HENSEL

PASSION FOR POWER.

Guide

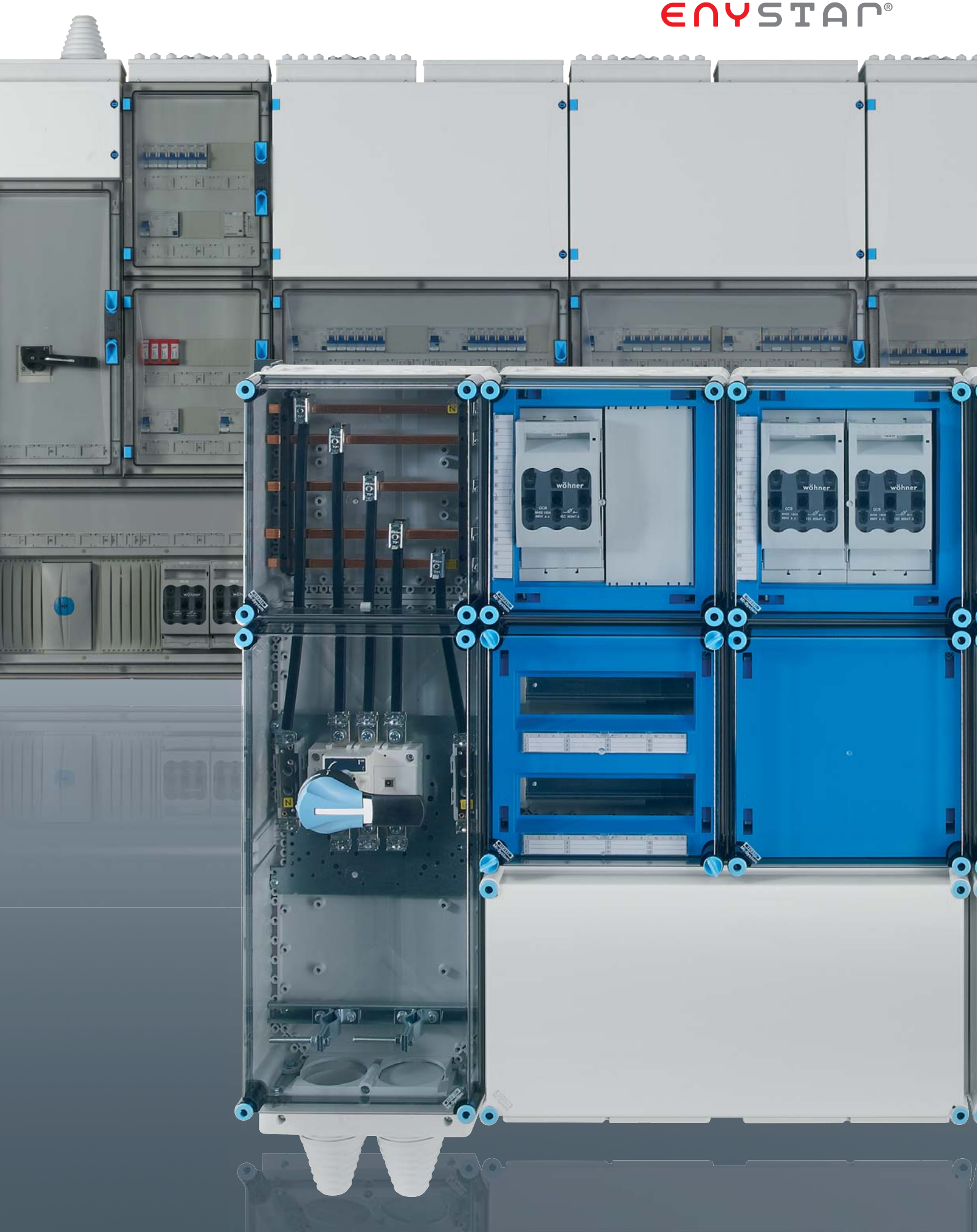
Design and assembly according to IEC 61439 / EN 61439

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

Download at www.hensel-electric.de/61439

HENSEL

ENYSTAR®



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

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

EU only

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

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

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)
  EU only
- 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.

PORTAL|61439

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

Step 1: Collecting all the project data

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

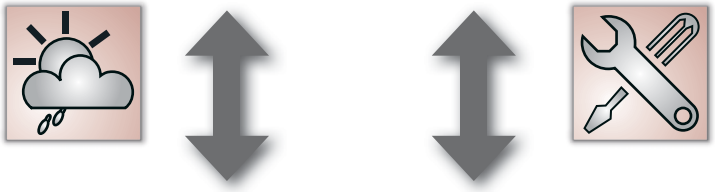
1.4 Electrical circuits and consumers

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)

BLACK BOX

ENYSTAR
Combinable enclosure system, insulation-enclosed, totally insulated, IP 66, for the assembly of distribution boards up to 250 A intended to be operated by ordinary persons (DBO) according to IEC/EN 61439-3

Mi Distributor
Combinable enclosure system, insulation-enclosed, totally insulated, IP 65, for the assembly of power switchgear and controlgear assemblies (PSC) to 630 A in accordance with IEC/EN 61439-2

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

Checklist to design switchgear assemblies in accordance with IEC 61439 / EN 61439

❑ **Request/Offer** **Hensel expert:** _____ **Date:** _____

Client: **Project:**

Name: _____ _____

Address: _____ _____

_____ _____

Phone: _____ _____

E-Mail: _____ _____

1. Installation and ambient conditions

Type of business: _____ Indoor/ambient temperature (°C): _____

Installation

- indoors: ❑ in the locked electrical operation room ❑ in production area

- outdoors: ❑ protected outdoors ❑ unprotected outdoors

Available wall surface in mm: Width: _____ Height: _____ Depth: _____

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_k (%): ❑ 4 ❑ 6

Rated voltage _____ ❑ V a.c. ❑ V d.c. ❑ ____ Hz ❑ _____ Rated current (A): _____

Conductor designation: ❑ L1, L2, L3 ❑ N ❑ PE ❑ PEN

Protection class: ❑ I ❑ II

Incoming device: _____

Connection incoming:

❑ from top ❑ from bottom ❑ from left ❑ from right ❑ _____

❑ copper ❑ aluminum

❑ with cable lug ❑ with terminal

❑ conductor ❑ single conductor cross section (mm²): _____

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:

	Quan-tity	Type of protective device (fuse, circuit breaker, ...)	Rated values of the consumer (current, power, ...)	Comments
Consumer				
Consumer				
Consumer				
Consumer				
Consumer				

Gustav Hensel GmbH & Co. KG · Industrial Electrical Power Distribution Systems · D 57368 Lennestadt · Germany · www.hensel-electric.de/61439

1.1 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. Installation / ambient conditions

Type of business: _____ Indoor / ambient temperature (°C): _____

Installation

Indoor: ❑ in locked electrical operating room ❑ in production area

Outdoors: ❑ protected outdoors ❑ unprotected outdoors

Available wall surface in mm: Width: _____ Height: _____ Depth: _____

Assembly type: ❑ wall-mounted ❑ floor-standing

Degree of protection: ❑ IP 44 ❑ IP 54 ❑ IP 55 ❑ IP 65 ❑ IP _____

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** **- 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

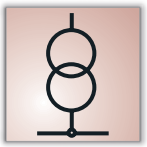
The checklist queries the necessary requirements for the switchgear assembly for the operation taking into account the qualifications of persons who require access to the respective areas or must operate equipment.

2. Operation ❑ by skilled persons (electricians) ❑ by unskilled person

Doors/lids: ❑ opaque/without inspection pane ❑ transparent/with inspection pane ❑ _____

Operation by	**Electrician (skilled person)**	IP XXB 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
	Electro-technical unskilled person Selection of equipment for unskilled persons! Only installation devices such as series built-in equipment, fuses up to 63A, circuit-breakers and IT components permitted.	IP XXC: Protection against direct contact with hazardous live parts For distribution boards, IEC 61439-3 / EN 61439-3 requires special protective measures for areas to which unskilled persons have access: - Live parts should be covered with a protection cover. - Devices which may be operated by a qualified electrician only, shall be installed behind separate lids or doors, which can be opened only with a tool. Hand-operation for the access areas of unskilled persons or use of hinged lids allowing easy control of equipment.
Devices operated	Behind the door / lid	Protection measures must be observed
Doors / covers		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 ❑ 6

Rated voltage _____ ❑ V a.c. ❑ V d.c. ❑ _____ Hz ❑ _____ Rated current (A): _____

Conductor designation: ❑ L1, L2, L3 ❑ N ❑ PE ❑ PEN

Protection class: ❑ I ❑ II

Incoming device: _____

Connection incoming:

❑ from top ❑ from bottom ❑ from left ❑ from right ❑ _____

❑ copper ❑ alumini

❑ with cable lug ❑ with terminal

❑ conductor ❑ single conductor 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
Rated current	Infeed current (rated current transformer / upstream protective device)	Determine I_{nA}, 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. I_{cp} I_K" **For detailed information about** - determination of the rated current (I_{nA}) Page 22 - determination of the rated short-time withstand current (I_{CW}) Page 20-21
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): _____

Equipped with	Quantity	Type of protective device (fuse, circuit breakers, ...)	Rated values of the consumer (current, power, ...)	Comments
Consumer				
Consumer				
Consumer				
Consumer				
Consumer				

Outgoing cable connection	Type of outgoing cable Type of cable Type of connection	
Equipping		
Type of protective device	Fuse, miniature circuit breaker, circuit breaker	**For detailed information about**
Rating data of the consumer	Current Power Type (ohmic, inductive or capacitive load) cos φ	- Rating of an outgoing circuit (I_{nC}) Page 23 - Determination of the operating current (I_B) Page 24 - Calculation of the power dissipation (P_V) 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

Checklist to design switchgear assemblies in accordance with IEC 61439 / EN 61439

