

Prüfbericht-Nr.: Test report no.:	CN260XFO 001	Auftrags-Nr.: Order no.:	P02287520 326175300	Seite 1 von 36 Page 1 of 36
Kunden-Referenz-Nr.: Client reference no.:	2719643	Auftragsdatum: Order date:	2026-02-05	
Auftraggeber: Client:	Ginlong Energy storage Co., Ltd. No.57 Jintong Road, Binhai Industrial Park, DongChen, Xiangshan, Ningbo, 315712 Zhejiang, P.R. China			
Prüfgegenstand: Test item:	Rechargeable Li-ion Battery System			
Bezeichnung / Typ-Nr.: Identification / Type no.:	FlexCore-ID-60kWh, FlexCore-ID-80kWh, FlexCore-ID-100kWh, FlexCore-ID-120kWh, FlexCore-ID-140kWh, FlexCore-ID-160kWh, FlexCore-ID-180kWh, FlexCore-ID-200kWh, FlexCore-ID-220kWh, FlexCore-ID-240kWh, FlexCore-ID-260kWh			
Auftrags-Inhalt: Order content:	Test Report			
Prüfgrundlage: Test specification:	IEC 60730-1:2022 Annex H			
Wareneingangsdatum: Date of sample receipt:	2026-02-05			
Prüfmuster-Nr.: Test sample no.:	Engineering Sample			
Prüfzeitraum: Testing period:	2026-02-05 - 2026-04-02			
Ort der Prüfung: Place of testing:	No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by: Vincent Guan		genehmigt von: authorized by: Ding Guan		
Datum: Date: 2026-04-02		Ausstellungsdatum: Issue date: 2026-04-02		
Stellung / Position:	Project Engineer	Stellung / Position:	Authorizer	
Sonstiges / Other:	N/A			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Anmerkungen
Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>



TEST REPORT IEC 60730-1 Automatic electrical controls for household and similar use Controls using software	
Report Number.:	CN260XFO 001
Date of issue	See cover page
Total number of pages	See cover page
Name of Testing Laboratory preparing the Report	See cover page
Applicant's name	See cover page
Address	See cover page
Test specification: Standard	
Test procedure.....	
Non-standard test method.....	
Test Report Form No.....	
Test Report Form(s) Originator.....	
Master TRF	
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General disclaimer: The test results presented in this report relate only to the object tested. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.	

Test Item description	See cover page	
Trade Mark	 SolisStorage	
Manufacturer	See cover page	
Model/Type reference	See cover page	
Ratings	See copy of marking label and model list	
Software module(s) and associated version(s)	MCU: STM32H563ZIT6 HW version: BCU-B30-208 BMU-B30-26-508 PDU-E10-C250-408F-E-C SW Version: 13.93.1.9	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☐ CB Testing Laboratory:		
Testing location/ address.....:		
Tested by (name, function, signature).....:		
Approved by (name, function, signature)....:		
☐ Testing procedure: CTF Stage 1:		
Testing location/ address.....:		
Tested by (name, function, signature).....:		
Approved by (name, function, signature)....:		
☐ Testing procedure: CTF Stage 2:		
Testing location/ address.....:		
Tested by (name + signature)		
Witnessed by (name, function, signature) .:		
Approved by (name, function, signature)....:		
☐ Testing procedure: CTF Stage 3:		
☐ Testing procedure: CTF Stage 4:		
Testing location/ address.....:		
Tested by (name, function, signature).....:		
Witnessed by (name, function, signature) .:		

Approved by (name, function, signature)...:		
Supervised by (name, function, signature) :		

List of Attachments (including a total number of pages in each attachment):

- Attachment 1 - Fault insert testing

Summary of compliance with National Differences (List of countries addressed):

- N/A

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.



SolisStorage

Product Name: Rechargeable Li-ion Battery System

Charge Temperature: - 0~55°C

Discharge Temperature: - 20~55°C

Ingress Protection: IP20

Protective Class: ClassII

Rated Capacity: 314Ah

Auxiliary Voltage/Current/Frequency: AC220V/2.7A/50Hz

Max Short Circuit Current/Time: 3.0kA/40ms

PD: II

Model / N / Energy / Max.Operating Power/Nominal Voltage/Voltage Range/Battery Designation

☐ FlexCore-ID-60kWh / 3P / 60kWh / 30kW / 192V / 150-216V / IfpPT3/LTS/209/(1P20S)3SJE/-20+50/95

☐ FlexCore-ID-80kWh / 4P / 80kWh / 40kW / 256V / 200-288V / IfpPT3/LTS/209/(1P20S)4SJE/-20+50/95

☐ FlexCore-ID-100kWh / 5P / 100kWh / 50kW / 320V / 250-360V / IfpPT3/LTS/209/(1P20S)5SJE/-20+50/95

☐ FlexCore-ID-120kWh / 6P / 120kWh / 60kW / 384V / 300-432V / IfpPT3/LTS/209/(1P20S)6SJE/-20+50/95

☐ FlexCore-ID-140kWh / 7P / 140kWh / 70kW / 448V / 350-504V / IfpPT3/LTS/209/(1P20S)7SJE/-20+50/95

