear or non-linear impedance limits the output in compliance with Table 16. If a positive temperature coefficient device (e.g. PTC) is used, it shall pass the applicable tests specified in IEC 60730-1; or c) a regulating network limits the output in compliance with Table 16, both with and without a single fault in the regulating network; or d) an overcurrent protective device is used and the output is limited in compliance with Table 17.		N/A
	Compliance to determine the maximum available power is checked by test of 5.2.3.9.		N/A
4.7	Protection against mechanical hazards		P
4.7.1	General		P
	Failure of any component within the PECS shall not release sufficient energy to lead to a hazard, for example, expulsion of material into an area accessible to ordinary persons or skilled persons.		P
4.7.2	Specific requirements for liquid cooled PECS		N/A
4.7.2.1	Coolant		N/A
	Coolant temperature in operation not exceed the limit specified in Table 14.	No liquid cooled PECS	N/A
	The coolant used in a cooling system shall be a medium investigated for the purpose, water, glycol, a mixture of water and glycol or non flammable synthetic oils.		N/A
	Sealed heat-pipe cooling systems, used to transfer heat from a hot component to a heat sink, are not considered to be liquid cooling systems in this document.		N/A
	However, the possible failure of such components should be considered during the analysis of 4.2.		N/A

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4.7.2.2	Design requirements		N/A
4.7.2.2.1	General		N/A
	The liquid containment system components shall be compatible with the coolant medium to be used.		N/A
	PECS using liquids shall be so constructed that it is unlikely that either a hazardous concentration of these materials or a hazard in the meaning of this document will be created by condensation, vaporization, leakage, spillage or corrosion during normal operation, storage, filling or emptying.		N/A
4.7.2.2.2	Corrosion requirements		N/A
	All cooling system components shall be suitable for use with the specified coolant. They shall be corrosion resistant and shall not corrode as a result of prolonged exposure to the coolant and/or air.		N/A
4.7.2.2.3	Tubing, joints and seals		N/A
	Cooling system tubing, joints and seals shall be designed to prevent leakage during excursions of pressure over the life cycle of the PECS.		N/A
	The entire cooling system including tubing satisfy the requirements of the hydrostatic pressure test of 5.2.7.		N/A
4.7.2.2.4	Leakage of coolant		N/A
	Means taken to prevent leakage of coolant onto live parts as a result of normal operation, servicing or loosening or detachment of hoses or other cooling system parts during the expected life cycle.		N/A
	If a pressure relief mechanism is provided, this shall be located so that there shall be no leakage of coolant onto live parts when it is activated.		N/A
	During a leakage, means shall ensure that coolant will not result in wetting of live parts or electrical insulation.		N/A
4.7.2.3.5	Loss of coolant		N/A
	Loss of coolant from the cooling system not result in thermal hazards, mechanical hazard or electric shock hazard.		N/A
	The requirements of the loss of coolant test of 5.2.4.9.4 shall be satisfied.		N/A
4.7.2.3.6	Insulation requirements for coolant and coolant system		N/A
	When the coolant is intentionally in contact with live parts (for example non-earthed heatsinks), hazards shall not be present under normal operating conditions or single fault conditions.		N/A
4.7.2.3.8	Insulation requirements for coolant hoses		N/A
	When the coolant is intentionally in contact with live parts (for example non-earthed heatsinks), the coolant hoses form a part of the insulation system. Depending on the location of the hoses, the requirements of 4.4.7 for functional or simple or protective separation shall be applied where relevant.		N/A
	Also, the coolant system (e.g. hoses) form a part of the insulation system. The requirements of 4.4.7 for		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	functional protection, basic protection or enhanced protection and 4.4.5.5 shall be applied where relevant.		
4.7.3	Mechanical hazards from rotating parts		N/A
4.7.3.1	General		N/A
	Rotating parts not cause hazards.	No rotating parts	N/A
4.7.3.2	Mechanical hazards caused by fan		N/A
	Fans and their blades shall not cause injury under normal operating conditions, and during service and maintenance in service access areas.		N/A
	Hazardous fan blades shall be protected by an enclosure or barriers fulfilling IP2X.		N/A
	For compliance, see test in 5.2.2.2.		N/A
	The fan maximum speed in the application taken into account.		N/A
4.7.3.3	Expelled parts		N/A
	Risk of injury due to loosening of moving parts shall be mitigated as required by 4.2.		N/A
	Possible mitigations include:		N/A
	• protection by enclosure, barrier or guarding; or		N/A
	• usage of common mechanical practices such as lock washers, self-retaining hardware, proper torquing of hardware, rivets, welding.		N/A
4.7.4	Sharp edges		P
	Edges, projections, corners, openings, guards, handles and the like that are accessible to the user smooth and rounded so as not to cause injury during installation, normal operating conditions and maintenance of the PECS.		P
	Conformity is checked by visual inspection type test in 5.2.1 and, if necessary, by application of an object that represents a finger in size, shape and hardness, to check for abrasions or cuts.		P
4.8	PECS with multiple sources of supply		P
	PECS intended to be provided with more than one supply connection (for example, with different voltages or frequencies or as backup power), shall be designed such that all of the following conditions are met: • separate means of connection are provided for different circuits; • supply plug connections, if any, are not interchangeable if a hazard could be created by incorrect plugging; and • hazards, within the meaning of this document, shall not be present under normal operating conditions or single fault conditions due to the presence of multiple sources of supply. Actions such as disconnection or de-energizing of a supply are considered a normal operating condition.		P
	Examples of the types of hazards that should be considered are: a) Backfeed prevention – preventing voltage		P

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Clause	Requirement + Test	Result - Remark	Verdict
	or energy available within the PECS or one of its sources from being fed back to any of the input terminals for another source, either directly or by a leakage path. b) Protection against unintentional islanding. c) Touch current levels may be higher with multiple sources connected simultaneously. d) Hazard resulting from damage to one or more connected sources due to energy from another source, for example the mains. e) Damage to wiring due to currents higher than the wiring is designed for flowing from another source.		
4.9	Protection against environmental stresses		P
	The manufacturer has to specify the following conditions for operation, storage and transportation according to IEC 60721: - Coolant temperature (min/max); - Ambient temperature (min/max); - Humidity (min/max) - Pollution degree; - Vibration; - U.V. resistance; - Over voltage category (OVC); - Altitude for thermal consideration, if rated for operation above 1000 m; - Altitude for insulation coordination considerations, if rated for operation above 2000 m.		P
	The manufacturer shall state the environmental service condition for the PECS according to Table 18.		P
4.10	Protection against excessive acoustic noise hazards		N/A
	The PECS shall provide protection against excessive acoustic noise. Compliance tests are carried out if the PECS is likely to cause such hazards.	No acoustic noise hazards	N/A
	If the sound pressure – except alarms – exceeds 70 dBA, the documentation shall provide information regarding the sound pressure of the PECS.		N/A
	Compliance is checked by visual inspection in 5.2.1, measurement or calculation of the maximum sound pressure level in accordance with ISO 3746:2010 or ISO 9614-1:1993.		N/A
4.11	Wiring and connections		P
4.11.1	General		P
	The wiring and connections between parts of the equipment and within each part protected from mechanical damage during installation. The		P

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	insulation, conductors and routing of all wires of the equipment suitable for the electrical, mechanical, thermal and environmental conditions of use. Conductors which are able to contact each other shall be provided with insulation rated for the DVC requirements of the relevant circuits. The compliance with 4.11.2 to 4.11.8 checked by inspection (see 5.2.1) of the overall construction and datasheets if applicable.		
4.11.2	Insulation of conductors		P
4.11.2.1	General		P
	Conductors provide insulation according to the requirements of this document. This may be achieved either by clearance and creepage distance or by solid insulation.		P
	Uninsulated conductors, for example bus-bars, shall meet the appropriate requirements for clearance and creepage distances within the circuit and against other circuits for the DVC of the voltage involved according to Table 8 and Table 9.		P
	Cable product standards do not specify impulse withstand voltage capability and ability against partial discharge.		P
	However, it is considered for this document that the combination of the insulation of the individual conductors and the non-metallic sheath of the cable provides enhanced protection according to Table 3 if the cable complies with the following requirements:		P
	a) the cable complies with an applicable cable product standard;		P
	b) the rated voltage of the insulated conductor or cable not less than the rated voltage within the circuit and against other circuits; and		P
	c) the test voltage of the insulated conductors shall comply with the applicable Table 28 or Table 29.		P
	The insulation of the conductor is considered basic protection and the non-metallic sheath is considered fault protection.		P
4.11.2.2	Accessible wiring system		P
	Accessible wiring systems outside of the enclosure are considered to meet the requirements of barriers or enclosure in 4.4.3.3 for PECS, if adequate mechanical protection of the insulated conductor is provided by one or more of the following:		P
	a) a non-metallic sheath of the cable, provided that the requirements 4.11.2 are met; or		P
	b) an insulated conductor providing basic insulation with 1) a non-metallic cable duct complying with IEC 61084 (all parts); 2) a non-metallic conduit complying with IEC 61386 (all parts) or equivalent; 3) a metallic cable duct or conduit, provided that that metallic parts are connected with the equipotential bonding system and comply with 4.4.4.2.2; or 4) an insulated conductor complying with an applicable insulated conductor product standard and providing reinforced insulation.		P
4.11.2.3	Conductors of different circuits		N/A
	Conductors of different circuits in multiconductor		

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	cable or occupying the same duct (for example conduit, cable trunking system) shall be adequately protected against all other conductors according to Table 3, or all conductors shall have protection for the highest voltage involved.		
	If the insulation relies on clearance and creepage distance, means shall be provided to keep the conductors separated.		N/A
4.11.3	Stranded wire		P
	The connection points provided shall be of appropriate construction to preclude the possibility of loose strands reducing the spacing between conductors when careful attention is paid to installation.		P
	When stranded wiring or stranded shields of shielded wire is connected to a wire-binding screw, terminal or other means for connecting, the construction shall be such that loose strands will meet the requirements in 4.4.7.4 and 4.4.7.5 against:		P
	• other uninsulated live parts not always of the same potential as the wire; or		P
	• conductive metal parts not connected with PE.		P
4.11.4	Routing and clamping		P
	A hole through which insulated wires pass in a sheet metal wall within the enclosure of the PECS shall be provided with a smooth, well-rounded bushing or grommet or shall have smooth, well-rounded surfaces upon which the wires bear to reduce the risk of abrasion of the insulation.		P
	Wires shall be routed away from sharp edges, screw threads, burrs, fins, moving parts, drawers, and similar parts, which abrade the wire insulation.		P
	The minimum bend radius specified by the wire manufacturer not be violated.		P
	Clamps and guides, either metallic or non-metallic, used for routing stationary internal and external wiring provided with smooth, well-rounded edges.	Not applicable	N/A
	the clamping action and bearing surface such that abrasion or deformation of the insulation does not occur.	Not applicable	N/A
	If a metal clamp is used for conductors having thermoplastic insulation less than 0,8 mm thick, non-conducting mechanical protection shall be provided.	Not applicable	N/A
4.11.5	Identification of conductors and terminals		P
	Where the identification of internal conductors, terminals and field wiring terminals is considered necessary for safety during installation and/or maintenance, it is in the responsibility of the PECS manufacturer to choose the appropriate method. Guidance is given in IEC 60445:2021 and IEC 61148:2011.		P
	When identification by colour is used, it at terminations and preferably throughout the length of the conductor either by the colour of the insulation or by colour markers, except for bare conductors where the colour identification shall be at termination and connection points.		P
	When identification by colour is used, the colour green-and-yellow shall be used for protective		P

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	equipotential bonding or PE conductor(s). Green-and-yellow colour shall not be used for other purpose. Where a circuit includes a neutral identified by colour, the colour used for this purpose light blue.		
	The choice of light blue for the neutral conductor and green or green-and-yellow for the protective equipotential bonding or PE conductor(s) is covered by national regulations. In some countries, the colour code deviates from the above requirement or allows other alternatives.		P
	For insulated conductors which are integral to ribbon cable or multi-cord signal cable, only identified by the colour, the usage of single colours green, yellow and blue is permitted; however, the manufacture shall provide information and/or marking(s) which clearly indicate the colour code meaning. This shall also prevent mis-identification with earthing or other systems that might classically use these colours.		P
4.11.6	Splices and connections		P
	All splices and connections shall be mechanically secured and shall provide electrical continuity.		P
	Electrical connections soldered, welded, crimped, or otherwise securely connected. A soldered joint, other than a component on a PWB, shall additionally be mechanically secured.		P
	Stranded wire not be consolidated with solder where secured in a terminal that relies on pressure for contact.		P
	When screw terminal connections are used, the resulting connections may require routine maintenance (tightening).		P
	Appropriate reference shall be made in the documentation.		P
4.11.7	Accessible connections		P
	In addition to means given in 4.4.2.5, it shall be ensured that neither insertion error nor polarity reversal of connectors can lead to a voltage on an accessible connection higher than the maximum of DVC As, unless all circuits which supply this connection meet the single fault condition requirements of Table 5 and all requirements of 4.5.1.2.		P
	If the PECS is designed to be supplied only at voltages not exceeding DVC As in normal operating conditions or single fault condition, or from a source used solely to supply that PECS, the plugs of the power supply cord shall not fit into the plug and socket-outlets of mains supply systems at voltages above the rated supply voltage of the PECS.		P
	Standard mains supply plugs and socket-outlets shall not be used for purposes other than connection of a mains supply. This applies for example to plug-in sub-assemblies or other plug-in devices which can be plugged in without the use of a tool or key or which are accessible without the use of a tool or key. This does not apply to PECS		P

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	intended to be installed in restricted access areas.		
	If plug pins of cord-connected PECS receive a charge from an internal capacitor, the pins shall investigated to 4.4.2.5 and 4.4.9.		P
	Test according to 5.2.3.8 conducted, if necessary.		N/A
	Marking is required on PECS with plug and socket-outlets:		N/A
	a) if the plug and socket-outlet can accept a standard mains supply plug, there shall be a marking as specified in 6.3.7.5; or		N/A
	b) if the plug and socket-outlet has a terminal contact for a PE conductor, the input mains supply connection to the PECS shall include a PE conductor connected to a PE conductor terminal.		N/A
	If relevant, non-interchangeability and protection against polarity reversal of connectors, plugs and outlets shall be confirmed by visual inspection in 5.2.1 and trial insertion.		N/A
4.11.8	Interconnections between parts of the PECS		P
	Consideration shall be given to the voltage and the current rating of the circuit(s) and the temperature of the surroundings for wiring between parts of the complete PECS. All sections of the PECS comply with one of the following requirements of		P
	• applicable subclauses 4.11.2 to 4.11.11;		P
	• IEC 60364 (all parts); or		P
	• local installation rules.		P
	Cable assemblies and flexible cords provided for interconnection between sections of PECS or between parts of a system shall be suitable for the electrical, mechanical, thermal and environmental conditions of use taking into account 4.4.7 and 4.9.		P
	For enclosed PECS, cables protected from physical damage as they leave the enclosure and provided with mechanical strain relief according to 4.12.6.		P
	Misalignment of male and female connectors, insertion of a multipin male connector in a female connector other than the one intended to receive it, and other manipulations of accessible parts not result in mechanical damage or a risk of thermal hazards, electric shock, or injury to persons.		P
	When external interconnecting cables terminate in a plug which mates with a receptacle on the external surface of an enclosure, no risk of electric shock shall exist at accessible part of contacts of either the plug or receptacle when disconnected.		P
	Requirements for external interconnecting of DVC As and DVC B are given in 4.4.2.5.		P
4.11.9	Supply connections		N/A
4.11.9.1	General		N/A
	PECS intended to be permanently connected to the mains supply or non-mains supply have means for connection to the applicable wiring system in accordance with the requirements where it is being installed.	Not connected to the mains	N/A
4.11.9.2	Mains supply cords		N/A
	The following requirements apply to non-detachable mains supply cords and to detachable mains supply cords supplied with the PECS.		N/A

