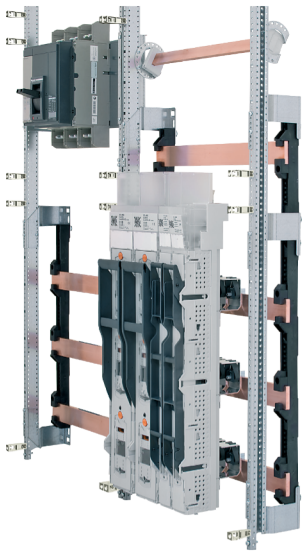

Prisma XS

Technical system manual

abn-elektro.de

Life Is On

ABN by Schneider Electric

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When assembling and using this product, all applicable state, national, regional and local safety requirements must be observed. For safety reasons and to better ensure compliance with documented system information, components should only be repaired by the manufacturer.

When using devices for applications with technical system requirements, the relevant instructions must be observed.

The use of software other than Schneider Electric’s own software or software approved by Schneider Electric in connection with other Schneider Electric hardware products can cause personal injury, damage or faulty operation.

Failure to observe this information may cause personal injuries or material damage.

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Chapter 1 About this manual

Overview

This chapter provides an overview of this document and how to use it.

Contents of this chapter

1.1 Aim of this document

Target group

Pursuant to DIN EN 61439-1/-2/-3, these technical guidelines are directed at planners, switchgear builders (manufacturers), operators and users of the Prisma XS system (previously known as the ESPRO system).

Objective

The technical guidelines describe the composition, function and use of the Prisma XS system. You can also find information about transport, assembly, installation, commissioning, operation, maintenance and repair, as well as decommissioning and dismantling.

The information in this document is a prerequisite for ensuring the safe handling of all the components of the Prisma XS system.

1.2 Observe any accompanying documentation

Reference to assembly instructions

Observe the instructions enclosed with the system housing, inner fitting system modular assembly sets, fields, installation devices and operating equipment. Keep the instructions ready to hand.

1.3 Storing the documents

Reading and storing the technical guidelines

The technical guidelines are part of the Prisma XS system.

Read this document carefully before carrying out any work on system components. Particularly read and observe the “Safety information” chapter and the safety measures in other chapters.

Keep the technical guidelines and component instructions near the switchgear and controlgear assembly. Authorised personnel must have access to the technical guidelines at all times. The operator is responsible for keeping the documents.

1.4 Symbols and warnings used

Hazard symbols

The symbols and warnings listed below bring your attention to potential risks and dangers.

This symbol means that there is the risk of an electric shock.

This is a general warning symbol. It indicates possible risks of injury. Observe all the information beneath this symbol to prevent injuries or fatalities.

Presentation of warning symbols

Hazard level	Consequences	Probability
⚠ DANGER	Death/serious injury (irreversible)	Imminent
⚠ WARNING	Death/serious injury (irreversible)	Possible
⚠ CAUTION	Minor injury (reversible)	Possible
NOTE	Damage to property	Possible

Chapter 2 For your safety

Overview

This chapter helps you to identify hazards and to avoid them. This information is a prerequisite for safely assembling, installing and handling the Prisma XS system.

Please read this chapter in particular very thoroughly and carefully.

Contents of this chapter

2.1 Basic safety requirements

Meaning of these requirements

These requirements are intended to ensure that all people who handle the low voltage switchgear and controlgear assemblies are thoroughly informed of the dangers and safety measures and that they observe the warning symbols found in the technical guidelines and on the switchgear and controlgear assembly. If you do not follow these requirements, you potentially risk fatal injury and damage to property.

Using the technical guidelines

Observe the following requirements:

- Thoroughly read this chapter and the chapters concerning your activities.
- Always keep the technical guidelines available for consultation.

Observing the five safety rules

Work on low voltage systems can be associated with electrical hazards. To avoid electrical hazards, follow these five safety rules before starting work on the switchgear and controlgear assemblies.

1. Disconnect completely (all poles/all sides).
2. Secure against re-connection.
3. Ensure that the power is off.
4. Carry out earthing and short-circuiting.
5. Provide protection against adjacent live parts.

Exercising caution when not earthing and short-circuiting components

When working on low voltage systems, you may only refrain from earthing and short-circuiting components if there is no risk of voltage transmission or of reverse feeding of energy.

Observing vitally important rules

Observe the vitally important rules when dealing with electricity:

As the operator	As the electrician
⇨ Give clear instructions. ⇨ Employ competent personnel. ⇨ Only allow work to be carried out using safe and intact working tools. ⇨ Make sure that work is only carried out using suitable protective equipment. ⇨ Make sure that the inspections prescribed for the switchgear are carried out and documented. ⇨ Only allow tested switchgear to be set into operation. ⇨ Document any changes to the switchgear.	⇨ Do not start the work until you have clearly understood the task. ⇨ Only carry out work for which you meet the following conditions: • You have the appropriate professional qualifications. • You possess the knowledge and experience required for the area of activity. • You can assess the tasks. • You can assess any dangers that exist. ⇨ Use safe, suitable, intact and insulated work equipment. ⇨ Use protective equipment suitable for the work to be carried out. ⇨ Only put tested switchgear into operation.

2.2 Intended use

Standard applied

The basis for installing the system are all parts of the German standard DIN EN 61439.

Use

The type-tested Prisma XS system is suitable for the construction of low voltage controlgear and switchgear assemblies in accordance with DIN EN 61439-1/-2/-3:

- Power switchgear and controlgear assemblies in accordance with DIN EN 61439-1/-2
- Installation distribution boards intended to be operated by unskilled persons according to DIN EN 61439-1/-3 (DBO)

Prisma XS comprises system housing with a cabinet layout and an inner fitting system made up of compatible built-in devices and accessories. Depending on the system components used, low voltage switchgear and controlgear assemblies with a maximum supply current of 1,600 A can be constructed with Prisma XS.

The system housing, inner fitting system, components and built-in devices tested by the original manufacturer ABN GmbH may only be operated within the specifications and areas described in the technical information.

The ecoreal^{XS} software is used for planning the Prisma XS switchgear and controlgear assemblies.

Ensuring compliance with DIN EN 61439

A switchgear and controlgear assembly must be manufactured in compliance with the DIN EN 61439 standards. This includes at least the planning, manufacture (assembly), testing and documentation of a switchgear and controlgear assembly.

For each type of switchgear and controlgear assembly, at least the following must be applied:

- Basic standard DIN EN 61439 part 1
- The applicable product standard DIN EN 61439 part 2 or DIN EN 61439 part 3 for the switchgear and controlgear assembly.

Compliance with environmental requirements

The closed design of the Prisma XS inner fitting system is intended to accommodate switchgear and controlgear assemblies that are permanently installed indoors on a wall or on the floor. The assemblies are permanently fixed to the installation site throughout the duration of their use.

The operating conditions for indoor installation according to DIN EN 61439 and the maximum ambient temperatures must be observed at the installation site.

Paying attention to restrictions in the operating areas

The Prisma XS system's housing must not be used in certain areas in order to prevent hazards or damage being caused to the sheathing. The system housing is not suitable for use in the following cases:

- In areas that require a higher degree of protection than that of the cabinet system
- In areas where ATEX directives must be observed
- In areas where there is an increased risk of fire

The Prisma XS system must not be used in corrosive environments either. In particular, the system housing and inner fitting system can become damaged if used in environments that contain chlorine, sulphur, acid or saline.

Complying with the protection class and degree of protection

Observe the information in the “Inner fittings” and “Assembly” chapters in order to comply with the protection class and degree of protection.

Note that the respective protection class and degree of protection can only be achieved by using correctly mounted, undamaged components. This particularly applies to the following components:

- Undamaged, closed door
- Cable inlets on the switchgear and controlgear assembly
- Plastic liners of the switchgear and controlgear assembly (if present as required by the degree of protection)
- Cover plates in the switchgear and controlgear assembly

Observing requirements concerning authorised personnel

The switchgear and controlgear assembly may only be planned, set up, installed and operated by personnel who meet certain requirements. Observe the respective requirements concerning training and qualifications in this chapter.

Avoiding misuse

Any other use or use which goes beyond the defined scope, and any modifications or amendments are considered misuse. The original manufacturer, ABN GmbH shall not be held liable for damage caused by misuse.

- Avoid dangers such as arc flashes, electric shocks or overheating caused by misuse. This could lead to serious injuries and even to death or damage to property caused by fire or explosions.
- Also observe the technical information and instructions in these technical guidelines and in the assembly instructions, as well as the technical information and instructions for the installed components and devices in their documentation.
- Particularly observe the tolerance limits of the mains voltage, mains current and power frequencies. Fluctuations or deviations from the nominal value in the mains voltage, mains current and power frequencies could cause hazardous conditions and functional failures.
- Always observe the requirements concerning personnel qualifications.
- Make sure that the technical data of the switchgear and controlgear assemblies complies with the requirements for the place of installation and operation. When planning the system, all interface parameters must be coordinated with the operator, and documented.
- Only amend or build on components and devices that comply with the applicable standards.

2.3 Required personnel

Overview of personnel qualification for power switchgear and controlgear assemblies in accordance with DIN EN 61439-2 (PSC)

Phase of life of product	Training, qualifications or aptitude (minimum specifications)
Planning	Electrical engineer, senior electrical engineer, electrically skilled person, electrically skilled planner
Construction of the switchgear and controlgear assembly	Electrically skilled person
Transport	Logistics professionals, transport professionals
Assembly	Electrically skilled person; for clearly defined mechanical and electrical work: electrically trained person
Installation	Electrically skilled person
Commissioning	Electrically skilled person with testing experience, in certain cases with specialised training
Operation	Electrically skilled person, electrically trained person
Cleaning	Electrically skilled person; if it is ensured that work can be carried out on the equipment in a de-energised state: semi-skilled electrically trained person
Retrofitting, upgrading	Electrically skilled person, manufacturer/electrically skilled planner
Eliminating faults	Electrically skilled person with testing experience
Maintenance and repair	Electrically skilled person with testing experience
Decommissioning	Electrically skilled person
Dismantling	Electrically skilled person; for clearly defined mechanical and electrical work: electrically trained person
Waste disposal	Recycling and waste management specialist

Reducing risks by restricting access to power switchgear and controlgear assemblies

With power switchgear and controlgear assemblies, the risk of arc flashes, misuse and mishandling can be clearly reduced by taking measures to restrict access. Measures to restrict access can include technical and organisational measures such as:

- Setting up the switchgear and controlgear assembly in designated electrical operating rooms/control rooms
- Setting up the switchgear and controlgear assembly behind walls, fences or barriers
- Effectively preventing possible switching operations or access to open switch cabinets by unauthorised persons
- Marking paths with appropriate clearance
- Using safety instructions
- Using locking devices

A power switchgear and controlgear assembly is operated in an enclosed operating area and permanently attached to the site of installation throughout the duration of use. If the power switchgear and controlgear assembly is installed in an area which can be accessed by unskilled persons, switching operations and access to the open switch cabinet must be prevented. It must then be possible to lock the switchgear and controlgear assembly with a padlock or only to open it using tools.

Overview of personnel requirements for installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3 (DBO)

Phase of life of product	Training, qualifications or aptitude (minimum specifications)
Planning	Electrical engineer, senior electrical engineer, electrically skilled person, electrically skilled planner
Construction of the switchgear and controlgear assembly	Electrically skilled person
Transport	Logistics professionals, transport professionals
Assembly	Electrically skilled person; for clearly defined mechanical and electrical work: electrically trained person
Installation	Electrically skilled person
Commissioning	Electrically skilled person with testing experience, in certain cases with specialised training
Operation	• Components intended to be operated by unskilled persons according to 61439-3: Unskilled persons • All other components: Electrically skilled person. It must also be ensured that components and devices which must not be operated by unskilled persons are secured against operation by unskilled persons. It should also be ensured that unskilled persons cannot carry out any settings on these devices.
Cleaning	• Cleaning the outside of the housing (door not open): unskilled persons • Cleaning the interior: Electrically skilled person; if it is ensured that work can be carried out on the equipment in a de-energised state: semi-skilled electrically trained person
Retrofitting, upgrading	Electrically skilled person, manufacturer/planner
Eliminating faults	• Electrically skilled person with testing experience • Switching back on components intended to be operated by unskilled persons according to DIN EN 61439-3: Unskilled persons
Maintenance and repair	Electrically skilled person with testing experience
Decommissioning	Electrically skilled person
Dismantling	Electrically skilled person; for clearly defined mechanical and electrical work: electrically trained person
Waste disposal	Recycling and waste management specialist

Important prerequisites for installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3

For installation distribution boards in accordance with DIN EN 61439-3 (DBO), at least the following important points must be ensured to secure reliable operation by unskilled persons:

- The installation distribution board must always be protected against contact with live parts, the ingress of solid foreign bodies and water to at least degree of protection IP2XC. When operating devices or replacing fuse links, protection against all contact with live parts must be provided. Only during the replacement of certain fuse links or lamps which may be operated by unskilled persons are openings larger than those defined by protection rating IPXXC allowed.
- The installation distribution board must comply at least with the protection rating against mechanical impacts, IK05.
- At least degree of contamination 2 applies.
- The rated voltage against earth is maximum 300 V, the rated current of the outgoing circuit is maximum 125 A, and the rated current of the installation distribution board is maximum 250 A
- The number of neutral conductor connections corresponds at least to the number of outlet connections of the outgoing circuit which require a neutral conductor connection
- The DBO has at least two connections for protective bonding conductors of the electrical system

Operation by unskilled persons only for short-circuit protection devices inside installation distribution boards

- Only short-circuit protection devices intended to be operated by unskilled persons may be operated by unskilled persons. Short-circuit protection devices intended to be operated by unskilled persons must be specified for use by unskilled persons by the manufacturer. Requirements for short-circuit protection devices for operation by unskilled persons are defined in the following standards: DIN EN 60898-1 (circuit breakers), DIN EN 61008 (residual current circuit breaker), DIN EN 61009 (RCCB/MCB), DIN EN 62423 (residual current circuit breaker type B and RCCB/MCB type B) and DIN EN 60269-3 (fuses for use by unskilled persons). Also refer to chapter 8.5.3 of standard DIN EN 61439-3.
- Unskilled persons may only replace fuse links in accordance with DIN EN 60269-3 (VDE 0636-3) of up to 63 A. Here, the prerequisite is that system-related sleeve sockets are used which ensure protection against contact and polarisation of the fuse links with regard to the rated current. For screw locking devices of the DO or D system intended to be operated by unskilled persons, fuse sizes cannot be interchanged. For fuses in accordance with DIN EN 60269-3 (VDE 0636-3), protection against contact is ensured. Approval is limited in certain countries.
- Operation by unskilled persons must be effectively prevented when using operating equipment and circuit breakers which are not permitted for use by unskilled persons. To do so, depending on the operating material, device type and equipment in question, and in accordance with the manufacturer's instructions, use the following:
  - Locking devices,
  - Padlock(s)/locking mechanisms,
  - Sealing/locking and sealing.
  - With circuit breakers, the visibility of the settings/calibration must be secured. It must not be possible to change the settings/calibration of the circuit breaker without deliberate action using a key or tool. Access to carry out electronic calibration of the circuit breaker must be password-protected.

NH fuse systems not suitable for use by unskilled persons

The NH fuse system is not suitable for use by unskilled persons. Polarisation with regard to the rated current and current protection is not provided. Therefore, unskilled persons must be effectively prevented from using operating equipment with NH fuse systems. Access for replacing NH fuse links must require a key or tool. Switching operations or the replacement of fuses may only be carried out by electrically skilled persons or electrically trained persons. In doing so, suitable protective equipment must be used.

Unskilled persons must not carry out switching operations when work is being performed on the switchgear and controlgear assembly.

- Switching operations by unskilled persons are prohibited in connection with work on the switchgear and controlgear assembly.
- Only electrically skilled or electrically trained persons are permitted to carry out switching operations when carrying out work on the switchgear and controlgear assembly. The prohibition of operation by unskilled persons also includes disconnecting equipment to work in a de-energised state, and switching equipment back on again after carrying out work in a de-energised state.

2.4 Personnel qualifications

Definition of electrically skilled persons

Based on their professional training, knowledge and experience, as well as their knowledge of relevant provisions, an electrically skilled person is able to assess the work with which they are entrusted and to identify any possible dangers.

The following minimum requirements for an electrically skilled person must be met without exception:

- Professional training in the field of electrical engineering (vocational training and in-house training),
- Knowledge and experience in the field of activity,
- Knowledge of the relevant provisions, for example, accident prevention rules and standards,
- The ability to assess the work being entrusted to them for their own safety and the safety of others,
- The ability to recognise hazards.

Definition of an electrically trained person

An electrically trained person must be sufficiently informed and supervised by an electrically skilled person. The trained person must therefore be capable of recognising and avoiding risks and hazards, including those caused by electricity.

An electrically trained person may only carry out activities on switchgear and controlgear assemblies if the following minimum requirements are met:

- They have been trained by the electrically skilled person.
- They only carry out limited, precisely defined activities.
- They are familiar with the local circumstances.
- They have been trained in possible hazards that can occur in the event of improper conduct.
- They know which protective devices, protective measures and safety distances are required.
- They are clear about the task to be carried out assigned by their work supervisor.
- They work exclusively with safe and intact work equipment and suitable protection devices.
- The switchgear and controlgear assemblies have been secured by an electrically skilled person in accordance with the five safety rules.

Special training of the electrically trained person is necessary for the following activities:

- Cleaning of electrical systems (prerequisite: work in a de-energised state is ensured),
- Working near live components (observing safety distances),
- Checking for the absence of voltage,
- Operating devices or work equipment near live parts.

Definition of unskilled persons

Any person who is neither electrically skilled nor electrically trained should always be considered an unskilled person. Even if someone has carried out many years of work in the field of electrical engineering, that does not mean that they may be considered an electrically skilled or an electrically trained person.

2.5 Personal protective equipment (PPE)

Purpose of the protective equipment

Only appropriate protective equipment can provide protection against electrical and mechanical hazards.

Wearing protective equipment to protect against arc flashes

Arc flashes occur without warning. An arc flash can be caused by errors during assembly or maintenance, operational errors or improper removal of an NH fuse under load. If personnel are not wearing protective equipment, this can result in serious or even fatal injuries.

- Wear suitable protective equipment to protect yourself from arc flashes. Protective equipment for performing work safely on low voltage switchgear and controlgear assemblies includes at least:
  - A plug-in grip with a permanently attached leather gauntlet for NH fuses,
  - A helmet with face protection or a flame-retardant cover,
  - Closed, flame-retardant and light arc-tested work clothes (hearing protection, gloves, safety boots).
- Check the sound condition of the protective equipment prior to each use.
- When working and carrying out switching operations on high-current power distribution systems, stand on suitable insulating mats.

Wearing protective equipment to ensure occupational safety

When carrying out all work on the switchgear and controlgear assembly, including assembly and installation, always wear suitable personal protective equipment (PPE) to ensure occupational safety and protect your health. This includes for example:

- Suitable close-fitting electricians' overalls or work clothes,
- Protective gloves suitable for the respective purpose of use,
- Safety boots,
- Hearing protection (for example when drilling),
- Safety glasses if there is a risk of dust, sparks, fire or liquids,
- Respiratory protection when working with dust or gases,
- Equipment preventing falls from a height if carrying out specific activities at a height.

Visually inspect the PPE each time before starting work and carry out a performance check.

2.6 Hazards and safety measures

Electrical hazards

Danger	In which situations does the danger arise?	Counter measures
Risk of electric shock due to live parts	• When work is carried out near live parts • If unauthorised persons have access to the danger zone • If unauthorised persons undertake switching operations • If the five safety rules are not observed • If covers or the system housing is damaged • If the cabinet falls or topples over	• Observe the permissible proximity to live parts. • Keep your distance from live parts. • Protect yourself with covers or enclosures over live parts throughout the duration of the work. • When working near live parts, use insulating covers to protect yourself from accidentally coming into contact with them. • Only work near live parts if suitable measures have been taken to ensure that you cannot come into contact with them. • Make sure that only authorised personnel have access to open switch cabinets and the danger zone. • Provide basic protection, protection against contact and fault protection. • Keep the switch cabinet or operating area closed. • Replace defective covers or system housing using original replacement parts. • Attach the cabinet in accordance with the mounting instructions.
Risk of arch flashes Arc flashes occur without warning. The possible consequences are: • Temperatures of several thousand degrees Celsius • Shock waves, flying parts, toxic gases and dust • Serious burns, damage to eyesight, hearing impairments and other injuries or even death • Often significant damage to the system and subsequent costs	• Assembly errors: Working on live systems or near live parts, errors when connecting or mounting devices, forgotten work materials or tools • Operational errors: Faulty insulation, clearances and creepage distances which are too short, overloaded busbars, condensation, contamination, overvoltage, overheating, weak contacting • Animals: Rodents, slugs and other creatures in the switchgear • Insufficient inspection and maintenance: Quantities of dust, moisture, faulty devices, fuses or connections	• Only work on live systems in exceptional cases (taking measurements when searching for faults). • Only suitable skilled workers with corresponding qualifications may undertake work on live systems. • Only use suitable tools and appropriate measurement and inspection instruments. • Wear suitable equipment providing protection against arc flashes, and take further preventive measures. • Keep a look out for possible causes of arc flashes. • Ensure inspection and maintenance by electrically skilled persons with testing experience.

