New IEC standard series for low-voltage switchgear and control assemblies

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Paving the path

Introduction and brief history

In January 2009, a new standard was introduced by the International Electrotechnical Commission (IEC), which governs the safety and performance of electrical switchgear and controlgear assemblies. The IEC 61439 – the new IEC standard series - is available for low-voltage switchgear and control gear assemblies.

The IEC 61439 series replaces the old IEC 60439 standard series following dissatisfaction over the uses of the series which were lacking in several areas. Since 1998, an international project group has been working on a task named the 'Radical restructuring and revision of IEC 60439 series'.

The targets set out by this task team aimed to provide:

- An aligned structure with the IEC 60947 series
- One document for general rules
- One subsidiary part for each application (product standards)
- A concept eliminating type-tested assemblies (TTA) and partially type-tested assemblies (PTTA)
- Alternative methods of verification by tests, calculations and design rules
- Critical case verification
- Framework for a series of standards to fully encompass the wide variety of assemblies
- Clarification for existing performance requirements
- Elimination of additional test house interpretations
- Introduction of equal alternative methods for testing to verify the design of assemblies
- A practical standard for the "black box" method
- Easy usage for all stakeholders

The new standard

The introduction of the IEC 61439 was intended to be a positive step forward in enabling panel and system builders to produce assemblies that meet essential quality and safety standards.

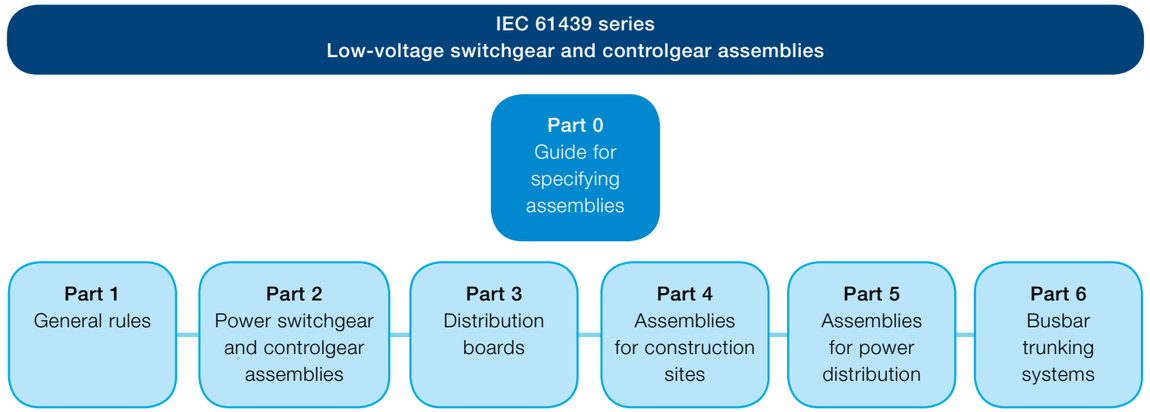
Subsidiary parts of the new standard

- IEC 61439-1: General rules
- IEC 61439-2: Power switchgear and controlgear assemblies
- IEC 61439-3: Distribution boards
- IEC 61439-4: Assemblies for construction sites
- IEC 61439-5: Assemblies for power distribution
- IEC 61439-6: Busbar trunking systems
- IEC 61439-0: Guide for specifying assemblies

New is the implementation of a part 0. This guide for specifying assemblies is a technical report and has mainly technical content. There are system and application details that need to be specified by the User to enable the Manufacturer to produce an assembly that meets the needs and expectations of the User. This part 0 identifies, from the User's perspective, those functions and characteristics that should be defined when specifying assemblies. It provides:

- explanation of the assembly characteristics and options within the IEC 61439 series;
- guidance on how to select the appropriate option and to define characteristics so as to meet specific application needs, using a functional approach; and
- assistance in the specification of assemblies.

This part 0 contains today only part 2 assemblies. Other parts and types of assemblies will be added in this part 0 later on and thus part 0 will give an overview of the total variety of assemblies and their requirements.