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	Cords shall comply with 4.11 as applicable and be rated for the maximum current for the PECS.		N/A
	If a cord is likely to contact hot external parts of the PECS, it made of suitably heat-resistant material.		N/A
	If the cord is detachable, both the cord and the appliance inlet shall have adequate temperature ratings.		N/A
	The identification of the conductors and terminals shall be according to 4.11.5.		N/A
	Detachable mains supply cords with mains supply connectors according to the relevant parts of IEC 60320 (all parts) shall either meet the requirements of IEC 60799:2018, or shall be rated at least for the current rating of the mains supply connector fitted to the cord.		N/A
4.11.9.2.1	Fitting of non-detachable mains supply cords		N/A
4.11.9.2.1.1	Cord entry		N/A
	Mains supply cords shall comply with 4.11.4 and be protected against abrasion and sharp bends at the point where the cord enters the PECS, by one of the following means:		N/A
	a) an inlet or bushing with a smoothly rounded opening; or		N/A
	b) reliably fixed flexible cord guard made of insulating material protruding beyond the inlet opening by at least five times the overall diameter of a cord with the largest cross-sectional area which can be fitted. For flat cords, the larger cross-sectional dimension is taken as the overall diameter.		N/A
	Compliance is checked by visual inspection in 5.2.1 and, if needed by measurement of dimensions.		N/A
4.11.9.2.1.2	Cord anchorage		N/A
	The cord anchorage shall comply with the requirements and tests of strain relief in 4.12.6.		N/A
4.11.9.2.1.3	Plugs and connectors		N/A
	Plugs and connectors for connecting PECS to the mains supply, including appliance couplers used to connect detachable mains supply cords, conform to the relevant specifications for plugs and socket-outlets and connectors and shall comply with 4.11.7.		N/A
4.11.10	Field wiring terminals and internal terminals		P
4.11.10.1	Construction requirements		P
	All parts of field wiring terminals and internal terminals which maintain contact and carry current of metal having adequate mechanical strength.		P
	Terminals such that the conductors can be connected by means of screws, springs or other equivalent means so as to ensure that the necessary contact pressure is maintained.		P
	Terminals shall be constructed so that the conductors can be clamped between suitable surfaces without any significant damage either to conductors or terminals.		P

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	Terminals not allow the conductors to be displaced or be displaced themselves in a manner detrimental to the operation of PECS and the insulation shall not be reduced below the rated values.		P
	The requirements of 4.11.10.1 are met by using terminals complying with IEC 60947-7 (all parts).		P
4.11.10.2	Connecting capacity		P
	Field wiring terminals and internal terminals accommodate installation of wiring specified in the documentation. Possible to perform the installation according to the wiring rules applicable at the installation.		P
	The terminals shall be sized to cover all of the following requirements:		P
	• the wire size for 125 % of the maximum nominal current:		P
	– the intended material of the conductor for example copper or aluminium; and – the longest permitted cable length;		P
	• the wire size for the lowest specified load current intended to be used: the shortest permitted cable length;		P
	• the temperature rating of the intended insulation for the conductor; and		P
	• the highest ambient temperature of the intended installation of the load cable.		P
4.11.10.3	Connection to external conductors		P
	Field wiring terminals for connection of external conductors shall be readily accessible during installation. See 4.11.5.		P
	Sets of terminals for connection to the same input or output shall be grouped together and located in proximity to each other and to the main protective earthing terminal, if any. If the documentation provides detail on the proper earthing of the system, the protective earthing terminal need not be placed in proximity to the terminals.		P
	For each connection with a neutral and/or PE terminal, these terminal(s) shall be located near the associated phase terminals.		P
	The required tightening torque stated in the installation documentation.		P
	For PE terminals, 4.4.4.3.2 and 4.4.4.3.3 apply.		P
	For marking, see 6.3.7.4.		P
4.11.10.4	Wire bending space for wires 10 mm ² and greater		N/A
	For PECS, the distance between a terminal for connection to the mains supply, or between major parts of the PECS (for example transformer, part of the PECS), and an obstruction toward which the wire is directed upon leaving the terminal shall be at least that specified in Table 19.		N/A
4.11.11	Means for shield connection of shielded wire or shielded cable		N/A
	If means for connecting the shield of shielded wire or shielded cable are provided, their construction comply with 4.4.4.3.2, 4.11.3, 4.11.4, 4.11.10.1 and 4.12.6.		N/A
4.12	Enclosures		P
4.12.1	General		P
4.12.2	Handles and manual controls		P
	Handles, knobs, grips, levers and the like shall be		P

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	reliably fixed so that they will not work loose in normal use, if this could result in a hazard. Sealing compounds and the like, other than self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this could result in a hazard.		
4.12.3	Cast metal		P
	Die-cast metal, except at threaded holes for conduit, where a minimum of 6,4 mm thickness is required, shall be: • not less than 2,0 mm thick for an area larger than 155 cm² or having any dimension larger than 150 mm; • not less than 1,2 mm thick for an area of 155 cm² or less and having no dimension larger than 150 mm. The area under evaluation may be bounded by reinforcing ribs subdividing a larger area. Malleable iron or permanent-mould cast aluminium, brass, bronze, or zinc, except at threaded holes for conduit, where a minimum of 6,4 mm thickness is required, shall be: • at least 2,4 mm thick for an area greater than 155 cm² or having any dimension more than 150 mm; • at least 1,5 mm thick for an area of 155 cm² or less having no dimension more than 150 mm. A sand-cast metal enclosure shall be a minimum of 3,0 mm thick except at locations for threaded holes for conduit, where a minimum of 6,4 mm is required.		P
4.12.4	Sheet metal		N/A
	The thickness of a metal enclosure at points to which a wiring system is to be connected not be less than		N/A
	• 0,8 mm thick for uncoated ferrous metal; and		N/A
	• 1,2 mm thick for non-ferrous metal.		N/A
	The base thickness of coated ferrous metal 0,8 mm minimum.		N/A
	Constructions without supporting frame include		N/A
	• a single sheet with single formed flanges – formed edges;		N/A
	• a single sheet which is corrugated or ribbed;		N/A
	• an enclosure surface loosely attached to a frame, for example, with spring clips; or		N/A
	• an enclosure surface having an unsupported edge.		N/A
4.12.5	Stability requirement for enclosure		P
	Under conditions of intended use, floor-standing PECS without fixing or other PECS during commissioning shall not become physically unstable to the degree that they could become a hazard.		P
	If PECS are designed to be fixed together on site and not used individually, the stability of each individual PECS is exempt from the requirements of 4.12.5.		P
	The requirements of 4.12.5 are not applicable if the		N/A

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	documentation specifies that the PECS is to be secured to the building structure before operation.		
	During operations performed by an ordinary person, a stabilizing means, if needed, automatic in operation when drawers, doors, etc., are opened.		N/A
	During operations performed by a skilled person, the stabilizing means, if needed, either be automatic in operation, or a marking shall be provided to instruct the skilled person to deploy the stabilizing means.		P
4.12.6	Strain relief		N/A
	Where an external flexible cord or cable are connected to the PECS, strain relief provided to protect the conductors of the cord or cable from strain, including twisting. The strain relief be also protect the insulation of the conductors from abrasion.	Only battery system	N/A
	Strain reliefs shall meet the following requirements:		N/A
	a) the cord not be clamped by a screw which presses directly on the cord;		N/A
	b) knots in the cord not be used as a means of strain relief;		N/A
	c) the cord not be damaged when subjected to a torque of the value and time shown in Table 25 as close as possible to the external end of the cord strain relief or bushing;		N/A
	d) clamps and guides, either metallic or non-metallic, shall be provided with smooth, well-rounded edges to prevent failure of the insulation;		N/A
	e) in general access areas, it not be possible to loosen the cord strain relief without the use of a tool.		N/A
	A cable gland not be used as a strain relief unless the cable gland manufacturer's specification states that it is suitable for use as a strain relief.		N/A
4.12.7	Polymeric enclosure stress relief		N/A
	Enclosures of moulded or formed thermoplastic materials be constructed that any shrinkage or distortion of the material due to release of internal stresses caused by the moulding or forming operation does not result in the exposure of hazardous parts or in the reduction of creepage distances or clearances below the minimum required.	Metal	N/A
4.12.8	Polymeric enclosure UV resistance		N/A
	Polymeric parts of an outdoor enclosure subjected to ultra-violet (UV) exposure sufficiently resistant to degradation by UV radiation.	Metal	N/A
	Compliance is checked by visual inspection in 5.2.1 of the construction and also either by		N/A
	• available data regarding the UV resistance characteristics of the enclosure material and any associated protective coating; or		N/A
	• test according to 5.2.5.9.		N/A
4.13	Components		P
4.13.1	General		P
4.13.2	PTC thermistors		N/A
	PTC thermistors used for limited power sources		N/A

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	according to 4.6.5 comply with IEC 60730-1:2013 and IEC 60730-1:2013/AMD2:2020, Clause 15, Clause 17, Clause J.15, Clause J.17, Type 2.A.L. action.		
	For PTC thermistors whose continuous power dissipation that appears at its maximum voltage at an ambient temperature of 25 °C or otherwise specified by the manufacturer for tripped state, determined as given in IEC 60738-1:2009, 3.38, exceeds 15 W and with a size of 1 750 mm ³ or more, the encapsulation or tubing shall be made of V-1 class material or better.		N/A
4.13.3	Mains supply cords		N/A
4.13.4	Capacitors and RC units bridging insulation		N/A
	Capacitors and RC units for electromagnetic interference suppression that serve as (electrical) insulation and connected to mains supply or non-mains supply comply with IEC 60384-14:2013.		N/A
	RC units and EMC filters may consist of discrete components. Refer to IEC 60384-14:2013, Table 1 and Table 2, and IEC 60940:2015, 7.1, for substitution of Y capacitors.		N/A
	Capacitors other than as mentioned above shall comply with relevant IEC standards based on the construction, type of dielectric medium, connection and application.		N/A
	Capacitors and RC units used for bridging functional insulation do not need to fulfil the above requirements, when evaluated according to 4.2 for single fault conditions.		N/A
4.13.5	Wound components		P
	Varnish or enamel insulation of wires not be used for basic insulation, supplementary insulation, double insulation or reinforced insulation.		P
	Wound components meet the requirements of 4.4.7.8.1, 4.4.7.8.3 and 4.4.7.10.		P
4.13.6	Plug and socket-outlets		P
	Requirements are given in 4.11.7.		P
4.14	Protection against electromagnetic fields		N/A
	For more information, refer to Annex P.		N/A
5	TEST REQUIREMENTS		P
5.1	General		P
5.1.1	Test objectives and classification		P
5.1.2	Selection of test samples		P
5.1.3	Sequence of tests		P
5.1.4	Earthing conditions		P
5.1.5	General conditions for tests		P
5.1.5.1	Application of tests		P
	Unless otherwise stated, upon conclusion of the tests, the equipment need not be operational.		P
5.1.5.2	Test samples		P
5.1.5.3	Operating parameters for tests		P
5.1.5.4	Mounting		P
5.1.5.5	Representative tests		N/A
5.1.6	Compliance		P
5.1.7	Test overview		P
5.2	Test specifications		P

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5.2.1	Visual inspections (type test, sample test and routine test)		P
	Before type testing, a check shall be made that the PECS delivered for the test is as expected with respect to supply voltage, input and output ranges, etc.		P
5.2.2	Mechanical tests		P
5.2.2.1	Clearances and creepage distance test (type test)		P
	It shall be verified by measurement or visual inspection that the clearance and creepage distances comply with 4.4.7.4 and 4.4.7.5.	See table 4.4.7.4 and 4.4.7.5 for details.	P
	Where this verification is impossible to perform, an impulse voltage test (see 5.2.3.2) shall be performed between the considered circuits.		P
5.2.2.2	Non-accessibility test (type test)		P
	Test 1 (Protection against access with a finger, IP2X, IPXXB)	IP65	P
	Test 2 (Protection against solid foreign objects, IP2X)		P
	Test 3 (Protection against access with the back of the hand, IPXXA)		P
	Test 4 (Protection against access to hazardous parts with a tool, IP3X, top surface)		P
5.2.2.3	Ingress protection test (IP rating) (type test)		P
	The claimed IP rating of the enclosure shall be verified. This test shall be performed as a type test of the enclosure of a PSCS as specified in IEC 60529 for the enclosure classification.	IP65	P
5.2.2.3.1	General		P
5.2.2.3.2	Atomized water test (type test)		P
5.2.2.3.3	Enclosure category 1 or 2 test for IP5X (type test)		P
5.2.2.3.4	Acceptance criteria		P
5.2.2.4	Enclosure integrity test (type test)		P
5.2.2.4.1	General		P
	The integrity tests apply to PSCS, and also where PSCS are intended for operation without a further enclosure in restricted access areas. After completion of the integrity test, the PSCS shall pass the tests of 5.2.3.2 and 5.2.3.4 and shall be inspected to confirm that:		P
	- no degradation of any safety-relevant component of the PSCS has occurred.		P
	- live parts have not become accessible (see 4.4.3.3).		P
	- enclosures show no cracks or openings which could cause a hazard.		P
	- clearances are not less than their minimum permitted values and other insulation is undamaged.		P
	- barriers have not been damaged or loosened.		P
	- no moving parts which could cause a hazard are exposed.		P
	The integrity tests shall be performed at the worst case point on representative accessible face(s) of the enclosure.		P
	The PSCS is not required to be operational after testing and the enclosure may be deformed to such an extent that its original IP rating is not maintained.		N/A

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5.2.2.4.2	Deflection test (type test)		P
5.2.2.4.2.1	General		P
	If requested by 4.4.7.4.5 or 4.12.1, the test in 5.2.2.4.2.2 and 5.2.2.4.2.3 apply for metallic enclosure, as applicable.		P
5.2.2.4.2.2	Steady force test, 30 N (type test)	Not for restricted access area.	N/A
5.2.2.4.2.3	Steady force test, 250 N (type test)		P
5.2.2.4.3	Impact test (type test)		P
5.2.2.4.4	Drop test (type test)		N/A
	The following is considered to be sufficiently rigid for the drop test:		N/A
	• the horizontal surface consists of hardwood at least 13 mm thick, mounted on two layers of plywood each 19 mm to 20 mm thick, all supported on a concrete or equivalent non-resilient floor; or	>18kg	N/A
	• the horizontal surface consists of 50 mm thick hardwood board having a density of more than 700 kg/m ³ lying flat on a rigid base such as concrete.		N/A
	The height of the drop for be		N/A
	• 1 000 mm for PECS designed as hand-held equipment and direct plug-in equipment; or		N/A
	• 750 mm for PECS designed as movable equipment.		N/A
5.2.2.4.5	Mould stress relief distortion test (type test)		N/A
5.2.2.5	Stability test		P
5.2.2.6	Wall or ceiling mounted PECS test (type test)		N/A
5.2.2.7	Handles and manual controls securement test (type test)		N/A
5.2.2.8	Strain relief test (type test)		N/A
5.2.2.8.1	Performing the test		N/A
	Each strain relief in 4.12.6 and cord anchorage in 4.11.9.2.1.2 of a PECS shall be tested with each combination of cord and bushing:		N/A
	a) the cord is pushed one time into the PECS as far as possible;		N/A
	b) the cord is subjected 25 times to a steady pull test with the value shown in Table 25, applied for 1 s each time in the least favourable direction; and		N/A
	c) the cord is subjected for 1 min to a rotational torque test with the value shown in Table 25 as close as possible to the external end of the cord strain relief or bushing.		N/A
5.2.2.8.2	Acceptance criteria		N/A
	All of the following criteria be met:		N/A
	1) the cord not have been damaged;		N/A
	2) the cord not have been displaced longitudinally by more than 2 mm;		N/A
	3) there no signs of strain at the point where the strain relief clamps the cord;		N/A
	4) clearance and creepage distances not have been reduced below the applicable values; and		N/A
	5) the cord shall pass the AC or DC voltage test of 5.2.3.4 as follows:		N/A
	a) for PECS with a PE conductor:		N/A
	i) the test is made between the PE conductor and the phase and neutral conductors joined together, with the test voltage for basic protection; and		N/A
	ii) the continuity between conductive accessible parts and the PE conductor tested according to 5.2.3.11.4;		N/A
	b) for PECS without a PE conductor, the test is		N/A

