Set Series

Okken *evo*

Master

Catalogue 2019

Low voltage switchboard

schneider-electric.com

Life Is On Schneider Electric

General Contents

Okken*evo*

Introduction

Other chapters

Intelligence and flexibility to solve your toughest challenges

Okken: intelligent switchboard solutions

With safety and reliability within reach, why settle for less?

Embodying decades of expertise, Okken™ solutions are complete and customized low-voltage (LV) power distribution, motor control, and integrated power control centres. Okken switchboards contribute to answer the need for operational safety in today's high-performance LV power applications. Versatile and durable, Okken switchboards have the comprehensive capabilities and intelligence you need to keep your business competitive.

Industry-leading features, design, and support make implementation and operation quick, easy, and reliable, so you can lower costs and realize a faster return on investment.

Okken solutions combine high level of safety and reliability with an optimized footprint, modular architecture, and smart devices.

A global player with local capabilities

Schneider Electric is present in more than 100 countries, delivering reliable products and solutions around the world. Our global reach helps us ensure high quality and local project and service capabilities, no matter your location.

Smart grid ready

Our broad expertise in electrical network management makes us a partner who knows what the smart grid means for your business, and how best to keep you at the forefront of technology.

15%

Okken solutions can provide up to 15% energy savings.*

150k

More than 200,000 cubicles installed. Customers worldwide trust Okken LV switchboard solutions.

*Based on previous data, 2015. This is not a guarantee of future performance or performance in your particular circumstances.

Electrical safety for personnel

Tested and certified by independent ASEFA and LOVAG labs.

Note: In working environment, full operator safety measures should always be adopted.

With Okken, protection is never left to chance

With high modularity and total insulation, safety is engineered into every Okken switchboard, from conception, through design, installation, and everyday operation.

Smart engineering and user-friendly operation

Full type tests as per IEC 61439-1&2 confirm high level of electrical installation and operational safety. Insulation and provided screening of all live parts enhance service life and provide outstanding protection.

- Forms of internal separation up to 4b
- Embedded interlock systems to secure on-load disconnection
- Live-part protection up to IPxxD
- Fully insulated busbars
- Padlockable with three different locks
- Protection with optional doors and accessories
- Closed door racking drawers for extra operator protection in all drawer positions, particularly in case of internal short-circuit or arc event, and even during connecting and disconnecting

Internal arc withstand and short-circuit protection

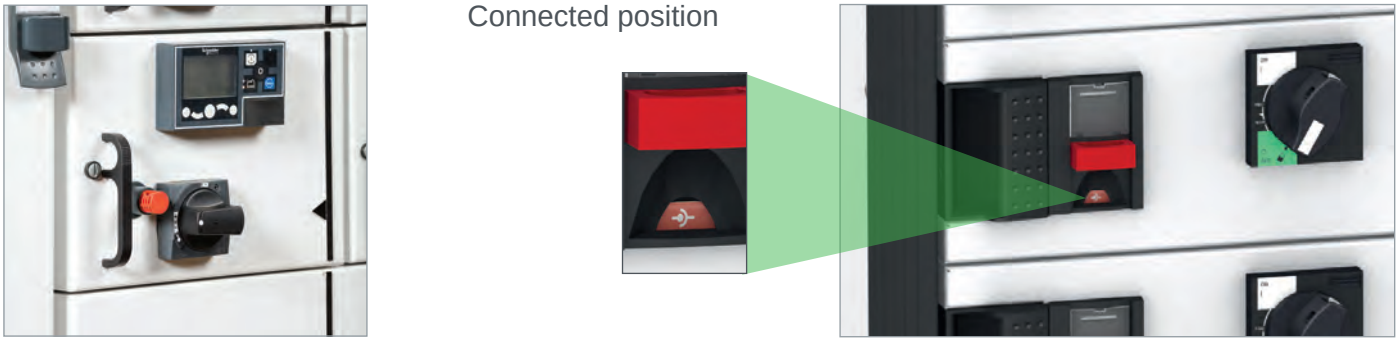
- Fully type tested in compliance with IEC TR 61641 edition 3
- Internal arc withstand up to 100 kA/0.5 s
- Arc-free zone with encapsulated active parts in the whole switchboard: incomer, horizontal busbar, withdrawable cubicle
- Active optical arc-flash detection with VAMP system
- Operator protection at three levels:
  - Horizontal and vertical busbars
  - Functional units on all three positions of withdrawable drawers
  - Outgoing cable connections
- Internal arc risk reduction thanks to our unique Polyfast™ system
- Partitioned terminals for electrical insulation between the upstream circuit breaker and the double contact clamps on the main busbar
- Rated conditional short-circuit current (Isc) up to 150 kA

Three interlocked drawer positions and drawer stop

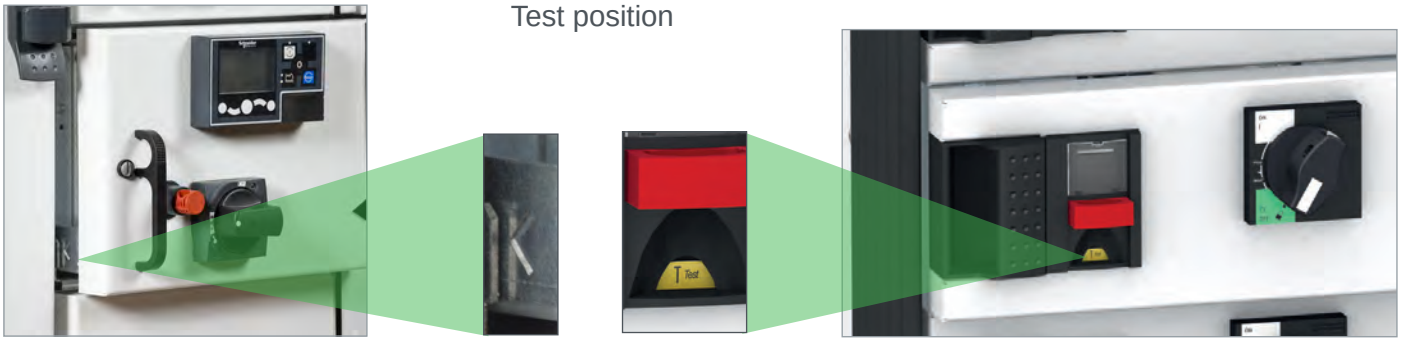
70-M drawer

70-2 drawer

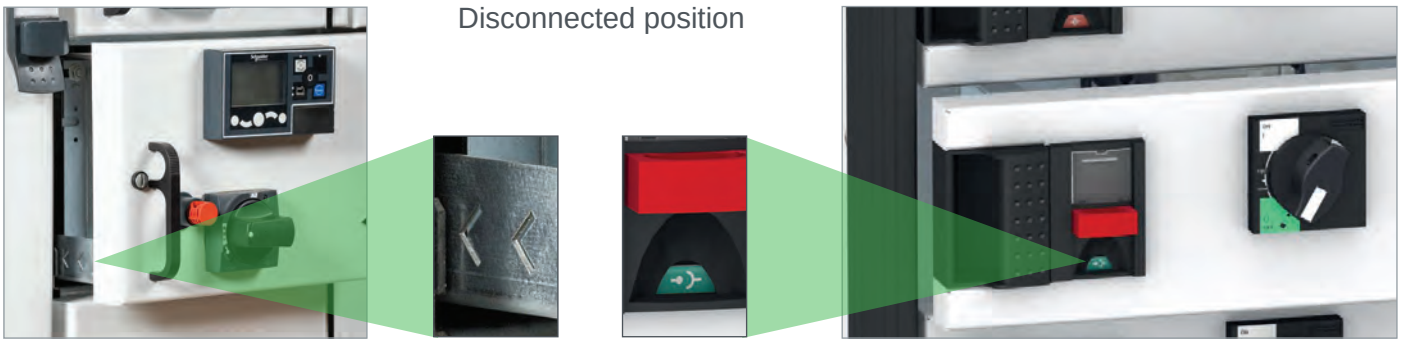
Connected position



Test position



Disconnected position



Reliability and continuity of service

Customized solutions for any application and severe environment.

An ‘install-and-forget’ level of dependability

The Okken design is based on a robust and type-tested architecture, standardized modules, and Schneider Electric devices. This allows functionality, continuity of supply, and installation reliability, even in very difficult environments.

- All components and devices are designed by Schneider Electric and manufactured to rigorous quality standards
- Tested and validated compatibility between switchboards, functional units, and built-in devices
- Outstanding electrical and mechanical consistency and electromagnetic compatibility (EMC) of all Schneider Electric™ components

Resistance to corrosive environments

- Tin or nickel busbar coating on copper conductive parts for H_2S and SO_2 atmosphere withstand
- Anticorrosion surface treatments on metallic sheets
- Okken switchboards provide a variety of protection levels (up to IP54)

Thermal monitoring

- Permanent temperature monitoring with sensors on critical parts
- Predictive maintenance to increase the reliability of your switchboard

Tough enough for Oil & Gas applications

- Okken switchboards are DEP Shell approved for demanding needs of Oil & Gas facilities
- Total™, Chevron™, British Petroleum™, Air Liquide™, and others place their trust in Okken intelligent switchboard solutions

Optimized for marine installations

- Okken switchboards satisfy the requirements of marine, offshore, and floating production storage and offloading applications
- They are DNV (Det Norske Veritas) and RINA (Registro Italiano Navale Group) certified for high vibration and saline environments

Durability for seismic areas

- Okken 2.7G and 5G provide mechanical resistance and robust installation in seismic zones in compliance with the most demanding local and international standards: IBC 2006/AC 156, IEC68-3-3, AS1170, EAK-2000, ENDESA-1986, GOST 17516.1-90, IEEE 693-1997, EDF CRT 91 C 112 00 (on Okken 5G)
- 5G versions are specifically engineered for high-demanding nuclear and industrial applications

Oil & Gas

Offshore Platforms

Mining, Metals, Minerals

Marine

Nuclear

Water and Wastewater Treatment

Healthcare

Data Centres

Note: In working environment, full operator safety measures should always be adopted.

High performance and superior efficiency

Compact, modular design — the right fit for your organization

Industry-leading capabilities

- Maximum busbar rating up to 7300 A
- Maximum rating of Power Control Centre (PCC), up to 6300 A
- Maximum rating of Motor Control Centre (MCC), up to 250 kW
- Smart communicating devices for connected switchboards
- Compact design for higher stacking density and optimized footprint
- Upgradeable energized equipment

+

- Electrical distribution up to 7300 A
- Incomer and feeder up to 6300 A
- Motor control up to 250 kW

A disconnectable design for power distribution

The Polyfast system reinforces the electrical isolation of power distribution switchboard.

Power distribution

PCC including protection and power factor correction:

- Main busbar up to 7300 A
- Incomers up to 6300 A (Masterpact™ circuit breakers)
- Feeders up to 6300 A (Masterpact circuit breakers), and up to 630 A (Compact™ circuit breakers)
- Power factor correction up to 540 kVAR

A flexible, withdrawable design for motor control and power distribution

Compact and powerful Okken switchboards answer the needs of the most demanding motor control and power distribution applications. Combining continuity of supply and performant operational services.

Motor control

MCC including protection, starters, and drives:

- Conventional starters up to 250 kW
- Soft starters up to 315 kW
- Drives up to 400 kW

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Improved versatility and flexibility

24/7 visibility of energy use and power quality

A compact and modular design for every function

Okken is a simple and modular solution that is easy to choose, intuitive to use, cost effective, and simple to install or upgrade.

Fast, easy installation, upgrading, and maintenance

Single front or double front access thanks to back-to-back configuration, top or bottom direct power connections, rear or side power connections for easy installation. Plus, standardized dimensions and an optimized footprint save time and money during installation.

- Fixed, disconnectable, or withdrawable functional units
- Withdrawable drawer size optimization: full and half-widths, different heights from 100 to 600 mm
- Direct power plug connection to the vertical busbar (50 mm pitch)
- Drawer position indicators on front faces and drawer stop
- Withdrawable Masterpact and plug-in
- Compact circuit breaker modules
- Current transformers inside

Upgrade Okken while under load

Easily modify and upgrade your Okken solution and add new functions as your needs change: scalability while under load, equipping of additional slots in reserved spaces, association of cubicles, fast interchangeability without special tools.

- Degree of protection up to IPxxD on busbar with automatic shutters, and on connections on busbar by plug-in clamps
- Customer connection separate from the functional unit (form up to 4b)

Smart devices to improve productivity and energy efficiency

All our stand-alone devices and fully integrated solutions for energy monitoring, motor control, and power factor correction provide advanced technology and outstanding capabilities.

Power circuit protection and control
Masterpact MTZ-NW-NT, Compact NS-NSX-NSXm

Motor motion control
Altivar™ ATV630, ATV930, ATV31, Altistart™ ATS48

Energy server
Com'X 200

Coupler control
Sepam™

Motor protection monitoring, and control
TeSys™ T, TeSys U, TeSys D, TeSys GV

Process automation
Quantum, Premium, M340 and M580

Energy and power quality metering
PowerLogic™ PM 800, PM 5000

Double front access

Plug-in distribution feeders on Polyfast system

Comprehensive range of full and half-width drawers

Direct connection to the arc-free vertical busbars

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iPMCC by Okken: built-in intelligence

Our digital solution for power distribution, motor control, and power factor correction.

The intelligent Power and Motor Control Centre (iPMCC) by Okken is a highly capable and advanced smart solution for application fault prevention, protection, and automatic restart in continuous and critical processes. It helps you boost productivity and optimize the energy management and efficiency of your assets while enhancing continuity of service, and reducing downtime.

Energy savings up to 15%*

- Integration of all your equipment to lower electrical energy consumption
- Synchronizing motors to loads with progressive starters and variable speed drives and reducing peak consumption by 50% or more*
- Managing reactive power compensation (capacitors) and thermal withstand control to reduce costs and increase energy availability

Optimized motor performance

- Motor monitoring and protection in accordance with IEC/EN 60947-7-1
- Motor and protection device configuration accessible at all times
- Associated with TeSys T, iPMCC by Okken enables the detection of electrical loads faults like no-load running, shaft bearing seizure, abnormal starting or heating, pump cavitations, and pulsating torque

Enhanced control and monitoring

- Better traceability and control
- Local or remote real-time information access
- Motor operating status and time monitoring (alarms and tripping)
- Parameter monitoring and management of status, measurements, diagnostics, trends, and energy consumption

Smart-grid integration

- Pretested communication architectures offering leading industry protocols engineered to optimize asset energy efficiency (Ethernet TCP/IP, Ethernet/IP, Profibus®-DP, DeviceNet™, Modbus, CANopen®, etc.)
- Seamless integration with energy management and control systems and process automation management systems
- Complete range of design assistance tools

A complete range to match your toughest needs

For power distribution and motor control including variable speed drives, motor starters, power factor correction, and harmonic filtering

Enhanced efficiency and productivity

15%

Up to 15% increase in productivity.*

70%

Up to 70% reduction in untimely shutdowns.*

90%

Up to 90% fewer motor burn-outs.*

50%

Up to 50% reduction in maintenance costs.*

PCC[1]

230
Very high-power incomers and feeders up to 6300 A

115
High-power incomers and feeders up to 4000 A

Single Masterpact MTZ-NW
Single incomer or feeder (width 650 mm)

Single Masterpact MTZ-NT-NS
Single incomer or feeder (width 450 mm)

70-F
Fixed feeders

185
Fixed feeders

PCC/MCC

115/70-2
Mixed incomers and feeders

MCC and PCC

70-M
Withdrawable feeders

70-2
Polyfast plug-in feeders
Disconnectable mounting plate

MCC[2]

VSD[3]
Variable speed drives and soft starters

PFC[4]

PFC[4]
Capacitors

[1] PCC = Power Control Centre
[2] MCC = Motor Control Centre
[3] VSD = Variable Speed Drive
[4] PFC = Power Factor Correction and harmonic filtering

* Based on previous data, 2015. This is not a guarantee of future performance or performance in your particular circumstances.

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Okken intelligent switchboard specifications

General data	
Applications	Power distribution, motor control
MCC (Motor Control Centre)	up to 250 kW
VSD (Variable Speed Drive)	up to 400 kW
PCC (Power Control Centre)	incomer & feeder up to 6300 A
PFC (Power Factor Correction)	up to 6* 90 kVAR
Standards	IEC 61439-1 & 2, IEC TR 61641, IEC 60529
Certifications	EAC (Gost), CCC, AS
Electrical data	
Voltage	up to 690 Vac (50/60 Hz)
Main busbar rating	up to 7300 A
Distribution busbar rating	up to 2100 A
Rated short-time current (Icw)	
horizontal main busbar	up to 150 kA rms - 1s (peak current Ipk up to 330 kA)
vertical distribution busbar	up to 100 kA rms - 1s (peak current Ipk up to 220 kA)
Conditional short-circuit current (Isc)	up to 150 kA
Internal arc withstand current	100 kA – 0.5 s (IEC TR 61641 edition 3)
Earthing system	TT-IT-TNS-TNC
Communication	
Protocols	Ethernet TCP/IP, Ethernet/IP, Profibus-DP, DeviceNet, Modbus, CANopen, etc.
Mechanical data	
Form	2b/3b/4a/4b
Withdrawability	FFF/WFD/WFW/WWW
Seismic withstand	IBC 2006/AC 156 (site class B-C-D, floor level only), IEC68-3-3 (equivalent to Richter scale up to level 9), AS1170, EAK-2000, ENDESA-1986, GOST 17516.1-90 (civil market, all seismic intensity, up to installation level 2), IEEE 693-1997, EDF CRT 91 C 112 00 (Okken 5G only for nuclear applications)
Installation	indoor environment type 2
Degree of protection	IP20, IP31, IP41, IP54
Operating temperature	- 5 °C to 35 °C/50 °C

Dedicated support for complete peace of mind

Around the world, the acknowledged leadership of Schneider Electric in energy management and power protection means you can count on us to deliver the products, services, and support you need to be most efficient.

Our highly skilled service and support professionals are there to provide business-aligned results for a measurable return on your investment.

Tools and support services

- Validated tools and architectures
- Regional and local services for the installed base, plus assistance and troubleshooting
- Customized vocational training on-site or in one of our training centres

Auditing, consulting, and solution engineering

- Customized projects, including critical applications
- Engineering expertise for new and existing sites
- Installation and energy audits
- Enterprisewide energy efficiency solutions

The Okken panelbuilder network offers optimum localized service

- Okken can be supplied by the Schneider Electric equipment units or by licensed partner panelbuilders present around the world
- These partners, selected for their expertise, are trained and regularly audited by Schneider Electric to provide top-quality equipment and support

Green Premium™ equipment

- Ecologically designed and manufactured without hazardous materials
- Compliant with RoHS and REACh standards
- Designed for reduced carbon footprint and energy consumption
- Designed for optimal recycling and end-of-life management

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Whatever your process...

Oil & gas, petrochemicals, mining, metals, minerals, water and wastewater treatment, food & beverage, pharmaceuticals, microelectronics, airports...

Our iPMCC solutions adapt to the specific requirements of your continuous and critical process.

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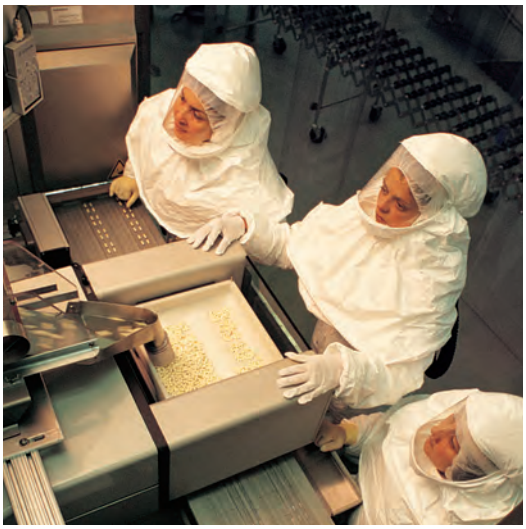
iPMCC_03.eps

iPMCC_04.eps



iPMCC_05.eps

iPMCC_06.eps

Up to 70%

The share of total electrical energy consumed by motors within the infrastructure and industrial sectors.

Source: Motor Decisions Matter SM in USA - www.motorsmatter.org

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Improve the dependability of your production tool

> In today's highly competitive markets, you need to maximise production time by ensuring the reliability of your installation through increased dependability: continuity of service, safety of personnel and assets, maintainability and upgradability.

> Designed to provide LV electrical distribution optimising the performance of your motors and loads, our iPMCC solutions will help you achieve your goal.

...manage lead times and reduce costs...

> You are faced with the challenge of keeping lead times and risks under control and reducing costs throughout the entire lifecycle of your installations.

> iPMCC solutions include effective and innovative tools to help you design and implement, scalable systems quickly and flexibly.

...particularly your electrical energy costs

> Electrical energy represents a major proportion of your production costs.
It is therefore essential to reduce your electrical energy consumption, not only in the face of rising energy prices but also to meet your commitments to sustainable development and environmental protection.

> With its iPMCC range of solutions, the global specialist in energy management can help you reduce your energy consumption and allocate your electricity consumption costs per motor application.

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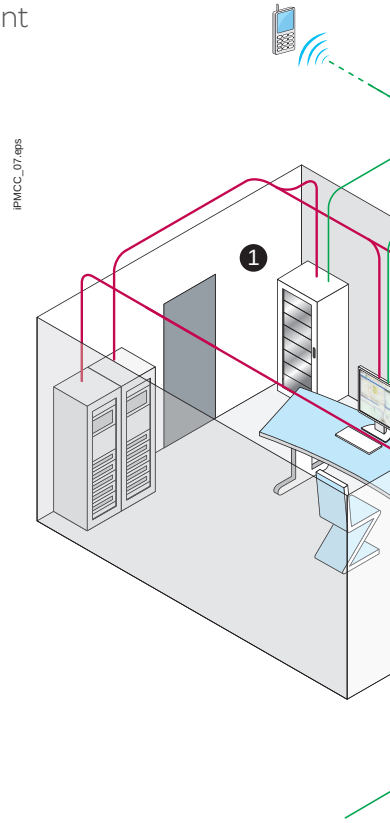
Intelligent solutions for fast and easy access to information from anywhere, around the clock

Our iPMCC solutions for continuous and critical processes were developed through our specific expertise in energy and industrial process control management. Forming the keystone of the energy efficiency of your process units, they incorporate a range of functions to supply power (intelligent Power Control Centre - iPCC), start up, control, protect and monitor your LV network electric motors and loads (intelligent Motor Control Centre - iMCC). The breadth of the range allows that all types of continuous and critical process as well as specific requirements are covered.



Our iPMCC solutions help your teams optimise the energy efficiency of your assets, offering the following benefits:

- Dependability, even in severe industrial environments,
- Improved safety of personnel and assets, maintainability and upgradability,
- Lead time management and risk as well as cost reduction throughout your installation's entire lifecycle.

1 Remote control and monitoring of your installation

A continuous, real-time communication interface with your control and monitoring systems for energy management and process control.

> iPMCC solutions communicate with the major industrial local area networks on the market (Ethernet TCP/IP, Ethernet IP, Profibus-DP, DeviceNet, Modbus, etc.).
> With data delivered in real time, your operational and maintenance staff will have immediate access to the relevant information to control your motors and electrical distribution locally or remotely.
> Warning messages can be sent automatically to a mobile phone in the event of an alarm or group of alarms.

2 Information for local operation, maintenance and upgrading of your installation

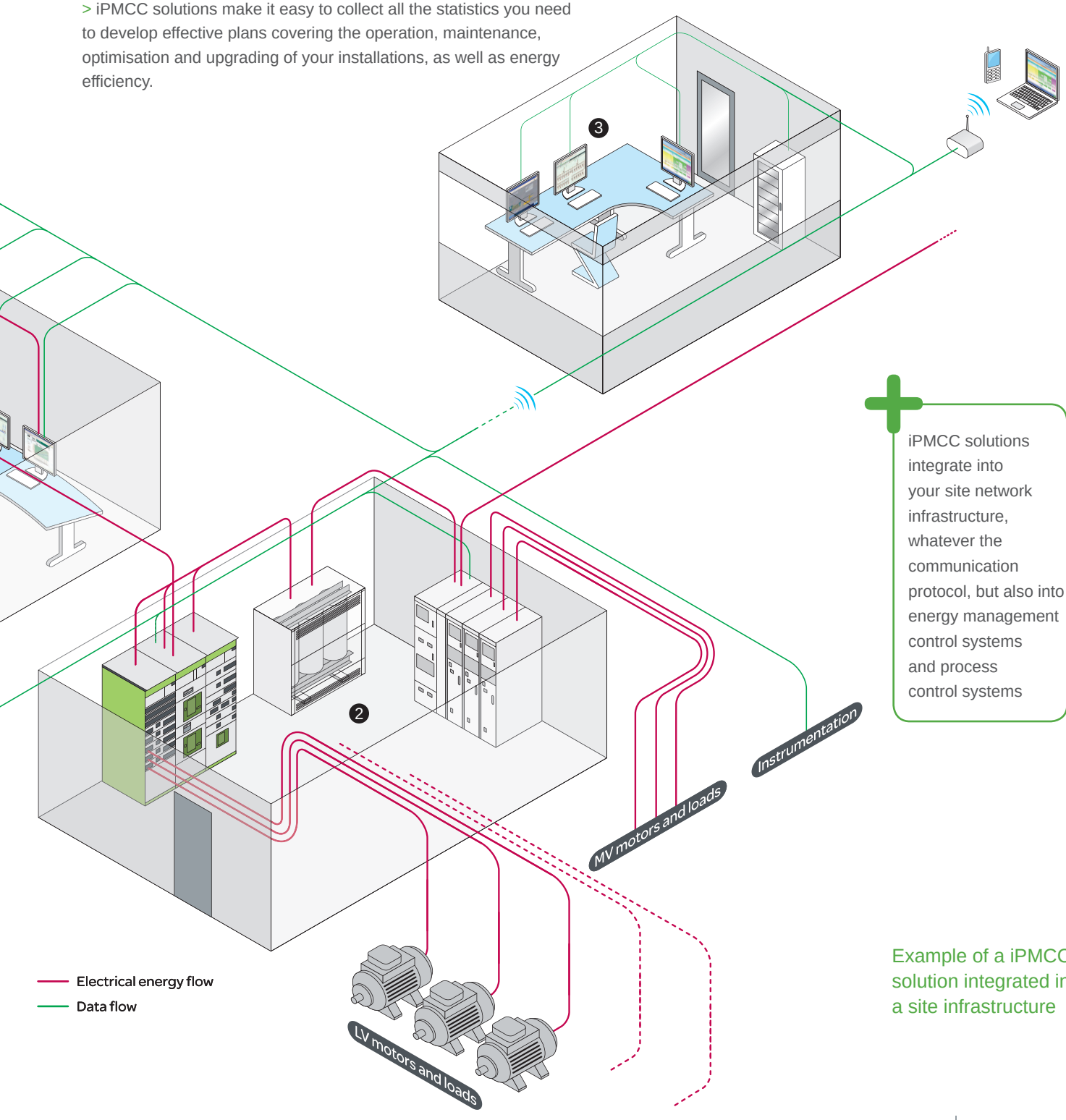
Information on electrical distribution, motor operation and power consumption can be accessed.

> iPMCC solutions can integrate a dedicated human-machine interface (HMI) or communicate via a personal computer directly on the motor starters.

❸ Information for site engineering

With information delivered to ensure the traceability of electrical distribution, motor operation and power consumption data, installations are constantly improved.

> iPMCC solutions make it easy to collect all the statistics you need to develop effective plans covering the operation, maintenance, optimisation and upgrading of your installations, as well as energy efficiency.



iPMCC solutions integrate into your site network infrastructure, whatever the communication protocol, but also into energy management control systems and process control systems

Example of a iPMCC solution integrated into a site infrastructure

Increase the dependability of your installation

Up to

70%

reduction in untimely shutdowns

You want to maximise production time by reducing your installation downtimes.
Designed to optimise the performance of your motors by monitoring electrical installation malfunctions and reducing shutdown time, iPMCC can significantly contribute to improve the safety and dependability of your installations throughout their lifecycle.

Provide dependable electrical energy in your process units

> Our iPMCC solutions are built around highly dependable functional switchboards for the LV electrical distribution. Their reliability is reinforced by the outstanding electrical and mechanical consistency and electromagnetic compatibility (EMC) of all the Schneider Electric components.

> Developed and tested in accordance with IEC 61439, they deliver a high level of reliability and dependability.

> In addition to a modular design with fully withdrawable (WWW-type) motor starters, the switchboards can be reconfigured without shutting down power.

> iPMCC solutions are resistant to the most severe environments, including seismic zones and offshore, and can be used in even the harshest operating conditions, such as pollution, humidity and dust.

Optimise the operational performance of your motors and loads

> One of the key functions of our iPMCC range is motor control and protection, offering an appropriate behaviour in the even of motors and loads failure in accordance with IEC/EN 60947-4-1.

> They include communicating electronic relays using the highest precision motor protection models available on the market.

> All the information required for controlling, optimising and monitoring your process can be accessed at any time, locally or remotely. You can:
- set parameters and activate protection devices
- configure and control the motor commands
- monitor the operating times and status of the motors (alarms and trips)
- exchange data (states, measurements, diagnostics, logs, counters).

> Our technology provides type 2 coordination for protection devices and total coordination up to 15 kW.

IEC 61439-1&2

Our solutions are built around tested, compliant LV switchboards

Improve maintainability

Up to

90%

fewer motor burn-outs

The safety of your personnel and assets is one of your top priorities.
iPMCC solutions actively help to secure and optimise the operation and maintenance of your electrical equipment.

iPMCC_10.eps

Operate, maintain, upgrade while energised

> Switchboards in the iPMCC range have a test position feature so that the drawers can be handled while the energised parts are protected by IP20 screens.

> Functions can be tested and simulated in real situations without risk to operators, motors or their environment thanks to a range of devices that prevent handling when under load:
- visible power disconnection
- mechanical indication of circuit breaker position
- continuity of service of other equipment supplied by auxiliary voltage
- pre-tripping system
- mechanical and electrical interlocking system
- electrical switching system.

> The ergonomic design of the switchboards simplifies operation. The operator interfaces on the front face display the measured values and data relating to load status. They provide local and remote access to the protection relay configuration functions.
An integrated communication bus can be used to connect to a personal computer.

> During operation, maintenance and upgrading, your teams can work on the system without having to cut the power:
- programming and configuring protection relays, locally or remotely
- modifying the configuration of the switchboard (adding, modifying or removing motor starters).

Reinforce your installation

> Our iPMCC solutions incorporate systems in accordance with IEC 61439:
- prevention of internal arcing and confinement at three levels
- high short-circuit current withstand.

> Our solutions also offer different levels of protection (IP31/IP41/IP54) to match your installation's specific environmental characteristics.

iPMCC_11.eps

Test position

Reduce your costs, particularly the electrical energy bill

Up to

50%

reduction in maintenance costs

To maintain a competitive edge, you need to reduce commissioning times and cut operating and maintenance costs.
iPMCC solutions help you optimise your overall cost of ownership and save energy.

Reduce lead times and costs throughout the entire lifecycle

> iPMCC solutions can help you save time at different stages of the process:
- Engineering with pre-designed solutions and a whole range of design assistance tools
- Wiring with fieldbuses
- Installation with downloadable parameters
- Commissioning with diagnostic functions and statistics to identify faults and errors

> iPMCC solutions also help you to reduce costs related to:
- Civil engineering due to its compact design and its density in motor starters, iPMCC solutions can optimise square footage, while free unassigned slots ensure that they can be upgraded very easily.
- Operation with remote monitoring and control capabilities, pre-tripping alarms and prevention of machine shutdowns.
- Maintenance thanks to a modular design for a proven reliability, as well as the motor protection and control functions which reduce the number of shutdowns required to resolve problems. iPMCC solutions cover also a wide power range with just a handful of product references to manage, thus reducing the number of spare parts you need to keep in stock.
By the end, detailed statistics on motor operation provide the basis for a targeted preventive maintenance strategy.
- Upgrades with free unassigned slots which can be incorporated into each switchboard by design. This allows you to build on your investment and upgrade your solution to meet any new requirements, even at the last minute.
The motor starters are preassembled for easier installation.