To provide users with a clearer and more concise reference documents, the IEC 61439 series of standards uses the same structure as others within the IEC.

Part 1 is General Rules, which refers to the specific standards that cover the various types of low-voltage switchgear and controlgear assemblies. It contains the definitions and states the service conditions, construction requirements, technical characteristics and verification requirements for low-voltage switchgear and controlgear assemblies.

Part 2 defines the specific requirements of power switchgear and controlgear assemblies, whereby the rated voltage does not exceed 1000 V a.c. or 1500 V d.c. It is the only part that has a dual role, covering power switchgear and controlgear assemblies, as well as any assembly not covered by any other product-specific part.

This part 2, or any other product-specific part, is to be read in conjunction with part 1. The provisions of the general rules dealt within part 1 are only applicable to this part 2 insofar as they are specifically cited. When this standard states "addition", "modification" or "replacement", the relevant text in part 1 is to be adapted accordingly.

The other parts are currently being developed by the IEC to cover all product-specific parts from the old standard. Parts 3, 5 and 6 are expected to be published in 2011, and Part 4 in 2012.

Changes in the numbering of subsidiary parts

With the new series, some numbers of the subsidiary parts will be changed while other part numbers remain the same.

Subsidiary part numbers that will change

Old	New	
IEC 60439-1	**IEC 61439-2**	**Power switchgear and controlgear assemblies**
IEC 60439-2	**IEC 61439-6**	**Busbar trunking systems**

Subsidiary part numbers that will remain

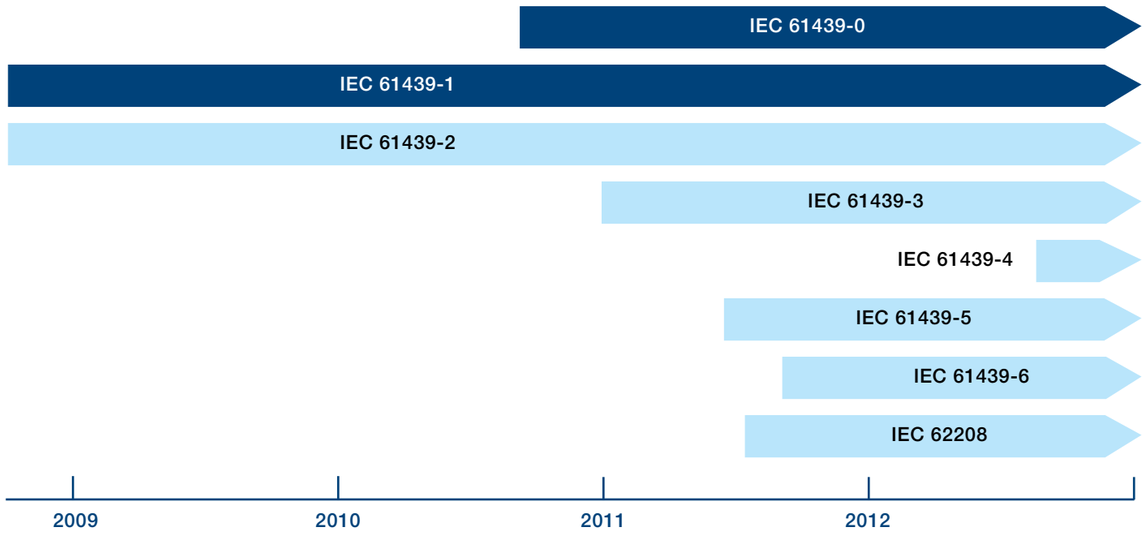
Old	New	
IEC 60439-1	**IEC 61439-1**	**General Rules**
IEC 60439-3	**IEC 61439-3**	**Distribution Boards**
IEC 60439-4	**IEC 61439-4**	**Assemblies for Construction Sites**
IEC 60439-5	**IEC 61439-5**	**Assemblies for Power Distribution in Public Networks**