☐ FlexCore-ID-160kWh / 8P / 160kWh / 80kW / 512V / 400-576V / IfpPT3/LTS/209/(1P20S)8SJE/-20+50/95

☐ FlexCore-ID-180kWh / 9P / 180kWh / 90kW / 576V / 450-648V / IfpPT3/LTS/209/(1P20S)9SJE/-20+50/95

☐ FlexCore-ID-200kWh / 10P / 200kWh / 100kW / 640V / 500-720V / IfpPT3/LTS/209/(1P20S)10SJE/-20+50/95

☐ FlexCore-ID-220kWh / 11P / 220kWh / 110kW / 704V / 550-792V / IfpPT3/LTS/209/(1P20S)11SJE/-20+50/95

☐ FlexCore-ID-240kWh / 12P / 240kWh / 120kW / 768V / 600-864V / IfpPT3/LTS/209/(1P20S)12SJE/-20+50/95

☐ FlexCore-ID-260kWh / 13P / 260kWh / 130kW / 832V / 650-936V / IfpPT3/LTS/209/(1P20S)13SJE/-20+50/95














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Tel:+86(0)574 6578 1806

www.solisstorage.com

Made in China

TEST ITEM PARTICULARS:	
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.....:	See cover page
Date (s) of performance of tests.....:	See cover page
GENERAL REMARKS:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. This Test Report is only applicable to controls using software. This TRF is to be used in conjunction with the IEC 60730-1, Edition 5.1 Test Report. Throughout this report a ☐ comma / ☒ point is used as the decimal separator. When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)	Zhejiang Lingchu New Energy Technology Co., Ltd. No. 101, Workshop 1, No. 2069 East Outer Ring Road, Huimin Sub-district, Jiashan, Jiaxing, 314110, Zhejiang, P.R. China
GENERAL PRODUCT INFORMATION:	

Rated Capacity [Ah]	314	314
Cell Quantity	1	20
Battery structure	-	1P20S
Nominal voltage [V]	3.2	64
Rated energy [Wh]	1004.8	20096
Upper limit charging voltage [V]	4.0	72
Recommend charging/discharging power [W]	502.4	10048
Maximum charging/ discharging power [W]	1004.8	10048
Discharge cut-off voltage [V]	2.5 (T>0°C) 2.0 (T≤0°C)	58
Temperature range for charging [°C]	0 to 65	0 to 55
Temperature range for discharging [°C]	-30 to 65	-20 to 55
Temperature threshold for protection	-	58
Overcharge protected voltage supply by battery system	-	≥3.6V /Cell
Recommend charging method by manufacturer	Charge at constant power 502.4W until the voltage reaches 3.65V	charge with 0.5P constant power to 72V or any cell reaches 3.6V, stop charging, rest for 30 min
Dimension [mm]	(71.7±1)*(173.7 ±1)*(207.2±1) T*W*H(mm) with terminal	490mm (W)×896.5mm (H)×230mm (D)
Weight [kg]	5.6±0.3	Approx.153.4kg
Ingress Protection (IP)	-	IP20
Protective Class	-	I
Cooling type	-	Air-cooling
Altitude [m]	-	4000

	Battery system	Battery system
Product	Rechargeable Li-ion Battery system	Rechargeable Li-ion Battery system
Type/model	FlexCore-ID-60kWh	FlexCore-ID-80kWh
Rated Capacity [Ah]	314	314
Cell Quantity	60	80
Battery structure	((10S)2S)3S	((10S)2S)4S
Nominal voltage [V]	192	256

Rated energy [Wh]	60288	80384
Upper limit charging voltage [V]	216	288
Recommend charging/discharging power [W]	30144	40192
Maximum charging/ discharging power [W]	30144	40192
Discharge cut-off voltage [V]	174	232
Temperature range for charging [°C]	0 to 55	0 to 55
Temperature range for discharging [°C]	-20 to 55	-20 to 55
Temperature threshold for protection	58	58
Overcharge protected voltage supply by battery system	≥3.6V /Cell	≥3.6V /Cell
Recommend charging method by manufacturer	charge with 0.5P constant power to 216V or any cell reaches 3.6V, stop charging, rest for 30 min	charge with 0.5P constant power to 288V or any cell reaches 3.6V, stop charging, rest for 30 min
Dimension [mm]	953*532*1330	953*532*1610
Weight [kg]	Approx 510	Approx 660
Ingress Protection (IP)	IP20	IP20
Protective Class	I	I
Cooling type	Air-cooling	Air-cooling
Altitude [m]	4000	4000
Notes:		

	Battery system	Battery system
Product	Rechargeable Li-ion Battery system	Rechargeable Li-ion Battery system
Type/model	FlexCore-ID-100kWh	FlexCore-ID-120kWh
Rated Capacity [Ah]	314	314
Cell Quantity	100	120
Battery structure	((10S)2S)5S	((10S)2S)6S
Nominal voltage [V]	320	384
Rated energy [Wh]	100480	120576
Upper limit charging voltage [V]	360	432
Recommend charging/discharging power [W]	50240	60288