Mechanical hazards

Danger	In which situations does the danger arise?	Counter measures
Hazard caused by the switch cabinet falling or toppling over	• If the switch cabinet has not been installed using the minimum number of fastening points. • If the load-bearing capacity of the wall or floor is insufficient • If the fasteners are not suitable for supporting the switch cabinet's weight • If the fasteners are not suitable for the quality of the wall or floor	• Check the load-bearing capacity of the subsurface. • Use fastening points in accordance with the assembly instructions. • Select fasteners according to the switch cabinet's weight. • Select fasteners suitable for the subsurface.

Working on live systems in exceptional cases only

Work is not intended to be carried out on live systems.

Always check that no voltage is present before carrying out maintenance and assembly work on the switchgear and controlgear assembly.

Only electrically skilled persons with testing experience may undertake work on live systems for the purpose of commissioning and identifying faults.

2.7 Basic safety measures when handling switchgear and controlgear assemblies

Switchgear and controlgear assemblies should only be operated by authorised personnel

Always observe the instructions in this manual concerning personnel requirements.
Power switchgear and controlgear assemblies in accordance with DIN EN 61439-2 may only be operated by skilled personnel.

Prior to switching on each time

Before switching the switchgear and controlgear assembly on, make sure that the following conditions are met:

- The access authorisations are clearly defined.
- Only authorised persons may enter the switchgear and controlgear assembly work area.
- Nobody can get injured by starting up the switchgear and controlgear assembly.
- The switchgear and controlgear assembly shows no signs of visible damage.
- The switchgear and controlgear assembly is in a normal and good condition.
- Any defects identified have been immediately reported to the person responsible for the system.
- Only materials/objects required for operating the system are present in the switchgear and controlgear assembly danger zone.

Risk of accidents when carrying out installation work in the vicinity of the switchgear and controlgear assembly

When carrying out work or laying cables in the vicinity of the switchgear and controlgear assembly, invisible dangers are often underestimated.

- Using the switchgear and controlgear assembly or its equipment in a manner that is not appropriate for its intended use can cause accidents.
- Dangerous situations can be caused by short-circuits or ignition by arc flashes.

The consequences of this can be death or serious burns.

To avoid accidents, observe the following points:

- Carry out a risk assessment before carrying out any work in the vicinity of the switchgear and controlgear assembly.
- Do not make things up as you go along, but work in a planned manner and with a clear focus.
- Only authorised personnel may work in the vicinity of the switchgear and controlgear assembly.
- Do not enter areas where there is a risk of falling.
- Cover any system parts at risk from droplets, weld spatter or similar.
- Use suitable personal protective equipment when carrying out all installation work.

Risk of accident by entering or climbing into the switch cabinet

Accidents can occur when entering or climbing into the switch cabinet. The system housing is not meant to be entered or climbed into.

Entering or climbing into the switch cabinet can damage sheet metal parts. Damaged sheet metal parts can cause short circuits or impair the protective function.

To work safely on the switchgear and controlgear assembly follow these instructions:

- Only authorised persons may work in the vicinity of the switchgear and controlgear assembly.
- Never use the switch cabinet as a work platform or climbing aid.
- Do not enter areas where there is a risk of falling. Use suitable tools, devices and ladders when working above the cabinet.

Regular inspection and maintenance

Have the switchgear and controlgear assembly regularly checked and maintained to ensure the safety of persons and of the switchgear and controlgear assembly and to prevent accidents.

- Observe the inspection and maintenance intervals in these technical guidelines.
- The inspection intervals may be shortened in the event of special operating or environmental conditions.
- Perform separate inspections in the event of particular incidents such as moisture, condensation, water ingress in the switchgear area, contamination or vibrations.
- Before carrying out maintenance work, prevent unauthorised persons from accessing the switchgear and controlgear assembly.
- Prevent the switchgear and controlgear assembly from being switched on or switched back on by unauthorised persons when carrying out inspections and maintenance.

Replacing devices or upgrading switchgear

Before replacing electrical equipment with other types of devices or before upgrading the switchgear, new project planning and a new inspection of the switchgear and controlgear assembly must be carried out in accordance with DIN EN 61439.

If the switchgear builder modifies the switchgear and controlgear assembly by replacing the equipment with components that are not included in the design verification of the original manufacturer ABN GmbH, that switchgear builder will then become the original manufacturer for those modifications (DIN EN 61439-1, chapter 10.1). In this case, a new design verification must be produced. A parts verification is not adequate.

During upgrades or retrofits, observe the following points in particular:

- Any upgrades or retrofits must be planned.
- When upgrading or modifying a switchgear and controlgear assembly which already exists, it is necessary to prove that the safety of the existing switchgear and controlgear assembly will not be impaired.
- Modifications to the switchgear and controlgear assembly must be documented.

2.8 Duties of the operator

Overview of the operator's duties (non-exhaustive minimum specifications)

The operator responsible for a switchgear and controlgear assembly must ensure that the following prerequisites are met at the very minimum:

- The switchgear and controlgear assembly is used only according to its intended purpose and is in a good functional condition.
- The safety equipment is regularly checked for integrity.
- The required personal protective equipment is made available for authorised personnel and is worn when carrying out the appropriate work.
- Transport, assembly, installation, commissioning, operating, maintenance, decommissioning, dismantling and disposal of the switchgear and controlgear assembly are only carried out by qualified, expert and authorised personnel in accordance with this manual and the component instructions.
- This manual and the documentation concerning the switchgear and controlgear assembly are always kept available in a legible condition near the switchgear and controlgear assembly.
- All safety instructions attached to the switchgear and controlgear assembly and safety-related markings are always legible. Any missing or damaged safety instructions and markings must be replaced.

Risk assessment and instruction by the operator

The operator responsible for a switchgear and controlgear assembly must create a risk assessment for its switchgear and draw up a safety concept based on this. Within the scope of this concept, the operator must at least instruct persons who have access to the operating area, those who undertake operational actions or who work on the switchgear.

Persons who have access to the operating area must be regularly instructed. The interval between two instruction sessions must be based on:

- The level of training of the persons in question,
- The work to be undertaken,
- The type of switchgear in question.

At the very least, the instructions must impart knowledge about:

- The risk of approaching live parts and the protective measures to be taken against accidentally coming into contact with live parts such as placing covers or enclosures over the parts or respecting distances,
- The immediate measures to be taken and assistance to be given in the event of an accident,
- Notices indicating escape routes and information about calling the emergency services,
- The operational activities and work to be carried out by personnel,
- What to do in the event of a fire,
- What to do in the event of damage caused by moisture and water.

The switchgear operator appoints one person for each work space who is responsible for taking the necessary protective measures and ensuring that work is carried out safely. The operator also ensures that the persons employed cannot be endangered by third parties and takes appropriate measures.

Chapter 3 System description

Overview

The system description introduces you to the specifications of the Prisma XS inner fitting system. It covers the system's basic design and concept, and provides you with information about the compatibility of the various system components.

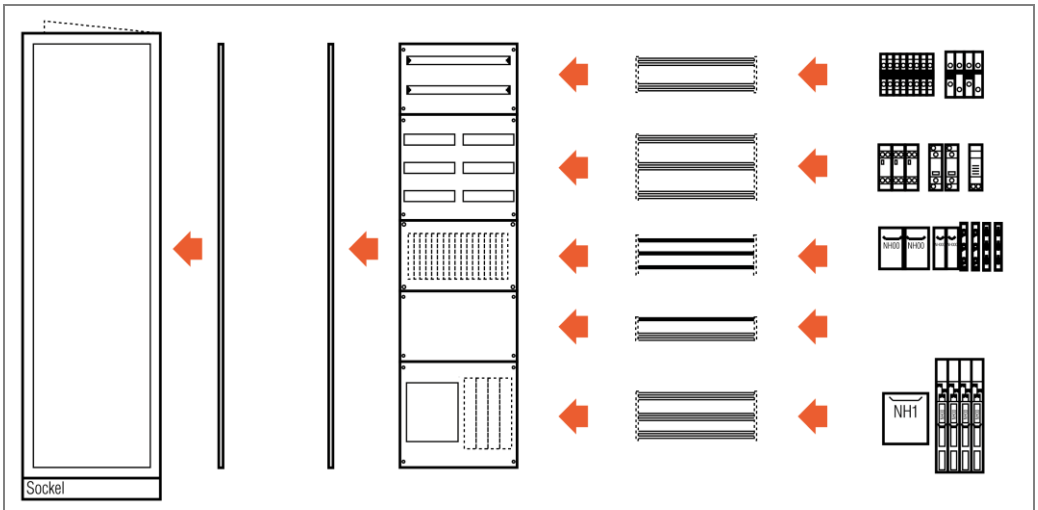
Contents of this chapter

3.1 Prisma XS system concept

3.1.1 Introduction

System construction

Prisma XS is a well thought-out system concept and offers you great flexibility during the planning of your switchgear and controlgear assembly. The Prisma XS system housing is essentially composed of the field distributor, the wall-mounted distributor and free-standing distribution cabinets from the ABN range of housing. The entire inner fitting system is compatible with this system housing and is made up of support frames, busbars, copper rails, modular assembly sets and installation devices.



System housing	Inner fitting system			
	Support frame	Modular assembly sets	Busbars/copper rails/DIN rails for devices	Installation devices

Depending on the housing type, self-assembly installation devices of up to 1,600 A can be built in. This means that the system is suitable for the widest variety of application areas.

Forms of delivery

The Prisma XS system comes in the form of individual parts, modular assembly sets or mechanically pre-mounted components. Depending on requirements, the modular assemblies can be combined with each other and quickly and correctly assembled thanks to the installation-friendly system design.

3.1.2 Planning the system

General planning steps

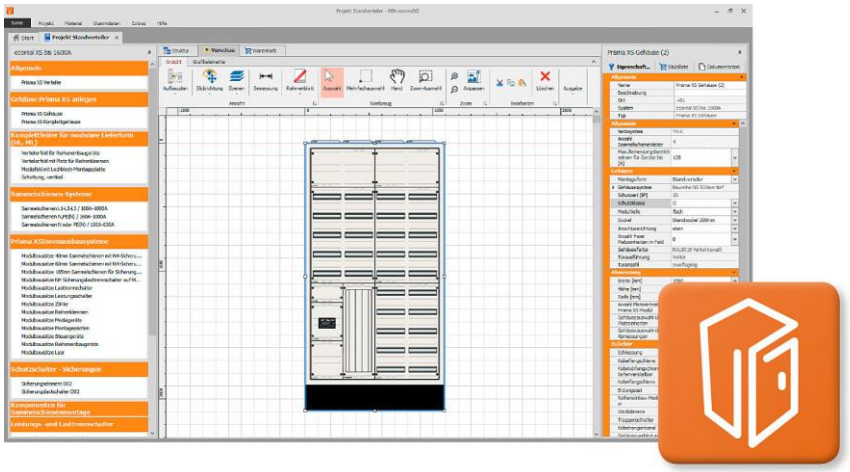
The following general planning steps will guide you to your individual switchgear and controlgear assembly with the aid of the system catalogue:

Step	Action
1	Select suitable system housing
2	Select a support frame to meet your requirements
3	Select the module • Select modular assembly sets • Select busbar assembly sets
4	If you have selected busbar assembly sets **without** copper rails: Select the copper rails
5	Select the installation devices

Planning with ecoreal^{XS} configuration software

Switchgear and controlgear assemblies with the Prisma XS inner fitting system can be easily configured by using ecoreal^{XS} configuration software.

The ecoreal^{XS} configuration software enables standardised and practical planning. ABN system housing or housing series and all matching components from ABN and Schneider Electric are available for planning purposes.



Obtaining the configuration software

To obtain the ecoreal^{XS} configuration software, you must first log on to your personal customer portal at "Mein Schneider Electric":

- https://partner.schneider-electric.com
- https://www.abn-electro.com/service/planungstools

A licence fee must be paid when placing the order.

Heat calculation during planning

During the system planning stage, a heat calculation or power loss inspection must be carried out. For this purpose, it is important to know the complete data of each respective interface and to have coordinated this with the operator.

You can find a tool for conducting the heat calculation on the ABN website.

3.2 System housing

3.2.1 Overview

System housing for interior installation

Type/ series	Design	Height [mm]	Width [mm]	Depth [mm]	Suitable for installation devices of up to (A)	Degree of protec-tion	Protec-tion class *	Application **
Field distributor								
U	UL...	520 - 1120	320 - 1070	110	125	IP30	⧈	FM/CW
	UK...	520 - 1120	320 - 1070	110	125	IP30	⧈	FM/CW
M	ML...	500 - 1100	300 - 1050	160	250	IP43	⧈	SM
	MK...	500 - 1100	300 - 1050	160	250	IP43	⧈	SM
Wall-mounted distributor								
S	S...	500 - 1400	300 - 1300	210	400	IP43	⧈	SM
	SV...	500 - 1400	300 - 1300	210	400	IP43	⏚	SM
	SP...	500 - 1400	300 - 1300	210	400	IP54	⧈	SM
	SE...	500 - 1400	300 - 1300	210	400	IP54	⏚	SM
N	NF...P	690 - 1440	340 - 1340	280	630	IP55	⧈	SM
	NF...E	690 - 1440	340 - 1340	280	630	IP55	⏚	SM
	NT...P	690 - 1440	340 - 1340	340	630	IP55	⧈	SM
	NT...E	690 - 1440	340 - 1340	340	630	IP55	⏚	SM
Free-standing distributor								
S	SF...	1980	300 - 1300	210	630	IP43	⧈	SM
	SV...	1980	300 - 1300	210	630	IP43	⏚	SM
	SP...	1980	300 - 1300	225	630	IP54	⧈	SM
	SE...	1980	300 - 1300	225	630	IP54	⏚	SM
N	NF...P	1890	340 - 1340	280	800	IP55	⧈	SM
	NF...E	1890	340 - 1340	280	800	IP55	⏚	SM
	NT...P	1890	340 - 1340	340	1200	IP55	⧈	SM
	NT...E	1890	340 - 1340	340	1200	IP55	⏚	SM
	NS...P	1890	340 - 1340	500	1600	IP55	⧈	SM
	NS...E	1890	340 - 1340	500	1600	IP55	⏚	SM

* ⏚ Protection class I: earthed; ⧈ Protection class II: protective isolation

** FM: flush-mounted; CW: cavity wall installation: SM: surface mounted

Please consult the ABN catalogue for more information about the system housing.

3.3 Inner fitting system

3.3.1 Overview

Design

The main characteristic of the inner fitting system is the simple way in which the device support rails and busbar supports from the 40 mm and 60 mm systems can be directly mounted on the support frame. The inner fitting system is designed for use in housing depths from 160 mm to 500 mm.

In the case of the 110-mm-deep field distributors from the U series, only special complete fields can be used for installation in these flat housing types. It is not possible to use individual modular assembly sets for the installation in this case.

The complete assembly, including busbars, the devices and wiring, must first be put together outside of the housing. The complete, finished support frame with the modular assemblies can then be installed inside the housing where it can be screwed onto the support frame mounts.

Components

The inner fitting system includes the following main components:

- Support frames for the internal structure consisting of:
  - Two different profiles for vertical assembly, in lengths 1 – 12 module heights or 6 – 14 module heights
  - Field distributor bars for vertical assembly in lengths 2 and 3 module width
  - Cross beams for horizontal assembly in length 2 module width
  - Frame support holders and field connectors
- Modular assembly sets with a closed and open design for mounting corresponding devices on mounting plates or support rails
- Modular assembly sets for special switchgear
- Busbar assembly sets consisting of busbar supports and corresponding assembly consoles. Design with or without pre-assembled copper rails
- Pre-assembled copper rails for different installation variations
- Busbar connector assemblies and connecting terminals
- Connector rail sets for specific switchgear
- Switchgear matching the respective modular assembly sets

See the ABN catalogue for more information about the inner fitting system.

Chapter 4 Project planning

Overview

This chapter provides information about project planning for a switchgear and controlgear assembly.

Contents of this chapter

4.1 Main steps for project planning and building the switchgear and controlgear combination

Main step 1

Influences, operating conditions and interface parameters are to be defined or selected. These parameters should be selected by the user.

The project data includes information about connecting to the electricity grid, electric circuits and consumers, the installation and environmental conditions and operating, maintenance and access information.

The detailed preparation of the points to be agreed are listed in annex BB of DIN EN 61439.

Main step 2

The switchgear and controlgear assembly is designed by the manufacturer in a way which fulfils the agreements, parameters and functions that apply to the specific application.

Project planning should be carried out based on the original manufacturer's data; ABN GmbH is the original manufacturer of the Prisma XS system.

The rated current for power feeds and outflows must be determined. The temperature rise verification must be carried out.

The switchgear and controlgear assembly manufacturer must obtain the design verification for the parts used from the original manufacturer. If this is not available, the manufacturer of the switchgear and controlgear assembly must itself carry out the design verification.

If the manufacturer makes changes to a switchgear and controlgear assembly which are not included in the original manufacturer's design verification, that manufacturer then becomes the original manufacturer and will have to carry out the design verification. This rule must also be observed when replacing switchgear and operating equipment made by different manufacturers. It must also be observed if other switchgear and operating equipment are used than those that have been tested and approved by the original manufacturer. A change of manufacturer inevitably requires a new design verification to be carried out.

Main step 3

The switchgear and controlgear assembly is mounted under consideration of the instructions, manuals and documentation of the device manufacturer and the original manufacturer of the system.

Main step 4

The manufacturer must draw up a parts verification for each switchgear and controlgear assembly.

Main step 5

The conformity assessment procedure must be carried out.

The switchgear and controlgear assembly may only be put on the market and set into operation if it complies with the provisions of all directives and laws applicable at the current time. The conformity assessment must have been carried out in accordance with all applicable directives and laws.

The creation of a CE Declaration of Conformity and the CE marking are a prerequisite for the first placing on the market (or commissioning) of products for which the CE marking is required in accordance with the EU directive specified below. The manufacturer must create the standard-compliant designation label and attach it to the switchgear and controlgear assembly.

Low voltage switchgear and controlgear assemblies are subject to the European Low Voltage Directive in EU member states and in countries within the EEA, as well as the EMC Directive and the respective national implementation of these laws, for example, when installing electronic operating equipment/devices.

If necessary, any additional national and regional provisions must also be observed.

Guide to project planning and building switchgear

With the guide to project planning and building switchgear, ABN GmbH by Schneider Electric provides a practical explanation of the steps to follow when building a switchgear and controlgear assembly in accordance with the DIN EN 61439 series of standards.

https://www.abn-electro.com

https://www.abn-electro.com/service/din-en-61439/

Excel and/or PDF templates are also available.

- Temperature rise verification up to 630 A
- Design verification template
- Parts verification protocol
- Checklist for the conformity assessment procedure
- Declaration of Conformity

Observe the latest version of the templates and tools.

4.2 Switchgear and controlgear assembly: project participants and user group

Responsibilities according to DIN EN 61439-1

Under the DIN EN 61439 series of standards, as far as the user group is concerned, a distinction is made between the original manufacturer, the switchgear and controlgear assembly manufacturer, and the user.