Validity and publication

Publication schedule for the new IEC 61439 series

Part 0	September 2010
Part 1	Published January 2009
Part 2	Published January 2009
Part 3	December 2010
Part 4	August 2012
Part 5	May 2011
Part 6	July 2011
IEC 62208	June 2011

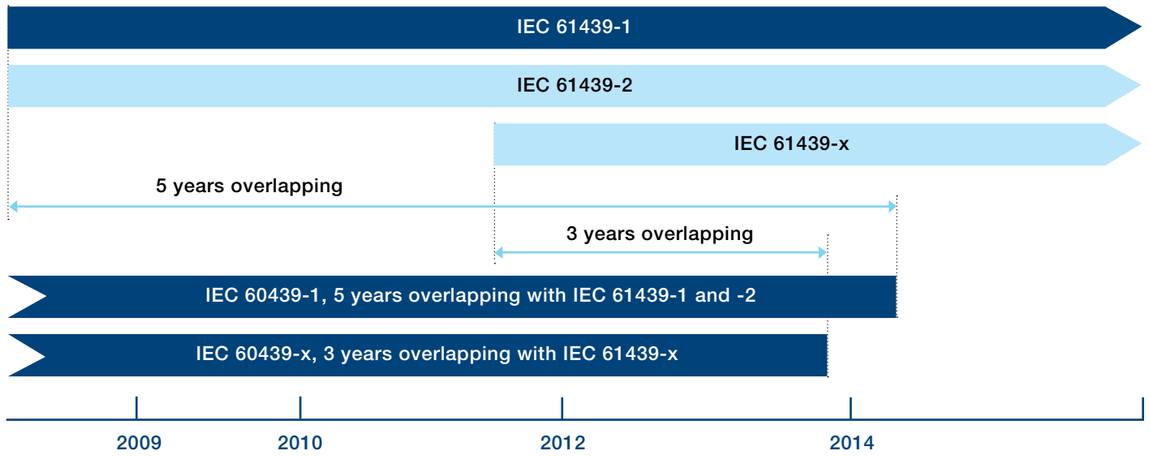
IEC 61439-1 and IEC 61439-2 were published in January 2009 to replace the old IEC 60439-1. IEC 61439-3, IEC 61439-5 and IEC 61439-6 are being developed and are expected to be published in 2011, while IEC 61439-4 is expected to be published in August 2012.



Publication schedule

Until all parts of the new IEC 61439 series are available, the current product parts of the IEC 60439 series will be applicable. In this regard, IEC 60439-1 will remain applicable in the context of the IEC 60439 series until the final product part, IEC 61439-4, has been integrated into the new series.

Overlapping period between the old and the new series



The IEC 60439-1, which will be replaced by the new IEC 61439-1 and IEC 61439-2 will have a five-year overlapping period before it is withdrawn in January 2014.

All the other new subsidiary parts of the IEC 61439 series, which will be published later than IEC 61439-1 and IEC 61439-2, will have a three-year overlapping period with its corresponding IEC 60439 subsidiary parts.

For the new part 61439-0, no overlapping period will be established as there is nothing comparable in the old IEC 60439 standard.

Note: All given dates and timelines are correct at the time of printing and is subject to change.

The old and the new: What's the difference

Several of the old standards have been removed in the new IEC 61439 standard series. The new methods of confirming design performance are practical, reflecting the different market needs and ways in which assemblies are produced.

