

ERIFLEX AND THE NEW IEC 61439 SERIES



- Updates regarding low-voltage switchgear and control gear assemblies
- What is new for the Assembly Manufacturer/ Panel Builder?
- How is Pentair helping Assembly Manufacturers/ Panel Builders comply with the new requirement?

Introduction

In 2011, the International Electrotechnical Commission (IEC) published the new IEC 61439 standard series. This standard governs the safety and performance of electrical panels. The purpose of the new IEC 61439 is to harmonize, as far as practical, all of the general rules and requirements that apply to switchgear and control gear assemblies. This new standard aims to align the requirements for assemblies, promote consistency in the verification of assemblies, and eliminate the need for designers and installers to verify their work to other standards.

Specific subjects of wide interest, such as temperature rises and dielectric properties, have been gathered in Part 1 of the IEC 61439 series as general rules. More specific assembly standards are included as Part 2. Each assembly must meet both parts to comply with the standard.



Pentair Engineered Electrical & Fastening Solutions is a leading global manufacturer and marketer of superior engineered products for niche electrical, mechanical and concrete applications. These Pentair products are sold globally under a variety of market-leading brands: ERICO welded electrical connections, facility electrical protection, and rail and industrial products; CADDY fixing, fastening and support products; ERIFLEX low voltage power and grounding connections; and LENTON engineered systems for concrete reinforcement.

For more information on ERICO, CADDY, ERIFLEX and LENTON, please visit erico.pentair.com.

What is Changing?

The new IEC 61439 series is expected to have a similar structure to IEC 60439 with several new additions*:

IEC 60439

IEC 60439-1

Standard assemblies and assemblies derived from the standard

IEC 60439-2

Busbar trunking systems

IEC 60439-3

Distribution boards

IEC 60439-4

Assemblies for construction sites

IEC 60439-5

Assemblies for power distribution

New IEC 61439 Series

IEC 61439-1

General rules

IEC 61439-2

Power switchgear and controlgear assemblies

IEC 61439-6

Busbar trunking systems

IEC 61439-3

Distribution boards

IEC 61439-4

Assemblies for construction sites

IEC 61439-5

Assemblies for power distribution

*Other parts may be added

*For the time being, IEC 61439 will overlap with IEC 60439. IEC 60439 shall be completely phased out in 2014. Assemblies can be manufactured in accordance with either standard thru the phase out period.

What is Changing?

IEC 61439 removes the terms “type tested assembly” and “partially type tested assembly.” The standard replaces them with the phrase “design verification”. The new standard also replaces the type test with a 13 point design verification characteristics test. IEC 61439 also covers common questions such as manufacturing at alternative premises and substitution of alternative functional components.

One of the most significant differences between IEC 61439 and the previous standard is the introduction of ‘alternative and equivalent’ methods of design verification. While the modification initially appears to reduce the requirements for actual testing, in fact the ability to use a reference design has been replaced by three alternative methods of verification (Testing, Comparison, Assessment). The verification tests described in IEC 61439 confirm the reference design against which subsequent configurations must be verified by the alternative methods described. The introduction of these methods within the standard enables more transparent and consistent designs to be offered for specific projects.

Despite these changes, the actual requirements of most of the verification tests are very similar. Some existing testing methods that conform to IEC 60439 may fulfill the requirements of IEC 61439.**

**Note: Where tests on the ASSEMBLY have been conducted in accordance with the IEC 60439 series, and the test results fulfill the requirements of the relevant part of IEC 61439, the verification of these requirements need not be repeated.

[Extract IEC 61439.1: §10:1]

Main Definitions

Original Manufacturer:

Organization that has carried out the original design and the associated verification of an ASSEMBLY in accordance with the relevant ASSEMBLY standard. *[Extract IEC 61439.1: § 3.10.1]*

Assembly Manufacturer:

Organization taking the responsibility for the completed ASSEMBLY (e.g. panel builder using an ASSEMBLY system from an Original Manufacturer) (NOTE: The ASSEMBLY manufacturer may be a different organization to the original manufacturer) *[Extract IEC 61439.1: § 3.10.2]*

User:

Party who will specify, purchase, use and/or operate the ASSEMBLY, or someone acting on their behalf. *[Extract IEC 61439.1: § 3.10.3]*

Original Component Manufacturer:

Party who will design manufacture and sale components which can be used in the assembly. The ORIGINAL manufacturer of the Component provides the design verification according to the IEC 61439.1 (Ex: Pentair)

Component Manufacturer:

Party who will manufacture and sell components but does not provide sufficient design verification. In this case, the assembly manufacturer (Panel builder) needs to realize the design verification of the component. Manufacturer producing copy of original component Manufacturer is inside this category. The component manufacturer is not able to provide any test report or certificate.