Reduce electrical energy consumption and allocate costs per motor application

> iPMCC solutions will have an immediate and measurable impact on your electrical energy consumption. They include variable speed drives and soft starters that adapt to the motor production and load requirements to reduce load peaks by 50% or more.

> Variable speed drives and soft starters can be combined with capacitors to manage reactive power factor correction and thermal withstand to:
- eliminate reactive power-related costs
- reduce subscribed demand while increasing energy availability
- improve power quality and increase the service life of devices connected to the supply network.

> Other devices also help to optimise energy usage and consumption.
The motor protection relays with functions for controlling, managing and monitoring parameters (voltage, current, power and energy) allows you to optimise the motor's consumption and help you pinpoint any deviations. These measurements, particularly those relating to the useful energy consumed (cos φ), help to define and track the load profile of the motors and their energy consumption, thus improving the performance of your energy efficiency plan.

> Using all the available data on the motor application's energy consumption, you can allocate the cost of electrical energy to each of the individual motor starters, to the entire switchboard and, consequently, to the process unit.
iPMCC solutions allow you to convert the energy costs related to production from based costs to variable costs.

24/7
visibility over your energy use and quality

Solutions that integrate into your installation, simply

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Our iPMCC solutions integrate into your site network infrastructure, whatever the communication protocol, but also into all energy management control systems and process control systems.

> Given the complexity of data flows and communication network infrastructures, from instrumentation to corporate management systems, simple to integrate and scalable solutions are the natural choice.

> Based on architectures that have been pre-tested and pre-validated for an integration in the leading communication protocols used in process industry and infrastructures, our solutions help you rapidly and efficiently optimise the energy efficiency of your assets.

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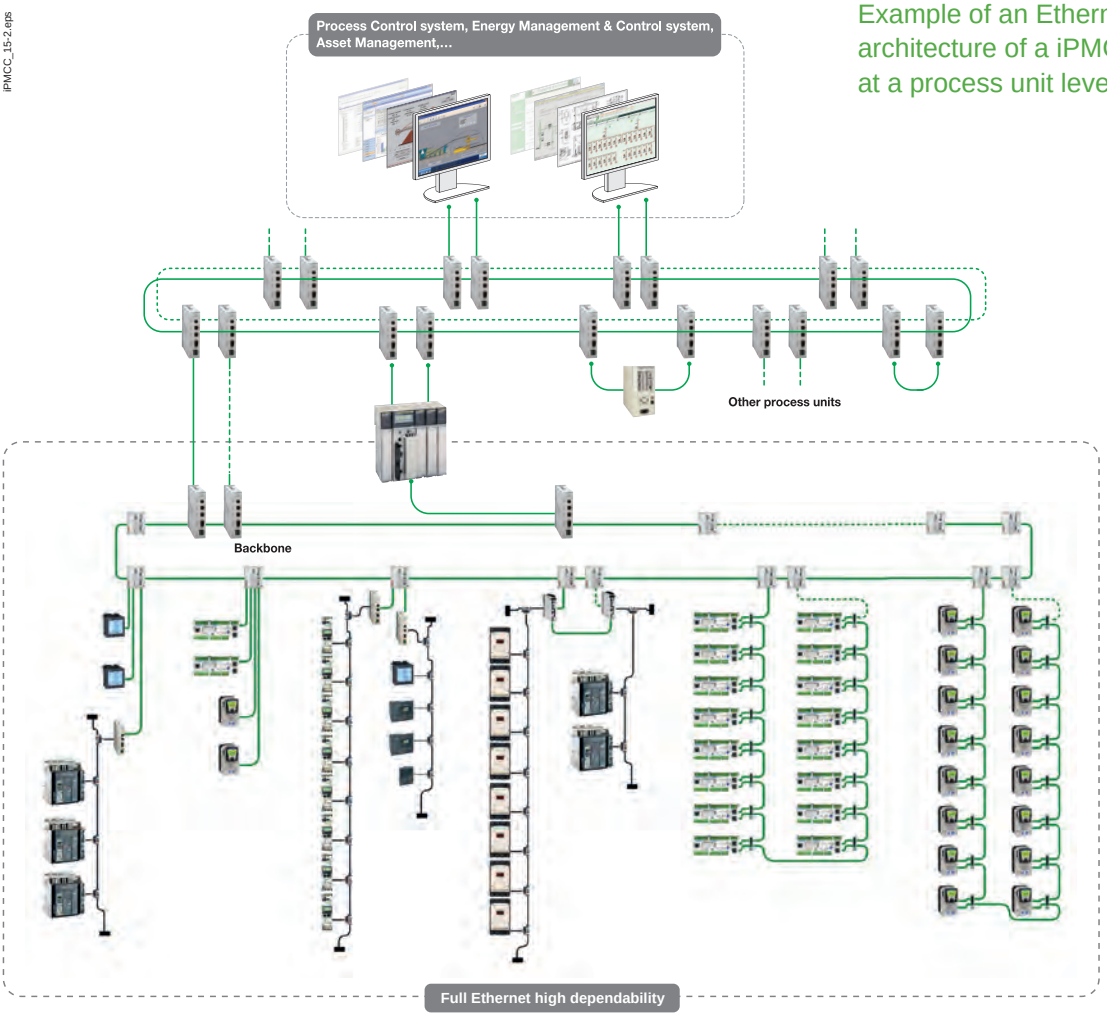

Example of an Ethernet communication architecture of a iPMCC solution, at a process unit level

Innovation
Bypass switch in a Daisy Chain Loop for an optimum dependability

A range of associated services close at hand

You want more efficient solutions that help to boost your installation's performance and reliability and a provider that offers local services.

> Ethernet TCP/IP, Ethernet/IP, Profibus-DP, DeviceNet, Modbus...

Simple integration to your local industrial network (LAN) with the communication protocol of your choice.

> Pre-tested architectures

Architectures that have been pre-tested, pre-validated and documented by our experts both in electrical distribution and process control, on the Schneider Electric's research and development platform dedicated to innovative solutions.

> Full set of engineering tools

For design, wiring, configuration and installation : diagrams, guides, choice tables,...

iPMCC_14.eps

> Throughout the world, our Schneider Electric service experts as well as our licensed partners are attentive to your needs, providing a comprehensive and unique range of support services for the iPMCC offer to increase the reliability of your equipment:
- validated tools and architectures
- local services for the installed base: availability of components, assistance and troubleshooting
- advice and support for equipment maintenance and renovation
- customised professional training on site or in one of our fifty training centres.

> Schneider Electric is your partner, providing services to help increase your installation's performance throughout its entire lifecycle.
In addition to services associated with the iPMCC range, Schneider Electric offers complete audit and consultancy services (engineering expertise, installation audits, energy audits, comprehensive energy efficiency solutions, etc.) and solutions engineering (project management and implementation, site modernisation, customised or critical infrastructure projects, process simulation, energy management, etc.).

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iPMCC_13.eps

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Customised solutions incorporating the products and systems from Schneider Electric


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With our wide range of iPMCC, solutions we answer to the needs of your continuous and critical process. For each of your installation, Schneider Electric and its licensed partners define with you the solution which will meet your requirements in terms of electrical distribution (intelligent Power Control Centre - iPCC) and motor control and protection (intelligent Motor Control Centre - iMCC).

Power circuit protection and control

A range of circuit breakers for the protection, control and isolation of low voltage DC loads and circuits.

Masterpact and Compact NSX and NSXm

> For all configurations:
- fixed or withdrawable equipment
- connection via front/back connector or via cable
- manual, electrical and rotary handle control

> Modularity of auxiliaries and common control units across product ranges

> Simplified selection of protection devices

> Compliance with the requirements of type 2 coordination when combined with a Schneider Electric contactor

> Protection function with an added energy and power monitoring unit in the Compact NSX range.

Communication modules :

IFE*, IFM* and IO modules*

> Ethernet and Modbus communication module for low voltage circuit breakers
> Fully compatible with ULP system
> Easy configuration
> Embedded web pages

Power consumption and quality measurement

A range for the energy management: measurement, quality, availability.

PowerLogic PM 800 and PM 5000

> Optimum equipment performance through energy and power monitoring
> Remote monitoring of electrical equipment (optional remote display unit)

> Power quality monitoring (total harmonic distorsion -THD- metering, individual harmonic magnitudes and angles, waveform capture, detection of voltage and current disturbances - sag and swell, etc.)

> Prevention of critical situations using associated alarms

> Logging of data, trends and forecasts (modular options).

Process control

A range of PLCs for process control with communication, diagnostic and data storage functions.

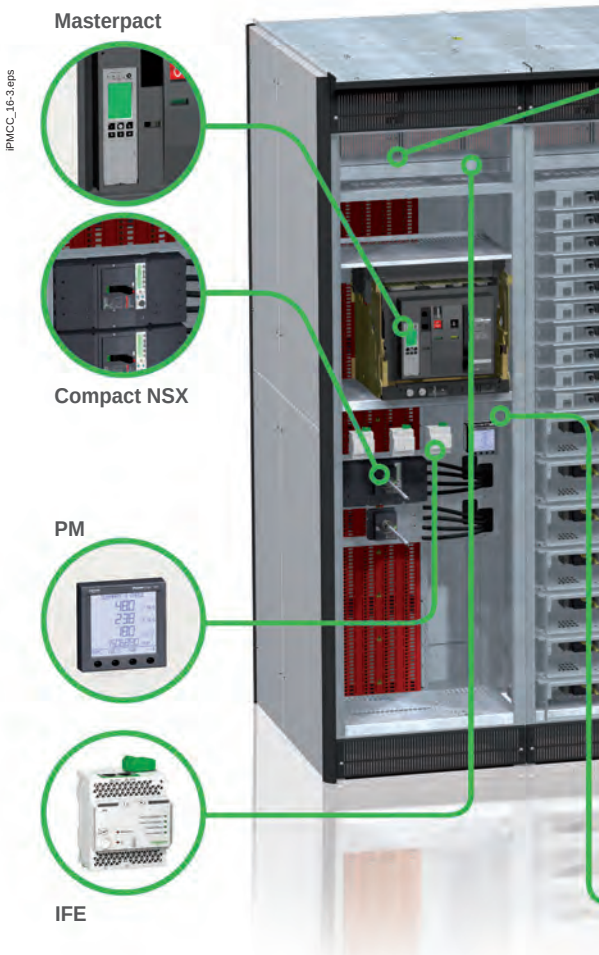
Quantum, Premium, M340, and M580

> High-level, multitasking system

> Suitable for complex processes

> Shorter cycle times

> Can be installed as a redundant system to ensure maximum dependability of your installations.



iPMCC_16-3.eps

Integration of the electrical distribution functions (PCC), motor control and protection functions (MCC) into intelligent and communicating architectures (iPMCC)

A range of LV functional systems for the realisation of Schneider Electric switchboards which are compliant IEC 61439 and provide a maximum level of dependability (continuity of service, improved safety of personnel and assets, maintainability) throughout the entire lifecycle, even in the most severe environments.

iPMCC by Okken

> Electrical distribution (iPCC) up to 7300 A

> Motor control and protection (iMCC) up to 250 kW - 415 V, 300 kW - 690 V.

Speed drives

A range of variable speed drives and soft starters for effortless variable speed control offering extensive power, application and protection options for the entire installation (drive, motor, machine, environment).

Altivar Process, Altivar 31, Altivar 630, Altivar 930, and Altistart 48

> A suitable match whatever your requirements - simple machines, pumping and ventilation machines, high power machines

> Power and energy measurement and power quality control

> Sub-metering and cost allocation

> Optimum demand and power factor management

> Load analysis and circuit optimisation.

Example of a iPMCC configuration

Motor control and protection

A wide range of relays, motor controllers and management systems to meet all your needs, from the simplest to the most complex.

TeSys T, TeSys U and TeSys D

> Comprehensive motor protection supported by a range of metering, control and monitoring functions

> Modular design - adapted to your requirements with an optional module for additional protection functions (voltage and power measurement, additional inputs).

Connected Offer

Getting services thanks to cloud enability (Com'X 200 Energy Server)

❶ Measure and collect

- Integrated communication interfaces
- Embedded metering and control capabilities

❷ Collect to understand

- Ready to connect to asset and energy management platforms

❸ Understand and save

- Data-driven energy efficiency actions

> Large embedded connectivity (I/Os, Ethernet, Modbus, GPRS...)

> Worldwide unique solution for remote connection (GPRS + SIM card + Vodafone)

> Easy to install and configure : plug & connect ready to commission the data acquisition up to the cloud platform

> Easy connection to the RSP* (Data delivery, Device Management): register and connect with the unique Schneider Electric service infrastructure

And much more functions...

(*) **IFE:** Ethernet interface for LV circuit breaker and gateway
IFM: Modbus SL interface for LV circuit braker
IO: input/output interface module for LV circuit breaker
RSP: Remote service platform

Overview of the iPMCC solutions

We design with you the solution which meets your needs as well as your process requirements.

iPMCC Solutions Range	iPMCC	MCC
Protection		
Short-circuit, Thermal overload, Overcurrent, Ground current	■	■
Current phase imbalance & phase loss	■	■
Current phase reversal	■	
Undercurrent	■	
Long start (stall) & Jam (locked rotor)	■	
Motor temperature sensor	■	
Rapid cycle lockout	■	
Load shedding	■	
Voltage phase imbalance, phase loss, & phase reversal	□	
Undervoltage & Overvoltage, Underpower & Overpower, Under & Over power factor	□	
Measurements		
Line currents, Ground current, Average current, Current phase imbalance, Thermal capacity level	■	
Motor temperature sensor	■	
Frequency	■	
Line-to-line voltage, Line voltage imbalance, Average voltage	□	
Active & Reactive power, Power factor, Active & Reactive power consumption	□	
High level functions		
Custom logic at starter level	■	
Advanced motor starting modes	■	
Automatic restarting of motors	□	
Fast Device Replacement	□	
Connectivity & Communication architectures		
Schneider Electric Process Control System, Energy Management and Control System, PLCs (1)	interop. tested	interop. tested
Third-party Process Control System, Energy Management and Control System, PLCs (1)	□	□
Native Ethernet Modbus/TCP in Daisy Chain Loop, Star, Proxy	■	■
Native Ethernet IP with RSTP in Daisy Chain Loop, Star	■	■
Native Profibus-DP, Native DeviceNet, Native Modbus-SL	■	
Other protocols	□	
Operational modes		
Consignment	■	■
Starters test position	■	■
Maintenance & Upgrade live	■	□
Control at motor level	□	□
PC set-up	□	
Remote management	■	
Local HMI	■	□
"Nominal current only" set-up (screwdriver)	■	■

(1) PLC: Programmable Logic Controller

■ ■ Standard
□ □ Optional

Green Premium™

An industry leading portfolio of offers delivering sustainable value

Green Premium™

More than 75% of our product sales offer superior transparency on the material content, regulatory information and environmental impact of our products:

- RoHS compliance
- REACh substance information
- Industry leading # of PEP's*
- Circularity instructions

The Green Premium program stands for our commitment to deliver customer valued sustainable performance. It has been upgraded with recognized environmental claims and extended to cover all offers including Products, Services and Solutions.

CO_2 and P&L impact through… Resource Performance

Green Premium brings improved resource efficiency throughout an asset's lifecycle. This includes efficient use of energy and natural resources, along with the minimization of CO_2 emissions.

Cost of ownership optimization through… Circular Performance

We're helping our customers optimize the total cost of ownership of their assets. To do this, we provide IoT-enabled solutions, as well as upgrade, repair, retrofit, and remanufacture services.

Peace of mind through… Well-being Performance

Green Premium products are RoHS and REACh compliant. We're going beyond regulatory compliance with step-by-step substitution of certain materials and substances from our products.

Improved sales through… Differentiation

Green Premium delivers strong value propositions through third-party labels and services. By collaborating with third-party organizations we can support our customers in meeting their sustainability goals such as green building certifications.

Discover what we mean by green
Check your products!

*PEP: Product Environmental Profile (i.e. Environmental Product Declaration)

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iPMCC by Okken - a range of intelligent Power Control Centre solutions

iPMCC, Intelligent Power and Motor Control Centre, is a complete Schneider Electric package offer, including intelligent motor protection relays (IMPR), motor control center (MCC), intelligent electrical distribution devices, power control center (PCC), and communications architecture solutions with tested, validated and documented architectures (TVDA).

iPMCC is a powerful motor protection and control solution that provides a full set of motor protection functions, from protections based on current measurement to protections based on voltage measurement. Moreover, it provides accurate parameter measuring and an alarm mechanism. It provides the possibility to define customized control modes besides the predefined ones.

Customers can choose the appropriate configuration to build an optimized solution per their needs. All the key components and switchboards are from Schneider Electric, which implies high interoperability.

iPMCC is intended to be one of the most “open” solutions on the market. It supports the major protocols used in industrial communications networks in native mode:
- CANopen
- DeviceNet
- Profibus
- Modbus serial line
- Modbus over Ethernet
- EtherNet/IP

iPMCC performances are being continuously tested as a complete installation, not only communications but also performance, interoperability, cost and dependability issues, as well as installation issues such as EMC (Electro Magnetic Compatibility), heat dissipation, ease of wiring and so on.

iPMCC provides illustrated documentations and guidelines dedicated to:
- the selection and the wiring of the auxiliary power supply architecture (Rules, expert tips, accessories, details…),
- the help to the selection of the communication network architecture,
- he cabling of the communication network architecture (Rules, expert tips, accessories, details…),
- the configuration of the communication network (Switches, architectures …),
- the installation and configuration of every intelligent devices,
- the configuration of the DCS system (Foxboro and Wonderware),
- the presentation of performances and interoperability test results.

All these helps to ease the engineering and panel building work required.

iPMCC solution, with highly dependable and high performance, is fully compliant with IEC 61439-1&2 standard, including options for marine, anti-corrosive for harsh environments, as well as seismic withstand (G2 for earthquake and G5 for nuclear plants).

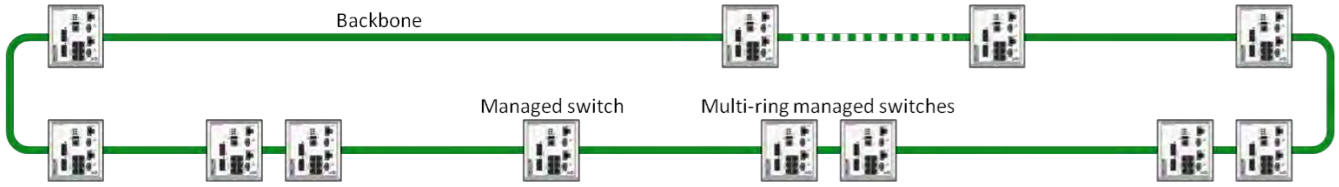
iPMCC communication network overview: the backbone

The backbone is the main network of an installation. It centralizes the devices' sub-networks. Among the many ways to implement a backbone, two have been selected by Schneider Electric as iPMCC reference architectures. These two backbone reference architectures are:

■ Ethernet High Dependability architecture

Ethernet High Dependability architecture is based around a fault tolerant (Redundant) ring backbone (either optic fiber or copper) to which all the subsystems (devices' sub-network) are connected via managed switches.

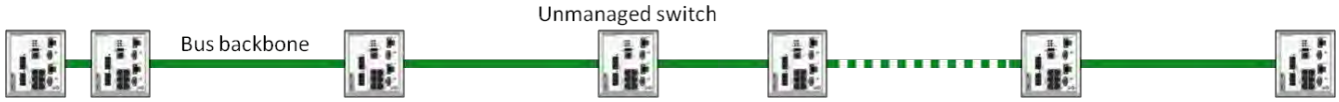
Ethernet HD architecture.png



■ Ethernet Competitive architecture

The Ethernet Competitive architecture is based around a bus backbone (either optic fiber or copper) to which all the subsystems (devices' sub-network) are connected via unmanaged switches. This architecture is cost effective and dedicated to systems that not requires redundancy.

Ethernet Competitive architecture.png



Guide and documentations

Couv 1.pdf

Commissioning guide

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iPCC Daisy Chain architecture

The Daisy chain network topology is implemented as part of a communicating system with dedicated application where redundancy is not required by the customer.

Unlike the star topology and while maintaining the consistency with the overall system dependability approach, this topology could be connected, either to a redundant backbone (Ethernet High Dependability Architecture) or to a "BUS" backbone (Ethernet Competitive Architecture).

Guide and documentations

Couv 2.pdf

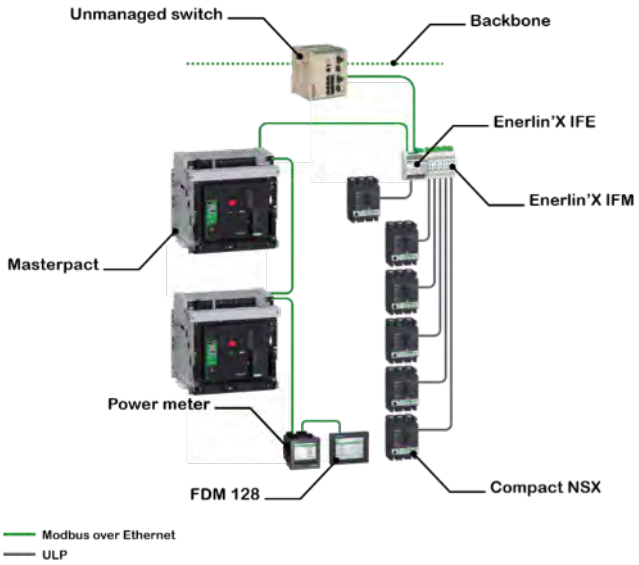
Commissioning guide

Couv 3.pdf

TVDA

Chain reference architecture:

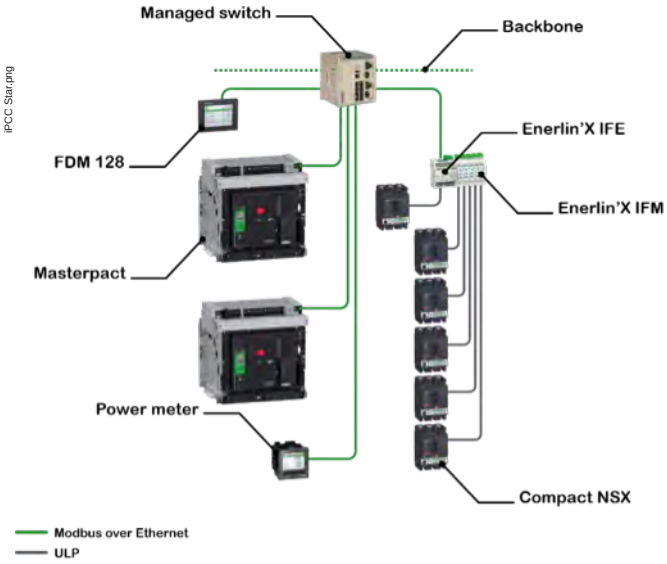
iPCC Daisy chain reference architecture.png



iPMCC Star architecture

The Star network topology choice allows to maximize the process availability with intermediate level of redundancy and performances.
To keep consistency with the overall system dependability approach, this topology must be connected to a redundant backbone (Ethernet High Dependability Architecture).

iPCC Star reference architecture:



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Commissioning guide

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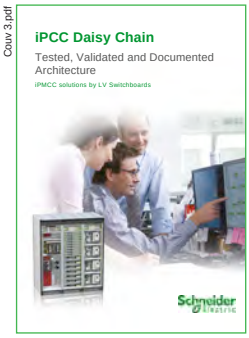
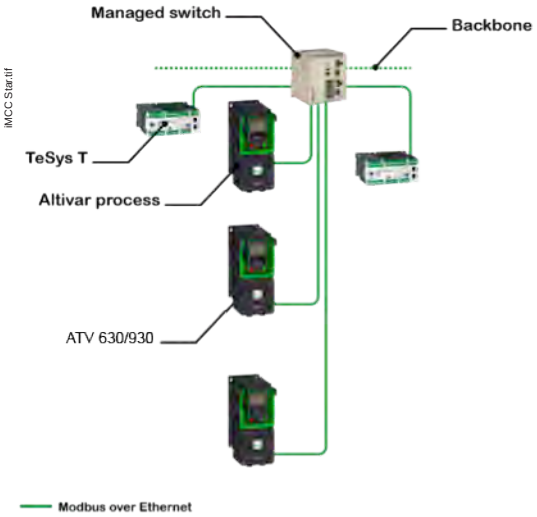


TVDA

iMCC Star reference architecture:

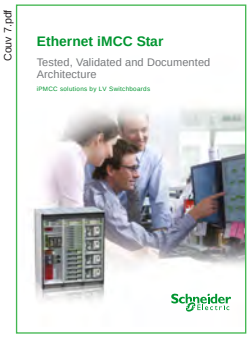


Guide and documentations

Couv 6.pdf

Commissioning guide

Couv 7.pdf



TVDA

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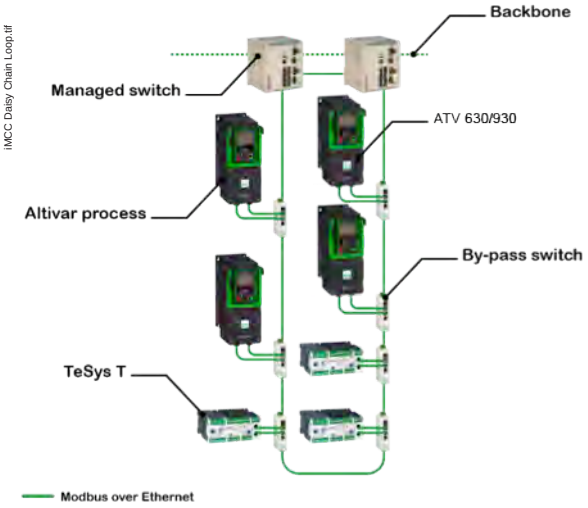
iMCC Daisy Chain Loop architecture

The "Daisy Chain Loop" or "Redundant Ring" network topology allows to maximize the process availability with the higher level of redundancy and performances. This very robust and redundant architecture requires the presence of a specific functionality inside each device of the loop: The ring management protocol.

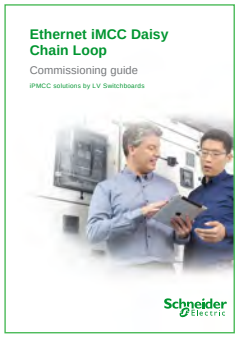
To keep consistency with the overall system dependability approach, this topology must be connected to a redundant backbone (Ethernet High Dependability Architecture).

Reference architecture:



Guide and documentations

Couv 8.pdf



Commissioning guide

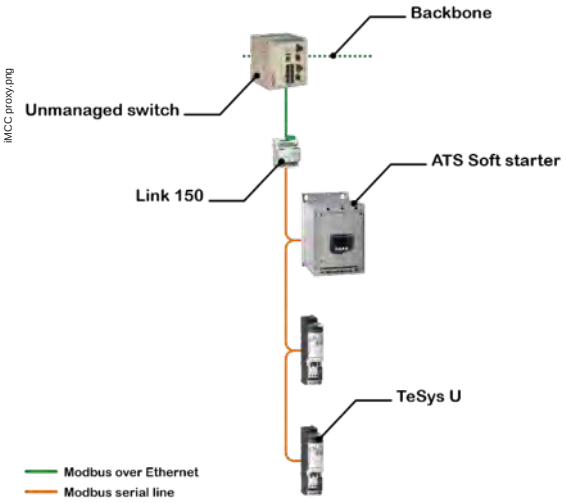
Couv 9.pdf

TVDA

iMCC proxy architecture

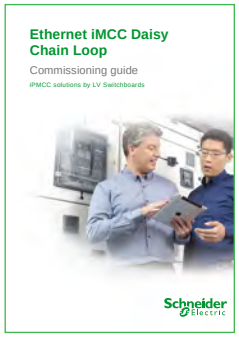
iMCC proxy architecture offers a way to connect Modbus serial line devices to an Ethernet network. The performances of such architecture are lower than Ethernet architecture and the quantity of devices is limited. Link 150 is the dedicated gateway (Modbus serial line to Modbus over Ethernet converter) for iMCC proxy architecture.

Reference architecture:



Guide and documentations

Couv 8.pdf



Commissioning guide

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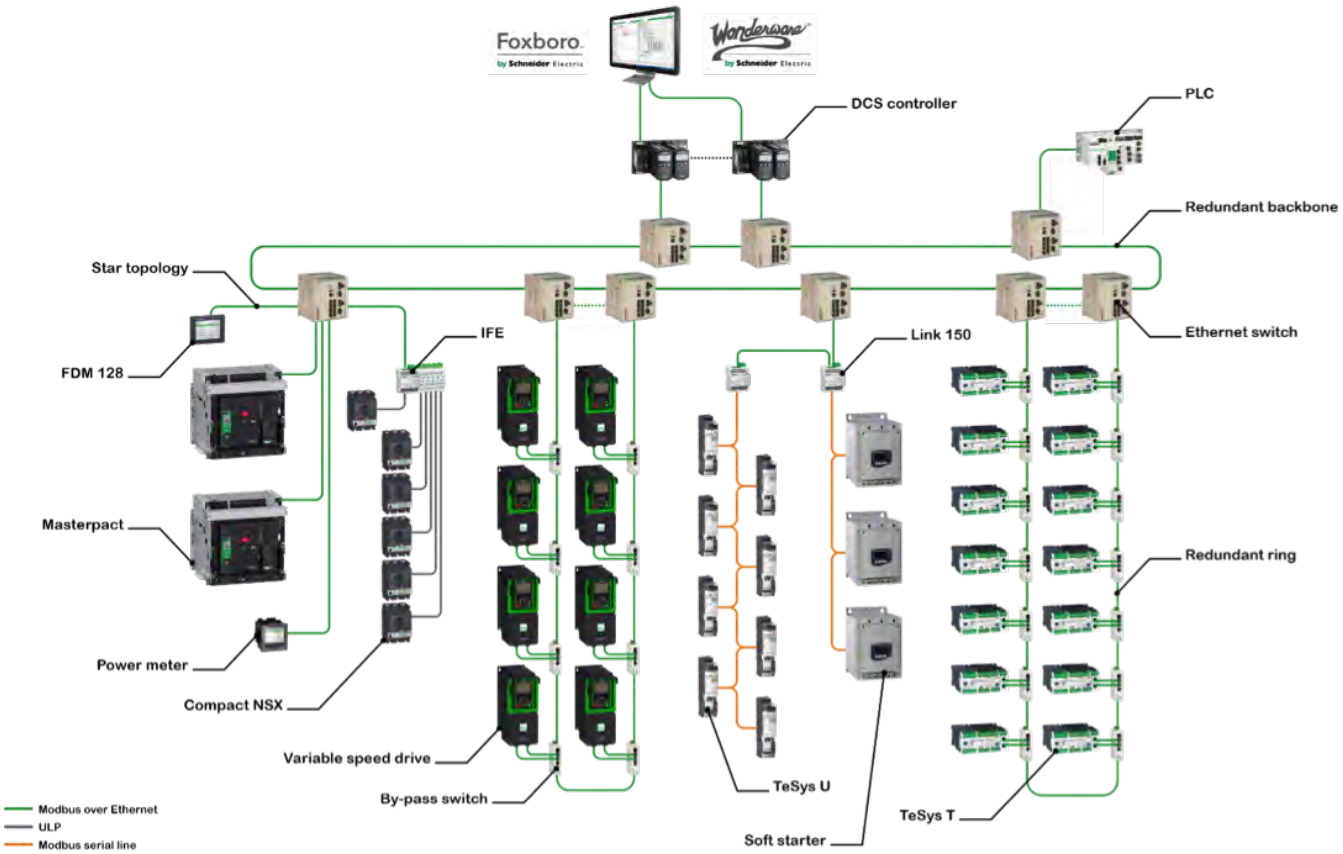
iPMCC overall architecture

By combining the backbone architectures and devices' sub-network architectures, it is possible to create any type of communication architecture that perfectly fits the levels of redundancy and performances required by your installation.