The following responsibilities apply according to DIN EN 61439-1:

Project participants	Overview of responsibilities according to DIN EN 61439
Planner	Specifies a requirements profile for a switchgear and controlgear assembly in which the switchgear and controlgear assembly is regarded as a black box with four interfaces: • Installation and environment conditions • Operation and maintenance • Connection to the electrical grid • Electric circuit and consumers The switchgear and controlgear assembly is dimensioned by defining the values for these interfaces. The planning is also based on the statements in DIN EN 61439 part 1, supplement 1.
Original manufacturer	Built the original switchgear and controlgear assembly. Responsible for verifying the design by inspection, calculation or based on the construction rules in accordance with DIN EN 61439. Provides the manufacturer with this information as a basis for evaluating the individually-created switchgear and controlgear assembly. ABN GmbH by Schneider Electric is the original manufacturer or the Prisma XS system. The Prisma XS system has a modular design and features tested system components that are coordinated with each other. The switchgear and controlgear assembly in accordance with DIN EN 61439 may be manufactured/assembled by manufacturers other than the original manufacturer.
Manufacturer	Builds the finished switchgear and controlgear assembly and takes responsibility for the finished switchgear and controlgear assembly. The manufacturer is responsible for: • Calculating the switchgear and controlgear assembly according to planning data • Complying with the design verification and specifications of the original manufacturer • Marking the switchgear and controlgear assembly and documentation • Carrying out the parts verification • Assessment and Declaration of Conformity If the manufacturer makes changes to a switchgear and controlgear assembly which are not included in the original manufacturer's design verification, that manufacturer then becomes the original manufacturer and will have to carry out the design verification. This rule must also be observed when replacing switchgear and operating equipment made by different manufacturers.
User	In accordance with DIN EN 61439, the user is a participant who specifies, purchases, uses and/or operates the switchgear and controlgear assembly. A user can also be someone who works on behalf of a user. The operator is a user pursuant to DIN EN 61439. The operator obtains a switchgear and controlgear assembly in accordance with DIN EN 61439 and the required certificates to verify its conformity. The operator assigns persons in charge of the systems. The operator instructs the personnel. The operator develops a safety concept/risk assessment. The operator arranges suitable safety measures.

Work supervisor

In accordance with standard EN 50110 (VDE 0105-1), the work supervisor is a person who is assigned to take direct responsibility for implementation of the work.

Some of the duties connected to this responsibility can also be transferred to other persons.

Depending on the type of activity and the electrical hazards, at least one electrically trained person must be employed as a work supervisor. We recommend employing a qualified electrically skilled person as the work supervisor.

Person responsible for the system

The person responsible for the system is directly responsible for the operation of the electrical system. The person responsible for the system is assigned this task by the operator.

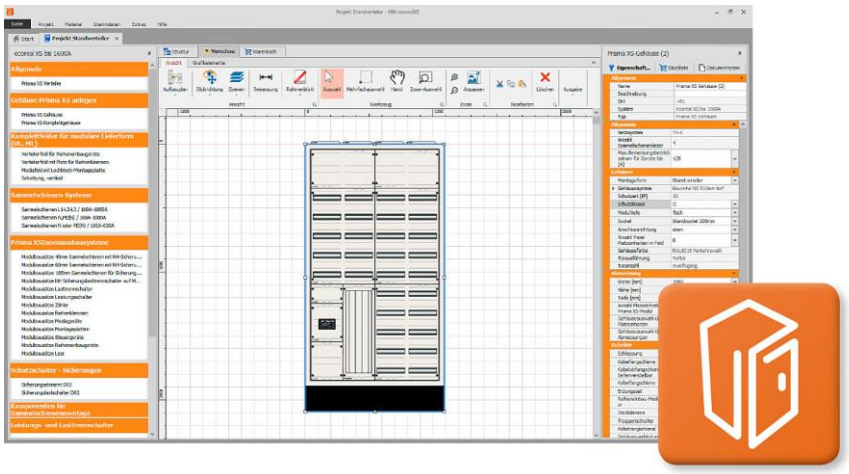
Some of the duties connected to this responsibility can also be transferred to other persons.

4.3 Planning and configuration with the configuration software

Planning with ecoreal^{XS} configuration software

Switchgear and controlgear assemblies with the Prisma XS inner fitting system can be easily configured by using ecoreal^{XS} configuration software.

Ecoreal^{XS} configuration software enables standardised and practical planning. ABN system housing or housing series and all matching components from ABN and Schneider Electric are available for planning purposes.



Planning is carried out efficiently with finished modules.

Significant advantages of the ecoreal^{XS} configuration software:

- Drawing to scale with an adaptable scale
- Detailed representation of the system housing and components, assembly drawing
- Automatic configuration of the support frame
- Automatic positioning of the assemblies with the option of manual adjustment
- Parts list handling: creation, display with finished modules or alternatively with individual parts, export in various formats
- Compatibility with other Schneider Electric tools

Obtaining the configuration software

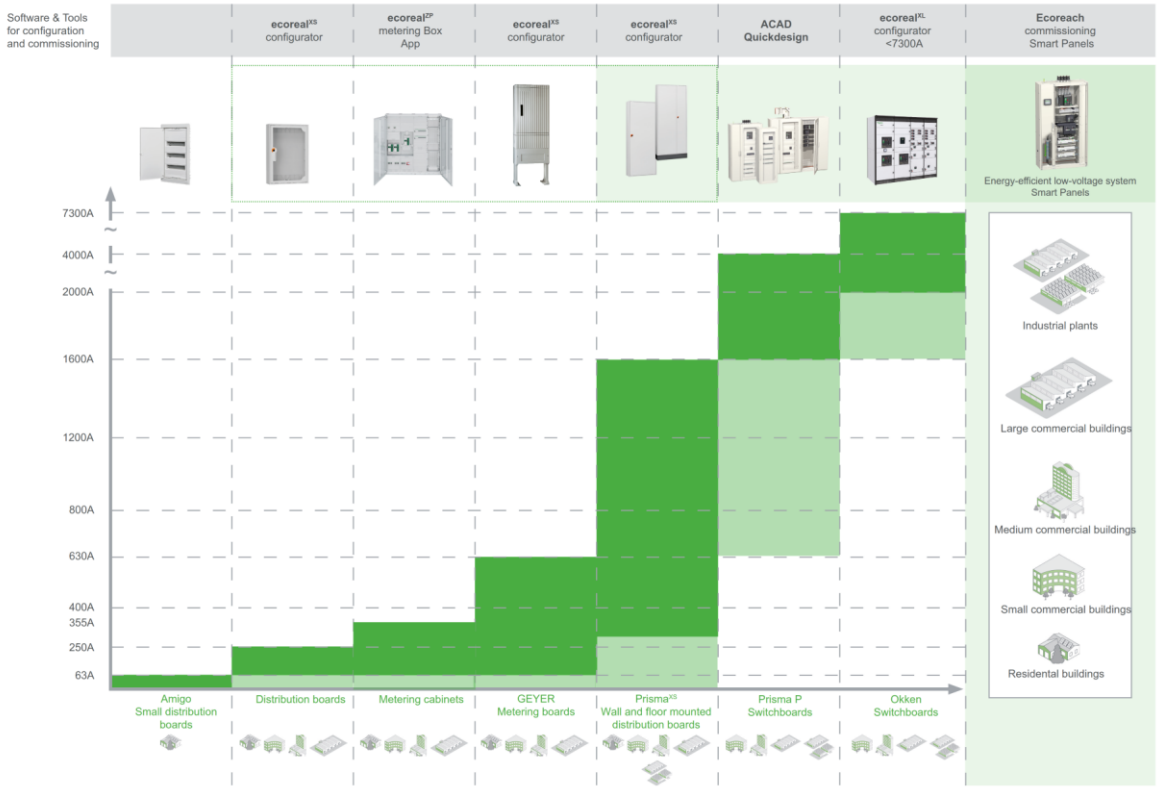
To obtain the ecoreal^{XS} configuration software, you must first log on to your personal customer portal at "Mein Schneider Electric":

- https://partner.schneider-electric.com
- https://www.abn-electro.com/service

A licence fee must be paid when placing the order.

Configuration software for low voltage switchgear and controlgear assemblies by Schneider

With its software and tools, Schneider Electric offers efficient configuration options for low voltage switchgear and controlgear assemblies from residential buildings to industrial plants.



4.4 Temperature rise verification

Purpose

The temperature rise verification checks that the temperature rise limits for the different parts of the switchgear and controlgear assembly are not exceeded.

High temperatures arise due to the fact that, when in operation, switchgear and controlgear assemblies generate heat which can cause the following:

- People or animals in the vicinity of the switchgear and controlgear assembly can suffer burns under normal operating conditions.
- Significant deterioration or premature ageing of the switchgear and controlgear assembly can occur.
- Excessive heat is generated on external conductors which could impair the operational reliability of the external conductors or connected operating equipment.

Responsibility for the implementation

The switchgear and controlgear assembly manufacturer is responsible for carrying out the temperature rise verification by following a suitable procedure and attaching the documentation to the switchgear and controlgear assembly.

- Here, observe DIN EN 61439-1, section 10.10 and the supplements in DIN EN 61439-3 on installation distribution boards intended to be operated by unskilled persons (DBO). Standard DIN EN 61439-1 provides (informational) guidelines in annex O.
- Observe the information on temperature rise limits in section 9.2 and in table 6 of DIN EN 61439-1.

Procedure

The temperature rise verification must be carried out by following one of the procedures below or a combination of verification procedures:

- Verification by inspection in accordance with 10.10.2 of DIN EN 61439-1 and supplements in DIN EN 61439-3 for DBO
- Verification by deriving rated values for similar variants (from a tested design) in accordance with 10.10.3 of DIN EN 61439-1 and supplements in DIN EN 61439-3 for DBO
- Verification by calculating a switchgear and controlgear assembly in accordance with 10.10.4 of DIN EN 61439-1 and supplements in DIN EN 61439-3 for DBO

4.5 Temperature rise verification by tests

Verification by tests for the specific arrangement of the switchgear and controlgear assembly

The temperature rise verification for a switchgear and controlgear assembly must be carried out by means of one of the following procedures:

Procedure 1: Verification by jointly testing the integrity of individual functional units, the main busbars, the distribution busbars and the switchgear and controlgear assembly

Procedure 2: Verification by the separate testing of individual functional units, and testing the complete switchgear and controlgear assembly including the main busbars and the distribution busbars

Procedure 3: Verification by separate testing of individual functional units, the main busbars, the distribution busbars and the complete switchgear and controlgear assembly

Observe the information in standard DIN EN 61439-1, section 10.10.2.

For installation distribution boards (DBO): Observe the supplements in DIN EN 61439-3.

Validity of the tests

Procedures 1 and 2 are considered valid as a verification of the concrete arrangement of the tested switchgear and controlgear assembly.

Procedure 3 is considered valid as a verification of the modular system, not just for a special arrangement of the tested switchgear and controlgear assembly.

Assessing the results

At the end of the test, the temperature rise should not exceed the temperature rise limits specified in DIN EN 61439-1, table 6. The devices must function faultlessly under the temperatures prevailing in the switchgear and controlgear assembly and within the voltage limits prescribed for the devices.

4.6 Temperature rise verification by derivation from similar variants

Derivation for similar variants through representative arrangements

Under certain conditions, the test results from a concrete, tested switchgear and controlgear assembly system can be used to determine the rated values for similar variants without the need for further testing.

In doing so, the least favourable arrangements of the switchgear and controlgear assembly system must be selected as representative arrangements.

Conditions for deriving the verification for similar variants

The following conditions apply so that the rated values can be determined for similar variants without the need for further testing:

- The functional units must belong to the same group as the functional unit selected for the test.
- The design must be the same as the one used for the test.
- The overall dimensions must be the same as or larger than those of the tested unit.
- Ventilation must be exactly the same as, or better than, that of the tested unit (forced ventilation or natural convection, similar or larger ventilation openings).
- The inner division (if present) must be the same as or smaller than that of the tested unit.
- The power dissipation in the same field must be the same as or smaller than that of the tested unit.

4.7 Temperature rise verification by calculation

In principle

DIN EN 61439-1 authorises two different calculation procedures. In both calculation procedures, the power loss generated from all electric circuits is taken into consideration, and the approximate heating of the air inside the housing is calculated. The temperature reached by the heating of the air inside the housing is compared with the limit values of the operating equipment installed. Necessary restrictions and safety margins must also be taken into consideration as the actual local temperatures of the live components cannot be calculated.

The procedures only differ in the way in which the relationship between the power loss generated and the heating of the air inside the housing is determined.

Calculation procedure up to 630 A

The calculation procedure in accordance with 10.10.4.2 of DIN EN 61439-1 (and the supplements in DIN EN 61439-3 for DBO) can be applied under the following conditions:

- Switchgear and controlgear assemblies ≤ 630 A with a single compartment
- Switchgear and controlgear assemblies with rated frequency ≤ 60 Hz

The power loss of all electric circuits, including the internal conductors, is calculated based on the rated current of the electric circuits. The overall power loss of the switchgear and controlgear assembly is the sum of the power losses of the electric circuits considering that the overall load current is limited to the rated current of the switchgear and controlgear assembly. The power loss of the conductors is determined by calculation (see DIN EN 61439-1, annex H).

The increase in temperature inside the switchgear and controlgear assembly is determined from the overall power loss. In the process, information about the temperature rise depending on the generated power loss (power dissipation) in the housing is used.

Calculation procedure up to 1600 A

The calculation procedure in accordance with 10.10.4.3 of DIN EN 61439-1 (and the supplements in DIN EN 61439-3 for DBO) and the Technical Report in DIN EN 61439-1 supplement 2 can be applied under the following conditions:

- Switchgear and controlgear assemblies ≤ 1600 A with one or more compartments
- Switchgear and controlgear assemblies with rated frequency ≤ 60 Hz

The power loss of all electric circuits, including the internal conductors, is calculated based on the rated current of the electric circuits. The overall power loss of the switchgear and controlgear assembly is the sum of the power losses of the electric circuits considering that the overall load current is limited to the rated current of the switchgear and controlgear assembly. The power loss of the conductors is determined by calculation (see DIN EN 61439-1, annex H).

The increase in temperature inside the switchgear and controlgear assembly is determined from the overall power loss. In the process, the procedure specified in DIN EN 60890 is used. The calculation procedure is described in the Technical Report in EN 61439-1 supplement 2.

4.8 Temperature rise verification using the calculation procedure up to 630 A

Basic conditions for the application

The calculation procedure can be applied under the following basic conditions:

- Switchgear and controlgear assembly rated current ≤ 630 A
- Switchgear and controlgear assembly with a single compartment
- Switchgear and controlgear assembly rated frequency ≤ 60 Hz

Additional conditions for the application

The calculation procedure can be applied under the following conditions:

- The rated currents of the electric circuits of the switchgear and controlgear assembly must not exceed 80% of the conventional current in free air (I_{th}) or the rated current (I_n) of the electrical operating equipment in the electric circuit. In the process, the switchgear and controlgear assemblies of the electric circuits must be selected so that the outgoing circuits are appropriately protected under the calculated temperature in the switchgear and controlgear assembly.
- Information about the power loss of all installed devices is available.
- The housing was selected according to the spatial requirements of the devices to be installed.
- The power loss is more or less evenly distributed inside the housing.
- The mechanical parts and the installed operating equipment are arranged so that air circulation is not significantly affected.
- The arrangement of conductors above 200 A and their neighbouring construction parts reduces eddy currents and hysteresis loss.
- All conductors must have a minimum cross-section of 125% corresponding to the permissible rated current of the associated electric circuit. If a device manufacturer specifies a conductor with a larger cross-section, the larger cross-section is taken into account. The conductors should be selected in accordance with DIN EN 60364-5-52.
- Information about the power dissipation is known.

Information about the power dissipation

Information about the power dissipation is known for the following reasons:

- It is made available by the housing manufacturer for various approved types of installation such as installation into walls and surface mounting onto walls.
- It is determined by measuring the temperature rise depending on the power loss generated in the housing, by testing in accordance with 10.10.4.2.2.
- If active cooling is used, the performance characteristics and installation criteria of the cooling device manufacturer are taken into account.

Details about the calculation procedure

With this simple method for verifying the temperature rise, it is assumed that the heat loss of all operating equipment and electrical conductors is more or less evenly distributed throughout the housing.

Standard DIN EN 61439-1 assumes the following:

- Any internal compartments should not hinder the distribution of heat loss.
- The ambient temperature is maximum 35°C (daily average), with a daily maximum of 40 °C.

However, the heat loss will not actually be dissipated evenly in the housing. Therefore, the standard requires that a reduction factor (derating factor) of at least 0.8 (see manufacturer's information) is taken into account for the verification by calculation. All components should only be loaded with maximum 80% of their rated current.

The power loss of all electric circuits including the internal conductors is calculated based on the rated current of the electric circuits:

- Installed power loss of all installed devices in power feeds and outflows. There are devices which generally have a constant power loss. There are devices on which the power loss is generally proportional to I^2. In addition to the derating factor of at least 0.8, a load factor is also taken into consideration depending on the number of electric circuits. Through the mutual warming of the installation devices, the power reduction in the form of a load factor must be determined. This load factor not only differs according to the number of electric circuits, but also between power switchgear and controlgear assemblies (PSC) and installation distribution boards (DBO).
- Installed power loss of busbars
- Installed power loss of conductors (wiring): Determination by calculation.

The overall power loss of the switchgear and controlgear assembly is calculated by adding the power loss of the electric circuits. In doing so, the fact that the overall load current is limited to the rated current of the switchgear and controlgear assembly is taken into account.

When calculating the temperature rise inside the switchgear and controlgear assembly, information about heating depending on the power loss (power dissipation) generated in the housing is used.

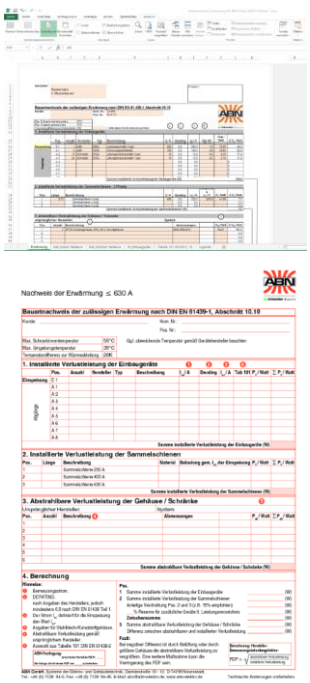
Results of the verification procedure

The temperature rise verification for the switchgear and controlgear assembly is deemed to be satisfied if the temperature of the air, determined from the calculated power loss, does not exceed the temperature of the air in operation specified by the device manufacturers. It is confirmed that the overall power loss of the components and conductors in the switchgear and controlgear assembly do not exceed the known values of the housing's capacity to dissipate heat.

For switchgear or electrical operating equipment in the main electric circuits, this means

- That the continuous load does not exceed the permissible load under the calculated air temperature,
- That the continuous load is not more than 80% of its rated current.

ABN GmbH Excel and PDF templates for temperature rise verification



Nachweis der Erwärmung ≤ 630 A

Bauartnachweis der zulässigen Erwärmung nach DIN EN 61439-1, Abschnitt 10.10

1. Installierte Verlustleistung der Einbaugeräte

2. Installierte Verlustleistung der Sammelschienen

3. Abstrahlbare Verlustleistung der Gehäuse / Schränke

4. Berechnung

ABN GmbH by Schneider Electric makes temperature rise verification tools available:

- Excel templates for temperature rise verification by calculation for switchgear and controlgear assemblies with a single compartment of up to 630 A.
  - With information about system housing heat calculations
  - With information about the power loss of the installed devices and busbars
  - With power reduction tables in the form of a load factor according to the number of electric circuits
    Observe the different load factor values for power switchgear and controlgear assemblies (PSC) or installation distribution boards (DBO).
- Editable PDF template for the documentation

Download from:

www.abn-electro.com > Service > DIN EN 61439

https://www.abn-electro.com/service/din-en-61439/

Observe the latest version of the templates and tools.

4.9 Temperature rise verification using the calculation procedure up to 1600 A

Basic conditions for the application

The calculation procedure can be applied under the following basic conditions:

- Switchgear and controlgear assembly rated current ≤ 1600 A
- Switchgear and controlgear assembly with a single compartment or several compartments
- Switchgear and controlgear assembly rated frequency ≤ 60 Hz
- There are no more than three horizontal compartments in the switchgear and controlgear assembly or in a switchgear and controlgear assembly field.

Additional conditions for the application

The calculation procedure can be applied under the following conditions:

- The rated currents of the electric circuits of the switchgear and controlgear assembly must not exceed 80% of the conventional current in free air (I_{th}) or the rated current (I_n) of the electrical operating equipment in the electric circuit. In the process, the switchgear and controlgear assemblies of the electric circuits must be selected so that the outgoing circuits are appropriately protected under the calculated temperature in the switchgear and controlgear assembly.
- Information about the power loss of all installed devices is available.
- The housing was selected according to the spatial requirements of the devices to be installed.
- The power loss is more or less evenly distributed inside the housing.
- The mechanical parts and the installed operating equipment are arranged so that air circulation is not significantly affected.
- The arrangement of conductors above 200 A and their neighbouring construction parts reduces eddy currents and hysteresis loss.
- All conductors must have a minimum cross-section of 125% corresponding to the permissible rated current of the associated electric circuit. If a device manufacturer specifies a conductor with a larger cross-section, the larger cross-section is taken into account. The conductors should be selected in accordance with DIN EN 60364-5-52.
- For housing with natural ventilation, the cross-section of the ventilation openings must be at least 1.1 times the ventilation openings.
- For housing with compartments and natural ventilation, the cross-section of the ventilation openings in each horizontal compartment must be at least 50 % of the compartment's horizontal cross-section.