Maximum charging/ discharging power [W]	50240	60288
Discharge cut-off voltage [V]	290	348
Temperature range for charging [°C]	0 to 55	0 to 55
Temperature range for discharging [°C]	-20 to 55	-20 to 55
Temperature threshold for protection	58	58
Overcharge protected voltage supply by battery system	≥3.6V /Cell	≥3.6V /Cell
Recommend charging method by manufacturer	charge with 0.5P constant power to 360V or any cell reaches 3.6V, stop charging, rest for 30 min	charge with 0.5P constant power to 432V or any cell reaches 3.6V, stop charging, rest for 30 min
Dimension [mm]	953*1164*1050mm	Left: 953*532*1050mm Right: 953*532*1330mm
Weight [kg]	Approx 810	Approx 960
Ingress Protection (IP)	IP20	IP20
Protective Class	I	I
Cooling type	Air-cooling	Air-cooling
Altitude [m]	4000	4000
Notes:		

	Battery system	Battery system
Product	Rechargeable Li-ion Battery system	Rechargeable Li-ion Battery system
Type/model	FlexCore-ID-140kWh	FlexCore-ID-160kWh
Rated Capacity [Ah]	314	314
Cell Quantity	140	160
Battery structure	((10S)2S)7S	((10S)2S)8S
Nominal voltage [V]	448	512
Rated energy [Wh]	140672	160768
Upper limit charging voltage [V]	504	576
Recommend charging/discharging power [W]	70336	80384
Maximum charging/ discharging power [W]	70336	80384
Discharge cut-off voltage [V]	406	464
Temperature range for charging	0 to 55	0 to 55

[°C]		
Temperature range for discharging [°C]	-20 to 55	-20 to 55
Temperature threshold for protection	58	58
Overcharge protected voltage supply by battery system	≥3.6V /Cell	≥3.6V /Cell
Recommend charging method by manufacturer	charge with 0.5P constant power to 504V or any cell reaches 3.6V, stop charging, rest for 30 min	charge with 0.5P constant power to 576V or any cell reaches 3.6V, stop charging, rest for 30 min
Dimension [mm]	953*1164*1330mm	Left: 953*532*1330mm Right: 953*532*1610mm
Weight [kg]	Approx 1110	Approx 1260
Ingress Protection (IP)	IP20	IP20
Protective Class	I	I
Cooling type	Air-cooling	Air-cooling
Altitude [m]	4000	4000
Notes:		

	Battery system	Battery system
Product	Rechargeable Li-ion Battery system	Rechargeable Li-ion Battery system
Type/model	FlexCore-ID-180kWh	FlexCore-ID-200kWh
Rated Capacity [Ah]	314	314
Cell Quantity	180	200
Battery structure	((10S)2S)9S	((10S)2S)10S
Nominal voltage [V]	576	640
Rated energy [Wh]	180864	200960
Upper limit charging voltage [V]	648	720
Recommend charging/discharging power [W]	90432	100480
Maximum charging/ discharging power [W]	90432	100480
Discharge cut-off voltage [V]	522	580
Temperature range for charging [°C]	0 to 55	0 to 55
Temperature range for discharging [°C]	-20 to 55	-20 to 55
Temperature threshold for protection	58	58

Overcharge protected voltage supply by battery system	≥3.6V /Cell	≥3.6V /Cell
Recommend charging method by manufacturer	charge with 0.5P constant power to 648V or any cell reaches 3.6V, stop charging, rest for 30 min	charge with 0.5P constant power to 720V or any cell reaches 3.6V, stop charging, rest for 30 min
Dimension [mm]	953*1164*1610mm	Left: 953*532*1050mm(one) Right: 953*1164*1330mm(two)
Weight [kg]	Approx 1410	Approx 1560
Ingress Protection (IP)	IP20	IP20
Protective Class	I	I
Cooling type	Air-cooling	Air-cooling
Altitude [m]	4000	4000
Notes:		

	Battery system	Battery system
Product	Rechargeable Li-ion Battery system	Rechargeable Li-ion Battery system
Type/model	FlexCore-ID-220kWh	FlexCore-ID-240kWh
Rated Capacity [Ah]	314	314
Cell Quantity	220	240
Battery structure	((10S)2S)11S	((10S)2S)12S
Nominal voltage [V]	704	768
Rated energy [Wh]	221056	241152
Upper limit charging voltage [V]	792	864
Recommend charging/discharging power [W]	110528	120576
Maximum charging/ discharging power [W]	110528	120576
Discharge cut-off voltage [V]	638	696
Temperature range for charging [°C]	0 to 55	0 to 55
Temperature range for discharging [°C]	-20 to 55	-20 to 55
Temperature threshold for protection	58	58
Overcharge protected voltage supply by battery system	≥3.6V /Cell	≥3.6V /Cell
Recommend charging method by manufacturer	charge with 0.5P constant power to 792V or any cell reaches 3.6V, stop charging, rest for 30 min	charge with 0.5P constant power to 864V or any cell reaches 3.6V, stop charging, rest for 30 min

	min	
Dimension [mm]	953*1796*1330mm	Left: 953*1164*1330mm(two) Right: 953*532*1610mm(one)
Weight [kg]	Approx 1710	Approx 1860
Ingress Protection (IP)	IP20	IP20
Protective Class	I	I
Cooling type	Air-cooling	Air-cooling
Altitude [m]	4000	4000
Notes:		

