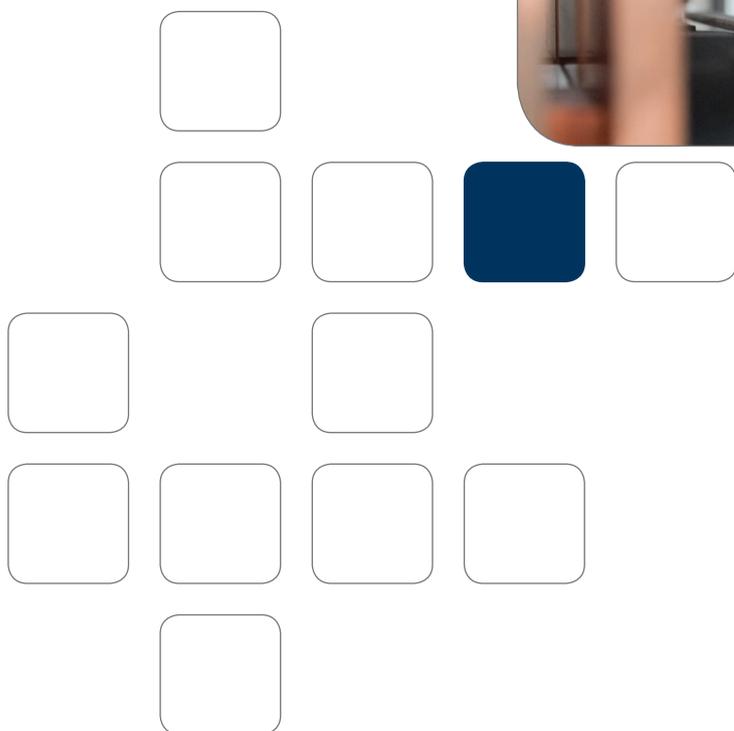


The new standard IEC 61439

Low voltage switchgear and controlgear assemblies



Normative
guide and
Hager
Solutions



IEC 61439

IEC 61439-1
General rules

IEC 61439-2
Power switchgear and
controlgear assemblies

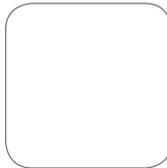
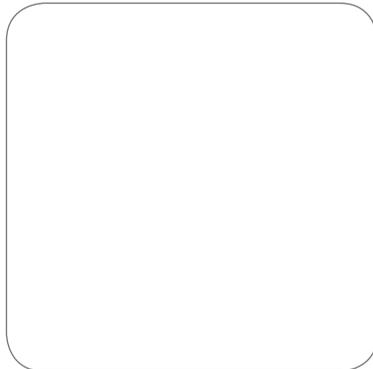
IEC 61439-3
Distribution boards

IEC 61439-4
Assemblies for construction
sites

IEC 61439-5
Assemblies for public
distribution networks

IEC 61439-6
Busbar trunking systems

IEC 61439-7
Particular applications
(e.g. charging stations...)



The first series of standards for switchgear and controlgear assembly IEC 60439 was published in 1973. Consequently, this series of standards has often been criticized and considered as difficult to understand and implement. It also had several grey areas and some elements that were subject to interpretation.

Thus, the international electrotechnical committee carried out an in-depth reform of these standards, which led to the publication of the new renumbered series IEC 61439. The standards IEC 61439-1 & 61439-2 were revised for the first time in January 2009 and have been fully applicable since November 2014. A second edition was published in August 2011.

This new version is meant for the final requirement by taking into account the constraints of all the stakeholders of the economic chain. Thus, it must lead to a wider usage and in general greater security. It is also articulated in the same manner as the series IEC 60947 governing low voltage equipment with a first part bearing the general rules and interfaces to which the other standards of the series refer.

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- quadro+ range	12
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Cap
on
performance

The implications of the new standard

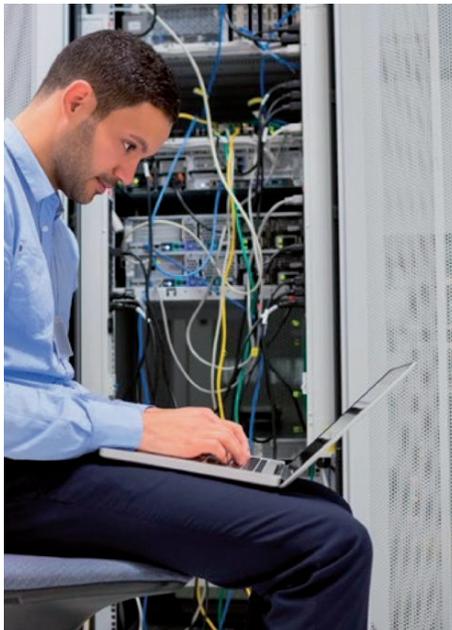
This standard aims to standardize all the rules and requirements applicable to the low voltage switchgear and controlgear assemblies (Assemblies) in order to make the requirements and checks uniform and thus avoid any verification according to other standards.

All the requirements relating to the different standards applicable to the Assemblies which may generally be considered has been collected with specific aspects such as, for example, heating, dielectric properties, etc.

In particular, it specifies the responsibilities of each party, by differentiating those of the original manufacturer from those of the assembly manufacturer.

Mains changes

- A new structure, similar to IEC 60947.
- Shared and clearly defined responsibilities.
- Removal of concept of type-tested and partially type-tested assemblies.
- Three different methods for verification of requirements but equivalent, in terms of test, calculation and design rules.
- Short-circuit performance requirements, performance when heated, dielectric properties, factor of diversity and resistance of the covered hardware in detail.