Details about the calculation procedure

The power loss of all electric circuits including the internal conductors is calculated based on the rated current of the electric circuits:

- Installed power loss of all installed devices in power feeds and outflows. There are devices which generally have a constant power loss. There are devices on which the power loss is generally proportional to I^2.
- Installed power loss of conductors (wiring): Determination by calculation.

The overall power loss of the switchgear and controlgear assembly is calculated by adding the power loss of the electric circuits. In doing so, the fact that the overall load current is limited to the rated current of the switchgear and controlgear assembly is taken into account.

The increase in temperature inside the switchgear and controlgear assembly is determined from the overall power loss. In the process, the procedure specified in DIN EN 60890 is used. The calculation procedure is described in the Technical Report in EN 61439-1 supplement 2.

Results of the verification procedure

The temperature rise verification for the switchgear and controlgear assembly is deemed to be satisfied if the temperature of the air of each device determined at assembly height does not exceed the permissible ambient temperature in operation specified by the device manufacturers.

For switchgear or electrical operating equipment in the main electric circuits, this means

- That the continuous load does not exceed the permissible load at the calculated ambient air temperature,
- That the continuous load is not more than 80% of its rated current.

4.10 Verification of the short-circuit withstand strength

Purpose

The verification of the short-circuit withstand strength verifies the amounts of the short-circuit current's rated values because the safety of an electric system also depends, among other things, on its behaviour during short-circuiting. A short-circuit should not cause damage to people, animals or property.

The switchgear and controlgear assembly must be dimensioned so that any short-circuit currents that could occur in the event of a fault can be safely managed and disconnected.

To ensure this, the short-circuit current (uninfluenced (I_{cp}) at the switchgear and controlgear assembly connection point) should be calculated to establish the basis for selecting the operating equipment when planning the switchgear and controlgear assembly.

The switchgear and controlgear assembly manufacturer selects and correctly procures the operating equipment so that the functional safety of the switchgear can be ensured according to the planning basis ($I_{cp} \leq I_{cw}$ and $I_p \leq I_{pk}$ or $I_{cp} \leq I_{cc}$).

To determine whether the short-circuit protection device should be located as a separate unit outside or inside the switchgear and controlgear assembly, it must be ensured that the short-circuit surge current (I_p) and the uninfluenced short-circuit current (I_{cp}) at the connection point are smaller than or equal to the manufacturer's corresponding specifications for the switchgear and controlgear assembly (I_{cw} or I_{cc}).

I_p	Short-circuit surge current
I_{cp}	Uninfluenced short-circuit current (effective value); expected short-circuit current; expected short-circuit conditions at the switchgear and controlgear assembly connection point
I_{pk}	Rated surge current resistance (resistance of the switchgear and controlgear assembly to the largest instantaneous value of the short-circuit current/resistance to electrodynamic forces; manufacturer's information), it is specified if there is no current-limiting circuit breaker in the switchgear and controlgear assembly's supply circuit
I_{cw}	Rated short-time withstand current (effective value of the short-time current that can be withstood under specific conditions without damage/resistance of the switchgear and controlgear assembly to the thermal effect of the current); manufacturer's specification as current together with duration
I_{cc}	Conditional rated short-circuit current with SCPD (resistance of switchgear and controlgear assembly to the thermal effect and the electrodynamic power of the circuit which is determined by a short-circuit protection device in duration (switch off time) and in amount (effective value); manufacturer's specifications)
SCPD	Short-circuit protection device; depending on the SCPD used, the manufacturer's specifications of I_{cw} and I_{pk} can be omitted • Manufacturer's specifications of I_{cw} are omitted in the event of an instantaneous reaction to a short-circuit and no current-limiting effect of the SCPD: Short-time withstand current is restricted by SCPD • Manufacturer's specifications of I_{pk} are omitted if the SCPD is also current-limiting

Responsibility for the implementation

The switchgear and controlgear assembly manufacturer is responsible for carrying out the verification of the short-circuit withstand strength using a suitable procedure. The verification of the short-circuit withstand strength is required from $I_{cw} > 10$ kA/$I_{cc} > 10$ kA; $I_D > 17$ kA and must be added to the documentation.

- In the process, observe DIN EN 61439-1, section 10.11 and the supplements in DIN EN 61439-3 on installation distribution boards intended to be operated by unskilled persons (DBO).

Procedure

The short-circuit withstand strength must be verified by means of one of the following procedures:

- Verification by comparison with a tested reference construction – using a checklist
  - In accordance with DIN EN 61439-1, section 10.11.3 and table 13 of DIN EN 61439-1
- Verification by comparison with a tested reference construction – by calculation
  - In accordance with DIN EN 61439-1, section 10.11.4
  - In compliance with annex P of DIN EN 61439-1 (normative) and using table 13 (points 6, 8, 9, 10) of DIN EN 61439-1
- Verification by inspection in accordance with 10.11.5 of DIN EN 61439-1 (and supplements in DIN EN 61439-3 for DBO)

When is the short-circuit current resistance verification not required?

The short-circuit current resistance verification is not required for

- $I_{cw} \leq 10$ kA/$I_{cc} \leq 10$ kA: Switchgear and controlgear assemblies with a rated short-time withstand current (I_{cw}) or a conditional rated short-circuit current (I_{cc}) of maximum 10 kA effective value.
  In many switchgear and controlgear assemblies up to 630 A, the verification of the short-circuit withstand strength can there be omitted in practice if the assemblies are connected, for example, to a transformer with 400 kVA and with a short-circuit current (I_{cp}) of 10 kA; i.e., a short-circuit withstand strength $I_{cp} \leq I_{cc}/I_{cp} \leq I_{cc}$ must be fulfilled, but not verified.
- $I_D \leq 17$ kA for switchgear and controlgear assemblies or electric circuits of switchgear and controlgear assemblies protected by current-limiting equipment: If the on-state current (I_D) in the highest permissible uninfluenced short-circuit current (I_{cp}) does not exceed the switchgear and controlgear assembly power feed of 17 kA at the connection points, i.e., if the short-circuit current-limiting operating equipment (circuit breaker, NH fuse, etc.) in the power feed restricts the I_{cp} to an on-state current (I_D)of maximum 17 kA.
  In many switchgear and controlgear assemblies, the verification of the short-circuit withstand strength can therefore be omitted in practice. However, the prerequisite is that the cut-off characteristics of the individual protective device are analysed.
- Auxiliary circuits of switchgear and controlgear assemblies intended for connection to transformers with a rated power of maximum
  - 10 kVA, with a secondary rated voltage of ≥ 110 V with short circuit impedance ≥ 4%.
  - 1.6 kVA, with a secondary rated voltage of ≥ 110 V with short circuit impedance ≥ 4%.

Chapter 5 Installation at the switchgear builder

Overview

This chapter provides information about the interior fittings of the Prisma XS system.

Contents of this chapter

5.1 Your safety when installing the interior fittings

Requirements for personnel during installation

Installation work on the Prisma XS system cabinets and all associated parts and devices must be undertaken by electrically skilled persons.

Requirements for personnel during assembly

Mechanical assembly work does not necessarily have to be carried out by electrically skilled persons. Rather, the manufacturer must establish which work requires which qualifications. The manufacturer is responsible for correctly assigning the work along with ensuring quality.

Preventing the cabinet from tipping over

When fitting the internal components, cabinets can tip over. A change in the centre of gravity, for example, if the doors remain open, can cause the cabinet to tip over. To prevent the cabinet from tipping over, follow these safety instructions before installing the internal fittings:

- Pay attention to the cabinet's centre of gravity.
- Prevent the cabinet from tipping.
- Remove the cabinet doors if necessary.

Ensuring protected storage of doors

Store the assembled cabinet doors in a way that ensures that they cannot become damaged or deformed.

Using suitable tools

The tools intended for carrying out assembly work can be found in the assembly instructions.

- Only use suitable, intact tools.
- Only use tools on the cabinet for their intended purpose.

5.2 Basic information about the internal components

Following the assembly instructions

Follow the assembly instructions enclosed with the product in order to perform all assembly steps safely and correctly.

Incorrectly performed assembly steps can lead to product defects and put people's lives in danger when subsequently operating the switchgear and controlgear assembly.

Leaving the assembly instructions in the device

Where required, leave the assembly instructions for the assembled cabinet and the operating instructions in the device.

Construction/manufacture of the switchgear and controlgear assembly

	Important construction requirements (assembly instructions) when manufacturing the switchgear and controlgear assembly	**Excerpt from product standard DIN EN 61439-2/-3**

1.1	**Assembly of individual components/groups of components in enclosures/cabinets**
	• Observe the system manufacturer's information in catalogues/assembly instructions
	• Observe the protective measures for switchgear in
	  • Protection class I (with protective conductor)
	  • Protection class II (double insulation)
		
		8.4.3.2 part 1
		8.4.4 part 1

1.2	**Installation of the devices**
	• The devices must be installed according to the manufacturer's instructions Care should be taken in particular to ensure:
	  • Accessibility of the devices
	  • Sufficient heat dissipation/ventilation
	  • For installation distribution boards, the protective devices must be suitable for operation by unskilled persons.
		8.5 part 1
		8.5.4
		8.5.5
		8.7
		8.5.3

1.3	**Wiring inside switchgear**
	• General requirements for wiring of bare and insulated conductors Selecting the cross-sections
	  • Recommendations for cross-sections
	• Select the cross-sections according to N, PE and PEN conductors It is assumed that the neutral conductor current will not exceed 50% of the phase conductor current. Due to the usual operating conditions (e.g. harmonics, non-synchronous loads due to AC consumers), the cross-section of the N and PEN conductors should correspond to the cross-section of the phase conductors.
	  • Cross-section of N conductors -> up to and including 16 mm², 100% of the associated phase conductor -> over 16 mm², 50% of the associated phase conductor, at least 16 mm²
	  • Cross-section of PEN conductors -> PEN min. 10 mm² for Cu and 16 mm² for Al, not smaller than the neutral conductor
	  • Cross-section of PE conductors
	• Earthed and short-circuit protected installation
	• Wire markings of insulated conductors in main and auxiliary circuits
	  • Phase conductor marking (black)
	  • Marking of PE, N, PEN
		
		8.6.3 + notice H part 1
		
		8.6.1 part 1
		
		8.4.3.2.3
		
		8.4.3.2.2 + table 3
		8.6.1 section 1+2
		8.6.4 + table 4
		
		8.6.5
		8.6.6

	Important construction requirements (assembly instructions) when manufacturing the switchgear and controlgear assembly	Excerpt from product standard DIN EN 61439-2/-3

	• Compliance with clearances and creepage distances
	Up to a rated insulation voltage of AC 690 V, compliance with the following clearances is recommended (especially for busbars):
	  • Bare, energized live parts to each other: 10 mm
	  • Bare, energized live parts to bodies and constructional components: 15 mm
		8.3

1.4	**Incoming/outgoing terminals for external protective conductors** • The terminals must be designed according to the circuit's current load capacity and short-circuit withstand strength. • Terminals for external protective conductors	8.8 part 1 Table A.1, annex A

1.5	**Assembly of doors, covers and cladding**
	• Compliance with the protection against direct contact (e.g. IP2X or IPXXB for PSC)
	• Compliance with the protective measure
	  • Protection class I (with protective conductor)
	  • Protection class II (double insulation)
	• Compliance with the IP degree of protection
		
		8.4.2 part 1
		
		8.4.2.3
		8.4.4
		8.2.2

1.6	**Labels/documentation** • Designation label • Information for the switchgear and controlgear assembly • Handling, installation, operating and maintenance instructions • Equipment markings/wiring diagrams	 6.1 part 1 6.2.1 6.6.2 6.3

5.3 Delivery of materials

Checking the delivery

Upon receipt of the delivery, check the contents for damage and completeness:

- The boxes and packaging materials used for transport have not been damaged.
- All components listed on the delivery note have actually been delivered.
- The components have not suffered any damages that could affect the insulation or operation.
- The contents and weight of the delivery correspond with the information on the delivery note.

Handling the packaging

If possible, do not remove the packaging from the cabinet or delivered components until the equipment has arrived in the place in which they are to be installed.

5.4 Specifications for the screw connections

Observe the torque specifications on brackets and installation devices

Only the correct torque can ensure reliable connections.

- Observe the torque information and information about connections in the manufacturer's instructions.
- Observe the torque instructions directly on the brackets or installation devices to be connected.

The respective optimal torque in Nm can often be found directly on the busbar terminals or on the installation devices:

- Directly on the busbar terminals
- Directly on the NH fuse connections
- Directly on the side of the load break switches or circuit breakers

Tightening torque and attachment of busbars in accordance with DIN 43673 part 1

The information in the following table applies to direct current and alternating current up to 60 Hz.

		Interior
Screw	Property class	8.8 or higher in accordance with ISO 898-1
	Corrosion protection	A2G, A4G (gal Zn) B2G, B4G (gal Cd) in accordance with ISO 4042 (DIN 267-9)
Nut	Property class	8 or higher in accordance with ISO 898-2
	Corrosion protection	A2G, A4G (gal Zn) B2G, B4G (gal Cd) in accordance with ISO 4042 (DIN 267-9)
Spring element	Conical spring	In accordance with ISO 10670/DIN 6796 Corrosion-protected
Torque (Nm) for thread	M4	1.5
	M5	2.5
	M6	4.5
	M8	10.0
	M10	20.0
	M12	40.0
	M16	80.0

Contact pressure on spring elements

Maintenance of sufficient contact pressure on spring elements must be ensured. In the process, the following must be ensured:

- Loosening of the screw connection during transport or operation due to shocks or vibrations must be prevented.
- Suitable spring elements to compensate for thermal expansion must be used so that the specified contact pressure is not undercut under all potential prevalent temperatures. In the process, take into account the temperature range of -5°C to the highest temperatures in the event of a short-circuit of up to 250°C.
- Other spring elements may also be used which are suitable for maintaining the required contact pressure. If necessary, washers should also be provided.

Marking paint

Marking paint facilitates inspection when checking that the nut has been tightened. It facilitates the identification of loose nuts throughout the switchgear's service life.

Therefore, after tightening each electrical connection using the applicable torque, apply marking paint to the screw connection, particularly between

- The nut and the screw or
- The screw head and the copper bar or
- The tightening device on a threaded part.

Paint characteristics

The marking paint must have the following characteristics:

- Coloured acrylic paint, water-resistant and resistant to temperatures of up to 150°C.
- Select a paint in a highly visible colour.

5.5 Using aluminium conductors

Only use aluminium conductors for suitable terminals

Aluminium conductors may only be used if the respective terminal is designed for the purpose. The suitability of terminals for aluminium conductors must be confirmed by the terminal manufacturer.

- See the information concerning this in the catalogue and device instructions.

Correctly attaching aluminium conductors

Before being connected or reconnected, aluminium conductors must be prepared in accordance with the applicable technical rules. Upon contact with oxygen, the surface of aluminium as a conductor is immediately coated with an insulating oxide film. This increases contact resistance.

Step	Action
1	Carefully clean the stripped conductor end by scraping the oxide film using a knife, for example. Files, sandpaper or brushes are not suitable for this purpose.
2	Immediately after removing the oxide film, rub grease into the conductor end. The grease must be acid and alkali free. Technical Vaseline is suitable, for instance.
3	Immediately connect into the terminal. This prevents the formation of insulating oxide films.
4	Tighten the terminal, observing the torque.

Retightening aluminium terminal points

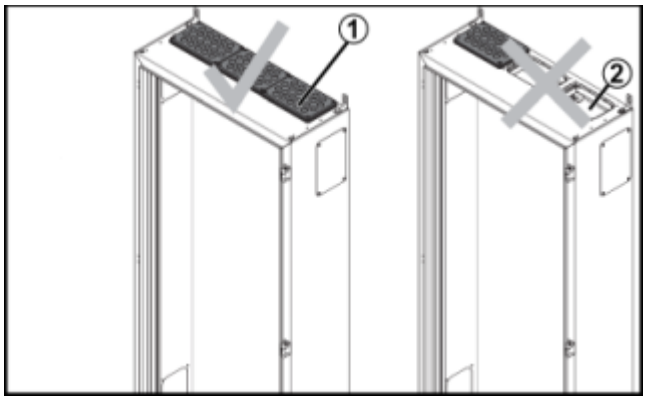
Aluminium terminal points must be tightened again every 200 operating hours. Observe the torque when doing so.

5.6 Achieving the degree of protection

Wall-mounted/free-standing distributors from the NF...P/NF...E and NT...P/NT...E series

To achieve the required degree of protection, all cut-outs (2) at the top and bottom of the system housing must be sealed with suitable cable entry plates (1) and seals from the system range.

Example of a free-standing distributor:

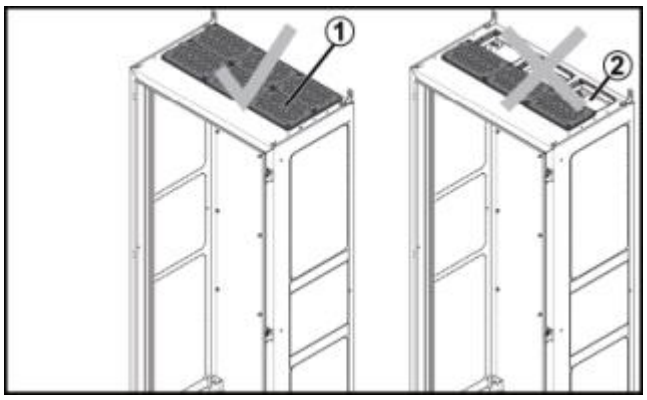


Compliance with the degree of protection can only be guaranteed if the housing is assembled perfectly plumb and level.

Wall-mounted/free-standing distributor from the NS...PB/NS...EB series

To achieve the required degree of protection, all cut-outs (2) at the top and bottom of the system housing must be sealed with suitable cable entry plates (1) and seals from the system range.

Example of a free-standing distributor:



The side openings must also be sealed with corresponding side plates.

Compliance with the degree of protection can only be guaranteed if the housing is assembled perfectly plumb and level.

5.7 Marking the switchgear and controlgear assembly

Attaching designation labels and warning signs

Markings, designation labels and warning signs must be:

- Affixed in a clearly legible manner,
- Permanently legible.

If necessary, cleaning must be carried out by an electrically trained person or an electrically skilled person.

Information on the designation label

The information on designation labels for switchgear and controlgear assemblies includes:

- Name and address or trademark of the switchgear and controlgear assembly manufacturer,
- Clear type designation or identification number or other marking indicating the necessary information from the switchgear and controlgear assembly manufacturer,
- Indication of the date of manufacture,
- Information about the applicable part of standard DIN EN 61439.

Warning about steady-state touch current and charges

If the switchgear and controlgear assembly contains operating equipment that may have steady-state touch current and charges after they have been switched off (capacitors, etc.), a warning plate is required DIN EN 61439-1 (section 7.1)).

Areas containing external power and which could therefore also be considered dangerous should be indicated too.

5.8 Drawing up or supplementing a parts verification

Purpose and content of the parts verification

A parts verification must be carried out on each finished switchgear and controlgear assembly (in accordance with DIN EN 61439-1 (section 11) and DIN EN 61439-1 supplement 1 (section 14.2) and DIN EN 61439-2 (section 11) and DIN EN 61439-3 (section 11)).

The Prisma XS system and the operating equipment inside the system are subject to design verifications. The parts verification serves as proof that the corresponding specifications of the design verification have been observed. It provides a way of disclosing planning errors.

The parts verification is also used to determine manufacturing errors. As a whole, the parts verification contributes to ensuring the safe operation of the finished switchgear and controlgear assembly.

The parts verification should include the following:

- Construction requirements for the switchgear and controlgear assembly,
- Behaviour of the switchgear and controlgear assembly.

