

System pro *E* power
According to IEC 61439-1/2

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As from November 1st, 2014, the IEC 61439-1 and IEC 61439-2 Standards are to be used for the construction and specification of low voltage assemblies (e.g.: Power Centers and secondary distribution switchboards).

IEC 61439-1 includes all the rules and general prescriptions applicable to the protective and switching assemblies in low voltage (LV assemblies). This Standard deals with the definitions and establishes service conditions, construction rules, technical characteristics and verification prescriptions for LV assemblies ($U \leq 1000$ V a.c or $U \leq 1500$ V d.c.). Part 1 cannot be used alone to specify an assembly or to determine its compliance with the Standard, but it has to be used together with the specific product Standard. For System pro E power, the specific product Standard is IEC 61439-2 that deals with "Power switchgear and controlgear assemblies" and is used for the assembly designation marking.

The whole of these two Standards identifies the design and testing requirements as regards the industrialization of the product and the tests to be performed to ensure its performances.

A significant change introduced by the IEC 61439 series has been the elimination of the distinction between type-tested assemblies (TTA) and partially type-tested assemblies (PTTA), replaced with the concept of design verification.

IEC 61439-1 defines as "design verification" a verification made on a sample of an assembly or on parts of assemblies to show that the design meets the requirements of the relevant assembly standard.

In particular, the Standard admits three different but equivalent methods to verify the compliance of the design with the Standard, namely:

- verification by laboratory testing (previously defined type-tests and now verification tests); or
- verification by comparison with a tested reference design; or
- verification by assessment (verification through design rules, appropriate safety margins, calculation etc.).

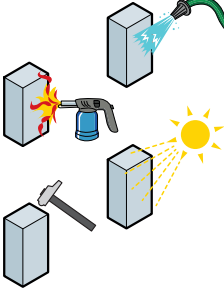
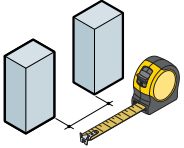
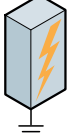

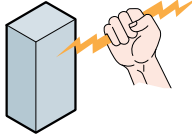
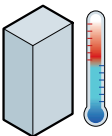
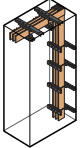
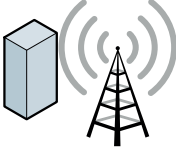
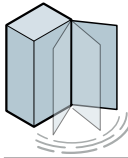
The different characteristics (e.g.: temperature-rise, short-circuit withstand strength, insulation, degree of protection, etc.) can be verified using these three methods according to Annex D of the IEC 61439-1 (see Table 1) that prescribes, for each characteristics to be verified, which of the three verification options can be used.



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Table 1 – List of design verifications to be performed.

	No.	Characteristic	Clauses or subclauses	Verification options available		
				Testing	Comparison with a reference design	Assessment
	1	Strength of material and parts:	10.2			
		Resistance to corrosion	10.2.2	YES	NO	NO
		Properties of insulating materials	10.2.3			
		Thermal stability	10.2.3.1	YES	NO	NO
		Resistance to abnormal heat and fire due to internal electric effects	10.2.3.2	YES	NO	YES
		Resistance to ultra-violet (UV) radiation	10.2.4	YES	NO	YES
		Lifting	10.2.5	YES	NO	NO
		Mechanical impact	10.2.6	YES	NO	NO
Marking	10.2.7	YES	NO	NO		
	2	Degree of protection of enclosures	10.3	YES	NO	YES
	3	Clearances	10.4	YES	NO	NO
	4	Creepage distances	10.4	YES	NO	NO
	5	Protection against electric shock and integrity of protective circuits:	10.5			
		Effective continuity between the exposed conductive parts of the assembly and protective circuit	10.5.2	YES	NO	NO
		Short-circuit withstand strength of the protective circuit	10.5.3	YES	YES	NO
	6	Incorporation of switching devices and components	10.6	NO	NO	YES
	7	Internal electrical circuits and connections	10.7	NO	NO	YES
	8	Terminals for external conductors	10.8	NO	NO	YES
	9	Dielectric properties:	10.9			
		Power-frequency withstand voltage	10.9.2	YES	NO	NO
		Impulse withstand voltage	10.9.3	YES	NO	YES
	10	Temperature-rise limits	10.10	YES	YES	YES
	11	Short-circuit withstand strength	10.11	YES	YES	NO
	12	Electromagnetic compatibility (EMC)	10.12	YES	NO	YES
	13	Mechanical operation	10.13	YES	NO	NO

For the end user, the method used is irrelevant, provided that the assembly design has been verified according to Table 1.