❑ **Request/Offer** **Hensel expert:** Hoffmann **Date:** 05.05.2016

Client:
Name: Metal working shop Brands
Address: Musterstraße 10
50000 Musterstadt
Phone:
E-Mail: info@ brands-metalworkingshop.de

Project:
Extension to the production facility
Section II

1. Installation and ambient conditions

Type of business: Metal working shop Indoor/ambient temperature (°C): 25

Installation
- indoors: ❑ in the locked electrical operation room ☒ in production area
- outdoors: ❑ protected outdoors ❑ unprotected 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_k (%): ❑ 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:

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

Gustav Hensel GmbH & Co. KG · Industrial Electrical Power Distribution Systems · D 57368 Lennestadt · Germany · www.hensel-electric.de/61439

Download editable checklist:
www.hensel-electric.de/61439

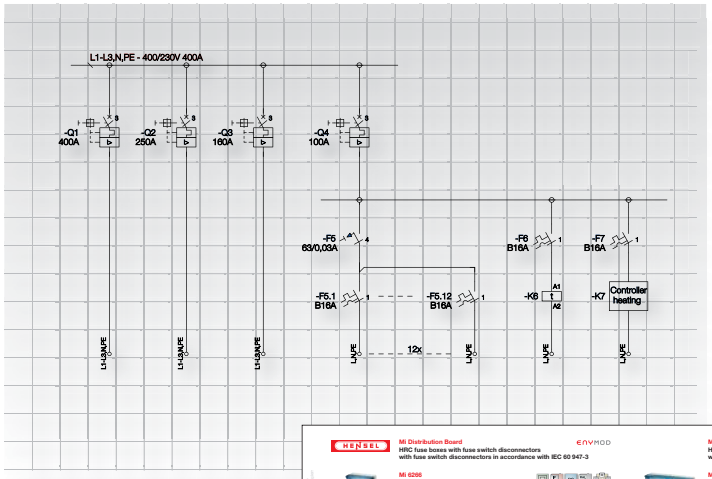
Example: Project design using the data from the checklist

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

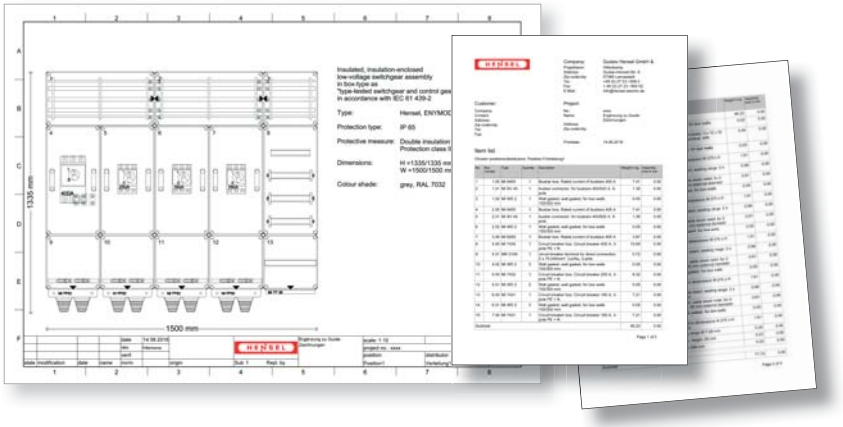
ENYGUIDE

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.

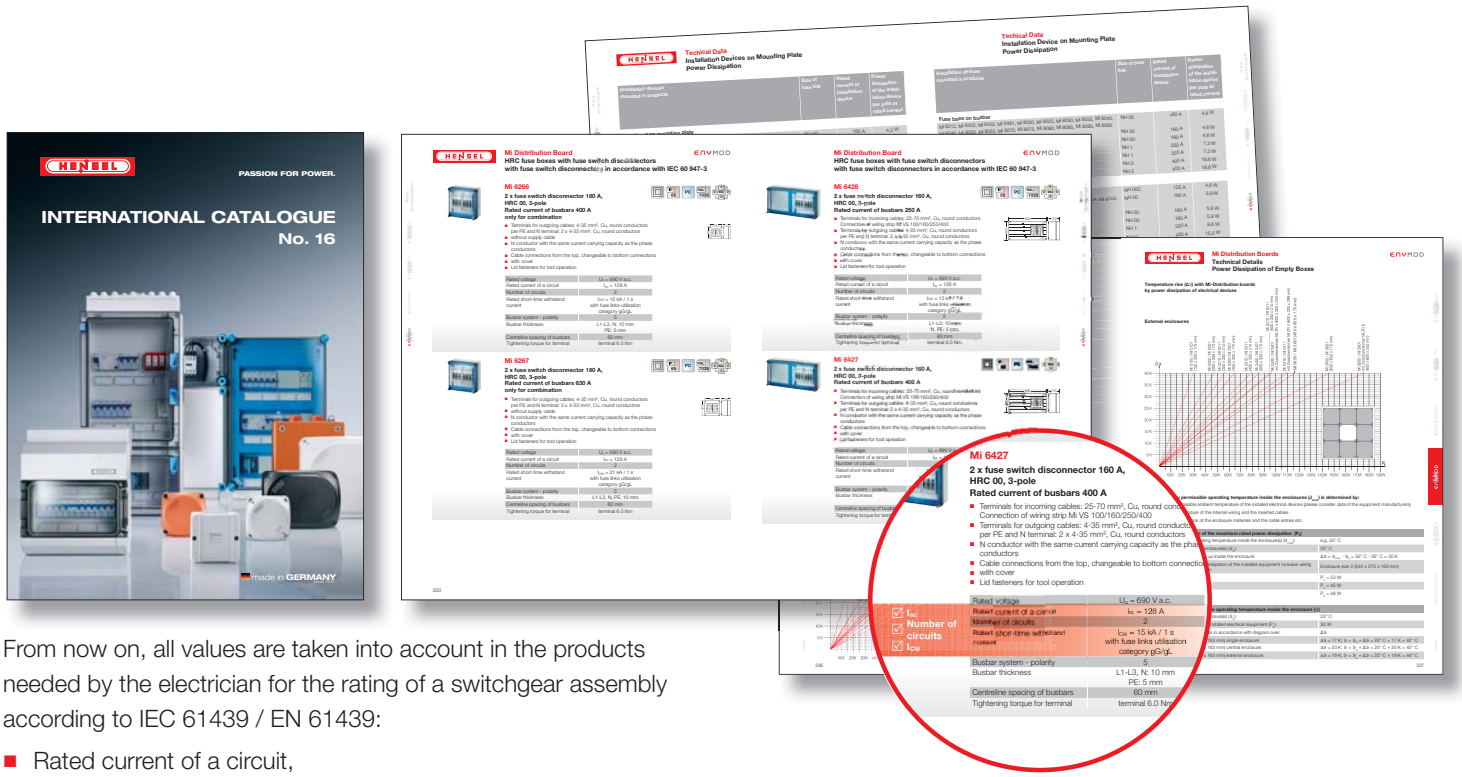
HENSEL provides comprehensive planning tools that simplify the planning.



Step 2: Design of an assembly and design verification

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.

ENYGUIDE

- 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.

offline or online via internet
www.enyguide.de

HENSEL website with the package of services for electricians:
Everything for planning according to IEC 61439 / EN 61439 ONLINE for download!

www.hensel-electric.de

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

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

Step 2: Design of an assembly and design verification

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.

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

EU only

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.


Technische Information
Konformitätserklärung
ENYSTAR

Erklärung
der EG-Konformität
Declaration of EC-Conformity

Nr./No. ENY 2009b

Das Produkt,
The product

Typ / Type: ENYSTAR
Typ / type: FP ...

Hersteller / Manufacturer: Gustav Hensel GmbH & Co. KG
Gustav-Hensel-Straße 6
57368 Lennestadt

Beschreibung / Description: Installationsverteiler bis 250 A "OBO"
Distribution boards up to 250 A "OBO"

auf das sich diese Erklärung bezieht, stimmt mit folgenden Normen oder normativen Dokumenten überein:
to which this declaration relates is in conformity with the following standard(s) or normative document(s):

Norm / Standard: DIN EN 61439-3
IEC 61439-3
EN 61439-3

und entspricht den Bestimmungen der folgenden EG-Richtlinie(n):
and is in accordance with the provisions of the following EC-directive(s):

Niederspannungs-Richtlinie 2006/95/EG
Low voltage directive 2006/95/EC

Diese Konformitätserklärung entspricht der Europäischen Norm EN 17050-1 „Allgemeine Anforderungen für Konformitätserklärungen von Anbietern". Das Unternehmen Gustav Hensel GmbH & Co. KG ist Mitglied von ALPHA im VDE. Diese Erklärung gilt weltweit als Erklärung des Herstellers zur Übereinstimmung mit den oben genannten internationalen und nationalen Normen.

This Declaration of Conformity is suitable to the European Standard EN 17050-1 „General requirements for supplier's declaration of conformity". The company Gustav Hensel GmbH & Co. KG is member of ALPHA at VDE. The declaration is world-wide valid as the manufacturer's declaration of compliance with the requirements of the a.m. national and international standards.

Jahr der Anbringung der CE-Kennzeichnung:
Year of affixing CE-Marking: 2013

Ausstellungsdatum:
Date of issue: 31.03.2015

Gustav Hensel GmbH & Co. KG

O. Gutzeit
- Technische Geschäftsleitung -
- Technical Managing Director -


Technische Information
Konformitätserklärung
Mi-Verteiler

Erklärung
der EG-Konformität
Declaration of EC-Conformity

Nr./No. K 2010b

Das Produkt,
The product

Typ / Type: Mi-Verteiler
Mi-Distributor
Typ / type: MI ...