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	made between conductive accessible parts of the PECS and the phase and neutral conductors joined together, with the test voltage for enhanced protection.		
5.2.3	Electrical tests		P
5.2.3.1	General		P
	The electrical tests described in 5.2.3.2 to 5.2.3.5 are applicable to basic insulation, supplementary insulation, double insulation and reinforced insulation when required by 4.4.7.4 (clearance) and 4.4.7.8 (solid insulation).		P
	When performing electrical and preconditioning tests, the preferred procedure is to test the complete PECS; however, it is acceptable to test the components or sub-assemblies providing the basic insulation and reinforced insulation. When components or sub-assemblies are tested, test conditions shall simulate the least favourable conditions occurring inside the PECS at the place of installation.		P
5.2.3.2	Impulse voltage test (type test and sample test)		N/A
5.2.3.3	Alternative to impulse withstand voltage test (type test, sample test)		N/A
	For verification of clearance and solid insulation, an AC or DC voltage test according to 5.2.3.4 with following modifications may be used as an alternative method to the impulse withstand voltage test of 5.2.3.2.		N/A
	For an AC voltage test, the peak value of the AC test voltage shall be equal to the impulse test voltage of Table 27 and applied for three cycles of the AC test voltage.		N/A
	For a DC voltage test, the average value of the DC test voltage shall be equal to the impulse test voltage of Table 27 and applied three times for 10 ms in each polarity.		N/A
	For PECS, the voltage can be applied using a ramp of up to 1 s in duration.		N/A
5.2.3.4	AC or DC voltage test (type test, routine test)		P
5.2.3.4.1	Purpose of test		P
	The type test is used to verify that the clearances and solid insulation of components and assembled PECS have adequate dielectric strength to resist temporary overvoltage conditions and to verify the insulation coordination between adjacent circuits.		P
5.2.3.4.2	Value and type of test voltage		P
	The values of the test voltage for circuits connected to mains supply are determined from column 2 or 3 of Table 28. The voltage test shall be performed with a sinusoidal voltage at 50 Hz or 60 Hz. If the circuit contains capacitors, the test may be performed with a DC voltage of a value equal to the peak value of the specified AC voltage.		P
5.2.3.4.3	Additional test considerations		N/A
	Protective devices designed to reduce impulse voltages on the circuits under test (see 4.4.7.2.3 and 4.4.7.2.4), and circuits belonging to monitoring or protection circuits, not designed to sustain the		N/A

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	test overvoltage for the duration of the test, shall be disconnected in order to avoid damage and to ensure that the test voltage can be applied without a false indication of failure.		
	Wherever practicable, individual components forming part of the insulation under test, for example interference suppression capacitors, should not be disconnected or bridged before the test. In this case, it is recommended to use the DC test voltage according to 5.2.3.4.2.		N/A
	Where testing is not possible in the assembled PECS due to a low impedance of SPD not designed to sustain the test voltage for the duration of the test, the connection to the SPD opened before testing. In this case, the connection shall be carefully restored after the voltage test.		N/A
	Protective impedances according to 4.4.5.5 either be included in the testing or the connection to the protectively separated part of the circuit shall be opened before testing. In this case, the connection shall be carefully restored after the voltage test.		N/A
5.2.3.4.4	Performing the voltage test		P
	a) Test (1) between conductive accessible part (connected to earth) and each circuit sequentially (except DVC As circuits). Test voltage according to Table 28 or Table 29, column 2, corresponding to voltage of considered circuit under test. Test (2) between accessible surface (non-conductive or conductive but not connected to earth) and each circuit sequentially (except DVC As circuits). Test voltage according to Table 28 or Table 29, column 3 (for type test) or column 2 (for routine test), corresponding to voltage of considered circuit under test.	See table 4.4.7.10	P
	b) Test between each considered circuit sequentially and the other adjacent circuits connected together. Test voltage according to Table 28 or Table 29, column 2, corresponding to voltage of considered circuit under test.		P
	c) Test between DVC As circuit and each adjacent circuit sequentially. Test voltage according to Table 28 or Table 29, column 3 (for type test) or column 2 (for routine test), corresponding to the circuit with the higher voltage. Either the adjacent circuit or the DVC As circuit may be earthed for this test. It is necessary to test basic insulation between DVC As circuits, but it is not necessary to test functional insulation between adjacent DVC As circuits.		P
5.2.3.4.5	Duration of the AC or DC voltage test		P
	The test voltage may be applied with increasing and/or decreasing ramp voltage but the full voltage shall be maintained for minimum 60 s and 1 s respectively for type and routine tests.		P
5.2.3.4.6	Verification of the AC or DC voltage test		P
	The test is successfully passed if no electric breakdown occurs during the test.		P
5.2.3.5	Partial discharge test (type test, sample test)		N/A
	The partial discharge test shall confirm that the		N/A

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	solid insulation (see 4.4.7.8.2) used in components and sub-assemblies for enhanced protection of electrical circuits remains partial-discharge-free within the specified voltage range (see Table 30).		
	This test shall be performed as a type test and a sample test. It may be omitted for insulating materials which are not degraded by partial discharge, for example ceramics. The partial discharge inception and extinction voltage are influenced by climatic factors (e.g. temperature and moisture), equipment self-heating, and manufacturing tolerance. These influencing variables can be significant under certain conditions and shall therefore be taken into account during type testing.		N/A
5.2.3.6	Protective impedance test (type test, routine test)		N/A
	A type test shall be performed to verify that the current through a protective impedance under normal operating conditions or single fault conditions does not exceed the values given in 4.4.5.5.		N/A
	The test shall be performed using the circuit of IEC 60990:2016, Figure 4 (see Figure L.1), or by measuring the current through the protective impedance to protective earth.		N/A
5.2.3.7	Touch current test and leakage current test		P
5.2.3.7.1	General		P
	If a PECS is intended to be connected to more than one supply system earthing (see 4.4.7.1.5), each of these different system networks (or the worst case, if that can be determined) used to make the touch current and leakage current measurement. The highest value of the measured current will be taken as the definitive result.		P
	a) For a PECS to be connected to an earthed neutral system, the neutral of the mains supply or non-mains supply of the test site shall be directly connected to the PE conductor.		P
	b) For a PECS to be connected to an isolated system or impedance system, the neutral connected through a resistance of 1 kΩ to the PE conductor which shall be connected to each input phase in turn. The highest value will be taken as the definitive result.		N/A
	c) For a PECS to be connected to a corner-earthed or high-leg delta system, the PE conductor connected to each input phase in turn. The highest value will be taken as the definitive result.		N/A
	The PECS shall be set up in an insulated state without any connection to earth and operated at rated voltage.		N/A
5.2.3.7.2	Touch current test (type test)		N/A
	The touch current test shall be performed as a type test to determine if the means in 4.4.4.3.3 are applicable. The touch current shall be measured between the means of connection for the PE conductor and the PE conductor itself with the test circuit of IEC 60990:2016, Figure 4 (see Figure L.1)		N/A

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	For PECS which may be energized from multiple sources of supply, the touch current limits in 4.4.4.3.3 apply in all possible intended installation configurations and combinations of sources that may be energized at the same time, unless one of the means in 4.4.4.3.3 a) or 4.4.4.3.3 b) is used.		N/A
5.2.3.7.3	Leakage current test (type test)		P
	The leakage current test shall be performed as a type test with the PECS in normal operating conditions to determine if the means in 4.4.4.3.3 are applicable.	Leakage current: 1,2mA	P
	The PECS shall be set up in an insulated state with an current measuring device of negligible impedance (less than 0,5 Ω) inserted between the means of connection for the PE conductor and the PE conductor itself.		P
5.2.3.8	Capacitor discharge test (type test)		N/A
	The capacitor discharge time as required by 4.4.9 and 4.5.1.2 verified by a type test and/or by calculation taking into account the relevant tolerances.		N/A
5.2.3.9	Limited power source test (type test)		N/A
	When required by 4.6.5, a limited power circuit tested as below, with the PECS operating under normal operating conditions.		N/A
	In case the limited power source requirement depends on overcurrent protective device(s), the device(s) short-circuited.		N/A
	Single fault conditions are applied in a regulating network according to Clause 4.2 while operating under the following conditions.		N/A
	The open-circuit output voltage shall not exceed the relevant value of Table 16 or Table 17, as applicable.		N/A
	With the PECS operating under normal operating conditions, a variable resistive load is connected to the parts under consideration. The resistive load is adjusted to obtain the limit of apparent power or current as indicated in Table 16 or Table 17. Further adjustment is made, if necessary, to maintain the limit of apparent power or current for the time period indicated in Table 16 or Table 17.		N/A
	The test is passed if, after the test period, the available apparent power or current does not exceed the limits indicated in Table 16 or Table 17.		N/A
	In case the limited power source requirement depends on overcurrent protective device(s), the current rating of at least one of the protective device(s) in the current path shall not exceed the limit in Table 17.		N/A
5.2.3.10	Temperature rise test (type test)		P
	The test is intended to ensure that parts and accessible surfaces of the PECS do not exceed the temperature limits specified in 4.6.4 and the component manufacturer's temperature limits of safety-relevant parts.		P
	The PECS tested at worst case conditions of rated power and PECS output current, taking derating		P

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	and cooling control characteristic into account.		
	For PECS where the amount of heating or cooling is designed to be dependent on temperature (for example, the PECS contains a fan that has a higher speed at a higher temperature), the temperature measurement shall be performed at the worst case ambient temperature condition within the manufacturer's specified operating range.		N/A
	If this is not possible, it is permitted to simulate the temperature rise, if the validity of the simulation can be demonstrated by tests at lower power levels.		N/A
	The PECS tested with at least 1,2 m of wire attached to each field wiring terminal. The wire shall be of the smallest size intended to be connected to the PECS as specified by the manufacturer for installation. When there is only means for the connection of bus-bars to the PECS, they shall be of the minimum size intended to be connected to the PECS as specified by the manufacturer, and they shall be at least 1,2 m in length.		P
	The test maintained until thermal stabilization has been reached. That is, when three successive readings, taken at intervals of 10 % of the previously elapsed duration of the test and not less than 10 min intervals, indicate no change in temperature, defined as ± 1 °C between any of the three successive readings, with respect to the ambient temperature.		P
	The temperature of an electrical insulation (other than that of windings) is measured on the surface of the insulation at a point close to the heat source, if a failure of this insulation could cause a hazard. If temperatures of windings are measured by the thermocouple method, the thermocouple shall be located on the surface of the winding assuming the hottest part due to surrounding heat emitting components. See also footnotes in Table 14.		P
	The maximum temperature attained corrected to the rated ambient temperature of the PECS by adding the difference between the ambient temperature during the test and the maximum rated ambient temperature.		P
	For compliance		P
	• no corrected temperature exceed the rated temperature of the material or component measured; and		P
	• thermal cutout, overload detection functions and devices shall not operate during the test.		P
5.2.3.11	Protective bonding tests (type tests and routine test)		N/A
5.2.3.11.1	General		N/A
	Each conductive accessible part under consideration tested separately, to determine if the protective equipotential bonding path for that part is adequate to withstand the test current that the bonding path may be subjected to under single fault conditions.		N/A
	The conductive accessible part under consideration shall be selected from amongst those circuits		N/A

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	adjacent to the accessible part under consideration and not separated by enhanced protection.		
	All of these selected circuits analysed regarding prospective short-circuit current and the associated protective element(s).		N/A
	• If the circuit under consideration exceeds the 5 s disconnection time requirement of IEC 60364-4-41:2005 and IEC 60364-4-41:2005/AMD1:2017, the protective equipotential bonding impedance test of 5.2.3.11.2 and the protective equipotential bonding short-circuit test of 5.2.3.11.3 performed.		N/A
	• If the circuit under consideration meets the 5 s disconnection time requirement of IEC 60364-4-41:2005 and IEC 60364-4-41:2005/AMD1:2017, the protective equipotential bonding short-circuit test of 5.2.3.11.3 performed.		N/A
	• If the circuit under consideration meets the disconnection time requirement of IEC 60364-4-41:2005 and IEC 60364-4-41:2005/AMD1:2017, Table 41.1, as applicable, depending on the earthing system of the installation, no type test is required.		N/A
	• For PECS designed as pluggable equipment type A only, the protective equipotential bonding impedance test of 5.2.3.11.2 performed.		N/A
	The testing include an individual test of the protective equipotential bonding path for each conductive accessible part unless analysis shows that the results of one combination are representative of other combinations.		N/A
5.2.3.11.2	Protective equipotential bonding impedance test (type test)		P
5.2.3.11.2.1	Test Conditions		P
	Where required by 4.4.4.2.2 and 5.2.3.11.1, the impedance of protective equipotential bonding means checked by passing a test current through the bond for a period of time. The test current is based on the rating of the overcurrent protective device for the PECS or part of the PECS under consideration, as follows:		P
	• for PECS designed as pluggable equipment type A, the overcurrent protective device is that provided external to the PECS (for example, in the building wiring, in the mains supply plug or in an equipment rack);		N/A
	• for PECS designed as pluggable equipment type B and permanently connected equipment, the maximum rating of the overcurrent protective device external to the PECS as specified in the documentation; or		P
	• the rating of the overcurrent device for a circuit or part of the PECS for which an overcurrent protective device is provided as part of the PECS.		P
5.2.3.11.2.2	Test current, duration, and acceptance criteria:		P
	a) For PECS with an overcurrent protective device rating of 16 A or less, this test may be omitted, if an impedance not exceeding 0,1 Ω can be demonstrated.		N/A
	b) As an alternative to Table 31, where the time-current characteristic of the overcurrent protective		P

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	device that limits the fault current in the protective equipotential bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic. The tests are conducted for a duration corresponding to the 200 % current value on the time-current characteristic.		
	c) For PECS with an overcurrent protective device rating of more than 460 A, calculations or simulations according to IEC 60949:1988 and IEC 60949:1988/AMD1:2008 used to show the ability of the prospective short-circuit current to fulfil the requirements. The protective equipotential bonding continuity routine test of 5.2.3.11.4 shall be performed to show that the impedance of the protective equipotential bonding means during and at the end of the test not exceed the expected value.		N/A
	The test current is 200 % of the overcurrent protective device rating and the duration of the test is as shown in Table 31. The voltage drop in the protective equipotential bonding means, during and at the end of the test, shall not exceed the limits from Figure 7 with respect to the accessible surface of the enclosure.		P
	After the tests, visual inspection in 5.2.1 show no damage to the protective equipotential bonding means.		P
5.2.3.11.3	Protective equipotential bonding short-circuit withstand test (type test)		N/A
	As required by 5.2.3.11.1, the short-circuit test in 5.2.4.3 performed to ensure that protective equipotential bonding has the ability to withstand the prospective short-circuit current that it subjected to under single fault conditions.		N/A
	The testing include an individual test of the protective equipotential bonding path for each conductive accessible part unless analysis shows that the short-circuit withstand capability of the path is adequate, or that the results of one combination are representative of the anticipated results of another combination.		N/A
5.2.3.11.4	Protective equipotential bonding continuity test (type test, routine test)		P
	The protective equipotential bonding continuity routine test conducted when		P
	• the continuity of the protective equipotential bonding is achieved by a single means only (for example a single conductor or a single fastener),	Use conforms ground cable	P
	• the PECS is assembled at the installation location, or		P
	• this is required by 5.2.3.11.2.2 c).		P
	The test current may be any convenient value sufficient to allow measurement or calculation of the resistance of the protective equipotential bonding means.		P
	The expected value of the resistance is the result of calculation or simulation according to 5.2.3.11.2.2 considering the length, the cross sectional area and the material of the related protective bonding		P