Assembly:

(low-voltage switchgear and controlgear 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. *[Extract IEC 61439.1: § 3.1.1]*

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. *[Extract IEC 61439.1: § 3.1.2]*

Busbar:

Low-impedance conductor to which several electric circuits can be separately connected. NOTE the term "busbar" does not presuppose the geometrical shape, size or dimensions of the conductor. *[Extract IEC 61439.1: § 3.1.5]*

Distribution Busbar:

Busbar within one section which is connected to a main busbar and from which outgoing units are supplied. NOTE: Conductors that are connected between a functional unit and a busbar are not considered as a part of the distribution busbars. *[Extract IEC 61439.1: § 3.1.7]*

Functional Unit:

Part of an ASSEMBLY comprising all the electrical and mechanical elements including switching devices that contribute to the fulfillment of the same function. NOTE Conductors which are connected to a functional unit but which are external to its compartment or enclosed protected space (e.g. auxiliary cables connected to a common compartment) are not considered to form part of the functional unit. *[Extract IEC 61439.1: § 3.1.8]*

The 13 Design Verification Tests

The following tests must be performed on a sample assembly or components of an assembly to demonstrate that the design satisfies the requirements of IEC 61439. The standard allows either the original manufacturer or the assembly manufacturer to be responsible for the verification of the final assembly.

N°	Characteristic to be checked	Items	Verification option		
			Tests	Comparison	Assessment
1	Strength of materials and parts	10.2	Yes	No	-
2	Degree of protection (IP)	10.3	Yes	No	Yes
3	Clearance	10.4	Yes	No	No
4	Creepage distance	10.4	Yes	No	No
5	Electric shock protection and integrity of protection circuits	10.5	Yes	-	No
6	Integration of connection 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	Yes	No	-
10	Temperature rise	10.10	Yes	Yes	Yes
11	Short-circuit resistance	10.11	Yes	Yes	No
12	Electromagnetic compatibility	10.12	Yes	No	Yes
13	Mechanical operation	10.13	Yes	No	No

Verification Options

Verification test

Test made on a sample of an assembly or on parts of assemblies to verify that the design meets the requirements of the relevant assembly standard.

NOTE: Verification tests are equivalent to type tests. [Extract IEC 61439.1: § 3.9.1.1]

Verification comparison

Structured comparison of a proposed design for an assembly or parts of an assembly, with a reference design verified by test.

[Extract IEC 61439.1: § 3.9.1.2]

Verification assessment

Design verification of strict design rules or calculations applied to a sample of an assembly or to parts of assemblies to show that the design meets the requirements of the relevant assembly standard.

[Extract IEC 61439.1: § 3.9.1.3]

Who is Responsible for Verification?

Option 1 The Assembly Manufacturer Builds the Assembly as Designed By the Original Manufacturer

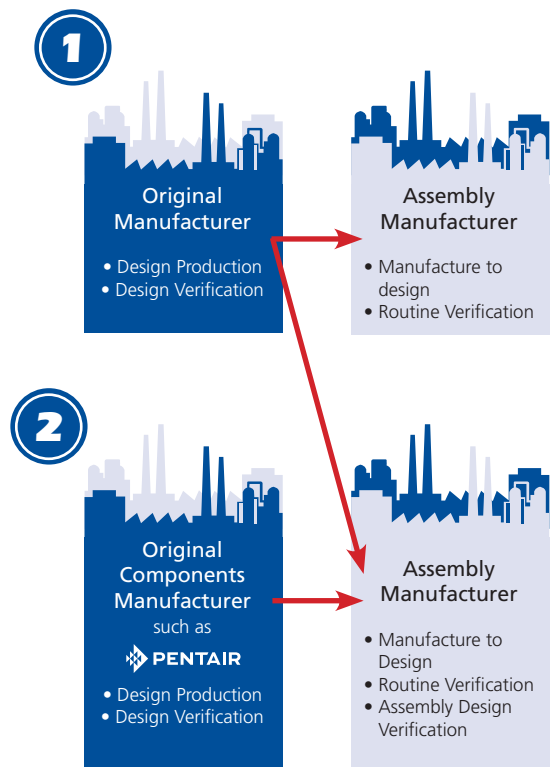
In this scenario, the assembly manufacturer uses the exact design and part specifications provided by the original manufacturer. Accordingly, the assembly manufacturer is only required to perform the second stage verification, also known as “routine verification”.