Carrying out the parts verification

Perform the following tests, also see the detailed checklists in the annex:

Test step	Criterion
1	Degree of protection of housing (seals, covers)
2	Clearances and creepage distances
3	Protection from electric shocks and consistency of the protective circuit
4	Integration of operating equipment
5	Internal electric circuit and connections
6	Terminal connections for conductors introduced externally
7	Mechanical function (actuators, locking)
8	Insulation characteristics such as insulation test (voltage dividers) and verification of insulation resistance
9	Wiring, operational behaviour and function

Chapter 6 Transport and storage

Overview

This chapter provides information about transporting and storing cabinets for the Prisma XS assembly system.

Contents of this chapter

6.1 For your safety during transport and storage

Transporting heavy cabinets

⚠WARNING

DANGER OF CRUSHING CAUSED BY THE CABINET FALLING, SHIFTING OR TIPPING OVER DURING TRANSPORT.

- ⇨ In principle, cabinets should only be transported individually.
- ⇨ Make sure that the subsurface is suitable both along the entire route of transport and at the place of installation.
- ⇨ Pay attention to the weight, dimensions and load distribution.
- ⇨ Always secure the transported cabinet using suitable equipment and lifting tools. The load must be secure at all times.
- ⇨ Immediately after transport, fasten or secure the cabinet in the place of installation.
- ⇨ Make sure that transport is only carried out by skilled personnel and that personal protective equipment is worn.

Parts of the body can get crushed if the cabinet falls, shifts or tips over.

Suitable subsurface

The subsurface along the route of transport and at the place of installation must have the following characteristics:

- It must be clean, firm and even.
- It should be horizontal if possible. Inclines are to be avoided. If an incline cannot be avoided, braking or coasting must be possible.
- The subsurface must be able to support the weight of the cabinet.

Weight, dimensions and load distribution

Specifications about the means of transport and lifting tools are derived according to the weight of the cabinet. The cabinet dimensions determine the requirements along the route of transport.

The centre of gravity of the individual cabinet must be taken into account during transport. The centre of gravity of the individual cabinet depends on the extent to which the cabinet has been assembled.

The weight and centre of gravity of the assembled cabinet must be determined prior to transport.

Securing the cabinet during transport

To transfer the cabinet safely, the following rules apply:

- Equipment used to transport the cabinet must be adequately secured and attached. Securing also includes sufficient labelling of the load and warning of hazards (centre of gravity, anchor points, safety measures).
- The routes of transport must be sufficiently illuminated and secured.
- No unauthorised persons should remain in the danger zone.
- When loading or transporting with a fork-lift truck, the cabinet must be secured to the truck with retaining straps. In the process, the cabinet's weight and centre of gravity must be taken into account. The centre of gravity of the cabinet depends on the extent to which the cabinet has been assembled.

Securing the cabinet in the place of installation

After transport, the following rules apply:

- After transport, the cabinet must be fixed in place immediately. In the case of intermediate storage, the cabinets must be safely positioned, and prevented from shifting or tipping over.
- An external visual inspection of the cabinet for damage caused during transport must be carried out.

6.2 Basic information about transport

Types of transport

The cabinets can be lifted in the following two ways:

- Ground transportation with fork-lift trucks, pallet trucks or roller devices from underneath
- Crane transportation of individual cabinets from above (N series only)

Spatial requirements during transport

Make sure that the width and height along the entire route of transport are sufficient for transporting the cabinet.

The cabinet dimensions can be found in the description of the cabinet in question in the section System housing on page 25 on page 28.

Load-bearing capacity during transport

Make sure that the means of transport has an adequate load-bearing capacity. Pay attention to the weight of the cabinets to determine the minimum load-bearing capacity of the means of transport.

What to do in the event of damage to the surface

If the surface of the cabinet becomes damaged during transport, it must be repaired to protect the system housing from rust.

Use a touch-up stick to repair any scratches on the cabinet surface.

6.3 Ground transportation with a fork-lift truck or pallet truck

Rules for safe ground transportation

The following rules for safe ground transportation must be observed:

- The cabinets must always be securely transported on pallets by a fork-lift truck or pallet truck.
- The cabinets must always be transported individually, even if the respective system housing is intended to allow cabinets to be attached next to each other or on top of one another. The cabinets should only be connected together after being transported to the place of installation.
- When transporting the assembled cabinet, the centre of gravity must be taken into account.
- To prevent the cabinet from tipping over or shifting, it must be attached according to the transport device manufacturer's specifications, e.g. with tension straps. Follow the transport device manufacturer's instructions.
- After transport, check the site and position, and the secure footing of the components.

Transporting cabinets lying on their side

You can transport Prisma XS system cabinets lying on their side. When doing so, observe the following:

- If there are busbars inside a cabinet, the cabinet must lie on its back during transport as the busbars can become deformed if the cabinet is transported on its side.
- Attach the cabinet to prevent it from shifting.

Transporting standing cabinets

You can transport assembled Prisma XS system cabinets in the standing position. When doing so, observe the following:

- Pay attention to the centre of gravity and the weight of the transport unit.
- Prevent the cabinet from tipping. For N series cabinets, for which crane transportation is permitted, the transport lugs are also suitable as an additional way to secure the cabinet.
- During transport, do not lift the cabinet with the fork-lift truck or pallet truck higher than is absolutely necessary. There is a risk that it will tip over.
- Make sure that the cabinet is set down slowly and evenly.

6.4 Crane transportation (N series)

Rules for safe crane transportation

The following rules for safe crane transportation must be observed:

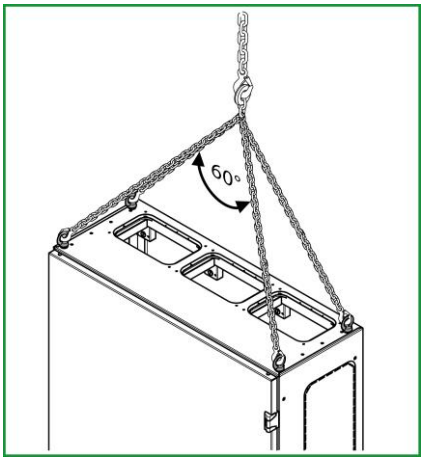
- Never hang lifting tackle/suspension ropes on the cabinet unit; only use transport lugs for this task.
- The overall weight of the cabinet should not exceed 300 kg/500 kg when being lifted by crane.
- Do not lift the cabinet over people's heads.
- After transport, check the site and position, and the secure footing of the components.

Crane transportation with transport lugs

During crane transportation, N series cabinets can be lifted using M10 transport lugs which must be screwed into the openings provided in the roof of the cabinet unit as follows:

The transport lugs must be aligned with their ring parallel to the side walls of the cabinet.

Transporting with chain slings

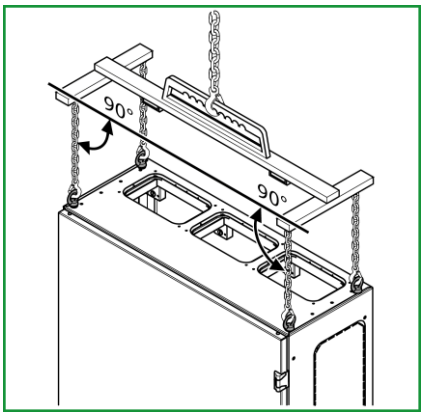


Max. overall weight of cabinet: 300 kg

The crane hook must be positioned above the centre of gravity.

When lifting a cabinet with a crane, the cabinet is suspended, balanced between four hoisting chains of equal length, see illustration.

Transporting with a lifting beam



Max. overall weight of cabinet: 500 kg

When lifting a cabinet with a crane, the cabinet is suspended, balanced between four hoisting chains of equal length, at an angle of 90° to the cabinet's surface.

6.5 Storage/intermediate storage

Storage conditions

The Prisma XS system and all its associated components is designed for permanent indoor installation. If the switch cabinet is placed in storage or intermediate storage, the devices and components must comply with the following conditions in order to protect the system components from damage.

Stipulated equipment environment

- Storage temperature between -5°C and 40°C
- Relative ambient humidity of 50% at 40°C

Stipulated condition of storage location

- Dry, clean, well-ventilated interior
- Protected from rain, moisture, condensation
- Protected from dust, sand, chemicals

Stipulated securing of equipment

- Secured in position on a stable, firm substructure or by fixing it to prevent it from falling over. In the process, pay attention to the switch cabinet's weight and centre of gravity.
- Protected from external damage
- Store the door in a way that prevents it from becoming deformed

Precautionary measures to take prior to subsequent transport

During subsequent transport:

- Prior to subsequent transport, a competent person must check that the transport lugs on the switch cabinet are secure and firmly attached and that there are no signs of damage (fine cracks in the material, deformations, indentations). In the event of damage, the transport lugs must be replaced.
- Follow the instructions for safe transportation.

Precautionary measures to take prior to subsequent commissioning

During subsequent commissioning:

- Let the switch cabinet acclimatise for several hours. Open the doors to do so.
- Perform a visual inspection prior to transport to check that no foreign bodies have been left behind.
- Check the stability of the components and the entire switch cabinet.
- Clean all components.
- Remove any moisture or condensation.
- Check the insulation.
- Follow the instructions for safe commissioning.

Chapter 7 Assembly at the place of installation

Overview

This chapter provides information about assembling the Prisma XS system at the place of installation.

Contents of this chapter

7.1 For your safety during assembly

Assembling heavy switch cabinets

⚠WARNING

DANGER OF CRUSHING CAUSED BY THE SWITCH CABINET FALLING, SHIFTING OR TIPPING OVER AT THE PLACE OF INSTALLATION.

- ⇨ When assembling field/wall-mounted and free-standing distributors, make sure that the switch cabinet can be attached to a solid wall.
- ⇨ When assembling free-standing distributors, make sure that the substructure in the place of installation is suitable.
- ⇨ Pay attention to the weight, dimensions and load distribution.
- ⇨ Immediately after transport, fasten or secure the switch cabinet in the place of installation.
- ⇨ Make sure that assembly is only carried out by skilled personnel and that personal protective equipment is worn.

Parts of the body can get crushed if the switch cabinet falls, shifts or tips over.

Suitable wall for wall mounting

The wall must have the following characteristics:

- The wall must allow the switch cabinet to be securely anchored.
- It must not be flammable.
- The wall's load-bearing capacity must be statically designed to support the weight of the switch cabinet.

Suitable subsurface for free-standing distributors

The subsurface at the place of installation must have the following characteristics:

- It must be clean, firm and even.
- It must not be flammable.
- The subsurface at the place of installation must be statically designed to support the weight of the switch cabinet.

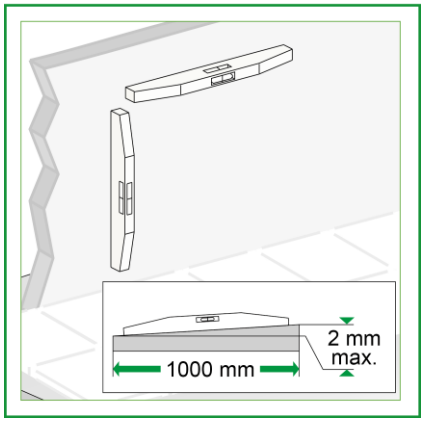
7.2 Requirements for the place of installation

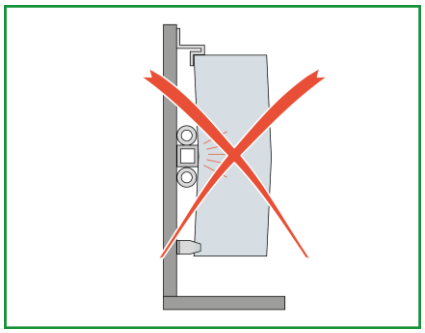
General requirements

The place of installation must meet the following requirements:

- The environmental conditions must be observed: Clean, dry, non-corrosive atmosphere
- Protected from dangers arising from liquid penetration (e.g. water ingress following pipe damage)
- Wall-mounted distributors can be attached to a solid wall.
- Free-standing distributors can be attached to the floor and wall.
- The general spatial requirements must be respected.

Requirements for wall mounting

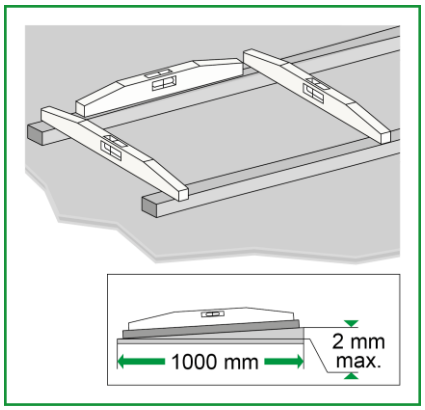


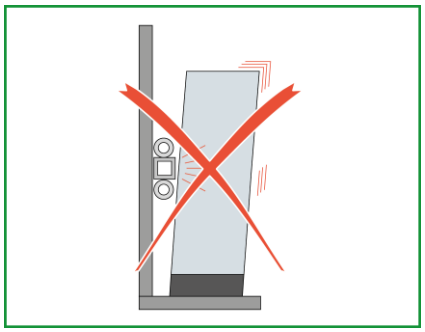


The following conditions apply to wall mounting:

- Any unevenness on the wall must not exceed +/- 2 mm per meter. If necessary, suitable underlay material must be used to flatten any unevenness.
- Do not install any objects behind the switch cabinet.
- The wall must have a sufficient load-bearing capacity and allow the cabinet to be securely anchored. In the process, attention must be paid to the weight of the assembled switch cabinet.
- It must not be flammable.

Requirements for installing free-standing distributors





The following conditions apply to the installation of free-standing distributors:

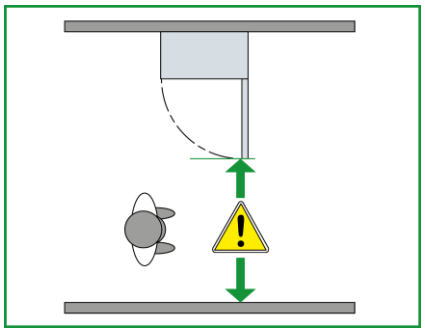
- Any unevenness on the wall and floor or substructure must not exceed +/- 2 mm per meter. If necessary, suitable underlay material must be used to flatten any unevenness. If any unevenness exists, compliance with the respective degree of protection cannot be guaranteed.
- Do not install any objects behind the switch cabinet.
- The wall and floor must have a sufficient load-bearing capacity and allow the switch cabinet to be securely anchored. In the process, attention must be paid to the weight of the assembled switch cabinet.
- It must not be flammable.

Basic spatial requirement

The site of installation must provide enough space to meet the following requirements:

- The escape routes must be ensured. The corresponding safety distances must also be observed.
- Clearance for operation, maintenance and emergencies must be taken into account.
- Sufficient space for incoming cables (also take permissible bending radii into account) must be provided.

Minimum width requirement for operation and maintenance



The minimum passage width in front of the switch cabinet is 700 mm.

If the doors are open as shown in the illustration opposite, a space of 500 mm must be allowed for, including when the doors which are 90° open.

Observe the locally applicable provisions.

7.3 Assembly

Performing assembly

When assembling the switch cabinet, follow the enclosed assembly instructions in order to perform all assembly steps safely and correctly.

The assembly instructions for the different types and series can also be found on the ABN website.

Attaching one cabinet to another

M series field distributors and all wall-mounted/free-standing distributors can be combined horizontally. Wall-mounted distributors from the S series, SP.../SE ... model can also be combined vertically.

When connecting the switch cabinets, follow the assembly instructions included with the switch cabinet in order to perform all assembly steps safely and correctly.

The following table shows which housing connection sets are suitable for the system housing models.

Type/ series	Implement-ation	Degree of protection	Protec-tion class *	Application **	Assembly type	Housing connection set
Field distributor						
M	ML...	IP43	⧈	SM	Horizontal	GVS10
	MK...	IP43	⧈	SM	Horizontal	GVS10
Wall-mounted distributor						
S	S...	IP43	⧈	SM	Horizontal	GVS10
	SV...	IP43	⏚	SM	Horizontal	GVS10
	SP...	IP54	⧈	SM	Horizontal	GVS20
					Vertical	GVS21 (structural width 1)
						GVS22 (structural width 2)
						GVS23 (structural width 3)
						GVS24 (structural width 4)
						GVS25 (structural width 5)
	SE...	IP54	⏚	SM	Horizontal	GVS20
					Vertical	GVS21 (structural width 1)
						GVS22 (structural width 2)
						GVS23 (structural width 3)
						GVS24 (structural width 4)
						GVS25 (structural width 5)
N	NF..P	IP55	⧈	SM	Horizontal	NPVS
	NF..E	IP55	⏚	SM	Horizontal	NEVS
	NT..P	IP55	⧈	SM	Horizontal	NPVS
	NT..E	IP55	⏚	SM	Horizontal	NEVS
Free-standing distributor						
S	SF...	IP43	⧈	SM	Horizontal	GVS10
	SV...	IP43	⏚	SM	Horizontal	GVS10
	SP...	IP54	⧈	SM	Horizontal	GVS20
	SE...	IP54	⏚	SM	Horizontal	GVS20
N	NF...P	IP55	⧈	SM	Horizontal	NPVS
	NF...E	IP55	⏚	SM	Horizontal	NEVS
	NT...P	IP55	⧈	SM	Horizontal	NPVS
	NT...E	IP55	⏚	SM	Horizontal	NEVS
	NS...P	IP55	⧈	SM	Horizontal	NPVS
	NS...E	IP55	⏚	SM	Horizontal	NEVS

* ⏚ Protection class I: earthed; ⧈ Protection class II: protective isolation

** SM: surface mounted

See the ABN catalogue for more information about the housing connection sets.

Chapter 8 Installation and connection

Overview

This chapter provides information about installing and connecting the switchgear and controlgear assembly to the power supply.

Contents of this chapter

8.1 Observe EMC regulations

8.1.1 Tasks and rules to be observed

Ensuring electromagnetic compatibility

The manufacturer of a switchgear and controlgear assembly that is ready to be installed must ensure its electromagnetic compatibility (EMC). The electrical installer must observe the appropriate installation regulations and the manufacturer's regulations. By following these regulations, the electrical installer can ensure that the installed items of equipment do not influence each other or the immediate environment.

Legal and normative regulations

Protection goal: Electrical devices must operate correctly in a defined environment without interfering with other devices or being interfered with by other devices. All electrical operating equipment must meet the relevant requirements for EMC and the standards applicable to EMC. This means that planners and installers of electrical systems must observe the EMC guidelines set out in the directives and standards.

- EMC Directive 2014/30/EC and its implementation in national legislation in the EU.
- VDE 0100-443:2016-10/DIN EN 60364-4-44:2007/A1:2015 (HD 60364-4-443:2016)
- DIN EN 61439 (at least part 1 plus the applicable product part, part 2 and part 3)
- EMC basic standards from the DIN EN 61000-4-x … series

Observing assembly and installation regulations

The following assembly and installation regulations must be observed when assembling, equipping and connecting low voltage switchgear and controlgear assemblies:

- In principle, only operating equipment with CE marking should be installed if the switchgear is affected by EU directives. In exceptional cases, additional assembly and installation regulations regarding EMC should be observed. These regulations can be found in the technical documents of the installation devices, where applicable.
- EMC environment (according to DIN EN 61439-1): The user specifies the requirements for environment A or B. For intended operation in environment A, environment B or other environments, restrictions may apply, regardless of the respective case of application.
  To avoid causing undesired electromagnetic interference, the user may be required to take appropriate countermeasures.
  In accordance with DIN EN 61439-1 (supplement 1, section 8.11), the manufacturer/installer is then required to take the necessary measures specified in the operating instructions.

8.1.2 Causes of failure in the event of a non-EMC-compliant installation

Failures in the event of non-EMC-compliant installation

A non-EMC-compliant installation can lead to the following errors:

- Sporadically occurring failures
- Failures or even destruction of devices or parts of the switchgear
- Faulty measurement instruments, communication equipment and arrangements
- Interference with other electrical devices operated on the high-voltage current system
- Exposure to high-frequency interference of frequency converters in the network
- Radiation of high-frequency parts through fluctuation of the output voltages
- Interference voltages in nearby conductors caused by high-frequency leakage currents to earth
- Interfering sources or interference sinks

Causes of a non-EMC-compliant installation

A non-EMC-compliant installation occurs if, for example:

- The functional earthing or shielding has not been carried out correctly,
- The protective-earthing-conductor and return-conductor are laid separately,
- The underlying cable routing is carried out chaotically,
- Metallic housing parts are not connected in an HF-compatible manner.

8.1.3 Measures for ensuring electromagnetic compatibility

Prerequisites for an EMC-compliant installation

An electrical device (system, housing, components) must operate in a given electromagnetic environment in the intended way without electromagnetic effects exerting an undue influence on this environment.