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	conductor(s).		
	For acceptance criteria, the resistance measured within 90 % up to 110 % of the expected value.		P
5.2.3.12	Input test (type test)		P
	The input test performed to determine the maximum input current and input power either by test or calculation or simulation with respect to the worst case conditions such as, but not limited to,		P
	• input voltage ratings range,		P
	• power source characteristics range,		N/A
	• maximum rated output power,		P
	• maximum output current,		P
	• derating characteristics,		N/A
	• operation mode, and		N/A
	• cooling control characteristics.		N/A
	The test conducted for each power input port.		P
	These worst case values of the maximum input current or maximum input power from all power input ports are used for the temperature rise test in 5.2.3.10 and specified according to 6.2.1.3.		P
	Product standards (see Annex S) may specify more precise test conditions as applicable.		P
5.2.3.13	Thin sheet material test (type test)		P
5.2.3.13.1	General		P
	5.2.3.13 provides requirements for tests of thin sheet materials according to 4.4.7.8.3.		P
5.2.3.13.2	Standard test procedure for non-separable thin sheet material (type test)		P
	One layer of the material is placed in the electric strength test instrument, as shown in Figure 20, and the test voltages according to the requirements of Table 11 apply. In order to avoid an electrical breakdown around the edges of the layer of insulating material, the specimen under test sufficiently large to keep its edges away from the vertical test rods.		P
	This test can be waived for non-separable material consisting of three or more layers used for reinforced insulation, in which case the mandrel test in 5.2.3.13.3 applies.		N/A
5.2.3.13.3	Mandrel test (type test)		N/A
	The purpose of the mandrel tests is to ensure that the material has adequate mechanical strength to resist damage when hidden in inner layers of insulation.		N/A
	The test requirements for reinforced insulation made of non-separable material consisting of three or more layers are specified below.		N/A
	Three test samples are used. The test is repeated on each sample.		N/A
	Each sample is fixed to the mandrel of the test fixture given in Figure 21. The fixing performed as shown in Figure 22.		N/A
	A pull force is applied to the free end of the sample, using an appropriate clamping device. The mandrel is rotated		N/A
	• from the initial position (Figure 22) to the final position (Figure 23) and back, and		N/A
	• a second time from the initial position to the final position.		N/A

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	If a sample breaks during rotation where it is fixed to the mandrel or to the clamping device, this does not constitute a failure. If a sample breaks at any other place, the test has failed.		N/A
	After the above test, a sheet of metal foil, 0,035 mm $\pm$ 0,005 mm thick, at least 200 mm long, is placed along the surface of the sample, hanging down on each side of the mandrel (see Figure 23). The surface of the foil in contact with the sample shall be conductive, not oxidized or otherwise insulated. The foil is positioned so that its edges are not less than 20 mm from the edges of the sample (see Figure 24). The foil is then tightened by two equal weights, one at each end, using appropriate clamping devices.		N/A
	While the mandrel is in its final position, and within the 60 s following the final positioning, electric strength tests are applied between the mandrel and the metal foil in accordance with 4.4.7.10.		N/A
	For reinforced insulation, the test voltage U_{test} is		N/A
	• 100 % of the test voltage specified for the impulse withstand voltage test in 4.4.7.10, and		N/A
	• 150 % of the test voltage specified for the AC or DC voltage test in 4.4.7.10.		N/A
	Where the peak voltage of 150 % of U_{test} is less than 7,1 kV, the impulse withstand voltage test and the AC or DC voltage test shall be replaced by an AC voltage test of 5 kV RMS.		N/A
5.2.3.14	Determination of working voltage (type test)		P
	When required in 4.4.7.1.2, the working voltage shall be determined		P
	• within circuits,		P
	• against adjacent circuits, and		P
	• against PE.		P
	See A.5.1, A.5.3, A.5.4 and A.5.5 for guidance on evaluating voltage waveforms.		N/A
5.2.3.15	Internal SPD monitoring test (type tests)		N/A
	A PECS having an internal SPD with a monitoring circuit as described in 4.4.7.2.2 subjected to this test. A sample of the PECS shall have each SPD device in turn either shorted or open circuited, whichever is worst case. The PECS connected to its nominal source of supply. The PECS shall be monitored to determine if it detects and indicates the SPD failure.		N/A
5.2.3.16	Preconditioning of material (type test)		P
	When required in 4.4.7.8.4.2, 4.4.7.8.4.3 or 4.4.7.9, on the same sample, the following preconditioning according to IEC 60664-3:2016, 5.7, conducted before performing the type tests. The required number of samples is stated in the applicable 4.4.7.8.4.2, 4.4.7.8.4.3 or 4.4.7.9:		P
	1) the dry heat test in 5.2.6.3.1; followed by		P
	2) the rapid change of temperature test with -25°C to $+125^{\circ}\text{C}$ and 50 cycles according to IEC 60664-3:2016, 5.7.4 (test Na of IEC 60068-2-14); followed by		P
	3) the damp heat test in 5.2.6.3.2.		P
5.2.4	Abnormal operation and simulated faults tests		P
5.2.4.1	General	Reference to table 4.2 to 4.3	P
5.2.4.2	Acceptance criteria		P

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	As a result of the simulated fault or abnormal operation tests, the PECS comply with the following:		P
	a) there no emission of flame, burning particles or molten metal;		P
	b) the cheese cloth or surgical cotton indicator not have ignited;		P
	c) the earth connection and protective equipotential bonding of the PECS not have opened;		P
	d) doors and covers remain in place;		P
	e) accessible circuits of DVC As		P
	1) not exhibit voltages greater than the time dependent voltages of Table 2, Figure 5, Figure 6 and Figure 7 as applicable during the test, or		P
	2) proven to remain separated from hazardous live parts by performing the AC or DC voltage test of 5.2.3.4 for basic protection after the test;		P
	f) during and after the test, hazardous live parts not become accessible;		P
	g) no conductor being a hazardous live part get pulled out of its terminal connector;		P
	h) no parts ejected.		P
	The PECS comply with the AC or DC voltage test of 5.2.3.4 for basic protection following the abnormal operation tests of 5.2.4.7, 5.2.4.8 and 5.2.4.9. A single sample may be used for multiple tests; in this case, the AC or DC voltage test may be conducted following each test or after the final test of the sequence.		P
	The PECS is not required to be operational after testing and it is possible that the enclosure can become deformed. Overcurrent protective device integral to the PECS, or required to be used with the PECS, is allowed to open.		N/A
5.2.4.3	Protective bonding short circuit withstand test (type test)		N/A
5.2.4.3.1	General		N/A
	When required by 5.2.3.11.1, a protective bonding path shall be subjected to the following short-circuit withstand test.		N/A
5.2.4.3.2	Test conditions		N/A
	The PECS under test shall be supplied with power and the output port operating as intended in 5.2.4.1 prior to closing the switching means that applies the short-circuit, unless energizing the PECS with the short-circuit already applied will be more severe.		N/A
	The protective equipotential bonding short-circuit test performed with the PECS working with light load, unless analysis shows that higher short-circuit currents are available under higher loading conditions.		N/A
	The PECS may be tested un-energized and not operating as intended prior to the protective equipotential bonding test, unless analysis shows that the test result is affected.		N/A
	A new sample used for each short-circuit test.		N/A
5.2.4.3.3	Protective equipotential bonding short-circuit test method		N/A
5.2.4.3.4	Acceptance criteria		N/A
5.2.4.4	Output Short-circuit test (type test)		P

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5.2.4.4.1	Load conditions		P
	When required in 4.3.2.2, the short-circuit test performed with the PECS at full load or light load whichever creates the more severe condition.		P
5.2.4.4.2	Short-circuit test method		P
	Power output port terminals shall be provided with cable of a cross-section as specified for the installation connected to an appropriate switching means that will not limit the short-circuit current. The complete length of the cable (forth and back) approximately 2 m, unless the size of the PECS requires a greater length, in which case the length shall be as short as practical to perform the test.		P
	The PECS under test supplied with power and the output port operating as intended prior to closing the switching means that applies the short-circuit, unless energizing the PECS with the short-circuit already applied will be more severe.		P
	The testing include individual tests of each output port where combinations of two or more terminals, including earth, on each individual port are subjected to short-circuit tests on those terminals.		P
	A new sample used for each short-circuit test.		P
	In addition to determining compliance with the criteria of 5.2.4.2, this test is used to determine the output short-circuit current rating of the port under consideration, in accordance with 4.3.2.4. An oscilloscope or other suitable instrument shall be used to measure the peak current during the test, and to measure or calculate the RMS value of the current.		P
	The value(s) to be recorded and to be provided with the documentation, in accordance with 6.2, are the peak current, and the highest of the RMS current values measured or calculated over a time period as follows:		P
	a) for AC signals, three cycles of the nominal AC frequency for the port under consideration, in which case the value shall be stated as the 3-cycle RMS value;		N/A
	b) for all signals, the duration of the short-circuit from the time the short-circuit is applied, until the time the short-circuit current is interrupted by a protective device or other mechanism, in which case the value stated include the RMS value and the time period in seconds; and	RMS current 2070,8A, 22,343ms	P
	c) for short-circuit tests that result in a continuous non-zero value, the steady-state RMS value, in which case the value shall be stated as a continuous RMS value.		N/A
	For PECS with internal short-circuit protection according to 4.3.2.4, which protects the output port within some few μ s, the requirements in a), b) and c) above are not applicable.		N/A
	The PECS comply with the acceptance criteria of 5.2.4.2.		P
5.2.4.4.3	Short-time withstand current (Icw) test (type test)		P
5.2.4.4.3.1	General		P
	As required in 4.3, the short-time withstand current test performed as a type test to verify the safety of		P

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Clause	Requirement + Test	Result - Remark	Verdict
	the PECS.		
	Short-circuits are applied in the PECS at locations based on the evaluation in 4.2 so that terminals and other parts in the fault current path are being exposed to the short-circuit current.		P
5.2.4.4.3.2	Short-time withstand current test method		P
	The input mains supply port terminals provided with a cable with a cross-section as specified for the installation.		P
	If a switching device is used to initiate the short-circuit or switch the power to the PECS, it not limit the test current.		P
	The testing include individual tests for each input mains supply port. The worst case combination of terminals (including neutral and earth) shall be subjected to a short-circuit test.		P
	The PECS can be tested un-energized and not operating as intended prior to the short-circuit withstand test, if it can be shown that the test result is not affected.		P
	A new sample may be used for each short-circuit test.		P
	If the specified Icp value is higher than listed in Table 32, the recommended test current is: 16 kA, 20 kA, 25 kA, 35 kA, 50 kA, 65 kA, 85 kA, 100 kA.		N/A
	Depending on the characteristics of the PECS, the actual values observed during the test different from those listed in Table 32, in which case the observed values used for the declaration of Icw.		P
5.2.4.4.3.3	Acceptance criteria		P
	As a result of the short-time withstand current (Icw) test, the PECS comply with the acceptance criteria of 5.2.4.2.		P
5.2.4.5	Output Overload test (type test)	Considered	P
5.2.4.6	Breakdown of components test (type test)		P
5.2.4.6.1	Load conditions		P
	The breakdown of a component, identified as a result of the analysis of 4.2, tested with the PECS at full load or light load, whichever creates the more severe condition.		P
5.2.4.6.2	Application of short-circuit or open-circuit		P
	The short-circuit shall be applied with cable of a cross-section appropriate for the current that normally flows through the component, but not less than 2,5 mm ² . The length of the loop as short as practical to perform the test. Short-circuits and open circuits are applied using an appropriate switching device.		P
	Each identified component shall be subjected to only one breakdown of components test unless both open-circuit failure and short-circuit failure modes are likely in that component.		P
5.2.4.6.3	Test sequence		P
	For the Breakdown of components test, identified components shall be short-circuited or open-circuited, whichever creates the worst hazard, one at a time.		P
5.2.4.7	Material short-circuit test (type test)		P

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	Functional insulation provided by clearances and creepage distances which are less than those specified in Table 8 and Table 9 type tested as described below.		P
	The decreased clearances and creepage distances shall be short-circuited one at a time, on representative samples, and the short-circuit shall be maintained until no further damage occurs.		P
5.2.4.8	Loss of phase test (type test)		N/A
	A multi-phase PECS operated with each phase (including neutral, if used) disconnected in turn at the input. The test performed by disconnecting one phase with the PECS operating at its maximum normal load and shall be repeated by initially energizing the PECS with one lead disconnected.		N/A
	If the disconnection of a single phase can decisively be determined to result in a more severe condition, for example disconnection of the phase with the protective device least likely to respond to the loss of phase, then the test can be conducted by disconnecting only that phase instead of each phase in turn.		N/A
	The test shall continue until terminated by a protective mechanism, a component failure occurs, or the temperature stabilizes.		N/A
	For PECS with rated input current greater than 500 A, compliance can be shown through simulation.		N/A
	The PECS comply with the acceptance criteria of 5.2.4.2.		N/A
5.2.4.9	Cooling failure tests (type test)		N/A
5.2.4.9.1	General and acceptance criteria		N/A
	For PECS having a combination of cooling mechanisms, all relevant tests performed. It is not necessary to perform the tests simultaneously.		N/A
	• the temperature stabilizes, in which case the temperature limits of 4.6.4.3 apply, or		N/A
	• terminated by a protective mechanism or a component failure occurs, in which case the temperature limits of accessible parts in 4.6.4.3 may be exceeded by not more than 5 °C. If this is not possible, a warning statement shall be provided in the documentation.		N/A
	The PECS comply with the acceptance criteria of 5.2.4.2.		N/A
5.2.4.9.2	Inoperative blower motor test (type tests)		N/A
	A PECS having forced ventilation shall be operated at rated load with fan or blower motor or motors made inoperative by physically preventing their rotation. If more than one blower motor is comprised, analysis according to 4.2 demonstrate whether one after the other or more at the same time blocked, taking into account a single fault condition.		N/A
5.2.4.9.3	Clogged filter		N/A
	Enclosed PECS having filtered ventilation openings shall be operated at rated load with the openings blocked to represent clogged filters.		N/A
	The test shall be performed initially with 50 % of the		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	ventilation openings surface blocked. The test repeated under a 100 % blocked condition.		
5.2.4.9.4	Loss of coolant test (type tests)		
	A liquid cooled PECS operated at rated load. Loss of coolant shall be simulated by draining the coolant, blocking the flow or disabling the system coolant pump.		N/A
	If the PECS is shut down due to the operation of a thermal device measuring the coolant temperature, then the test repeated with the coolant drained out of the system.		N/A
5.2.4.9.5	Covering of openings for cooling air test (type test)		N/A
	The top, sides, bottom and the back of enclosed PECS, if such have openings for cooling, covered one at a time.		N/A
	All openings of a PECS designed as movable equipment are covered simultaneously.		N/A
	Openings above 1,8 m do not need to be blocked.		N/A
5.2.5	Material tests		P
5.2.5.1	General		P
	When requested by 4.4.7.8.2, the flammability properties of the materials used for insulating purposes tested, as defined in 5.2.5.2, 5.2.5.3 and 5.2.5.4. When requested by 4.6.3.2, the flammability properties of the materials used for fire enclosure tested, as defined in 5.2.5.5.		P
5.2.5.2	High current arcing ignition test (type test)		N/A
5.2.5.3	Glow-wire test (type test)		P
	The glow-wire test shall be made under the conditions specified in 4.4.7.8.2 according to IEC 60695-2-10:2013 and IEC 60695-2-13:2010 and IEC 60695-2-13:2010/AMD1:2014.		P
5.2.5.4	Hot wire ignition test (type test)		N/A
5.2.5.5	Flammability test (type test)		N/A
5.2.5.6	Flaming oil test (type test)		N/A
5.2.5.7	Test of cemented joints (type test)		N/A
	After the conditioning, the samples pass all of the following tests in the prescribed order. a) The mechanical strength of the joint evaluated by loading the joint using the forces anticipated to be present under normal conditions. There shall be no separation of the parts. b) The insulation resistance between the conductive parts separated by the joint at least 100 MΩ and measured according to IEC 60664-3:2016, 5.8.3. c) Cemented joints treated as to be thin sheet material and tested according to 4.4.7.8.3. d) The sectioning of the joint shall not show any cracks, voids or separation. The joint visually examined according to IEC 61189-3:2007, 6.2 (test 3V02).		N/A
5.2.5.8	Durability, legibility and permanence of marking test (type test)		P
	Each required printed or screened marking tested. However, if the data sheet for a label confirms compliance with the test requirements, the test need not be performed. The test is conducted as		P