At a glance, the differences are as follows:

IEC 60439 series	IEC 61439 series
EN 60439-1 **Type-tested and partially type-tested assemblies**	**EN 61439-2** **Power switchgear and controlgear assemblies**
Mix of different rules and demands in each part	**Clearly structured and comparable with apparatus standard IEC 60947:** **IEC 61439-1 General rules** **IEC 61439-0 Guide for specifying assemblies** **IEC 61439-2 … -6 Subsidiary parts (product standard)**
Each part is a complete part and can be used by itself	**Each subsidiary part is based on the general rules (Part 1) and includes only the specific additional rules for the actual product**
Testing each type of combination: **Partially type-tested or type-tested**	**Three alternative Methods for verification:** **Test, calculation, design rules**
Appendix E: **Agreements between Customer and Manufacturer**	**Appendix C:** **Agreements between Customer and Manufacturer, more detailed and extended**
	Technical changes: **Diversity factor, Verification of temperature rise, Mechanical characteristics, N minimum 50%, PEN minimum 50%**

Main changes

In addition to the change in the standard's whole structure, which has been aligned with its new function as a 'General Rules' standard, the main changes to the IEC 61439 compared to its predecessor are as follows:

Design verification replaces TTA/PTTA

The fundamental change between the old and new standard is the elimination of type-tested assemblies (TTA) and partially type-tested assemblies (PTTA) in favour of the new design verification approach. This new approach was adopted to reflect current market and application requirements through a controlled and consistent approach.

In the previous standard, panels which were too small to be covered by TTA or PTTA fell outside any particular standard. Under the new standard, these categories have been discarded in favour of a design 'verified assembly', where demonstration of design capability can be achieved by test and/or by other equivalent means that include appropriate safety design margins.

Alternative methods for verification

Three different, but equivalent types of verification of requirements have also been introduced, which are:

- Verification by testing
- Verification by calculation/measurement
- Verification by satisfying design rules

Technical changes

Verification of mechanical operation

- The number of mechanical operating cycles for main contacts and any other parts has been increased to 200

Verification of temperature rise

- The test methods to verify temperature rise limits have been extended and adapted
- Derivation is allowed for similar modules, with limitations being clearly listed
- Verification by calculation is limited to assemblies not exceeding 630A for single compartments and not exceeding 1600A for multiple compartments

Rated diversity factor

- The rated diversity factor is more clearly described, with each circuit requiring a defined rating

Clearance verification

- Clearance verification by design may be applied utilising a 'safety factor' of 50%

Neutral cross section

- Neutral cross section is raised to a minimum of 50% of the phase cross section. This is also valid for dimensioning PEN conductors.

Items subject to agreement between the Assembly manufacturer and user

- The items subject to agreement between the Assembly manufacturer and user have been revised and extended

Compliance with the new standard is compulsory. All assemblies must be shown to meet minimum safety and performance standards by design and routine verification. However, if reference is made to a part of the IEC 60439 series which has not been published under the new IEC 61439 standard, the superceded IEC 60439 still applies.

Design verification of the new standard

Design verification is intended to verify compliance of the design of the assembly with the requirements of the IEC 61439 standards. The tests shall be performed on a clean and new representative sample of an assembly.

Design verification shall be achieved by the publication of one or more of the following equivalent and alternative methods that are deemed appropriate: testing, calculation, physical measurement of the validation of design rules.

Routine verification is intended to detect faults in materials and workmanship and to ascertain proper functioning of the manufactured assembly. Made on each assembly, the assembly manufacturer shall determine if routine verification is carried out during and/or after manufacture. Where appropriate, the routine verification shall confirm that design verification is available.

Characteristic to be verified		Verification options available		
		Verification by testing	Verification by calculation	Verification by design rules
10.2	Strength of material and parts	Yes	No	No
10.3	Degree of protection	Yes	No	Yes
10.4	Clearances and creepage distances	Yes	Yes	Yes
10.5.2	Effective continuity between parts and PE	Yes	No	No
10.5.3	Effectiveness of the assembly for external faults	Yes	Yes	Yes
10.6	Incorporating of apparatus	No	No	Yes
10.7	Internal electrical circuits and connections	No	No	Yes
10.8	Terminals for external conductors	No	No	Yes
10.9.2	Power frequency withstand voltage	Yes	No	No
10.9.3	Impulse withstand voltage	Yes	No	Yes
10.10	Temperature rise	Yes	Yes	Yes
10.11	Short-circuit withstand strength	Yes	Yes	Yes
10.12	EMC	Yes	No	Yes
10.13	Mechanical operation	Yes	No	No

Benefiting customers worldwide

IEC 61439 identifies the original manufacturer as the one responsible for the basic design and its verification, and possibly the supply of a kit or parts such as modular systems. It then designates the manufacturer who completes the assembly and conducts the routine tests, as the assembly manufacturer.