Hersteller / Manufacturer: Gustav Hensel GmbH & Co. KG
Gustav-Hensel-Straße 6
57368 Lennestadt

Beschreibung / Description: Niederspannungs-Schaltgerätekombination „PSC"
Low-voltage switchgear and controlgear assemblies "PSC"

auf das sich diese Erklärung bezieht, stimmt mit folgenden Normen oder normativen Dokumenten überein:
to which this declaration relates is in conformity with the following standard(s) or normative document(s):

Norm / Standard: DIN EN 61439-2
IEC 61439-2
EN 61439-2

und entspricht den Bestimmungen der folgenden EG-Richtlinie(n):
and is in accordance with the provisions of the following EC-directive(s):

Niederspannungs-Richtlinie 2006/95/EG
Low voltage directive 2006/95/EC

EMV-Richtlinie (EMC) 2004/108/EG
Electromagnetic Compatibility (EMC) Directive 2004/108/EC

Diese Konformitätserklärung entspricht der Europäischen Norm EN 17050-1 „Allgemeine Anforderungen für Konformitätserklärungen von Anbietern". Das Unternehmen Gustav Hensel GmbH & Co. KG ist Mitglied von ALPHA im VDE. Diese Erklärung gilt weltweit als Erklärung des Herstellers zur Übereinstimmung mit den oben genannten internationalen und nationalen Normen.

This Declaration of Conformity is suitable to the European Standard EN 17050-1 „General requirements for supplier's declaration of conformity". The company Gustav Hensel GmbH & Co. KG is member of ALPHA at VDE. The declaration is world-wide valid as the manufacturer's declaration of compliance with the requirements of the a.m. national and international standards.

Jahr der Anbringung der CE-Kennzeichnung:
Year of affixing CE-Marking: 2012

Ausstellungsdatum:
Date of issue: 31.03.2015

Gustav Hensel GmbH & Co. KG

O. Gutzeit
- Technische Geschäftsleitung -
- Technical Managing Director -

HENSEL declarations of conformity for download:
www.hensel-electric.de/61439

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 ...

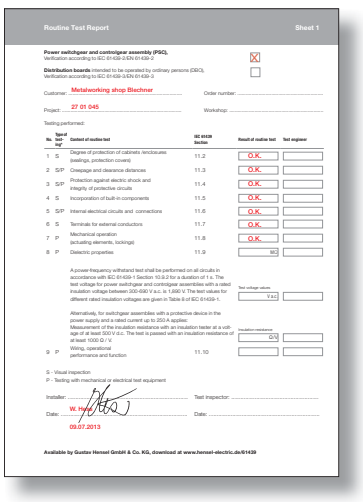
Verifications which the PANEL BUILDER is required to perform himself	Standards section	Panel builder must provide VERIFICATION
Clearances and creepage distances	10.4	by routine testing
Protection against electric shock and integrity of protective cirduits - Effective earth continuity between the exposed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

... 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.


Routine Test Report Sheet 1

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

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

Customer: Metalworking shop Blechner Order number:

Project: 27 01 045 Workshop:

Testing performed:

No.	Type of test	Content of routine test	IEC 61439 Section	Result of routine test	Test engineer
1	S	Degree of protection of cabinets /enclosures (sealings, protection covers)	11.2	O.K.	
2	S/P	Creepage and clearance distances	11.3	O.K.	
3	S/P	Protection against electric shock and integrity of protective circuits	11.4	O.K.	
4	S	Incorporation of built-in components	11.5	O.K.	
5	S/P	Internal electrical circuits and connections	11.6	O.K.	
6	S	Terminals for external conductors	11.7	O.K.	
7	P	Mechanical operation (actuating elements, locking)	11.8	O.K.	
8	P	Dielectric properties	11.9	see	
		A power-frequency withstand test shall be performed on all circuits in accordance with IEC 61439-1 Section 10.9.2 for a duration of 1 s. The test voltage for power switchgear and controlgear 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 61439-1.		Test voltage values: V a.c.	
		Alternatively, for switchgear assemblies with a protective device in the power supply and a rated current up to 250 A applies: Measurement of the insulation resistance with an insulation tester at a voltage of at least 500 V d.c. The test is passed with an insulation resistance of at least 1000 Ω / V.		Insulation resistance: Ω/V	
9	P	Wiring, operational performance and function	11.10		

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

Installer: Test inspector:

Date: W. Hensel Date:

09.07.2013

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439

Routine test report for download as editable checklist:
www.hensel-electric.de/61439

Step 2: Design of an assembly and design verification

Determining the rated short-time withstand current (I_{cw}) 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.

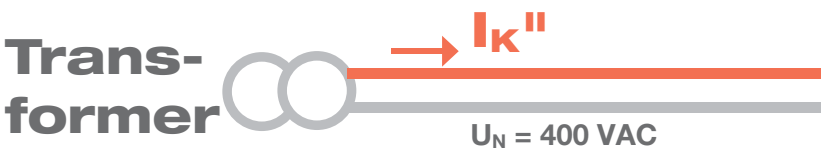
The **panel builder** must specify the **rated short-time withstand current I_{cw}** of the connection point in his documentation, e.g. in the circuit diagram or technical document.

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 I_{cw} value of the busbars.

Rated short-circuit withstand current is determined by the values I_K'', I_{cw}, I_{cp}, I_{cu}.

HV = Main Distribution board
UV = Sub-distribution board

Example:



Step 1:

Determining the transformer power and determining the value I_K''

The I_K'' can be determined by reading table 1.

Transformer	
S_r = 250 kVA	see identifier plate
U_N = 400 VAC	see identifier plate
I_N = 360 A	see table 1
I_K'' = 9.025kA	see table 1

Alternatively, the I_K'' is calculated using the formula:

$$I_K'' = \frac{S_r \cdot 100}{\sqrt{3} \cdot U_N \cdot u_K}$$

I_K'' in kA
S_r in kVA
U_N in V
u_K in %

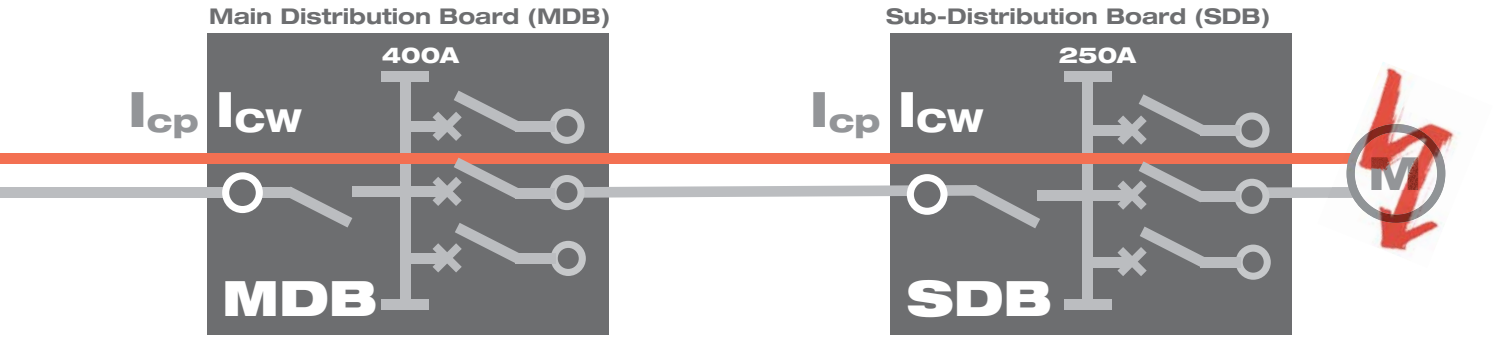
Table 1:
Excerpt from HENSEL main catalogue

Rated power of the transformer S_r in kVA	Rated current at rated voltage U_n=400 V a.c. I_N in A	Initial short-circuit current at u_k = 4% I_K'' in kA	Initial short-circuit current at u_k = 6% I_K'' in kA
100	144	3.610	2.406
160	230	5.776	3.850
250	**360**	**9.025**	6.015
315	455	11.375	7.583
400	578	14.450	9.630

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

Installation device in HENSEL distribution boards	Short-circuit withstand capacity
Busbar 250 A / 400 A	I_{CW} =15kA / 1s
NH fuse switch disconnector 250 A	I_{CC} = 50kA
Circuit breaker 250 A / 400 A	I_{CU} = 50kA
Switch disconnector 160 A	I_{CC} = 50kA
MCCB 160 A / 250 A	I_{CS} = I_{CU} = 8 kA / 690 V a.c. I_{CS} = I_{CU} = 36 kA / 415 V a.c.
Other values can be obtained from the device manufacturers or in the HENSEL main catalogue!	

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.

MDB installed devices	I_{cw} or I_{cu}
Circuit breaker 400 A	I_{cu} = 50kA *
Busbars 400 A	**I_{cw} = 15kA / 1s ***
MCCB 250 A	$I_{cs} = I_{cu}$ = 8 kA / 690 V a.c. $I_{cs} = I_{cu}$ = 36 kA / 415 V a.c.*

*see table 2

Lowest value of the devices: I_{CC} / I_{CU} = 50kA
Lowest value of the busbars: I_{CW} = 15kA
⇒ I_{CW}(MDB) = 15kA
I_{CW}(MDB) ≥ I_K"
15kA ≥ 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.

SDB installed devices	I_{cw}
Circuit breaker 250 A	I_{cu} = 50kA *
Busbar 250 A	**I_{cw} = 15kA / 1s ***
MCCB 160 A	$I_{cs} = I_{cu}$ = 8 kA / 690 V a.c. $I_{cs} = I_{cu}$ = 36 kA / 415 V a.c.*

*see table 2

Lowest value of the devices: I_{CC} / I_{CU} = 50kA
Lowest value of the busbars: I_{CW} = 15kA
it follows: I_{CW}(SDB) = 15kA
⇒ I_{CW}(SDB) ≥ I_K"
15kA ≥ 9.025kA ✓

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_K" of the transformer:

I_{cw} (MDB) ≥ I_K" (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_K". The prospective short-circuit current I_{cp} at the installation site of the MDB is smaller because of the cable attenuation than I_K" 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!