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Clause	Requirement + Test	Result - Remark	Verdict
	follows: a) by rubbing the marking by hand without appreciable force for 15 s with a piece of cloth soaked with water and at a different place or on a different sample for 15 s with a piece of cloth soaked with petroleum spirit; or b) the markings are rubbed by hand, without undue pressure, for 30 s with a cloth soaked with each specified cleaning agent or, if not specified, with 70 % isopropyl alcohol.		
5.2.5.9	UV resistance test (type test)		P
5.2.6	Environmental tests (type test)		P
5.2.6.1	General		P
	Compliance is shown by conducting test of 5.2.6.3, 5.2.6.4, 5.2.6.5 and 5.2.6.6 according to Table 33 as applicable for the environmental conditions specified by the manufacture.		P
5.2.6.2	Acceptance criteria		P
	The following acceptance criteria shall be satisfied: a) no degradation of any safety-relevant component of the PECS; b) no potentially hazardous behaviour of the PECS during the test; c) no sign of component overheating; d) no hazardous live part shall become accessible; e) no cracks in the enclosure and no damaged or loose insulators; f) pass routine AC or DC voltage test 5.2.3.4; g) pass protective equipotential bonding impedance test 5.2.3.11.2; h) no potentially hazardous behaviour when the PECS is operated following the test.		P
5.2.6.3	Climatic tests		P
5.2.6.3.1	Dry heat test (steady state)		P
	To prove the ability of components and equipment to be operated, transported or stored at high temperatures the dry heat (steady state) test shall be performed according to the conditions specified in Table 34.		P
5.2.6.3.2	Damp heat test (steady state) (type tests)		P
	To prove the resistance to humidity, the PECS subjected to a damp heat test (steady state) according to the conditions specified in Table 35.		P
5.2.6.4	Vibration test (type test)		P
	To verify the mechanical vibration strength, the PECS in combination with its installation evaluated by a) tests defined in 5.2.6.4 according to the conditions specified in Table 36, or b) calculation or simulation based on tests, as defined in 5.2.6.4, on a representative model of PECS.		P
5.2.6.5	Salt mist (type test)		P
	To verify the resistance against salt mist, the PECS in combination with its installation shall be evaluated by tests defined in this section according to the conditions specified in Table 34. For PSCS with a mass more than 100 kg, this test		P

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Clause	Requirement + Test	Result - Remark	Verdict
	may be performed on sub-assemblies.		
5.2.6.6	Dust test (type test)		P
	To verify the mechanical strength against dust, the PECS in combination with its installation evaluated by tests defined in 5.2.6.6 under the conditions specified in Table 38. For PECS with a mass more than 100 kg, this test performed on sub-assemblies.		P
5.2.6.7	Sand test (type test)		N/A
	To verify the ability to operate under the influence of sand, the PECS in combination with its installation evaluated by tests defined in 5.2.6.7 under the conditions specified in Table 39 mainly to demonstrate the robustness against abrasion by sand.		N/A
5.2.7	Hydrostatic pressure test (type test, routine test)		N/A
	For type tests, the pressure inside the cooling system of a liquid cooled PECS (see 4.7.2.2.3) increased at a gradual rate until a pressure relief mechanism (if provided) operates, or until a pressure of twice the operating value or 1,5 times the maximum pressure rating of the system is achieved, whichever is the greater.		N/A
	For routine tests, the pressure shall be increased to the maximum pressure rating of the system.		N/A
	For acceptance criteria, • there shall be no thermal, electric shock, or other hazard resulting from the test. There no leakage of coolant or loss of pressure during the test, other than from a pressure relief mechanism during a type test, and • the PECS pass the AC or DC voltage test in 5.2.3.4 after the hydrostatic pressure type test.		N/A
5.2.8	Electromagnetic fields (EMF)		N/A
	For more information, refer to Annex P.	Refer to EMC report	N/A
6	INFORMATION AND MARKING REQUIREMENTS		P
6.1	General		P
6.2	Information for selection		P
6.2.1	General		P
6.2.1.1	Overview		P
	As required in 4.1, each part of a PECS including specified accessories that is supplied as a separate product provided with information for the intended use relating to its function, electrical characteristics, and intended environment (see 6.3.3), so that its fitness for purpose and compatibility with other parts of the PECS can be determined. This information includes, but is not limited to, 6.2.1.2, 6.2.1.3, 6.2.1.4, 6.2.1.5 and 6.2.1.6.		P
6.2.1.2	Identifying the product		P
	• name or trademark of the manufacturer, supplier or importer;		P
	• catalogue number or equivalent.		P
6.2.1.3	Electrical ratings for each port		P
	• maximum nominal input voltage;		P
	• maximum nominal output voltage;		P
	• maximum nominal output current or nominal power output rating;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	• duty cycle rating for PECS designed to operate intermittently;		N/A
	• maximum nominal input current RMS for dimensioning overload protective elements and wiring;		N/A
	• number of phases (e.g. 3 AC);		N/A
	• nominal frequency range (e.g. 50 Hz to 60 Hz);		N/A
	• equipment class (I, II, III), see 6.3.9.2;		P
	• A DVC As circuit durably marked where visible after installation to indicate the class of supply and its electrical rating (for example, 30 Vac, DVC As), or equivalent.		P
6.2.1.4	Supplementary information for each port		P
	• multiple rated PECS;		P
	• DVC classification according to 4.4.2.1;		P
	• for a DVC As circuit not evaluated for use in wet or salt water-wet locations, one of the following information, whichever is applicable according to Table 18, or equivalent wording:		P
	– "Not for use in wet locations"; or		P
	– "Not for use in salt water-wet locations";		N/A
	• electrical (overvoltage category);		P
	• the type of electrical supply system (e.g. TN, IT, etc.) to which the PECS may be connected (see 4.4.7.1.5);		N/A
	• thermal derating characteristics for operation at an altitude above 1 000 m or by increased ambient temperature; and		N/A
	• short-circuit current rating(s) in terms of		N/A
	– conditional short-circuit current (I _{cc}) and minimum required prospective short-circuit current I _{cp,mr} and the characteristics of the short-circuit protective device according to 4.3.2.2,		N/A
	– rated short-time withstand current (I _{cw}), duration and the rated peak withstand current (I _{pk}) according to 4.3.2.3,		N/A
	– output short-circuit current in accordance with 4.3.2.4,		N/A
	– protective device characteristics, in accordance with 4.3.2 and 5.2.4.4, or		N/A
	– supply requirements of the load (if applicable).		N/A
6.2.1.5	Liquid cooled PECS		N/A
	• liquid coolant type;		N/A
	• nominal operating pressure;		N/A
	• maximum operating pressure.		N/A
6.2.1.6	General PECS marking		P
	• intended use (see 4.1);		P
	• specified accessories (see 4.1);		P
	• specific auxiliary equipment (see 4.1);		P
	• reference(s) to relevant standard(s) for manufacture, test, or use;		P
	• reference to documentation for installation, use and maintenance.		P
6.2.2	Instructions and markings pertaining to accessories		P
	As required in 4.1, the following information for identification shall be marked on the accessory when the accessory is not delivered with the PECS:		P
	a) the manufacturer's name or trademark;		P
	b) the catalogue number or equivalent;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	c) other information, as specified in 6.3 to 6.5.		P
6.3	Information for installation and commissioning		P
6.3.1	General		P
6.3.2	Mechanical considerations		P
	As required in 4.1, the following information provided:		P
	• IP rating for enclosed PECS;		P
	• dimensional drawing;		P
	• mounting drawing;		P
	• mass information.		P
	For enclosed PECS designed as pluggable equipment type A, marking of the IP rating is not mandatory on the product.		N/A
	For PECS weighing 18 kg or less, marking of the mass information is not mandatory on the product.		N/A
6.3.3	Environment		P
	As required in 4.1, and in accordance with 4.9, the following environmental conditions specified for operation, transportation and storage:		P
	• climatic (ambient temperature, humidity conditions, altitude, ultra-violet light (UV), etc.);		P
	• mechanical (vibration, shock, drop, topple, etc.);		P
	• pollution degree for which the PECS has been designed, when required in 4.4.7.1.3.		P
6.3.4	Handling and mounting		P
	In order to prevent injury or damage as required in 4.2, the installation documents include warnings of any hazards which can be experienced during installation. Where necessary, instructions shall be provided for		P
	• packing and unpacking,		P
	• moving,		P
	• lifting,		P
	• strength and rigidity of mounting surface,		P
	• fastening, and		P
	• provision of adequate access for operation, adjustment and maintenance.		P
6.3.5	Enclosure temperature		N/A
	When surface temperatures of the PECS, close to mounting surfaces, exceed the limit of 4.6.4.3, the installation manual shall contain a warning to consider the combustibility of the mounting surface.		N/A
	The following marking or equivalent shall appear:		N/A
	"Suitable for mounting on concrete or other non-combustible surfaces only".		N/A
6.3.6	Open type PECS		N/A
6.3.6.1	Fire protection for open type PECS		N/A
	When required by 4.6.4.3, the documentation shall include the following warning text or equivalent:		N/A
	"This open type PECS does not provide comprehensive mitigation for fire hazards. It is intended to be installed inside a supplementary enclosure or in a restricted access area which provides appropriate protection against the spread of fire."		N/A
6.3.6.2	Protection against electric shock not provided by enclosures or barriers		N/A
	When required by 4.4.3.3, the documentation include the following warning text or equivalent:		N/A
	"This open type PECS does not provide protective		N/A

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	means for access to hazardous live parts. It is intended to be installed inside a supplementary enclosure or in a restricted access area which provides appropriate protection against access to hazardous live parts".		
6.3.7	Connections		P
6.3.7.1	General		P
	Information provided to enable the installer to make safe electrical connection to the PECS. This include information for protection against hazards that may be encountered during installation, operation or maintenance.		P
6.3.7.2	Interconnection and wiring diagrams		P
	As required in 4.1 and 4.2, the documentation include details of all necessary connections, together with a suggested interconnection diagram.		P
6.3.7.3	Conductor (cable) selection		P
	As required in 4.11.2, the documentation define the voltage and current levels for all connections to the PECS, together with cable insulation requirements. These worst case values, taking into account short-circuit and overload conditions and the possible effects of non-sinusoidal currents.		P
6.3.7.4	Identification and other details of field wiring terminals		P
6.3.7.4.1	Identification of field wiring terminals		P
	The identification of all field wiring terminals marked on the PECS, either directly or by a label attached close to the terminals (see 4.11.5 and 4.11.10.3).		P
	The documentation identify all field wiring terminals relating to circuits of DVC As.		P
	A field wiring terminal for the connection of the neutral conductor as required by 4.11.5 readily distinguishable by location and/or marking or colour from the other field wiring terminals, or proper identification of the field wiring terminal for the connection of the neutral conductor clearly shown in some other manner, such as on an attached wiring diagram.		P
6.3.7.4.2	Other details of field wiring terminals		P
	To ensure a safe installation, the documentation shall specify the following in a), b), c), d) and e) as applicable.		P
	a) Terminal capacity		P
	• range of acceptable conductor sizes and types (solid or stranded) for all terminals (see 4.11.10.2);		P
	• maximum number of conductors which can simultaneously be connected in parallel per terminal;		P
	• size of the fasteners (see d)).		P
	b) Tightening torque value		P
	• required tightening torque value;		P
	• required strength of bolts and nuts.		P
	c) Cable type and temperature		P
	• whether the terminals are suitable for connection of copper, aluminium and/or copper-clad aluminium conductors;		P
	• the insulation temperature rating requirements for the conductor or cable based on the results of the		P

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	temperature test in 5.2.3.10.		
	d) Accessories for wire connection		P
	• the stripping length of the wire;		P
	• specific ring lugs, ferrules, leads, wire binding screws or pressure wire connectors;		P
	• pressure wire connector or component terminal accessory kits;		P
	• wiring accessories such as nuts, bolts, spring washers;		P
	• accessories for the securement, routing and fixing of cables.		P
	e) Wire terminal components		P
	• when wire terminals components are not provided on the PECS as shipped, the documentation state which component terminal kits are intended for use with the PECS;		P
	• when parts of terminals (e.g. cable lugs or removable part of two-part connectors) are not provided on the PECS as shipped, the documentation state which terminal kits are intended for use with the PECS, or standard off the shelf parts of the terminals.		P
6.3.7.5	Plug and socket-outlets		N/A
	When required in 4.11.7, plug and socket-outlets accepting standard mains supply plugs marked with the voltage if it is different from the mains supply voltage. If the plug and socket-outlet is for use only with specific accessories, it shall be marked to identify the accessories for which it is intended. If not, the maximum rated current or power marked, or symbol ISO 7010-W001:2011-05 or ISO 7000-0434:2006-12 shown in Annex C placed beside the plug and socket-outlet with the full details included in the documentation.		N/A
6.3.8	Commissioning		N/A
	If commissioning tests are necessary to ensure the electrical and thermal safety of a PECS, information to support these tests provided for each part of the PECS. This information can depend on the specific installation, and close cooperation between manufacturer, installer, and user can be required.		N/A
	As required in 4.1 and 4.2, commissioning information include references to hazards that might be encountered during commissioning, for example those mentioned in 6.4 and 6.5.		N/A
6.3.9	Protection requirements		P
6.3.9.1	Accessible parts circuits		P
	The installation and maintenance documentation identify any conductive accessible parts and accessible circuits at voltages greater than DVC As (see 4.4.2.1), and describe the insulation and protective means required for protection.		P
	The documentation also indicate the precautions to be taken to ensure that the safety of DVC As connections is maintained during installation.		P
	Where a hazard is present after the removal of a cover of an enclosed PECS (see 4.4.3.3), a warning label shall be placed on the PECS. The label shall		P

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	be visible before the cover is removed.		
	The documentation of a PECS state the maximum voltage allowed to be connected to each port.		P
	The documentation provide instructions for the use of DVC As circuits within a zone of equipotential bonding.		P
6.3.9.2	Equipment class		P
6.3.9.2.1	General		P
6.3.9.2.2	PECS designed as class I equipment		P
	Means of connection for the external PE conductor to the PECS as required by 4.4.4.3.2 clearly and indelibly marked with one or more of the following:		P
	• the symbol IEC 60417-5019:2006-08 (see Annex C);		P
	• the letters "PE";		P
	• the colour coding green or green-and-yellow.		P
	When requested by 4.11.5, the documentation specify clear instruction on the location of the PE-terminal and correct connection to the terminal.		P
6.3.9.2.3	PECS designed as class II equipment		N/A
	PECS of class II equipment marked with symbol IEC 60417-5172:2003-02 (see Annex C). Where such PECS has means for the connection of an earthing conductor for functional reasons (see 4.4.6.3), the means of connection marked with symbol IEC 60417-5018:2011-07 (see Annex C).	Class I	N/A
6.3.9.2.4	PECS designed as class III equipment		N/A
	PECS of class III equipment marked with symbol IEC 60417-5180:2003-02 (see Annex C).	Class I	N/A
6.3.9.3	Protective equipotential bonding circuit		P
	The protective equipotential bonding circuit in 4.4.4.2 marked as follows.		P
	• For the means of connection for the external PE conductor in 4.4.4.3.2, see 6.3.9.2.2.		P
	• The internal protective equipotential bonding conductor readily distinguishable from other conductors by shape, location, marking, or colour.		P
	• Where the internal protective equipotential bonding conductor can be easily identified by its shape, position, or construction (for example a braided conductor, uninsulated stranded conductor), no additional marking is required.		P
	• When identification is by colour alone, the bicolour combination green-and-yellow used throughout the length of the conductor, or where the insulated conductor is not readily accessible or is part of a multicore cable, colour coding throughout its length is not necessary. However, where the conductor is not clearly visible throughout its length, the ends or accessible locations clearly identified by		P
	– the symbol IEC 60417-5017:2006-08,		P
	– the bicolour combination green-and-yellow, or		P
	– markings, if explained in the documentation.		P
	• However, where terminals for the connection are provided on a component or subassembly, either the symbol IEC 60417-5017:2006-08 or the symbol IEC 60417-5019:2006-08 is permitted.		P
	As required in 4.4.4.2.1, where screws for connecting the protective equipotential bonding are used for other purpose, this specified in the documentation.		P

