Guide

Design and assembly according to IEC 61439 / EN 61439

ENYSTAR Distribution Boards up to 250 A and
Mi Power Distribution Boards up to 630 A

Download at www.hensel-electric.de/61439
GUIDE
Design and assembly according to
IEC 61439 / EN 61439
ENYSTAR Distribution Boards up to 250 A and
Mi Power Distribution Boards up to 630 A

Basics
IEC 61439 / EN 61439

Step 1: Collecting all the project data
Interface characteristics of assemblies
Checklist to design switchgear assemblies according to IEC 61439 / EN 61439
Interface: Installation and ambient conditions
Interface: Operation and maintenance
Interface: Connection to the public power supply system
Interface: Electrical circuits and consumers

Step 2: Design of an assembly and design verification
Example: Checklist to design switchgear assemblies according to IEC 61439 / EN 61439
Project design using the data from the checklist
HENSEL Planning tools at a glance
Verifications supplied by the system manufacturer
Verifications to be created by the panel builder

Determining the rated short-time withstand current (Icw) of a circuit of an assembly
Feed: Determining the rated current (InA) of an assembly
Rated current of an outgoing circuit (InC)
Determining the operating current (Ib)
Calculation of the power dissipation (Pv)
Determining the rated diversity factor (RDF)
Design verification of permissible temperature rise according to IEC 61439-1 / EN 61439-1 Section 10.10

ENYGUIDE Online tool

Step 3: Assembly / manufacture of the distribution board
Assembly instructions for distribution board systems
Routine verification / inspection (routine test report)

Step 4
Manufacturer’s marking

Step 5
Declaration of EC conformity (check lists for the manufacturer of an assembly)
Documentation
Why a guide to practice?

There is a precise conformity on the content of the Standard 61439 in the IEC and EN world of standards. Consequently this document uses the writing IEC 61439 / EN 61439 in the following.

IEC 61439 / EN 61439 - New tasks and responsibilities for the electrician

IEC 61439 / EN 61439 shows how a low-voltage switchgear assembly, which is safe for the user, can be built. In addition to changes affecting the design of an assembly, the manufacturer of a switchgear assembly is faced with new tasks and responsibilities. Defines which documents belong to a low-voltage switchgear assembly and which verifications need to be maintained. Makes statements regarding the rating of the assembly so that a design verification can be maintained.

Guide 61439 for the practice: 5 steps to a standard-conforming switchgear assembly

The guide lists the process of design, assembly and documentation of a low-voltage switchgear assembly in the order of the necessary steps and at the same time assigns to these steps the relevant sections from the standard IEC 61439 / EN 61439. The application of the guide is focused on the manufacturing of distribution boards up to 630 A and in addition to checklists and instructions regarding the verification of compliance with the maximum temperature rise.

The guide can be downloaded from:

www.hensel-electric.de/61439

Step 1
Collecting all the project data

Step 2
Assembly design and design verification

Step 3
Assembly / manufacture of the distribution board

Step 4
Manufacturer's marking

Step 5
Declaration of CE conformity (check lists)

HENSEL, as the system manufacturer, supports panel builders with this guide to design and assemble safe low-voltage switchgear assemblies according to IEC 61439 / EN 61439.
Basics of IEC 61439 / EN 61439

Legal Basis of LVD 2014/35/EU*

In the European Union, the Low Voltage Directive LVD 2014/35/EU forms the legal basis for all electrical equipment between 50 and 1000 V a.c., or 75 and 1500 V d.c.

This directive pursues the protection objective that electrical equipment must not jeopardize the safety of persons, livestock, and the preservation of property, and refers to the harmonized standards, which are published in the Official Journal of the EU.

Compliance with this legal basis is confirmed by the declaration of conformity by the manufacturer of a switchgear assembly. Reference to EN 61439 implies that the basic requirements of the directive have been met. If the legal requirements are not met, the purchaser has no liability protection!

If harmonized standards are not applied, the manufacturer of the switchgear assembly has a duty to establish compliance with the above protection objectives by appropriate means.

*LVD = Low Voltage Directive

Structure of IEC 61439 / EN 61439

IEC/TS 61439-7
Distributor for camping, market places, marinas and charging stations for electric vehicles

IEC 61439-1 / EN 61439-1
General requirements for low-voltage switchgear assemblies

IEC 61439-2 / EN 61439-2
Power switchgear and controlgear assembly (PSC)

IEC 61439-3 / EN 61439-3
Distribution boards intended to be operated by ordinary persons (DBO)

IEC 61439-4 / EN 61439-4
Construction site distributors

IEC 61439-5 / EN 61439-5
Cable Distribution Cabinets

IEC 61439-6 / EN 61439-6
Busbar distributors

IEC/TR 61439-0
Planning guide for low-voltage switchgear assemblies

IEC 61439-1 / EN 61439-1
is a general part which must be read in conjunction with the product section IEC 61439-2 to -7 / EN 61439 -2 to -7.

Does not include product-specific requirements.

Describes operating conditions, assembly requirements, technical properties and requirements, as well as verification options for low-voltage switchgear assemblies and lists the terms used.

New terminology of product responsibility:
Original manufacturer (system manufacturer) and manufacturer of switchgear assembly (panel builder) with new regulation for product responsibility.

More safety through the definition of requirements
for switchgear assemblies that affect the construction of the system, e.g. rated short-time withstand current, current carrying capacity, resistance to temperature rise.

More safety by determining the rating data
that are essential for the function of a switchgear assembly under operating conditions. For this purpose, the switchgear is considered as a BLACK BOX.
Manufacturer’s product responsibility

The manufacturer is primarily responsible for compliance with the law and the safety of a distribution board. He must provide evidence that the distributor was free of design, manufacturing and instruction errors when brought on the market. Thereby he must prove the safety of the assembly according to the appropriate documents (risk analysis and assessment). These documents must be retained. He must create a declaration of conformity and affix the CE marking visibly.

EU only

Who is the manufacturer of a switchgear assembly?

The new standard clearly regulates the responsibility for a distribution board placed on the market. It distinguishes between the original manufacturer (system manufacturer) and the manufacturer of the switchgear assembly (panel builder).

Original manufacturer (system manufacturer)

Responsible for:

- the distribution board system
- the verification of the design by testing, calculation or construction rules
- the documentation of this design verification, e.g. test documentation, derivations, calculations
- the creation of tools to design and appropriate instructions for assembling and testing

The original manufacturer (system manufacturer) already provides the respective verifications for its distribution board system.

Manufacturer of the switchgear assembly (Panel Builder)

Responsible for:

- the rating of the switchgear assembly according to the customer/operator requirements
- the compliance with the design verification of the original manufacturer
- the declaration of conformity to the customer (Declaration of Conformity)
- the marking and documentation of the assembly
- the performance of the design verification and documentation

Panel builders who have no distribution board system of their own and assemble verified systems into ready-to-connect switchgear assemblies thus decide for themselves about their own verification efforts, as they can use the documents of the original system manufacturer.
PORTAL61439
All about design and assembly according to IEC 61439 / EN 61439

With this portal, HENSEL supports you to implement the requirements of IEC 61439 / EN 61439 from the first step - collecting all project data - via the design of standard-complying HENSEL distribution board systems, up to the provision of the necessary design verification and routine test verification.