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

I_{cp} is the prospective short-circuit current at the installation site of the assembly at the incoming terminals. It (I_{cp}) is calculated from transformer and cable data (length, cross section). Here, the cable attenuation due to distance and associated cable length between the transformer and sub-distribution board (SDB) is considered. The cable attenuation reduces the I_K" of the transformer.

If a calculation is not possible, I_{cp} = I_K" can be assumed.

The rated short-time withstand current (I_{CW}) must satisfy the following requirements:

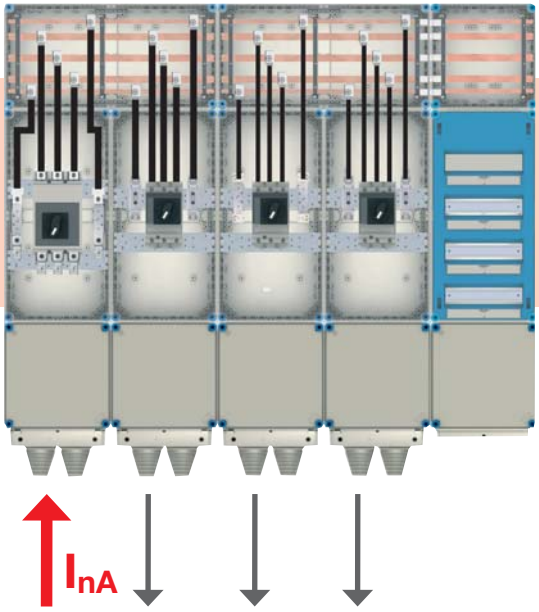
I_{CW}(SDB) ≥ I_{cp}(SDB)

The rated short-time withstand current (I_{CW}) of the sub-distribution board is determined the same way as for the main distribution board. **The respectively lowest value of the devices also determines the maximum rated short-circuit withstand current I_{cw} of the sub-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 whithin the assembly operated in parallel and the total current which the main busbar is capable of distributing in the particular assembly arrangement.

Transformer ratings

Rated voltage U_N	230/400 V			400/690 V		
Short-circuit voltage U_K		4%	6%		4%	6%
Rated power S_N	Rated current I_N	Short-circuit current I_K"		Rated current I_N	Short-circuit current I_K"	
(kVA)	(A)	(A)	(A)	(A)	(A)	(A)
50	72	1805	-	42	1042	-
100	144	3610	2406	84	2084	1392
160	230	5776	3850	133	3325	2230
200	280	7220	4860	168	4168	2784
250	360	9025	6015	210	5220	3560
315	455	11375	7583	263	6650	4380
400	578	14450	9630	336	8336	5568
500	722	18050	12030	420	10440	7120
630	910	22750	15166	526	13300	8760

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

$$I_N = \frac{S_N}{\sqrt{3} \times U_N} \qquad I_K = \frac{I_N}{U_K(\%)} \cdot 100$$

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

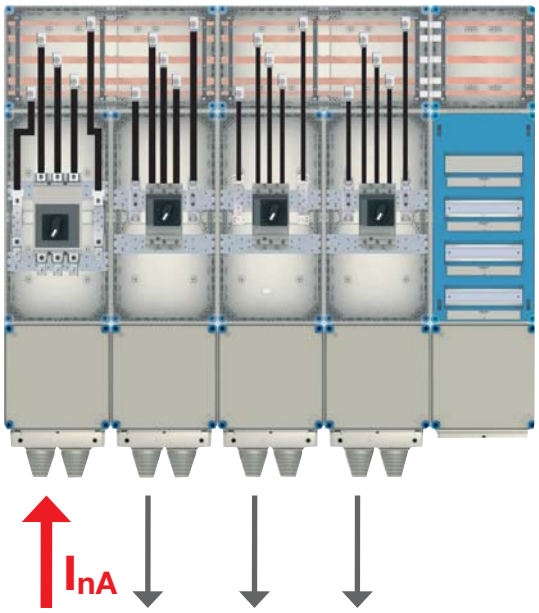
Selection of the installed device of outgoing circuits based on the rated current of the circuits I_{nC}

Example 1: WITH specified operating current of the load	**Example 2: WITHOUT specifying the operating current of the load**
If an operating current (I_B) is specified, the rated current of the installed device must be calculated. It results from the division of the operating current and the factor 0.8 according to IEC 61439 / EN 61439	If no operating current (I_B) is specified, an installation device is selected and the rated current of the circuit (I_{nc}) is calculated.
Example operating current: 180 A 180 A: 0.8 = 225 A The rated current of the installed device must be **at least** 225 A. The next size for MCCB is 250 A.	Example device selection: MCCB: 250 A 250 A x 0.8 = 200 A The maximum rated current of the circuit I_{nc} is 200 A.

The rated current of the circuit I_{nc} is 200 A.

Determining the operating current (I_B)

I_{nc} x assumed loading factor = I_B



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

The operating current (I_B) can be specified.

If no operating current (I_B) 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 asseumed loading factor for the calculation of the operating current (I_B) may be used depending on the number of circuits.

The operating current I_B is calculated according to the formula:
$I_B = I_{nc}$ x assumed loading factor

Table 101 from IEC 61439 / EN 61439

Number of outgoing circuits	*Assumed load factor*	
	Mi distribution board IEC 61439-2 / EN 61439-2	*ENYSTAR distribution board IEC 61439-3 / EN 61439-3*
2-3	*0.9*	*0.8*
4-5	*0.8*	*0.7*
6-9	*0.7*	*0.6*
10 or more	*0.6*	*0.5*

Determination of the operating current I_B

Example 1: WITH specified operating current	**Example 2: WITHOUT specifying the operating current**
The customer specifies the rated operating current I_B.	The I_B is calculated according to the formula: $I_B = I_{nc}$ x assumed loading factor The assumed loading factor from Table 101 may be used.
Example Operating current: 180 A	Example Number outgoing circuits: 3 Assumed load factor: 0.9 I_{nc} = 200 A 200 A x 0.9 = 180 A
The operating current I_B is 180 A. **I_B = 180 A**	The operating current I_B is 180 A. **I_B = 180 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

ONLINE calculation tool HENSEL "Design verification of permissible temperature rise".

Design verification of permissible temperature rise according to IEC 61439-1 / EN 61439-1 Section 10.10

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

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.

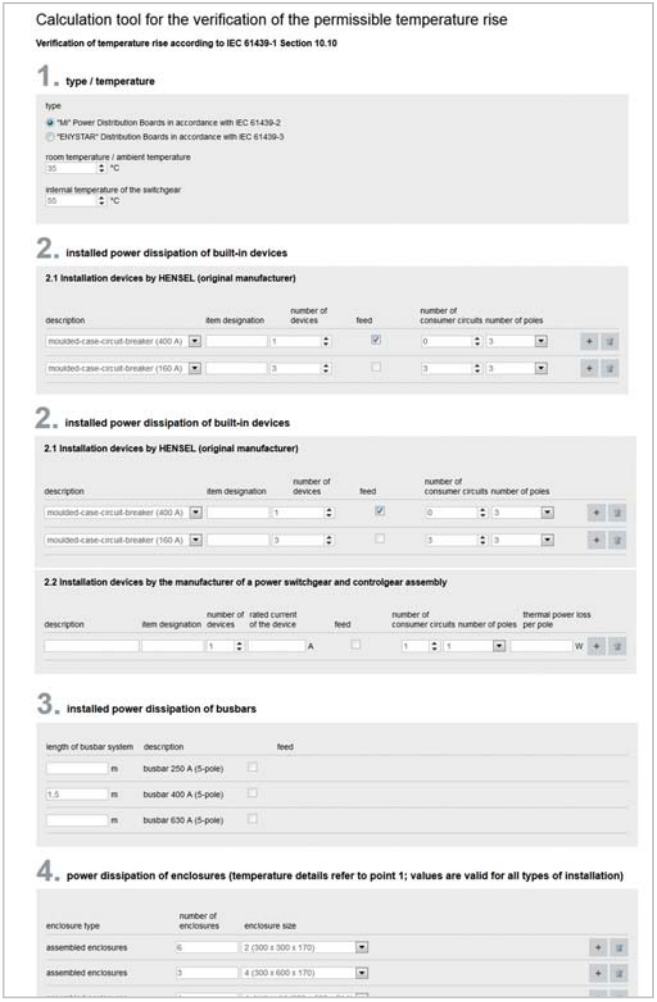
The result is the difference of installed and dissipated power dissipation. It can be positive or negative.

- 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).



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

Determining the rated diversity factor (RDF)

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

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

IEC 61439 / EN 61439 -1 Section 5.4
Rated diversity factor RDF (Rated Diversity Factor)
"The rated diversity factor is the per unit value of the rated current, assigned by the assembly manufacturer, to which outgoing circuits of an assembly can be continuously and simultaneaously loaded taken into account the mutual thermal influences."

- 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.

Formula 1:

$$RDF = \frac{I_B}{I_{nc}}$$

Formula 2:

$$RDF = \sqrt{\frac{\text{dissipated power dissipation}}{\text{installed power dissipation}}} \times \text{assumed loading factor}$$

Determining the rated diversity factor RDF

Example 1: WITH specified operating current

The customer specifies the operating current I_B.