IPMCC overall.png



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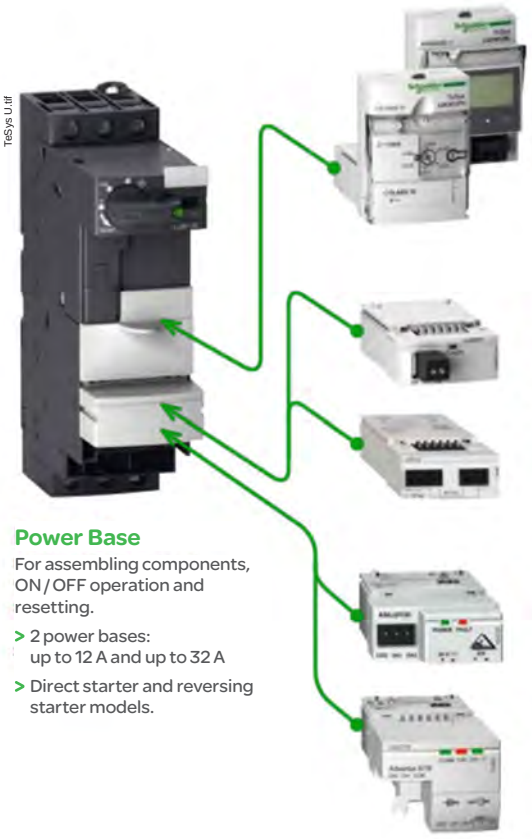
The TeSys U motor starter succeeds in combining all functions (thermal & magnetic protection, switching, and contactor) in a single product.

This unique design ensures total coordination between protection and contactor functions (According to IEC 60947-6-2). The TeSys U covers main motor applications (Direct On Line, reversers, drive protection) from 0 to 15 kW (0 to 32 A) ensuring a short circuit breaking capacity of 50 kA with perfect coordination.

The TeSys U electronic trip units cover most of your needs with a very few reference numbers:
■ to easily adapt your motor starter to different control circuit types (24 V DC, 24 V AC, 110-240 V AC),
■ to directly connect your motor starter to a communication network (6 different protocols available).



TeSys U.tif

Control Unit

Performs all the electrical protection functions to cover main applications from 0 to 32 A.
Some of thes also provide advanced measurement, alarm and display functions.

4 simple function modules

> Thermal overload alarm
> Indication of motor load
> Thermal overload signalling and manual reset
> Thermal overloaded signalling and automatic or remote reset

Power Base

For assembling components, ON / OFF operation and resetting.

> 2 power bases: up to 12 A and up to 32 A
> Direct starter and reversing starter models.

6 communication modules

> AS-Interface
> Profibus DP
> CANopen
> DeviceNet
> Advantys STB
> Modbus.

PB114917.eps

Advanced protections embedded on GVAPEM (multifunction)

in addition to basic protections, GV4PEM embed protections against:

- Long start (high inertia, resistive torque machines),
- Jam (overtorque, machine failure),
- Ground fault (reduced isolation),
- Unbalanced (phase currents are not equal),
- Phase loss (1 or 2 phases missing).

Fully configurable-advanced protections:

- wireless with an application on Android smartphone through NFC (near field communication),

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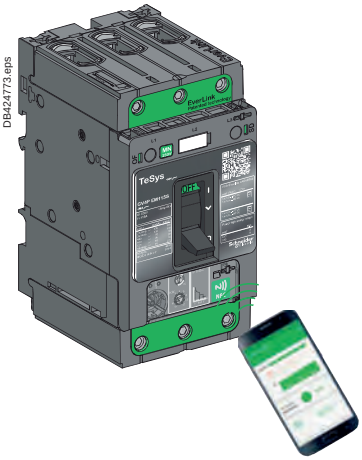

- with Ecoreach software on a computer connected to the test socket through a configuration and maintenance module.

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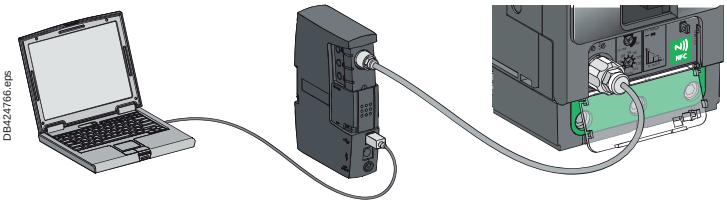

Remote indications:
GVA4PEM circuit breaker may be equipped with an SDx alarming / fault differentiation module to prevent to trip or to identify the type of fault after a trip.

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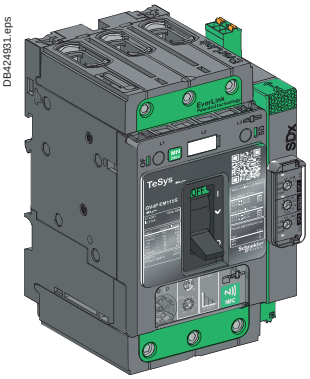

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Presentation

TeSys T is a motor management system that provides protection, metering and monitoring functions for single-phase and 3-phase, constant speed, a.c. motors up to 810 A.

Suitable for the harshest applications, this product range offers:
- high-performance multifunction protection, independent of the automation system,
- a local HMI control unit for reading, displaying and modifying the parameters monitored, diagnostics, etc.,
- configuration using SoMove software,
- connection to the automation system via a communication network (selection per various protocols).

Application

The TeSys T motor management system is used for motor control and protection in harsh industrial applications, in which downtime must be avoided because it is very costly: Oil & Gas, chemical industry, water treatment, metal, minerals and mining, pharmaceutical industry, microelectronics, tunnels, airports etc..

With TeSys T, unexpected stops of a process or manufacturing, associated with a motor, are anticipated via predictive analysis of fault situations. Fault tripping is therefore reduced to a minimum.

Its use in motor control panels makes it possible to:
- increase the operational availability of installations,
- improve flexibility from project design through to implementation,
- increase productivity by making available all information needed to run the system.

The TeSys motor management system integrates perfectly with Schneider Electric Okken low voltage equipment and therefore iPMCC applications.

PF130802D.eps

VSD Altivar Process ATV630 & 930

Altivar Process drives offer extensive flexibility in water & wastewater, mining, minerals & metals, oil & gas and food & beverage applications. Depending on customer requirements, wall-mounting drives, built-in cabinet and floor-standing solutions are available with IP 21, IP 23, IP 54, and IP 55 protection.

- Optimum monitoring of your process
  - Instant reaction if pump efficiency drops thanks to the embedded pump monitoring.
  - Notification of critical operating points without additional sensors.
  - Process integration with pressure, flow, and level control including compensation of flow losses.
- The energy-saving drive solution
  - Up to 30% energy saving when on standby due to the innovative “Stop & Go” operation without additional costs.
  - Smart control of the internal fans depending on operation.
  - Optimum energy efficiency over the whole life cycle.
  - Data logging and graphic display of the power consumption.
- Web server and services via Ethernet
  - Embedded Web server interface based on the Ethernet network gives you process monitoring with your daily working tools.
  - Local and remote access to energy use and customized dashboards means your energy is visible anywhere, any time, on PC, tablet, or smartphone.
- Simple integration in PLC environments
  - Easy integration thanks to standardized FDT/DTM and ODVA technology.
  - Supported by predefined Unity Pro libraries.
  - Easy access via PC, tablet, or smartphone.
  - Secure connection via “Cyber-secure Ethernet”.
  - iPMCC TVDA architecture available.

Altivar Process drives are designed to take numerous accessories and options to increase their functionality and their capacity for integration and adaptation.

Optional communication card:
- EtherNet/IP and Modbus TCP Dual port
- CANopen bus
- PROFINET bus
- Profibus DP V1 bus
- DeviceNet bus

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Circuit breaker and switch-disconnectors

- Ratings:
  - Masterpact NT 630 to 1600 A,
  - Masterpact NW 800 to 6300 A.
- Circuit breakers type N1, H1, H2, H3, L1.
- Switch-disconnectors type NA, HA, HF.
- 3 or 4 poles.
- Fixed or drawout versions.
- Option with neutral on the right.
- Protection derating.

Micrologic control units.png

Micrologic control units

- Ammeter A and Energy E
  - 2.0 basic protection
  - 5.0 selective protection
  - 6.0 selective + earth-fault protection
  - 7.0 selective + earth-leakage protection
- Power meter P
  - 5.0 selective protection
  - 6.0 selective + earth-fault protection
  - 7.0 selective + earth-leakage protection
- Harmonic meter H
  - 5.0 selective protection
  - 6.0 selective + earth-fault protection
  - 7.0 selective + earth-leakage protection

Power meter functions.png

Power meter functions

Masterpact equipped with Micrologic 2/5/6/7 trip units offer type A (ammeter) or E (energy) metering functions as well as communication.
Using Micrologic sensors and intelligence, Masterpact provides access to measurements of all the main electrical parameters on the built-in screen, on a dedicated FDM 121 display unit or via the communication system.

Switchboard display unit.png

Switchboard display unit functions

The main measurements can be read on the built-in screen of Micrologic 2/5/6/7 trip units. They can also be displayed on the FDM 128 switchboard display unit along with pop-up windows signaling the main alarms.

Modbus.png

Screen.png

Communication

Communications modules are available for the entire Masterpact range.
Allowing to integrate the circuit breaker inside a communication network to ensure the following functions:

- Configuration and setting
- Real-time monitoring
- Control
- Maintenance

These functions are available via two communication protocols:

- Modbus over Ethernet (Modbus TCP/IP)
  - IFE: Ethernet interface module.
- Modbus serial line
  - IFM: Modbus interface module.

Masterpact range is fully integrated and compliant with iPMCC communication architectures.

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Circuit breaker and switch-disconnectors

- Ratings:
  - Compact NSX100 to 250 A,
  - Compact NSX400 to 630 A,
  - Compact NSXm from 16 to 160A.
- Circuit breakers type E, B, F, N, M, H, S, L, R, HB1, HB2.
- 2, 3 or 4 poles.
- Molded case circuit breaker.

Micrologic control units

- Micrologic 1.3, 2 and 4*
  - Electronic protection.
  - Indications (local and remote).
- Micrologic 5/6 A or E and 7 E*
  - Electronic protection.
  - Display of type of fault.
  - Indications (local and remote).
  - Measurements.

** Earth leakage protection.*

Power meter functions

Compact NSX equipped with Micrologic 5/6/7* trip units offer type A (ammeter) or E (energy) metering functions as well as communication. Using Micrologic sensors and intelligence, Compact NSX provides access to measurements of all the main electrical parameters on the built-in screen, on a dedicated FDM 121 display unit or via the communication system.

** Micrologic 7 only available with Energy metering (type E).*

Switchboard display unit functions

The main measurements can be read on the built-in screen of Micrologic 5/6 trip units. They can also be displayed on the FDM 128 switchboard display unit along with pop-up windows signaling the main alarms.

Communication

Communications modules are available for the entire Masterpact range.
Allowing to integrate the circuit breaker inside a communication network to ensure the following functions:

- Configuration and setting
- Real-time monitoring
- Control
- Maintenance

These functions are available via two communication protocols:

- Modbus over Ethernet (Modbus TCP/IP)
  - IFE: Ethernet interface module.
- Modbus serial line
  - IFM: Modbus interface module.

Compact NSX range is fully integrated and compliant with iPMCC communication architectures.

Features

The Link150 gateway provides fast, reliable Ethernet connectivity in the most demanding applications, from a single building to a multi-site enterprise. This gateway supports power and energy meters, circuit monitors, protective relays, trip units, motor controls and other devices that need to communicate data quickly and efficiently. It is the simple, cost-effective serial line to full Ethernet connectivity.

Security

- Secure user interface including user's name and password for login.
- Advanced security features to allow users to specify which Modbus TCP/IP master devices may access attached serial slave devices.
- Modbus TCP/IP filtering feature.
- Allows user to specify the level of access for each master device as Read-only or Full access.

Benefits

- Easy to install, configure and maintain.
- Compatible with Schneider Electric software offers (EcoStruxure™ Power Monitoring Expert, EcoStruxure Power SCADA Operation, etc.).
- Reliable Modbus to Ethernet protocol conversion.

Applications

- Energy management
- Power distribution
- Building automation
- Factory automation

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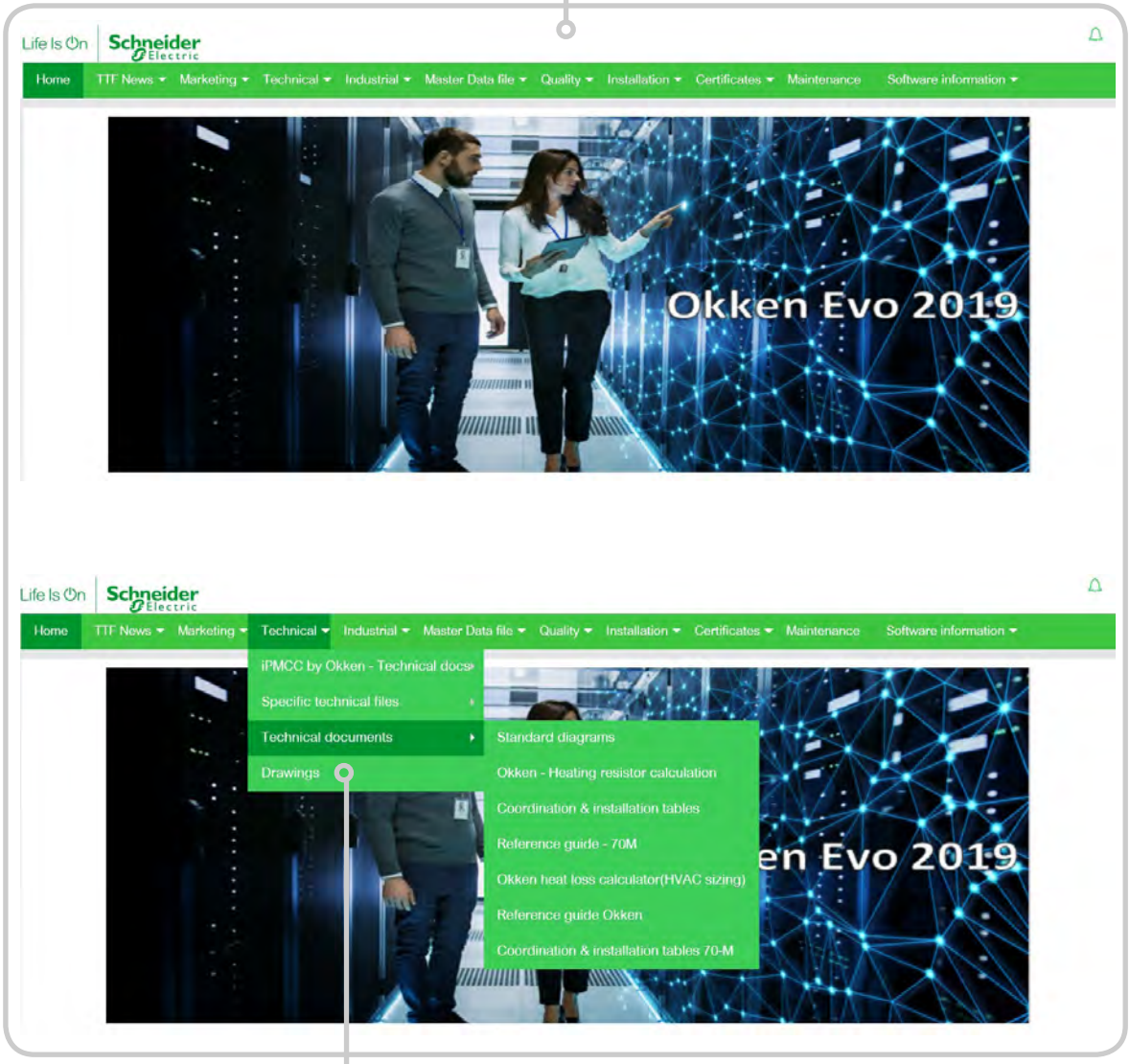
The new online service to facilitate your business.

Whatever your profession, this site provides all the help you might need:
- marketing information
- technical Transfer file
- trainings
- a network of people with same challenges as you
- ...

New portal...
... same content



Complete transfer file
available :
files downloaded
through ToolBox

What is Partner Portal?

The new online service to facilitate your business.

Whatever be your profession, this site provides all the help you might need:
- marketing information
- technical transfer file
- trainings
- a network of people who face the same challenges as you.

Why Partner Portal?

To be closer to Schneider Electric at all the steps of your business,...

...to be connected with Schneider Electric at all times (blog, forum, etc.),...

...through a single reference website,....

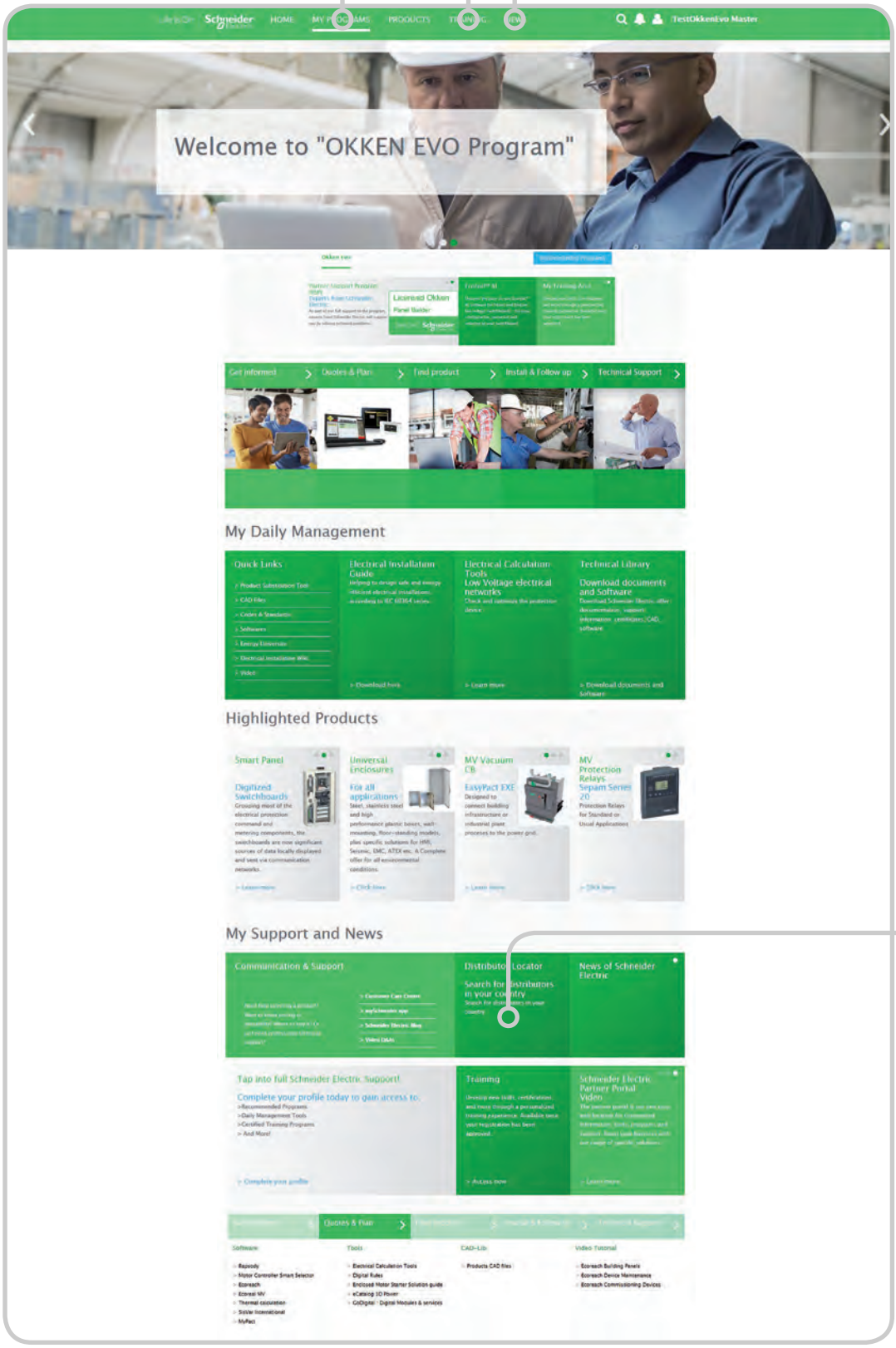
.....providing you reliable tools (downloadable),...

A

The Trainings

Technical transfer file

The latest news and updates



Support from Schneider Electric experts

Notes

EcoStruxure Power Build
Large site switchboard software

A

What is EcoStruxure Power Build?

A tool for exclusive Large Sites panelbuilders to realize:
- switchboard configuration,
- switchboard quotation,
- switchboard order.

Why EcoStruxure Power Build?

- Large sites switchboards offer a wide range of solutions.

→ EcoStruxure Power Build helps the panelbuilder to choose the most optimized one.

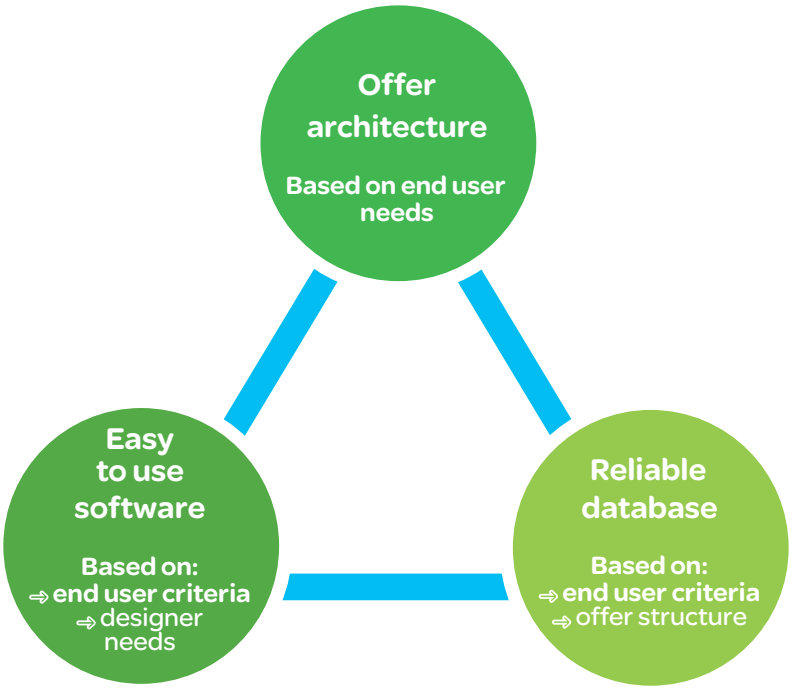
- Each customer need is unique.

→ Ecoreal helps the panelbuilder to give a quick and reliable quotation to his customer.

How EcoStruxure Power Build is done?

- Configurator
  - User dialog with mindset & language of the end user
  - appropriate configuration mechanisms
  - quick comparison of different solutions according to different assumptions
  - quick translation in engineering language

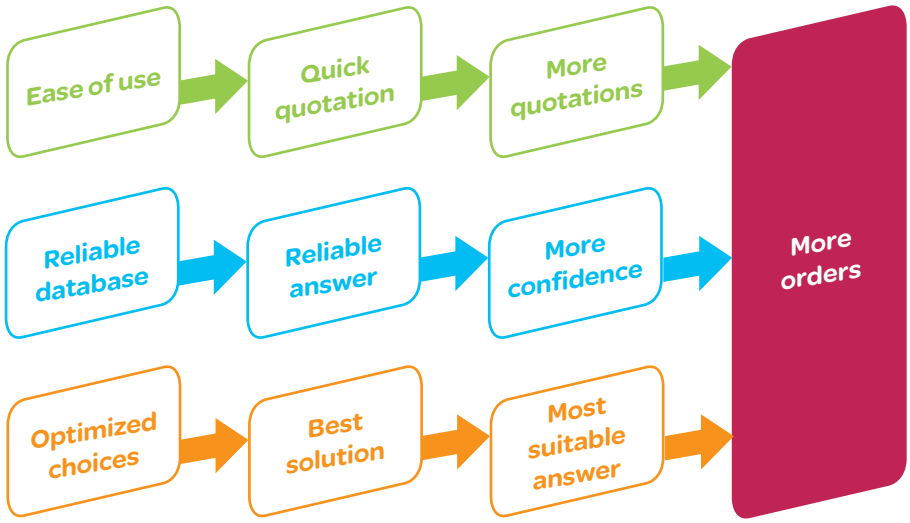
- Database
  - structured on offer architecture
  - taking the solution rules into account
  - with all the documents needed for the project (bill of materials, drawings, certificates…)



EcoStruxure Power Build
Large site switchboard software

EcoStruxure Power Build screens

What EcoStruxure Power Build offers?



A

The transfer file is a collection of helpful tools for each step of business.
From pre-sales to after-sales, the panelbuilder can find in this file, all which will facilitate his work.

Promotion

Collection of tools:
- to explain the offer architecture,
- to present Schneider Electric Okken solution.

Designing

- The **catalogue:** description of the detailed offer.
- EcoStruxure Power Build: the **software** for all the business information between quick quotation and bill of material.

Certification

- Collection of **certificates**.

Industrialization

- Technical **specifications** for manufacturing - subcontracting.
- Guide to prepare / use the **workshop tools**.

Qualification

- The **Low voltage switchboard quality guide**.
- **Checking cards** to help verifying specific points during and at the end of the manufacturing.

Manufacturing

Guides for:
- mounting,
- connecting (power connection),
- wiring (thin wires).

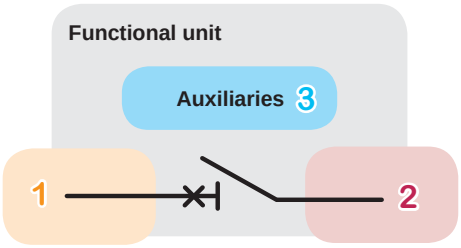
Operation

Guides to:
- The shipping preparation (packing, handling, …).
- The installation and the commissionning at the customer's.

Maintenance

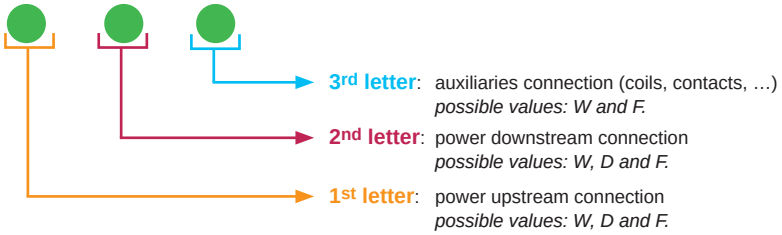
Guides to:
- maintenance,
- extension,
- replacement.

Withdrawability of functional units



Composition

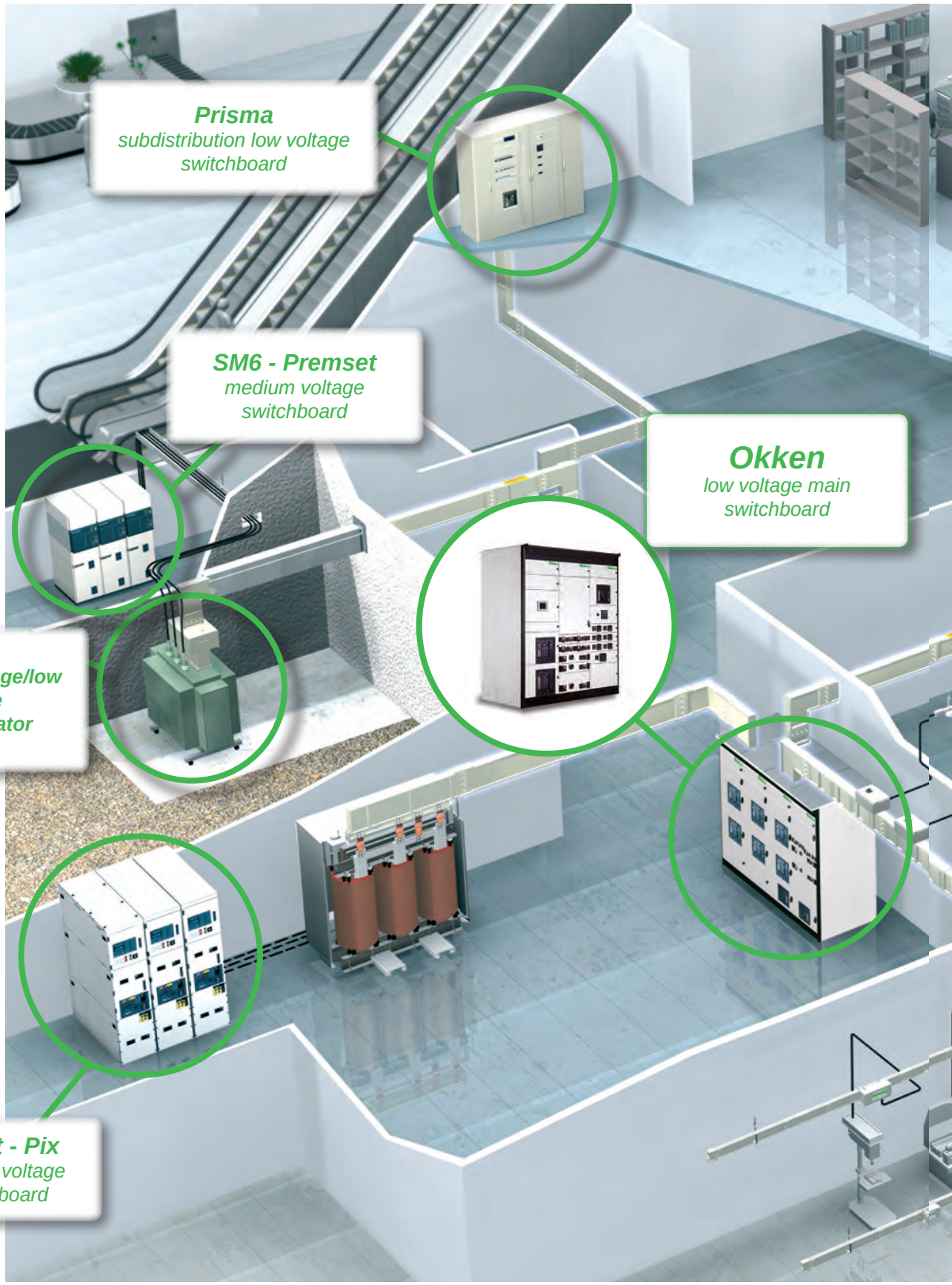
Okken offers several options to answer the installation needs and the service continuity required.
The withdrawability is defined by 3 letters.