- All installed electrical operating equipment must meet the relevant requirements for EMC and the applicable directives and standards. The aim of the protection is to prevent mutual electromagnetic interference of devices.
- Electrical installation must not interfere with other, correctly used installations or equipment in an inadmissible way.
- Electrical installations must not be influenced in an inadmissible way.
- Here, EMC components comprise the electrical systems, including the line system, reinforcement structures and associated air-conditioning systems.

Observing fundamental EMC aspects

At least the following EMC aspects are considered fundamental:

- Include external and internal lighting protection in the EMC approach. Ensuring the EMC of switchgear is directly connected with the measures to be taken to ensure external and internal lighting protection.
- Consider an item of switchgear in its entirety.
- Optimize the equipotential bonding system including conductive paths (routes), metal structures and shielding.
- Observe interfering sources and interference sinks of all high-voltage and low-voltage systems.
- Observe the network structures with respect to EMC requirements and vagrant currents.

Allocate different levels of performance and interference

Pay attention to the allocation of different levels of performance and interference in EMC areas and spatially separate the EMC areas.

- Separate high performance and low performance with separate areas or internal compartments/partitions.
- Protect sensitive modules and components by enclosing them with protected housing or partitioned module racks.
- Also pay attention to EMC area zoning when laying cables and terminal devices.
- Keep sufficient distance between the cable routes of EMC-sensitive supply networks.
- Separate the terminal areas into EMC-sensitive groups.
- Pay attention to the space for taking shielding measures for incoming cables.

Ensuring well-ordered cable routing

Ensure well-ordered cable routing:

- Spatially separate the different cable groups from each other.
- Keep the cables in the switch cabinet as short as possible.
- Lay interference-emitting cables and cables that are sensitive to interference separately.
  - Avoid including interference-emitting cables and cables that are sensitive to interference in the same cable harness.
  - Ensure a distance of at least 100 mm between interference-emitting cables and cables that are sensitive to interference.
  - Interference-emitting cables and cables that are sensitive to interference should be crossed at right angles in the switch cabinet.
- Avoid large conductor loops: Lay power cables as close as possible to the reference potential.
- Lay outward and return conductors together along the entire length.

Using shielded cables

Use shielded cables, particularly for interference-emitting cables such as signal cables.

Enclosed metal cable channels are recommended for unshielded cables.

To utilise the shielding effect, lay unshielded cables in the corners of the cable channel. The cable channels must be connected together and to the functional earth across the entire surface.

Earthing cable shields

- Earth the cable shields:
  - At the entrance and exit to the cabinet (directly at the point of entrance or point of exit),
  - On the devices,
  - Several times for long cables,
  - Always at least on both sides.
- To prevent dangerous contact voltages, include the cable shields and unused cores on both sides in the equipotential bonding system.
- Make sure that no equipotential current is conducted past the shield.
- Perform EMC-compliant cable connections.

Implementing consistent equipotential bonding

Implement interconnected, consistent and well-conducting equipotential bonding, intermeshed as closely as possible, between all metal masses, housing, cabinet covers, the cabinet unit and all system parts. Large-scale metal and paint-free connections and connections with high-frequency grounding straps are suitable for this purpose.

- Equipotential bonding bars should be preferred to wire connections.
- For equipotential bonding with earthing braids, use the largest cross-section possible. Attach the earthing braids with a lock washer to surfaces which are free of paint and grease.
- Ensure low-inductance large-scale conductive mounting of the equipotential bonding connections.
- For a better high-frequency connection, screw connections should only be implemented as an earth connection between bare and unpainted parts.
- After connecting metal parts together, check that the fastening has been bolted on tightly with the recommended torque.

Including cable ducts in the equipotential bonding system

Include metal cable ducts in the equipotential bonding system.

- Metal cable ducts integrated into the equipotential bonding system between two switch cabinets must be directly attached to the switch cabinet with unpainted, bare metal connections.
- Metal cable channels must be electrically conductive and attached.

8.2 Network systems according to the type of earth connection

8.2.1 TT system

Personal protection

Residual current-operated protective devices (RCDs) must be used.

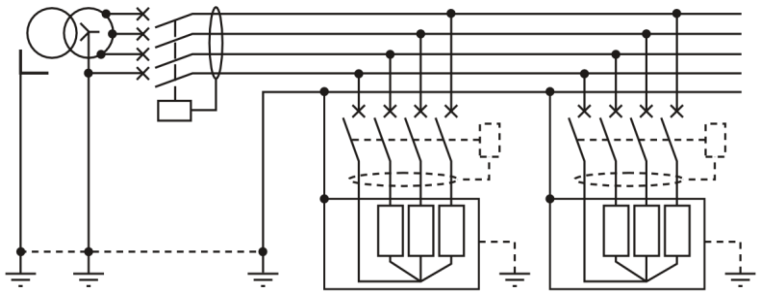
Operation

Interruption when an insulation fault occurs for the first time

The most important characteristics

The TT system has the following characteristics:

- In the TT system, one point is earthed directly and the parts in the network are connected to earth lines separate from the power supply system.
- With regard to planning and installation, the TT system represents the easiest solution. It is used in networks which are directly supplied by the public LV distribution network.
- The TT network does not require continual monitoring during operation. If applicable, it may be necessary to perform a regular check of the residual current-operated protective devices.
- Protection using special installations: residual current-operated protective devices (RCDs), which can also be used for fire safety if they are set to ≤ 500 mA.
- Each insulation fault interrupts the power supply. However, the failure is limited to the faulty electric circuit by series switching (selective RCDs) or parallel switching (electric circuit groups) of the residual current-operated protective devices.



8.2.2 TN system

Personal protection

The connection and earthing of touchable and conductive parts and the neutral conductor are mandatory.

The power supply is interrupted the first time a fault occurs with the aid of an overcurrent protection device (power switches, circuit breakers or fuses).

Operation

Interruption when an insulation fault occurs for the first time

The most important characteristics

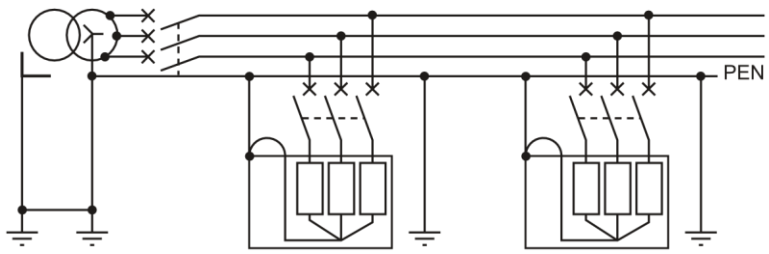
General aspects of the TN system:

- The TN system is made up of several sub-schemas (TN-C, TN-S, TNC-S).
- Each earthing schema can be used for the entire LV system. However, several earthing schemas can also be present in the same switchgear simultaneously, but never TN-C after TN-S.
- To be sure that the protection is effective independently of the fault location, the fault current must be higher than the safety device's tripping current. This condition must be checked when planning the switchgear by calculating all electric circuits of the distribution.
- Any modifications or enhancements must be planned and implemented by an electrically skilled person.
  - Can cause major damage to the windings of rotating machines in the event of insulation faults.
  - Can pose a great danger at points of use which are at risk of fire due to the high fault currents. Therefore, the use of residual current-operated protective devices is recommended in these areas.

Particularities of the TN-C system

The TN-C system has the following characteristics:

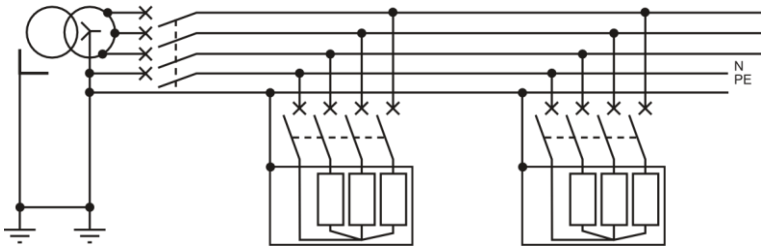
- At first, it appears to be less costly (one less conductor)
- It is not permitted in certain cases:
  - Points of use at risk of fire
  - For IT systems (harmonic currents in neutral conductors)



Particularities of the TN-S system

The TN-S system has the following characteristics:

- It can be used with flexible conductors and small cross-sections.
- IT offers a pure PE conductor through the separation of the neutral conductor and the protective conductor (computer systems and points of installation with particular risks).



8.2.3 IT system

Personal protection

The connection and earthing of touchable and conductive parts are mandatory.

The first failure is indicated by an isolation monitoring device (IMD).

When a fault occurs for the second time, the interruption occurs via overcurrent protection devices (power switches, circuit breakers or fuses).

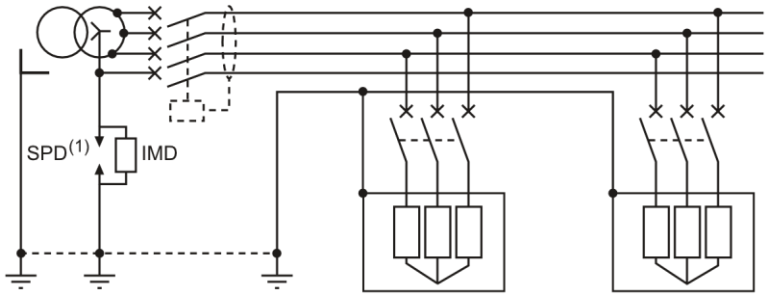
Operation

- Monitoring the first insulation fault
- Mandatory fault detection and elimination
- Interruption when two insulation faults occur at the same time

The most important characteristics

The IT system has the following characteristics:

- In the IT system, all active earth parts are separated or one point is connected to earth via an impedance. The parts of the electrical switchgear are either earthed individually or jointly or connected together to the system's earth.
- This solution provides the best operational continuity.
- The fault voltage of an initial fault remains low and is not dangerous, and the switchgear can remain in operation when an initial fault occurs. However, the first insulation fault must be indicated so that the user is informed that a fault exists in order to identify and eliminate it before a second fault occurs.
  - Requires maintenance personnel for system monitoring and operation.
  - Requires a high insulation level in the network (on very large networks, requires allocation and use of isolating transformers to supply consumers with high leakage current).
- The activation of the tripping device when two faults occur simultaneously must be checked with the aid of calculations, carried out during the planning phase, of the different possibilities of two faults occurring.



1) Surge protection device

8.3 Information about correct installation

Note on protection class I housing

Note the information on protection class I housing:

- In earthed cabinets, the housing and all other conductive parts must be connected to the equipotential bonding system.
- When mounting device doors, the protective conductor must be dimensioned according to the rated current of the installed device as soon as the protective low voltage is exceeded. In this respect, see the note on DIN EN 61439.

Note on protection class II housing (double insulation)

Note the information on protection class II housing:

- In double-insulated cabinets, the mounting rails are attached to the housing and insulated.
- In accordance with DIN EN 61439, mounting rails and other metal parts (such as doors, housing, mounting plates) are not connected to the PE/PEN by an earthing conductor.
- Free-standing switch cabinets belonging to protection class II must also be connected in the base plate to plastic insulating cable entry flanges or closing plates in order to ensure protective insulation.

Observing torque for cables and conductors

Observe the recommended torque for cables and conductors. The recommended torque for cables and conductors can be found:

- In the operating equipment manufacturer’s instructions
- In the “Installation at the switchgear builders” chapter.

Connecting outlet cables

Fundamental recommendations for connecting the outlet cable to installation devices:

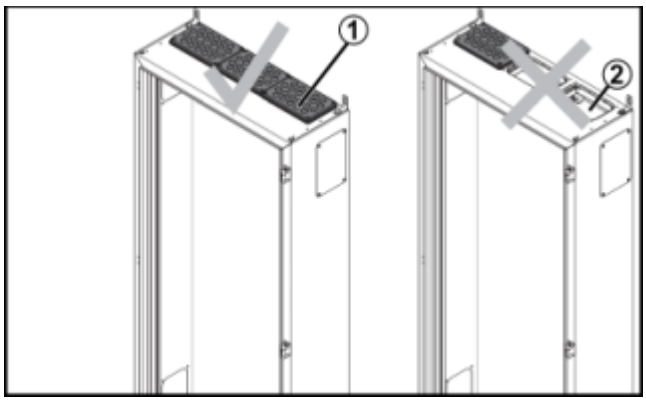
- Observe the minimum bending radius.
- Avoid exerting high tension and pressure strain on the devices’ outlet connections.
- Attach the cables every 400 mm.

Take sealing measures

Take sealing measures to achieve the required degree of protection.

To achieve a high degree of protection, all cut-outs (2) on the top and bottom of the system housing must be sealed with suitable cable entry plates (1) and seals from the system range. The same applies to any cut-outs on the sides.

Example of a free-standing distributor from the NF..P/NF..E and NT..P/NT..E series:



Compliance with the degree of protection can only be guaranteed if the housing is assembled perfectly plumb and torsion-free.

Removing transport protections

Carefully remove any existing transport protections.

Removing foreign bodies

Check the switch cabinet for foreign bodies (tools, screws and bolts) that could prevent correct operation.

Remove any remaining pieces of cable and foreign bodies.

Cleaning insulating parts

Clean all insulated parts with an anti-static cloth.

Cleaning the switch cabinet after installation.

Always clean the switch cabinet with a vacuum cleaner:

- Remove the dust from the inside. Do not carry out pressure cleaning as this can generate chips and deposits which accumulate in areas where there are conducting parts.
- Carry out any necessary small repairs.
- After cleaning, check that there are no more foreign bodies or tools in the switch cabinets.

Clean the switch cabinet externally:

- Remove any dust with a vacuum cleaner.
- Wipe the outside.
  - If necessary, use a neutral cleaning agent which is suitable for the switch cabinet and will not damage the colour.
  - If necessary, repair the paint work.

After installation

Check the installation by carrying out another visual inspection.

Chapter 9 Commissioning

Overview

This chapter provides information about commissioning the switchgear and controlgear assembly.

Contents of this chapter

9.1 For your safety during commissioning

Electric shocks or arc flashes

⚠DANGER

LIFE-THREATENING DANGER DUE TO ELECTRIC SHOCKS OR ARC FLASHES.

⇨ Make sure that the switch cabinet has been installed correctly.

⇨ Cordon off the switch cabinet's danger zone. Persons not involved in switching operations should leave the danger zone.

⇨ Perform the initial inspection on the switchgear in full before starting it up for the first time in accordance with the section "Carrying out the initial switchgear inspection". The initial inspection must be carried out by a specially trained electrically skilled person with testing experience.

Even after a thorough initial inspection has been carried out, faults in the switchgear can still cause electric shocks or arc flashes. Therefore, switching on the system for the first time can be particularly dangerous. Life-threatening injuries or even death could result.

Safety measures prior to recommissioning

If the switchgear has been switched off for a long time, the following precautionary measures must be taken:

- Perform a visual inspection, including of all fastenings and connections.
- When doing so, observe the notes on initial commissioning.
- Make sure that no foreign bodies, auxiliary materials or tools have been left behind in the switch cabinet.
- Clean all components.
- Inspect and check the insulation.
- Take insulation measurements.
- Remove any moisture or condensation.
- Make sure that all outgoing circuits have been switched off.

9.2 Performing the initial inspection on the switchgear and controlgear assembly

Requirement: Connections and torque have been checked

Check the sealing tightness and strength of all connections and tightening torque:

- Of the electrical connections,
- Of the mechanical connections,
- Of the switchgear fastenings.

All connections must be protected from working themselves loose.

Refer to the manufacturer's instructions for the tightening torque of the operating equipment and the installation device connections.

Test tightening torques are 15 percent lower than actual tightening torques. Pay attention to the tightening torques in the section "Installation at the switchgear builders".

Performing the initial inspection on the switchgear and controlgear assembly

Before starting up the switchgear and controlgear assembly for the first time, an initial inspection must be carried out by an electrically skilled person with testing experience. The initial inspection must be performed to ensure that there are no hazards due to accident, fire or explosion.

The initial inspection consists of:

- Inspections
- Testing and measuring

Inspections

During the inspection, check that the switchgear and controlgear assembly and all associated operating equipment and installed devices are in perfect condition. During the inspection, it is checked that

- The operating equipment meets the safety requirements of operating equipment standards.
- The operating equipment has been selected in compliance with the acknowledged rules of technology.

The inspection also includes externally inspecting the switchgear and controlgear assembly and inspecting the interior fittings.

- Pay full attention when carrying out the inspection.
- Allow sufficient time.

Carry out the following steps to ensure the minimum requirements of the initial inspection. See also the checklist in the annex:

Steps
Check the measures taken to prevent electric shocks. The direct and indirect contact of live parts must be prevented by taking suitable protective measures.
Check the basic protection and basic insulation.
Check the additional insulation for fault protection.
Check all necessary covers for personal protection.
Check the protection against thermal influences.
Check the selection of operating equipment such as conductors with regard to current carrying capacity and voltage drop.
Check the switchgear and monitoring devices.
Check the marking of the protective conductor and the neutral conductor, the marking of the electric circuit and protections.
Check that the operating equipment is easily accessible for maintenance purposes.
Check the installation for obvious insulation faults such as: • Trapped wires or damaged cables, • Faulty connection points, • Humidity, • Clearances and creepage distances.

Testing and measuring

After the inspection, testing and measuring must be carried out by an electrically skilled person with appropriate experience or who has been specially trained. Suitable measurement instruments must be used for taking measurements during the initial inspection.

Testing and measuring comprises at least the following tests:

1. Consistency of the conductor and protective conductor
2. Insulation resistance of the switchgear and controlgear assembly
3. Protection through protective separation or protective insulation
4. Insulation impedance in the non-conductive environment
5. Automatic shutdown of the power supply
6. Voltages, polarity and phase sequence of the conductor
7. Functional testing of devices and operating equipment
8. Functional testing of ancillary equipment
9. Auxiliary circuit testing
10. Safety equipment testing

Chapter
10 Control and operation

Overview

This chapter provides information about controlling and operating the switchgear and controlgear assembly. Controlling the switchgear forms part of operating the switchgear and, when performed as intended, comprises the safe observation, control, regulation and switching of electrical systems.

Contents of this chapter

10.1 For your safety during control and operation

Electric shocks or arc flashes

⚠DANGER

LIFE-THREATENING DANGER DUE TO ELECTRIC SHOCKS OR ARC FLASHES.

⇨ Make sure that the switching operations are only carried out by authorised persons.
- Electrically skilled or electrically trained persons for power switchgear and controlgear assemblies in accordance with DIN EN 61439-2 (PSC). Suitable personal protective equipment (PPE) must be worn.
- Operation by unskilled persons only for components in installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3 (DBO)

⇨ Cordon off the switch cabinet's danger zone. Persons not involved in switching operations should leave the danger zone.

Unauthorised, unintentional or careless switching could cause electric shocks or arc flashes. Life-threatening injuries or even death could result.

No operation by unskilled persons for power switchgear and controlgear assemblies

Unskilled persons are not permitted to operate power switchgear and controlgear assemblies.

Effectively prevent operation by unskilled persons

Operation by unskilled persons must be effectively prevented when using operating equipment and circuit breakers which are not permitted for use by unskilled persons. To do so, depending on the operating equipment, device type and equipment and in accordance with the manufacturer's specifications, use

- Locking devices
- Padlock(s)/locking mechanisms
- Sealing/locking and sealing
- With circuit breakers, the visibility of the settings/calibration must be secured. It must not be possible to change the settings/calibrate the circuit breaker without deliberate action requiring the use a key or tool. Access to carry out electronic calibration of the circuit breaker must be password-protected.

Operation of installation distribution boards (DBO) by unskilled persons

In the case of installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3 (DBO), only short-circuit protection devices intended to be used by unskilled persons may be used. Short-circuit protection devices intended to be operated by unskilled persons must be specified for use by unskilled persons by the manufacturer.

Accessing the switchgear in the case of power switchgear and controlgear assemblies in accordance with DIN EN 61439-2 (PSC)

Access and switching operations by unauthorised persons must be prevented, and all disconnecting devices and activation devices must be prevented from being switched back on:

- By effective barriers,
- With padlocks,
- With locking elements,
- And suitable prohibition signs.

10.2 Switching operations on switchgear and controlgear assemblies

Conditions to be met prior to switching on each time

Before switching the switchgear and controlgear assembly on, make sure that the following conditions are met:

- The access authorisations are clearly defined.
- Only authorised persons may enter the switchgear and controlgear assembly work area.
- Nobody can get injured by starting up the switchgear and controlgear assembly.
- All final electric circuits are connected and correctly secured.
- The switchgear and controlgear assembly shows no signs of visible damage.
- The switchgear and controlgear assembly is in a normal and good condition.
- Any defects identified have been immediately reported to the person responsible for the system. Any further measures should be implemented. If any defects are reported, switching on is NOT permitted.
- Only materials/objects required for operating the system are present in the switchgear and controlgear assembly's danger zone.