This value is used in Formula 1.

$$RDF = \frac{I_B \text{ according to customer specification}}{I_{nc}}$$

Example: I_B =180 A and I_{nc} = 200A

$$RDF = \frac{180\ A}{200A} = 0.9$$

RDF = 0.9

Example 2: WITHOUT specifying the operating current

- With a positive difference, the RDF corresponds to the assumed loading factor.
- With a negative difference, the RDF must be determined by means of a calculation. For this purpose, the values from the calculation tool for dissipated power dissipation and installed power dissipation are used.

$$RDF = \sqrt{\frac{\text{dissipated power dissipation}}{\text{installed power dissipation}}} \times \text{assumed loading factor}$$

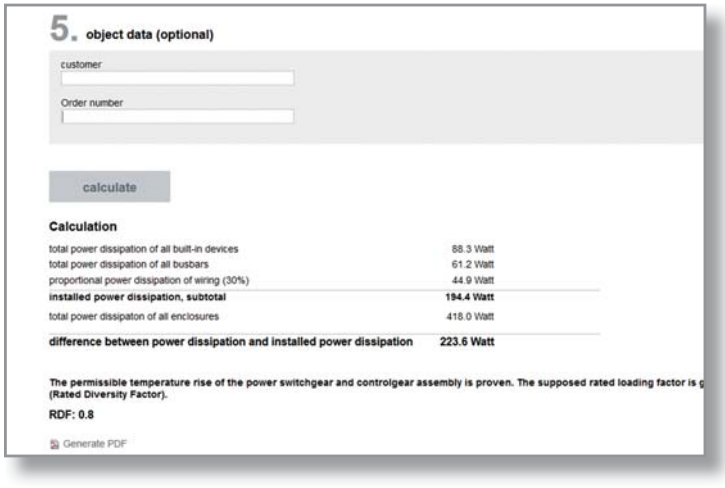
Example:
Result from the calculation table is 0.9.

RDF = 0.9

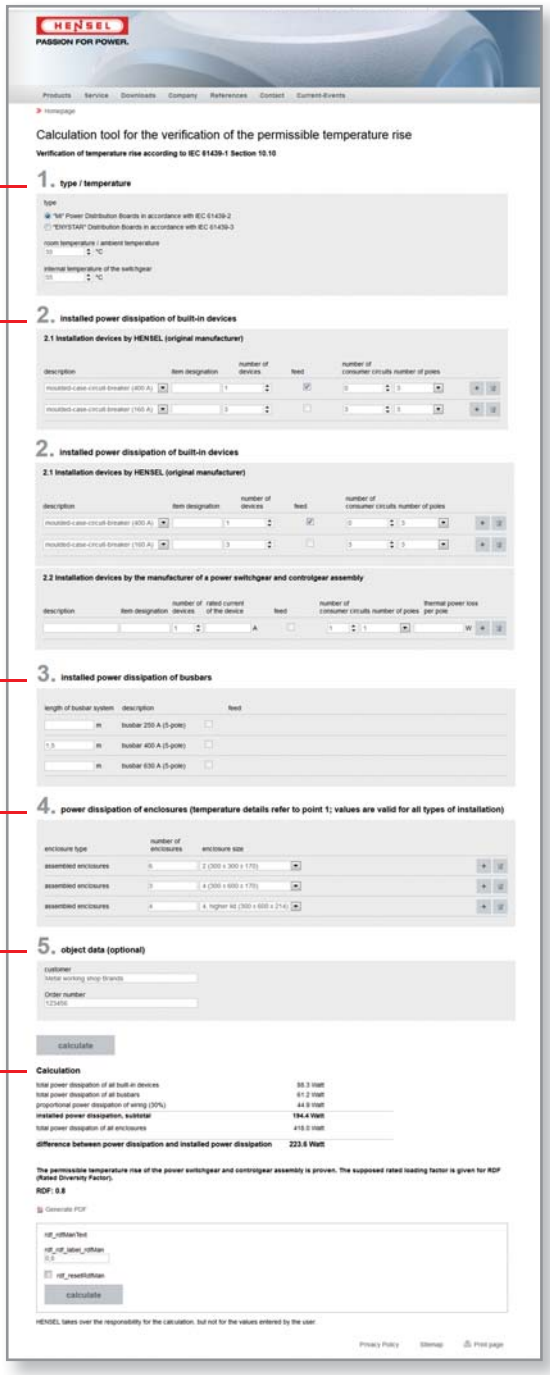
Online via internet
www.hensel-electric.de/61439

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.



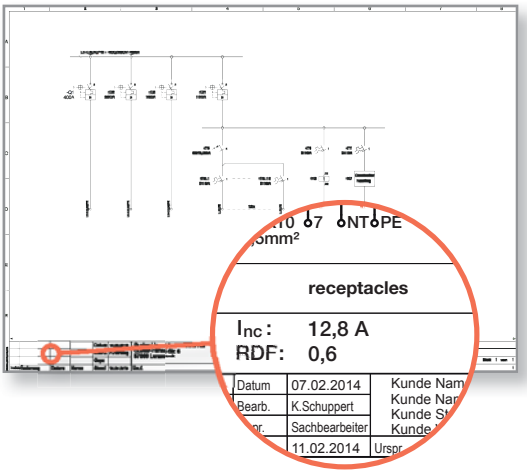
Design verification of permissible temperature rise according to IEC 61439-1 / EN 61439-1 Section 10.10

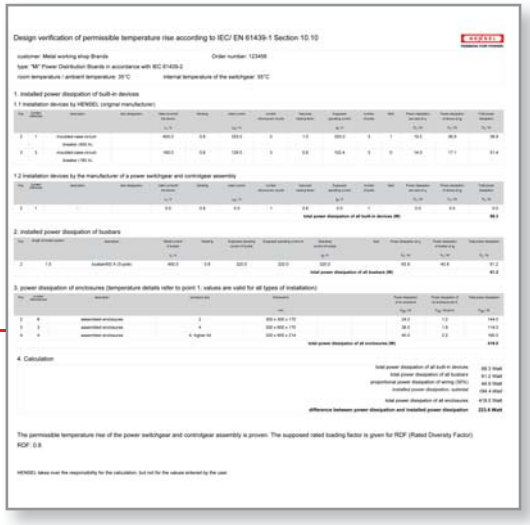


1. **Type / temperature**
   (Installation and ambient conditions)
2. **Installed power dissipation of the installed equipment**
   (Connection to the public power supply system)
3. **Installed power dissipation of the busbars**
   (circuits and consumers)
4. **Dissipated power dissipation of the enclosures**
5. **Optional object data**
6. **Determination of RDF:**
   The calculation tool determines the RDF.

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.





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.

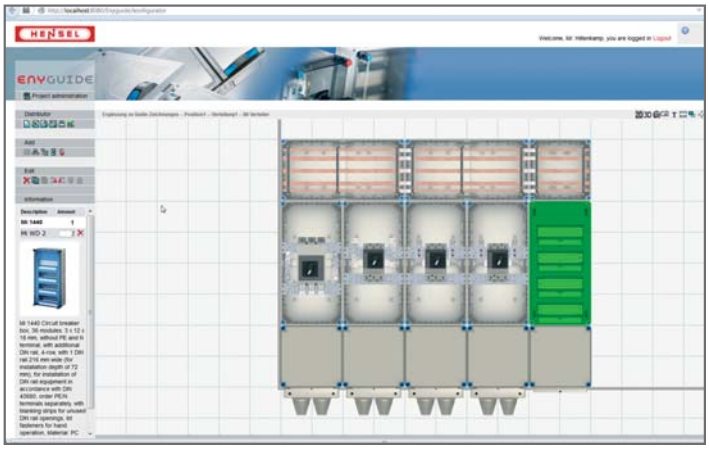
Online via internet
www.hensel-electric.de/61439

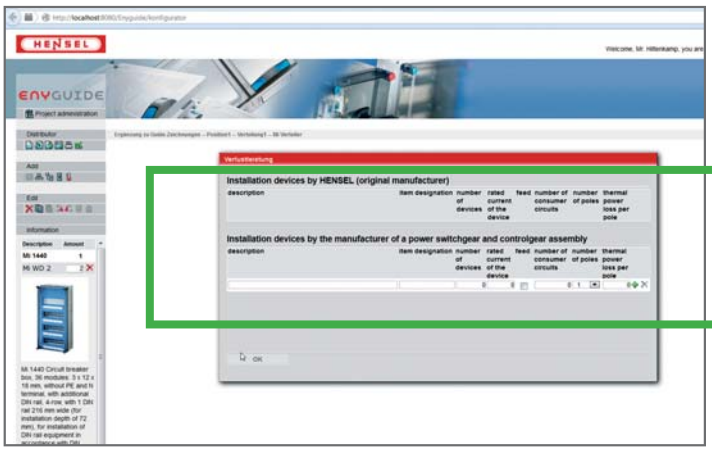
Calculation of the power dissipation (P_V) with ENYGUIDE planning software

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

Example: Mi isolator box

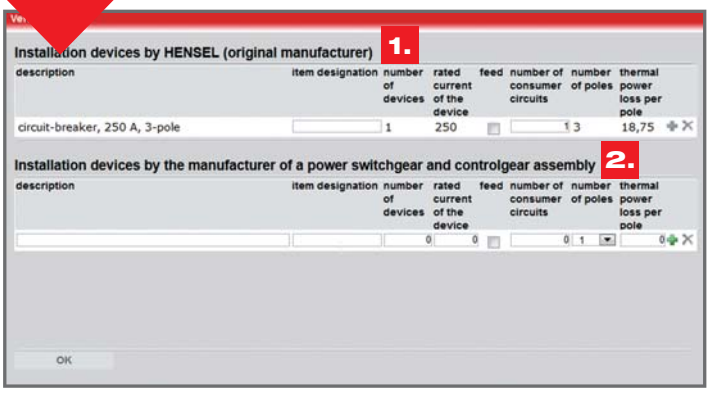
Example: Mi Circuit breaker box





The power loss calculation differentiates between installation devices, which have been built-in by the original manufacturer (Hensel) (1.) and those which have been additionally selected by the manufacturer of the assembly (panel builders) (2.).

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.



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.