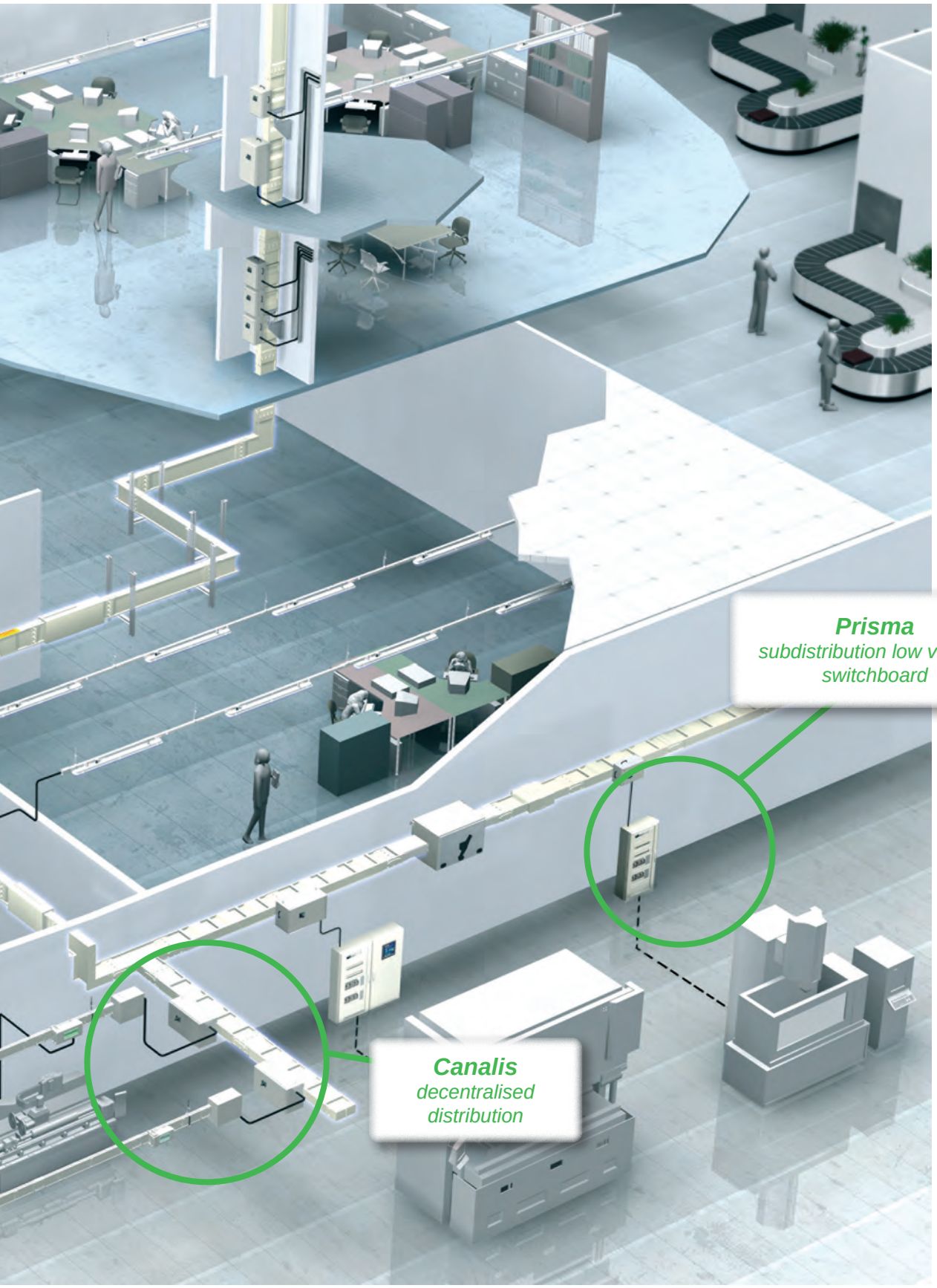


Letter value signification

	W Withdrawable	D Disconnectable	F Fixed
			
Signification	No direct access to the connections of the functional unit	Possible direct action on the downstream connections of the functional unit	The connections are screwed
Condition for any action on the functional unit	Only the concerned functional unit must be turned off	Only the concerned functional unit must be turned off	Whole switchboard must be turned off
Precaution while operating the switchboard	Work on the functional units is possible even if the switchboard is turned on	With some precautions, work on the functional units is possible even with the switchboard turned on	Forbid any internal access to the switchboard.
Maintenance / upgrade time	< 1/4 h	1/4 h < t < 1 h	> 1 h
Minimum form required	3b	2b	1

P.D405157.tif




Prisma
subdistribution low voltage
switchboard
Canalis
decentralised
distribution

Very high power incomer/feeder
Masterpact NW

A

Principle of high electrical distribution:
Okken makes it easier to install, maintain and upgrade incomers and feeders in switchboards up to 7300 A.

Type of cubicle	
	230
In distribution busbar	
	4500/7300 A
Incomers	
	NW40b/63
Feeders	
> 630A	NW40b/63

Withdrawability

Principle of high electrical distribution:
Okken makes it easier to install, maintain and upgrade incomers and feeders in optimized busbar cubicle up to 3200 A.

PD405090.tif

Type of cubicle	
	Single NW
In distribution busbar	
	1600/3200 A
Incomers	
	NW08/32
Feeders	
⩾ 630A	NW08/32

PB106363A35.eps

Withdrawability

High power incomer/feeder
Masterpact NT - Compact NS

A

Principle of high electrical distribution:
Okken makes it easier to install, maintain and upgrade incomers and feeders in optimized cubicle up to 1600 A.

PD405089.tif

Type of cubicle	
	Single NT/NS
In distribution busbar	
	800/1600 A
Incomers	
	NT08-16/NS630b-1600
Feeders	
⩾ 630A	NT08-16/NS630b-1600

PB106367A24.eps

Withdrawability

Principle of high electrical distribution:
Okken makes it easier to install, maintain and upgrade incomers and feeders in switchboards up to 4000 A.

PD405069.eps

Type of cubicle	
	115
In distribution busbar	
	1750/4000 A
Incomers	
	NT08-16/NS630b-1600 NW08-40
Feeders	
⩾ 630A	NT08-16/NS630b-1600 NW08-40

PB106363A.35.eps

PB106367A.24.eps

Withdrawability

Feeders - 70-F, 70-2 & 70M
Fixed device - device on base

A

The fixed PCC solution combines ease of implementation and economy in buildings and infrastructures (tertiary equipment and machines).

PD405087.tif

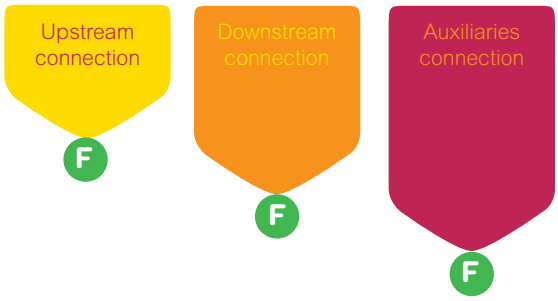
Type of cubicle	
	70-F
In distribution busbar	
	2100 A
Incomers	
	NT08-16
Feeders	
⩾ 630A (nominal rating)	NT08-16
⩽ 630A (nominal rating)	■ fixed mouting plate for 1 NSXm ■ fixed mounting plate for 1 NSX or NS100-630 ■ fixed mounting plate for 2 NSX100-250

PB106367A24.eps

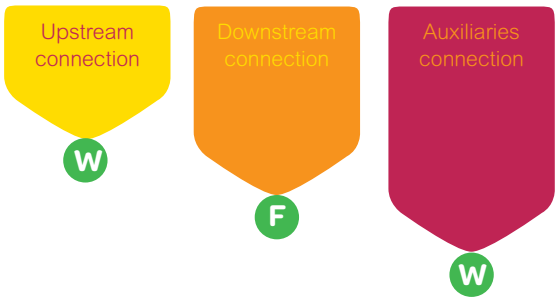
Withdrawability of high power device

Withdrawability of feeders

Fixed device (Compact NSXm and NSX-NS)



Device on base (Compact NSX-NS only)



Feeders

Disconnectable & Plug-in Polyfast - Disconnectable mounting plate - Drawers

A

Principle of feeders in withdrawable drawers: Okken makes it easier to install, maintain and upgrade motor feeders and electrical distribution in switchboards.

PD405071bb.eps

Type of cubicle		
		70-2
In distribution busbar		
		1000 / 2100 A
Incomers		
		NT08-16 / NS800-1600
Feeders		
> 630A (nominal rating)		NT08-16 / NS630b-1600
⩽ 630A (nominal rating)	PCC	■ disconnectable mounting plate ■ disconnectable Polyfast ■ plug-in Polyfast ■ drawer
	MCC	■ disconnectable mounting plate ⩽ 37 kW ■ drawer ⩽ 250 kW

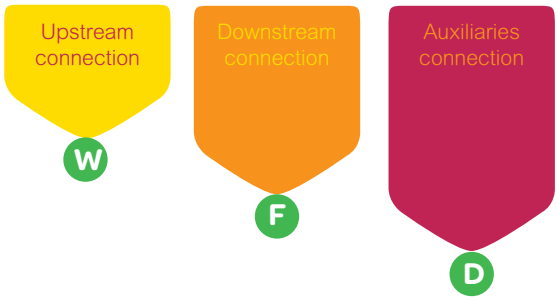
PB106367A24.eps

Withdrawability of high power device

Withdrawability of feeders

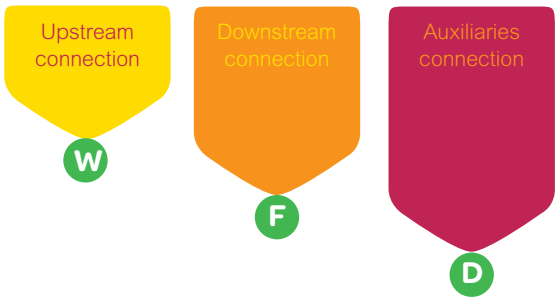
Disconnectable mounting plate

PD391112.eps



Disconnectable on Polyfast

PD405134.eps



Plug-in Polyfast

PD405133.eps

Drawer

PD405004.eps

Mixed incomers/feeders
Disconnectable - Plug-in - Drawers

A

Principle of mixed incomers and feeders:
Okken optimizes the compactness of incomers and feeders, whilst saving space and prioritising simplicity.

PD405070.tif

Type of cubicle	
	115/70-2
In distribution busbar	
	1750 / 3200 A
Incomers	
	NW08-32
Feeders	
> 630A (nominal rating)	NW08-32
⩽ 630A (nominal rating)	■ disconnectable mounting plate ■ disconnectable Polyfast ■ plug-in Polyfast ■ drawer

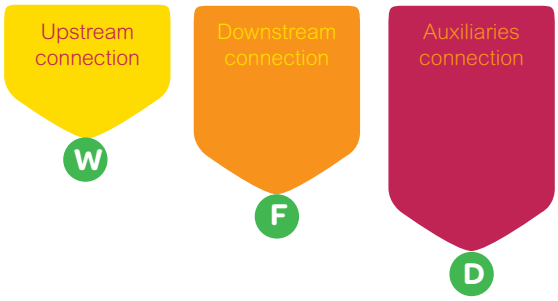
PB106363A35.eps

Withdrawability of high power device

Withdrawability of feeders

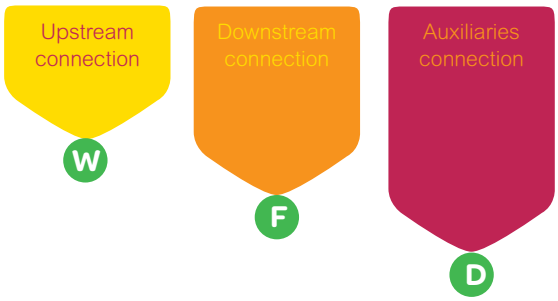
Disconnectable mounting plate

PD391112.eps



Disconnectable on Polyfast

PD405134.eps



Plug-in on Polyfast

PD405133.eps

Drawer

PD405004.eps

A

Principle of feeders in withdrawable drawers: Okken makes it easier to install, maintain and upgrade motor feeders and electrical distribution in switchboards.

PD405103.eps

Type of cubicle		
		70-M
In distribution busbar		
		2000 A
Incomers		
		-
Feeders		
> 630A (nominal rating)		-
⩽ 630A (nominal rating)	PCC	■ drawer
	MCC	■ drawer ⩽ 250 kW

PD405112.eps

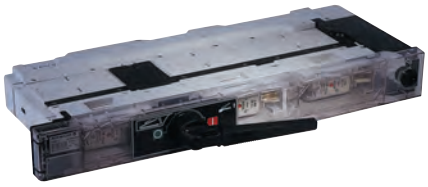
Withdrawability

Principle of fuse switch: Okken makes it easier to install, maintain and upgrade fuse-switch feeders in high-safety cubicle up to 1500 A.

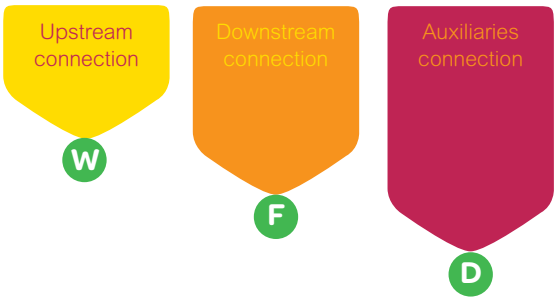
PD405083.tif

Type of cubicle	
	185
In distribution busbar	
	630/1500 A
Incomers	
	-
Feeders	
> 630A (nominal rating)	Jean Müller

0580001hdr.tif



Fuses



A

Variable speed drive is the essential additional function for controlling motors.
The functional units are either fixed or withdrawable.

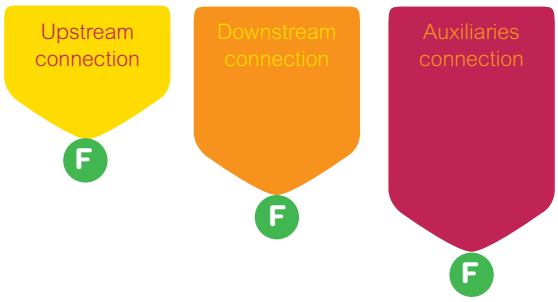
Type of cubicle	
	Soft starter
In distribution busbar	
	-
Incomers	
	-
Feeders	
MCC	■ fixed mounting plate ⩽ 315 kW ■ drawer ⩽ 22 kW

PB115597.eps

PB115598.eps

Withdrawability

Fixed device



the whole switchboard must be shut down for all upgrading and maintenance

Device in drawer

PB115599.eps

PB120813.eps

Power factor correction and harmonic filtering

A

The Okken reactive power factor correction and harmonic filtering range combines optimised choice with ease of installation of anti-pollution solutions for electrical networks.

PB120116.eps

Okken solutions

PB120117.eps

VarPlus Can

The VarPlus Can power factor correction modules are designed to be installed in power factor correction cubicles which are either freestanding or integrated in the Main General Distribution Board.

VarPlus Can power factor correction modules makes it possible to cover different power ratings (kVAR), depending on the voltage(V), the frequency (Hz) and the harmonic pollution level of the network.

PB100029.tif

Detuned reactor

In addition to "Okken – Varplus Logic detuned reactor" range, the purpose of the detuned reactors is to protect the capacitors and prevent the amplification of harmonics present on the network.

63430_main.eps

VarPlus Logic

VarPlus Logic is a relay which measures monitors and controls the reactive energy.

It offers a fast, power factor correction while monitoring the real time data of the systems and alerting on preventive maintenance.

Power factor correction and harmonic filtering

A wide selection for sensitive applications

Statistical studies determine the frequency of the solutions used, according to the applications.

very frequently
usually
occasionally

	Varplus Logic (detuned reactor)	Varplus Logic (detuned reactor) + detuned reactor
Pollution rate	Gh/Sn ≤ 20 %	20% < Gh/Sn ≤ 50%
Oil & Gas		
Automotive		
Water treatment		
Mines & Minerals		
Infrastructures		
Tertiary		
Marine & Off-shore		
Agri-food		

Sn: apparent power of the transformer.
Gh: apparent power of harmonics-generating loads (variable speed motors, static converters, power electronics, etc.).

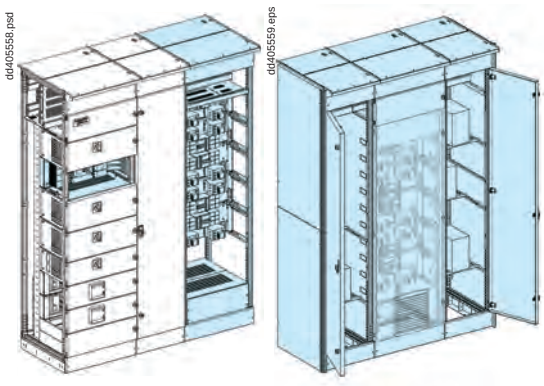
It is however recommended that measurements be carried out on site to check that the correct solution is adopted.

A source of energy savings

Power factor correction means using your transformer and your facility at maximum efficiency by reducing energy losses (iron, heat, etc.)

	Power output by your transformer (kVA)				
Cos φ	**250**	**400**	**630**	**1000**	**1600**
0.5	125	200	315	500	800
0.7	175	280	441	700	1120
0.9	225	360	567	900	1440
0.95	238	380	598	950	1520

Many configuration possibilities



- As is the case with the other products in the Okken range, the power factor correction and filtering column has been designed to integrate perfectly with a full switchboard, 2350 or 2200 mm high.
- The power factor correction and filtering elements can be protected as follows:
  - externally, by an NSX630(1) circuit breaker in an adjacent cubicle,
  - internally, by an NSX100 (1) separate circuit breaker on each mounting plate.
- The choice affects the number of mounting plates per column.

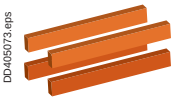
(1) NSX with Micrologic 4.2/4.3 & 7.2/7.3E Distribution and earth leakage protection.

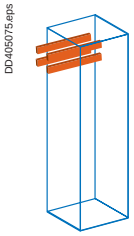
Description and characteristics

B

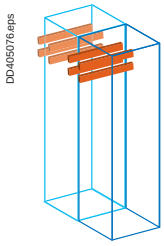
Electrical and mechanical data
Busbars

Horizontal busbar = main busbar



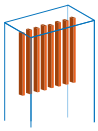
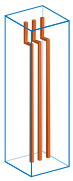
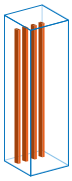
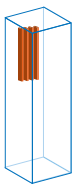
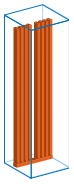
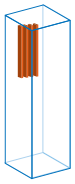
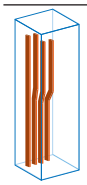
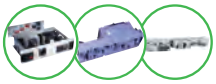
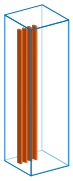
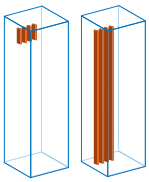


single busbar
up to 4000A



double busbar
up to 7300A

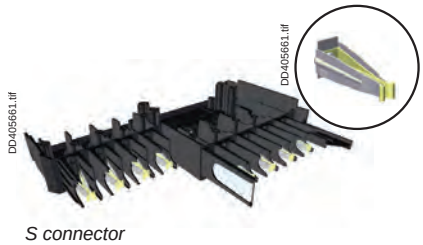
Vertical busbar = distribution busbar

PCC		MCC	
Nominal rating		**≤ 250 kW**	**≤ 400 kW**
> 630A	**< 630 A**		
 **230 busbar** ■ single device up to 6300A 	 **185 busbar** ■ for fuse-switch feeders cubicle 		
 **115 busbar** ■ multi devices up to 4000 A 			
 **Single NW busbar** ■ single device up to 3200A 	 **70-M busbar** ■ for feeders cubicle up to 2000A. 		
 **Single NT busbar** ■ single device up to 1600A 			
 **115/70-2 busbar** ■ single device up to 3200 A 	■ 70-2 drawers ■ Polyfast ■ fixed mounting plates 	■ 70-2 drawers ■ disconnectable mounting plates 	
 **70-F and 70-2 busbar** ■ multi devices up to 2100 A 	■ 70-2 drawers ■ Polyfast ■ fixed mounting plates 	■ 70-2 drawers ■ disconnectable mounting plates 	
		 **VSD (ATV) and Soft Starter (ATS)** 	

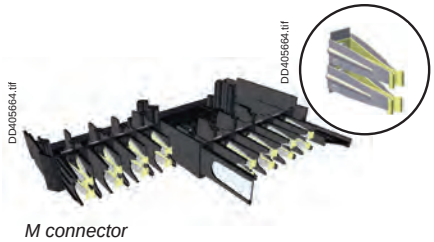
Description and characteristics
70-M connections

Power connections

The power connectors depend on the vertical busbar:
- 4 types of connectors depending on the rating current of the functional unit:
  - S connector: I max = 32 A
  - M connector: I max = 60 A
  - L connector: I max = 200 A
  - XL connector: I max = 630 A.
  - XM connector: I max = 250 A.



S connector

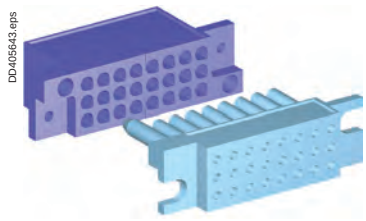


M connector

L connector

XL clamp.

Auxiliary connections



Withdrawable auxiliary blocks	
rated insulation voltage (Ui)	500 V AC
rated operation voltage (Ui)	230 V AC
rated current (In)	10 A
signal maximum frequency	∿2 Mb/s (*)
equipment capacity	1 or 2 blocks of 24 contacts max.

(*) in accordance with the following communication buses:
- *Ethernet*
- *Modbus ST*
- *Profibus DP (1,5 Mb)*
- *DeviceNet*
- *CanOpen*

B

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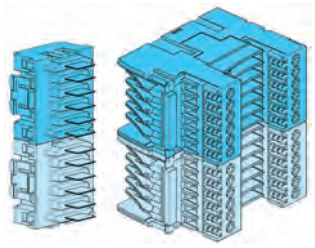

Auxiliary connections

Withdrawable auxiliary blocks		
rated operation voltage (Ue)		up to 500 V AC
rated current (In)		10 A
signal maximum communication performance		∿100 Mb/s (*)
equipment capacity	drawers from 6 modules	4 blocks (24 contacts) + 2 optional on the left side (12 contacts)
	drawers from 8 modules	4 blocks (24 contacts)
	3 modules drawers	2 blocks (12 contacts) + 1 optional
	"Polyfast" plug-in	2 blocks (12 contacts)
	"Polyfast" disconnectable	2 blocks (12 contacts)

(*) in accordance with the following communication buses:

- *Ethernet*
- *Modbus ST*
- *Profibus DP (1,5 Mb)*
- *DeviceNet*
- *CanOpen*

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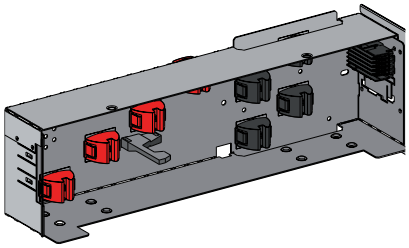


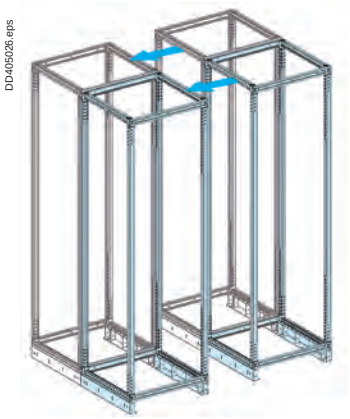
Power connections

The power connectors depend on the vertical busbar:
■ 1 type of connector valid for all the functional units.

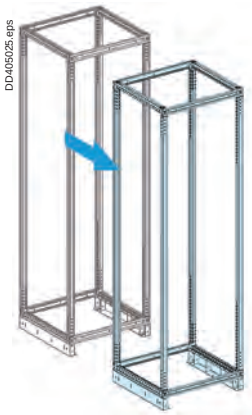
Description and characteristics
Types of connection

Okken **switchboards** are constituted of several associated **columns**.

Each **column** is made by the association of a **device cubicle** and a **cable compartment** and/or an auxiliaries compartment.
The resulting switchboard must remain of **constant height.**

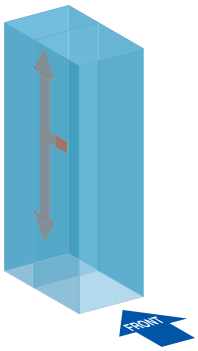
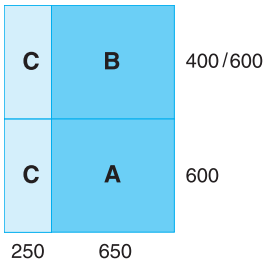
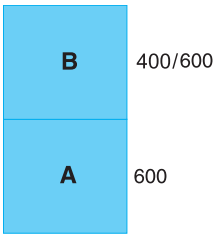
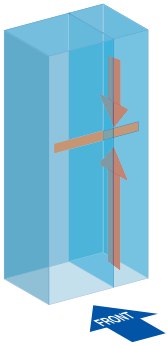
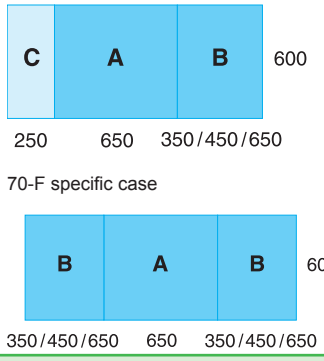
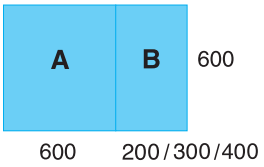
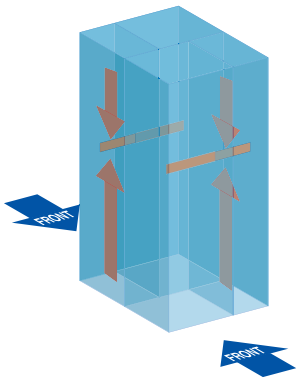
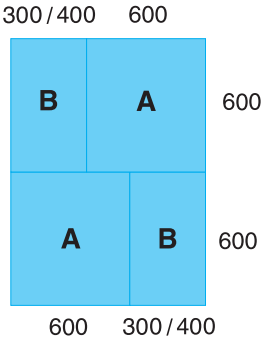


switchboard = association of columns



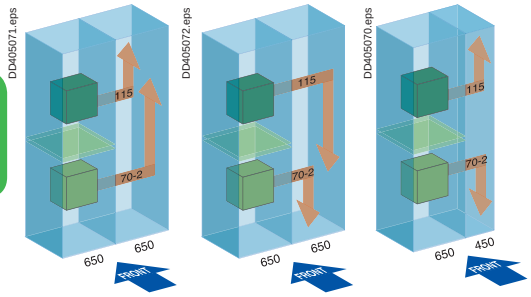
column = association of cubicles and compartments

Type of connection

	Connection	230, 115, 115-70, 70-F, 70-2 and 185 cubicles	70-M cubicle
Single front	Rear connection 		
	Side connection 		
Double front	Back to back 		

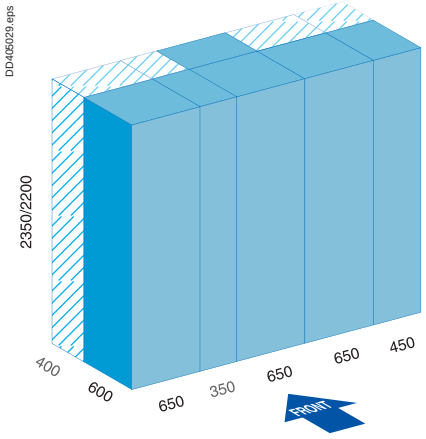
A device cubicle **B** cable compartment **C** auxiliaries (option)

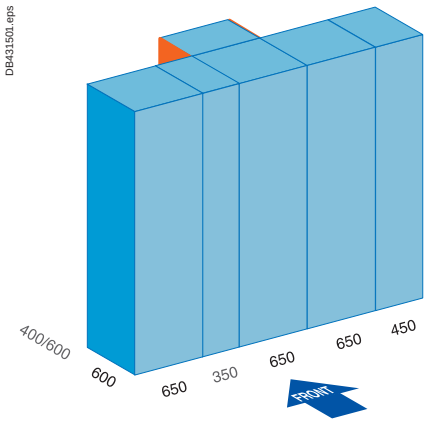
B



Particular case: 115/70-2 SC cubicles

In case of a 115/70-2 cubicle, the type of connection of the 115 and 70-2 FUs can require specific dimensions for the lateral cable compartment if the FUs are both top- or bottom-connected:
■ **in that case, the compartment must be 650 mm wide.**





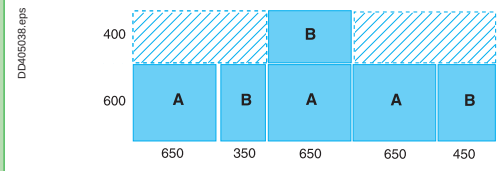
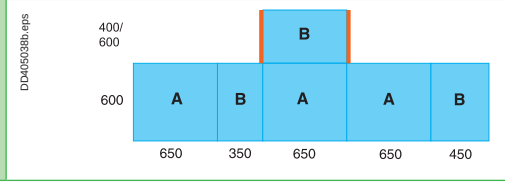
complementary rear compartments

lateral panel to be manufactured according to supplied drawing

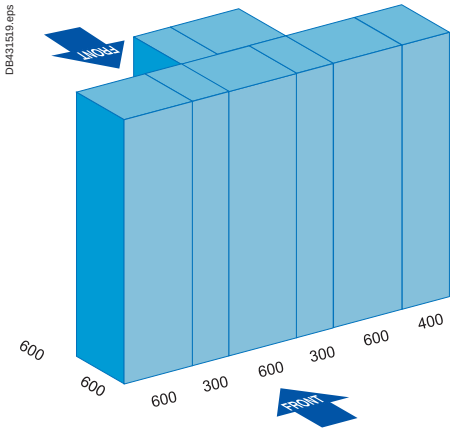
Particular case: RC column + SC column

If the switchboard is made up of both RC and SC columns, Okken gives you the following choice :
■ either a constant depth is ensured throughout the whole switchboard's length, by the addition of RC compartments at the back of the SC columns
■ or allowing a variable depth, while ensuring the panelling of the deepest RC column by the addition of specific lateral panels.

Example of rear + lateral connection

switchboard depth 1000 mm throughout its whole length	
switchboard depth 600 mm for SC columns, and 1000 mm for RC column	

A device cubicle **B** cable compartment

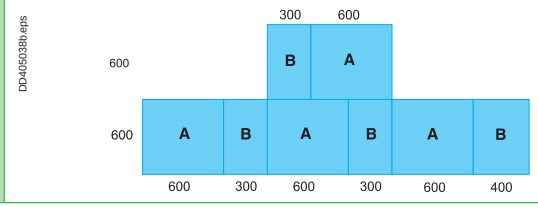


Particular case: side + back to back connection

If the switchboard is made up of both back to back and side connection cubicles, Okken gives you the following choice:
- either a constant depth is ensured throughout the whole switchboard's length, by the addition of rear connection compartments at the back of the side connection cubicles,
- or allowing a variable depth, while ensuring the panelling of the deepest rear connection cubicle by the addition of specific lateral panels.

Example of back to back + lateral connection

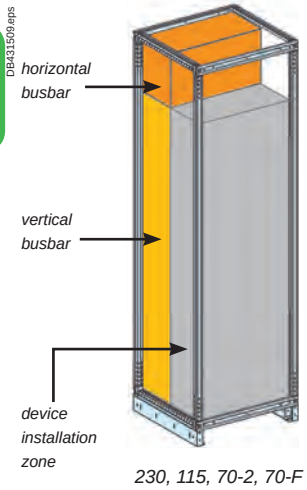
switchboard depth 600 mm for back to back column



A device cubicle

B cable compartment

B



230, 115, 70-2, 70-F and 185 cubicles

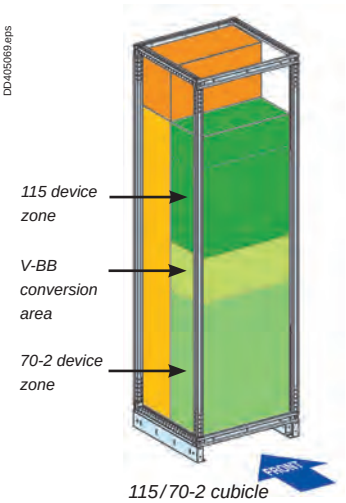
Device cubicles architecture

Device installation zone in W1150mm and W650mm cubicles

Single horizontal busbar				
Cubicle height	2200 mm		2350 mm	
No. of poles	3P	3P+N	3P	3P+N
Available modularity	66 modules		72 modules	

Double horizontal busbar				
Cubicle height	2200 mm		2350 mm	
No. of poles	3P	3P+N	3P	3P+N
Available modularity	60 modules		66 modules	

Note: *1 module = 25 mm.*



115/70-2 cubicle

Special case
Device installation zone in 115/70-2 cubicle

Single and double horizontal busbars				
Cubicle height	2200 mm		2350 mm	
No. of poles	3P	3P+N	3P	3P+N
115 device zone	28 modules			
70-2 device zone	30 modules		36 modules	
V-BB conversion area	8 modules			

Note: *1 module = 25 mm.*

Device cubicles architecture (contd.)