Advantage for the Assembly Manufacturer:

- No design responsibility as a sub-contractor of the Original manufacturer
- The assembly is a preassembled kit, ready to be installed

Disadvantage for the Assembly Manufacturer:

- No opportunity for valued added services versus other Assembly Manufacturers
- The only cost difference in the assembly between vendors is directly linked to the labor cost to install the products
- Only able to offer a generic solution that may not meet the needs of the end user



Option 2 The Assembly Manufacturer Customizes the Assembly According to End User Needs

In this scenario, the assembly manufacturer works directly with the end user to define the desired outcomes of a particular project. Together, the assembly manufacturer and the end user will determine the appropriate specifications for the assembly. Based on this work, the assembly manufacturer will create the assembly design. By doing specific design or by modifying an existing assembly system from an original manufacturer, the assembly manufacturer becomes the original manufacturer for the sake of the requirements of the standard and must conform to the verification requirements placed on the original manufacturer under IEC 61439. The assembly manufacturer also has to perform the second stage verification, namely “routine verification”.

Advantage for the Assembly Manufacturer:

- Ability to offer customized solutions to the end user that meets their needs
- Opportunity to offer added value services such as professional expertise in the assembly design
- Ability to differentiate from other assembly manufacturers who only offer standard solutions

Disadvantage for the Assembly Manufacturer:

- Time needed to create the technical report about the design verification**

**Note: Pentair as an original component manufacturer, can help the assembly manufacturer significantly reduce the time required to complete technical reports by providing the assembly manufacturer all needed certificates, tests reports or calculation for the IEC 61 439.1 compliance file.

*The new IEC 61439 is similar to the IEC 60439 standard in this area but more explicitly specifies the responsibilities of each party involved in an assembly build.

Component Substitutions Under IEC 61439

The new standard expressly allows assembly manufactures to replace components in an assembly so long as the characteristics of the replacement component meets or exceeds the characteristics of the replaced part.

An assembly manufacture with competent and professional skills could easily substitute original component manufacturer products certified according to this new standard, such as ERIFLEX power connection, grounding, and bonding products, for inferior products that are included in the original manufacturer's design.

Example 1:



A 3 or 4 pole distribution block 125A, Icc3: 18kA was used in a type-tested panel. The assembly manufacturer can use a substitute product if the product is equal or better. He cannot install a distribution block 125A, Icc3 12 kA, but he can install a distribution block 125A, Icc3: 30 kA. The temperature rise also needs to be taken in account. The standard covers in writing what it was logically done in the past.

[See IEC 61439.1: § 10.10.3.5]

Example 2:



A temperature rise is done by an original manufacturer for 2000 A copper bars 120x10, in a metallic enclosure 2000x2000x600mm, it is possible to substitute the enclosure if the thermal characteristics of dissipation of the enclosure is similar or better. (Some other parameter need to be checked such as IP, mechanical resistance, corrosion resistance...)

Note: Verification of the temperature-rise of a single or multiple compartment assembly with the total supply current not exceeding 1600 A may be made by calculation.

[See IEC 61439.1: § 10.10.4.3.1]

Example 3:



Busbar supports taken from an assembly verified by testing can be replaced if the alternative has been previously tested for the required mechanical strength. All ERIFLEX busbar supports have been certified and tested and can be substituted in most all assemblies. Calculation can be done using our Interactive ERIFLEX Software Available Online at www.erico.pentair.com

[See IEC 61439.1: Annex P.4.4, and P.3 Method of verification]

Example 4:



ERIFLEX FLEXIBAR is certified as a Class II / reinforced insulation conductor (IEC 61439-1 Chapter 8.4.4 Protection by total insulation) and can be used as power conductor between devices and or busbars while other conductors with only basic insulation must not be allowed to come into contact with bare live parts with different potentials.

[See IEC 61439.1: § 8.6.3] The ERIFLEX FLEXIBAR can be substituted for the original component.

Other conductors with only basic insulation may only be loaded such that an operating temperature of 80 % of the maximum permissible conductor operating temperature is not exceeded. [See IEC 61439.1: Table 4]

Example 5:



ERIFLEX Power Terminals and Power Blocks have been tested and certified according to IEC 60947-7-, and have very high short circuit current rating. These products may be substituted in most all assemblies. Assembly manufacturer must ensure that the necessary contact pressure corresponding to the current rating and the short-circuit strength of the apparatus and the circuit is maintained.