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Clause	Requirement + Test	Result - Remark	Verdict
6.3.9.4	Touch current or high leakage current		P
6.3.9.4.1	General		P
6.3.9.4.2	Touch current		P
	Where the touch current exceeds the limits given in 4.4.4.3.3.3, this stated in the documentation. In addition, a warning symbol ISO 7010-W001:2011-05 or ISO 7000-0434:2006-12 (see Annex C) shall be placed on the PECS, and a notice provided in the documentation to instruct the user that the minimum size of the PE conductor comply with the local safety regulations for high touch current.		P
6.3.9.4.3	High leakage current		N/A
	If the PE conductor current exceeds the limits given in 4.4.4.3.3.4, this stated in the documentation. In addition, a warning symbol ISO 7010-W001:2011-05 or ISO 7000-0434:2006-12 (see Annex C) shall be placed on the PECS and a notice provided in the documentation about the protective means to instruct the user that connection of simultaneously conductive accessible parts adjacent to the PECS to the protective bonding circuit of the PECS is required.		N/A
6.3.9.5	Compatibility with RCD		N/A
	The documentation shall indicate compatibility with RCDs (see 4.4.8). When 4.4.8 b) applies, a caution notice and the symbol ISO 7010-W001:2011-05 or ISO 7000-0434:2006-12 (see Annex C) shall be provided in the documentation, and the symbol placed on the PECS. The caution notice the following or equivalent:		N/A
	"This product can cause a DC current in the PE conductor. Where a residual current-operated protective device (RCD) is used for protection against electric shock, only a RCD of type B is allowed on the supply side of this product."		N/A
6.3.9.6	External protective devices		N/A
	Where external protective devices are necessary to protect against hazards, the documentation specify the required characteristics (see also 5.2.4 and 4.3.2.1).		N/A
6.3.9.7	Fire enclosure		N/A
	When it is intended to use the PECS only in areas without combustible material to avoid the use of a fire enclosure according to 4.6.3.1, the following marking or an equivalent text appear:		N/A
	"Intended to be used only in areas without combustible materials".		N/A
	When required by 4.6.3.3.4, the documentation include information for correct removal and reinstallation of the door or cover, to ensure that the fire enclosure is maintained during installation or maintenance.		N/A
	When required by 4.6.3.3.2, the documentation specify appropriate mounting instructions to ensure moveable equipment has a well-defined top and bottom.		N/A
6.4	Information for intended use		P
6.4.1	General		P
	As required in 4.1, the documentation include all information regarding the safe operation of the PECS. In particular, it identify any		P
	• hazardous materials,		P
	• risks of electric shock,		P

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Clause	Requirement + Test	Result - Remark	Verdict
	• overheating,		P
	• explosion, and		P
	• excessive acoustic noise (see 4.10).		N/A
6.4.2	Adjustment		P
	As required in 4.2, the documentation give details of all safety-relevant adjustments intended for the user. The identification or function of each control or indicating device and overcurrent protective devices marked adjacent to the item. Where it is not possible to do this on the product, the information shall be provided pictorially in the documentation.		P
	Maintenance adjustments also be described in this documentation, but it made clear that they should only be made by skilled persons.		P
	Clear warnings provided in the documentation where excessive adjustment could lead to a hazardous state of the PECS.		P
	Any special tools necessary for making adjustments specified and described.		P
6.4.3	Labels, signs, symbols and signals		P
6.4.3.1	General		P
	Labelling in accordance with good ergonomic principles so that notices, controls, indications, test facilities, overcurrent protective devices, etc., are sensibly placed and logically grouped to facilitate correct and unambiguous identification.		P
	As required in 4.2, all safety related PECS labels located so as to be visible after installation or readily visible by opening a door or removing a cover.		P
	All safety related caution and warning labels required for location "2" according to 6.1 and Table 40 indicating a hazard shall be located so as to be visible after installation or readily visible by opening a door or removing a cover when PECS is installed as intended including side-by-side with specified clearance.		P
	Where a symbol is used, the information provided with the PECS contain an explanation of the symbol and its meaning.		P
	Labels shall		P
	• wherever possible, use international symbols as given by ISO 3864-1, ISO 7000, ISO 7010 or IEC 60417,		P
	• if no international symbol is available, be worded in an appropriate language or in a language associated with a particular technical field,		P
	• be conspicuous, legible and durable,		P
	• be concise and unambiguous, and		P
	• state the hazards involved and give ways in which risks can be reduced.		P
	When instructing the person(s) concerned as to		P
	• what to avoid, the wording should include "no", "do not" or "prohibited",		P
	• what to do, the wording should include "shall" or "must",		P
	• the nature of the hazard, the wording should include "caution", "warning" or "danger", as appropriate, and		P

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Clause	Requirement + Test	Result - Remark	Verdict
	• the nature of safe conditions, the wording should include the noun appropriate to the safety device.		P
	The signal words indicated hereinafter used and the following hierarchy respected:		P
	• DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury, for example: "High voltage";		P
	• WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury, for example: "This surface can be hot";		P
	• CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury, for example: "Some of the tests specified in this document involve the use of processes imposing risks on persons concerned".		P
	Danger, warning and caution markings on the PECS shall be prefixed with the signal word " DANGER ", " WARNING ", or " CAUTION " as appropriate in letters not less than 3,2 mm high. The remaining letters of such markings shall be not less than 1,6 mm high.		P
	If the danger, warning or caution marking is on a visible surface whose width and length are both 20 cm or more, the signal word " DANGER ", " WARNING ", or " CAUTION " as appropriate have letters not less than 5 mm high. The remaining letters of such markings shall not be less than 2,5 mm high.		P
	Cautionary markings not be located solely on a part that is removable unless removal of the part is only possible by means of a tool and impairs the operation.		P
	The signal word hierarchy shall be observed as a minimum. For example, "Danger" may be substituted for either "Warning" or "Caution" but not vice versa.		P
	Cautionary marking for operating instructions shall be legible and visible during normal operation conditions of the PECS.		P
	A marking that provides servicing instructions shall be legible and visible when such servicing is being performed.		P
	All markings		P
	• moulded, die-stamped, paint-stencilled, stamped,		P
	• etched metal that is permanently secured, or		P
	• indelibly stamped lettering on a pressure-sensitive label secured by adhesive that is rated for the environmental ratings of the PECS.		P
	Usage, handling, storage, and similar conditions to which the product is exposed applied in the determination of the permanency of a marking. For test, see 5.2.5.8.		P
	Unless otherwise specified, safety signs do not need to be in colour.		P
	If a safety sign is in colour, the colour in accordance with ISO 3864 (all parts).		P
	Markings that are engraved or moulded need not be in contrasting colours provided that they are legible and readily discernible under normal lighting		P

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Clause	Requirement + Test	Result - Remark	Verdict
	conditions.		
6.4.3.2	Isolating devices and disconnects		N/A
	Where an isolating device is not intended to interrupt load current, a warning state:		N/A
	DO NOT OPEN UNDER LOAD		N/A
	The following requirements apply to any supply isolating device which does not disconnect all sources of power to the PECS.		N/A
	• If the isolating device is mounted in a PECS enclosure with the operating handle externally operable, a warning label provided adjacent to the operating handle stating that it does not disconnect all power to the PECS.		N/A
	• Where a control circuit disconnect can be confused with power circuit disconnectors due to size or location, a warning label provided adjacent to the operating handle of the control circuit disconnect stating that it does not disconnect all power to the PECS.		N/A
6.4.3.3	Visual and audible signals		P
	Visual signals such as flashing lights, and audible signals such as sirens, may be used to warn of an impending hazardous event such as the driven equipment start-up and identified.		P
	It is essential that these signals		P
	• are unambiguous,		P
	• can be clearly perceived and differentiated from all other signals used,		P
	• can be clearly recognized by the user, and		P
	• are emitted before the occurrence of the hazardous event.		P
	It is recommended that higher frequency flashing lights be used for higher priority information.		P
6.4.5	Control and device marking		P
	As required in 4.2, the identification of each control or indicating devices and internal overcurrent protective devices marked adjacent to the item.		P
	Each replaceable internal overcurrent protective device marked with its characteristics or manufacturer's name and catalogue number nearby.		P
	Where it is not possible to do this on the PECS, the information provided pictorially in the documentation.		P
	There shall also be a marking near all replaceable fuses that states the following text or equivalent wording:		P
	Warning – Risk of fire. Replace fuses only as marked		P
	Appropriate identification marked on or adjacent to each movable connector.		P
	Test points individually marked with the circuit diagram reference.		P
	The polarity of any polarized devices marked adjacent to the device.		P
	The diagram reference and, if possible, the function marked adjacent to each pre-set control in a position where it is clearly visible while the adjustment is being made.		P
6.5	Supplementary information		P
6.5.1	Maintenance		P
6.5.1.1	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
	As required in 4.2, the manufacturer provide information to ensure that maintenance of the PECS can be conducted in a safe manner providing safety markings as specified in 6.5.1.2 and 6.5.1.3.		P
6.5.1.2	Manufacturing date		P
	The manufacturing date of the PECS determined by a code marked on the product. This code can be a unique identification code, date code, serial number or similar.		P
6.5.1.3	Safety information		P
	The documentation include, as appropriate, the following safety information:		P
	• preventive maintenance procedures and schedules;		P
	• safety precautions during installation, commissioning and maintenance;		P
	• location of hazardous live parts that can be accessible during maintenance (for example, when covers are removed) – see 4.4.3.3;		P
	• sub-assembly and component repair and replacement procedures;		P
	• any other relevant information;		P
	• qualification required for installation, commissioning and maintenance.		P
6.5.2	Capacitor discharge		N/A
	When required by 4.4.9 c) or 4.5.2, the warning symbol IEC 60417-6042:2010-11 or ISO 7010-W012:2011-05 and IEC 60417-5416:2015-04 (see Annex C) and an indication of the minimum discharge time (see Annex C) required for discharge under worst conditions (e.g. discharge time 5 min) shall be located according to 6.4.3.1 in a clearly visible position on the enclosure, the capacitor protective barrier, or at a point close to the capacitor(s) concerned (depending on the construction). The symbol explained and the time required for the capacitors to discharge after the removal of power from the PECS stated in the documentation.		N/A
6.5.3	Auto restart/bypass connection		N/A
	As required in 4.2, if a PECS can be configured to provide automatic restart or bypass connection, the documentation contain appropriate warning statements.		N/A
	A PECS which is set to provide automatic restart or bypass connection, after the removal of power, be clearly identified at the installation.		N/A
6.5.4	Other hazards		N/A
	As required in 4.2, the manufacturer identify, as applicable, any components and materials of a PECS which require special procedures to prevent hazards.		N/A
6.5.5	Equipment with multiple sources of supply		N/A
	In accordance with 4.8, where there is more than one source of supply energizing the PECS, information provided to indicate which disconnect device or devices are required to be operated in order to completely isolate the PECS.		N/A
6.5.6	Replaceable fuses in neutral of single-phase PECS		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	When required in 4.3.4, a suitable marking provided in the documentation to inform a skilled person of a possible hazard, where both of the following conditions exist:		N/A
	• a fuse is used in the neutral of single-phase PECS either permanently connected or provided with a non-reversible plug;		N/A
	• after operation of the fuse, parts of the PECS that remain energized might represent a hazard during servicing.		N/A
	The following or similar wording is regarded as suitable:		N/A
	CAUTION DOUBLE POLE/NEUTRAL FUSING		N/A
	As an alternative to the above wording, the use of the following combination of representative symbols is permitted:		N/A
	• the electric shock hazard symbol IEC 60417-6042:2010-11 or ISO 7010-W012:2011-05;		N/A
	• the fuse symbol IEC 60417-5016:2002-10;		N/A
	• an indication that the fuse is in the neutral N (see Annex C).		N/A
	However, in this case, the statement also be provided in the documentation.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

Test Result

4	TABLE: electrical data in normal condition						P
Type	Input			Output			
	U (V) DC	I (A) DC	P (kW) DC	U (V) DC	I (A) DC	P (kW) DC	
Charge	203,12	15,01	3,05	--	--	--	
	208,63	14,99	3,13	--	--	--	
Discharge	--	--	--	196,27	15,00	2,94	
	--	--	--	193,22	15,00	2,90	

4.2 to 4.3		TABLE: fault condition tests					P
		ambient temperature (°C) : 25°C					—
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1	DC+ to DC-	s-c before start-up	384	10min	--	--	The EUT can't startup, No hazard.
2	R165	s-c before start-up	384	10min	--	--	The EUT normally works, no danger, no damage
3	ZD3 (BAT_2 AND BAT_3)	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
4	C37	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
5	R49	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
6	R37	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
7	C5	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
8	R11	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
9	C14	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
10	F1	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.
11	C9	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
12	C101	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
13	C107	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
14	C152	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
15	C126	s-c before start-up	384	10min	--	--	The EUT shutdown, no dangerous
16	XL3	s-c before start-up	384	10min	--	--	The EUT stop working. No hazard.
17	XL3	o-c before start-up	384	10min	--	--	The EUT stop working. No hazard.
18	C35	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
19	R144	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
20	C58	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
21	C76	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
22	R184	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
23	Relay 1	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay 2 open and no dangerous
24	Relay 2	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay 1 open and no dangerous
25	R487	o-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
26	C244	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous.

27	C242	s-c before start-up	384	10min	--	--	The EUT shutdown, Relay open and no dangerous
supplementary information: O-C: Open circuit; S-C: Short circuit.							

4.6.4	TABLE: heating temperature rise measurements		P
	test voltage (V)	Charging: 200,14V Discharging: 184,42V	—
	Charging (°C).....	51	—
	Discharging (°C)	51	—
temperature rise dT of part/at:	dT (K)		permitted dT (K)
	Charging	Discharging	
DC switch (inside)	52,95	53,00	85
Relay 1	60,65	60,70	85
Relay 2	61,40	61,40	85
IVU board	56,20	56,40	130
Fuse 80A	55,40	55,60	125
Fuse 70A	52,00	52,25	125
IC U22 (BMS Board)	58,80	58,85	130
Power wire +	53,45	53,50	105
Power wire -	53,05	53,00	105
BCU board	57,25	57,30	130
Bobbin (TX1)	58,10	58,25	130
Cell in the middle of cell string	54,40	54,30	Ref.
Extinguisher	52,05	52,00	Ref.
Enclosure (top side)	50,85	50,85	70
Enclosure (left side)	51,05	51,10	70
Enclosure (bottom side)	50,90	50,85	70
DC switch (outside)	51,15	51,15	75
Connector + (outside)	50,95	50,95	85
Connector - (outside)	51,00	50,95	85
Power Cable + (outside)	51,05	51,10	75
Power Cable - (outside)	51,10	51,15	75
Ambient	50,85	50,85	--
Supplementary information:			

4.4.7.4 to 4.4.7.5	TABLE: clearance and creepage distance measurements					P
clearance cl and creepage distance dcr at / of:	Up (V)	U r.m.S. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Battery inputs to PE (BI)	219	--	0,57	8,93	1,71	8,93
Battery inputs + to – (BI)	219	--	0,57	23,05	1,71	23,05
BCU Board						
Battery input to SELV (RI)	219	--	1,71	>1,71	1,71	>1,71
Supplementary information:						

4.4.7.8.3.2 to 4.4.7.9	TABLE: distance through insulation measurement				N/A
distance through insulation di at/of:	U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)	
--	--	--	--	--	
--	--	--	--	--	
--	--	--	--	--	
--	--	--	--	--	
--	--	--	--	--	
Supplementary information: The unit haven't that part.					