Here you will find:

- Checklists and forms
- ENYGUIDE panning software
- ONLINE calculation tool for the verification of the permissible temperature rise
- Instructions for determining design values (I_{NA}, I_{NC}, I_{CW})
- Technical data

www.hensel-electric.de/61439
The user specifies the operational requirements and conditions for a low-voltage switchgear assembly. Where special operating conditions exist that are not covered by the standard, in addition also the applicable special requirements have to be met or special agreements between the manufacturer of the switchgear assembly and the user must be made. The user must inform the manufacturer if such extraordinary conditions exist.

The correct rating of the key interfaces in the switchgear assembly is crucial for its function under operating conditions. For this purpose, the switchgear assembly is considered a "BLACK-BOX" with four interfaces for which the manufacturer of the switchgear assembly must define the correct design values when designing the assembly.

The design of the switchgear assembly is dependent on the conditions and data such as:

1.1 Installation and ambient conditions
1.2 Operation and maintenance
1.3 Connection to the public power supply system
1.4 Electrical circuits and consumers

**Interface characteristics of assemblies**

**Switchgear assembly as BLACK BOX with the 4 interfaces according to IEC 61439 / EN 61439**

1.1 **Conditions at place of installation/environment**
- Installation site
- Special requirements for use in commercial and industrial applications

1.2 **Operation and maintenance**
- (Device) operation by ordinary persons - unskilled persons
- Access and operation only by skilled persons (electricians)

1.3 **Connection to the public power supply system**
- Nominal data of the feed
- Nominal values transformer
- Short-time withstand current

1.4 **Electrical circuits and consumers**
- Rating of outgoing circuits
- Determination of the thermal power dissipation
- Determination of the rated diversity factor (RDF)
HENSEL checklist to design switchgear assemblies according to IEC 61439 / EN 61439

This editable checklist supports you in step 1 when collecting all data for the design of a distribution board on site. It reflects the determination of the correct design values for the four interfaces of the assembly.

The checklist to design switchgear assemblies according to IEC 61439 / EN 61439 can be quickly and easily downloaded.

www.hensel-electric.de/61439
### 1. Installation / ambient conditions

The checklist queries these installation and ambient conditions on site, which need to be provided by the planner. The manufacturer considers this information and assembles the distribution board according to these requirements. The measures and recommendations given must be considered for the safe operation of the distribution board.

#### 1.1 Installation / ambient conditions

<table>
<thead>
<tr>
<th>Type of business</th>
<th>Indoor / ambient temperature (°C):</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installation</strong></td>
<td></td>
</tr>
<tr>
<td>Indoor:</td>
<td>❑ in locked electrical operating room  ❑ in production area</td>
</tr>
<tr>
<td>Outdoors:</td>
<td>❑ protected outdoors              ❑ unprotected outdoors</td>
</tr>
<tr>
<td>Available wall surface in mm: Width:</td>
<td>Height:</td>
</tr>
<tr>
<td>Assembly type:</td>
<td>❑ wall-mounted            ❑ floor-standing</td>
</tr>
<tr>
<td>Degree of protection:</td>
<td>❑ IP 44            ❑ IP 54            ❑ IP 55            ❑ IP 65            ❑ IP _________</td>
</tr>
</tbody>
</table>

#### Type of business

Take into account special requirements for use in commercial and industrial applications, such as strong mechanical and chemical stress on assembly material.

#### Room / ambient temperature (°C) according to IEC 61439 / EN 61439

Temperature range: -5°C to +35°C, max. +40°C  
Humidity: 50% at 40°C, 100% at 25°C  
Measures: Specify power dissipation of the assembly for the rating of the ventilation / room size. Higher ambient temperatures must be considered in planning.

#### Installation indoors

In locked electrical operating room: Only accessible by skilled persons (electricians)  
During operation: Accessibility by unskilled persons  
IP degree of protection  
Protection against foreign bodies: dust-proof IP 6X  
Water protection: waterproof IP X6 / IP X5 (deflected water without high pressure)

#### Installation outdoors

- Protected outdoors  
  - Direct sunlight  
    The material has been tested for UV resistance.  
    UV-resistant according to IEC 61439-1 / EN 61439-1 paragraph 10.2.4.  
    If necessary, protect with additional measures against direct sunlight, for example with canopy  
    Temperature and humidity  
    Higher ambient temperatures, possibly due to direct sunlight have to be considered in the planning stage.  
    IP degree of protection for protected or unprotected outdoor installation  
- Unprotected outdoors  
  - Direct sunlight  
    The material has been tested for UV resistance.  
    UV-resistant according to IEC 61439-1 / EN 61439-1 paragraph 10.2.4.  
    If necessary, protect with additional measures against direct sunlight, for example with canopy  
    Temperature and humidity  
    Higher ambient temperatures, possibly due to direct sunlight have to be considered in the planning stage.  
    IP degree of protection for protected or unprotected outdoor installation  
Where appropriate, consider measures against occasional condensation forming as a result of temperature variations, such as venting, heating, air-conditioning (also with unprotected installation).

#### Type of installation

Specify the system type for wall-mounting or floor-standing installation

#### Available sizes

Consider installation conditions on site and specify restrictions as needed.

For details, see HENSEL main catalogue or www.hensel-electric.de.
1.2 Operation and maintenance

The checklist queries the necessary requirements for the switchgear assembly for the operation taking into account the qualifications of persons who require access to the respective areas or must operate equipment.

2. Operation

- by skilled persons (electricians)
- by unskilled person

Doors/lids:
- opaque/without inspection pane
- transparent/with inspection pane

Operation by

**Electrician (skilled person)**

<table>
<thead>
<tr>
<th>IP XXB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools-operated areas for feeding-in, back-up fuse and outgoing terminals.</td>
</tr>
<tr>
<td>Tool-operated areas for feeding-in, back-up fuse and outgoing terminals.</td>
</tr>
<tr>
<td>Here, merely a qualified electrician must have access!</td>
</tr>
</tbody>
</table>

**Electro-technical unskilled person**

Selection of equipment for unskilled persons!

- Devices which must be operated by a qualified electrician only, shall be installed behind separate doors or lids which can be opened with a tool only.
- Tool-operated areas for feeding-in, back-up fuse and outgoing terminals.
- Here, merely a qualified electrician must have access!

Electrically trained person

| IP XXB, see qualified electrician |

**Devices operated**

- Behind the door / lid

**Doors / covers**

- Protection measures must be observed
- Lock available for retrofitting
- Conversion kits for door or lid fasteners from hand to tool operation available

For details, see HENSEL main catalogue or www.hensel-electric.de.
### 1.3 Connection to the public power supply system

The checklist describes the required features of the network (nominal data). These must be compared with the design data of the low-voltage switchgear assembly. For the planning of a switchgear assembly, the necessary rated values of the grid must be determined and specified.