	Battery system	
Product	Rechargeable Li-ion Battery system	
Type/model	FlexCore-ID-260kWh	
Rated Capacity [Ah]	314	
Cell Quantity	260	
Battery structure	((10S)2S)13S	
Nominal voltage [V]	832	
Rated energy [Wh]	261248	
Upper limit charging voltage [V]	936	
Recommend charging/discharging power [W]	130624	
Maximum charging/ discharging power [W]	130624	
Discharge cut-off voltage [V]	754	
Temperature range for charging [°C]	0 to 55	
Temperature range for discharging [°C]	-20 to 55	
Temperature threshold for protection	58	
Overcharge protected voltage supply by battery system	≥3.6V /Cell	
Recommend charging method by manufacturer	charge with 0.5P constant power to 936V or any cell reaches 3.6V, stop charging, rest for 30 min	

Dimension [mm]	Left: 953*532*1330mm(one) Right: 953*1164*1610mm(two)	
Weight [kg]	Approx 2010	
Ingress Protection (IP)	IP20	
Protective Class	I	
Cooling type	Air-cooling	
Altitude [m]	4000	
Notes:		
Additional application considerations – (Considerations used to test a component) – N/A		

DESCRIPTION OF SAFETY FUNCTION(S)

	Safety function 1 – Cell Voltage Monitoring	
	Software protection	Hardware protection
Description	The voltage sampling block module ADBMS1831 periodically collects the cell voltage information and sends them to the MCU via SPI. The BMS has pre-determined thresholds in memory with CRC checks for data integrity. The MCU checks if cell voltage exceeds maximum threshold value or falls below the minimum threshold value for a set time. If either condition is met, the MCU issues a command to switch off the contactors. The final safe state is a fully de-energized system. System will stay de-energized before the fault is cleared.	-
Class	Class B	-
Input	Cell voltage	-
threshold value	3.6V for over-voltage when charging 2.9V for under-voltage when discharging	-
Response time	5s	-
Output	Contactors switch off	-

	Safety function 2 – Cell Temperature Monitoring	
	Software protection	Hardware protection
Description	The temperature sampling module ADBMS6831 periodically collects the cell temperature information and sends them to the MCU via SPI. The BMS has pre-determined thresholds in memory with CRC checks for data integrity. The MCU checks if cell temperature data exceeds maximum threshold value or falls below the minimum threshold value for a set time. If either condition is met, the MCU issues a command to switch off the contactors. The final safe state is a fully de-energized system. System will stay de-energized before the fault is cleared.	-
Class	Class B	-
Input	Cell temperature	-
threshold value	58°C for over temperature during charging 58°C for over temperature during discharging 5°C for low temperature during charging 5°C for low temperature during discharging	-
Response time	5s	-
Output	Contactors switch off	-

	Safety function 3 – Over-current monitoring	
	Software protection	Hardware protection
Description	The charging and discharging current are sampled by both shunt circuit and hall sensor, and independently communicated to the MCU via SPI and CAN. The MCU processes the received current data. When the charging/discharging current exceeds the protection threshold or an abnormality in the comparison, the MCU issues a command to switch off the contactors. The final safe state is a fully de-energized system. System will stay de-energized before the fault is cleared.	-
Class	Class B	-
Input	Charge/discharge current	-
threshold value	170A for charge current (theoretical fixed extreme current threshold) 170A for discharge current (theoretical fixed extreme current threshold) Note: The theoretical fixed extreme current value referenced above demonstrates that the charging/discharging strategy is designed to strictly adhere to the cell's maximum current limit.	-
Response time	5s	-
Output	Contactors switch off	-

IEC 60730-1 Annex H			
Clause	Requirement + Test	Result - Remark	Verdict
H.5	Information in addition to Table 1 provided:		P
	H.3 - Software sequence documentation; clause: H.9.12.2.9; method: X	Considered.	P
	H.4 - Program documentation; clause: H.9.12.2.9, H.9.12.2.11; method: X		P
	H.5 - Software fault analysis; clause: H.9.1.2, 13.1.3; method: X		P
	H.6 - Software class(es) and structure; This information is not required for class A controls; clause: H.9.12.2, H.9.12.3, H.13.2.2.1, H.13.2.3.1; method: D		P
	H.7 - Analytical measures and fault/error control techniques employed; clause: H.3.17.10 H.9.12.2.6; method: X		P
	H.8 - Software fault/error detection time(s) for controls with software Classes B or C; clause: H.2.17.10, H.11.12.2.6; method: X		P
	H.9 - Control response(s) in case of detected fault/error; clause: H.9.12.2.7; method: X		P
	H.10 – Controls subjected to a second fault analysis and declared condition as a result of the second fault; clause H.13.2.3; method: X		P
	H.11 - Fault reaction time; clause H.3.22.2, H.13.2.2.2, H.13.2.2.3, H.13.2.3.2, H.13.2.3.3, H.13.2.4.2, H.13.2.4.3; method: X		P
	H.12 - Class or classes of control function(s), clause H.13.2.2, H.13.2.3; method: X		P
	a – For controls declared as entirely class A, the requirements H.3, H.4, H.5, H.7, H.8 and H.9 of Table H.1 are exempted. For controls with software classes B or C, information shall be provided only for the safety-related segments of the software. Information on the non-safety related segments shall be sufficient to establish that they do not influence the safety-related segments.....		P