4.4.7.10	TABLE: electric strength measurements, impulse voltage test and partial discharge test				P
test voltage applied between:	test voltage (V)	impulse withstand voltage (V)	partial discharge extinction voltage (V)	result	
BAT+ to PE	700	2500	--	Pass	
BAT- to PE	700	2500	--	Pass	
BAT+ to Can circuit	700	4000	--	Pass	
BAT- to Can circuit	700	4000	--	Pass	
Supplementary information:					

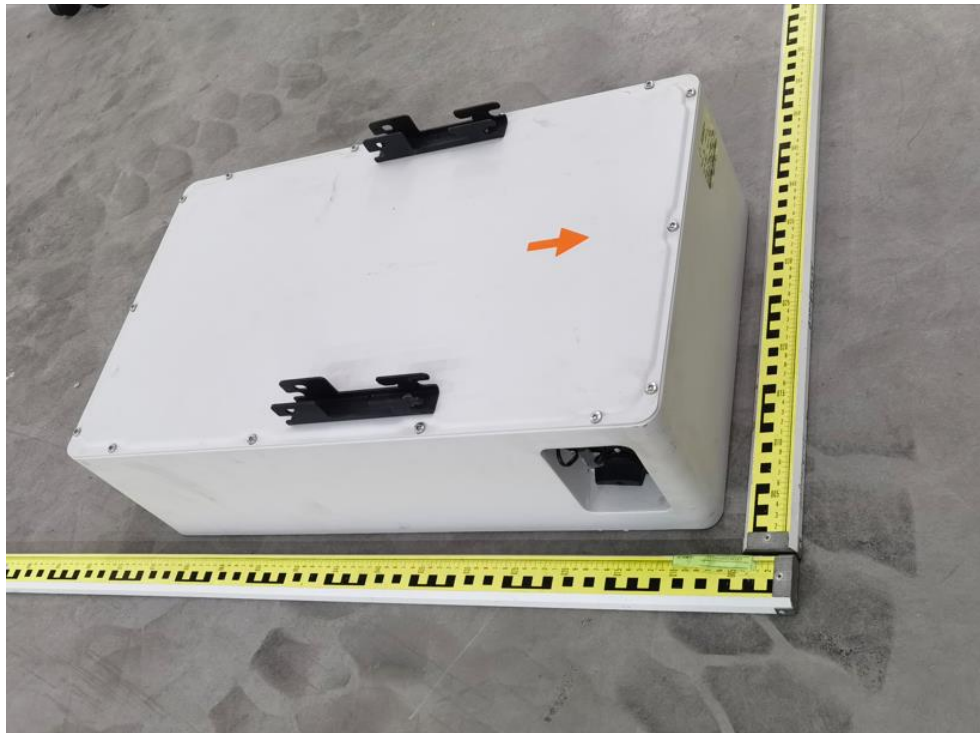
5.1	TABLE: Critical components information					P
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾	
Cell	Do-Fluoride New Energy Technology Co., Ltd.	LFR46160-30Ah	3.2V, 30Ah	IEC 62619: 2022	CB Certif. No:SG SGS-00624	
Enclosures	Suzhou Juxian Electric Technology Co., Ltd.	SGCC	Dimension: 380*640*185 Min. thickness: 1,2mm	EN IEC 62477-1: 2022	Tested with appliance	
- Alt. Enclosures	Shaoxing Detailed Technology Co., Ltd.	SGCC	Dimension: 380*640*185 Min. thickness: 1,2mm	EN IEC 62477-1: 2022	Tested with appliance	
Charging Wires for module	Suzhou Wanshih Electronic Element Co., LTD	1256	10AWG, 1000V, 105°C	UL 758	E248566	
CABLE SEALING (MALE)	Dongguan Vaconn Electronic Technology Co., Ltd.	VP-D4B-CHDM8B	DC1100V, 50A, -40°C~85°C	IEC62852:2014+A1 EN 62852:2015	TUV Rh R504921800001	
CABLE SEALING (FEMALE)	Dongguan Vaconn Electronic Technology Co., Ltd.	VP-D4B-CHDF8B	DC1100V, 50A, -40°C~85°C	IEC62852:2014+A1 EN 62852:2015	TUV Rh R504921800001	
M12 BULKHEAD (MALE)	Dongguan Vaconn Electronic Technology Co., Ltd.	VP-D4B-PHDM0B	DC1100V, 50A, -40°C~85°C	IEC62852:2014+A1 EN 62852:2015	TUV Rh R504921800001	
M12 BULKHEAD (FEMALE)	Dongguan Vaconn Electronic Technology Co., Ltd.	VP-D4B-PHDF0B	DC1100V, 50A, -40°C~85°C	IEC62852:2014+A1 EN 62852:2015	TUV Rh R504921800001	
Current Sensing Resistor (R117 R118 R120 R213)	YAGEO	PA2512FKE7 W0R001E	1mΩ±1%, 2W, 2512, -55°C ~ 170°C	EN IEC 62477-1: 2022	Tested With Application	
DC Fuse 1	ASTM	EV145-70-EP	500V, 70A	IEC 60269-1: 2006+A1+A2 IEC 60269-7: 2021	TUV R505947320001	
DC Fuse 2	ASTM	EV145-80-EP	500V, 80A	EC 60269-1: 2006 IEC 60269-7: 2021	TUV R505947320001	
PV Switch	SVRUI (Tianjin) Electrical Equipment Co., Ltd.	GHX5S-60P/2P-480-50-2	480V, 50A, 2P, -40°C to+85°C	EN IEC 60947-3:2021	TUV R505943160001	

TRIPLE WIRE	Suzhou yusheng electronic Co., LTD	FLW-B(LZ)	130°C	UL 2353	UL E364920
- Relay 1	Hongfa (Xiamen) Co., Ltd.	HF167F-GV/12-HTF	1000VDC, 50A	IEC EN 61810-1: 2015+A1	TUV R50651065 0001
- Relay 2	Vicvac Electronics Technology (Changzhou) Co., Ltd	VVE20-12SW-20B	1000VDC, 20A	EN IEC 60947-4-1: 2019	No.N8A 118067 0003
Heating film	Wuxi Xianxiang New Material Technology Co., Ltd	EP6- Silicone Heater	1,3±0,2mm, 1,4g/cm ³ , 0,5w/m.k, -40°C ~150°C	EN IEC 62477-1: 2022	Test with applicant
Extinguisher	Nanjing Xintong New Energy	QRRO.012G/S -AX	Aerosols: 12g, -30°C ~70°C	EN IEC 62477-1: 2022	Test with applicant
Key components for BCU Board					
- PCB	Wan An Yu Wei Electronic Co., Ltd.	Jh-m	130°C, V-0, Min thickness: 1,44mm	UL 796	UL E511912
- NTC (T_1_A, T_2_A, T_1_B, T_2_B, T_1_C, T_2_C, T_1_D, T_2_D)	Kemin shenzhen Electronic Technology Co., LTD	10KF3435-B2-1000-X-4413	R25 =10KΩ±1%, B(25/85) = 3435K±1%, -40°C~125°C	UL 1434	UL E356449
- IC for Communication (U46 U56)	Suzhou Novosense Microelectronics Co., Ltd.	NSI1050-DDBR	DDB8, VDD ₁ , VDD ₂ : -0,5~6,5V, V _{TXD} : -0,4~VDD ₁ +0,4V, I _o : -15~15mA, Topr: -40~125°C, Tstg: -40~150°C	EN IEC 62477-1: 2022	Test with applicant
- Transformer (TX1)	HANGZHOU YUZHENG ELECTRON CO., LTD	YZ2459-ER28	32:11:11 300uH 130°C	EN IEC 62477-1: 2022	Test with applicant
- Digital Isolator	NOVOSENSE	NSi824X	UP to 5000Vrms insulation voltage, 2.5v to 5.5v, high CMTI 250KV/us, -55°C ~125°C, min. clearance 8mm, min. creepage 8mm.	DIN EN IEC 60747-17:2021-10; EN IEC 60747-17:2020+AC:2021	VDE 40052820
- Resistor (R191)	FUTABA ELECTRIC CO., LTD.	RGWB0J2000 PG00NH	200Ω±5%, 1000V 20W	EN IEC 62477-1: 2022	Tested with appliance

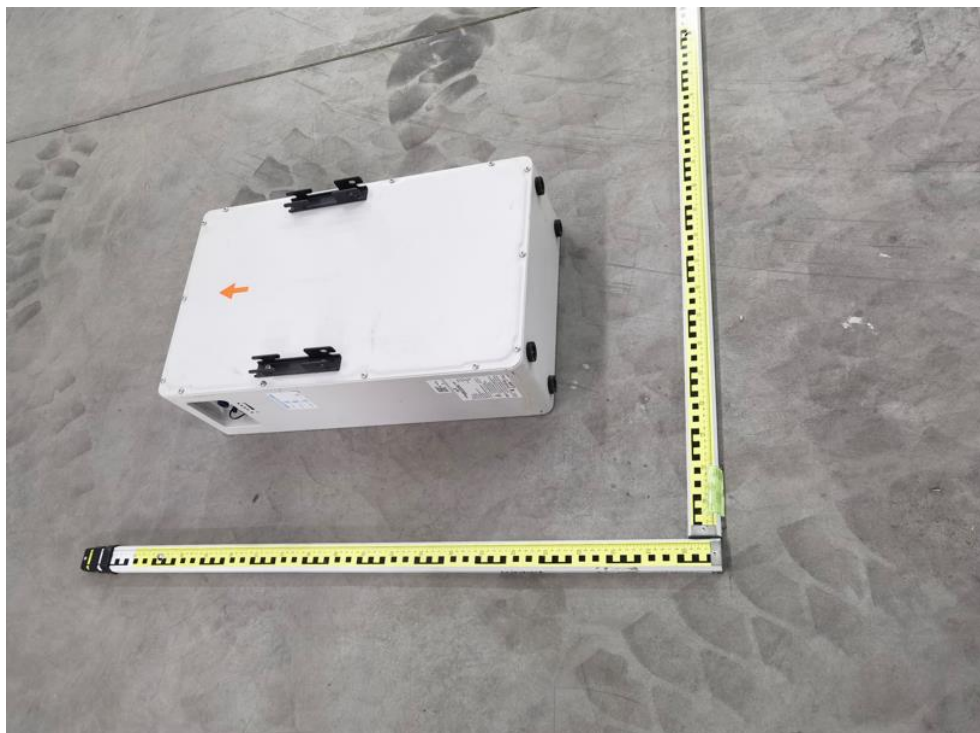
- Connector (P1,P2)	Suzhou Huijun Electronic Technology Co., Ltd.	PWT-350-DYS	100A, -40°C~+120°C	EN IEC 62477-1: 2022	Tested with appliance
MCU (U22)	GD	GD32F470ZK T6	LQFP144 -40- 85°C,32 bit	EN IEC 62477-1: 2022	Test with applicant
-Y capacitor (CY1, CY2, CY3, CY5, CY6)	TDK	CD45- B2GA471K- NKA	470pF 10% Y1 400VAC 2.5%	EN IEC 62477-1: 2022	Test with applicant
BMU Board					
- PWB	Wan An Yu Wei Electronic Co., Ltd.	Jh-m	130°C, V-0, Min thickness: 1,8mm	UL796	UL E250425
- IC (U7)	ADI	ADBMS6822 WCCSZ-RL	32-Lead LFCSP- SS -40°C to +125°C	EN IEC 62477-1: 2022	Test with applicant
- IC (U2, U4, U6, U8)	ADI	ADBMS6832M WCCSZ-RL	18-Channel Multicell Battery Monitors, Temperature rang: -40°C ~125°C	EN IEC 62477-1: 2022	Test with applicant
- Optocoupler (U1)	Everlight Electronics Co., Ltd	CNY65(B)-V	Min.clearance 13,64mm,opreatin g temperature up to 85°C, BVceo=80V(min)	EN/IEC 60747-5- 5:2020; DIN EN IEC60747-5- 5:2021-10	VDE 40027351
Supplementary information:					
¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