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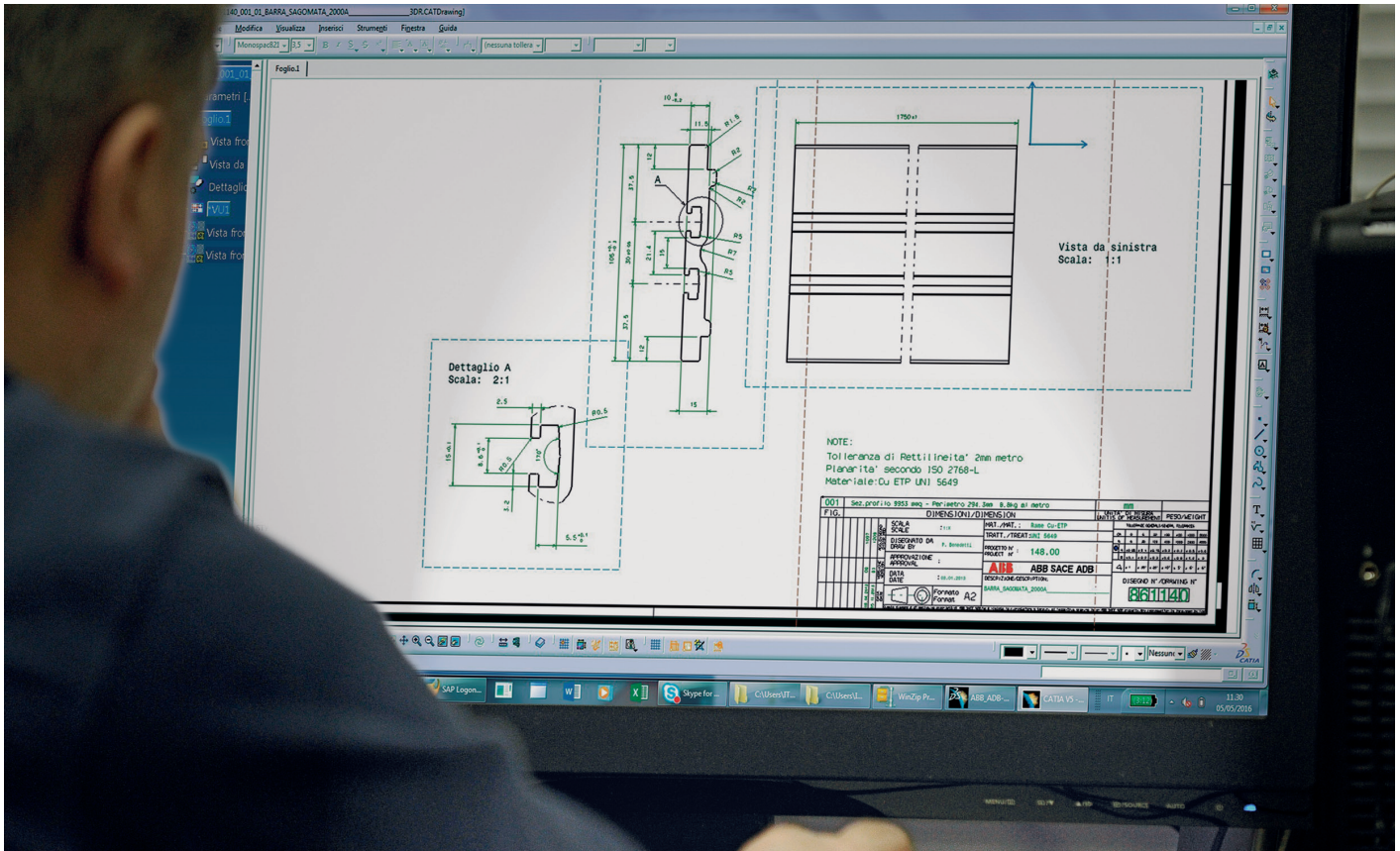
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The Standard IEC 61439-1 defines the two roles of the “Original manufacturer” and the “ASSEMBLY manufacturer”.

The “Original manufacturer” is the organization (e.g. ABB SACE) that has carried out the original design and the associated verification of an assembly, in accordance with the relevant assembly standard (IEC 61439-2 for System pro E power).

Besides, in case mounting of the assembly is carried out by others, the Original manufacturer defines and publishes the instructions necessary to produce various assemblies.

The Original manufacturer designs and sets up a wide range of assembly configurations (the assembly system¹), starting from a full and predefined range of components. The assembly system is verified by the Original manufacturer in the most onerous representative configurations. The Original manufacturer shall ensure the design verifications on the assembly system and provide the instructions for the selection of the components and for the mounting of the assembly.