5 key points to be considered

- 1 Clarification of responsibilities and engagements of each stakeholder in the project
- 2 Clarification of requirements of the specification
- 3 Systematic verification of each assembly: 9 points to check
- 4 Identification of the Assembly through marked labels
- 5 Traceability of documents and test certificates

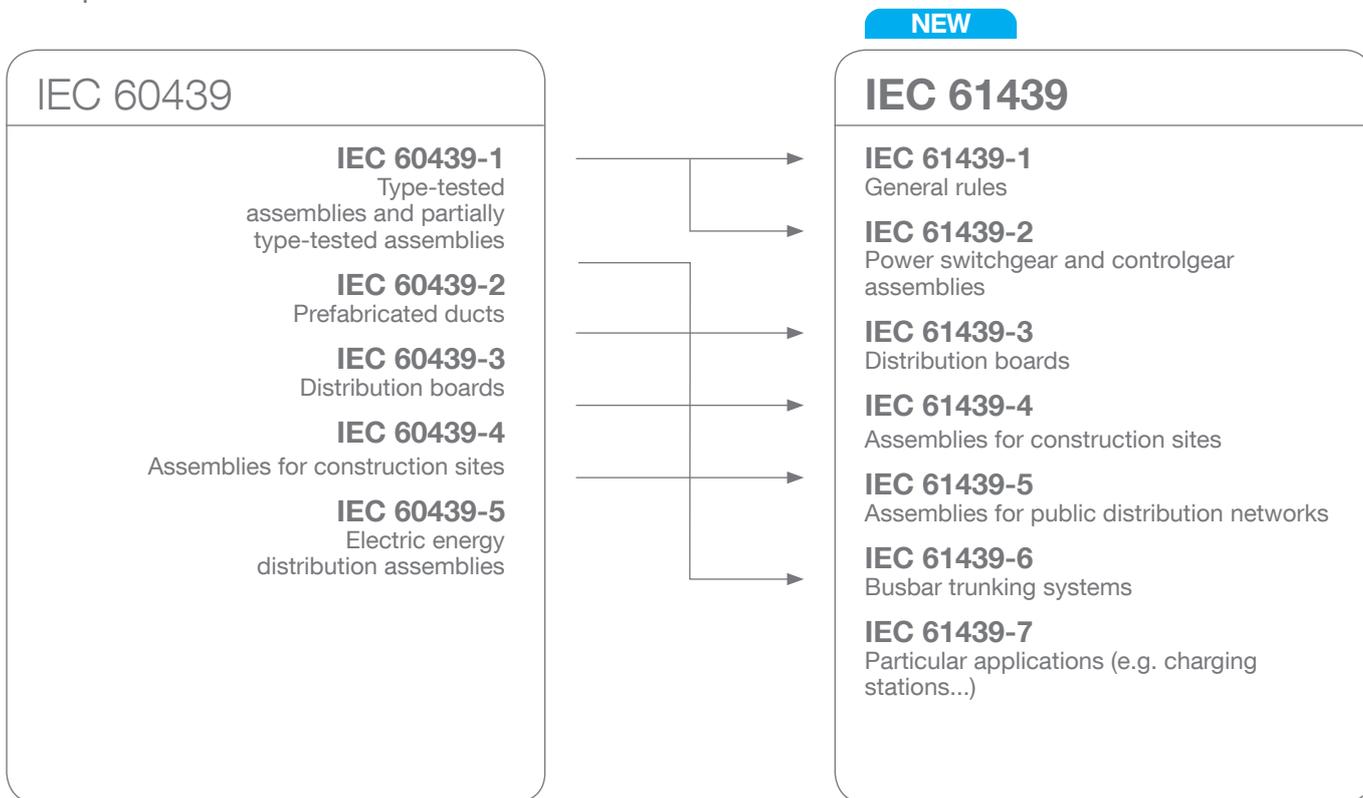
Main objectives

1. Guarantee of operation of the electric installation downstream of the assembly
2. Electric current conducting capacity
3. Resistance to short circuits
4. Electromagnetic compatibility
5. Protection of persons against electric shocks
6. Protection of persons and the assembly against fire
7. Resistance to mechanical and climatic environment
8. Protection of the assembly against power surges
9. Maintenance and modification capability
10. Ability to install on site

Revision of IEC 60439 to IEC 61439

The assembly standards IEC 60439 were published in 1973 and have been changed to IEC 61439 36 years later.

Chapters



Consideration of the stakeholders of the market

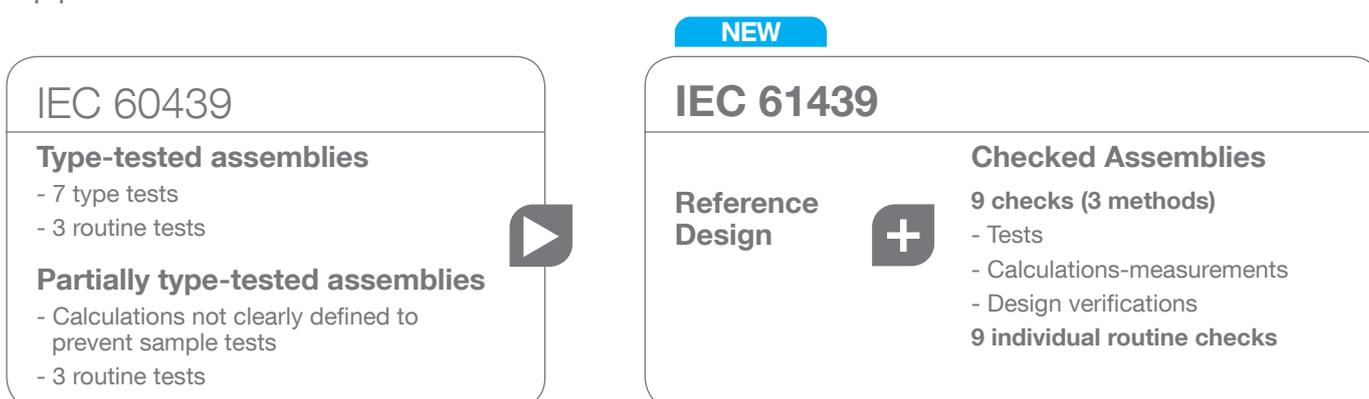
Original manufacturer

- System designer.
- Issues the system check principles.