### 3. Connection to the public power supply system

**Main distribution board:** Outgoing device: ______________________

**Transformer:**
- Rated power (kVA): __________________________
- Impedance \( u_k (%) \): 4 \( u_k \)

**Rated voltage**
- V a.c. __________________
- V d.c. __________________
- Hz __________________

**Conductor designation:**
- L1, L2, L3 __________________
- N __________________
- PE __________________
- PEN __________________

**Protection class:**
- I __________________
- II __________________

**Incoming device:** ______________________

**Connection incoming:**
- from top
- copper
- with cable lug
- conductor
- from bottom
- aluminum
- with terminal
- single conductor
- from left
- from right
- cross section (mm\(^2\)): ____________

**Rated voltage of the feed**
- in VAC a.c., Hz

**Grid system**
- TN-C, TN-C-S, TN-S, TT, IT

**Protection class II, protection by protective insulation**

**Protection class**

**Infeed current (rated current transformer / upstream protective device)**

**Determine** \( I_{\text{In}} \), see step 2, design of a distribution board, page 22

**Short-circuit resistance**

**Derive value from the size of the transformer or use the information from the local power supplier**

**Example calculation see pages 20-21.**

**For detailed information about**
- determination of the rated current \( I_{\text{In}} \) ____________
- determination of the rated short-time withstand current \( I_{\text{CW}} \) ____________

**Overvoltage**
- Overvoltage category III, IV

**Incoming cable connection**
- Type of incoming cable
- Type of cable
- Type of connection
1.4 Electrical circuits and consumers

Outgoing circuits in a switchgear assembly can be distinguished into distribution circuits (protective device and incoming cable to downstream distribution) and final circuits (protection device and incoming cable and consumers).

For a correct rating of the circuits, all information regarding the expected power demand and consumers must be known. Therefore, the technical data of the device manufacturer with information on derating, but also the rated current of a circuit and the rated diversity factor RDF must be considered.

4. Electrical circuits and consumers

| Connection outgoing: | | |
|----------------------|-----------------|
| □ from top          | □ from bottom   |
| □ from left         | □ from right    |
| □ connected to device | □ via terminal block |
| cross section (mm²): | _______________ |

<table>
<thead>
<tr>
<th>Equipped with</th>
<th>Quantity</th>
<th>Type of protective device (fuse, circuit breakers, ...)</th>
<th>Rated values of the consumer (current, power, ...)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outgoing cable connection</th>
<th>Type of outgoing cable</th>
<th>Type of cable</th>
<th>Type of connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipping</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of protective device</th>
<th>Fuse, miniature circuit breaker, circuit breaker</th>
</tr>
</thead>
</table>

For detailed information about
- Rating of an outgoing circuit ($I_{oc}$) Page 23
- Determination of the operating current ($I_0$) Page 24
- Calculation of the power dissipation ($P_d$) Page 25
- Creating the design verification of the permissible temperature rise according to IEC 61439-1 / EN 61439-1 Section 10.10. Page 26
Example: Checklist to design switchgear assemblies according to IEC 61439 / EN 61439

Collecting the data on-site with the checklist forms the basis to design a distribution board.

---

Hensel Expert: Hoffmann

Request/Offer Date: 05.05.2016

Client: Metal working shop Brands

Project: Extension to the production facility - Section II

Name: Musterstraße 10

50000 Musterstadt

Phone: info@brands-metalworkingshop.de

---

1. Installation and ambient conditions

Type of business: Metal working shop

Indoor/ambient temperature (°C): 25

Installation:

- indoors: in the locked electrical operation room

- outdoors: protected outdoors

Available wall surface in mm:

Width: 1500 Height: 1400 Depth: 500

Assembly type: wall-mounted floor-standing

Degree of protection: IP 44 IP 54 IP 55 IP 65 IP _______________

---

2. Operation

- by skilled persons (electricians)

- by unskilled persons

Doors/lids:

- opaque/without inspection pane

- transparent/with inspection pane ______________

---

3. Connection to the public power supply system

Main distribution board: Outgoing device: ______________

Transformer: Rated power (kVA): ______________ Impedance u (%) 4 6

Rated voltage 230/400 V a.c. V d.c. 50 Hz ______________ Rated current (A): 400

Conductor designation: L1, L2, L3 N PE PEN

Protection class: I II

Incoming device: Circuit breaker

Connection incoming:

- from top

- from bottom

- from left

- from right ______________

- copper aluminum

- with cable lug with terminal

- conductor single conductor cross section (mm²): 4x150/70

---

4. Electrical circuits and consumers

Connection outgoing:

- from top

- from bottom

- from left

- from right ______________

- connected to device via terminal blocks cross section (mm²): ______________

Equipped with:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Type of protective device (fuse, circuit breaker, ...)</th>
<th>Rated values of the consumer (current, power, ...)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer 1</td>
<td>MCB</td>
<td>200 A</td>
<td>Machine I</td>
</tr>
<tr>
<td>Consumer 1</td>
<td>MCB</td>
<td>128 A</td>
<td>Machine II</td>
</tr>
<tr>
<td>Consumer 1</td>
<td>MCB</td>
<td>128 A</td>
<td>Internal fuse</td>
</tr>
<tr>
<td>Consumer 1</td>
<td>RCBO</td>
<td>63 A</td>
<td>Internal protection for MCBs</td>
</tr>
<tr>
<td>Consumer 14</td>
<td>MCB</td>
<td>12 A</td>
<td>Light and socket outlets</td>
</tr>
</tbody>
</table>

---

Download editable checklist:

www.hensel-electric.de/61439
Example: Project design using the data from the checklist

The design is realized on basis of documents, catalogues, and technical data provided by HENSEL, as the original manufacturer (system manufacturer).

By complying with the information from catalogues, technical manuals and installation instructions, the effort required by the panel builder for providing the design verification is minimized.

1 A circuit diagram results from the determined data from the checklist, which defines the electrical functions.

2 Selection of products for the electrical functions.

3 ENYGUIDE

Selection of products for the electrical functions from manufacturers’ catalogues or with the planning tool ENYGUIDE.

4 At the end of the design, a dimensional drawing and a parts list must be created for the distributor.

HENSEL provides comprehensive planning tools that simplify the planning.
Plan quickly and easily with the HENSEL planning tools

Your planning is significantly simplified by the use of the HENSEL planning tools. The functions of the different planning tools are provided here in comparison.

From now on, all values are taken into account in the products needed by the electrician for the rating of a switchgear assembly according to IEC 61439 / EN 61439:

- Rated current of a circuit,
- Number of circuits and
- Rated short-time withstand current.

Planning tool Configurator ENYGUIDE
HENSEL supports you with the free planning software ENYGUIDE. Allows the quick and easy configuration of distribution boards.