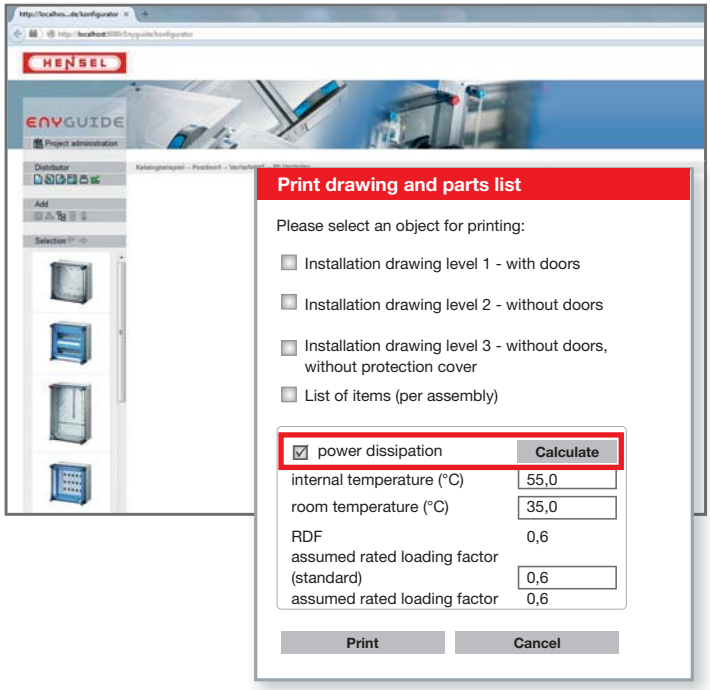
Individual planning of installation devices

Installation devices, which are not listed within the add-to-installation-device function, can be manually added (+) or can be deleted (X).

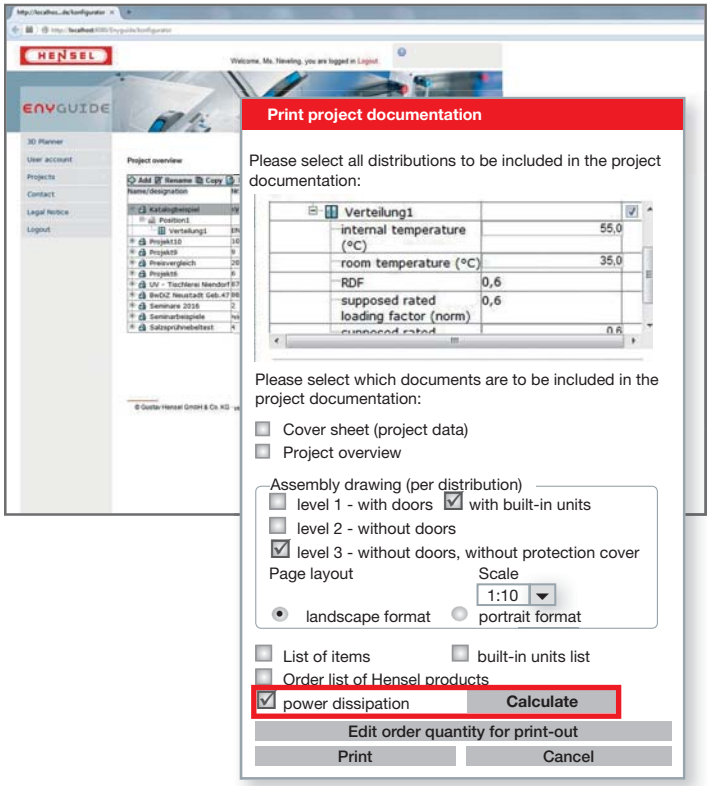
Determining the rated diversity factor RDF and design verification of permissible temperatur rise according to IEC 61439-1 Section 10.10

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.

Printing power loss calculation from view of distributor

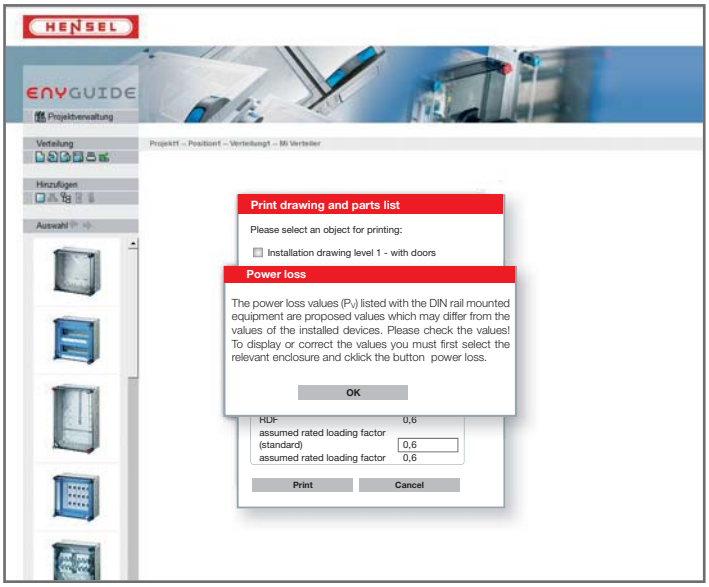


Printing power loss calculation from view of project overview



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!

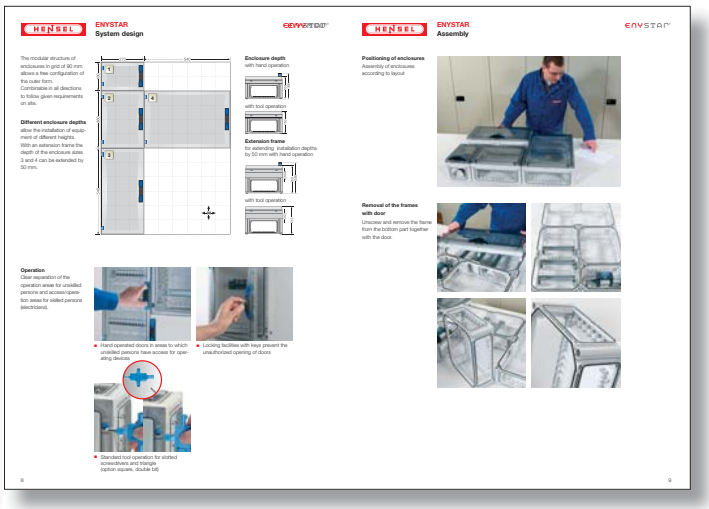


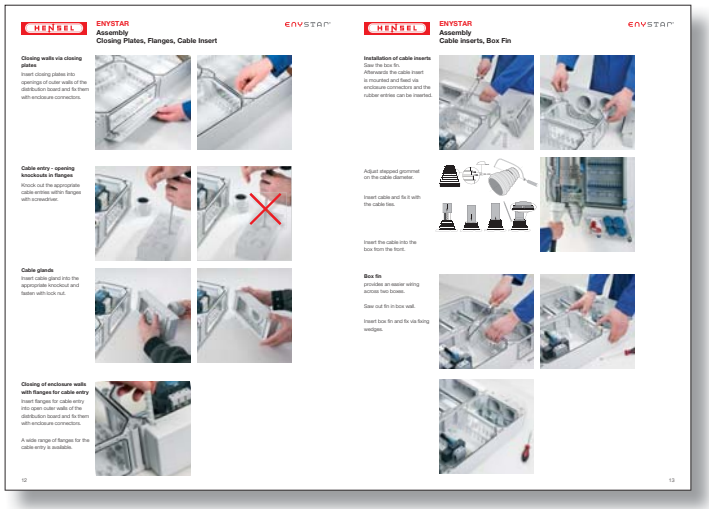
Step 3: Assembly / manufacture of the distribution board

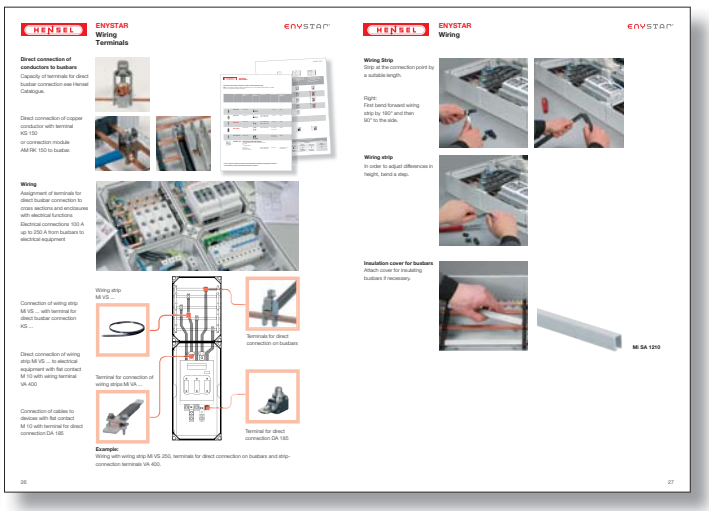
Assembly instructions for distribution board systems

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 for download:
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

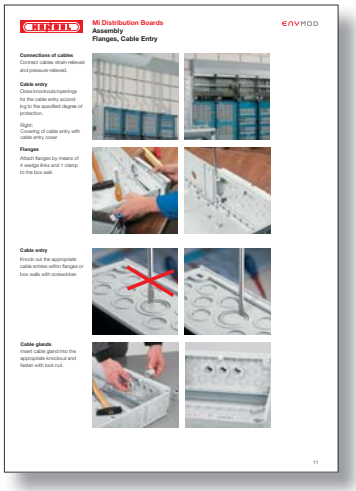
Device installation
mounting plate, DIN rails, PE and N terminals, protection against access to hazardous parts/covers

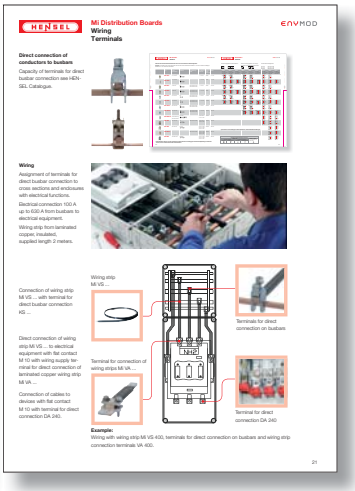
Wiring
busbar systems, connecting terminals, wiring, bending wiring strips, feed-in terminals, FIXCONNECT® plug-in terminals, connection of aluminum conductors