Assembly manufacturer (panel builder)

- Manufactures the assembly according to the original manufacturer's rules.
- Becomes the original manufacturer for any change in the original system.
- Carries out routine tests of the final Assembly (tests, calculations or rules).

Approval of assemblies



Design verification

These 12 verifications are carried out by the original manufacturer according to Appendix D, Table D1 of standard IEC 61439-1. They are meant as a check for compliance of an Assembly with the requirements of the standard.

Various equivalent methods are available according to the feature to be checked. They can be carried out either:

- by tests
- by calculation/measurement
- by fulfilment of the design verifications.

No.	Features to check	Articles or paragraphs	Available verification options		
			Tests	Comparison with a reference design	Evaluation
1	Resistance of materials and parts:	10.2			
	Corrosion resistance	10.2.2	yes	no	no
	Properties of insulating materials:	10.2.3			
	Thermal stability	10.2.3.1	yes	no	no
	Resistance of insulating materials to abnormal heat and fire due to internal electric effects.	10.2.3.2	yes	no	yes
	Resistance to ultraviolet radiation (UV)	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	10.3	yes	no	yes
3	Clearance and creepage distances	10.4	yes	no	no
4	Protection against electric shock and integrity of the protection circuits:	10.5			
	Continuity between the grounds of the Assembly and the protection circuit	10.5.2	yes	no	no
	Resistance to short-circuit of the protection circuit	10.5.3	yes	yes	no
5	Integration of connection devices and components	10.6	no	no	yes
6	Internal electric circuits and connections	10.7	no	no	yes
7	External conductor terminals	10.8	no	no	yes
8	Dielectric properties:	10.9			
	Power-frequency withstand voltage	10.9.2	yes	no	no
	Impulse withstand voltage	10.9.3	yes	no	yes
9	Heating limits	10.10	yes	yes	yes
10	Resistance to short-circuits	10.11	yes	yes	no
11	Electromagnetic compatibility (CEM)	10.12	yes	no	yes
12	Mechanical operation	10.13	yes	no	no

Low voltage switchgear and controlgear assemblies in line with IEC 61439



Example of LV Switchgear and Controlgear Assembly:
"Low Voltage Main Switch Board", power supply 2 x 800 kVA

Foreword

Low voltage switchgear and controlgear assemblies ($U_n \leq 1000 \text{ V AC}$) may be used at the origin of an electrical installation with:

- Low Voltage Main switch board (transformer area) LV MSB
- Low Voltage Main Distribution Board (technical area) LV MDB
- Sub Distribution boards SDB

The clauses and rules of the standard IEC 61439 are applicable to these boards in order to guarantee the security of persons and properties, quality and reliability and durability of the electrical equipment.



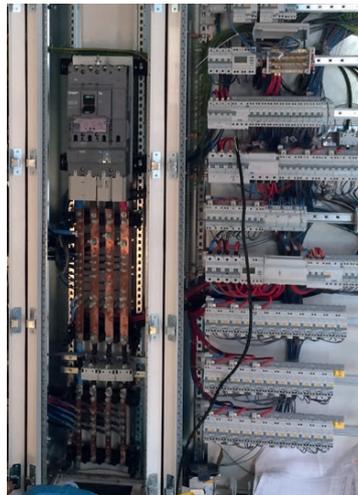
Power appliances up to: 630 A

2500 A

quadro4 IP 30 to 43

quadro5 IP 30 to 55

quadro+ IP 31 to 55



Switch boards and boxes to be assembled

- IP 30 to 43 (with or without door)
- 2 widths: 370 and 620 mm
- Height: 500 to 1850 mm
- Depth: 267 mm
- Internal modular equipment of 10 and 24 modules
- Full metal and transparent door
- 320 mm wide enclosure may be used to install the switchgear or busbars and may also serve as cable compartment with or without terminal.
- Enclosures may be connected widthwise

- Receive modular devices from 1 to 125 A and Power appliances from 160 to 630 A
- Power appliances from 160 to 630 A

Floor standing or wall mounting enclosures

- IP 30 to 55 (with or without door)
- 3 widths: 450, 700 and 900 mm
- Height: 510 to 2010 mm
- Internal modular equipment of 10, 24 and 36 modules
- Full metal and transparent door
- A mounting kit allows transforming the 900 mm wide cover into an equipment part that is 700 mm wide (24 modules) and a 200 mm wide cable compartment can accommodate a staged busbar of max. 400 A and a terminal or may serve as a cable compartment.

- Receive modular devices from 1 to 125 A and Power appliances from 160 to 630 A
- Power appliances from 160 to 630 A

Cells to be assembled (height 100 or 200 mm)

- IP 31 to 55 (with or without door)
- 4 widths: 450, 700, 900 and 1000 mm
- 3 busbar ducts or cable compartment with or without terminal of 200, 300 and 450 mm wide
- 1 height: 1900 mm
- 3 depths: 400, 600 and 800 mm (possibility to have a depth of 1000 mm by connecting 2 depths with an adapted accessory).
- Internal modular equipment of 10, 24 and 36 modules
- Full metal and transparent door
- "Main" energy distribution system (up to 2500 A), mounting in cable compartment or at the base of the cell, and "Distribution"

- Receive modular devices from 1 to 125 A and Power appliances from 160 to 2500 A
- Power appliances from 160 to 2500 A