Types of switching operations on switchgear and controlgear assemblies

EN 50110 (DIN VDE 0105-1), differentiates between two types of switching operation:

- Switching operations to change the electrical condition of switchgear, i.e. to operate equipment, switch it on and off and start up and stop equipment containing devices, the intended use of which is not dangerous.
  - For power switchgear and controlgear assemblies in accordance with DIN EN 61439-2: Switching operations may only be carried out by an electrically skilled person.
  - For installation distribution boards intended to be operated by unskilled persons according to DIN EN 61439-3 (DBO): Switching operations may also be performed by unskilled persons. However, switching operations may only be performed on equipment intended to be operated by unskilled persons.
- Switching switchgear off or switching it back on in connection with carrying out work, disconnecting equipment prior to carrying out work in a de-energised state and switching it back on again after carrying out work in a de-energised state.
  - All switching operations must be carried out by an electrically skilled or an electrically trained person.

Handling NH fuses under load

Switching operations (i.e. activating fuse links under load or replacing NH fuses) are not considered dangerous work.

The NH fuse is a system which must only be used by authorised persons. These persons must either be electrically skilled or electrically trained. Unskilled persons must not put this equipment into operation.

Switching operations and activating NH fuses when the system is live may only be carried out by authorised persons under the following conditions:

- Personal protective equipment must be checked for visible damage prior to each use.
- The authorised person must wear a suitable helmet with face protection or a flame-retardant cover.
- The authorised person must wear suitable, flame-retardant and electric arc-tested overalls.
- The authorised person must stand on an insulating mat.
- For NH fuses, NH plug-in grips with a permanently attached gauntlet must be used.

Make sure that disconnection switches open the circuit quickly. This will prevent the risk of combustion.

Switching disconnection switches back on in the power feed of an installation distribution board (DBO)

Molded case circuit breakers (MCCBs) in accordance with DIN EN 60947-2 in the power feed of an installation distribution board (DBO) must not be switched back on by unskilled persons. Unskilled persons must not switch disconnection switches in accordance with DIN EN 60947-2 in the power feed of an installation distribution board, nor may they change their calibration settings.

A disconnection switch in accordance with DIN EN 60947-2 in the power feed of the DBO must meet the following conditions:

- The disconnection switch must be effectively prevented from being switched back on by unskilled persons: The use of a key or tool is required. Alternatively, a plate must be attached with the information that the equipment may only be switched back on by an electrically skilled or an electrically trained person.
- The visibility of the setting or calibration of the disconnection switch is ensured.
- It is ensured that the settings or calibration of the disconnection switch can only be modified consciously using a tool or key.
- Password-protection has been set up on electronic tripping devices.

Replacing fuse links in installation distribution boards (DBO)

Fuse links which comply with DIN EN 60269-3 (VDE 0636-3) may be replaced by unskilled persons. Standard DIN EN 60269-3 (VDE 0636-3) defines additional requirements for fuses intended to be used by unskilled persons.

Short-circuit protection devices in outgoing circuits in installation distribution boards (DBO)

In the case of outgoing circuits in installation distribution boards intended to be operated by unskilled persons, only short-circuit protection devices intended to be operated by unskilled persons may be used. The requirements for these short-circuit protection devices are defined, for example, in the following standards:

- DIN EN 60898-1 (circuit breakers)
- DIN EN 61008 (residual current circuit breakers)
- DIN EN 61009 (RCCB/MCB)
- DIN EN 62423 (residual current circuit breaker type B and RCCB/MCB type B)
- DIN EN 60269-3 (fuses intended for use by unskilled persons)

During operation, observe the short-circuit protection device instructions.

10.3 Faults on power switchgear and controlgear assemblies in accordance with DIN EN 61439-2 (PSC)

Actions to take in the event of faults on power switchgear and controlgear assemblies

In the event of faults such as a short-circuit, the following points must be observed:

- The person responsible for the system must be informed immediately. The causes of the fault must be identified. Suitable measures must be taken to effectively remedy these causes.
- Faults may only be eliminated by electrically skilled persons.
- Faulty electrical operating equipment may not be used. Until it is repaired, faulty electrical operating equipment must be put out of operation.
- If it is not possible to put faulty electrical operating equipment out of operation, the danger must be limited by taking suitable measures such as shutting off the device and setting up warning signs.

After eliminating the faults, an electrically skilled person with testing experience must carry out tests to check that the switchgear is in good condition, and document these tests. The inspections are described in the chapters “Commissioning” and “Inspection and maintenance”.

10.4 Faults on installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3 (DBO)

Actions to take in the event of faults on installation distribution boards

In the event of faults on installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3 (DBO), two cases must be differentiated:

- Switching short-circuit protection devices back on, the intended use of which is not dangerous, after the short-circuit protection device intended to be operated by unskilled persons has been triggered.
- Disruptions caused by faults or damage to covers or components inside the installation distribution board or faults in the electrical system.

Switching back on short-circuit protection devices intended to be operated by unskilled persons

Before switching back on short-circuit protection devices intended to be operated by unskilled persons, observe the following points:

- The electrical installations and operating equipment are in good condition:
  - No visible faulty parts
  - No missing or damaged covers to protect live parts have been detected
  - No damaged housing/cables/connectors or live conductors are apparent
  - Components, switches and covers are tightly fitted
  - No signs of overloading can be detected and no traces of fire or smoke are visible
- Pay attention to the following signs of danger:
  - Weak or flickering lights
  - Electric arcs or sparking
  - Cracking or buzzing noises
  - Smell of burnt material, e.g. insulation material, plastic, rubber
  - Regular tripping of short-circuit protection devices/fuses
- Only put safe electrical installations and operating equipment into operation by switching them back on. Faulty electrical operating equipment may not be used.
- In the event of signs of danger or visible defects:
  - A fault may have been caused by an error or damage.
  - Do not switch the short-circuit protection device back on under any circumstances.
  - Do not remove the covers or damaged components under any circumstances. Risk of electric shock.
  - The switchgear and controlgear assembly or the electrical system must be tested by an electrically skilled person with testing experience. To do so, a risk assessment must be carried out.
  - Inform the person responsible for the system immediately.

Faults caused by error or damage: Electrically skilled person required

In the event of faults caused by error, defects or damage, the following points must be observed:

- The person responsible for the system must be informed immediately.
- Faults may only be eliminated by electrically skilled persons.
- Faulty electrical operating equipment must not be used if there is a risk of hazards associated with its use. Until it is repaired, faulty electrical operating equipment must be put out of operation.
- If it is not possible to put faulty electrical operating equipment out of operation, the danger must be limited by taking suitable measures such as shutting off the device and setting up warning signs.

After eliminating the faults, an electrically skilled person with testing experience must carry out tests to check that the switchgear is in good condition, and document these tests. The inspections are described in the chapters “Commissioning” and “Inspection and maintenance”.

10.5 Repair

Repair

High currents are often generated when there is a fault. This can cause damage to sheathing, devices, components, operating equipment and busbars for example.

If you notice any faults or damage, pay attention to the following points:

- The person responsible for the system must be informed immediately.
- The switchgear and controlgear assembly must be disconnected by an electrically skilled person.
- Repairs may only be carried out by an electrically skilled person with testing experience.
- After the repair, the switchgear must be inspected by an electrically skilled person with testing experience to check that it is in proper condition. The inspections cover the scope of the initial inspection. The inspections are described in the chapters “Commissioning” and “Inspection and maintenance”.
- The check to ensure proper condition must be documented.

10.6 Upgrades and retrofits

Upgrades and retrofits

In the event of any upgrade or retrofit, the following points must be observed:

- Any upgrade or retrofit of a switchgear and controlgear assembly must be planned.
- When upgrading or changing a switchgear and controlgear assembly which already exists, the safety of the existing switchgear must be verified to ensure that it will not be impaired.
- A new project plan must be drawn up and an inspection of the switchgear and controlgear assembly in accordance with DIN EN 61439 must be undertaken before replacing the electrical operating equipment with other types of devices or before upgrading the switchgear.
- If the switchgear manufacturer modifies the switchgear and controlgear assembly by replacing the equipment with components that are not included in the design verification of the original manufacturer ABN GmbH, that switchgear manufacturer will then become the original manufacturer for those modifications (DIN EN 61439-1, chapter 10.1). In this case, a new design verification must be produced. A parts verification is not adequate.
- Modifications to the switchgear and controlgear assembly must be documented.

10.7 Cleaning power switchgear and controlgear assemblies in accordance with DIN EN 61439-2 (PSC)

External and internal cleaning work on disconnected switchgear (electrically skilled persons only)

When cleaning power switchgear and controlgear assemblies, at least the following safety-related points must be observed:

- Cleaning work must be carried out by electrically skilled persons. Electrically trained persons must be specifically trained in cleaning work and must ensure that work is carried out on the equipment in a de-energised state.
- Before starting the cleaning work, the five safety rules must be followed and therefore the switchgear must be disconnected.
- Pay attention to residual energy and static discharge:
  - Secure any accumulated energy. Dangerous residual energy may be present in electrical systems.
  - If any compensation systems are present, you must wait until you have shut down the capacitors. Refer to the compensation system manufacturer's specifications for information about how long to wait. Do not carry out any cleaning work until you have respected this waiting period.
  - In addition to the disconnection, also pay attention to static unloading before touching the device. Static tension can injure people.
- Pay attention to external voltages.
- Watch out for hot surfaces and the resulting risk of burns.
- Dust deposits in or on air vents can cause overheating.

Clean with a vacuum cleaner and dry cloths

The following cleaning methods are permitted:

- Clean the equipment via a dry method using a vacuum cleaner and dry cloths. Do not clean with compressed air!
- Clean the door, housing and covers with a dry, lint-free cloth.
- Do not use scouring agents.
- Do not perform wet cleaning. Do not use liquids.

Remove all contamination. Remove dirt for operational safety reasons. Dirt deposits can cause overheating. Do not forget to clean the top of the housing or the cable inlets.

Only carry out cleaning work on live parts in exceptional cases (electrically skilled persons only)

When cleaning live parts, at least the following safety-related points must be observed:

- Only carry out cleaning work on live parts in exceptional cases. If cleaning work is carried out on switchgear that has not been disconnected, the protective measures for working on live systems must be taken into account.
- Cleaning work on power switchgear and controlgear assemblies must be carried out by electrically skilled persons.
- Arc flashes should be borne in mind when carrying out cleaning work on live systems.
- When carrying out cleaning work on live systems, personal protective equipment to ensure protection against arc flashes must be used.
- When carrying out cleaning work, static electricity on jet nozzles can directly and indirectly endanger personnel.

10.8 Cleaning installation distribution boards in accordance with DIN EN 61439-3 (DBO)

External cleaning (permitted by unskilled persons)

On installation distribution boards intended to be operated by unskilled persons in accordance with DIN EN 61439-3 (DBO), external cleaning of the housing and door (door not open) is permitted by unskilled persons:

- Clean the outside of the door and housing with a vacuum cleaner and a dry, lint-free cloth.
- Do not use scouring agents.
- Do not use liquids. Never undertake wet cleaning.
- Do not perform any cleaning work inside the switchgear and controlgear assembly. Any cleaning inside the switchgear and controlgear assembly must be carried out by electrically skilled persons.

Internal cleaning work on disconnected switchgear (electrically skilled persons only)

When performing cleaning work inside switchgear and controlgear assemblies, at least the following safety-related points must be observed:

- Internal cleaning work must be carried out by electrically skilled persons. Electrically trained persons must be specifically trained in cleaning work and must ensure that work is carried out on the equipment in a de-energised state.
- Before starting the cleaning work, the five safety rules must be followed and therefore the switchgear must be disconnected.
- Pay attention to residual energy and static discharge:
  - Secure any accumulated energy. Dangerous residual energy may be present in electrical systems.
  - If any compensation systems are present, you must wait until you have shut down the capacitors. Refer to the compensation system manufacturer's specifications for information about how long to wait. Do not carry out any cleaning work until you have respected this waiting period.
  - In addition to the disconnection, also pay attention to static unloading before touching the device. Static tension can injure people.
- When carrying out cleaning work, static electricity on jet nozzles can directly and indirectly endanger personnel.
- Pay attention to external voltages.
- Watch out for hot surfaces and the resulting risk of burns.
- Dust deposits in or on air vents can cause overheating.

Cleaning the inside with a vacuum cleaner and dry cloths

Carry out cleaning via a dry method using a vacuum cleaner and dry cloths. Do not clean with compressed air.

- Clean the inside of the door, housing and covers with a dry, lint-free cloth.
- Do not use scouring agents.
- Do not use liquids. Never undertake wet cleaning.
- Remove all contamination. Remove dirt for operational safety reasons. Dirt deposits can cause overheating.

Only carry out cleaning work on live parts in exceptional cases (electrically skilled persons only)

When cleaning live parts, at least the following safety-related points must be observed:

- Only carry out cleaning work on live parts in exceptional cases. If cleaning work is carried out on switchgear that has not been disconnected, the protective measures for working on live systems must be taken into account.
- Cleaning work on live switchgear and controlgear assemblies must be carried out by electrically skilled persons.
- Arc flashes should be borne in mind when carrying out cleaning work on live systems.
- When carrying out cleaning work on live systems, personal protective equipment to ensure protection against arc flashes must be used.
- When carrying out cleaning work, static electricity on jet nozzles can directly and indirectly endanger personnel.

Chapter
11 Inspection and maintenance

Overview

This chapter provides information about inspecting and maintaining the switchgear and controlgear assembly.

Contents of this chapter

11.1 For your safety when performing inspections and maintenance

Electric shocks or arc flashes

⚠DANGER

LIFE-THREATENING DANGER DUE TO ELECTRIC SHOCKS OR ARC FLASHES.

⇨ Make sure that the switch cabinet has been installed correctly.

⇨ Cordon off the switch cabinet's danger zone. Persons not involved in switching operations should leave the danger zone.

⇨ Prevent the switchgear from being switched on or switched back on by unauthorised persons when carrying out inspections and maintenance.

⇨ Make sure that inspections and maintenance are carried out by electrically skilled persons with testing experience.

Even after a thorough inspection has been carried out, faults in the switchgear can still cause electric shocks or arc flashes. Therefore, switching on the system for the first time can be particularly dangerous. Life-threatening injuries or even death could result.

Personnel requirements

Inspections should not cause hazards. Therefore strict requirements are imposed upon persons carrying out an inspection:

- An inspection must be conducted by an electrically skilled person with testing experience.
- The electrically skilled person must have extensive knowledge of the provisions on protective measures.
- The electrically skilled person must also have knowledge of the measurement instruments required to carry out the inspection.
  - The measurement instruments must be checked prior to use.

An inspection may only be carried out by an electrically trained person if:

- They are managed and supervised by an electrically skilled person with testing experience.
- Suitable measurement instruments and test devices are available for performing measuring and inspection tasks.

Working on live systems in exceptional cases only

Work is not intended to be carried out on live systems.

Always check that no voltage is present before carrying out maintenance and assembly work on the switchgear and controlgear assembly.

Only electrically skilled persons with testing experience may undertake work on live systems for the purpose of commissioning and identifying faults.

Initial inspection of the switchgear and controlgear assembly following maintenance

An initial inspection must be performed before a switchgear and controlgear assembly is put into operation for the first time.

An initial inspection of the switchgear and controlgear assembly must take place after the following events:

- Upgrade,
- Modification,
- Retrofit,
- Maintenance/repair of the switchgear and controlgear assembly.

11.2 Inspection intervals for regular inspections

General information about inspections

- Inspections and maintenance extend the service life of the products.
- Inspections should be carried out routinely at suitable intervals.
- The switchgear and controlgear assembly must also be inspected if faults such as short-circuiting occur.
- Regular inspections and maintenance create a secure environment and can prevent failures.

For more information about the scope of inspections, see the section “Scope of inspection”.

General inspection intervals/reasons for shorter inspection intervals

To maintain operational safety, an electrically skilled person must check that the switchgear and controlgear assembly is in proper condition at least every four years (proposal of DGUV 3 (formerly BGV A3)). The aim of the inspection is to ensure the functionality and safe operation of the switchgear and controlgear assembly.

An annual inspection according to the information provided below is recommended. If device and operating equipment instructions stipulate shorter inspection intervals (for example in the case of RCCBs), schedule in these shorter intervals.

The inspection interval can be extended or shortened in accordance with national provisions or the insurer’s provisions. Possible reasons for shorter inspection intervals include:

- External influences,
- Tougher operating conditions,
- Changes to operating parameters and environmental conditions,
- The manufacturer’s stipulations for devices or operating equipment in their instructions,
- Special areas and systems in accordance with DIN VDE 100 group 700 or corresponding similar national standards,
- Applicable national standards and regulations,
- Strain on operating equipment.

The inspection intervals must be checked/defined by the operator and if necessary, shorter intervals must be specified in the inspection manual.

Visual inspections and switching operations

The following inspections should be carried out at least once a year:

- Visual inspection (external inspection) of the switchgear and controlgear assembly,
- Switching operations of individual protective devices and switchgear.

Document all inspections, for example in an inspection manual.

Recommended regular inspections

All the inspections listed below should be carried out by an electrically skilled person.

System/operating equipment	Recommended maximum inspection interval	Type of inspection
Electrical systems and stationary operating equipment	4 years	Check the equipment is in proper condition
Electrical systems and stationary operating equipment in special types of operating sites, areas and systems in accordance with DIN VDE 100 group 700	1 year	Check the equipment is in proper condition
Switchgear and controlgear assemblies such as • Load switches • Compact circuit-breakers/MCCBs • Load break switches • Disconnection switches	1 year	• External visual inspection • Switching operation/functional check
Protective device (RCCB)	1/2 yearly	Switching operation/functional check

11.3 Scope of inspection

Regular inspections

The following regular inspections should be carried out in the event of commissioning, changes to the switchgear and controlgear assembly, after faults or at appropriate time intervals:

- Inspections
- Measurement
- Testing

Consequences of the inspection

After the inspections, the following steps should be taken:

- Document the results of the inspection.
- Repair any faults identified, for example, by replacing the faulty operating equipment, covers, sheathing components or devices.
- Document the work and modifications carried out.

11.4 Visual inspection

Visual inspection

During the visual inspection, check that the switchgear and controlgear assembly, its operating equipment and associated installation devices are in perfect condition. The inspection includes an external check of the switchgear and controlgear assembly and an inspection of the interior fittings.

- Check that all the necessary covers have personal protection:
  - Insulation for fault protection
  - Basic protection and basic insulation
  - Protection against direct and indirect contact of live parts
- Check for mechanical, chemical, electrical and thermal loads
- Check for ageing phenomena

External inspection

Inspections	Inspection values, comments, remedial action
Inspect the environmental conditions	• Effectiveness of the ventilation system and heating, operating area • Room temperature, relative humidity, aggressive airborne particles, dust
Accessibility, minimum distances	Escape routes, minimum distance above roof panel
Visual inspection of covers and sheathing	Damage that could affect the degree of protection such as: • Missing parts • Wear and tear on doors, cabinet walls • Paint damage • Ventilation openings • Roof panel • Position of drawer technology (operating position, separation position)
Assembly of devices	• According to planning documents • According to project-planning rules
Checking of fitting of sheathing	• Fixing screws tightened • Substructure still stable

Internal inspection

Inspections	Inspection values, comments, remedial action
Visual inspection of individual operating equipment and devices	• Switchgear according to manufacturer's instructions/manuals • Internal conditions free of contamination, moisture • Changes in shape or colour which could have been caused by thermal or electromagnetic influences • Insulation values • Contact distances • Contacting
Cable and connections	• Power feed and outflows corresponding to planning documentation • Strain relief, bending radii • Insulation distances • Covers, partitions, protection against contact
Visual protection against terminal points	If necessary, replace connections
Check the terminal points in main electric circuits	• If necessary, replace connections • Check busbar insulation: Flashovers, contamination, discolouration, fine cracks, creepage distances
Visual inspection to check for damage to individual conductors	Condition of insulation
Visual inspection of busbars	• Discolouration, contamination, fine cracks • Connection coupling

11.5 Carrying out inspections by testing and measuring

Inspection by testing

Testing establishes that the dimensions decisive for operational safety exist. This includes for example:

- The effectiveness of switches, test buttons and locks.
- The functionality of signalling equipment.