- Dimensional drawings and parts lists are automatically created.
- Representation of the distribution board as a detailed 3D-image or a 2D-drawing.
- Various view planes show the equipment, covers and doors.
- Determines the necessary accessories such as the number of wall separators independently.
- Power loss calculation
- No time-consuming program installation is needed.
## HENSEL planning tools at a glance

<table>
<thead>
<tr>
<th>Feature</th>
<th>Main Catalogue</th>
<th>HENSEL website</th>
<th>ENYGUIDE</th>
<th>Calculation tool power dissipation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product information + product image</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Detailed technical data on products</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Dimensional drawing for products</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Reference to appropriate accessories, such as mounting flanges</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Reference to appropriate rail-mounted devices, such as residual current protection device and terminal blocks</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Information regarding the option to combine with other enclosures</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Creating dimensional drawings (with dimensions)</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Automatic creation of project documentation</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Automatic creation of parts and order lists (PDF, Excel or ASCII format)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Automatic completion of compellingly required accessories (e.g., wall sealings)</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Product depiction in DXF format (after export or download)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Product presentation in 3D format</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Power dissipation calculation according to IEC 61439 / EN 61439</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

**HENSEL website with the package of services for electricians:**

Everything for planning according to IEC 61439 / EN 61439 ONLINE for download!

**ONLINE calculation tool from HENSEL for the design verification of the permissible temperature rise**

Design verification of permissible temperature rise according to IEC 61439-1 / EN 61439-1

The tool automatically calculates the power dissipation and installed power dissipation, and where appropriate, the RDF.

[Online via Internet](www.hensel-electric.de/61439)
Verifications supplied by the system manufacturer

Before design starts:

Does the selected distribution system meet the requirements on site?

HENSEL - as product provider and responsible party for the distribution system - has already provided a wealth of verifications supporting its distribution systems. These relate to the construction and behaviour of the switchgear assembly during operation and must include the following criteria.

These tests have already been performed by HENSEL.

<table>
<thead>
<tr>
<th>Verifications which were already provided by HENSEL (system manufacturer)</th>
<th>Standards section</th>
<th>VERIFICATION provided by HENSEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of materials and parts</td>
<td>10.2</td>
<td>✔</td>
</tr>
<tr>
<td>- Resistance to corrosion</td>
<td>10.2.2</td>
<td>✔</td>
</tr>
<tr>
<td>Properties of insulating materials</td>
<td>10.2.3</td>
<td>✔</td>
</tr>
<tr>
<td>- Thermal stability of enclosures</td>
<td>10.2.3.1</td>
<td>✔</td>
</tr>
<tr>
<td>- Resistance of insulating materials to abnormal heat and fire due to internal electric effects</td>
<td>10.2.3.2</td>
<td>✔</td>
</tr>
<tr>
<td>- Resistance to ultra-violet (UV) radiation</td>
<td>10.2.4</td>
<td>✔</td>
</tr>
<tr>
<td>- Lifting</td>
<td>10.2.5</td>
<td>✔</td>
</tr>
<tr>
<td>- Mechanical impact</td>
<td>10.2.6</td>
<td>✔</td>
</tr>
<tr>
<td>- Marking</td>
<td>10.2.7</td>
<td>✔</td>
</tr>
<tr>
<td>Degree of protection of assemblies</td>
<td>10.3</td>
<td>✔</td>
</tr>
</tbody>
</table>

HENSEL confirms the properties of its distribution board system according to EN 61439 with a declaration of conformity.

The compliance to the Low voltage directive LVD 2014/35/EU as the legal basis has to be confirmed by the final manufacturer of an assembly (panel builder) with a declaration of conformity.

HENSEL (system manufacturer) confirms the carried out tests with a declaration of conformity. This proves that the distribution system has the properties listed and complies with the requirements of the applicable standard EN 61439.

If the panel builder uses resources that have already been tested by the system manufacturer through design verification and confirmed by a declaration of conformity, there is no obligation to test for himself.

For everything about the documentation of an assembly see step 5.
Verifications to be created by the panel builder

During design process and after assembly:
Provide verification of the self-assembled distribution board.

If the panel builder complies with the information from the catalogues, technical manuals and assembly guides when assembling a distribution board, the efforts for providing design verification are minimized.

The panel builder as manufacturer of an assembly must also test the work which was performed by himself and document the safety of the assembly according to IEC 61439 / EN 61439 with a routine test report (Sheet 1), for tests see pages 30-31.

The panel builder checks his own work ...

<table>
<thead>
<tr>
<th>Verifications which the PANEL BUILDER is required to perform himself</th>
<th>Standards section</th>
<th>Panel builder must provide VERIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearances and creepage distances</td>
<td>10.4</td>
<td>by routine testing</td>
</tr>
<tr>
<td>Protection against electric shock and integrity of protective circuits</td>
<td>10.5</td>
<td>by routine testing</td>
</tr>
<tr>
<td>- Effective earth continuity between the exposed conductive parts of the assembly and the protective circuit</td>
<td>10.5.2</td>
<td>by routine testing</td>
</tr>
<tr>
<td>Incorporation of switching devices and components</td>
<td>10.6</td>
<td>by routine testing</td>
</tr>
<tr>
<td>Internal electrical circuits and connections</td>
<td>10.7</td>
<td>by routine testing</td>
</tr>
<tr>
<td>Terminals for external conductors</td>
<td>10.8</td>
<td>by routine testing</td>
</tr>
<tr>
<td>Dielectric properties</td>
<td>10.9</td>
<td>by routine testing</td>
</tr>
<tr>
<td>- Power-frequency withstand voltage</td>
<td>10.9.2</td>
<td>by routine testing</td>
</tr>
<tr>
<td>- Impulse withstand voltage</td>
<td>10.9.3</td>
<td>by routine testing</td>
</tr>
<tr>
<td>Verification of temperature rise</td>
<td>10.10</td>
<td>by calculating during design process</td>
</tr>
<tr>
<td>Short-circuit withstand strength</td>
<td>10.11</td>
<td>by calculating during design process</td>
</tr>
<tr>
<td>Electromagnetic compatibility (EMC)</td>
<td>10.12</td>
<td>by calculating during design process</td>
</tr>
<tr>
<td>Mechanical operation</td>
<td>10.13</td>
<td>by routine testing</td>
</tr>
</tbody>
</table>

... and documents the safety of his assembly according to IEC 61439 / EN 61439 with a routine test report.

The panel builder must enclose the report for the routine verification (routine test report) (Sheet 1) with the documentation of his self-assembled distribution board.

For everything about routine verification / inspection see step 3.

The assembly of the distributor is controlled and verified by routine testing.
Determining the rated short-time withstand current (Icw) of a circuit of an assembly

A switchgear assembly must be designed such that it withstands the thermal and dynamic stresses resulting from the short-circuit current. The maximum short circuit current at the connection point of an assembly must be determined on site.