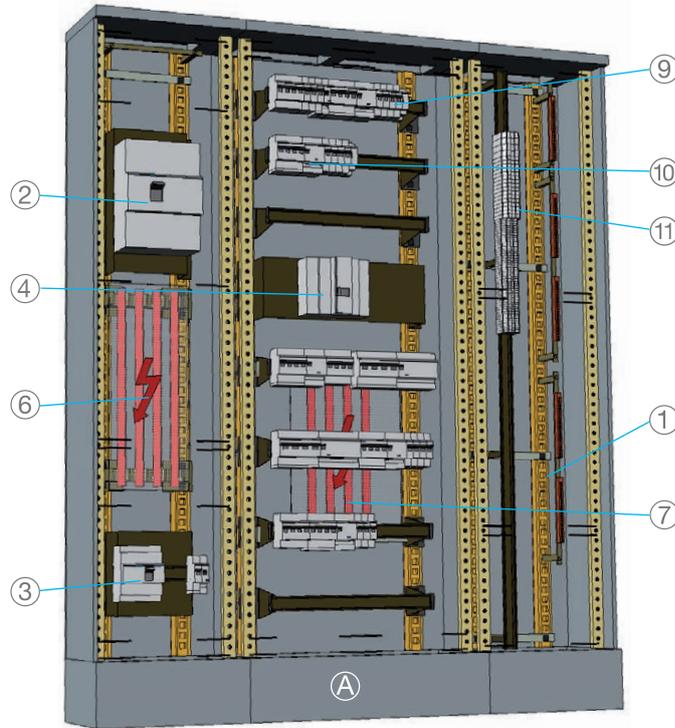
For configurations up to 630 A

The quadro4 range

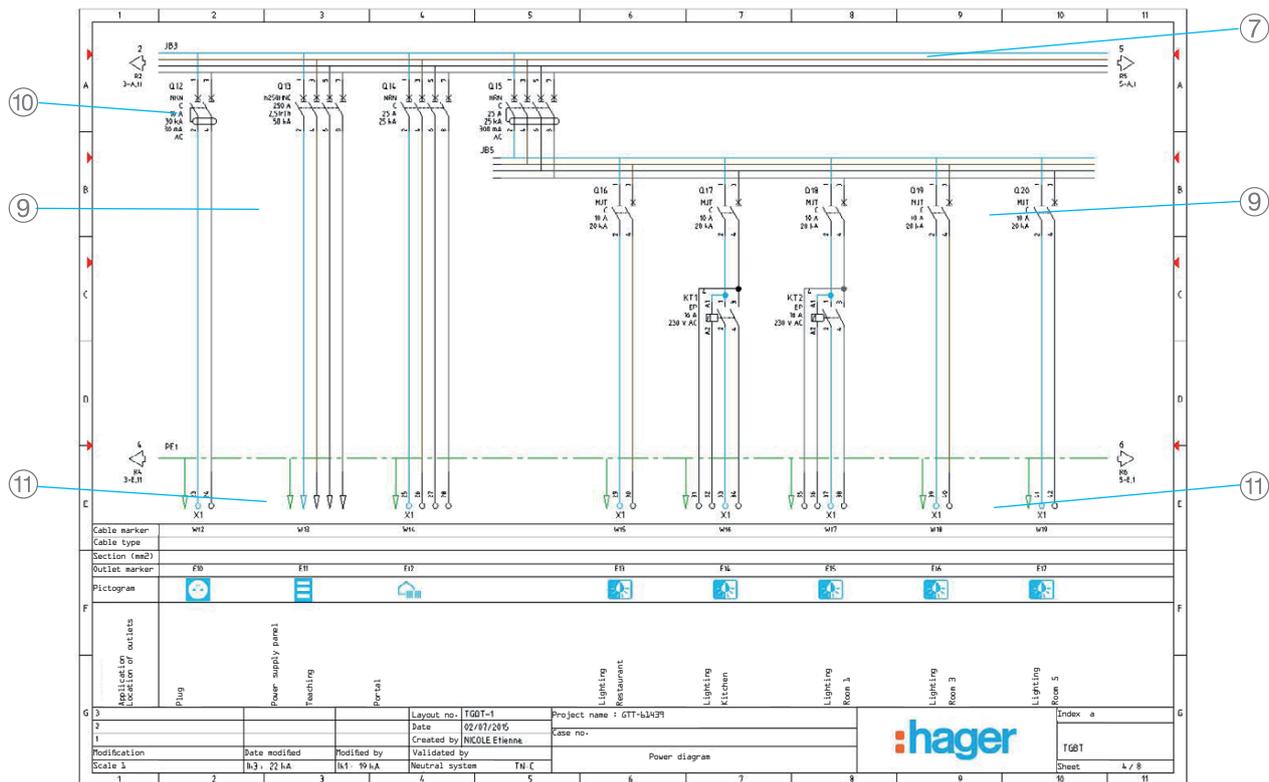
$I_n \leq 630 \text{ A}$ – $I_{cw}=35 \text{ kA}$ – IP30 to 43

Interior view of a switchgear and controlgear assembly

- ② h3 range of circuit breakers and moulded case switches
In 160 to 630 A
- ③ Vertical mounting of cable compartment
- ④ or horizontal mounting of equipment
- Energy distribution system
- ⑥ Inclined in vertical cable compartment or horizontal in equipment
- ⑦ Flat behind devices or vertical in equipment
- ⑨ Modular range of miniature circuit breakers (MCB)
1P + N, 1, 2, 3 and 4P,
Curves B, C and D,
from 1 to 125 A
- ⑩ With add-on-block
- ① Cable compartment
- ⑪ For connections up to 16 mm², cable compartment can be equipped with vertical terminal blocks (>16 mm²: direct connection on devices)



Electrical diagram



Nomenclature

No.	Description			Remarks
A	quadro4 enclosure 2 widths: 370 and 620 mm with various accessories			Distribution board to be assembled Internal height 450 to 1800 mm 2 widths: 370 and 620 mm (floor standing or wall mounting)
2	h3 range of circuit breakers and moulded case switches			Accessories: connection, control, signaling, ... Mounting kits Heights 200 to 600 mm 3 widths 250, 500 and 750 mm
3				
4				
6	Inclined busbar max. 630 A			Busbars Cu 20x5 (250 A), Cu 32x5 (400 A), Cu 30x10 (630 A)
7	Flat busbar max. 630 A			Busbars Cu 12x5 (160 A) Cu 20x5 (250 A) Cu 30x5 (400 A) Cu 30x10 (630 A)
8	Modular circuit breaker 1P + N, 2, 3 and 4P, Curves B, C and D, from 1 to 63 A			Mounting kits 2 heights 150 and 200 mm Equipment 10, 24 and 36 modules in width (250, 500 and 750 mm).
9	Modular circuit breaker 1, 2, 3 and 4P, Curves B, C and D, from 80 to 125 A			
10	Add-on-block 25 to 125 A			
11	Connecting terminals from 2.5 to 70 mm ²			Horizontal or vertical mounting on DIN rail (cable compartment of 370 mm)