¹ Assembly system: full range of mechanical and electrical components (enclosures, busbars, functional units, etc.), as defined by the original manufacturer, which can be assembled in accordance with the original manufacturer's instructions in order to produce various ASSEMBLIES.

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The “ASSEMBLY manufacturer” is the organization taking the responsibility for the completed assembly; The ASSEMBLY manufacturer may be a different organization to the original manufacturer.

The ASSEMBLY manufacturer (e.g.: the assembler/panel builder, the partner) puts together the assembly using spare parts/components and assembly kits, and, by following the instructions of the Original manufacturer, he obtains the final assembly complying with IEC 61439-2.

The ASSEMBLY manufacturer shall carry out:

- 1) selection and assembling of the components according to the instructions provided by the Original manufacturer;
- 2) design verifications, through further tests or comparisons or assessments, in case of deviations from the instructions of the Original manufacturer;
- 3) routine verifications on any assembly realized.

Hereunder the list of the routine verifications to be carried out by the “ASSEMBLY manufacturer”:

Characteristics relevant to construction:

- Degree of protection of enclosures;
- Clearances and creepage distances;
- Protection against electric shock and integrity of protective circuits;
- Installation of built-in components;
- Internal electrical circuits and connections;
- Terminals for external conductors;
- Mechanical operation.

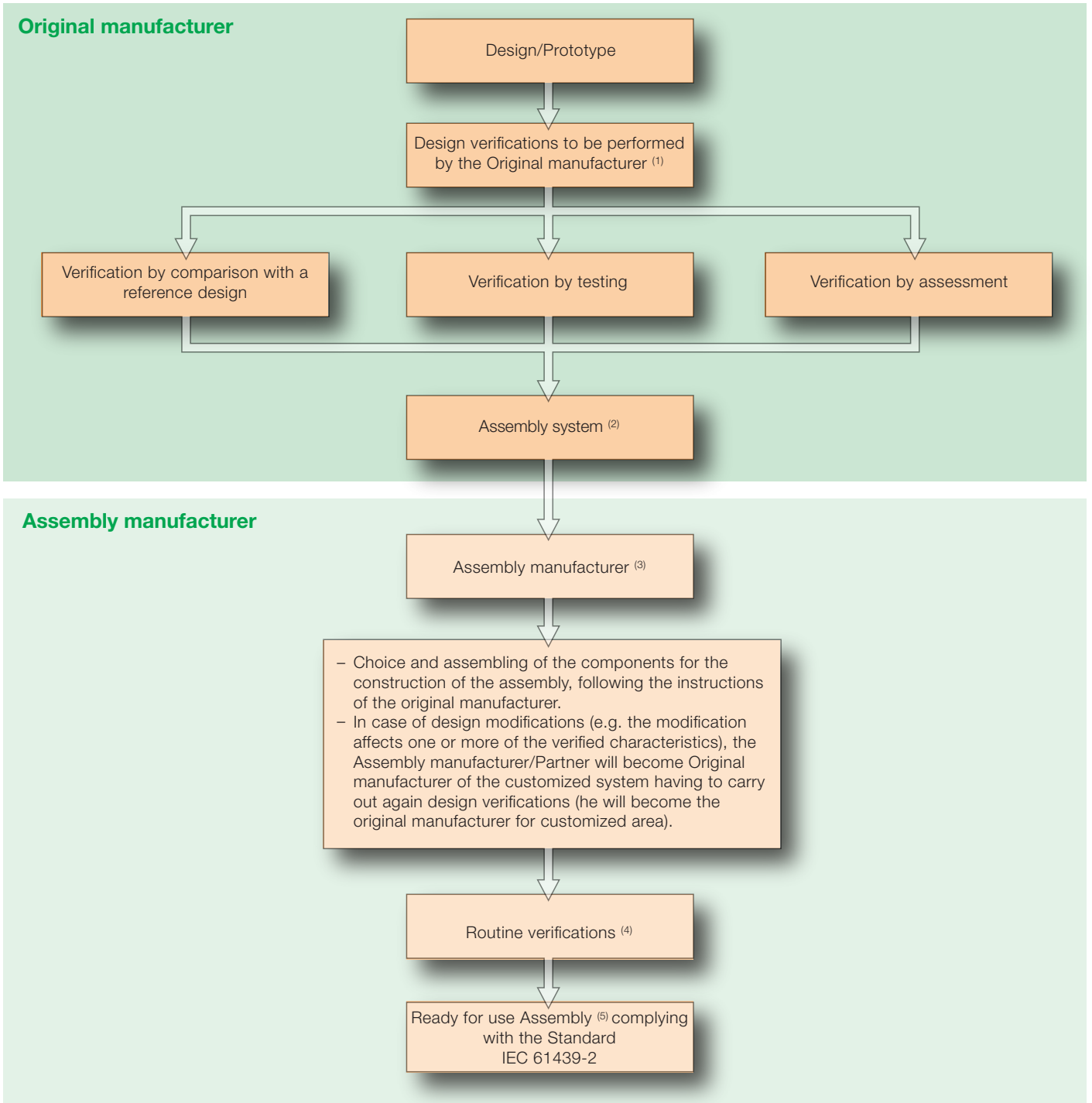
Characteristics relevant to performance:

- Dielectric properties;
- Wiring, operational performance and function

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The main changes introduced by the series of Standards IEC 61439 can be summarized in the following flowchart:



- 1) Original manufacturer: organization that has carried out the original design and the associated verification of an ASSEMBLY in accordance with the relevant ASSEMBLY standard
- 2) Assembly system: full range of mechanical and electrical components (enclosures, busbars, functional units, etc.), as defined by the original manufacturer, which can be assembled in accordance with the original manufacturer's instructions in order to produce various ASSEMBLIES
- 3) Assembly manufacturer: organization taking the responsibility for the completed ASSEMBLY; The ASSEMBLY manufacturer may be a different organization to the original manufacturer.
- 4) Routine verification: verification of each ASSEMBLY performed during and/or after manufacture to confirm whether it complies with the requirements of the relevant ASSEMBLY standard
- 5) Assembly: combination of one or more low-voltage switching devices together with associated control, measuring, signaling, protective, regulating equipment, with all the internal electrical and mechanical interconnections and structural parts

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System pro E power, the 100% compliant solution with IEC 61439-1/2

System pro E power assemblies are subject at ABB laboratories to the testing prescribed by the Standards IEC 61439-1/2.

The results of these verifications ensure the performances of System pro E power assemblies and relieve the ASSEMBLY manufacturer of the burden of carrying out further design verifications when ABB SACE structures, assembly kits, enclosures, busbars and devices are used following the selection criteria and mounting instructions of the Technical Catalogue and Instruction Handbook of System pro E power.

Reference can be made to such results (summarized in Table 2) when drawing up the declaration of conformity of the assembly.

Table 2

Characteristic	Section	Standard Rule/Rating	Verification method	Test report/Certificate No.
Resistance to corrosion	10.2.2	Severity test A for indoor assemblies/enclosures	Test	LBRS12753 LBRS13893
Thermal stability	10.2.3.1	Test for enclosures manufactured from insulating material.	Not required	Steel sheet enclosure.
Resistance to abnormal heat and fire due to internal electric effects	10.2.3.2	The Original manufacturer shall provide data on the suitability of materials from the insulating material supplier	Assessment	DATA SHEET – LET01b Declaration by the insulating material supplier verified by ACAE/LOVAG during temperature rise tests)
Resistance to ultra-violet (UV) radiation	10.2.4	Only for enclosures and external parts of assemblies for outdoor installation	Not required	Not required
Lifting	10.2.5	The maximum number of sections, allowed by the Original manufacturer to be lifted together, shall be equipped with components and/or weights to achieve a weight of 1.25 times its maximum shipping weight.	Test	IT 14.136 IT 14.097 IT 14.138 IT 15.024 IT 14.095 IT 14.094 IT 14.096
Mechanical impact	10.2.6	- IK9 (glass door) - IK10 (blind door)	Test	16-0367-01 1STC860049
Marking	10.2.7	The ASSEMBLY manufacturer shall provide each ASSEMBLY with one or more labels, marked in a durable manner and located in a place such that they are visible and legible when the ASSEMBLY is installed and in operation. Compliance is checked according to the test of 10.2.7 and by inspection.	Test	ASSEMBLY manufacturer
Degree of protection of enclosures	10.3	IP30 (without doors) IP40 (with doors) IP31/41 (with roof accessories) IP65 (with IP65 doors and panels) Verification by assessment is possible when an empty enclosure in accordance with IEC 62208 is used, and no external modification has been carried out that may result in a deterioration of the degree of protection.	Test	16-0367-01 1STC860049