The panel builder must specify the rated short-time withstand current Icw of the connection point in his documentation, e.g. in the circuit diagram or technical document.

The original manufacturer of the switchgear system, e.g. HENSEL, is responsible for the verification of the short circuit withstand capacity of the system components, e.g. the Icw value of the busbars.

Rated short-circuit withstand current is determined by the values Ik", Icw, Icp, Icu.

**Step 1:**
Determining the transformer power and determining the value Ik"

The Ik" can be determined by reading table 1.

<table>
<thead>
<tr>
<th>Transformer</th>
<th>Sr = 250 kVA</th>
<th>see identifier plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un = 400 VAC</td>
<td>see identifier plate</td>
<td></td>
</tr>
<tr>
<td>In = 360 A</td>
<td>see table 1</td>
<td></td>
</tr>
</tbody>
</table>

Ik" = \( \frac{Sr \cdot 100}{3 \cdot Un \cdot uK} \)

Ik" in kA
Sr in kVA
Un in V
uK in %

Example:

![Transformer](UN = 400 VAC)

Alternately, the Ik" is calculated using the formula:

**Step 2:**
Design of an assembly and design verification

Table 1: Excerpt from HENSEL main catalogue

<table>
<thead>
<tr>
<th>Rated power of the transformer Sr in kVA</th>
<th>Rated current at rated voltage Un=400 V a.c. In in A</th>
<th>Initial short-circuit current at uK = 4% Ik&quot; in kA</th>
<th>Initial short-circuit current at uK = 6% Ik&quot; in kA</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>144</td>
<td>3.610</td>
<td>2.406</td>
</tr>
<tr>
<td>160</td>
<td>230</td>
<td>5.776</td>
<td>3.850</td>
</tr>
<tr>
<td><strong>250</strong></td>
<td><strong>360</strong></td>
<td><strong>9.025</strong></td>
<td></td>
</tr>
<tr>
<td>315</td>
<td>455</td>
<td>11.375</td>
<td>7.583</td>
</tr>
<tr>
<td>400</td>
<td>578</td>
<td>14.450</td>
<td>9.630</td>
</tr>
</tbody>
</table>

Table 2: Rated short-circuit withstand current of installation device in HENSEL distribution boards

<table>
<thead>
<tr>
<th>Installation device in HENSEL distribution boards</th>
<th>Short-circuit withstand capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busbar 250 A / 400 A</td>
<td>Icw = 15kA / 1s</td>
</tr>
<tr>
<td>NH fuse switch disconnector 250 A</td>
<td>Icc = 50kA</td>
</tr>
<tr>
<td>Circuit breaker 250 A / 400 A</td>
<td>Icu = 50kA</td>
</tr>
<tr>
<td>Switch disconnector 160 A</td>
<td>Icc = 50kA</td>
</tr>
<tr>
<td>MCCB 160 A / 250 A</td>
<td>Ics = Icu = 8 kA / 690 V a.c.</td>
</tr>
<tr>
<td>Other values can be obtained from the device manufacturers or in the HENSEL main catalogue!</td>
<td>Ics = Icu = 36 kA / 415 V a.c.</td>
</tr>
</tbody>
</table>
Path of the short-circuit current from the transformer to the short-circuit

**Step 2:**
Determining the rated short-time withstand current $I_{cw}$ of the main distribution board (MDB)

Determining the lowest rated short-time withstand current $I_{cw}$ of the device installed in the main distribution board.

<table>
<thead>
<tr>
<th>MDB installed devices</th>
<th>$I_{cw}$ or $I_{cu}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit breaker 400 A</td>
<td>$I_{cu} = 50kA$</td>
</tr>
<tr>
<td>Busbars 400 A</td>
<td>$I_{cw} = 15kA / 1s$</td>
</tr>
<tr>
<td>MCCB 250 A</td>
<td>$I_{cs} = I_{cu} = 8kA / 690$ V a.c.</td>
</tr>
<tr>
<td></td>
<td>$I_{cs} = I_{cu} = 36kA / 415$ V a.c.</td>
</tr>
</tbody>
</table>

Lowest value of the devices: $I_{CC} / I_{cu} = 50kA$$

Lowest value of the busbars: $I_{cw} = 15kA$

$\Rightarrow I_{cw(MDB)} = 15kA$

$15kA \geq 9.025kA$

**Step 3:**
Determining the rated short-time withstand current $I_{cw}$ of the sub-distribution board (SDB)

Determining the lowest rated short-time withstand current $I_{cw}$ of the device installed in the in the sub-distribution board.

<table>
<thead>
<tr>
<th>SDB installed devices</th>
<th>$I_{cw}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit breaker 250 A</td>
<td>$I_{cu} = 50kA$</td>
</tr>
<tr>
<td>Busbar 250 A</td>
<td>$I_{cw} = 15kA / 1s$</td>
</tr>
<tr>
<td>MCCB 160 A</td>
<td>$I_{cs} = I_{cu} = 8kA / 690$ V a.c.</td>
</tr>
<tr>
<td></td>
<td>$I_{cs} = I_{cu} = 36kA / 415$ V a.c.</td>
</tr>
</tbody>
</table>

Lowest value of the devices: $I_{CC} / I_{cu} = 50kA$

Lowest value of the busbars: $I_{cw} = 15kA$

it follows: $I_{cw(SDB)} = 15kA$

$\Rightarrow I_{cw(SDB)} \geq I_{cu}$

$15kA \geq 9.025kA$

The rated short-time withstand current $I_{cw}$ of the MDB must be equal to or greater than the short-circuit current $I_{cs}$ of the transformer:

$I_{cw} (MDB) \geq I_{cs}$ (transformer)

In this analysis, the cable attenuation between the transformer and MDB is not considered. The cable attenuation can mean a reduction of the short-circuit current $I_{cs}$. The prospective short-circuit current $I_{cp}$ at the installation site of the MDB is smaller because of the cable attenuation than $I_{cs}$ of the transformer.

The rated short-time withstand current of the assembly results from the rated short-time withstand current of the installed equipment and busbars.

The original manufacturer, such as HENSEL, specifies these values in the technical data.

The respective lowest value determines the maximum rated short-time withstand current $I_{cw}$ of the main distribution board.

The panel builder must specify this value in the documentation of the assembly!

---

**MDB**

Determining the rated short-time withstand current $I_{cw}$

The rated short-time withstand current $I_{cw}$ of the MDB must be equal to or greater than the short-circuit current $I_{cs}$ of the transformer:

$I_{cw} (MDB) \geq I_{cs}$ (transformer)

In this analysis, the cable attenuation between the transformer and MDB is not considered. The cable attenuation can mean a reduction of the short-circuit current $I_{cs}$. The prospective short-circuit current $I_{cp}$ at the installation site of the MDB is smaller because of the cable attenuation than $I_{cs}$ of the transformer.

The rated short-time withstand current of the assembly results from the rated short-time withstand current of the installed equipment and busbars.

The respective lowest value determines the maximum rated short-time withstand current $I_{cw}$ of the main distribution board.