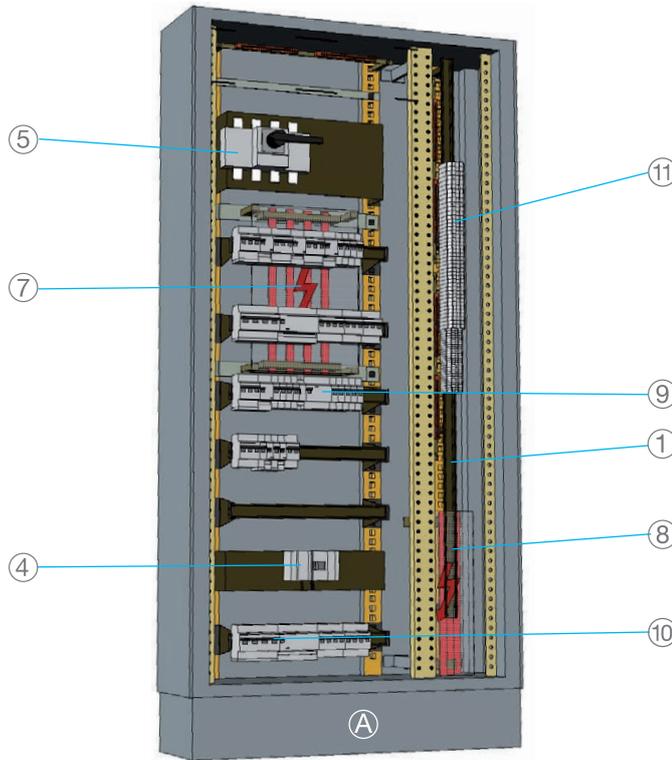
For configurations up to 630 A

The quadro5 range

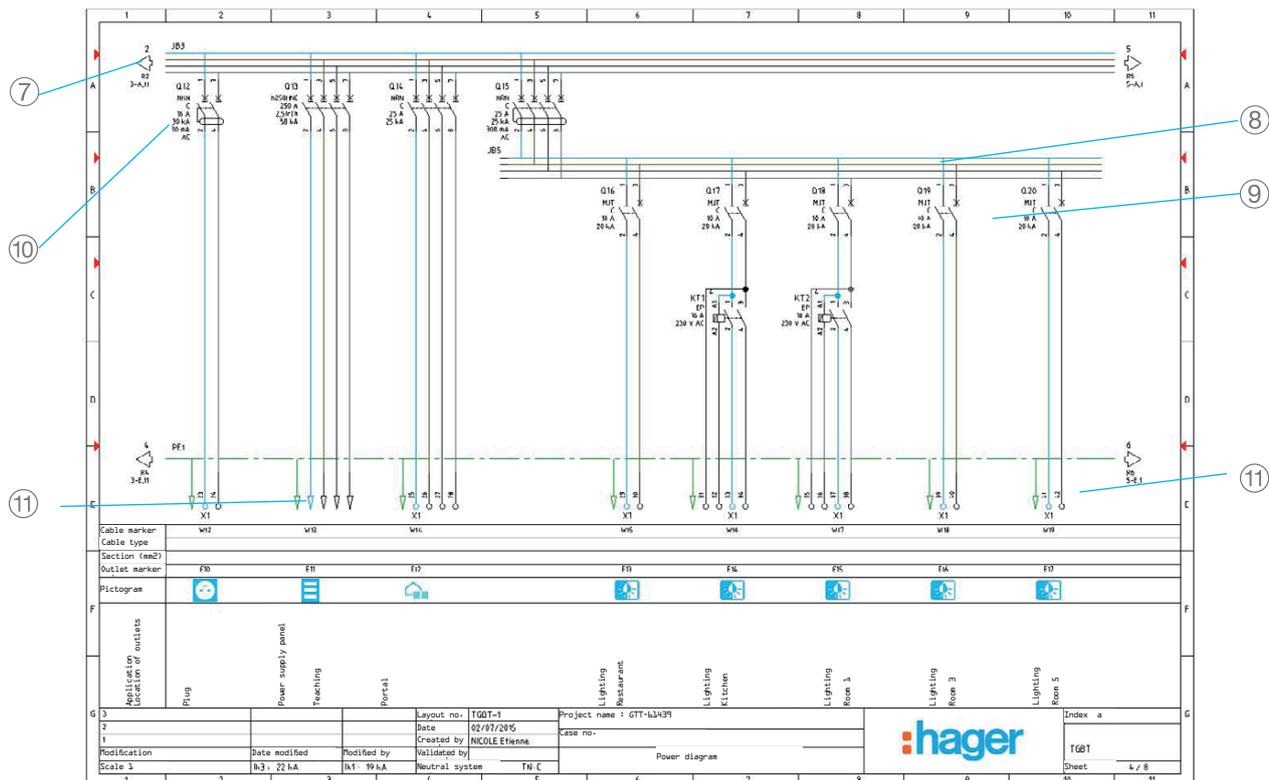
$I_n \leq 630 \text{ A}$ – $I_{cw} = 35 \text{ kA}$ – IP55 max