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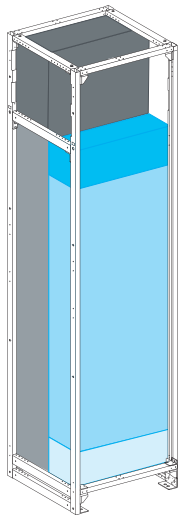

70-M cubicle

Device installation zone 70-M cubicle

Single vertical busbar

		Vertical busbar cross-section					
		20 x 8 and 30 x 8			40 x 8, 50 x 8 and 60 x 8		
Cubicle height 2350 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		72	70	68	70	68	66
Cubicle height 2200 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		66	64	62	64	62	60

Double vertical busbar

		Vertical busbar cross-section					
		20 x 8 and 30 x 8			40 x 8, 50 x 8 and 60 x 8		
Cubicle height 2350 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		70	68	64	70	68	64
Cubicle height 2200 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		64	62	58	64	62	58

For back to back connection configuration, available modularity is the same.

The plinth: for columns handling and switchboard's ventilation

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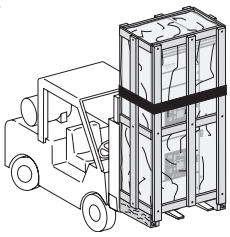

This area, always of the same height, includes a space for handling from the bottom, using a fork lift or a pallet-truck.
Anti-intrusion grids enable cool air to enter the column by natural convection in order to keep it at a normal operating temperature.
The plinth is also used to fix the switchboard to the floor.

High power electrical distribution and Power factor correction

C

Incomers / Feeders

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Masterpact NW

PB106367A24.eps

Masterpact NT

Compact NS

Choosing devices

High current incomers and feeders are realized with:
- withdrawable air circuit breakers Masterpact NW (800 to 6300 A)
- fixed or withdrawable ultra-compact air circuit breakers Masterpact NT (800 to 1600 A)
- moulded case circuit breakers Compact NS (630 to 1600 A)

They are generally used as front devices.

When equipped with electronic control unit, they can be easily a part of a communicating switchboard

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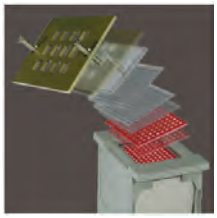

filtered breaking

056444N.tif

insulating shutters

The principle of filtered breaking in Masterpact circuit-breakers limits the switchboard's pollution.

Lockable insulating shutters (option) protect the plug-in clamps and ensures an IP3x protection.

The device can be equipped with a multi-locking system.

The "Normal-Replacement" or "Incoming-Coupling" functions are carried out in a minimum space, thanks to the association of several circuit-breakers with inter-locking systems.

Implementing in Okken switchboards

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lateral connection for cables

Masterpact NW circuit-breakers are installed in columns type 115, for power up to 4000A, and in columns type 230, for power above 4000A.
Masterpact NT and Compact NS circuit-breakers are installed in columns type 70-2 / 70-F and columns type 115.

Advanced tests have been performed to implement these circuit-breakers in Okken switchboards :
- to reduce the quantity of copper needed for the connection (from the top, the bottom or the rear)
- to ensure short-circuit current withstand (up to 150 kA rms/1sec)
- to reduce all maintenance operations.

These circuit-breaker's "customer-side" connection is standard, made by cables connected to pads linked to those of the circuit-breaker. It can be optimized with prefabricated busbar trunkings (Canalis BBT).

Connection via Canalis interface

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Okken switchboards can be connected via Canalis KT busbar trunkings.
They can either enter from the top (TDC) or from the rear (RC).

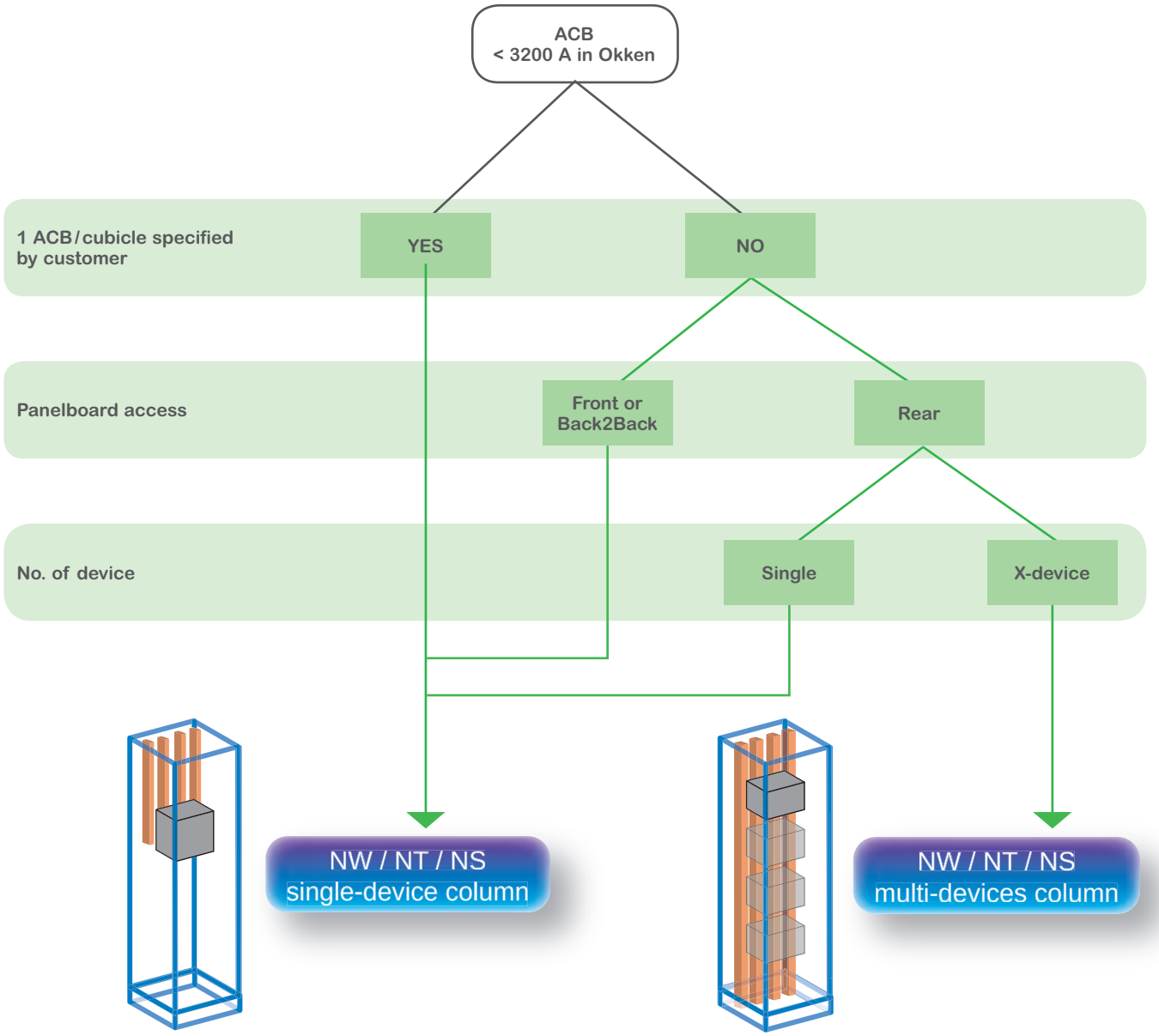
Connections are tested and qualified under normal operating conditions in terms of temperature rising and short-circuit currents (Isc). The prefabricated connections installed in the switchboard are designed to operate without derating
On site, Canalis is rapidly connected using a simple jointing unit.

Incomers / Feeders
Selection of the functional unit

In (A)	Icw max (kA)	Max. qty of circuit breakers per cubicle	Type of circuit breaker	Cubicle	In vertical busbar (A)
4000 < In < 6300	150	1	NW40b-63	 230	6300
3200 < In < 4000	100	1	NW40	 115-3	4000
		3	NW20-32	 115-2	4000
1600 < In < 3200	100	3	NW08-16	 115-1	3200
		1	NW08-32	 Single NW	3200
800 < In < 1600	100	4	NT08-16 NS 630-1600 A	 70-2	2100
	80	1	NT08-16 NS 630-1600 A	 Single NT / NS 70-F	2100

Incomers / Feeders

Choosing the type of column



Notes

Masterpact NW40b to 63
Cubicle 230

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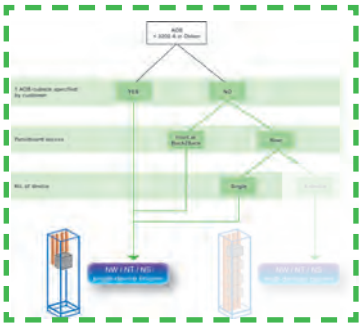


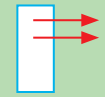
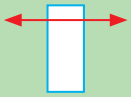
Installation rules

The cubicle

■ The 230 cubicle has two possible heights: 2350 mm or 2200 mm.
■ It accepts only one Masterpact NW40b-63 circuit breaker.

The busbars

■ The main busbar can be selected according to the position of the cubicle the switchboard:

	column location	main busbar	rated current
	end of the switchboard	double	7300 A
	middle of the switchboard	simple	2 x 4000 A

■ The height of the vertical busbar is reduced.

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The functional unit

■ The Masterpact is installed in the middle (M) of the cubicle.
■ It is connected via special pads
  □ top pads for connection to the busbar,
  □ bottom pads for connection to the load.
■ It is connected to the load by cables only.
■ As a part of a 2 incomers + 1 coupling installation, the type of connection is only the rear one.

Functional unit dimensions

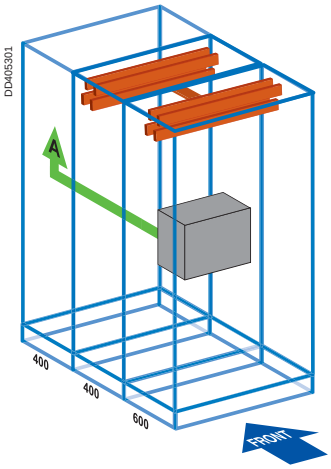
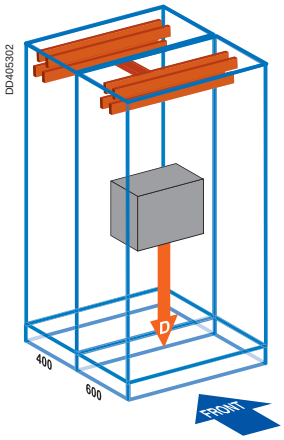
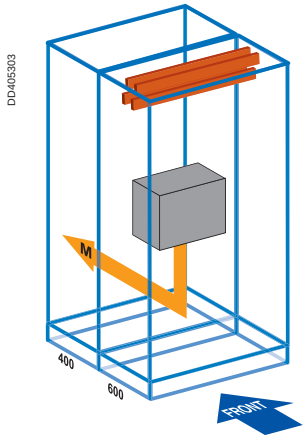
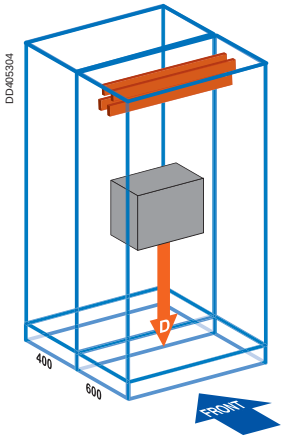
Withdrawability	Device connection	Possible device position			Modularity
		Top	Medium	Bottom	
Withdrawable	RC	-	■	-	32M
	BDC	-	■	-	32M

High power electrical distribution and power factor correction

Masterpact NW40b to 63

Cubicle 230

Type of connection

Rear connection	Bottom direct connection
Double horizontal busbar	
	
Single horizontal busbar	
	

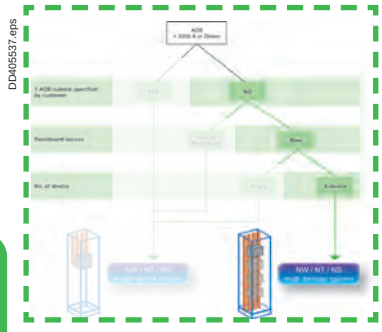
D direct connection

Rear connection from the top or the bottom

A A: Additionnal= 800 mm

M M : medium = 400 mm

Masterpact NW40
Cubicle 115-3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Installation rules

The cubicle

- The 115-3 cubicle has two possible heights: 2350 mm or 2200 mm.
- It can accept up to 2 Masterpact NW40 circuit breakers if they don't operate simultaneously.
- The forced ventilation optimises the busbar and device derating.

The functional unit

- Each device can be used as incomers or feeders.
- They can be installed at the top (T), in the middle (M) of the cubicle.

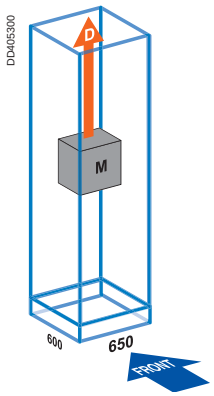
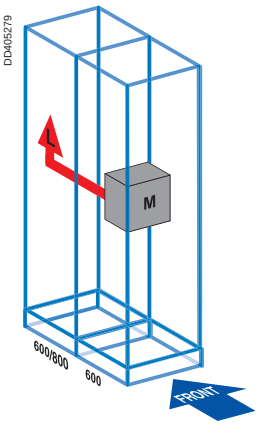
- Special connection pads are used to connect the device:
  - top pads for connection to the busbar,
  - bottom pads for connection to the load.

- Connection to the load can be done:
  - by cables, from the rear (RC),
  - or by busbar trunking, directly from the top (TDC) or from the rear (RC).

Functional unit dimensions

Withdrawability	Device connection	Possible device position			Modularity
		Top	Medium	Bottom	
Withdrawable	RC	■	■	-	19M
	TDC		■	-	19M

Type of connection (*)

Top direct connection	Rear connection
column depth 600 mm	column depth 1200 mm
 DD405300	 DD405279

(*) 2 NW4000A can be installed in the same column, if they operate alternatly

D direct connection

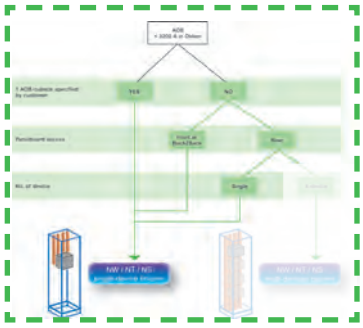
Rear connection from the top or the bottom

L: long = 600 mm

A: Additionnal= 800 mm

High power electrical distribution and power factor correction

Masterpact NW08 to 32
Cubicle Single NW


DD405537.eps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Installation rules

The cubicle

■ The single NW column is used exclusively for mounting a single withdrawable Masterpact NW08-32 circuit breaker.
■ It is 2350 mm or 2200 mm high.
■ The forced ventilation optimises the busbar and device derating.

The functional unit

■ The size of the busbar does not allow any other functional units to be added.
■ The device can be used as an incomer or a feeder.
■ It must be installed at the top of the cubicle.
■ The free area under the device can be used to install auxiliaries or measuring instruments.

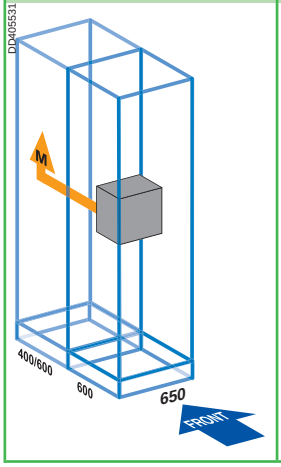
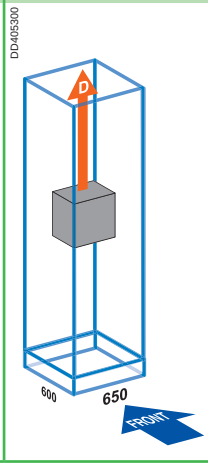
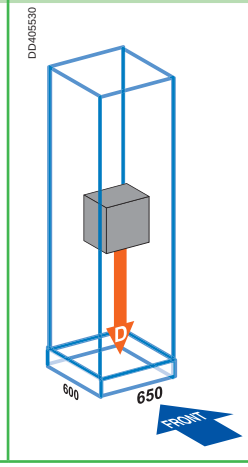
■ The device is connected via its standard connection pads:
  □ top pads for connection to the busbar,
  □ bottom pads for connection to the load.

■ Connection to the load is:
  □ by cables, directly from bottom (BDC), from the rear (RC) or from the top (TDC),
  □ by busbar trunking, directly from the top (TDC) or from the rear (RC).

Functional unit dimensions

Withdrawability	Device connection	Possible device position			Modularity
		Top	Medium	Bottom	
Withdrawable	RC	■	-	-	19M
	BDC	■	-	-	19M
	TDC	■	■	-	19M

Type of connection

Rear connection	Top direct connection	Bottom direct connection
column depth 1000/1200 mm	**column depth** 600 mm	**column depth** 600 mm
 DD405531	 DD405300	 DD405530

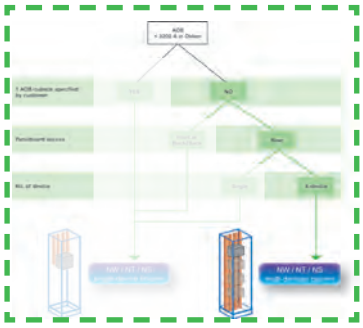
D direct connection

Rear connections from the top or the bottom:

M : medium = 400 mm

Masterpact NW08 to 32
Masterpact NT/Compact NS
Cubicle 115-2

DD405537.eps



PB120120.eps

Installation rules

The cubicle

- The 115-2 cubicle has two possible heights: 2350 mm or 2200 mm.
- It can accept:
  - 3 Masterpact NW/NT08-16 or Compact NS800-1600 circuit breakers max. if the height of the column is 2350 mm,
  - 2 Masterpact NW/NT08-16 or Compact NS800-1600 circuit breakers max. if the height of the column is 2200 mm.
- The forced ventilation optimises the busbar and device derating.

The functional unit

- Each device can be used as incomers or feeders.
- They can be installed at the top (T), in the middle (M) or at the bottom (B) of the cubicle.

- Special connection pads are used to connect the device:
  - top pads for connection to the busbar,
  - bottom pads for connection to the load.

- Connection to the load can be done by cables, from the top (TDC) or from the rear (RC).

Functional unit dimensions

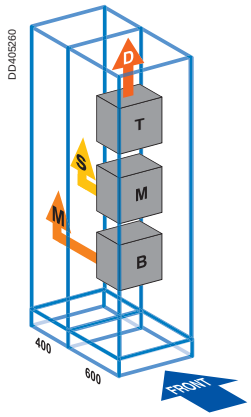
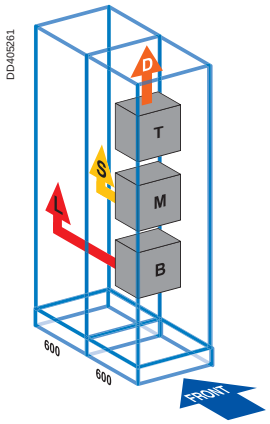
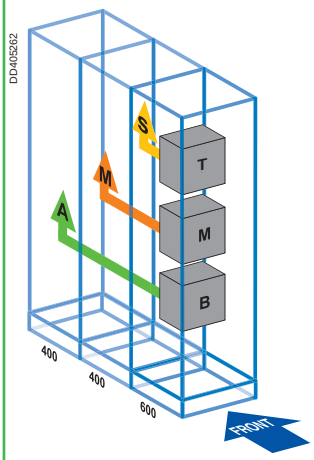
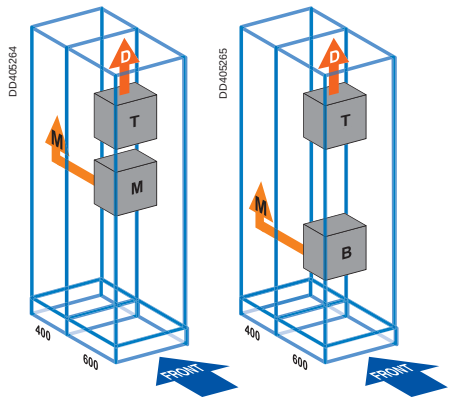
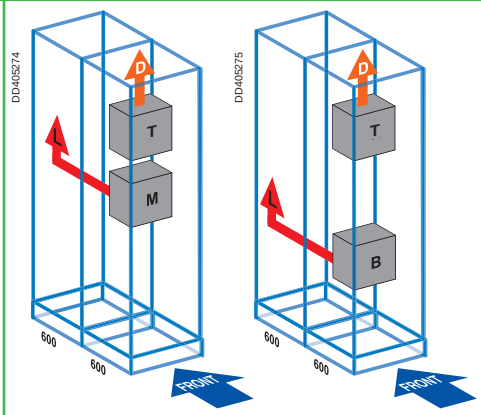
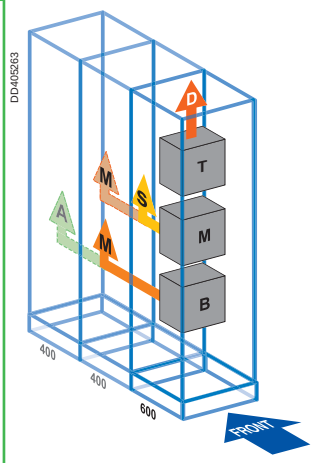
Withdrawability	Device	Device connection	Possible device position			Modularity
			Top	Medium	Bottom	
Withdrawable	NW08-32	RC	■	■	■	19M
		TDC	■	■	■	19M
	NT/NS	RC	■	■	■	19M
		TDC	■	■	■	19M

High power electrical distribution and power factor correction

Masterpact NW08 to 32
Masterpact NT/Compact NS
Cubicle 115-2

Type of connection

Rear and top direct connections

	column depth 1000 mm	column depth 1200 mm	column depth 1400 mm
Compact NS800-1600 Masterpact NW/NT08-16			
Masterpact NW20-32			

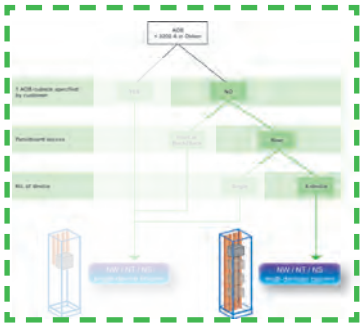
D direct connection

Rear connections from the top or the bottom

- S: short= 250 mm
- M: medium= 400 mm
- L: long = 600 mm
- A: additionnal = 800 mm

Masterpact NW08 to 32
Masterpact NT/Compact NS
Cubicle 115-1

DD405537.eps



PB120120.eps

Installation rules

The cubicle

- The 115-1 cubicle has two possible heights: 2350 mm or 2200 mm.
- It can accept:
  - 3 Masterpact NW/NT08-16 or Compact NS800-1600 circuit breakers max. if the height of the column is 2350 mm,
  - 2 Masterpact NW/NT08-16 or Compact NS800-1600 circuit breakers max. if the height of the column is 2200 mm.
- The forced ventilation optimises the busbar and device derating.

The functional unit

- Each device can be used as incomers or feeders.
- They can be installed at the top (T), in the middle (M) or at the bottom (B) of the cubicle.

- Special connection pads are used to connect the device:
  - top pads for connection to the busbar,
  - bottom pads for connection to the load.

- Connection to the load is:
  - by cables, directly from the top (TDC), directly from bottom (BDC), from the side (SC) or from the rear (RC),
  - or by busbar trunking, directly from the top (TDC) or from the rear (RC).

Functional unit dimensions

Withdrawability	Device	Device connection	Possible device position			Modularity
			Top	Medium	Bottom	
Withdrawable	NW08-32	RC	■	■	■	19M
		TDC	■	■	■	19M
		BDC	■	■	■	19M
		SC	■	■	■	19M
	NT/NS	RC	■	■	■	19M
		TDC	■	■	■	19M
		BDC	■	■	■	19M

High power electrical distribution and power factor correction

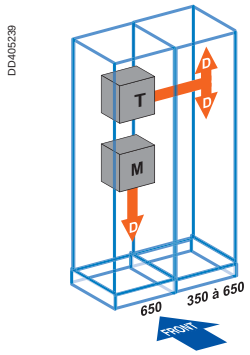
Masterpact NW08 to 32
Masterpact NT/Compact NS
Cubicle 115-1

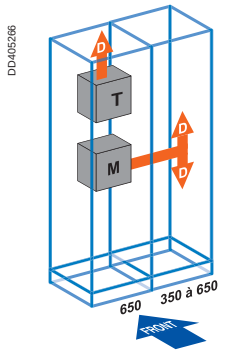
Type of connection

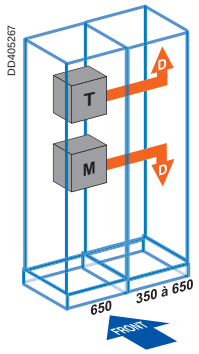
Side connection, depth 600 mm — **Top and bottom direct connection**

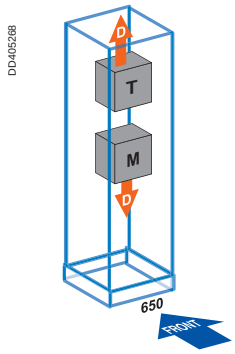
column width 350/450/650 mm

Masterpact NW/NT08-16



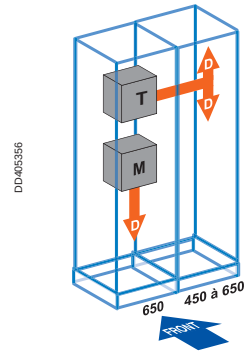


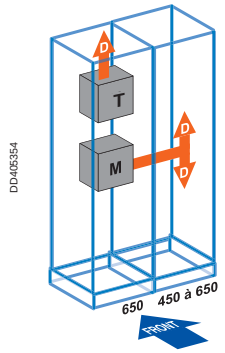


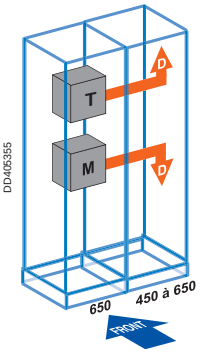


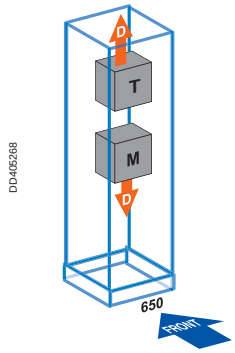
column width 650 + 450/650 mm

Masterpact NW20-32





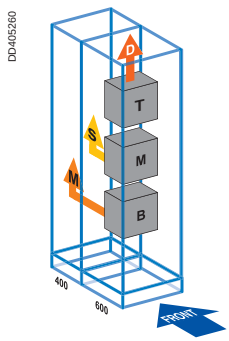


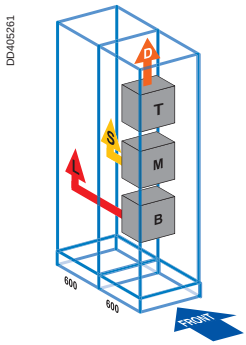


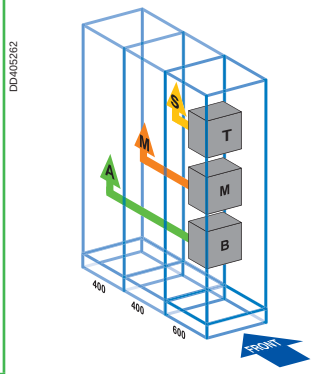
Rear and top direct connections, width 650 mm

column depth 1000 mm — **column depth 1200 mm** — **column depth 1400 mm**

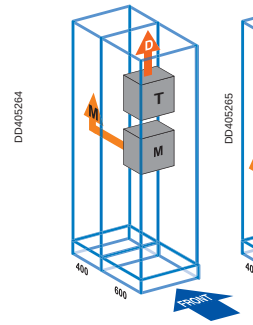
Compact NS800-1600
Masterpact NW/NT08-16

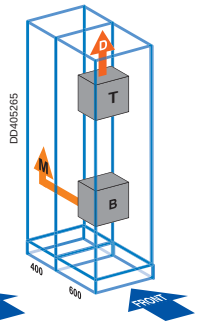


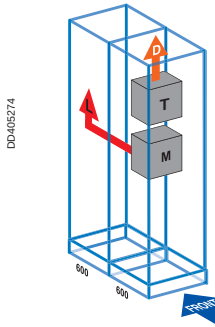


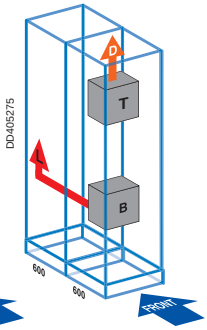


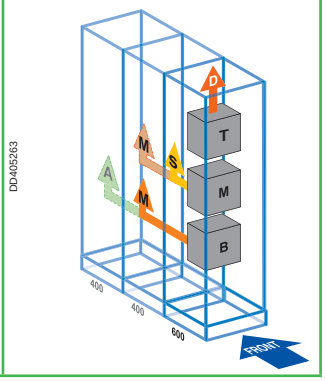
Masterpact NW20-32











D direct connection

Rear connections from the top or the bottom

S: short= 250 mm

L: long = 600 mm

M: medium= 400 mm

A: additionnal = 800 mm

Masterpact NT
Cubicle 70-F

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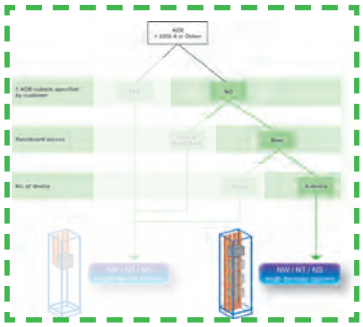

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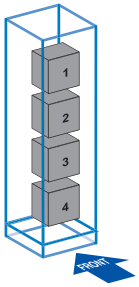


Installation rules

The cubicle

- The 70-F cubicle has two possible heights: 2350 mm ou 2200 mm.
- It can accept:
  - distribution feeders less than 630A
  - a Masterpact NT08-16 up to 1600A.
- The forced ventilation optimises the busbar and device derating.

The functional unit

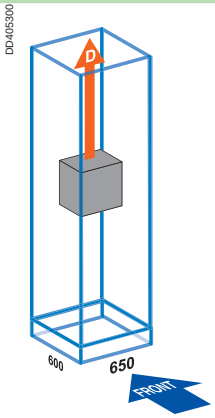
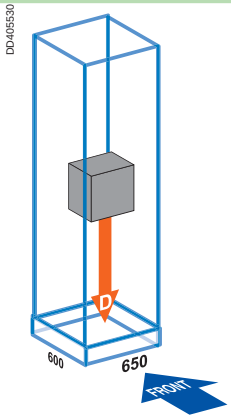
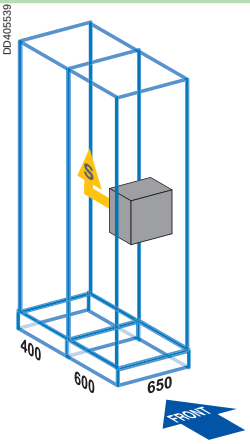
- The device is connected via its standard connection pads:
  - top pads for connection to the busbar,
  - bottom pads for connection to the load.