The panel builder must specify this value in the documentation of the assembly!

---

**SDB**

Determining the rated short-time withstand current $I_{cw}$

The rated short-time withstand current $I_{cw}$ of the MDB must be equal to or greater than the short-circuit current $I_{cs}$ of the transformer:

$I_{cw} (MDB) \geq I_{cs}$ (transformer)

In this analysis, the cable attenuation between the transformer and MDB is not considered. The cable attenuation can mean a reduction of the short-circuit current $I_{cs}$. The prospective short-circuit current $I_{cp}$ at the installation site of the MDB is smaller because of the cable attenuation than $I_{cs}$ of the transformer.

The rated short-time withstand current of the assembly results from the rated short-time withstand current of the installed equipment and busbars.

The respective lowest value determines the maximum rated short-time withstand current $I_{cw}$ of the main distribution board.

The panel builder must specify this value in the documentation of the assembly!
Determining the rated current ($I_{nA}$) of an assembly

The rated current of the switchgear assembly ($I_{nA}$) is determined on the basis of the rated current of the built-in device in the infeed or the busbar.

The rated current of the infeed ($I_{nA}$) is, in accordance with IEC/EN 61439-1 section 10.10.4.2.1c, 80% of the rated current of the built-in device in the infeed or the busbar.

**Example**

Determination of the rated current of the switchgear assembly $I_{nA}$:

- Rated current of MCCB = 400 A
- Thereof 80%: (400 A x 0.8) = 320 A
- Rated current of the switchgear assembly: $I_{nA} = 320$ A

**IEC 61439 / EN 61439-1 section 5.3.1**

**Rated current of the switchgear assembly ($I_{nA}$)**

The rated current of the switchgear assembly ($I_{nA}$) is the maximum permissible load current for which the switchgear assembly is designed and it can distribute. It is the smaller of the sum of the rated currents of the incoming circuits within the assembly operated in parallel and the total current which the main busbar is capable of distributing in the particular assembly arrangement.

**Transformer ratings**

<table>
<thead>
<tr>
<th>Rated voltage $U_N$</th>
<th>230/400 V</th>
<th>400/690 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-circuit voltage $U_k$</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>Rated power $S_N$ (kVA)</td>
<td>$I_N$ (A)</td>
<td>$I_k$&quot; (A)</td>
</tr>
<tr>
<td>50</td>
<td>72</td>
<td>1805</td>
</tr>
<tr>
<td>100</td>
<td>144</td>
<td>3610</td>
</tr>
<tr>
<td>160</td>
<td>230</td>
<td>5776</td>
</tr>
<tr>
<td>200</td>
<td>280</td>
<td>7220</td>
</tr>
<tr>
<td>250</td>
<td>360</td>
<td>9025</td>
</tr>
<tr>
<td>315</td>
<td>455</td>
<td>11375</td>
</tr>
<tr>
<td>400</td>
<td>578</td>
<td>14450</td>
</tr>
<tr>
<td>500</td>
<td>722</td>
<td>18050</td>
</tr>
<tr>
<td>630</td>
<td>910</td>
<td>22750</td>
</tr>
</tbody>
</table>

Rated currents and short-circuit currents of standard transformers:

- $S_N$ (kVA) = apparent power of the transformer
- $U_N$ (V) = rated voltage of the transformer
- $I_N$ (A) = rated current of the transformer
- $U_k$ (%) = short-circuit voltage of the transformer
- $I_k$ (A) = short-circuit current of the transformer

$$I_N = \frac{S_N}{\sqrt{3}U_N} \quad I_k = \frac{I_N}{U_k(\%)} \cdot 100$$
Rated current of an outgoing circuit ($I_{nc}$)

First, the installation device of the outgoing circuits is selected based on the electrical function, e.g., fuses, circuit breakers, switch disconnectors, etc.

Then the short list is based on the rated current of the circuits ($I_{nc}$).

The rated current of the circuit ($I_{nc}$) must not exceed 80% of the rated current of the installed device, IEC 61439-1 / EN 61439-1 section 10.10.4.2.1c.

IEC 61439 / EN 61439-1 section 5.3.2

Rated current of a circuit $I_{nc}$

"The $I_{nc}$ is the value of the current that can be carried by this circuit loaded alone, under normal service conditions."

Example:

MCCB

<table>
<thead>
<tr>
<th>Selection of the installed device of outgoing circuits based on the rated current of the circuits $I_{nc}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example 1:</strong> WITH specified operating current of the load</td>
</tr>
<tr>
<td>If an operating current ($I_b$) is specified, the rated current of the installed device must be calculated.</td>
</tr>
<tr>
<td>It results from the division of the operating current and the factor 0.8 according to IEC 61439 / EN 61439</td>
</tr>
<tr>
<td>Example operating current: 180 A</td>
</tr>
<tr>
<td>180 A × 0.8 = 225 A</td>
</tr>
<tr>
<td>The rated current of the installed device must be at least 225 A. The next size for MCCB is 250 A.</td>
</tr>
<tr>
<td><strong>Example 2:</strong> WITHOUT specifying the operating current of the load</td>
</tr>
<tr>
<td>If no operating current ($I_b$) is specified, an installation device is selected and the rated current of the circuit ($I_{nc}$) is calculated.</td>
</tr>
<tr>
<td>Example device selection:</td>
</tr>
<tr>
<td>MCCB: 250 A</td>
</tr>
<tr>
<td>250 A × 0.8 = 200 A</td>
</tr>
<tr>
<td>The maximum rated current of the circuit $I_{nc}$ is 200 A.</td>
</tr>
</tbody>
</table>

The rated current of the circuit $I_{nc}$ is 200 A.
Determining the operating current ($I_0$)

The operating current $I_0$ is necessary to detect the permissible thermal rise (power dissipation).

The operating current ($I_0$) can be specified.

If no operating current ($I_0$) is specified, it is calculated according to the formula.

Thereby, in addition to the already determined rated current of the circuit ($I_{nc}$), also the number of circuits is taken into account. As shown in Table 101, an assumed loading factor for the calculation of the operating current ($I_0$) may be used depending on the number of circuits.

The operating current $I_0$ is calculated according to the formula:

$$I_0 = I_{nc} \times \text{assumed loading factor}$$

### Table 101 from IEC 61439 / EN 61439

<table>
<thead>
<tr>
<th>Number of outgoing circuits</th>
<th>Mi distribution board IEC 61439-2 / EN 61439-2</th>
<th>ENYSTAR distribution board IEC 61439-3 / EN 61439-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>4-5</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>6-9</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>10 or more</td>
<td>0.6</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Determination of the operating current $I_0$

#### Example 1:
**WITH specified operating current**

The customer specifies the rated operating current $I_0$.

**Example**
 Operating current: 180 A

The operating current $I_0$ is 180 A.

$$I_0 = 180 \text{ A}$$

#### Example 2: WITHOUT specifying the operating current

The $I_0$ is calculated according to the formula:

$$I_0 = I_{nc} \times \text{assumed loading factor}$$

The assumed loading factor from Table 101 may be used.