ABB holds the distinction of being both an ‘Original Manufacturer’ and ‘Assembly Manufacturer’ in 30 locations around the world. This is possible due to its global MNS switchgear platform, and local ABB manufacturing facilities worldwide. Conformity to the new IEC 61439-1 and 61439-2 standards is ensured through its proprietary switchgear engineering tool which provides a comprehensive database with predefined engineering solutions for MNS. This database is then utilised with minimal engineering effort to provide customer specific solutions, thus meeting local specifications.

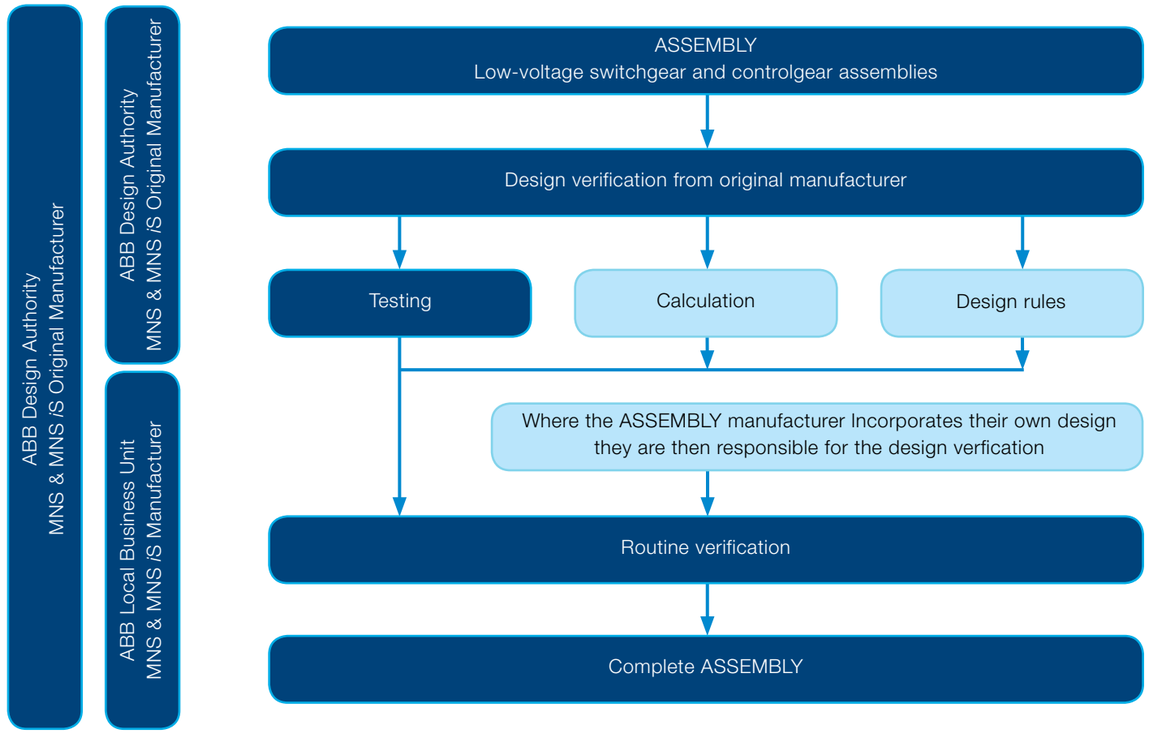
Where specific solutions are required on a global basis, these can easily be deployed throughout the ABB manufacturing facilities network.

In this regard, ABB’s unique position enables it to significantly reduce the transition time between concept and delivery for the benefit of its customers.