[See IEC 61439.1: § 8.8]

How Pentair helps with IEC 61439 Compliance

Our worldwide team of electrical power connection experts is committed to producing fully certified and tested high quality components. Assembly manufacturers can be confident specifying and installing Pentair products to meet the IEC 61439 standard.

To help assembly manufactures, our team provides:

- Design support
- Our proprietary interactive panel software
- Training & assistance during installation
- Early involvement of Pentair experts which results in optimal solutions for compactness, quality, cost-effectiveness, and compliance to relevant standards

Our diverse product offerings includes:

**Insulated braided conductor
(IBS, IBSB & IBSBR)**



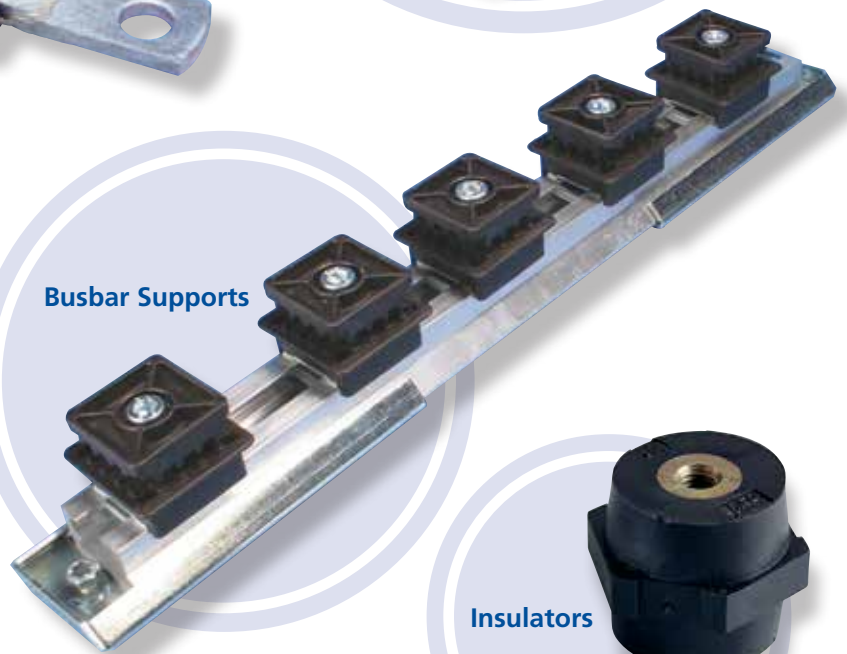
**Insulated flexible busbar
(ERIFLEX FLEXIBAR)**



**Distribution blocks
and Power Blocks**



Busbar Supports



Insulators

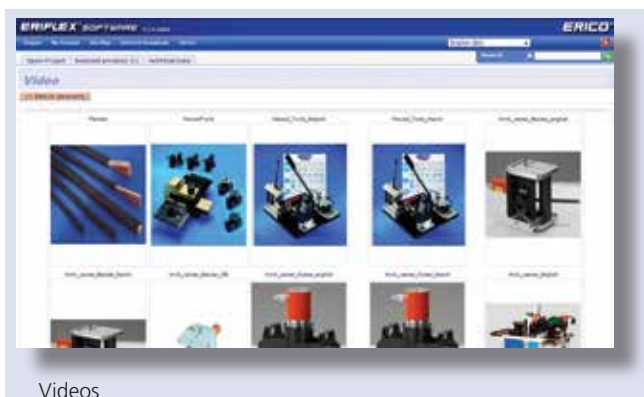
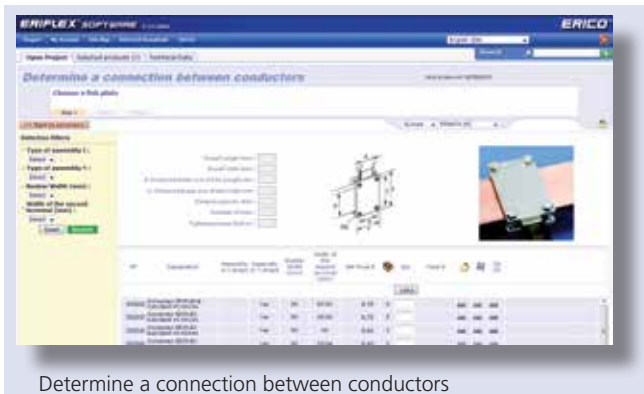
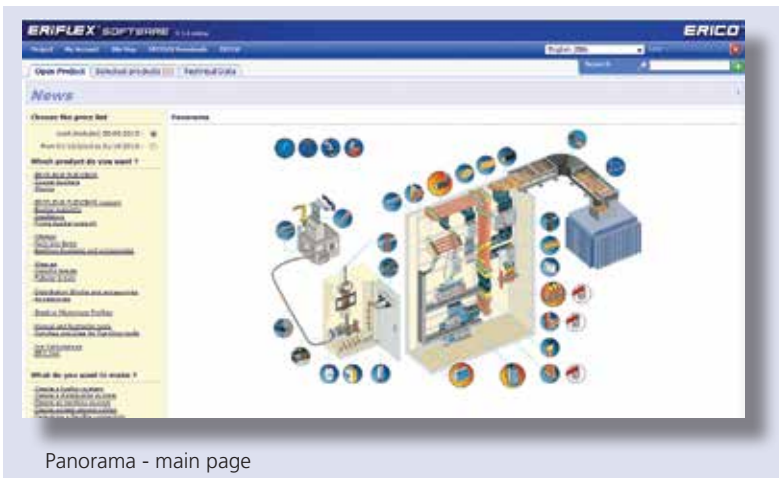