- In this column, connection cannot be made by prefabricated Busbar Trunkings (BBT). Connection to the load is only made by cables; the cables are connected directly from the top (TDC), directly from bottom (BDC) or from the rear (RC).

Functional unit dimensions

Withdrawability	Device connection	Possible device position				Modularity
		Top	Middle		Bottom	
		1	2	3	4	
Fixed	RC	■	-	-	-	18M
	TDC	■	-	-	-	36M
	BDC	-	-	■	-	36M
	SC	■	-	-	-	30M

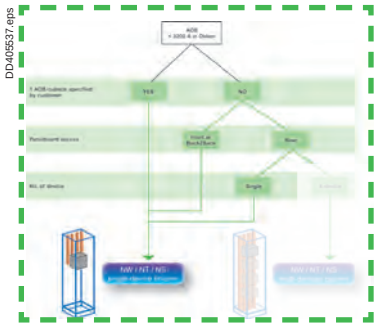
Type of connection

Top direct connection	Bottom direct connection	Rear connection
column depth 600 mm	column depth 600 mm	column depth 600 / 1000 mm
DD405300  	DD405530  	DD405539 

D direct connection

Rear connections from the top or the bottom:

S: short = 250 mm



Installation rules

The cubicle

- The single NT/NS column is used exclusively for mounting a single Masterpact NT08-16 or Compact NS800-1600 circuit breaker.
- It is 2350 mm or 2200 mm high.
- The single NT/NS column is 450 mm wide and has a standard depth of 600 mm.
- The components on its front panel (front plates, doors, etc.) are specific to this device.
- The forced ventilation optimises the busbar and device derating.

The functional unit

- The size of the busbar does not allow any other functional units to be added.
- The device can be used as an incomer or a feeder.
- It must be installed at the top of the cubicle.
- The free area under the device can be used to install auxiliaries or measuring instruments.

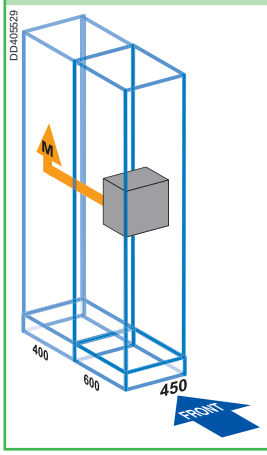
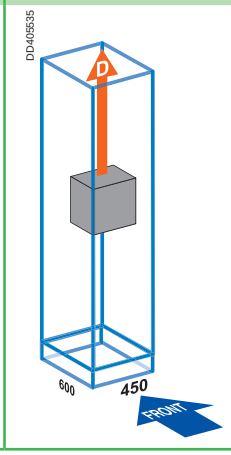
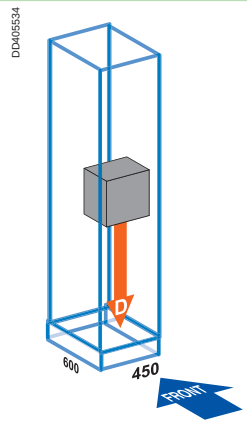
- The device is connected via its standard connection pads:
  - top pads for connection to the busbar,
  - bottom pads for connection to the load.

- It is connected to the load by cables; the cables are connected directly from the top (TDC), directly from bottom (BDC), or from the rear (RC).

Functional unit dimensions

Withdrawability	Device connection	Possible device position			Modularity
		Top	Middle	Bottom	
Withdrawable	RC	■	-	-	18M
	TDC	■	-	-	18M
	BDC	■	-	-	18M

Type of connection

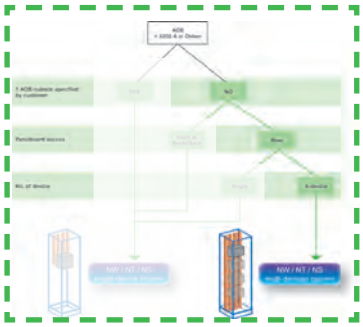
Rear connection	Top direct connection	Bottom direct connection
column depth 1000/1200 mm	**column depth** 600 mm	**column depth** 600 mms
		

D direct connection

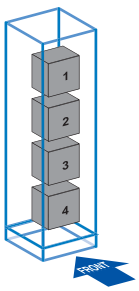
Rear connections from the top or the bottom:

M M : medium = 400 mm

Masterpack NT / Compact NS
Cubicle 70-2


DD405537.eps


PB120110.eps



DB431514.eps

C

Installation rules

The cubicle

- The 70-2 cubicle has two possible heights: 2350 mm or 2200 mm.
- It can accept:
  - feeders,
  - Masterpact NT08-16 or Compact NS800-1600 circuit breakers up to 1600 A.
- The forced ventilation optimises the busbar and device derating.

The functional unit

- These devices can:
  - be used as feeders or incomers,
  - be a maximum of 4 connected from the rear in a 2350 mm cubicle and 3 in a 2200 mm cubicle.

- The device is connected via its standard connection pads:
  - top pads for connection to the busbar,
  - bottom pads for connection to the load.

- It is connected to the load only by cables ; the cables are connected directly from the top (TDC), directly from bottom (BDC), from the side (SC) or from the rear (RC). Busbars trunking is not possible

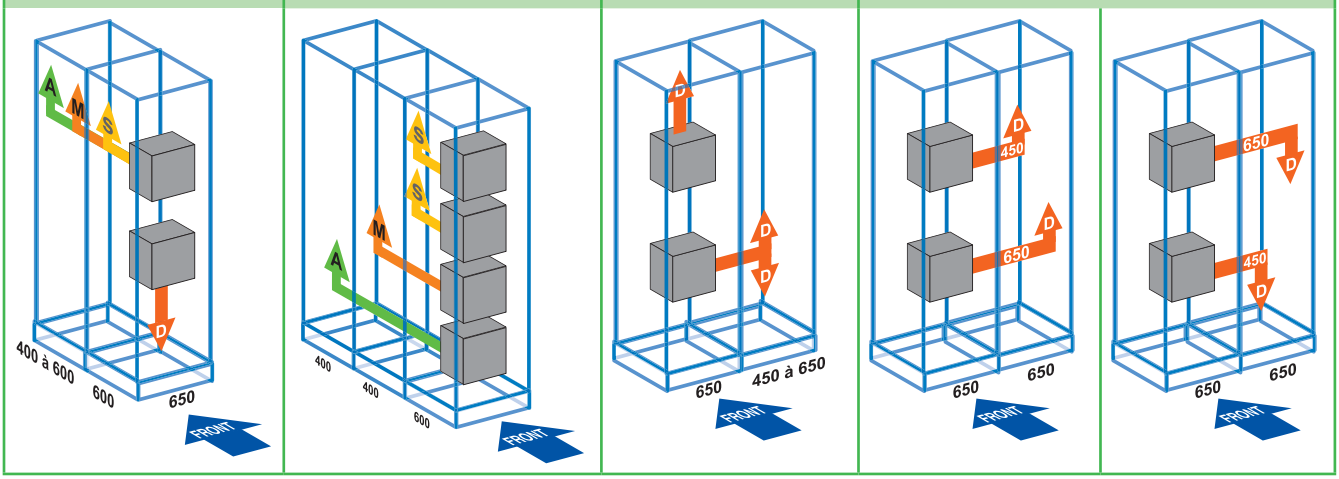
Functional unit dimensions

Withdrawability	Device connection	Possible device position				Modularity
		Top	Medium		Bottom	
			1	2		
Withdrawable	RC	■	■	■	■	18M
	TDC	■	-	-	-	30M
	BDC	-	-	-	■	36M
	SC	■	■	-	■	30M
Fixed	RC	■	■	■	■	18M
	TDC	■	-	-	-	36M
	BDC	-	■	-	■	36M
	SC	■	■	-	-	30M

High power electrical distribution and power factor correction
Masterpact NT/Compact NS
Cubicle 70-2

Type of connection - Configuration examples

Rear and bottom direct connection		Side and top direct connection	
column depth 1000 to 1200 mm	column depth1400 mm	column width 650 + 450/650 mm	column width 650 + 650 mm



D direct connection

Rear connections from the top or the bottom:

- S: short= 250 mm
- M: medium= 400 mm
- L: long= 600 mm
- A: additionnal= 800 mm

Source changeover switches
Cubicles 115

General rules

- The interlocking is made with cables.
- The installation and connection components are identical to those for feeders/ incomers.
- A W250 mm compartment to the right of the device cubicle is compulsory, to provide access to the interlocking.

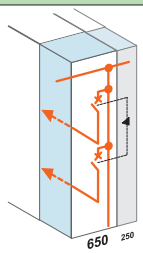
The diagrams below deals only with the installation of Masterpact NW08-32 and NT08-16/Compact NS08-16 in cubicles with 115-1 and 115-2 V-BB.

According to the devices installation configurations, the following diagrams can be carried out:

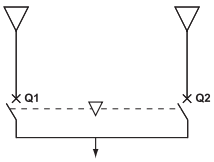
Type of mechanical interlocking	Combinations

2 devices

DD405353.eps



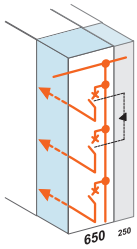
DD405232



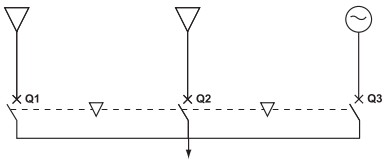
Q1	Q2
0	0
0	1
1	0

3 devices: 2 "Normal" sources + 1 "Replacement" source

DD405381.eps



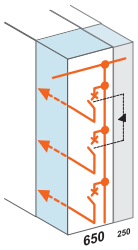
DD405276



Q1	Q2	Q3
0	0	0
1	0	0
0	0	1
1	1	0
0	1	0

3 devices: 3 sources, a single device closed

DD405381.eps



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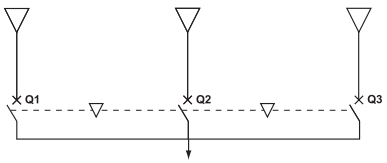


Q1	Q2	Q3
0	0	0
1	0	0
0	1	0
0	0	1

0 = normally open (NO)
1 = normally closed (NC)

High power electrical distribution and power factor correction

Coupling

C

General rules

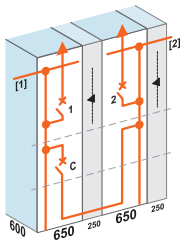
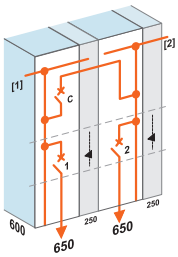
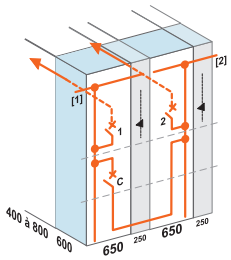
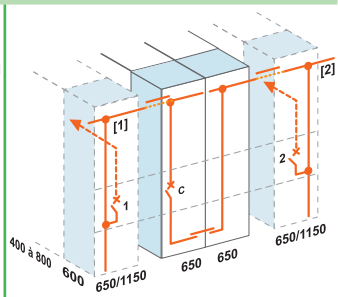
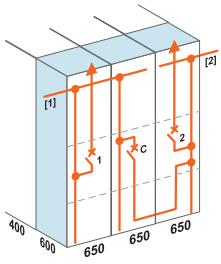
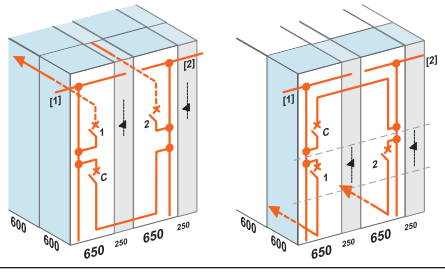
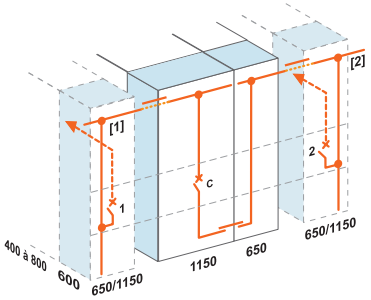
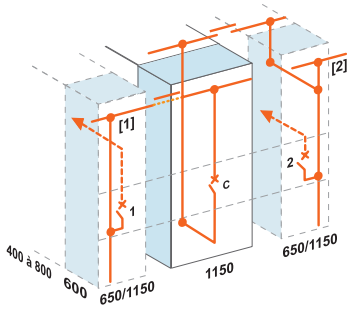
In a 115 V-BB column:

- The 2 incoming devices and the coupling device must be of the same type:
  - 3 NW
  - 3 NT
  - 3 NS.
- The installation items to be ordered for the 3 devices are standard, but an insulating screen for the coupling area has to be added.
- **Interlocking**:
  - electrical interlocking is recomended
  - for mechanical interlocking, a W250 mm compartment to the right of the device cubicle is compulsory, as well as mechanical adaptation. Contact your technical support.

In column 230:

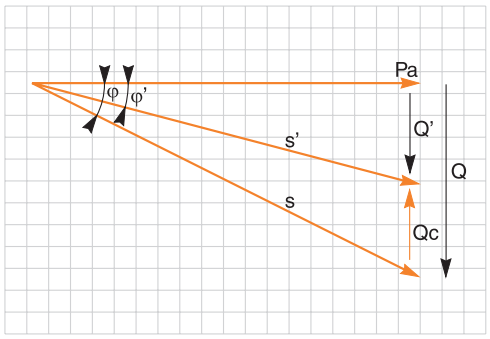
- Feeders and incoming devices are installed in columns to the left or the right of the coupling column.

Coupling panorama

Coupling devices	Type of connection			
	TDC	**BDC**	**RC**	
Masterpact NW08-32 Masterpact NT08-16 Compact NS800-1600			 Adjacent cubicles	 Non adjacent cubicles
Masterpact NW40				
Masterpact NW40b-63 DHBB				
Masterpact NW40b SHBB				

Power factor correction and harmonic filtering

DB109689.eps



Electrical network pollution

Asynchronous motors, transformers, reactors and static converters are the biggest consumers of reactive energy.
The main consequences are:
- overheating,
- line power losses,
- voltage drops,
- increased contractual demand.

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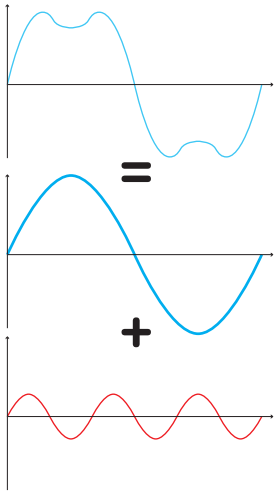


Devices using power electronics (variable speed drives, rectifiers, UPS, arc furnaces, fluorescent lamps, etc.) are responsible for the circulation of harmonic currents in electrical networks.
The main consequences are:
- interference with the operation of many devices,
- early ageing (breakdown) of capacitors.

The reactive components

PB120117.eps

VarPlus Can

VarPlus Can are low voltage aluminium can capacitors specially designed to deliver a long working life with low reduced power losses in standard, heavy-duty and severe operating conditions.

PB100929.tif

Detuned reactors

Detuned reactors are specific three phase inductors dedicated to attenuating the amplification of harmonics on highly polluted networks and to protecting the different components of the installation.

Power factor correction and harmonic filtering

PB120116.eps

DB431513.eps

Installation rules

Power factor correction functional units are installed in a specific cubicle:
- no vertical busbar,
- 650 mm width.

The functional units are connected to the horizontal busbar through a specific distribution busbar.
This specific distribution busbar can be installed at the top or at the bottom of the cubicle.

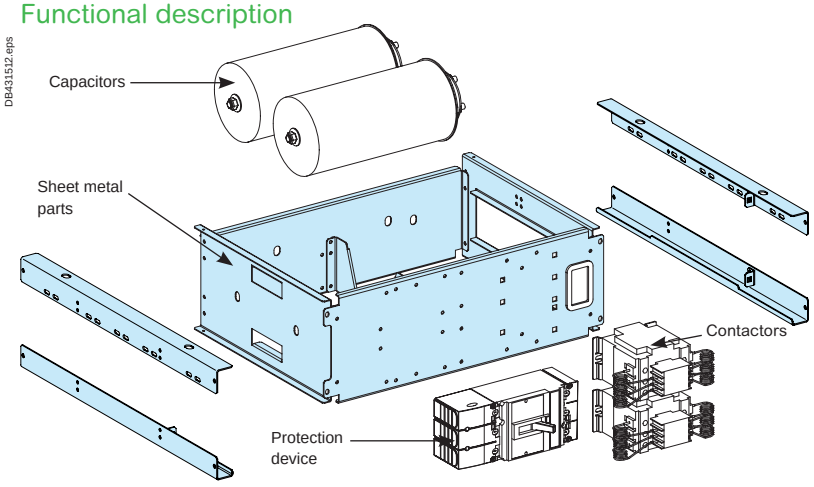
Functional units have 1, 2 or 3 capacitors.
The capacitors are controlled through 1 or 2 contactors ans protected with a circuit breaker.

Detuned reactor is installed in lateral W450 mm compartment.

C

Functional description

DB431512.eps



Functional unit dimensions

Max. modularity for 415 V - 50 Hz											
Current (A)	12.7	15	25.4	29.8	30	38.1	45	50	50.8	59.6	100
Reactive power	8M										

Busbar dimensions

Max. modularity		
Busbar position	TDC	BDC
Modularity	8M	

Power factor correction and harmonic filtering

PD405098.eps

Extractor fan on the front panel

PD405099.tif

Air outlet on the rear panel

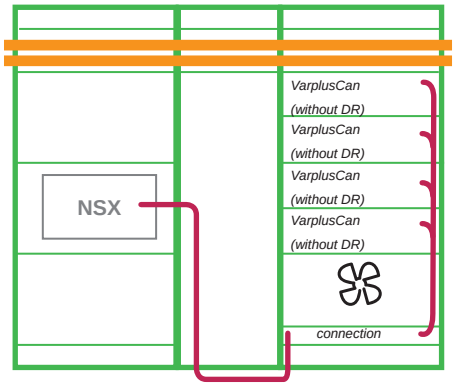
Product installation

The solution can be combined with the Varlogic N option: automated step control depending on the reactive power measured (up to 10 sequences).
It also controls the discharge time (1 minute) of the capacitors to protect them against early ageing.

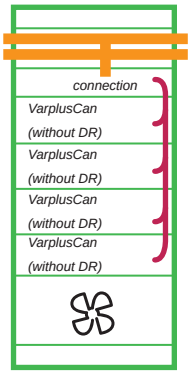
For optimised operation and to ensure the durability of the power factor correction and filtering components, the power factor correction and harmonic filtering column must be ventilated.
It will therefore be fitted with:
- an extractor fan behing a grill, at the bottom of the front panel,
- an air outlet on the rear panel.

Examples of Okken "Power factor correction and filtering" configurations

Without Detuned Reactor

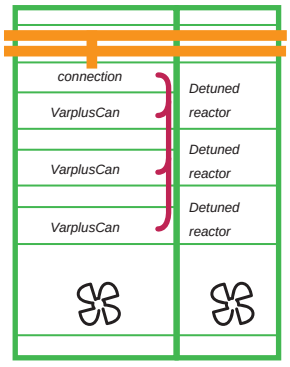


External protection, bottom connection

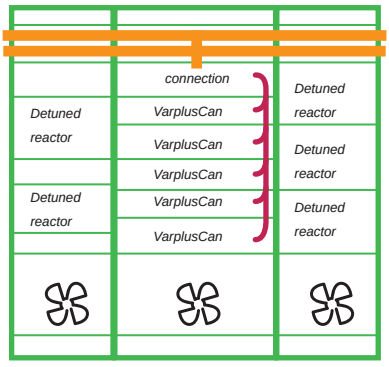


Internal protection, top connection

With Detuned Reactor



Internal protection, top connection.



Internal protection, top connection.

Max performance per cubicle

Pollution level of harmonics	Cubicle size (mm)	Rated voltage (V)	Step size (kvar)	Max rating per cubicle (A)
lower than 20%	D600 x H2350 x W650	415	50	600
		690	40	400
up to 50% using detuned reactors	D600 x H2350 x W1550	415	50	300
		690	25	125

Power factor correction and harmonic filtering

63430_main.eps

VarPlus Logic

VarPlus Logic - Intelligent power factor correction controllers

VarPlus Logic is a simple and intelligent relay which measures monitors and controls the reactive energy.
It offers a fast power factor correction while monitoring the real time data of the systems and alerting on preventive maintenance.

Technical data

- 90-550 V direct voltage input.
- 1 A or 5 A CT secondary compatible with 15 mA sensitivity.
- 4 quadrant operation – Suitable for operation with energy import and export.
- No restriction in step sequence.
- Inbuilt temperature monitor with fan control and alarm.
- Dedicated alarm contact and fan control relay.
- Automatic initialization and automatic step detection for fast and easy commissioning.
- Communication – RS485 communication in Modbus protocol.
- Digital inputs to control dual cos φ.

C

AccuSine+ Active filter

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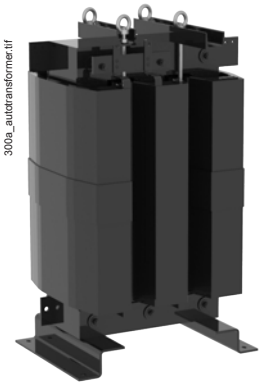
AccuSine+ Active filter

300a_autotransformer.tif



Autotransformer

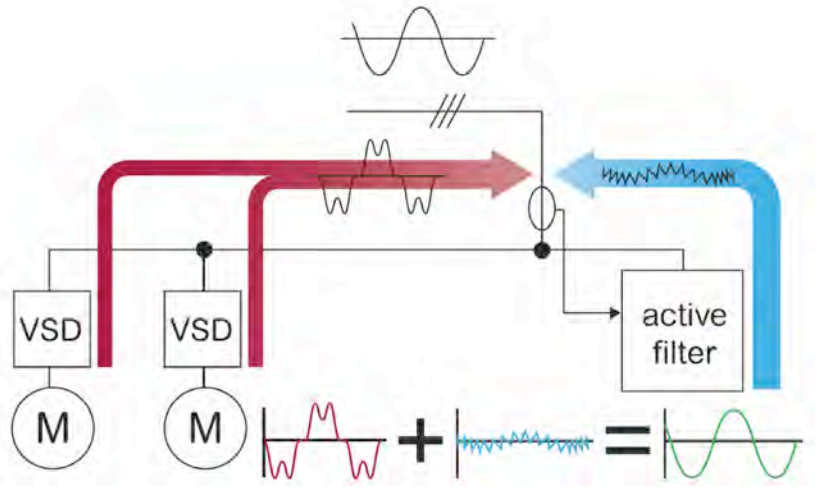
AccuSine+ Active Filter

Features

■ AccuSine+ Active filter performs both PF correction and Harmonic Filtering functions.

Features

■ Autotransformer is required in case of 690V.



Simplified illustration of AccuSine+ Active Filter (Active Filter)

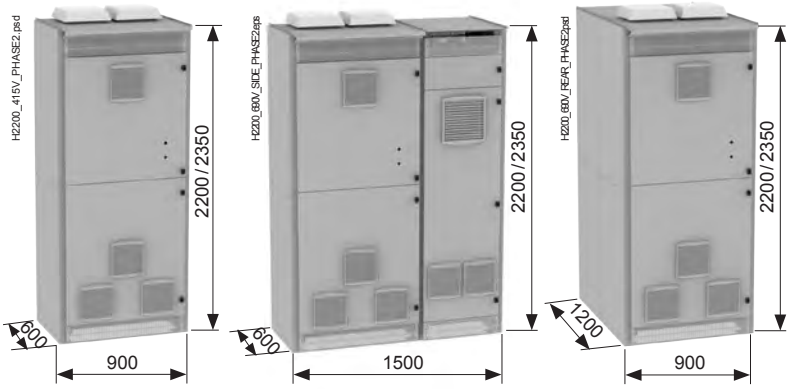
High power electrical distribution and power factor correction

AccuSine+ Active filter

Filter

- AccuSine+ Active filters provides total power factor Correction.
- It performs both PF correction and Harmonic Filtering functions.

Functional unit dimensions (200A/300A)

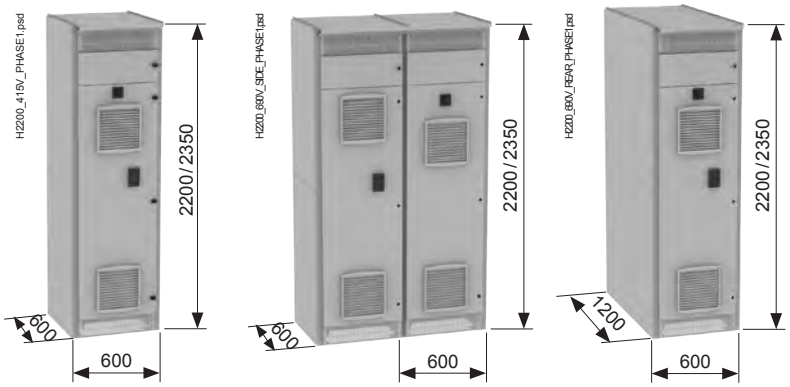


Filter mounted inside panel of W600 & D600 for 415V application

AT mounted in side compartment for 690V application.

AT mounted in rear compartment for 690V application

Functional unit description (60A/120A)



Filter mounted inside panel of W600 & D600 for 415V application

AT mounted in side compartment for 690V application.

AT mounted in rear compartment for 690V application

Functional unit information

Devices used for IP ≤ 31				
Current / Voltage	60A	120A	200A	300A
415V	NSX100S	NSX160S	NSX250HB2	NSX400HB2
	GS2J3	GS2kk3	GS2S3	GS2QQ3
690V	NSX100HB2	NSX160HB2	NSX250HB2	NSX400HB2
	GS2J3	GS2kk3	GS2S3	GS2QQ3

Power Control Centre

D

PB120115.eps

Fixed device on mounting plate (FFF)

PB120114.eps

Device on base (WWD)

D

Fixed FU

■ The fixed PCC mounting plates have been designed for installing non-priority functional units.
■ This solution provides substantial savings.
■ The option of mounting the devices on a base makes it easier to add a functional unit to a pre-equipped column.

■ The fixed PCC mounting plates allow the following types of feeders to be used:
□ a Compact NSXm 160 feeder, without Vigi and fixed mounted,
□ a Compact NSX100-250 feeder, with or without a Vigi module, fixed or base-mounted,
□ a Compact NSX400-630 feeder, with or without a Vigi module, fixed or base-mounted,
□ 2 Compact NSX100-250 feeders, without a Vigi module, fixed or base-mounted.

■ The devices are connected directly to the busbar by flexible screwed connections.
■ The customer's load can be connected either directly to the devices or via intermediate terminal blocks.

■ Form 2b can be implemented behind a common full-height door.
■ 4a can be used for mounting plates that accept only one device, by adding a horizontal separator and side covers, in addition to a separate door.

PD391161.eps

Disconnectable mounting plate FU (WFD)

■ FUs on disconnectable mounting plates are used in small distribution (iC60).
■ This solution, for front connection, optimises cost and installation capacity while giving priority to interchangeability and flexibility of live reconfiguration (*).
It requires intervention on downstream connections on extraction.
■ This FU consists of a fixed part, that can be installed and removed with power on (*), equipped with upstream double plug-in clamps and of a moving part supporting the fixed devices.
■ The downstream cables are connected to the device terminals and the auxiliaries to connectors.
■ The operating mechanisms are accessible behind the door.

058001hdr.tif

Jean Müller disconnectable fuse-switch FU (WFD)

■ Protection of distribution feeders by horizontal fuse-switch 160A (size 00) to 630A (size 3) in front connection, satisfies the habits of certain countries.
■ Okken allows functional, tested integration of such units, complying with the specifications of the fuse-switch manufacturer in order to provide the heat loss level required.
■ All the accessories equipping these devices can be implemented.
■ The downstream connections are made on terminals built into the device.
■ Access to fuses is interlocked with the switch.

(*) live work must be carried out by authorised personnel

Polyfast FU

■ This solution offers, for distribution:
- □ free addition and reconfiguration,
- □ easy modification of rating,
- □ non-propagation of arc inside the FU,
- □ racking in and racking out,
- □ cabling of power and auxiliaries circuits outside the switchboard,
- □ easy gripping.

PD405133.eps

Plug-in Polyfast FU (WWW)

■ The functional unit is made up of a fixed part, installable and removable with power on (*), equipped with double upstream and downstream plug-in clamps and with a Polyfast moving interface, supporting the fixed circuit-breaker.
■ Ergonomic handles simplify gripping of the moving part.
■ The downstream connections are made in the fixed part on connection bars in the side or rear compartment, and the auxiliaries on sliding withdrawable auxiliary blocks.

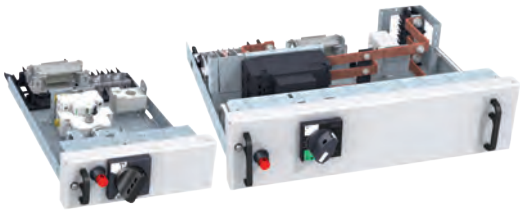
D

PD405134.eps

Disconnectable Polyfast FU (WFD)

■ Disconnectable solutions offer an economic alternative to plug-in solutions, if the skills of maintenance personnel and operating requirements allow intervention on downstream connections.
■ Same characteristics as for the plug-in Polyfast FU, except from the upstream clamps, the upstream cables connecting directly to the device upstream terminals.

PB120144.tif



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70-M drawers

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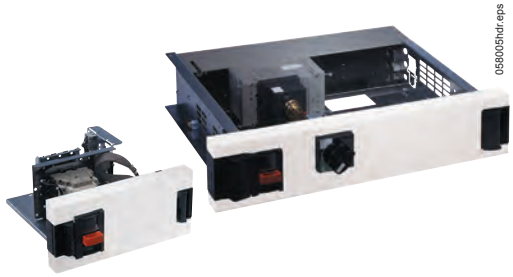

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70-2 drawers

D

Withdrawable FU in drawer (WWW)

■ The withdrawable drawer is used in a huge range of electrical distribution Functional Units, up to 630A. The drawer is used to make up a FU consisting of several mechanically attached devices, that can assume the “plug-in / test / draw-out / withdrawn” positions, allowing the padlocking procedures and incorporating the man / switchboard interface elements on the front panel.

■ In distribution, the need to indicate and control on the front panel of the FU and the necessity to padlock are the main choice criteria for this solution.

■ The fixed part is installed and removed with power on and supports the upstream and downstream plug-in clamps.

■ The moving part supports the switchgear by means of an interface or a mounting plate. It is guided in its movement and positioning, and ball bearings minimise the operating effort.

■ The “plug-in / test / draw-out” positions are mechanically marked by an indexing device associated with a mechanical indicator on the front panel.

■ The front panel of the drawer gives priority to ergonomics and intuition of operations by the arrangement of the locking facilities and operating mechanisms.

■ Access to the inside of the drawer may be necessary during operation, to make settings or carry out a thermographic check. A deliberate opening by swivelling the front panel is possible using a tool.

■ Operator protection is ensured by a mechanical device disabling working when the protection device is closed (for drawers equipped with Compact NSX range).

■ An IP 2X degree of protection is maintained in the test and draw-out positions.

■ Locking is possible in all positions by a padlock (3 padlocks not supplied), as is also padlocking of empty compartments.

Drawer position indicator

Drawers operation is very simple. Using the red indexing pushbutton, the operator can simply move the drawer in the “plug-in / test / draw-out” positions.
Each position is mechanically marked with an indicator on the drawer.