**Example**
 Number outgoing circuits: 3
 Assumed load factor: 0.9

$$I_{nc} = 200 \text{ A}$$

$$200 \text{ A} \times 0.9 = 180 \text{ A}$$

The operating current $I_0$ is 180 A.

$$I_0 = 180 \text{ A}$$
Calculation of the power dissipation ($P_V$)

The permissible power dissipation $P_V$ for the entire assembly is calculated from the difference of
- installed power dissipation through installed device, busbars and wiring and
- power dissipation of the enclosures in the form of heat emission.

The determination of the power dissipation is quick and easy with the HENSEL calculation tool.
ONLINE at www.hensel-electric.de/61439

After entering the data for installed device, busbar system and used enclosures, the calculation tool automatically determines the installed and dissipated power and, where appropriate, the RDF.

The result is the difference of installed and dissipated power dissipation. It can be positive or negative.

- With a **positive difference**, the permissible temperature rise of the assembly is verified.

- In case of a **negative difference**, there is a risk of overheating. This can be prevented by selecting larger or additional enclosures and thus the dissipated power dissipation is increased.

A further possibility is the reduction of the installed power dissipation.

Since the number of installed device cannot be reduced, a computational reduction of the power dissipation can be performed by applying the rated diversity factor (RDF).
Determining the rated diversity factor (RDF)

Specified operating current
If the operating current (I₀) is specified and not calculated, formula 1 can be used to determine the rated diversity factor (RDF).

Calculated operating current
If the operating current (I₀) is calculated, the rated diversity factor (RDF) is determined via the power dissipation (Pᵢ).

Formula 1:
\[ \text{RDF} = \frac{I₀}{I_{nc}} \]

Formula 2:
\[ \text{RDF} = \frac{P_{di}}{P_{ins}} \times \text{assumed loading factor} \]

Example 1: WITH specified operating current
The customer specifies the operating current I₀. This value is used in Formula 1.

Example: I₀ = 180 A and I_{nc} = 200A
RDF = \frac{180 \text{ A}}{200 \text{ A}} = 0.9
RDF = 0.9

Example 2: WITHOUT specifying the operating current
With a positive difference of installed and dissipated power dissipation, the rated diversity factor (RDF) is equal to the assumed loading factor.

With a negative difference, the HENSEL calculation tool automatically calculates the rated diversity factor (RDF) according to formula 2.

Example: Result from the calculation table is 0.9.
RDF = 0.9

Online via internet
www.hensel-electric.de/61439

The ONLINE calculation tool from HENSEL provides the design verification of permissible temperature rise in a safe, fast and easy way. The tool automatically calculates the installed and dissipated power dissipation and, where appropriate, the RDF. The tool provides the design verification of permissible temperature rise according to IEC 61439-1 / EN 61439-1 Section 10.10 as a PDF file.
Design verification of permissible temperature rise according to IEC 61439-1 / EN 61439-1 Section 10.10

1. Type / temperature
   (Installation and ambient conditions)

2. Installed power dissipation of the installed equipment
   (Connection to the public power supply system)

3. Installed power dissipation of the busbars
   (circuits and consumers)

4. Dissipated power dissipation of the enclosures

5. Optional object data

6. Determination of RDF:
   The calculation tool determines the RDF.

7. Design verification of permissible temperature rise
   according to IEC 61439-1 / EN 61439-1 Section 10.10
   The calculation tool provides the design verification as a PDF file.

ONLINE calculation tool from HENSEL:
Simply enter the values of the assembly and read the results!

The values determined with the HENSEL calculation tool must be included in the documentation in the circuit diagram.
Calculation of the power dissipation ($P_V$) with ENYGUIDE planning software

When selecting an enclosure, the power dissipation values for the selected enclosure can be displayed in a new dialog box "power loss".

The power loss calculation differentiates between installation devices, which have been built-in by the original manufacturer (Hensel) and those which have been additionally selected by the manufacturer of the assembly (panel builders).

The feed and the number of ultimate user circuits are preset. The values have to be checked and corrected if necessary. The device identification is optional.

### Example: Mi isolator box

The specific power loss values are reference values and must be checked and corrected if necessary.

---

**Step 2: Design of an assembly and design verification**

1. **Installation devices by HENSEL (original manufacturer)**
   - Example: Isolator boxes
   - The built-in devices in enclosures with electrical functions are pre-installed by the original manufacturer (Hensel).

2. **Installation devices by the manufacturer of a power switchgear and controlgear assembly**
   - Example: Circuit breaker boxes
   - Additionally selected installation devices, which have been selected by the panel builder using the add-to-installation-devices function.
   - The specified power loss values are reference values and must be checked and corrected if necessary.

---

**Individual planning of installation devices**

Installation devices, which are not listed within the add-to-installation-device function, can be manually added (+) or can be deleted (X).
Select the documents to be printed and the calculation of the power loss. Check the preset temperature data and make appropriate adjustments to these provisions where necessary.

Determining the rated diversity factor RDF and design verification of permissible temperature rise according to IEC 61439-1 Section 10.10

Printing power loss calculation from view of distributor

The power loss values of DIN rail mounted devices that are not supplied with Hensel must be checked!

The specified rated diversity factor can be adjusted if there is a reserve in the dissipated power dissipation of the enclosure! If not, the value from the standard is applicable!

The power loss values of DIN rail mounted devices that are not supplied with Hensel must be checked!
Assembly instructions for distribution board systems

HENSEL supports the manufacture and assembly of a distribution board with extensive assembly instructions.

ENYSTAR distribution boards up to 250 A with doors intended to be operated by ordinary persons (DBO) according to IEC 61439-3 / EN 61439-3

Assembly instruction ENYSTAR Distribution Boards up to 250 A
Intended to be operated by ordinary persons (DBO) in accordance with IEC 61439-3

Download at www.hensel-electric.de/61439
Installation and ambient conditions
Installation areas and degree of protection, condensation, system design

Assembly
lid hinges, wall openings, assembly of enclosures, flanges, cable entry, cable insertion, extension frame, box fin

Mounting
wall mounting, floor-standing, measures against condensation forming, canopy

Device installation
mounting plate, DIN rails, PE and N terminals, protection against access to hazardous parts/covers

Wiring
busbar systems, connecting terminals, wiring, bending wiring strips, feed-in terminals, FIXCONNECT® plug-in terminals, connection of aluminum conductors

Routine tests of switchgear assemblies
routine verification / inspection / report, marking, initial inspection before putting installation into operation and inspection periods, declaration of conformity

HENSEL supports the manufacture and assembly of a distribution board with extensive assembly instructions.