Annex No, 1

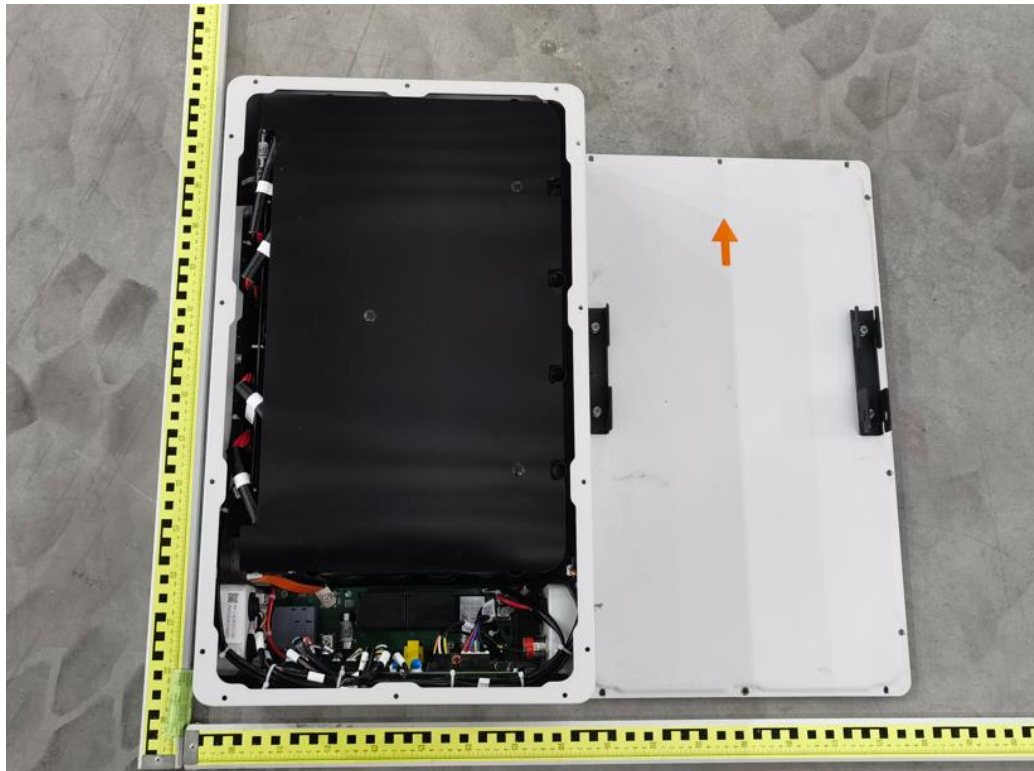
Pictures of the unit



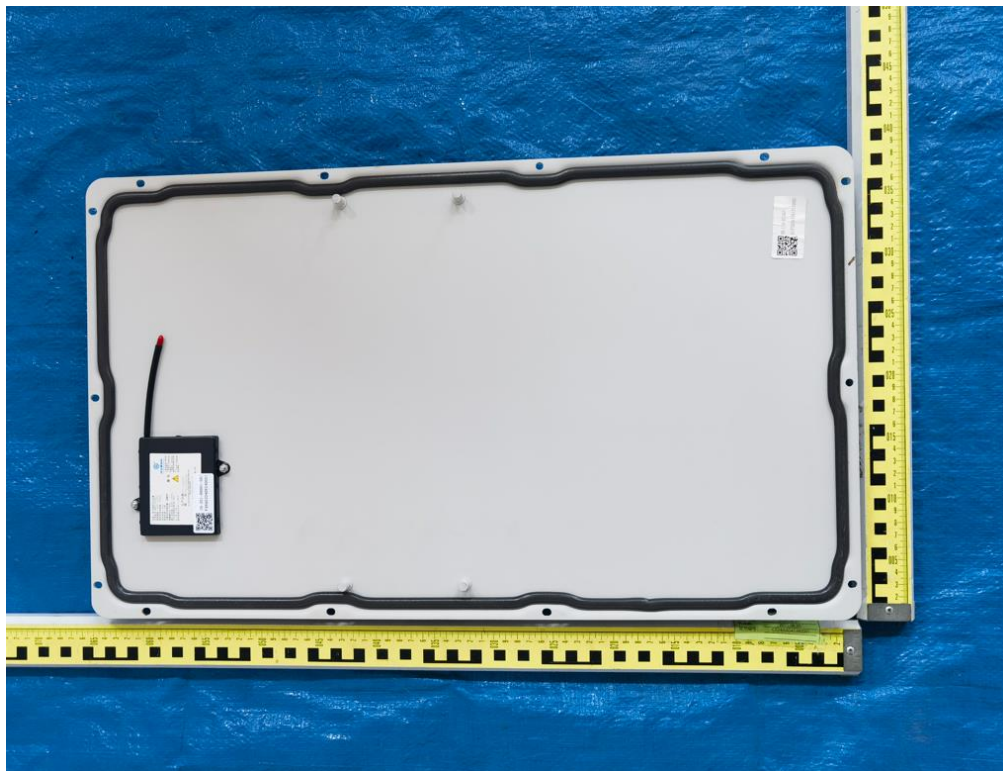
Overview of battery system



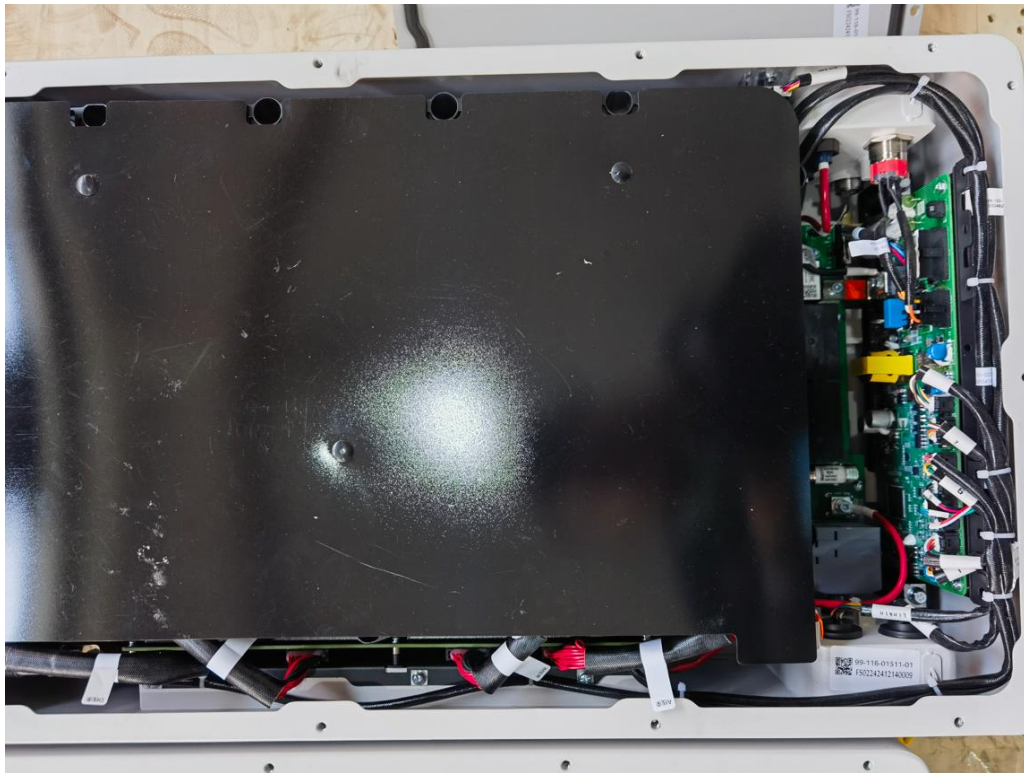
Overview of battery system



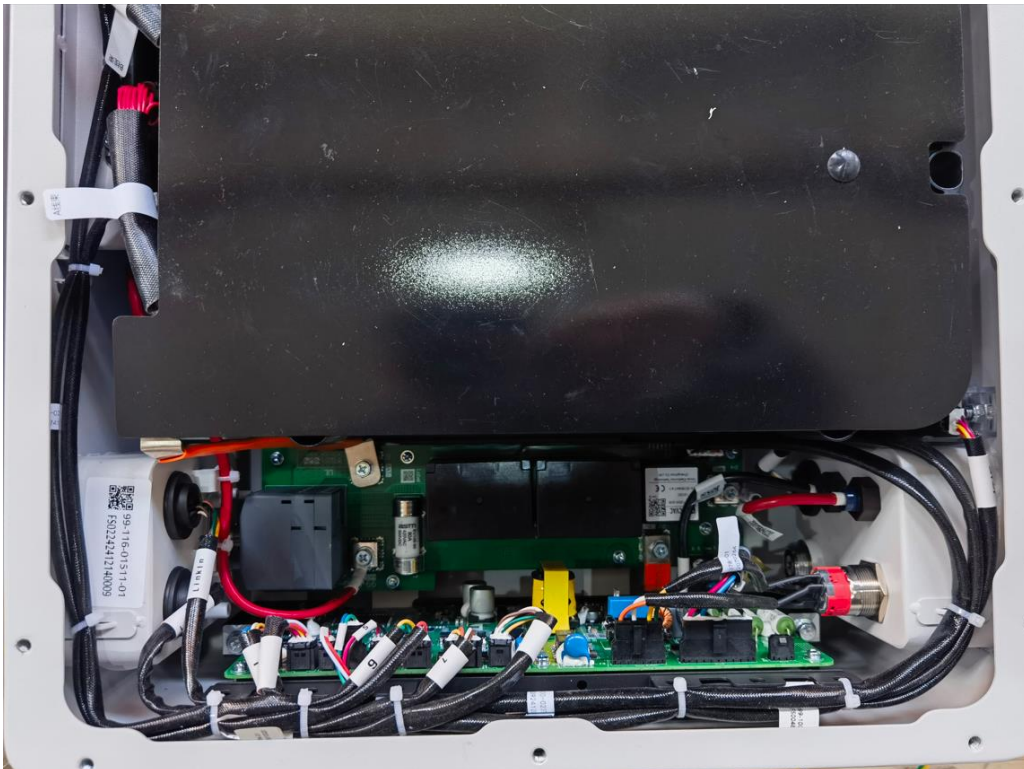
Interior view of Battery System



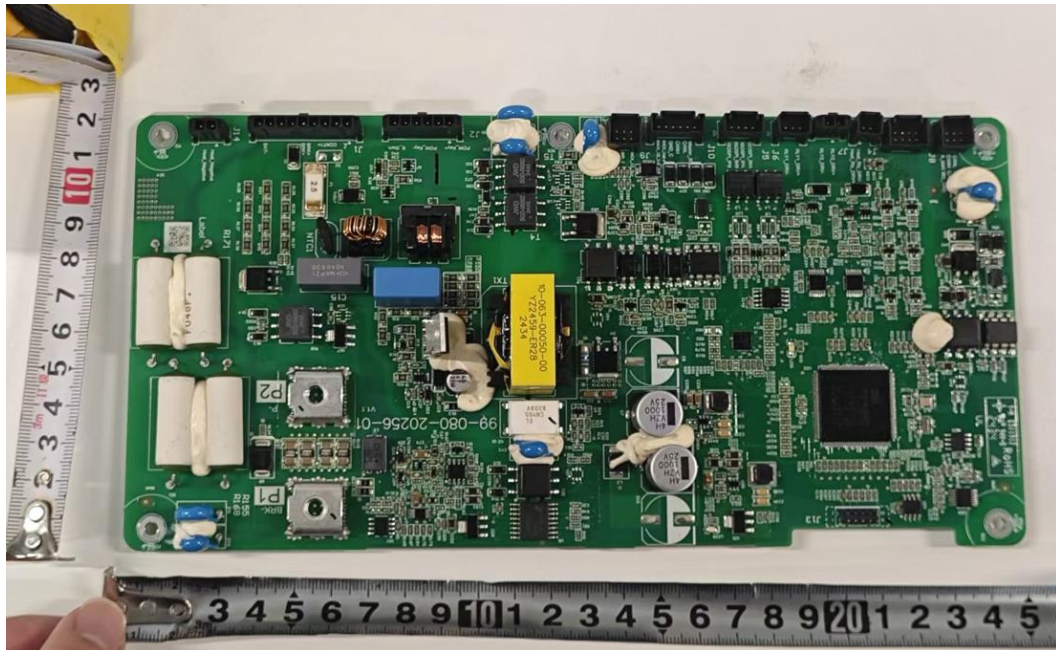
Interior view of Cover plate



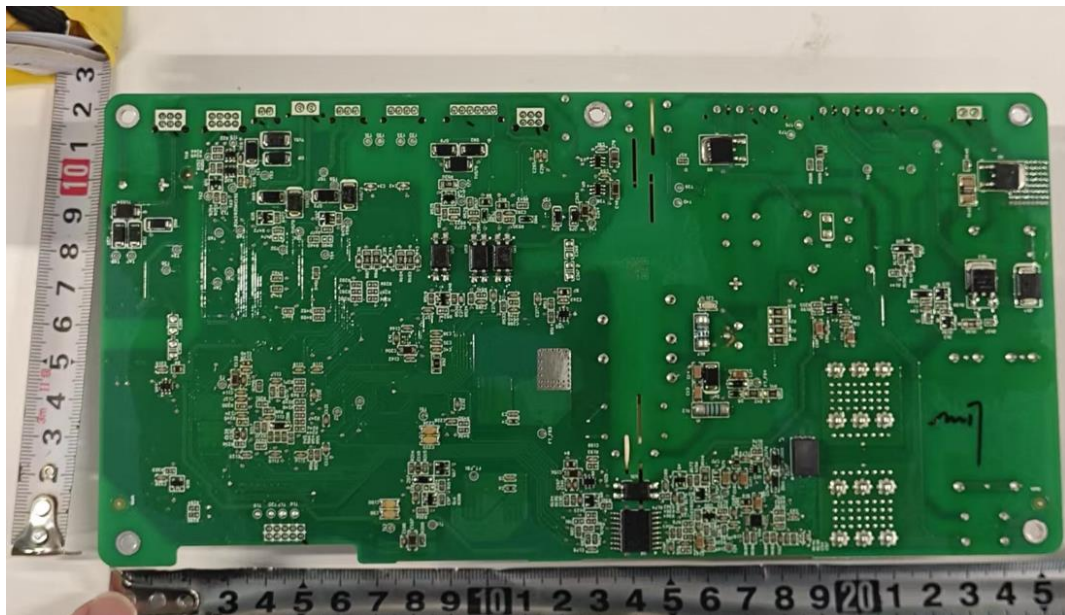
Interior view of Battery System



Interior view of Battery System



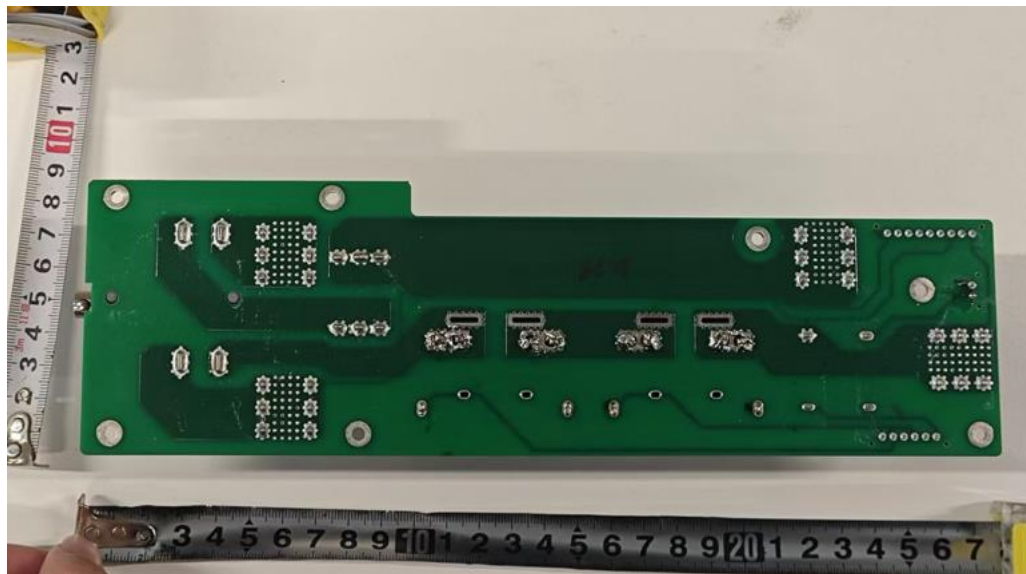
Picture of BCU board



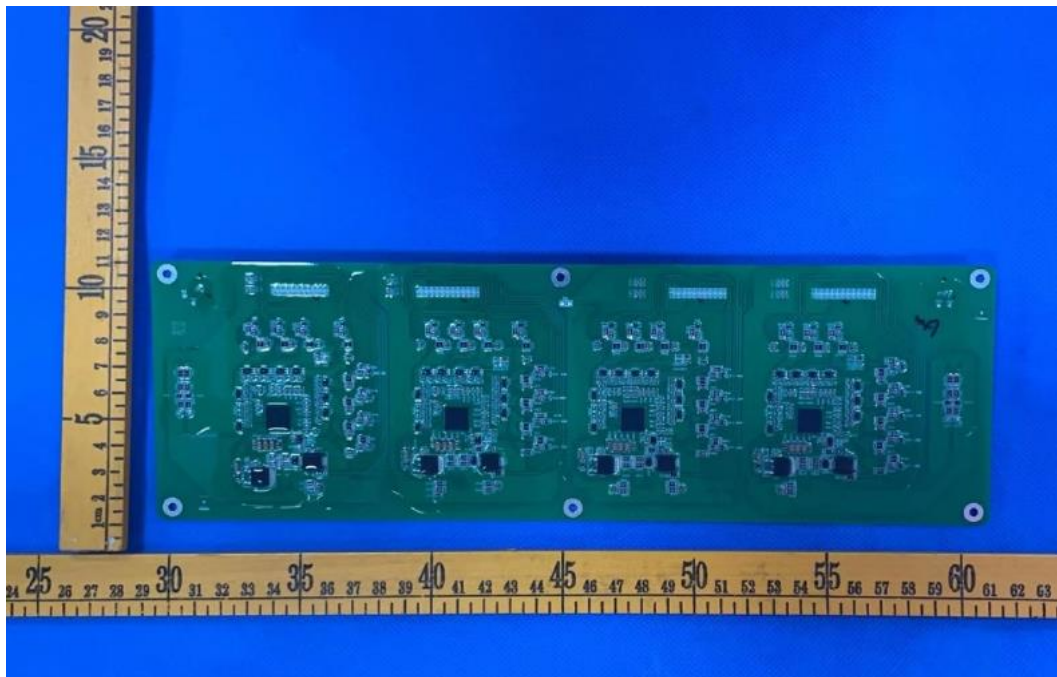
Picture of BCU board



Picture of IVU board



Picture of IVU board



Picture of BMU board



Picture of BMU board

Annex No, 2

Equipment list

No,	Equipment	Internal No,	Type/characteristics	Manufacturer	Last Calibration	Due Data
1	Oscilloscope	A4089036SH	DL850	YOKOGAWA	29-May-24	28-May-25
2	Voltage probe	A4089026SH	P5200A	Tektronix	19-Dec-24	18-Dec-25
3	Current probe	A4089037SH	960 30	YOKOGAWA	24-Aug-24	23-Aug-25
4	Current probe	A4089038SH	960 30	YOKOGAWA	24-Aug-24	23-Aug-25
5	Current probe	A4089039SH	960 30	YOKOGAWA	24-Aug-24	23-Aug-25
6	AC power supply	A7040057SH	61512	Chroma	30-Jun-24	29-Jun-25
7	AC power supply	A7040077SH	MX-30	AMETEK	26-Dec-24	25-Dec-25
8	Programmable DC source	A7040058SH	62150H-1000S	Chroma	-	-
9	Programmable DC source	A7040059SH	62150H-1000S	Chroma	-	-
10	Programmable DC source	A7040069SH	62150H-1000S	Chroma	-	-
11	Programmable DC source	A7040074SH	62150H-1000S	Chroma	-	-
12	Programmable DC source	A7040075SH	62150H-1000S	Chroma	-	-
13	Programmable DC source	A7040076SH	62150H-1000S	Chroma	-	-
14	Programmable DC source	A7040070SH	62150H-1000S	Chroma	-	-
15	Power Analyzer	A1240096SH	WT3000	YOKOGAWA	24-Aug-24	23-Aug-25
16	Anti-isolating test system	A7150074SH	ACTL-380SH	qunling	-	-
17	Load cabinet	A7150083SH	WSTF-LDJ60K/300	shanghai wen shun	-	-
18	Load cabinet	A7150084SH	WSTF-LDJ45K/0385	shanghai wen shun	-	-
19	Load cabinet	A7150085SH	WSTF-LDJ45K/0385	shanghai wen shun	-	-
20	Load cabinet	A7150075SH	WSTF-RC25k/0,3D 0,001kVA-25kVA	shanghai wen shun	-	-
21	Temperature recorder	A740037SH	G820	GRAPHIEC	24-Aug-24	23-Aug-25
22	Load cabinet(for flicker)	A7150090SH	200Ω , 250V;1200W	shanghai wen shun	-	-
23	Variable resistor	A7150076SH	BX8-67	LingOu	-	-
24	walk-in chamber	D1080023SH	MHK-1872AK	TERCHY	24-Aug-24	23-Aug-25
25	temperature & humidity meter	B4200079SH	314	center	31-May-24	30-May-25