Interactive ERIFLEX Software Available Online from Pentair

With the click of a mouse, Pentair makes it easy to create a technical panel layout with all of the necessary components. Available at www.erico.pentair.com, this interactive software walks the user through the creation of a project with easy to follow instructions. The software features updated pricelists, informative product datasheets and a project installation calculator.

Whether you're interested in making a complete low voltage busbar system or a distribution kit, or if you need to determine a flexible connection with FLEXIBAR, you can trust our ERIFLEX software to help simplify the process. The software will even provide you with technical and commercial datasheets dedicated to your project.

For more information or to request your personal login information, contact your local Pentair representative or visit www.erico.pentair.com.



Summary

The new standard IEC 61439 introduces clarification on low-voltage switchgear and control gear assemblies in comparison with the current standard (IEC 60439). The structure of the new standard is easier to understand with Part 1 dedicated to broader topics and general rules and Part 2 focusing on more specific assembly standards. New definitions have also been included in the standard (for example “Original Manufacturer” and Assembly Manufacturer”) and new assembly characteristics have been specified as compulsory (e.g. rated current of the assembly).

A new “design verified assembly” concept has been specified. This new concept completely discards the categories TTA and PTTA. The compliance of an assembly can either be verified by testing or by “alternative methods” which may include calculations, measurements, and design rules. The new standard is more precise, eliminating some vague definitions and requirements contained in the previous standard.

The responsibilities of each party involved in the design, manufacturing, and installation of an assembly are clearly defined, making the job of each “stakeholder” on the electrical market easier. Under the new standard, the assembly manufacturer/panel builder has two main options: The assembly manufacturer builds the assembly as designed by the original manufacturer or the assembly manufacturer customizes the assembly according to the end user needs.

Components in an assembly can be replaced so long as the replacement component meets or exceeds the performance specifications of the part that it is replacing. Replacements parts can be from the same manufacturer or a different manufacturer so long as the requirement is met. Some potential ERIFLEX brand replacement parts include:

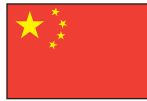
- **Distribution Blocks / Power Terminals:** As Pentair has a wide range of products with highest short circuit current resistance they can substitute most other products in every Assembly.
- **Insulators / Busbar Supports:** Because Pentair has made the design verification and provides you an online calculation tool conform the IEC 61439 series, they can be used in any assembly following the instructions on distances given by ERIFLEX Software.
- **ERIFLEX FLEXIBAR / Insulated power braid IBSB-R:** As Pentair manufactures with such high quality standards and class II insulation, any conductor can be replaced with this good, compact and flexible alternative.
- **Using products from Pentair that carry the certificate of compliance with IEC 61439.1 will allow the assembly manufacturer to more easily carry out the design verification process.**



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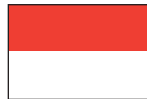
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WARNING

Pentair products shall be installed and used only as indicated in Pentair's product instruction sheets and training materials. Instruction sheets are available at www.erico.pentair.com and from your Pentair customer service representative. Improper installation, misuse, misapplication or other failure to completely follow Pentair's instructions and warnings may cause product malfunction, property damage, serious bodily injury and/or death, and void your warranty.