Internal view of a switchgear and controlgear assembly

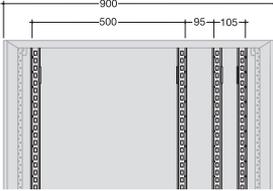
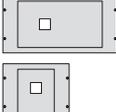
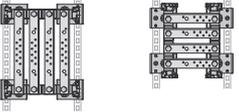
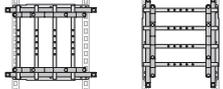
- ⑤ Load break switches range from 160 to 630 A, mounting of equipment
- ④ h3 range of circuit breakers and moulded case switches from 160 to 630 A
Horizontal equipment
Energy distribution system :
- Flat:
⑦ Behind devices
- Staged :
vertical cable compartment in 200 mm wide
- ⑧ Vertical in duct L200 mm
- ⑨ Modular circuit breaker 1P + N, 2, 3 and 4P, Curves B, C and D, from 1 to 125 A
- ⑩ With/without add-on-block
- ① Cable compartment
- ⑪ For connections up to 16 mm², cable compartment can be assembled with vertical terminal blocks (>16 mm²: direct connection on devices), and/or mounting of staged busbars
- ⑧ Max 250 A cable compartment



Electrical diagram



Nomenclature

No.	Description	Image	Diagram	Remarks
A	<p>quadro5 enclosure 3 widths: 450, 700 and 900 mm with various accessories</p> <p>Internal cable compartment</p>  <p>Possibility to create a cable compartment with 200 mm in 900 mm width enclosure</p>		<p>900 mm wide with cable compartment 200 mm wide for terminal</p> 	<p>quadro5 Wall-mounting boxes and floor-standing cabinet Height from 1710 to 2010 mm 3 widths: 450, 700 and 900 mm (with or without cable compartment 200 mm wide)</p>
5	<p>HA-switches from 160 to 630 A</p>			<p>Accessories, mounting kits</p>
4	<p>h3 range of circuit breakers and moulded case switches</p>			<p>Accessories: connection, control, signaling, ...</p> <p>Mounting kits height 200 to 600 mm and 3 widths: 250 / 500 / 750 mm</p>
7	<p>"Inclined" busbars max 630 A In cabinet: - vertical width 450 mm - horizontal width 700 mm</p>		<p>vertical horizontal</p> 	<p>Bars Cu 20 x 5 (250 A), Cu 32 x 5 (400 A), Cu 30 x 10 (630 A)</p>
	<p>"Flat" busbars max 630 A</p>			<p>Bars Cu 12 x 5 (160 A) Cu 20 x 5 (250 A) Cu 30 x 5 (400 A) Cu 30 x 10 (630 A)</p>
8	<p>"Staged" busbars, mounting in 200 mm cable compartment</p>			<p>Bars Cu 20 x 5 (250 A) Cu 30 x 5 (400 A)</p>
9	<p>Modular circuit breaker 1P + N, 2P, 3P, 4P curves B, C and D from 1 to 63 A</p>			<p>Mounting kits 2 heights 150 and 200 mm</p> <p>Equipment 10, 24 and 36 modules in width (250, 500 and 750 mm)</p>
9	<p>Modular circuit breaker 1, 2, 3 and 4P, curves B, C and D from 80 to 125 A</p>			
10	<p>Add-on-block 25 to 125 A</p>			
11	<p>Connecting terminals from 2.5 to 70 mm²</p>			<p>Horizontal or vertical mounting on DIN rail (370 mm cable compartment) Provide neutral bars</p>