PD405116.eps

PD405119.eps

70-M drawers

PB120136.eps

70-2 drawers

PB120136.eps

(*) live work must be carried out by authorised personnel

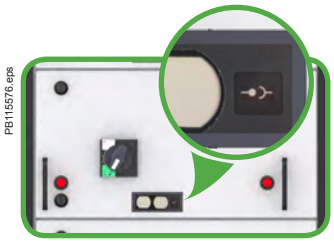
Drawer positions

Closed door racking

Connected
- The functional unit is operational.
- Power and auxiliaries are connected.

Test
- The functional unit is not operational.
- Only auxiliaries are connected.
- Allow padlocking.
- It allows the functional unit verification.
- Allow maintenance on the process.

Disconnected
- The functional unit is not operational.
- Power and auxiliaries are disconnected.
- The drawer can be fully extracted.
- Allow quick replacement.
- Allow switchboard live change.



70-M

70-2

Plug-in
- The functional unit is operational.
- Power and auxiliaries are connected.

Test
- The functional unit is not operational.
- Only auxiliaries are connected.
- Allow padlocking.
- It allows the functional unit verification.
- Allow maintenance on the process.

Draw out
- The functional unit is not operational.
- Power and auxiliaries are disconnected.
- Allow maintenance on the process.

Withdrawn
- The drawer can be fully extracted.
- Allow quick replacement.
- Allow switchboard live change.

D

PB120143.eps

PB120147.eps

Rotating racking mechanism

Closed Door Racking (WWW)

■ It is a drawer option which:
  □ makes it possible to do all drawer operations with its unit door remaining closed (rack in, test, rack out) ;
  □ on disconnected position, drawer is mechanically blocked.

■ Through a rotating racking mechanism, the stabs from the disconnect can be withdrawn from the busbar. This operation can be done through the use of a cranking tool through the front of the unit, with the door closed.

■ With the retractable disconnect, the stabs will be disconnected from the busbar with enough clearance to perform maintenance without removing the drawer from the section.

■ The inbuilt window will provide the status though a mechanical indication which will operate as the stabs are retracted.

■ Degree of protection: IP31 to IP54.

■ It is internal arc resistant.

Drawer position indicator

The indicator is tied to the disconnect, therefore it is a true mechanical representation of the position of the disconnect.

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Connected

PB120145.eps

Test

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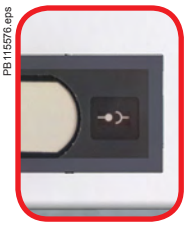
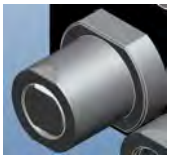


Disconnected

Button position

An activator button enables to to engage the racking mechanism.
The racking operation will be engaged once the button is pressed.



Pushed in

■ The button stays recessed once pushed.

Half-way pushed in

■ The button will come out half way once the racking starts as an indication that racking is in progress.

Completely out

■ The button will come completely out once it has reached the end of travel for the racking operation.

■ The button has a protruded hole to provide a means to LOTO.

Notes

Selection of functional unit

Selection of the functional unit - rated 415 V - 50/60 Hz - IP31/35°C

Circuit breaker	In (A) 0	16	63	100	125	160	250	400	630	Cubicle
Drawer (WWW)										
iC60	4M half width									
NG125	6M half width	6M (3P) & 8M (4P)								
NSXm100	6M half width & 6M full									
NSXm160				6M (3P) & 8M (4P)						
NSX100	6M half width	6M (3P) & 8M (4P)								
NSX160				6M (3P) & 8M (4P)						
NSX250						8M				
NSX400							10M			
NSX630								12M (3P) & 14M (4P)		
iC60	6M half width									
NSXm100		8M (3P & 4P)								
NSXm160				8M (3P & 4P)						
NSX100		8M (3P & 4P)								
NSX160				8M (3P & 4P)						
NSX250						8M (3P & 4P)				
NSX400							12M (3P & 4P)			
NSX630								12M (3P & 4P)		
NS630								12M (3P) & 14M (4P)		
Fixed (FFF)										
NSXm100	4M (3P) & 6M (4P)									
NSXm160					4M (3P) & 6M (4P)					
NSX100		8M								
NSX160				8M						
NSX250						8M				
NSX400							10M			
NSX630								10M		
Disconnectable mounting plate (WFD)										
SASIL00						2M				
SASIL01							3M			
SASIL02								6M		
SASIL03									6M	

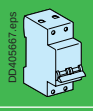
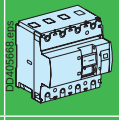
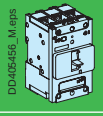
70-M

70-2

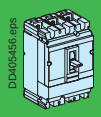
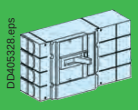
70-F

185

Panorama of configurations

device	iC60			NG125	NSXm 100/160		
							
technology	mounting plate	drawer		drawer	drawer	fixed mounting plate fixed device	
form	2b	3b/4b		3b/4b	3b/4b	2b	3b/4a
types of device connection	SC	SC RC	SC RC	SC RC	SC RC	SC RC	SC RC
front face	common door	individual front face	individual front face	individual front face	individual front face	common door	individual door
toggle control	•					•	
direct rotary handle						•	
motor mechanism							
extended rotary handle		•	•	•	•		•
Vigi block	•	•					
residual current relay							

D

device	NSX100/630										SASIL
											
technology	Polyfast				drawer		fixed mounting plate				Jean Müller mounting plate
	disconnectable		plug-in				fixed device		device on base		
form	3b	4a	3b	4b	3b/4b		2b	3b/4a	2b	3b/4a	3b/4b
types of device connection	SC	SC	SC RC	SC RC	SC RC	SC RC	SC RC	SC RC	SC RC	SC RC	SC
front face	common door	individual door	common door	individual door	individual front face	individual front face	common door	individual door	common door	individual door	individual front face
toggle control	•		•				•		•		-
direct rotary handle	•		•				•		•		-
motor control handle	•		•				•		• *(2)*		-
extended motor control handle		•		•	•	•		•		•	-
Vigi block							• *(1)*	• *(1)*	• *(1)*	• *(1)*	-
residual current relay	•	•	•	•	•		•	•	•	•	-

(1) except for Compact NSX100/250 on a 2-devices mounting plate.
(2) except for Compact NSX400-630.

PB105113.eps

Vigicompact NSX 100/630

PB100435_SE.eps

Earth leakage relay

Separate toroids

In Power control centers, there were two ways to add earth leakage protection to any three or four-pole Compact NSX100/630 circuit breakers equipped with a magnetic, thermal magnetic or Micrologic 2, 5 or 6 trip unit.

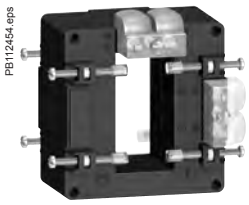
- By adding a Vigi module to the circuit breaker to form a Vigicompact NSX.
- By using a Vigirex relay and separate toroids.

Micrologic 4

Now power control centers can have earth leakage protection with new types of micrologic embedded in the NSX MCCB's.

- The Compact NSX range is now complemented with a new type of Micrologic trip unit including both circuit protection and earth leakage protection.
- It means that the earth leakage protection, lately located within the Vigi Add-on, will be embedded within the existing size of the Micrologic trip unit.
- Earth leakage protection can be achieve with MCCB with Micrologic 4 & Micrologic 7

Type and installation of current transformers



METSECT5DA●●●

METSECT5DC●●●

METSECT5MA●●●

METSECT5CC●●●

Types of current transformers

Schneider Electric Power Logic catalogue (920068E) provide a wide choice of current transformers.
The choice depends on:
- the secondary rating (5 A): R,
- the form of the internal profile according to the type and the size of the conductor passing through: FF,
- the primary current (from 40A to 6000 A): XXX.

Presentation of catalogue numbers

MET SE CT R FF XXX

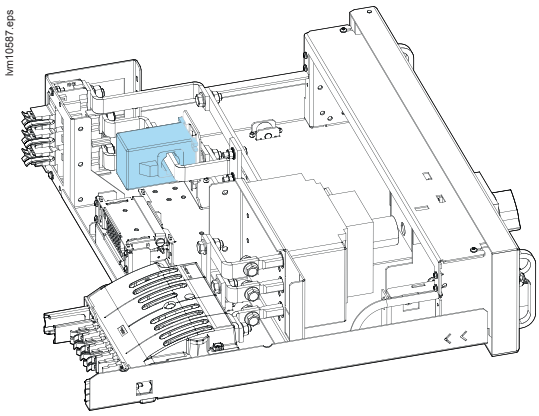
- R: First digit = secondary rating, R = 5 A mps
- FF: 2 letters = Form Factor
- XXX: Last 3 digits = primary rating / 10

D

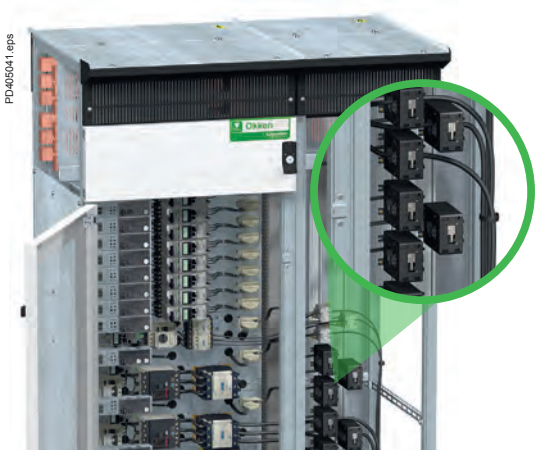
Classes and power

For measurement, Schneider Electric recommends class 1 CTs, rated output 5 VA.

Installing the current transformers



- In 70-M cubicle:
  - the CTs are in the drawer,
  - the CTs are choosen to optimize the size of the drawer.



- Distribution FUs ⩽ 630A :
  - NSX100/630 plug-in on Polyfast: on the fixed part's client connection pads
  - NSX100/630 disconnectable on Polyfast: in the late SC compartment
  - NSX100/630 Polyfast drawer: on the fixed part's client connection pads
  - ½-width drawer: in the connection compartment.

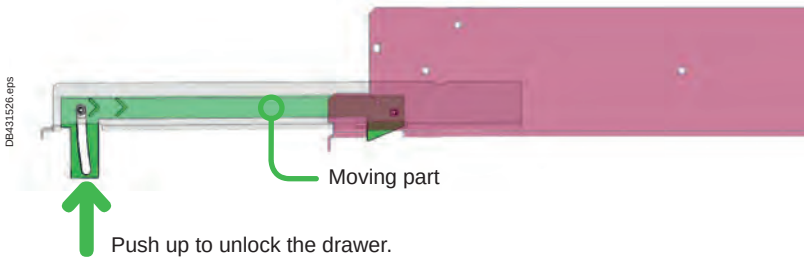
Principle

The drawer stop is a simple mechanism designed to block the drawer to avoid unintentional complete extraction.
This function is systematically integrated in 70-M cubicles.

Drawer stop positions

Drawer plugged position

Drawer in test or draw-out position



Drawer extracted position

Notes

iC60

70-2 disconnectable mounting plate

WFD

Functional unit description

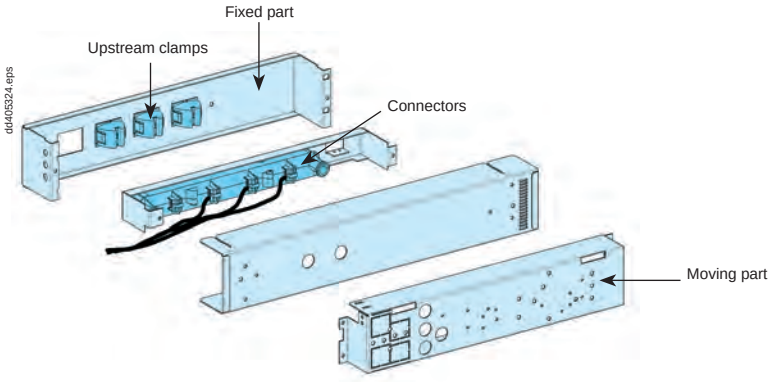
- Type of connection:
  - SC
- Control circuit supply from the busbar:
  - the mounting plate allows an easy and simplified control circuit powering from the vertical busbar (without any intervention on the busbar)
- Switchgear:
  - on-rail or screwed devices
  - distribution terminal blocks supports for power circuits
  - for auxiliary circuits: disconnectable connector recommended
- CT's installation:
  - in the lateral compartment
- Front face:
  - grouped feeders behind a plain or transparent door.

Modularity:

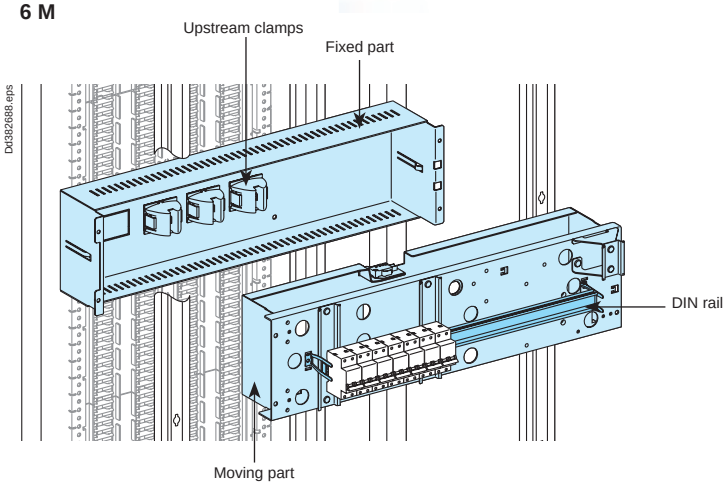
- Add 1M above the disconnectable mounting plate when it is installed right:
  - under a H-BB plate,
  - under a drawer.
- Add 1M under the disconnectable mounting plate when it is installed right:
  - at the bottom of the cubicle,
  - above a horizontal partition (for NT08-16/NS800-1600 A drawer).

Typical drawing

2 and 4 M



6 M



Example of functional unit modularity

Max. modularity for IP31/35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
iC60	2 to 6M							

Power Control Centre
NSXm100-160 and NSX100-630
70-F fixed mounting plate
FFF/WWD

PB120114.eps

PB120115.eps

Functional unit description

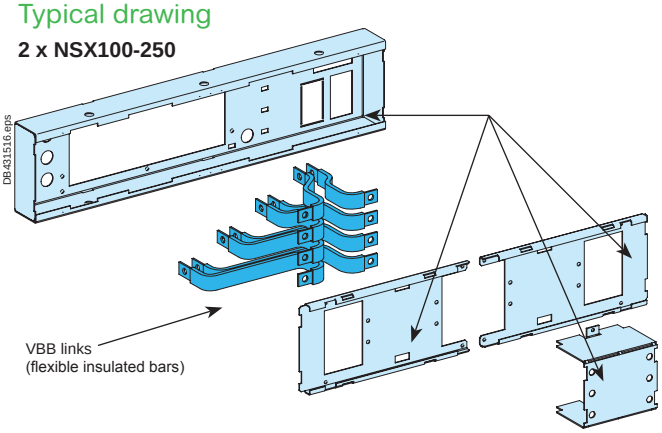
- Type of connection:
  - SC (right and/or left compartment),
  - RC.
- Switchgear assembly:
  - Compact NSXm160, fixed on a single-device mounting plate,
  - Compact NSX100-250, fixed or base-mounted, on a 1 or 2-device mounting plate,
  - Compact NSX400-630, fixed or base-mounted, on a single-device mounting plate
- Customer connection:
  - directly to the terminals of the device,
  - to terminal blocks situated in the connection compartments.
- Installation of CTs:
  - in connection compartments (non-functionalised installation).
- Front panel:
  - feeders grouped behind a solid or transparent door,
  - feeders behind separate doors.
- IP31/41/54: according to the IP of the device doors and controls.
- Modularity: it depends on the rating of the device and its installation mode (fixed or base-mounted).
- Cross-section of the connection cables (see "technical information" chapter).

D

Typical drawing

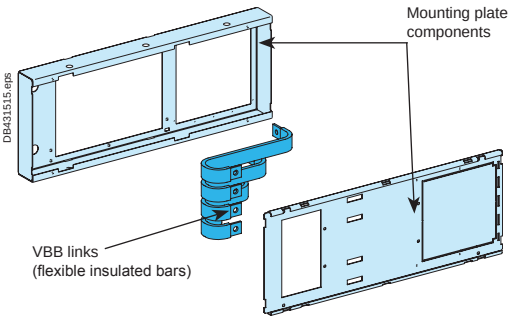
2 x NSX100-250

DB431516.eps



1 x NSX400-630

DB431515.eps



Example of functional unit modularity

Max. modularity for IP31/35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
NSXm100	4M (3P) to 6M (4P)							
NSXm160			4M (3P) to 6M (4P)					
NSX100		8M						
NSX160			8M					
NSX250					8M			
NSX400						10M		
NSX630							10M	

NSX100-630

70-2 disconnectable on Polyfast

WFD

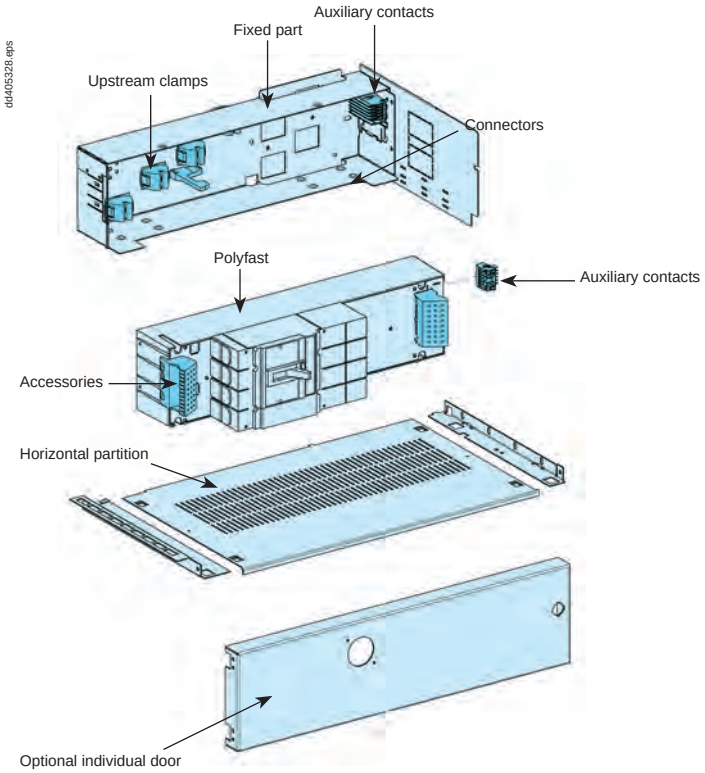
Functional unit description

- Type of connection:
  - SC
- Cables connection:
  - directly on the device's terminal blocks
- CT's installation:
  - in the lateral compartment (non-functionalised installation)
- Front face:
  - grouped feeders behind plain or transparent dooror feeders behind individual doors
- IP31/41/54: depending on IP level of doors and device commands

In order to facilitate the mounting of a disconnectable NSX100/630 on Polyfast, a 5M-installation cannot be carried out directly:
- under a H-BB top plate,
- under and above a drawer,
- under and above a NT08-16/NS800-1600 installation.

D

Typical drawing



Example of functional unit modularity

Max. modularity for IP31/35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
NSX100		7M						
NSX160				7M				
NSX250					7M			
NSX400						9M		
NSX630							9M	

Power Control Centre
NSX100-630
70-2 plug-in on Polyfast
WWW

Functional unit description

- Type of connection:
  - SC and RC
- Connection:
  - by cables on the copper pads fixed in the outgoing bushings
- CT's installation:
  - on the connection pads on the fixed part
- Front face:
  - grouped feeders behind plain or transparent door
  - or feeders behind individual doors (see table below)
- IP31/41/54: depending on IP level of doors and device commands
- Modularity:

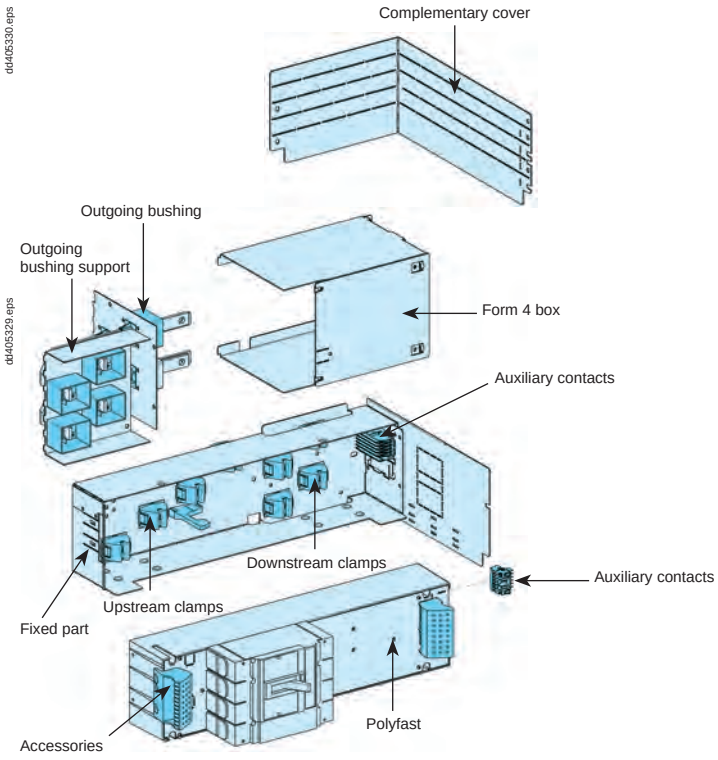
The plug-in feeder's modularity depends upon 3 criteria :
- device: NSX100-250 or NSX400-630,
- number of poles: 3 or 4P
- cables cross-section and CT's to be installed in F4 boxes.

- Distinctive features for the 5M-installation:

In order to facilitate the mounting of a plug-in NSX100-630 on Polyfast, a 5M-installation cannot be carried out directly:
- under a H-BB top plate,
- under and above a drawer,
- under and above a NT08-16/NS800-1600 installation

- Connection cables cross-section (see "technical information" chapter).

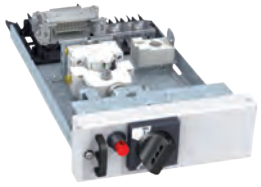
Typical drawing



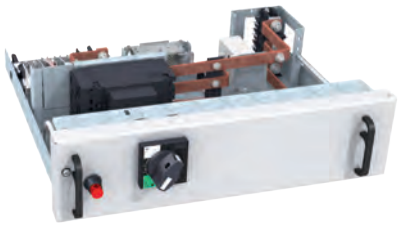
Example of functional unit modularity

Max. modularity for IP31 / 35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
NSX100		7M						
NSX160				7M				
NSX250					7M			
NSX400						9M		
NSX630							9M	

PB120144.tif



PB120145.tif



D

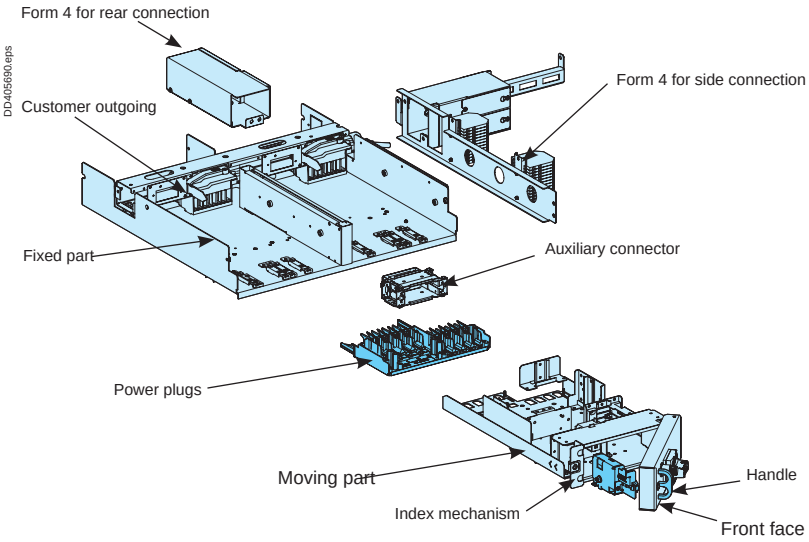
Functional unit description

- Type of connection
  - SC and RC,
- CTs installation
  - inside the drawer.
- Rotary handle
  - to order with the device.
  - Form
  - up to form 4.

Typical drawing

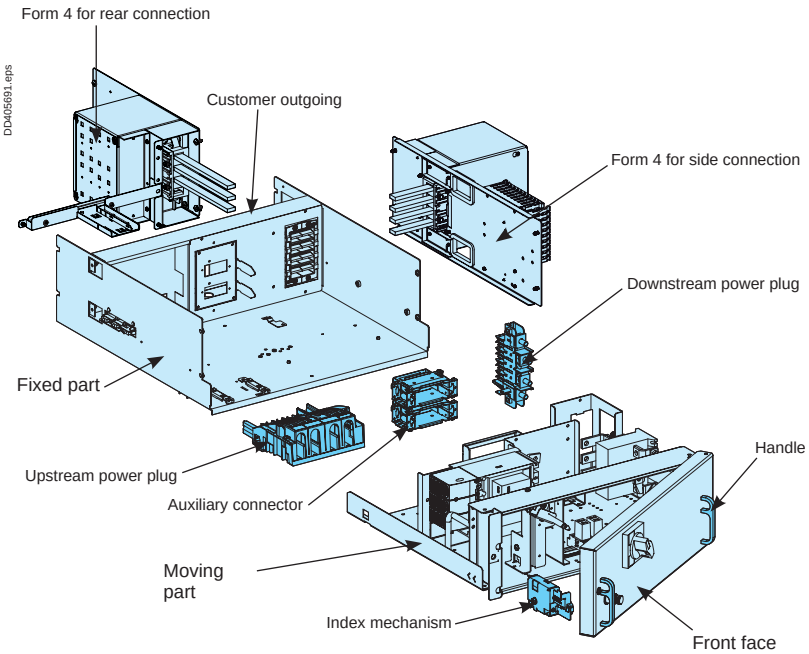
Half width drawer parts

DD405690.eps



Full width drawer parts

DD405691.eps



Example of functional unit modularity

Max. modularity for IP31/35°C - 415 V						
Current (A)	1	10	16	25	125	500
iC60	4M ½-width					
NG125		6M ½ width to 8M				

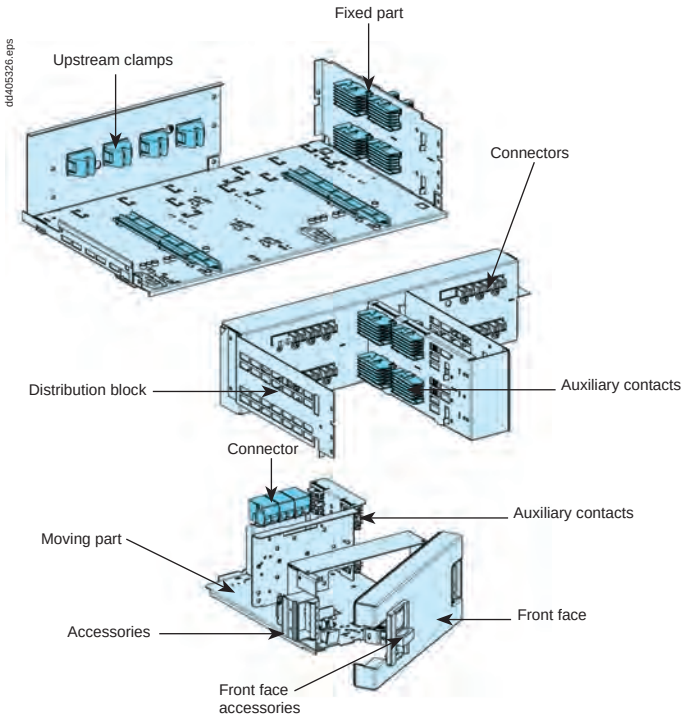
Power Control Centre
iC60
70-2 drawer
WWW

Functional unit description

- Position and type of connection:
  - horizontal device
  - SC and RC on pads
- Compulsory device for preventing on-load drawer operation:
  - tripping by micro-switch on operating signal
- CT's installation:
  - in the connection compartment (non-functionalised installation)
- iC60 front plate:
  - to be drilled for toggle control, according to drawing (refer to Panelbuilder Guide, section "Mounting Guide")

D

Typical drawing



Example of functional unit modularity

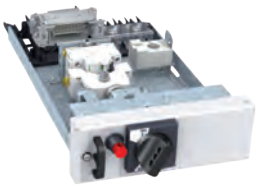
Max. modularity for IP31 / 35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
iC60	6M ½-width							

NSXm100-160 and NSX100-630

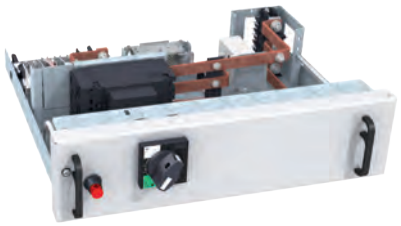
70-M drawer

www

PB120144.tif



PB120145.tif



D

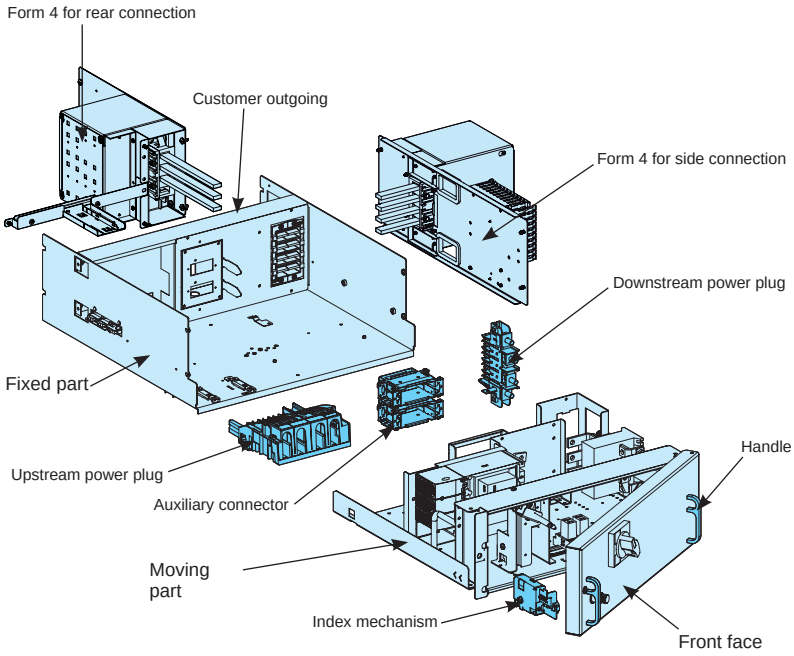
Functional unit description

- Type of connection
  - SC and RC
- CTs installation
  - inside the drawer
- Rotary handle
  - to order with the device
  - Form
  - up to form 4

Typical drawing

Full width drawer parts

DD405691.eps



Example of functional unit modularity

Max. modularity for IP31 / 35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
NSXm100	6M½ width to 8M							
NSXm160			6 M to 8M					
NSX100		6M½ width to 8M						
NSX160			6 M to 8M					
NSX250					6M to 8M			
NSX400						10M		
NSX630							12M to 14M	

Power Control Centre
NSXm100-160 and NSX100-630
70-2 drawer
WWW

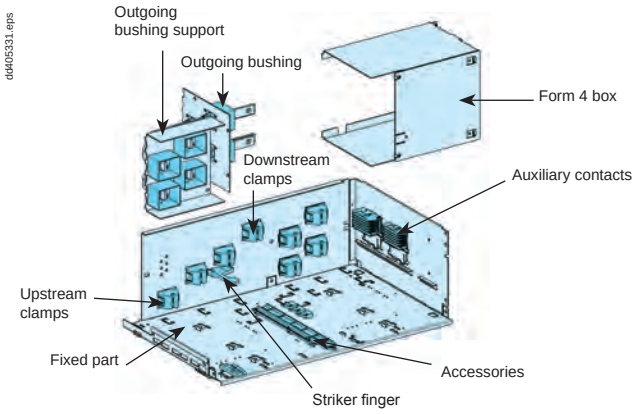
Functional unit description

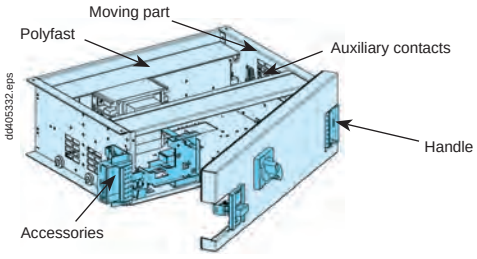
- Type of connection:
  - SC and RC
- Connection:
  - by cables on the copper pads fixed in the outgoing bushings
- Devices for preventing on-load drawer operation:
  - compulsory: drawer mechanical locking
  - optional: tripping by micro-switch on operating signal (O-C 16A-250V / 10A-400V)
  - pre-tripping striker finger
- CT's installation
  - on the connection pads on the fixed part
- Optional elements:
  - Fixed part: horizontal partition, to close the top of a drawer + complementary cover for reserve
  - Moving part: complementary hinges for front faces ≥12M
- Modularity:

The modularity of feeders in drawers depends upon 3 criteria :
  - device: NSXm100-160, NSX100-250 or NSX400-630,
  - number of poles: 3 or 4P
  - CT's: presence and type of CT on the fixed part's connections
- Connection cables cross-section (see "technical information" chapter).