IEC 60730-1 Annex H			
Clause	Requirement + Test	Result - Remark	Verdict
	b – The software sequence shall be documented and, together with the operating sequence of table requirement 46, shall include a description of the control system philosophy, the control flow, data flow and the timings.:		P
	c - Safety-related data and safety-related segments of the software sequence, the malfunction of which could result in non-compliance with the requirements of Clause 13, 19, 24 and H.25 shall be identified. This identification shall:		P
	– Included the operating sequence		P
	– Software fault analysis was related to the hardware fault analysis in Clause H.13.2		P
	e - Programming documentation was supplied in a programming design language declared by the manufacturer		P
	f – Different software classes applied to different control functions		P
	g - Measures declared are chosen by manufacturer from the requirements of Clauses H.11.12.1.2 to H.11.12.2.4 inclusive.....		P
H.9	Constructional requirements		P
H.9.12	Controls using software		P
	Controls using software were so constructed that the software did not impair control compliance with the requirements of this standard		P
H.9.12.1	Requirements for the architecture		P
H.9.12.1.1	Control functions with software class B or C use measures to control and avoid software-related faults/errors in safety-related data and safety-related segments of the software, as detailed in H.9.12.1.2 to H.9.12.3 inclusive.	Class B considered	P
H.9.12.1.2	Structure for control functions with software class B or C		P
H.9.12.1.2.1	Control functions with software class C have one of the following structures:		N/A
	– single channel with periodic self-test and monitoring (H.3.16.7)	Class B	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– dual channel (homogenous) with comparison (H.3.16.3)		N/A
	– dual channel (diverse) with comparison (H.3.16.2)		N/A
H.9.12.1.2.2	Control functions with software class B have one of the following structures:		P
	– single channel with functional test (H.3.16.5)	Used	P
	– single channel with periodic self-test (H.3.16.6)	Used	P
	– dual channel without comparison (H.3.16.1)	Not used	N/A
H.9.12.1.3	Other structure permitted with equivalent level of safety to those in H.9.12.1.2 :		P
H.9.12.2	Measures to control faults/errors		P
H.9.12.2.1	Redundant memory with comparison provided on two areas of the same component: data stored in different formats		P
H.9.12.2.2	Software class C using dual channel structures with comparison: additional fault/error detection means		N/A
H.9.12.2.3	Software class B or C: means for recognition and control of errors in transmission to external safety-related data paths: Means took into account errors of data, addressing, transmission timing and sequence of protocol		P
H.9.12.2.4	For control with software class B or C, the manufacturer shall provide, within the control, measures to address the fault/errors in safety-related segments and data indicated in Table H.2 and declared in Table H.1, requirement H.5.		P
H.9.12.2.5	Measures others than those specified in H.9.12.2.4 are permitted if they can be shown to satisfy the requirements listed in Table H.2.		P
H.9.12.2.6	Software fault/error detection:		P
	– occur not later than declared time(s), Table H.1, requirement H.8		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– acceptability of declared time(s): evaluated during fault analysis of the control		P
H.9.12.2.7	For controls with functions, classified as Class B or C, detection of fault/error:		P
	– results in the response declared in Table H.1, requirement H.9		P
	– for Class C: independent means capable of performing this response provided		N/A
H.9.12.2.8	Class C, dual channel structure, loss of dual channel capability: deemed to be an error		N/A
H.9.12.2.9	Software referenced:		P
	– to relevant parts of the operating sequence		P
	– to the associated hardware functions		P
H.9.12.2.10	Labels used for memory locations are unique		N/A
H.9.12.2.11	Software protected from user alteration of safety-related segments and data		P
H.9.12.2.12	Software and safety-related hardware under its control is initialized to and terminates at a declared state, Table H.1, requirement H.4		P
H.9.12.3	Measures to avoid errors		P
H.9.12.3.1	For controls with software class B or C the measures shown in Figure H.1 to avoid systematic faults are applied		P
	Other methods utilized that incorporate disciplined and structured processes including design and test phases		P
H.9.12.3.2	Specification		P
H.9.12.3.2.1	Software safety requirements		P
H.9.12.3.2.1.1	The specification of the software safety requirements includes:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- A description of each safety related function to be implemented, including its response time(s): - functions related to the application including their related software classes - functions related to the detection, annunciation and management of software or hardware faults		P
	A description of interfaces between software and hardware		P
	A description of interfaces between any safety and non-safety related functions		P
H.9.12.3.2.2	Software architecture		P
H.9.12.3.2.2.1	The description of software architecture include the following aspects:		P
	Techniques and measures to control software faults/errors (refer to H.9.12.2)		P
	Interactions between hardware and software		P
	Partitioning into modules and their allocation to the specified safety functions		P
	Hierarchy and call structure of the modules (control flow)		P
	Interrupt handling		P
	Data flow and restrictions on data access		P
	Architecture and storage of data		P
	Time based dependencies of sequences and data		P
H.9.12.3.2.2.2	The architecture specification is verified against the specification of the software safety requirements by static analysis		P
H.9.12.3.2.3	Module design and coding		P
H.9.12.3.2.3.1	Software is suitably refined into modules. Software module design and coding are implemented in a way that is traceable to the software architecture and requirements. The module design specified:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– function(s)		P
	– interfaces to other modules		P
	– data		P
H.9.12.3.2.3.2	Software code is structured		P
H.9.12.3.2.3.3	Coded software is verified against the module specification, and the module specification is verified against the architecture specification by static analysis		P
H.9.12.3.2.4	Design and coding standards		P
	Program design and coding standards is used during software design and maintenance		P
	Coding standards		—
	– specified programming practice		P
	– proscribed unsafe language features		P
	– specify procedures for source code documentation		P
	– specify data naming conventions		P
H.9.12.3.3	Testing		P
H.9.12.3.3.1	Module design (software system design, software module design and coding)		P
H.9.12.3.3.1.1	A test concept with suitable test cases is defined based on the module design specification.		P
H.9.12.3.3.1.2	Each software module is tested as specified within the test concept		P
H.9.12.3.3.1.3	Test cases, test data and test results are documented		P
H.9.12.3.3.1.4	Code verification of a software module by static means includes such techniques as software inspections, walk-throughs, static analysis and formal proof		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Code verification of a software module by dynamic means includes functional testing, white-box testing and statistical testing		P
H.9.12.3.3.2	Software integration testing		P
H.9.12.3.3.2.1	A test concept with suitable test cases is defined based on the architecture design specification		P
H.9.12.3.3.2.2	The software is tested as specified within the test concept		P
H.9.12.3.3.2.3	Test cases, test data and test results are documented		P
H.9.12.3.3.3	Software validation		P
H.9.12.3.3.3.1	A validation concept with suitable test cases is defined based on the software safety requirements specification		P
H.9.12.3.3.3.2	The software is validated with reference to the requirements of the software safety requirements specification as specified within the validation concept		P
	The software is exercised by simulation or stimulation of:		P
	input signals present during normal operation		P
	anticipated occurrences		P
	undesired conditions requiring system action		P
H.9.12.3.3.3.3	Test cases, test data and test results are documented		P
H.9.12.3.4	Other Items		P
H.9.12.3.4.1	Equipment used for software design, verification and maintenance was qualified appropriately and demonstrated to be suitable for purpose in manifold applications		P
H.9.12.3.4.2	Management of software versions: All versions are uniquely identified for traceability		P
H.9.12.3.4.3	Software modification		P