For configurations up to 2500 A

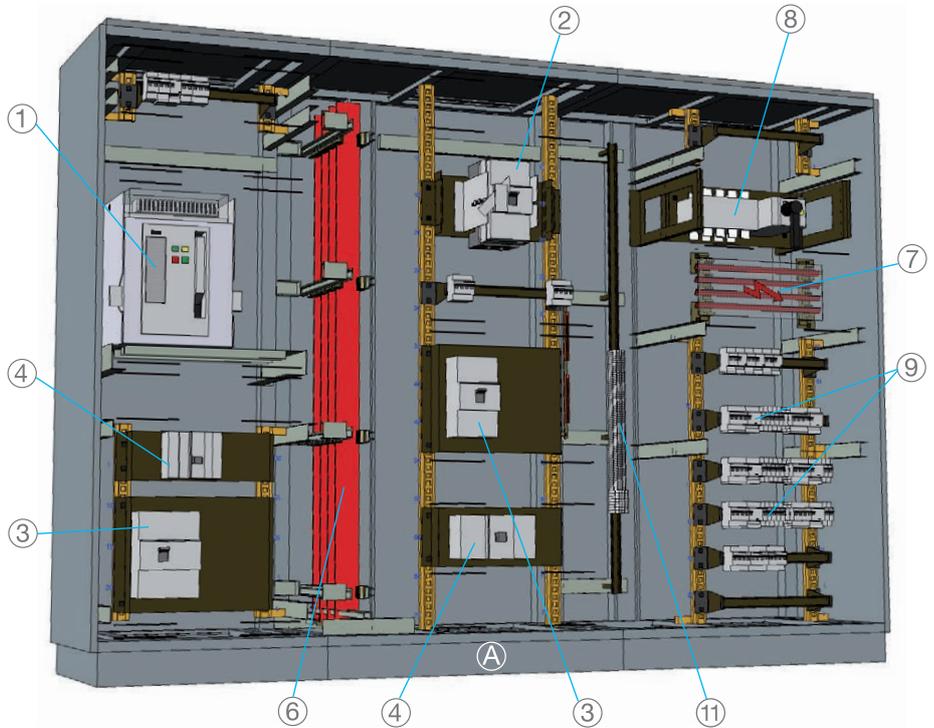
The quadro+ range

$I_n \leq 2500 \text{ A}$ – $I_{cw} = 85 \text{ kA}$ – IP55 maxi

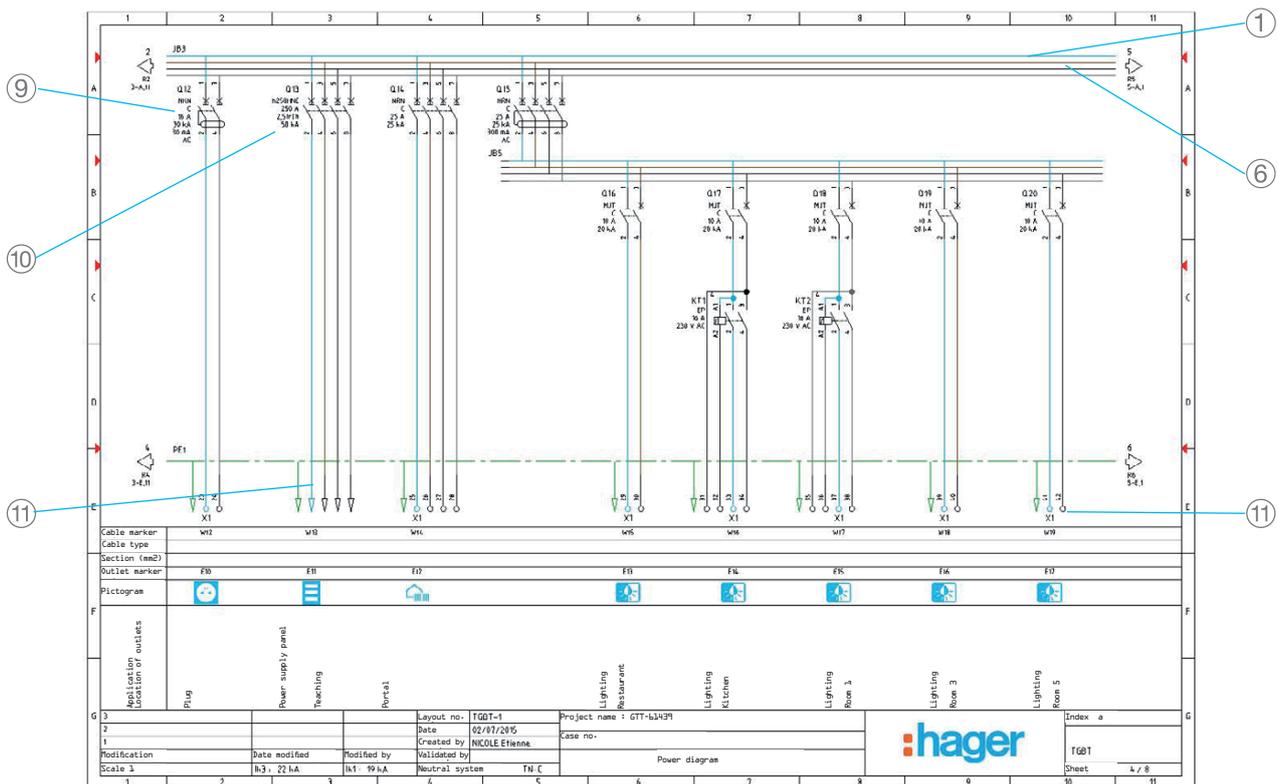
h3 range of circuit breakers and open switches from 800 to 2500 A

- ④ h3 range of circuit breakers and moulded case switches from 160 to 1600 A
- ⑥ Energy distribution system Side mounted busbars
- ⑦ Secondary busbar system from 160 to 630 A
- ⑧ Switch and changeover switch range from 16 to 1600
- ⑨ Modular circuit breaker 1Ph+N, 1, 2, 3 and 4P, Curves B, C and D, from 1 to 125 A
- ⑩ With add-on-block

Internal view of a switchgear and controlgear assembly



Electrical diagram



Nomenclature

No.	Description		Remarks	
A	<p>quadro+ Evo enclosure 4 widths: 450, 700, 900 and 1000 mm Height 1900 mm 3 depths: 400, 600 and 800 mm Various accessories for higher assembling flexibility</p>		<p>Equipment in 3 widths: 450 (10 mod.), 700 (24 mod.) and 900 mm (36 modules)</p>	
		<p>Assembled cells</p>	<p>quadro+ equipment funds</p>	
	<p>A cell is composed of: - top and bottom frame - uprights - functional uprights - side and rear panels - plinth - dividing uprights - cable compartment - various accessories</p>		<p>Busbar cable compartment and cables / terminal in 3 widths (200, 300 and 450 mm)</p>	
		<p>Internal equipment</p>		
			<p>Busbars mounted on perforated horizontal flat bars</p>	
1	<p>Open circuit breaker (removable - sectionable with locking system), electronic triggers and various accessories like: - trip coil - auxiliary contacts - motors, ...</p> <p>T1: 800 to 2000 A T2 : 2500 A</p>			<p>Mounting on 2 special kits 2 widths: 700 (T1) and 900 (T2)</p>
2	<p>h3 range of circuit breakers and moulded case switches</p>			<p>Mounting kit Height from 200 to 600 mm 3 widths: 250, 500 and 750 mm</p>
3				
4			<p>Mounting kits 3 widths: 450, 700 and 900 mm</p>	