In the application of the new standards, IEC 60439-1 (for low voltage switchgear) has been replaced by the following two standards:

- IEC 61439-1 which is a pure ‘general rules’ standard
- IEC 61439-2 which refers to ‘power switchgear and control gear assemblies’ and is directly applicable to MNS, MNS R and MNS iS portfolios

IEC 61439 Application



Indicates ABB preferred route

ABB: Raising the bar

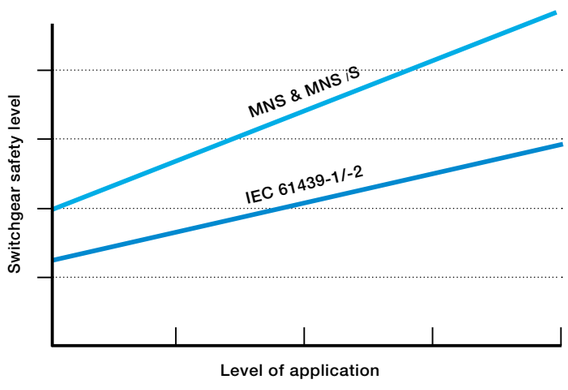
Since the inception of its MNS system in 1973, ABB has delivered over 1.4 million MNS cubicles across the globe, making it the global leader for low voltage switchgear. ABB's history in switchgear can be traced back even further, to the 1890's when the first switchgear systems were manufactured in Sweden.

Setting the benchmark in operational safety, reliability and quality

ABB draws on its vast experience in designing and manufacturing low voltage switchgear to provide the best products for its global and local customers. Its enviable track record has set the benchmark for operational safety, reliability and quality. This, together with the global service and support network established in over 30 manufacturing locations worldwide, ensures that the choice of MNS will be the right decision for ABB's customers.

ABB's dedicated engineering tool provides solutions for the following industries - oil & gas (on and offshore), chemical/ petrochemical, pharmaceutical, power stations, paper, water treatment, mining, steel, food, marine, as well as for infrastructure requirements at data centres, airports, office buildings, shopping centres, hospitals and rail.

The design of the ABB MNS system, a low voltage switchgear assembly, is verified in accordance to the IEC 61439-1 and 61439-2. The fulfilment of all instructions of the standard for low voltage switchgear and controlgear assemblies assures a basic level for personnel and system protection. With this, the ABB MNS system exceeds these levels as a standard.



ABB's Safety 'Plus' for operators and plant comes from the fulfilment of all instructions of IEC 61439-1/-2. ABB goes beyond the standards where a high degree of exposure is anticipated or specific risks have to be observed.

To ensure the highest possible degree of safety, ABB continues to conduct tests as per a continuous development programme. These tests are based on the most critical representative applications of the entire product or performance range of the switchgear with respect to the test standard.

Innovative MNS *i*S breaks technology barrier

Following a series of innovations in the last 30 years, ABB developed the first integrated Low Voltage MCC system, the MNS *i*S, in 2005. Its features include:

- An integrated MCC system configurable for all possible customer specifications. It can be provided based on conventional up to sophisticated Intelligent Motor Control System requirements
- Enables modifications/enhancement of control and protection functions at any time and at any project stage during the complete project life cycle, providing much needed flexibility for engineers, system integrators and end users
- Secures customer investments as it provides step-up possibilities with future technology developments with the same system
- Enables flexible usage of spare parts as a result of the system standardization
- Uniquely safe and simple to operate

MNS *i*S Condition Monitoring

MNS *i*S Condition Monitoring System is the first real-time condition supervision system which sets the standard for predictive maintenance. MNS *i*S Condition Monitoring System and its user interface (maintenance workplace) provide several important functions such as asset monitors, maintenance faceplates, historic data and trend displays to enable to work and interpret the switchgear fingerprint and its condition.

Its three main benefits are:

- Improvement of maintenance effectiveness
- Higher availability of MNS *i*S and the production plant
- Streamlined workflow and lower maintenance cost

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