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Clause	Requirement + Test	Result - Remark	Verdict
H.9.12.3.4.3.1	Software modifications are based on a modification request which details the following:		P
	the hazards which may be affected		P
	the proposed change		P
	the reasons for change		P
H.9.12.3.4.3.2	An analysis is carried out to determine the impact of the proposed modification on functional safety.		P
H.9.12.3.4.3.3	A detailed specification for the modification is generated including the necessary activities for verification and validation, such as a definition of suitable test cases		P
H.9.12.3.4.3.4	The modification is carried out as planned		P
H.9.12.3.4.3.5	The assessment of the modification is carried out based on the specified verification and validation activities.		P
H.9.12.3.4.3.6	All details of modification activities are documented		P
H.9.12.3.5	For class C control functions: One of the combinations (a–p) of analytical measures given in the columns of table H.10 is used during hardware development.....	Class B	N/A
H.9.12.4	Remotely actuated control functions		N/A
H.9.12.4.2.3.1	Communication of Safety Related Data – Transmission – Safety relevant data is transmitted authentically concerning:		N/A
	– data corruption		N/A
	– address corruption		N/A
	– wrong timing or sequence		N/A
	Data variation or corrupted data did not lead to an unsafe state		N/A
	Before transmitted data was used it was ensured that data corruption, address corruption and wrong timing or sequence are addressed using the measures as given in Annex H.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The following failure modes are addressed		—
	– permanent “auto-sending” or repetition,		N/A
	– interruption of data transfer		N/A
H.9.12.4.2.3.2	Access to data exchange		N/A
	Adequate hardware/software measures are taken to prevent unauthorized access to the control functions (class B and C; operating data, configuration parameters and/or software modules)		N/A
	Access to data exchange of class B control function or class C control function related operating data through public networks, has appropriate cryptographic techniques implemented.		N/A
H.9.12.4.2.3.3	For class B and class C software revisions the requirements of H.9.12.3 and hardware configuration management are applied and the control maintains its protective functions		N/A
H.9.12.4.5	Software Download and Installation		N/A
	Software updates provided by the manufacturer and transmitted to the control via remote communication were checked prior to its use:		N/A
	– against corruption through communication ensuring Hamming distance 3 for software class B, or Hamming distance 4 for software class C;		N/A
	– that the software version is compatible with the hardware version of the control according to the version management documentation.		N/A
	The software which performs the above mentioned checks had measures to control the fault/error conditions specified in H.9.12.2.		N/A
H.9.12.4.5.2	In case of software download via remote communication, the cryptographic techniques in H.9.12.4.6 were provided. In addition to the requirements in H.9.12.4.6, identification procedures were provided for the software packages.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The cryptographic techniques employed were part of the control, did not rely upon part of the router or similar data transmission device itself, and were performed prior to transmission.		N/A
H.9.12.4.5.3	Each update of software had provisions for authorization by the user and a version ID number which were accessible.		N/A
H.9.12.4.5.4	The installation of class B software or class C software was permitted during and after which the software installation process the control remained in compliance with the requirements of this standard.		N/A
H.9.12.4.6	Cryptographic techniques		N/A
	In cases where class B control function or class C control function related operating data, configuration parameters and/or software modules were transmitted over a public network, and/or where software updates were provided by the manufacturer via remote communication, cryptographic techniques were employed.		N/A
H.13	Fault assessment on electronic circuits		P
H.13.2	Protection against internal faults to ensure functional safety		P
H.13.2.1	Design and construction requirements		P
H.13.2.1.1	Fault avoidance and fault tolerance		P
	Controls incorporating control functions of class B or C are designed according to H.13.2 taking into account the failure modes of Table 14 and H.9.12 for software		P
	Systematic errors are avoided		P
	Random faults are dealt with by a proper system configuration		P
	Functional analysis of the application resulted in a structured design with:		P
	– Control flow		P
	– Data flow		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– Time related functions required by the application		P
	For custom-chips special attention was made to minimize systematic errors		N/A
	System configuration was failsafe or:		P
	Incorporated components with direct safety-critical functions guarded by safeguards that cause a completely independent safety shut-down in accordance to H.9.12 software class B or C		P
	- safeguards are built into hardware and,		P
	- safeguards are supplemented by software		P
	Time slot monitoring is sensitive to both an upper and a lower limit of the time interval.		P
	Faults resulting in a shift of the upper and/or lower limit are taken into account.		P
	In a class C control function when a single fault in a primary safeguard can render the safeguard inoperative, a secondary safeguard is provided		N/A
	The reaction time of the secondary safeguard is in accordance with Clause H.13.2.3.		P
H.13.2.1.2	Documentation		P
	The documentation was based on H.9.12.3		P
H.13.2.2	Class B control function		P
H.13.2.2.1	Design and construction requirements		P
	Software complies with software class B		P
H.13.2.3	Class C control function		N/A
H.13.2.3.1	Design and construction requirements		N/A
	Software complies with software class C		N/A
H.13.2.5	Circuit and construction evaluation		P
H.13.2.5.3	Assessment		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Only the safety related software (software class B and C) as identified according to H.13.2.1.2 were subjected to further assessment		P
H.25	Electromagnetic compatibility (EMC) requirements – Immunity		P
H.25.1	General requirements		P
	Electronic controls shall be so constructed as to: - withstand the effects of mains-borne perturbations	See EMC report CN25FICV 001	P
	- electromagnetic phenomena which can occur in normal use		P
H.25.2	Particular requirements for integrated and incorporated controls with type 2 action		N/A
	For integrated and incorporated controls with type 2 action, compliance is checked by H.25.5 and any other tests of Clause H.25 which are declared in Table H.1, requirement H.1.		N/A
H.25.3	Sample requirement		P
	A separate sample, as submitted, may be used for each test. At the option of the control manufacturer, multiple tests can be performed on a single sample.		P
H.25.4	Harmonics and interharmonics including mains signalling at AC power port, low frequency immunity tests		P
	The control is subjected to mains signals in accordance with IEC 61000-4-13, test level class 2 being applicable.		P
	During the test, the control is supplied with rated voltage. The test levels for Class 2 environment according to IEC 61000-4-13:2002, IEC 61000-4-13/AMD1:2009 and IEC 61000-4-13/AMD2:2015, Tables 1 to 4 shall be applied at the AC power port of the EUT. The control is tested under the test conditions as specified in the specific control standard.		P
	The following tests are performed in accordance with IEC 61000-4-13:2002, IEC 61000-4-13/AMD1:2009 and IEC 61000-4-13/AMD2:2015, Figure 1a for Class 2 environment:		P
	- "Harmonic combination" (IEC 61000-4-13:2002, IEC 61000-4-13/AMD1:2009 and IEC 61000-4-13/AMD2:2015, 8.2.1);		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- "Meister curve" (IEC 61000-4-13:2002, IEC 61000-4-13/AMD1:2009 and IEC 61000-4-13/AMD2:2015, 8.2.4).		P
H.25.5	Voltage dips, voltage interruptions and voltage variations in the power supply network		P
	The control shall tolerate voltage dips voltage interruptions and voltage variations in the power supply network.		P
H.25.5.1	Voltage dips and interruptions		P
H.25.5.1.1	Test levels for voltage dips and interruptions		P
	The test values in Table H.13 shall be applied to all the test levels		P
H.25.5.1.2	Test procedure for voltage dips and interruptions		P
	The test apparatus and procedures shall be as described in IEC 61000-4-11. During the test, the control shall be initially operated at its rated voltage.		P
H.25.5.2	Voltage variation test		P
	- verify the immunity of the control against voltage change taking place over a short period which can occur due to a change of load or stored energy in local power networks.		P
H.25.5.2.1	Test levels for voltage variations		P
	The test values in Table H.14 shall be applied to all the test levels.		P
H.25.5.2.2	Test procedure		P
	The test apparatus and procedures shall be as described in IEC 61000-4-11.		P
H.25.6	Test of influence of voltage unbalance		P
H.25.6.1	The influence of unbalance in a three-phase voltage system on equipment sensitive to this kind of interference shall be investigated.		P
H.25.6.2	Test voltage characteristics		P