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Characteristic	Section	Standard Rule/Rating	Verification method	Test report/Certificate No.
Clearances	10.4	Insulation clearances are guaranteed when the assembly instructions provided with the ABB SACE structures, busbars and devices are complied with Minimum clearances $\geq 14\text{mm}@12\text{kV}$	Test	IT 15.024 IT 15.075 1STC860049 SGABL 2014-11-13
Creepage distances	10.4	Minimum creepage distances $\geq 14\text{ mm}$ (pollution degree 3 and material group II)	Test	IT 15.024 IT 15.075 1STC860049
Effective continuity between the exposed conductive parts of the ASSEMBLY and the protective circuit	10.5.2	The exposed conductive parts are electrically connected with the main protective conductor; the maximum resistance value allowed for the protective circuit is $\leq 0.1\ \Omega$.	Test	IT 14.095 IT 14.096 IT 14.094 IT 14.093 IT 14.097 IT 14.136 IT 14.138 IT 14.137 IT 14.139 LBRP 14175/00 Earthing bolt
Short-circuit withstand strength of the protective circuit	10.5.3	According to the standard (at least 60% of three-phase short circuit current): up to 72 kA (1s).	Test	IT 14.085 IT 14.086 IT 14.087 IT 14.088 IT 14.089 IT 14.096 IT 15.024 IT 14.095 IT 14.094 IT 14.093 IT 14.097 IT 14.136 IT 14.138 IT 14.137 IT 14.139 IT 15.075 1STC860049 SGABL 2014-11-13
Incorporation of switching devices and components	10.6	Compliance with the design requirements in section 8.5 for the incorporation of switching devices and components.	Assessment by inspection	ASSEMBLY manufacturer must observe the Original Manufacturer's instructions of the assembly system and switching devices and components.
Internal electrical circuits and connections	10.7	Compliance with the design requirements in section 8.6 for internal electrical circuits and connections	Assessment by inspection	The original parts/components must be assembled according to the original manufacturer's instructions.
Terminals for external conductors	10.8	Compliance with the design requirements in section 8.8 for terminals for external conductors.	Assessment by inspection	The original parts/components must be assembled according to the original manufacturer's instructions.

Characteristic	Section	Standard Rule/Rating	Verification method	Test report/Certificate No.
Power-frequency withstand voltage	10.9.2	According to Table 8/9 of IEC 61439-1: Ui up to 1000 Vac/1500 Vdc	Test	IT 14.085 IT 14.086 IT 14.087 IT 14.088 IT 14.089 IT 14.096 IT 15.024 IT 14.095 IT 14.094 IT 14.097 IT 14.136 IT 14.138 IT 15.001 IT 15.075 1STC860049
Impulse withstand voltage	10.9.3	According to Table 10 of IEC 61439-1: Uimp = 12 kV/8 k	Test	IT 14.085 IT 14.086 IT 14.087 IT 14.096 IT 15.024 IT 14.088 IT 14.095 IT 14.094 IT 14.097 IT 14.089 IT 14.136 IT 14.138 IT 15.001 IT 15.075 SGABL 2014-11-13 1STC860049
Temperature-rise limits	10.10	Verification by test Rated current InA up to 6300 A InA max = 7000 A (main busbars)	Test	IT 14.085 IT 14.086 IT 14.087 IT 14.096 IT 15.024 IT 14.088 IT 14.095 IT 14.094 IT 14.097 IT 14.089 IT 14.136 IT 14.138 IT 14.137 IT 14.139 IT 15.001 IT 15.075 SGABL 2014-11-13 1STC860049

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Characteristic	Section	Standard Rule/Rating	Verification method	Test report/Certificate No.
Short-circuit withstand strength	10.11	Verification by test: l _{cw} line to line: up to 100 kA for 1s l _{cw} line to line: up to 120 kA for 1s (main busbars) l _{cw} line to neutral: up to 72 kA (1s) l _{pk} max: 264 kA Verification by comparison with the reference design: l _{cw} line to line: 69 kA for 3s (main busbars)	Test	IT 14.085 IT 14.086 IT 14.087 IT 14.096 IT 15.024 IT 14.088 IT 14.095 IT 14.094 IT 14.093 IT 14.097 IT 14.089 IT 14.136 IT 14.138 IT 14.137 IT 14.139 IT 15.075 SGABL 2014-11-13 1STC860049
Electromagnetic compatibility (EMC)	10.12	Ambient condition A and B No EMC test if the incorporated devices and components are in compliance with the requirements for EMC as required by the relevant product Standard and the internal installation and wiring is carried out in accordance with the devices and components manufacturer's instructions.	Verification by assessment	Not required
Mechanical operation	10.13	The movable parts of System pro <i>E</i> power (e.g. hinges for doors and panels) have been tested through 200 operating cycles. This verification test shall not be made on such devices (e.g. withdrawable circuit-breaker) of the ASSEMBLY when they have already been type-tested according to their relevant product Standard unless their mechanical operation has been modified by their mounting.	Test	16-0367-01 1STC860049

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