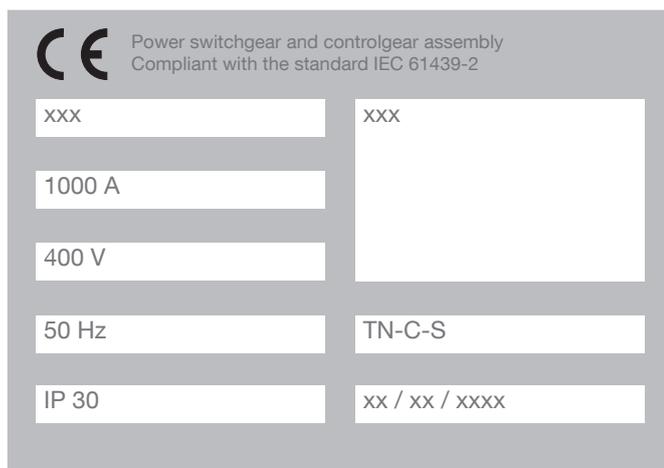
Nomenclature

No.	Description			Remarks
⑥	<p>Side mounting of main busbars in cable compartment 3 widths: 200, 300 and 400 mm (as per intensity) Composed of single-pole fixing busbars from 1 to 4 bars (thickness 5 mm), or from 2 to 3 bars (thickness 10 mm) Possible height of bars from 50 to 120 mm In busbars, aluminum profile sections and various brackets for mounting in the cells In busbars from 630 to 2500 A</p>		<p>Mounting scheme of busbar supports</p> <p>Phase-spacing</p>	<p>They will be fitted either:</p> <ul style="list-style-type: none"> - in a vertical cable compartment (distribution) - vertically at the bottom of the cell (distribution) - horizontally from cell to cell (main distribution or connection)
⑦	<p>"Inclined" busbars max 630 A - vertical in cabinet width 450 mm - horizontal in cabinet width 700 mm</p>		<p>vertical horizontal</p>	<p>Bars Cu 20x5 (250 A), Cu 32x5 (400 A), Cu 30x10 (630 A)</p>
	<p>"Flat" busbars max 630 A</p>		<p>vertical horizontal</p>	<p>Bars Cu 12x5 (160 A) Cu 20x5 (250 A) Cu 30x5 (400 A) Cu 30x10 (630 A)</p>
⑧	<p>Manual and motorized changeover switches In 160 to 1600 A</p>			<p>Special kits provided for their mounting or perforated bar and front plate</p>
⑨	<p>Modular circuit breaker 1P + N, 2P, 3P, 4P curves B, C and D from 1 to 63 A Modular circuit breaker 1, 2, 3 and 4P curves B, C and D from 80 to 125 A</p>			<p>Mounting kits 2 heights: 150 and 200 mm With 10, 24 or 36 modules (width of 250, 500 or 750 mm) Equipment of 10, 24 and 36 modules of width (250, 500 and 750 mm)</p>
⑩	<p>Add-on-block 25 A to 125 A</p>			
⑪	<p>Connecting terminals from 2.5 to 70 mm²</p>			<p>Horizontal or vertical mounting on DIN rail(370 mm cable compartment) Provide neutral bars</p>

The Assembly manufacturer must provide the following information with each Assembly:

Identification label

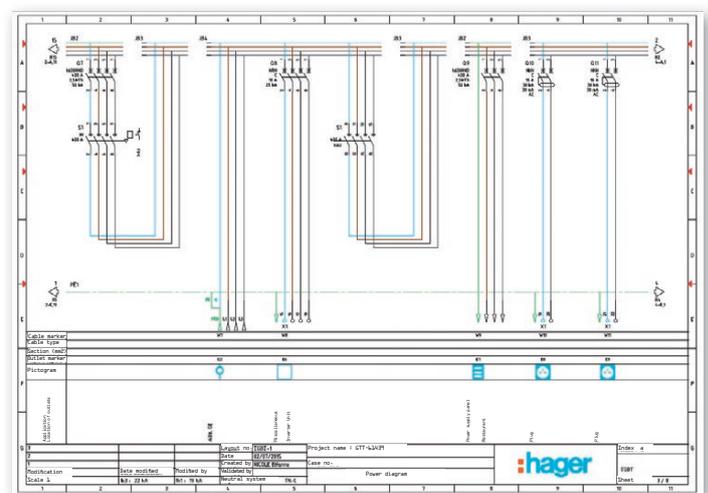
The Assembly manufacturer must be able to identify each Assembly with one or more labels, marked in a lasting manner and placed at a location allowing easy visibility and legibility when the assembly is installed and in use.



Handling, installation, operation and maintenance instructions

The Assembly manufacturer must communicate all the documents from the time of set up until maintenance of the Assembly. This includes information like:

- Installation layout
- Electric diagrams
- Connection layout of terminals
- List of materials
- Notice of products installed
- Weight of the Assembly
- xxx



List of individual checks

This document is to be filled up by the Assembly manufacturer.

Individual verification of series (List of operations to execute)

Low voltage switchgear and controlgear assemblies according to IEC 61439 1 & 2

Company : _____

Order : _____

Project : _____

Type : _____

List of individual verification of serie :

Sequence number	Test type	Test to be carried out	IEC 61439-1, Paragraph	Result	Controller
1	V	Degree of protection acquired through the covers	11.2	<input type="text"/>	<input type="text"/>
2	V/T	Clearance and creepage distances	11.3	<input type="text"/>	<input type="text"/>
3	V/T	Protection against electric shocks and integrity of protection circuits	11.4	<input type="text"/>	<input type="text"/>
4	V	Integration of incorporated components	11.5	<input type="text"/>	<input type="text"/>
5	V/T	Internal electric circuits and connections	11.6	<input type="text"/>	<input type="text"/>
6	V	Terminals for external conductors	11.7	<input type="text"/>	<input type="text"/>
7	T	Mechanical operation	11.8	<input type="text"/>	<input type="text"/>
8	T	Electrical properties	11.9	<input type="text"/>	<input type="text"/>
9	T	Wiring, electrical operation and function Power-frequency withstand voltage	11.10	<input type="text"/>	<input type="text"/>
The main, auxiliary and control circuits connected to the main circuit must be subjected to the test voltage according to Table 8 of IEC 61439-1. The test value is 1890 V for a rated insulation voltage between 300 V < Ui < 690 V for a period of 1s.				<input type="text" value="VAC"/>	<input type="text"/>

Glossary :
 V = Visual check
 T = Electrical check

Assembler : _____ Declarant : _____

Signature: _____ Date: _____

Version : Septembre 2015.

Declaration of compliance

This document is to be filled up by the Assembly manufacturer.

Declaration of EC compliance :hager

We, **[company]**, Stamp

The assembly manufacturer certifies in this document that the low voltage switchgear and controlgear assembly, described above was manufactured in accordance with the requirements of the standard IEC 61439-1 / IEC 61439-2.

Order, project or reference :

Is compliant with the following European directives, and existing national law:

Low voltage directive 2006 / 95 / EC

Directive on electromagnetic compatibility 2004 / 108 / EC

Application date of EC marking : ____ . ____ . ____
(Date and place)

(Date and place of issue)(Name and signature)

Version : Septembre 2015.

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