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Clause	Requirement + Test	Result - Remark	Verdict
	A power frequency three-phase voltage shall be applied to the control with the specified unbalance factor.		P
H.25.6.3	Test equipment/test generator		P
	The test arrangement shall consist of three single-phase auto-transformers, whose outputs are regulated individually, or the like.		P
H.25.6.4	Test level		P
	The test shall be carried out with an unbalance factor of 2 %.		P
H.25.7	Test of the influence of DC in AC networks		P
H.25.8	Surge immunity test		P
	The control shall tolerate voltage surges on the mains supply and relevant signal terminals.		P
	The tests as detailed in Table H.15 shall be applied.		P
	The test apparatus and procedure shall be as described in IEC 61000-4-5.		P
H.25.9	Electrical fast transient/burst immunity test		P
	The control shall tolerate fast transient bursts on the mains supply and on the signal lines.		P
	The tests shall be applied as specified in Table H.16.		P
	The test apparatus and test procedures shall be as described in IEC 61000-4-4.		P
H.25.10	Electrostatic discharge test		P
	This test is carried out in accordance with IEC 61000-4-2.		P
	The test values shall be applied to test level 3.		P
H.25.11	Radio-frequency electromagnetic field immunity		P
H.25.11.2.1	At minimum, the test levels in Table H.17 shall be applied.		P