Inspections	Inspection values, comments, remedial action
Functional check of switchgear	Protective devices according to manufacturer's instructions/manuals
Functional check of installed measurement devices (if present)	Measurement device instructions/manuals
Checking the settings of operating equipment and devices according to switching documentation	Instructions/manuals

Carrying out inspections by measuring

- Check the measurement device prior to each use.
- Measure the insulation resistance to check the condition of the insulation.
- Carry out the measurements and control checks. While doing so, observe the switchgear documentation.

11.6 Replacing electrical equipment

Replacing devices or upgrading switchgear

Before replacing electrical equipment with other types of devices or before upgrading the switchgear, new project planning and a new inspection of the switchgear and controlgear assembly must be carried out in accordance with DIN EN 61439.

If the switchgear builder modifies the switchgear and controlgear assembly by replacing the equipment with components that are not included in the design verification of the original manufacturer ABN GmbH, that switchgear builder will then become the original manufacturer for those modifications (DIN EN 61439-1, chapter 10.1). In this case, a new design verification must be produced. A parts verification is not adequate.

During upgrades or retrofits, observe the following points in particular:

- Any upgrades or retrofits must be planned.
- When upgrading or modifying a switchgear and controlgear assembly which already exists, it is necessary to prove that the safety of the existing switchgear and controlgear assembly will not be impaired.
- Modifications to the switchgear and controlgear assembly must be documented.

Chapter
12 Decommissioning and disposal

Overview

This chapter provides information about decommissioning and disposing of the switchgear and controlgear assembly.

Contents of this chapter

12.1 For your safety when decommissioning the switchgear

Electric shocks or arc flashes

⚠DANGER

LIFE-THREATENING DANGER DUE TO ELECTRIC SHOCKS OR ARC FLASHES.

⇨ Cordon off the switch cabinet's danger zone. Persons not involved in switching operations should leave the danger zone.

⇨ Make sure that decommissioning is carried out by experienced electrically skilled persons.

⇨ De-energise the system and prevent it from being switched back on.

⇨ Make sure that no voltages are present.

⇨ First earth, then short-circuit the components.

Faults in the switchgear can cause electric shocks or arc flashes. Life-threatening injuries or even death could result.

Additional safety measures

When working near live parts, take additional safety measures.
Suitable measures are, for example:

- Protection using covers or enclosures
- Protection by observing distances

12.2 Disposal and recycling

Dispose of components and operating equipment

Incorrect disposal of hazardous substances can have significant consequences for the environment. To protect the environment, observe the following points:

- Observe the local regulations concerning protection of the environment and protecting health.
- Observe the local regulations concerning recycling.
- Dispose of the equipment correctly and in an environmentally-friendly manner:
  - Electrical operating equipment and electrical components,
  - Metal, rubber and plastic parts,
  - Paint and coating materials.
- Observe the notes on disposal and recycling in the operating equipment's instructions.

Recycling NH fuses

Used NH fuses still contain recyclable material after being switched off.

Therefore, you can send used NH fuse links for recycling. For example, the NH/HH recycling system in Germany or similar systems in other countries are suitable for this purpose.

Even small quantities can be sent free-of-charge for recycling in an environmental-friendly manner. Find out where you can take the consumed NH fuses.

Chapter 13 Annex

Overview

This chapter provides checklists for the initial inspection prior to commissioning and for parts verification.

Contents of this chapter

13.1 Checklist – initial inspection prior to commissioning

Initial inspection

Steps	Inspection completed?
Check the measures taken to prevent electric shocks. The direct and indirect contact of live parts must be prevented by taking suitable protective measures.	
Check the basic protection and basic insulation.	
Check the additional insulation for fault protection.	
Check all necessary covers for personal protection.	
Check the protection against thermal influences.	
Check the selection of operating equipment such as conductors with regard to current carrying capacity and voltage drop.	
Check the switchgear and monitoring devices.	
Check the marking of the protective conductor and the neutral conductor, the marking of the electric circuit and protections.	
Check that the operating equipment is easily accessible for maintenance purposes.	
Check the installation for obvious insulation faults such as: • Trapped wires or damaged cables, • Faulty connection points, • Humidity, • Clearances and creepage distances.	

13.2 Checklist – Performing the parts verification

Carrying out the parts verification

	Performing the parts verification – checklist **Criterion**	**Excerpt from product standard DIN EN 61439-1/-2/-3**

1	**Degree of protection of housing (seals, covers)**
	• Check the measures required to achieve the degree of protection and cable inlets/locks, etc.
	• IP housing IP30, IP43, IP54, IP55
	• Inner fittings at least. IPXXB
	  • For SC I and unauthorised operation by unskilled persons
	• Inner fittings at least IP2XC
	  • For SC II and/or components intended to be operated by unskilled persons
	• Impact resistance for permanent indoor installation
	  • For components intended to be operated by unskilled persons IK05
		11.2

2	**Clearances and creepage distances** • Check clearances • Check creepage distances	11.3
3	**Protection from electric shocks and consistency of the protective circuit** • Check the measures taken to protect against hazardous body currents • Check the measures taken to protect against direct contact • Check the housing, covers, sheathing and their locks • Check the measures taken to protect against direct contact, check the protective conductor connections • Check that the protective insulation is completely enveloped on all conductive parts	11.4

4	**Integration of operating equipment**
	• Equipment markings
	• Equipment markings comply with wiring diagram
	  • Auxiliary contacts, fuse links, etc.
	• Equipment layout complies with assembly plan
	• Installation position of:
	  • Breaker actuators (direct drives, rotary drives, motors, etc.)
	  • Measurement devices (in door, behind the door, etc.)
	  • Control and signalling devices (in door, behind the door, etc.)
		11.5

5	**Internal electric circuit and connections** • Electrical connections/devices and busbar systems • Spot checks of cross-sections and torques	11.6

6	**Terminal connections for conductors introduced externally**
	• Outgoing terminals
	  • Cross-section, locking capacity, etc.
	• Material
	  • Copper, aluminium
	• Type of contacting
	  • Plug-in, screw-in, etc.
	• Conductor type
	  • Flexible, rigid
		11.7

	Performing the parts verification – checklist **Criterion**	**Excerpt from product standard DIN EN 61439-1/-2/-3**

7	**Mechanical function (actuators, locking)**
	• Ventilation grid, assembled, if applicable
	• Actuators
	• Interlocks, locks
	• Door couplings/switch actuators
	• Screw connections/device installation
	• Cabling/fastening/type of installation
	• Door requirements
	  • Door hinge left/right, door for narrow corridors, etc.
	• Closure system
	  • Double bit, swivel handle, etc.
	• Cabinet and/or enclosure type
	  • Wall, floor-standing, modular consumer units, etc.
	• Compliance with max. height/width/depth
	• Manufacturing documentation
	• Compliance with max. weight
	  • Site of installation, delivery specifications, documentation, etc.
	• Plinth dimensions
	  • e.g. 200 mm
	• Colour
	  • RAL
	• Cable inlet flanges
		11.7

8	**Insulation characteristics**
	
	Insulation check (voltage dividers)
	
	(Secure test sample using barriers, only the examiner is allowed to stay in the test area. Test duration not less than 1 second)
	• Phase conductor to enclosure/constructive parts
	• N to PE
	  • Only for 5-conductor system
	Testing of insulation resistance
	
	(Insulation measurement device with not less than 500 V; testing of the insulation resistance, >1000 Ω/V per circuit)
	• Phase conductor to enclosure/earth
	• Conductor to conductor
	• Auxiliary circuit to enclosure/earth
	• N to PE
	  • Only for 5-conductor system
		11.9

	Performing the parts verification – checklist **Criterion**	**Excerpt from product standard DIN EN 61439-1/-2/-3**

9	**Wiring, operational behaviour and function**
	• Cable colours and marking of main circuits
	• Cable colours and marking of main circuitsCable colours and marking of PE- and N-conductor
	• Wiring and equipment arrangement with regard to interference/observe EMC rules (check for shielded cables, well-ordered cable routing, etc.)
	• Wiring complies with wiring diagram
	• Individual switching devices
	  • Where possible, e.g. circuit breaker/RCD
	• Settings
	  • E.g. motor protection switch, circuit breaker, etc.
	• Designation label
	  • Name of the manufacturer or trademark
	  • Type designation or identifier
	  • Date of manufacture
	  • Applied standard DIN EN 61439-2/DIN EN 61439-3
	  • Rated voltage (U_n)
	  • Rated current (I_{nA})
	  • Rated frequency (f_n)
	  • Degree of protection
	  • Protection class
	  • CE marking
	Recorded in the documentation:
	• Rated operational voltage (U_e) of the outgoing circuits
	• Rated impulse withstand voltage (U_{imp})
	• Rated insulation voltage (U_i)
	• Rated current (InC) of the outgoing circuits
	• Rated diversity factor (RDF)
	• Rated peak withstand current (I_{pk})
	• Rated short-time withstand current (I_{cw})
	• Conditional rated short-time withstand current (I_{cc})
	Included in the documentation:
	• Wiring diagram (all poles)
	• Assembly plan
	• Temperature rise verification (inspection or calculation)
	• Verification of the short-circuit withstand strength (at I_{cw} ≥10 kA; ID ≥ 17 kA)
	• Assembly, operating instructions, system manual
	• CE Declaration of Conformity
		11:10

14 Glossary

Degree of contamination

The degree of contamination in accordance with DIN EN 61439 relates to the environmental conditions intended for the switchgear and controlgear assembly. The four degrees of contamination defined are used to assess the clearances and creepage distances in the microenvironment.

- Degree of contamination 3 is defined as a conductive contamination or a dry, non-conductive contamination which can become slightly conductive as a result of moisture condensation.
- Degree of contamination 2 is defined as only non-conductive substances; however, temporary conduction may be caused by accidental condensation.

Degree of protection

For each switchgear and controlgear assembly, the degree of protection is specified with the IP code in accordance with DIN EN 60529 and verified in accordance with DIN EN 61439

- regarding protection against contact with live parts and against the penetration of solid foreign bodies,
- regarding water ingress.

The degree of protection is important for protection against electric shock. The degree of protection applies to sheathing, covers and housing. The degree of protection is specified with two key figures for the IP safety classification with an additional optional letter.

- The first key figure (0-6) indicates protection against the penetration of solid objects and protection from contact with dangerous parts.
- The second key figure (0-8) indicates the protection from water ingress.
- The additional letter (A-D) indicates protection from contact with live parts.

DIN EN 61439/IEC 61439/EN 61439/VDE 0660-600

Standard DIN EN 61439 replaces the DIN EN 60439 series of standards. The objective of the DIN EN 61439 series of standards is to harmonise the rules and requirements for low voltage switchgear and controlgear assemblies.

In the DIN EN 61439 series of standards, the applicable part of the standard always applies such as DIN EN 61439-3 installation distribution boards intended to be operated by unskilled persons (PSC) together with part 1 of the standard (DIN EN 61439-1).

Parts 1-7 of the European standard (EN), the German standard (DIN EN) and the VDE regulations (VDE) correspond to the subdivision of the international standard (IEC). One exception is part 0 (IEC 61439-0) which has been added to the European standard, the German standard and the VDE regulations, part 1 as supplement 1.

German standard	International standard	European standard	Classification VDE regulations
DIN EN 61439 (VDE 0660-600) (all parts)	IEC 61439 (all parts)	EN 61439 (all parts)	VDE 0660-600 (all parts)
DIN EN 61439-1 supplement 1	IEC 61439-0	EN 61439-1 supplement 1	VDE 0660-600-1 supplement 1
DIN EN 61439-1	IEC 61439-1	EN 61439-1	VDE 0660-600-1
DIN EN 61439-2	IEC 61439-2	EN 61439-2	VDE 0660-600-2
DIN EN 61439-3	IEC 61439-3	EN 61439-3	VDE 0660-600-3
…	…	…	…

Table: Context of European standard and international standard

Electromagnetic compatibility

Electromagnetic compatibility (EMC) means the ability of equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment.

EMC environment A

Refers to non-public or industrial low voltage networks, areas or installations including strong sources of interference.

EMC environment B

Refers to public low voltage networks such as those used in housing, trade and light industrial areas. Strong sources of influences such as arc welding equipment, are not included in this environment.

IEC 61439/parts of the standard

Parts of the standard IEC 61439	Contents
IEC 61439-0	Guidance to specifying switchgear and controlgear assemblies
IEC 61439-1	Low voltage switchgear and controlgear assemblies – Part 1: General specifications
IEC 61439-2	Low voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies (PSC)
IEC 61439-3	Low voltage switchgear and controlgear assemblies – Part 3: Installation distribution boards intended to be operated by unskilled persons (DBO)
IEC 61439-4	Low voltage switchgear and controlgear assemblies – Part 4: Special requirements for building site main cabinets
IEC 61439-5	Low voltage switchgear and controlgear assemblies – Part 5: Switchgear and controlgear assemblies in public electricity network distribution assemblies (PENDA)
IEC 61439-6	Low voltage switchgear and controlgear assemblies – Part 6: Busbar trunking systems (busways)
IEC 61439-7	Low voltage switchgear and controlgear assemblies – Part 7: Switchgear and controlgear assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations

Table: Contents of the IEC 61439 series of standards

Important formula symbols first referred to in DIN EN 61439-1/-2/-3*

Abbreviation	Descriptions	Standard section DIN EN 61439-1/-2/-3* (first referred to)
CTI	Comparative tracking index	DIN EN 61439-1, 3.6.16
ELV	Extra-low voltage	DIN EN 61439-1, 3.7.11
EMC	Electromagnetic compatibility	DIN EN 61439-1, 3.8.13
f_n	Rated frequency	DIN EN 61439-1, 3.8.12
I_c	Short-circuit current	DIN EN 61439-1, 3.8.6
I_{cc}	Conditional short-circuit current	DIN EN 61439-1, 3.8.10.4
I_{cp}	Uninfluenced short-circuit current	DIN EN 61439-1, 3.8.7
I_{cw}	Rated short-time withstand current	DIN EN 61439-1, 3.8.9.3
I_n	Rated current	DIN EN 61439-1, 3.8.10.1
I_{nA}	Rated current of a switchgear and controlgear assembly	DIN EN 61439-1, 5.3.1
I_{nc}	Rated current of a circuit	DIN EN 61439-1, 5.3.2
I_{pk}	Rated peak withstand current	DIN EN 61439-1, 3.8.10.2
N	Neutral conductor	DIN EN 61439-1, 3.7.5
PE	Protective conductor	DIN EN 61439-1, 3.7.4

Abbreviation	Descriptions	Standard section DIN EN 61439-1/-2/-3* (first referred to)
PEN	PEN conductor	DIN EN 61439-1, 3.7.6
RDF	Rated diversity factor	DIN EN 61439-1, 3.8.11 / 5.4
SCPD	Short-circuit protective device	DIN EN 61439-1, 3.1.11
SPD	Surge protective device	DIN EN 61439-1, 3.6.12
U_e	Rated operational voltage	DIN EN 61439-1, 3.8.9.2
U_i	Rated insulation voltage	DIN EN 61439-1, 3.8.9.3
U_{imp}	Rated impulse withstand voltage Rated impulse withstand voltage	DIN EN 61439-1, 3.8.9.4 / 5.2.4
U_n	Rated voltage	DIN EN 61439-1, 3.8.9.1
PSC ASSEMBLY	Power switchgear and controlgear assembly/PSC switchgear and controlgear assembly	DIN EN 61439-2, 3.1.101
DBO	Installation distribution board intended for operation by unskilled persons	DIN EN 61439-3, 3.1.101

Installation distribution boards intended to be operated by unskilled persons (DBO) in accordance with DIN EN 61439-3

In accordance with DIN EN 61439-3, a DBO is an installation distribution board intended to be operated by unskilled persons. This is a switchgear and controlgear assembly for distributing electrical energy in household applications and other places in which operation by unskilled persons is intended.

- The manufacture and inspection are carried out on installation distribution boards intended to be operated by unskilled persons (DBO) in accordance with DIN EN 61439 part 1 and part 3. Part 3 of standard DIN EN 61439 defines the specific requirements for installation distribution boards intended to be operated by unskilled persons (DBO).
- A switchgear and controlgear assembly permitting operation by unskilled persons must include a designation label specifying the relevant part of DIN EN 61439-3 (VDE 0660-600-3) as the applicable standard.

Important criteria of an installation distribution board intended for operation by unskilled persons (DBO) include:

	Important criteria of an installation distribution board (DBO) in accordance with DIN EN 61439-3 (non-exhaustive)
1	Intended for operation by unskilled persons • Including switch operations • Including replacing fuse links The outgoing circuits must contain short-circuit protection devices intended to be operated by unskilled persons. Further information in DIN EN 61439-3, (chapter 8.5.3).
2	• Household and similar applications in functional buildings. • The switchgear and controlgear assembly is intended for the distribution of electrical energy. However, the switchgear and controlgear assembly may also contain control devices/signalling devices. • The switchgear and controlgear assembly is closed and stationary. • The switchgear and controlgear assembly can be intended for indoor or outdoor installation (in the case of the Prisma XS inner fitting system with system housings: indoor installation only).
3	Rated voltage to earth: maximum 300 V direct voltage.
4	Rated current (I_{nc}) of the outgoing circuits: maximal 125 A

	Important criteria of an installation distribution board (DBO) in accordance with DIN EN 61439-3 (non-exhaustive)
5	Rated current of the switchgear and controlgear assembly (I_{nA}): maximal 250 A DIN EN 61439-3 does not contain any specifications regarding the size of the operating equipment in the power feed if the rated current of the switchgear and controlgear assembly (I_{nA}) is limited to maximum 250 A. Therefore, the maximum permissible rated current (I_{nA}) up to 250 A can also be conducted via circuit breakers with 400 A in accordance with DIN EN 60947-2 as long as the following conditions are met: • The rated current of the switchgear and controlgear assembly (I_{nA}) is limited to maximum 250 A. • The disconnection switch is effectively prevented from being switched back on by unskilled persons (use of a key or tool is required or alternatively a plate is required with the information that the equipment may only be switched back on by an electrically skilled or an electrically trained person). • The visibility of the setting or calibration of the disconnection switch is ensured. • It is ensured that the settings or calibration of the disconnection switch can only be modified consciously using a tool or key. Access for replacing the fuse links in the power feed of a DBO may only be possible by key or a tool if the short-circuit protection device contains fuse links in the power feed which do not comply with standard DIN EN 60269-3. Standard DIN EN 60269-3 (VDE 0636-3) defines additional requirements for fuses intended to be used by unskilled persons.
6	Degree of protection for indoor installation: at least IP2XC
7	The IK code characterising the degree of protection against mechanical impacts in accordance with DIN EN 62262 for indoor installation: at least IK05
8	Degree of contamination: at least degree of contamination 2

Table: Important criteria of an installation distribution board (DBO) in accordance with DIN EN 61439-3

Personal protective equipment (PPE)

Personal protective equipment (PPE) includes any piece of equipment that is intended to be used or worn by people to protect themselves from risks to their health and safety. Personal protective equipment also includes any additional equipment connected to the personal protective equipment.

Power switchgear and controlgear assemblies (PSC) in accordance with DIN EN 61439-2

PSC switchgear and controlgear assemblies (power switchgear and controlgear assemblies). Distributed and controlled as low voltage switchgear and controlgear assembly in accordance with DIN EN 61439-2 electrical energy for all types of loads. Intended for industrial, commercial and similar applications, where operation by unskilled persons is not permitted. The rated voltage of power switchgear and controlgear assembly in accordance with DIN EN 61439-2, must not exceed 1,000 V with alternating voltage or 1500 V with direct voltage.

Installation in an area which unskilled persons are allowed to access is only permitted if operation by unskilled persons is effectively prevented.

The manufacture and inspection are carried out on power switchgear and controlgear assemblies (PSC) in accordance with DIN EN 61439 part 1 and part 2. Part 2 of standard DIN EN 61439 defines the specific requirements for power switchgear and controlgear assemblies.

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Life Is On

by Schneider Electric

Schneider Electric GmbH

Gothaer Straße 29
40880 Ratingen, Germany
Tel.: +49 2102 404 6000
Fax: +49 180 575 4575*
www.se.com
* €0.14/min. according to network operator rates
Mobile service max. €0.42/min.

ABN GmbH

Daimlerstraße 10-12
74196 Neuenstadt am Kocher, Germany
Tel.: +49 (0) 7139 / 94-0
Fax: +49 (0) 7139 / 94-49
DE-ABN-Zentrale@se.com
www.abn-elektro.de