Mi Power switchgear and controlgear assembly (PSC) according to IEC 61439-2 / EN 61439-2

Assembly instruction Mi Power Distribution Boards up to 630 A
Power switchgear and controlgear assemblies (PSC) in accordance with IEC 61439-2
### Routine verification / inspection (routine test report) sheet 1

The panel builder checks his work

He documents the safety of the self-made assembly based on IEC 61439 / EN 61439 by this routine test report (Sheet 1).

#### Verifications which the PANEL BUILDER is required to perform himself

<table>
<thead>
<tr>
<th>Standards section</th>
<th>Panel builder must provide VERIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection of cabinets/enclosures</td>
<td>11.2</td>
</tr>
<tr>
<td>Clearances and creepage distances</td>
<td>11.3</td>
</tr>
<tr>
<td>Protection against electric shock and integrity of protective circuits</td>
<td>11.4</td>
</tr>
<tr>
<td>Incorporation of switching devices and components</td>
<td>11.5</td>
</tr>
<tr>
<td>Internal electrical circuits and connections</td>
<td>11.6</td>
</tr>
<tr>
<td>Terminals for external conductors</td>
<td>11.7</td>
</tr>
<tr>
<td>Mechanical operation</td>
<td>11.8</td>
</tr>
<tr>
<td>Dielectric properties</td>
<td>11.9</td>
</tr>
<tr>
<td>Wiring, operational performance, function</td>
<td>11.10</td>
</tr>
</tbody>
</table>

---

### Routine Test Report Sheet 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of testing</th>
<th>Content of routine test</th>
<th>IEC 61439 Standard</th>
<th>Result of routine test</th>
<th>Test engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S</td>
<td>Degree of protection of cabinets/enclosures</td>
<td>11.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S/P</td>
<td>Clearances and creepage distances</td>
<td>11.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S/P</td>
<td>Protection against electric shock and integrity of protective circuits</td>
<td>11.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S/P</td>
<td>Incorporation of switching devices and components</td>
<td>11.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S/P</td>
<td>Internal electrical circuits and connections</td>
<td>11.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S/P</td>
<td>Terminals for external conductors</td>
<td>11.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>P</td>
<td>Mechanical operation</td>
<td>11.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>P</td>
<td>Dielectric properties</td>
<td>11.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>P</td>
<td>Wiring, operational performance, function</td>
<td>11.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- **S** - Visual inspection
- **P** - Testing with mechanical or electrical test equipment

---

The panel builder must enclose the report for the routine verification (routine test report) (Sheet 1) with the documentation of his self-assembled distribution board.

---

*Available by Gustav Hensel GmbH & Co. KG, download at [www.hensel-electric.de/61439](http://www.hensel-electric.de/61439)*
**Routine verification / inspection**

**Example: Mi Distribution Board**

1. **Degree of protection of cabinets / enclosures**

   The manufacturer must specify measures that must be implemented to maintain the designated degree of protection. Check that seals and covers have been installed according to the manufacturer’s instructions.

2. **Creepage and clearance distances**

   The clearances between different potentials should be greater than the values given in Table 1 of the standard. We recommend a minimum distance of 10mm.

3. **Protection against electric shock and integrity of the protective circuits**

   The protective circuits must be subjected to a test for integrity of electrical connection.

4. **Insulation and dielectric properties**

   A power-frequency withstand test must be performed on all circuits for a period of 1 second, as per IEC/EN 61439-1 section 10.9.2. The test voltage for switchgear assemblies with a rated insulation voltage between 300-690 V a.c. is 1.890 V. The test values for different rated insulation voltages are given in Table 8 of IEC/EN 61439-1.

5. **Internal electrical circuits and connections**

   Conduits must be checked for consistency with circuit diagrams and bolted connections have to be checked at random.

6. **Mechanical operation (actuating elements, lockings)**

   The effectiveness of mechanical actuating elements, interlocks and locks including those associated with removable parts must be checked.

7. **Routine verification / inspection**

   Example: Mi Distribution Board
The company / panel builder that is responsible for the ready-for-use switchgear assembly is considered the manufacturer (IEC 61439-1 / EN 61439-1).

Upon completion and assessment of the switchgear assembly by means of a routine verification, a manufacturer’s label must be affixed.

It must be legible when the system is connected.

HENSEL adds a manufacturer’s marking to all circuit breaker boxes.

**Manufacturer’s marking**
- Manufacturer’s name or trademark
- Type, name or ID number
- Date of manufacture
- Applied Standard
  - IEC 61439-2/-3 / EN 61439-2/-3

**Example**

![Manufacturer’s marking example](image)

**Installation note:**
- Complete label.
- Affix visibly on the exterior of the assembly.
- Protect with enclosed protective film.

**Manufacturer:**
- **Elektro Meister**
- **Musterstraße 123**
- **58764 Musterhausen**

**Order:**
- **20130815**

IEC 61439 - DIN EN 61439 - 2

**Date:**
- **01/15**

HENSEL adds a manufacturer’s marking to all circuit breaker boxes.
Declaration of European Community conformity (EC conformity)

The manufacturer of a switchgear assembly finally performs a conformity assessment according to LVD 2014/35/EU.

This can be done with the checklist for conformity assessment procedure (Sheet 2).

Finally, the Declaration of Conformity (Sheet 3) can be created. Both forms are editable and are made available for download at www.hensel-electric.de/61439.

CE marking

The laws for the safety of electrical equipment stipulate that a conformity assessment procedure has to be performed for assemblies as well. It is to prove that the assembly complies with the applicable regulations and conforms to the respectively valid safety standards.

Subsequently, a declaration of conformity must be created and the CE marking shall be affixed to the distributor.

Producing a new manufactured product from already existing manufactured goods, constitutes a manufacturer!

This shall be done by the final manufacturer of the assembly (panel builder).

Affix CE marking

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439.
What is part of the documentation of a self-assembled distribution board?

### Documentation of an assembly

1. **Wiring diagram/circuit diagram using the determined values** $I_{NA}$, $I_{NC}$, RDF, and $I_{CW}$
2. **Verification of permissible heating according to** IEC 61439-1 / EN 61439-1 Section 10.10
3. **EU only**: Declaration of conformity by the system manufacturer
4. **Protocol for part verification** (routine test protocol) (Sheet 1)
5. **EU only**: Checklist for conformity assessment procedures (Sheet 2)
6. **EU only**: Declaration of Conformity of European Community / EC Conformity (Sheet 3)
<table>
<thead>
<tr>
<th>Verification required</th>
<th>See also</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>page 27</td>
</tr>
<tr>
<td>✓</td>
<td>page 27</td>
</tr>
<tr>
<td>✓</td>
<td>page 18</td>
</tr>
<tr>
<td>✓</td>
<td>page 32</td>
</tr>
<tr>
<td>✓</td>
<td>page 35</td>
</tr>
<tr>
<td>✓</td>
<td>page 35</td>
</tr>
</tbody>
</table>

---

**4 Protocol for part verification (routine test protocol) (Sheet 1)**

**5 Checklist for conformity assessment procedures (Sheet 2)**

**6 Declaration of Conformity of European Community / EC Conformity (Sheet 3)**