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Clause	Requirement + Test	Result - Remark	Verdict
H.25.11.2.2	This test shall be carried out in accordance with IEC 61000-4-6.		P
H.25.11.3	The control shall tolerate high-frequency signals on the mains supply and relevant signal terminals.		P
H.25.11.3.1	Test levels for immunity to radiated electromagnetic fields shall be applied in accordance with Table H.18.		P
H.25.11.3.2	This test shall be carried out in accordance with IEC 61000-4-3.		P
H.25.12	Test of influence of supply frequency variations		P
	The test values in Table H.20 shall be applied.		P
	The test apparatus and procedures shall be as described in IEC 61000-4-28.		P
H.25.13	Power frequency magnetic field immunity test		P
H.25.13.1	The controls which are susceptible to magnetic field such as controls which use Hall-effect devices shall tolerate power-frequency magnetic fields.		P
H.25.13.2	The test levels shall be applied in accordance with Table H.21.		P
H.25.13.3	The control is supplied at rated voltage. Test equipment, test set-up and test procedure shall be in accordance with IEC 61000-4-8. The control is tested under the test conditions as specified in the relevant part 2.		P
H.25.14	Evaluation of compliance		P
H.25.14.1	After completion of all the tests of H.25.4 through H.25.13, the sample(s) shall meet the requirements of Clause 6, Clause 11 and 19.5.		P
H.25.14.2	The control shall meet the following:		P
	- the requirements of 19.14 or		P
	- the output(s) and functions shall be as declared in Table H.1, requirements H.1 and H.2.		P

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Clause	Requirement + Test	Result - Remark	Verdict
H.25.14.3	Different outputs and functions can be declared by the manufacturer after testing at test level 2, or test level 3, if relevant. Part 2 may specify particular criteria after each of these tests.		P
H.25.14.4	In cases where the compliance criteria is not specified for the control, the control shall comply with one of the following criteria:		P
	a) normal performance with no loss of protective functions and control is within specification or declared limits;		P
	b) loss of protective function within declared limits;		P
	c) loss of protective function with safety shut-down.		P

TABLE H.1 – MEASURES TO ADDRESS FAULT/ERRORS (Software Class B) Software of MCU			
Component	Fault / Error	Declared measures	Verdict
1. CPU	-	-	-
1.1 Registers	Stuck at	Functional test performed.	P
1.3 Program counter	Stuck at	Plausibility check	P
2. Interrupt handling and execution	No interrupt	Frequency monitoring	P
	Too frequent interrupt	Frequency monitoring	P
3. Clock	Wrong frequency (for quartz synchronized clock: harmonics/ sub-harmonics only)	Frequency monitoring	P
4. Memory	-	-	-
4.1 Invariable memory	All single bit faults	FLASH CRC integrity check	P
4.2 Variable memory	DC fault	March C test	P
4.3. Addressing (relevant to variable and invariable memory)	Stuck at	Coved by 4.1 and 4.2	P
5. Internal data path	-	-	-
5.1 Data	Stuck at	Coved by other items	P
5.2 Addressing	Wrong address	Coved by other items	P
6. External communication	-	-	-
6.1 Data	Hamming distance 3	CRC integrity check	P
6.2 Addressing	Wrong address		P
6.3 Timing	Wrong point in time	Scheduled transmission	P
	Wrong sequence	CRC integrity check	P
7. Input/output periphery	-	-	-
7.1 Digital I/O	Fault conditions specified in Cl.H.27	Plausibility check	P
7.2 Analog I/O	-	-	-
7.2.1 A/D and D/A-convertor	Fault conditions specified in Cl. H.27	Plausibility check	P
7.2.2 Analog multiplexer	Wrong addressing	N/A No such part	N/A

9. Custom chips e.g. ASIC, GAL, gate array	Any output outside the static and dynamic functional specification	N/A No such part	N/A
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- End of Test Report –