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 for download:
www.hensel-electric.de/61439

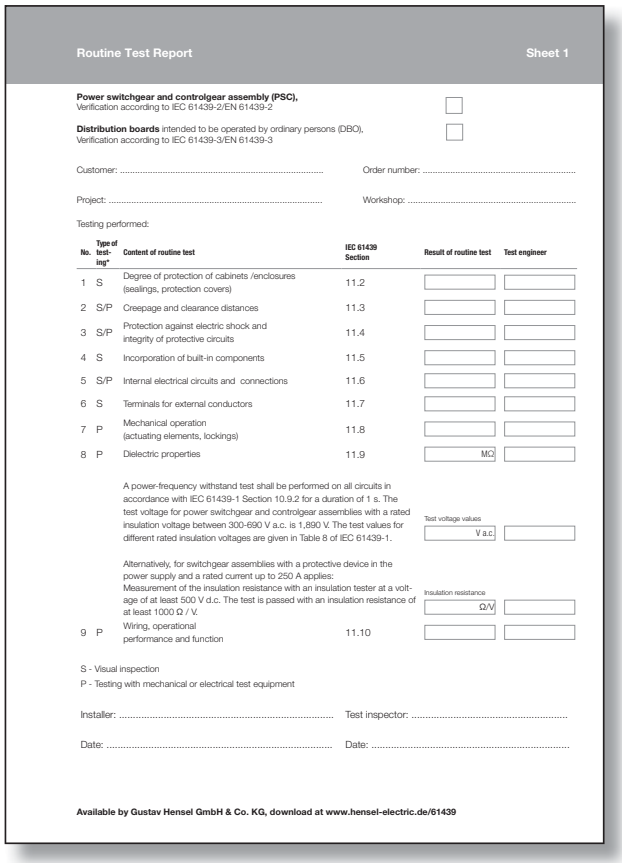
Step 3: Assembly / manufacture of the distribution board

Routine verification / inspection (routine test report) sheet 1
The panel builder checks his work

Inspection test by the manufacturer of the assembly (panel builder). Herby, the panel builder inspects and verifies the assembly of his distribution board.

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



Routine Test Report — Sheet 1

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

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

Customer: ..... Order number: .....

Project: ..... Workshop: .....

Testing performed:

No.	Type of testing*	Content of routine test	IEC 61439 Section	Result of routine test	Test engineer
1	S	Degree of protection of cabinets /enclosures (sealings, protection covers)	11.2		
2	S/P	Creepage and clearance distances	11.3		
3	S/P	Protection against electric shock and integrity of protective circuits	11.4		
4	S	Incorporation of built-in components	11.5		
5	S/P	Internal electrical circuits and connections	11.6		
6	S	Terminals for external conductors	11.7		
7	P	Mechanical operation (actuating elements, lockings)	11.8		
8	P	Dielectric properties	11.9	MΩ	
		A power-frequency withstand test shall be performed on all circuits in accordance with IEC 61439-1 Section 10.9.2 for a duration of 1 s. The test voltage for power switchgear and controlgear 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 61439-1.		Test voltage values V a.c.	
		Alternatively, for switchgear assemblies with a protective device in the power supply and a rated current up to 250 A applies: Measurement of the insulation resistance with an insulation tester at a voltage of at least 500 V d.c. The test is passed with an insulation resistance of at least 1000 Ω / V.		Insulation resistance Ω/V	
9	P	Wiring, operational performance and function	11.10		

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

Installer: ..... Test inspector: .....

Date: ..... Date: .....

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439

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.

Routine test report for download as editable checklist:
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.

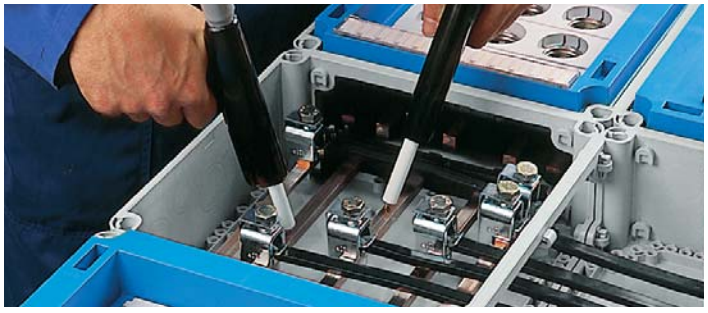
5. Internal electrical circuits and connections

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

7. Mechanical operation (actuating elements, lockings)

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

8. Dielectric properties

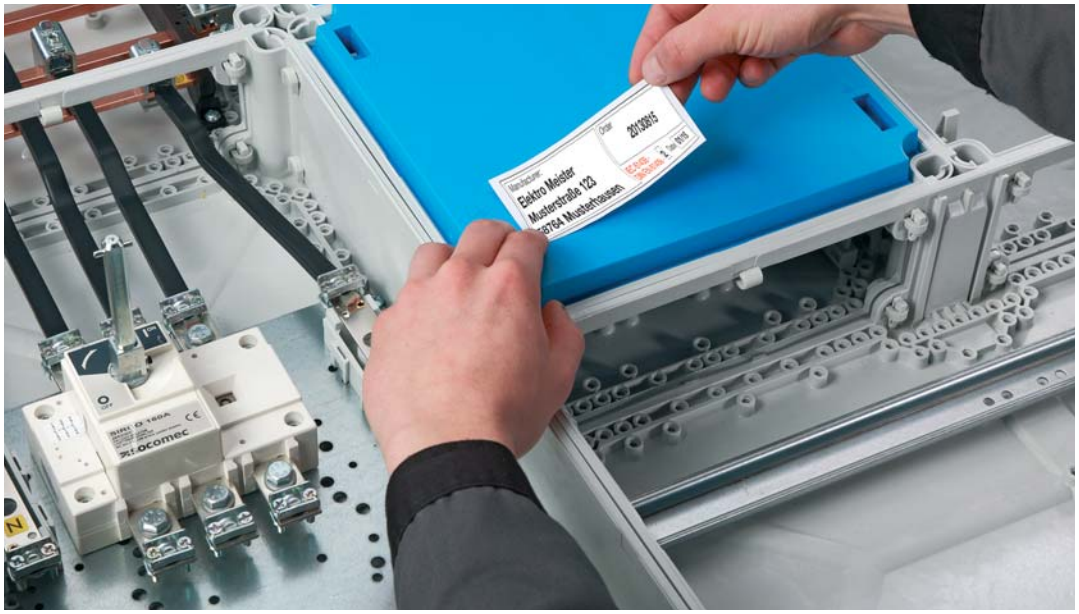


A power-frequency withstand test must be performed on all circuits for a period of 1 second, as per IEC/EN 61439-1 section 10.9.2. The test voltage for switchgear assemblies with a rated insulation voltage between 300-690 V a.c. is 1.890 V. The test values for different rated insulation voltages are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

Step 4: Marking

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

HENSEL
System manufacturer

98 01 994

Installation note:

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

Manufacturer:	Order
Elektro Meister **Musterstraße 123** **58764 Musterhausen**	**20130815**
	IEC 61439 - DIN EN 61439 - **2** Date **01/15**

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

Step 5: Declaration of European Community conformity (EC conformity)

EU only

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

Declaration of Conformity

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

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

Checklist for conformity assessment procedure — **Sheet 2**

Company: _____ Stamp

Order: _____

Project: _____

Type: _____

Low-voltage switchgear and controlgear assembly

☐ Power Switchgear and Controlgear Assembly (PSC), Design verification according to EN 61439-2

☐ Distribution board, intended to be operated by ordinary persons (DBO) Design verification according to EN 61439-3

☐ **1. Technical documentation**

Scope of Low Voltage Directive LVD 2014/35 EU

☐ Catalogues or other documentation of the original manufacturer of low-voltage switchgear assemblies (Important Contents: Name and address of the original manufacturer and type designation, applicable standard. Description of the product)

☐ Assembly and installation instructions of the original manufacturer.

☐ Circuit diagram, assembly drawing, parts list

☐ Carrying out the routine test according to EN 61439-1
Report for routine verification (sheet 1) is part of the documentation.

Scope of Electromagnetic Compatibility (EMC) Directive 2014/30/EC

☐ Supplementing the technical documentation by the manufacturer documents for all electronic equipment and devices that include electronic (Assembly and Installation Instructions).

☐ Declaration of conformity of the equipment manufacturer, that confirms the compliance of the product with the requirements of the EMC Directive. A note in the accompanying documents must be kept equal and accordingly.

☐ **2. Declaration of Conformity (see sheet 3)**

☐ **3. Affixing CE marking (see sheet 3)**

Conformity assessment procedure has been carried out:

....
(place/date of issue) (name and signature or equivalent marking of authorized person)

☒ Please tick as appropriate

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439

Declaration of European Community conformity (EC conformity) — **Sheet 3**

Herby, we (name of manufacturer) Stamp

declare under our sole responsibility that the following product

Low voltage switchgear and controlgear assemblies (PSC)

(Designation, type, catalogue- or order number)

_____

to which this declaration releates is in conformity with and is manufactured according to the following standard(s).

Low-voltage switchgear and controlgear assembly

☐ Power Switchgear and controlgear Assembly (PSC) according to EN 61439-2

☐ Distribution Board intended to be operated by ordinary persons (DBO) according to EN 61439-3

The designated product corresponds to the requirements of the following European directives:

☐ Low Voltage Directive LVD 2014/35 EU

☐ Electromagnetic Compatibility (EMC) Directive 2014/30/EC
for example in electronic equipment, installed in switchgear assemblies according to EN 61439-1

_____ _____
Affixing of CE marking*): (Date)

*) Affix visibly in combination with the manufacturer's marking on the low-voltage assembly or distribution board, if necessary, readable after opening the door.

_____ _____
(place and date of issue): (name and signature or equivalent marking of authorized person)

With this declaration of conformity the manufacturer ensures conformity with the mentioned directives and standards.

This declaration of conformity complies with DIN EN 17050-1 "General Criteria for Supplier's Declaration of Conformity".

☒ Please tick as appropriate

Available by Gustav Hensel GmbH & Co. KG, 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

Manufacturer:	Order 20130815 CE
Elektro Meister Musterstraße 123 58764 Musterhausen	IEC 61439 - DIN EN 61439 - 2 Date 01/15

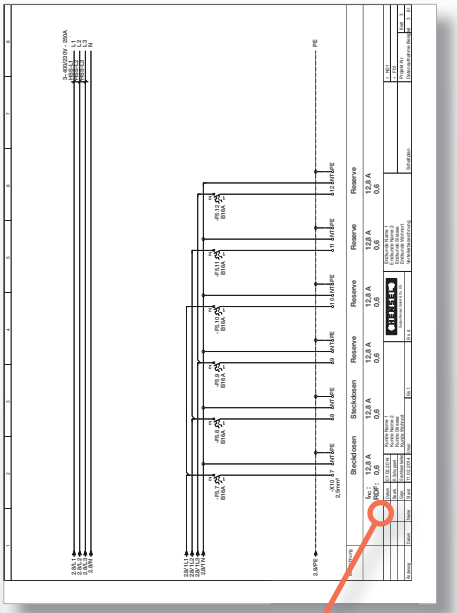
www.hensel-electric.de/61439

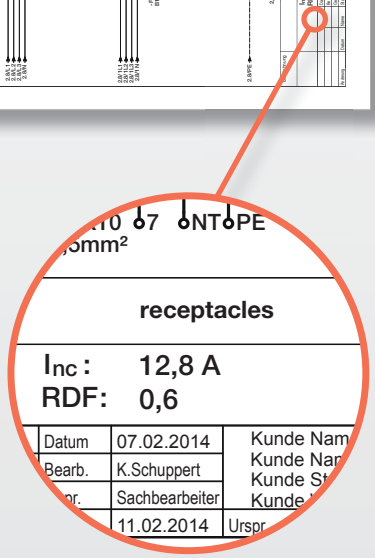
Step 5: Documentation

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)

1 Wiring diagram / circuit diagram with design values





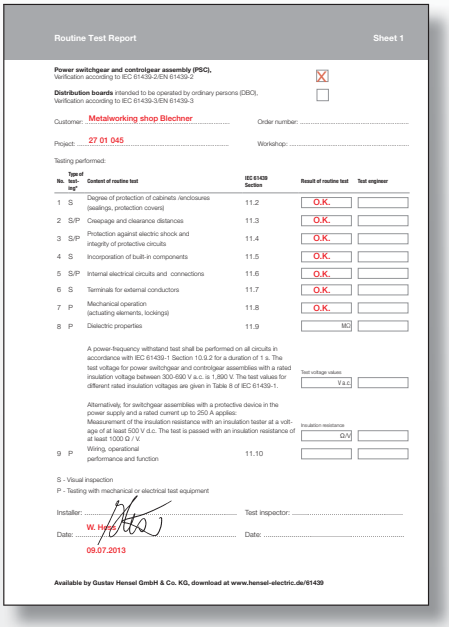
2 Verification of permissible heating according to IEC 61439-1 / EN 61439-1 Section 10.10

3 Declaration of conformity by the system manufacturer, for example Hensel

EU only

Verification required	See also
☑	page 27
☑	page 27
☑	page 18
☑	page 32
☑	page 35
☑	page 35

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



Routine Test Report — Sheet 1

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

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

Customer: Metalworking shop Blechner — Order number: .....

Project: 27 01 045 — Workshop: .....

Testing performed:

No.	Type of test-ing*	Content of routine test	IEC 61439 Section	Result of routine test	Test engineer
1	S	Degree of protection of cabinets /enclosures (sealings, protection covers)	11.2	O.K.	
2	S/P	Creepage and clearance distances	11.3	O.K.	
3	S/P	Protection against electric shock and integrity of protective circuits	11.4	O.K.	
4	S	Incorporation of built-in components	11.5	O.K.	
5	S/P	Internal electrical circuits and connections	11.6	O.K.	
6	S	Terminals for external conductors	11.7	O.K.	
7	P	Mechanical operation (actuating elements, locking(s))	11.8	O.K.	
8	P	Dielectric properties	11.9	MO	
		A power-frequency withstand test shall be performed on all circuits in accordance with IEC 61439-1 Section 10.9.2 for a duration of 1 s. The test voltage for power switchgear and controlgear 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 61439-1.		Test voltage values: V a.c.	
		Alternatively, for switchgear assemblies with a protective device in the power supply and a rated current up to 250 A applies: Measurement of the insulation resistance with an insulation tester at a voltage of at least 500 V d.c. The test is passed with an insulation resistance of at least 1000 Ω / V.		Insulation resistance: Ω/V	
9	P	Wiring, operational performance and function	11.10		

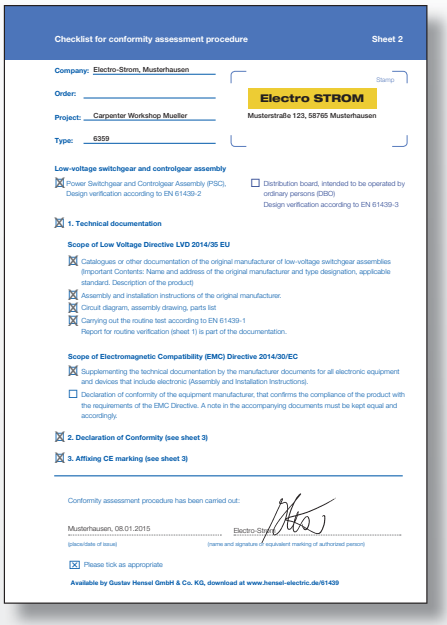
S - Visual inspection
P - Testing with mechanical or electrical test equipment

Installer: W. Hase — Test inspector: .....

Date: 09.07.2013 — Date: .....

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439

5 Checklist for conformity assessment procedures (Sheet 2)



Checklist for conformity assessment procedure — Sheet 2

Company: Electro-Strom, Musterhausen — Stamp: Electro STROM, Musterstraße 123, 58765 Musterhausen

Order: .....

Project: Carpenter Workshop Mueller

Type: 6359

Low-voltage switchgear and controlgear assembly

☒ Power Switchgear and Controlgear Assembly (PSC), Design verification according to EN 61439-2

☐ Distribution board, intended to be operated by ordinary persons (DBO) Design verification according to EN 61439-3

☒ **1. Technical documentation**

Scope of Low Voltage Directive LVD 2014/35 EU

☒ Catalogues or other documentation of the original manufacturer of low-voltage switchgear assemblies (Important Contents: Name and address of the original manufacturer and type designation, applicable standard, Description of the product)
☒ Assembly and installation instructions of the original manufacturer.
☒ Circuit diagram, assembly drawing, parts list
☒ Carrying out the routine test according to EN 61439-1
Report for routine verification (sheet 1) is part of the documentation.

Scope of Electromagnetic Compatibility (EMC) Directive 2014/30/EC

☒ Supplementing the technical documentation by the manufacturer documents for all electronic equipment and devices that include electronic (Assembly and Installation Instructions).
☐ Declaration of conformity of the equipment manufacturer, that confirms the compliance of the product with the requirements of the EMC Directive. A note in the accompanying documents must be kept equal and accordingly.

☒ **2. Declaration of Conformity (see sheet 3)**

☒ **3. Affixing CE marking (see sheet 3)**

Conformity assessment procedure has been carried out:

Musterhausen, 08.01.2015 (place/date of issue) — Electro-Strom (name and signature of equivalent marking of authorized person)

☒ Please tick as appropriate

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439

EU only

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

Declaration of European Community conformity (EC conformity) — Sheet 3

Herby, we (name of manufacturer)

Electro-Strom
Musterstraße 123
58765 Musterhausen

Stamp: Electro STROM, Musterstraße 123, 58765 Musterhausen

declare under our sole responsibility that the following product

Low voltage switchgear and controlgear assemblies (PSC)

(Designation, type, catalogue- or order number)

Mi Power distribution board (PSC)

to which this declaration releates is in conformity with and is manufactured according to the following standard(s).

Low-voltage switchgear and controlgear assembly

☒ Power Switchgear and controlgear Assembly (PSC) according to EN 61439-2
☐ Distribution Board intended to be operated by ordinary persons (DBO) according to EN 61439-3

The designated product corresponds to the requirements of the following European directives:

☒ Low Voltage Directive LVD 2014/35 EU
☒ Electromagnetic Compatibility (EMC) Directive 2014/30/EC
for example in electronic equipment, installed in switchgear assemblies according to EN 61439-1

Elektro-Strom (Affixing of CE marking*) — 08.01.2015 (Date)

*) Affix visibly in combination with the manufacturer's marking on the low-voltage assembly or distribution board, if necessary, readable after opening the door.

Musterhausen, 08.01.2015 (place and date of issue) — Electro-Strom (name and signature or equivalent marking of authorized person)

With this declaration of conformity the manufacturer ensures conformity with the mentioned directives and standards.

This declaration of conformity complies with DIN EN 17050-1 "General Criteria for Supplier's Declaration of Conformity".

☒ Please tick as appropriate

Available by Gustav Hensel GmbH & Co. KG, download at www.hensel-electric.de/61439

EU only

Notes

Notes

Gustav HENSEL GmbH & Co. KG
Industrial Electrical Power Distribution Systems

Altenhundem
Gustav-HENSEL-Straße 6
D-57368 Lennestadt
Germany
P.O. Box 1461
D-57344 Lennestadt, Germany

Phone: +49 (0)27 23/6 09-0
Fax: +49 (0)27 23/6 00 52
E-Mail: info@hensel-electric.de
www.hensel-electric.de

98 17 1000 06.16/1/11

made in GERMANY
since 1931