D

Typical drawing





Example of functional unit modularity

Max. modularity for IP31 / 35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
NSXm100	8M (3P & 4P)							
NSXm160			8M (3P & 4P)					
NSX100	8M (3P & 4P)							
NSX160			8M (3P & 4P)					
NSX250					8M (3P & 4P)			
NSX400						12M (3P & 4P)		
NSX630							12M (3P & 4P)	

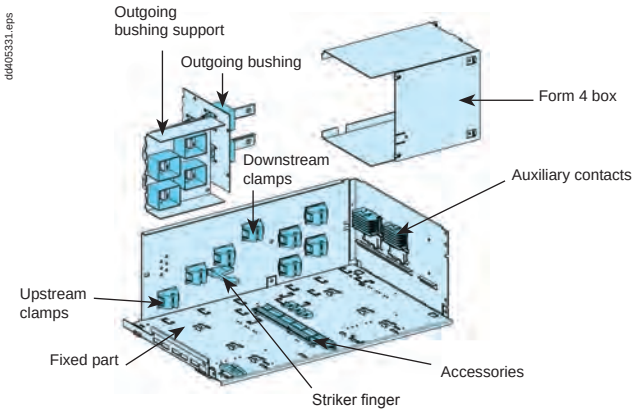
Power Control Centre
NS630
70-2 drawer
WWW

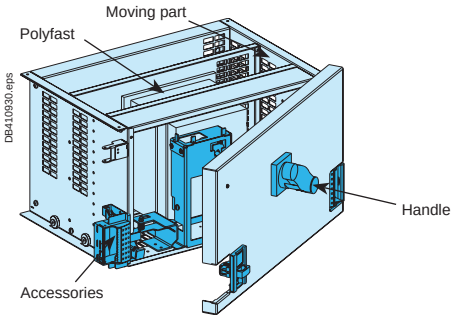
Functional unit description

- Type of connection:
  - SC and RC
- Connection:
  - by busbar from breaker to the outgoing bushings.
- Devices for preventing on-load drawer operation:
  - compulsory: drawer mechanical locking
  - optional: tripping by micro-switch on operating signal (O-C 16A-250V / 10A-400V)
  - pre-tripping striker finger
- CT's installation
  - on the connection pads on the fixed part
- Optional elements:
  - Fixed part: horizontal partition, to close the top of a drawer + complementary cover for reserve
  - Moving part: complementary hinges for front faces ≥12M
- Modularity:
  - The modularity of feeders depends upon 3P or 4P.

D

Typical drawing





Example of functional unit modularity

Max. modularity for IP31 / 35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
NS630							12M (3P)	
							14M (4P)	

Power Control Centre
NSX100-630
Closed door racking drawer
WWW

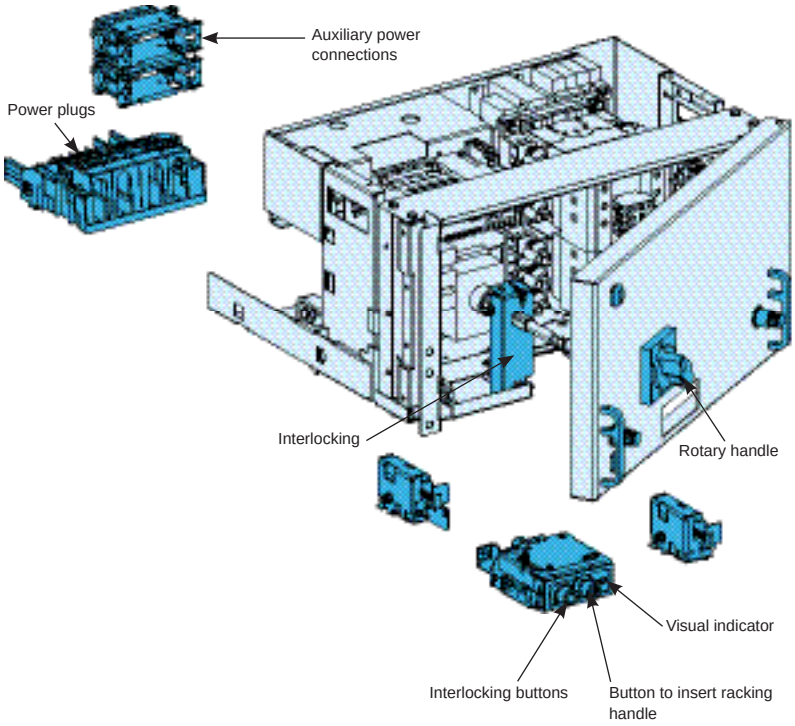
PB120143.eps

Functional unit description

- Type of connection
  - SC and RC.
- Connection
  - retractable stabs onto the busbar.
- Specific installation tools
  - cranking tool
  - remote racking device.

Typical drawing

DB431528.eps



D

Example of functional unit modularity

Max. modularity for IP31/35°C - 415 V								
Current (A)	16	63	100	125	155	200	400	500
NSX100		8M						
NSX160			8M					
NSX250					8M			
NSX400						16M		
NSX630							16M	

Fuse-switch SASIL

185 disconnectable mounting plate

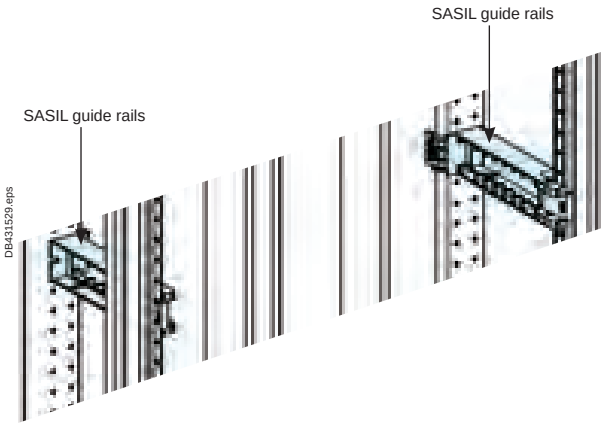
WFD

Functional unit description

- Type of connection
  - SC.
- Connection
  - by cables on device built-in pads
- Order from Jean Müller catalogue the following items:
  - SASIL00/1/2/3 fuse-switch
  - 3P collector busbar fixing plates
  - set of covering part fixing rails
  - covering busbar parts
  - IP2x covering connection terminals parts
  - space compartment caps
  - Form 4b insulating sleeves
  - Cubicle installation capacity:
  - 53M with 3 V-BB supports (Icw: 40 kA)
  - 52M with 4 V-BB supports (Icw: 50 kA)
  - 50M with 6 V-BB supports (Icw: 80 kA)
- Compulsory element:
  - guide rail

D

Typical drawing



Example of functional unit modularity

Max. modularity for IP31/35°C - 415 V								
Current (A)	16	63	100	125	160	250	400	630
SASIL00					2M			
SASIL01						3M		
SASIL02							6M	
SASIL03								6M

Motor Control Centre

E

In addition to the motor power and the starter type (direct, reverse, star-delta, 2-speed ...), 4 main criteria have to be taken into account when choosing a motor starter:
- the operational voltage,
- the type of thermal protection, electro-mechanical or electronical,
- the type of magnetic protection, according to the switchboard's Icc.

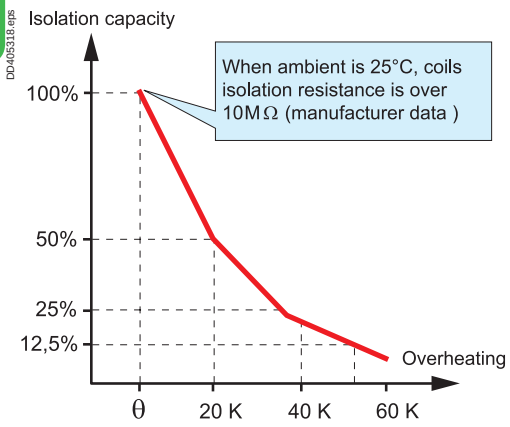
Operational voltage

Network's operational voltage is a decisive parameter in the choice of motor protection.
Indeed, the operational voltage will have an impact on the device's performances and the installation constraints.
For instance, the voltage will influence:
- the breaking performances.

Motor protection

E

Protecting the motors to extend their lifetime



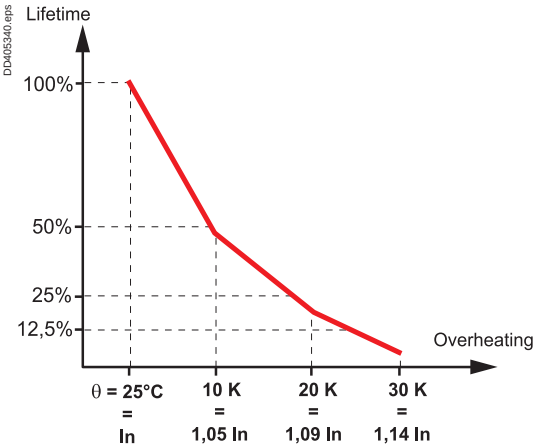
- Overheating in electrical motors is caused by copper and ferro-magnetic losses:
  - the current I is proportional to the motor's load. Copper losses are proportional to I^2 (stator and rotor).
  - hysteresis cycles in ferro-magnetic materials and the induced Foucault currents cause overheating, which is in particular proportional to frequency.

- The consequence of abnormal overheatings is a reduced isolation capacity of the materials, thus leading to a significant shortening of the motor lifetime, as shown in the opposite diagram.

- In continuous or semi-continuous processes, availability is a major issue. It is therefore decisive to observe accurately the operating conditions of the motors.

- Motor protection relays are the components dedicated to this task. They provide various levels of accuracy and functionalities, in order to meet the expectations of the process manager.

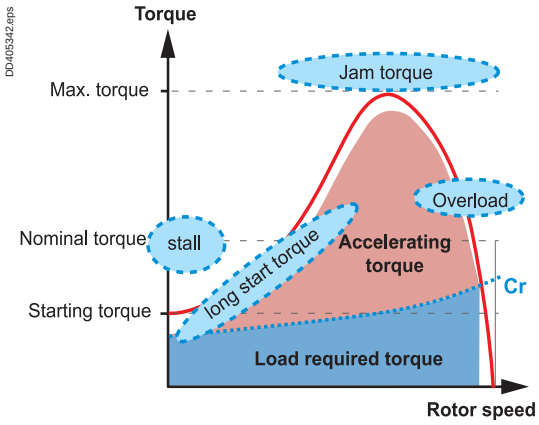
Supervising finely the motors to improve process availability



- An electrical motor transforms electrical energy in mechanical energy.
When the voltage, current and frequency change, the speed and torque of the motor change too. And conversely, any changes in charge have a direct impact on the electrical parameters.

- **Electromechanical thermal relays** protect the motor against overloads.

- **Electronical relays** protect the motor against overloads, on the basis of very sophisticated and highly accurate thermal patterns.
  - These relays are able to make out several cases of *motor overload*, and to transmit the information, thus allowing the operator to have a better understanding of the true nature of the problem,
  - These relays report for many *complementary parameters*, providing useful informations to the operator, therefore giving him the opportunity to avoid motor stops, or to re-start quickly if a stop has occurred.
  - Examples:
    - motor under-load can be the signal of a pump cavitation,
    - phase inversion can be the indication of a maintenance error, that should be hard to diagnose without that sign.



□ In addition to the observation of currents, the electronical relays can *monitor the voltage*, and consequently the power and the power factor. They can also watch the leakage currents and measure the actual coil temperature whenever it has a built-in sensor.
All these informations give an additional level of anticipation and shrewdness to help coping with problems.

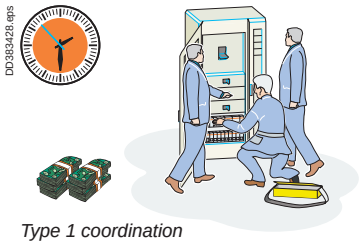
□ Finally, electronical relays can take on *information-processing* functions, like state and faults statistics. They are also able to suggest logical solutions, and to react in a process-specific way.

Magnetic protection: circuit-breakers and fuses

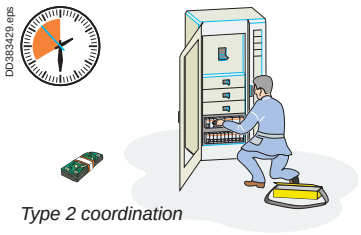
Schneider Electric have chosen to put forward circuit-breakers each time it is possible, as they have advantages in terms of maintenance and capacity of quick re-operating.

The advantages of magnetic circuit breakers over fuses are listed below:
■ universal solution that can be exported to all countries, unlike the fuses, which standards are not coordinated,
■ reduced dimensions,
■ limited temperature rise,
■ faster maintenance,
■ avoid over-rating the fuse cartridge (causing the motor destruction) or under-rating (untimely tripping).

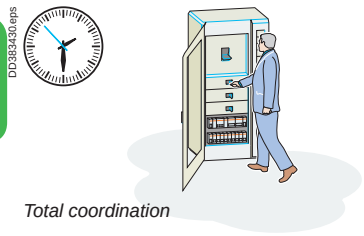
E



Type 1 coordination



Type 2 coordination



Total coordination

Coordination, what is it about ?

A "motor feeder" can be made up of 1, 2, or 3 different devices. They have to be coordinated in a way they ensure an optimal operation of the installation.

Aims of coordination

In case of a fault, the coordination's purposes are:
- to protect of the people and the equipment,
- to permit continuity of service,
- to reduce maintenance costs (manpower and replacement equipment).

Types of coordination as per IEC 60947-4-1

- Type 1 coordination: basic solution
  - no continuity of service,
  - important maintenance costs in case of a fault (manpower and equipment).
- Type 2 coordination: solution ensuring continuity of service
  - reduced machine shutdown time,
  - reduced cost of replacement equipment.
- Total coordination, as per IEC 60947-6-2:
  - no damage nor resetting of devices following a fault,
  - installation immediate return to operation.

Schneider Electric choices regarding coordination

For applications in Okken high availability switchboard, Schneider Electric has accepted:

➔ type 2 or total coordination on grounds of:
- a low cost for repairing the equipment,
- a reduced machine shutdown time,

and dismissed:

➔ type 1 coordination and non-coordoned feeders because of:
- an expensive return to operation,
- a long machine shutdown time.

Main characteristics of devices

Characteristics	Protection device									
	Tesys U	GV2P	GV3P	GV4P	GV2L	GV3L	GV4L	NSX100-630	Vario	GS2
P range (kW)	0.37 to 15	0.37 to 5.5	18.5 to 37	0.18 to 55	0.37 to 5.5	18.5 to 37	0.18 to 55	0.37 to 250	0.75 to 15	0.37 to 220
Icw maxi (kA)	100	100	100	100	100	100	100	100	100	100
Thermal protection	internal	internal	internal	internal	external	external	external	external	external	external
Coordination	Total	2	2	2	2	2	2	2	2	2
Starters	dol reverse	dol reverse star-delta	dol reverse star-delta	dol reverse star-delta	dol reverse star-delta	dol reverse star-delta	dol reverse star-delta	dol reverse star-delta	dol	dol reverse star-delta
MCC	yes	yes	yes	yes	with LRD	with LRD	with LRD	with LRD	with LRD	with LRD
iMCC	yes	no	no	no	with Tesys T	with Tesys T	with Tesys T	with Tesys T	with Tesys T	with Tesys T
Okken solution (no. of components)	1	2	2	2	3	3	3	3	3	3

1-component motor feeder

PB108208-Tesys U.eps

Circuit breaker-contactor combination Te*Sys* U

■ **Advantages**
- □ easy installation:
  - easy to order: 1 power base + 1 protection (control unit)
  - easy to install: only one device must be wired, reduced installation times
  - easy to set: locally via the LCD and keypad built into the control unit or remotely
- □ continuity of service:
  - total coordination between protection devices
  - protection functions modified by simply changing the control unit
  - manual or automatic reset following a thermal fault
- □ upgradeability: modular design. Functional modules (communication and protection) can be easily changed at any time without having to rewire the entire assembly.

■ **Applications**
- □ manufacturing and continuous and semi-continuous processes.

2-component motor feeder

PD405140.tif

Thermomagnetic circuit-breaker + contactor

■ **Advantages**
- □ very economic solutions
- □ suitable for all types of diagrams
- □ manual reset following a thermal fault
- □ type 2 coordination

■ **Applications**
- □ manufacturing and continuous and semi-continuous processes.

3-component motor feeder

PB120148.tif

PD405141.tif

Advantages
■ Wide choice of solutions.
■ Suitable for all types of diagrams.
■ Manual or automatic reset following a thermal fault.
■ 2 starting classes (10 And 20).
■ Type 2 coordination.
■ Segregation of thermal and magnetic faults.

Magnetic circuit-breaker + contactor + thermal protection
■ For manufacturing and continuous and semi-continuous processes.

Switch-disconnector fuse + contactor + thermal protection
■ For all types of machines.
■ For manufacturing and continuous and semi-continuous processes.

Advantages of magnetic circuit breakers over fuses

■ Universal solution that can be exported to all countries.
■ Reduced dimensions.
■ Limited temperature-rise.
■ Faster maintenance.

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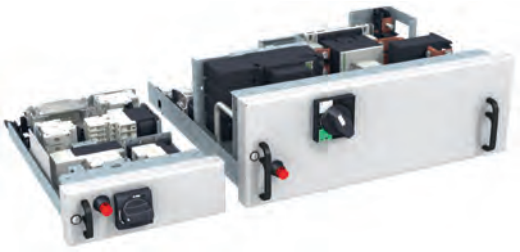

70-M drawers

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70-2 drawers

E

Withdrawable FU in drawer (WWW)

■ The withdrawable drawer is used in a huge range of motor control functional units, up to 250 kW. The drawer is used to make up a FU consisting of several mechanically attached devices, that can assume the “plug-in/test/draw-out/withdrawn” positions, allowing the padlocking procedures and incorporating the man/switchboard interface elements on the front panel.

■ In motor control, the need to indicate and control on the front panel of the FU and the necessity to padlock are the main choice criteria for this solution.

■ The fixed part is installed and removed with power on and supports the upstream and downstream plug-in clamps.

■ The moving part supports the switchgear by means of an interface or a mounting plate. It is guided in its movement and positioning, and ball bearings minimise the operating effort.

■ The “plug-in/test/draw-out” positions are mechanically marked by an indexing device associated with a mechanical indicator on the front panel.

■ The front panel of the drawer gives priority to ergonomics and intuition of operations by the arrangement of the locking facilities and operating mechanisms.

■ Access to the inside of the drawer may be necessary during operation, to make settings or carry out a thermographic check. A deliberate opening by swivelling the front panel is possible using a tool.

■ Operator protection is ensured by a mechanical device disabling working when the protection device is closed (for drawers equipped with Compact NSX range.

■ An IP 2X degree of protection is maintained in the test and draw-out positions.

■ Locking is possible in all positions by a padlock (3 padlocks not supplied), as is also padlocking of empty compartments.

Drawer position indicator

Drawers operation is very simple. Using the red indexing pushbutton, the operator can simply move the drawer in the “plug-in/test/draw-out” positions.
Each position is mechanically marked with an indicator on the drawer.

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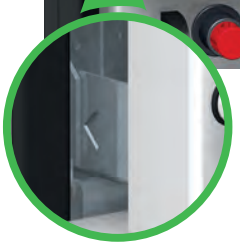
PD405119.eps



70-M drawers

PB120136.eps

70-2 drawers

PB120136.eps

(*) live work must be carried out by authorised personnel

Drawer positions

Closed door racking

Connected

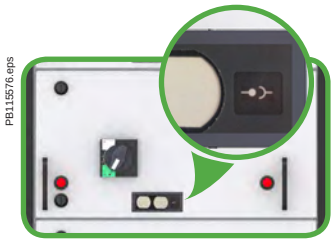
- The functional unit is operational.
- Power and auxiliaries are connected.

Test

- The functional unit is not operational.
- Only auxiliaries are connected.
- Allow padlocking.
- It allows the functional unit verification.
- Allow maintenance on the process.

Disconnected

- The functional unit is not operational.
- Power and auxiliaries are disconnected.
- The drawer can be fully extracted.
- Allow quick replacement.
- Allow switchboard live change.



70-M

70-2

Plug-in

- The functional unit is operational.
- Power and auxiliaries are connected.

Test

- The functional unit is not operational.
- Only auxiliaries are connected.
- Allow padlocking.
- It allows the functional unit verification.
- Allow maintenance on the process.

Draw out

- The functional unit is not operational.
- Power and auxiliaries are disconnected.
- Allow maintenance on the process.

Withdrawn

- The drawer can be fully extracted.
- Allow quick replacement.
- Allow switchboard live change.

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PB120143.eps

PB120147.eps

Rotating racking mechanism

Closed Door Racking (WWW)

■ It is a drawer option which:
  □ makes it possible to do all drawer operations with its unit door remaining closed (rack in, test, rack out) ;
  □ on disconnected position, drawer is mechanically blocked.

■ Through a rotating racking mechanism, the stabs from the disconnect can be withdrawn from the busbar. This operation can be done through the use of a cranking tool through the front of the unit, with the door closed.

■ With the retractable disconnect, the stabs will be disconnected from the busbar with enough clearance to perform maintenance without removing the drawer from the section.

■ The inbuilt window will provide the status though a mechanical indication which will operate as the stabs are retracted.

■ Degree of protection: IP31 to IP54.

■ It is internal arc resistant.

E

Drawer position indicator

The indicator is tied to the disconnect, therefore it is a true mechanical representation of the position of the disconnect.

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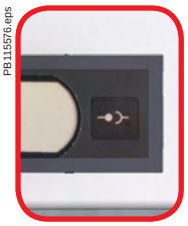
Connected

PB120145.eps

Test

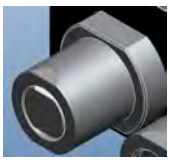
PB115576.eps



Disconnected

Button position

An activator button enables to to engage the racking mechanism.
The racking operation will be engaged once the button is pressed.



Pushed in

■ The button stays recessed once pushed.

Half-way pushed in

■ The button will come out half way once the racking starts as an indication that racking is in progress.

Completely out

■ The button will come completely out once it has reached the end of travel for the racking operation.

■ The button has a protruded hole to provide a means to LOTO.

PD391115.eps

PD391102.eps

Disconnectable FU on mounting plate (WFD)

The disconnectable mounting plate is used for low rating motor feeders, up to 15KW in 415V.
This solution, for front connection, optimises cost and installation capacity while giving priority to interchangeability and flexibility of live reconfiguration (*).
It requires intervention on downstream connections on extraction.

The FU consists of a fixed part, that can be installed and removed with power on (*), equipped with upstream double plug-in clamps and of a moving part supporting the devices, of fixed type.
The downstream cables are connected to the device terminals and the auxiliaries to connectors.
The operating mechanisms are accessible behind the door.

Panorama
Motor control solutions in 70-M cubicle

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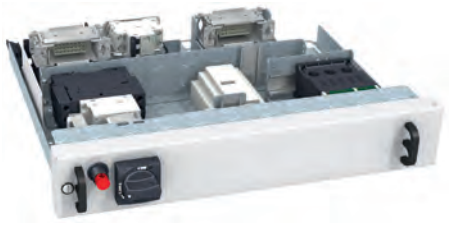
PB120149.eps



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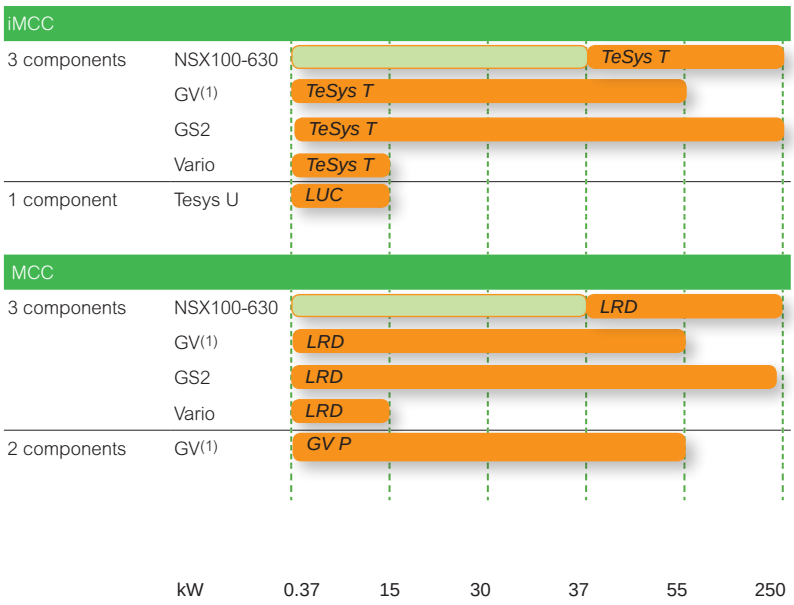
Withdrawable FU in drawer for 70-M

Ue = 415 V



(1) GV4 with Robust Rotary handle, TRIP indication, minimum rating 0.18 kW.

possible solutions in Okken switchboards

Schneider Electric recommended solutions

E

Disconnectable FU on mounting plate

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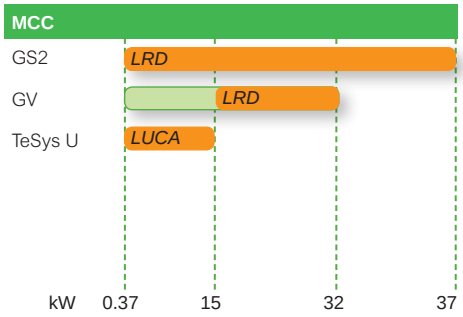
Ue = 415 V



Withdrawable FU in drawer for 70-2

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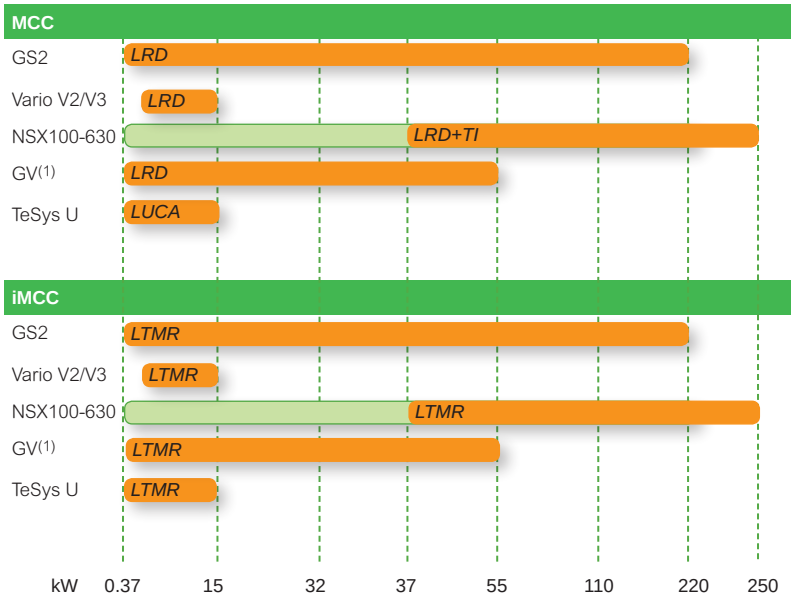
PD405067.eps

PD405061.eps

Tiroir GS2_ bbv11518013.eps

Ue = 415 V



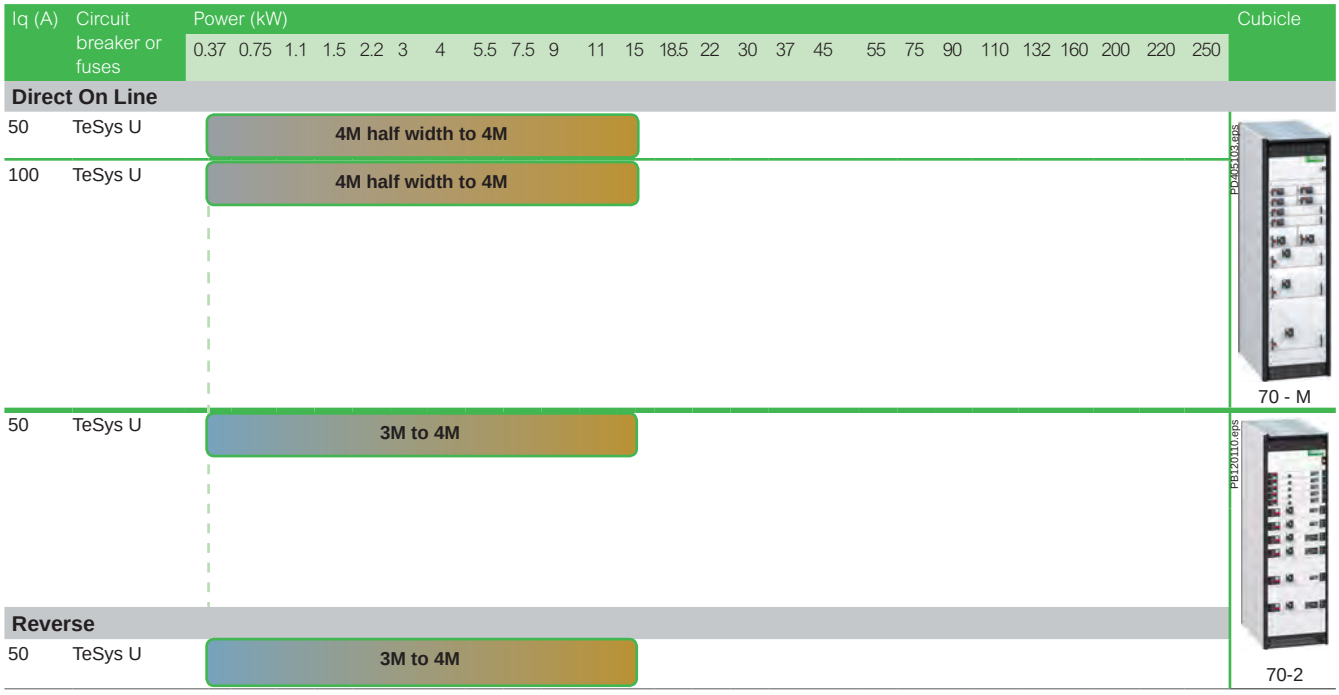
(1) GV4 with Robust Rotary handle, TRIP indication, minimum rating 0.18 kW.

possible solutions in Okken switchboards

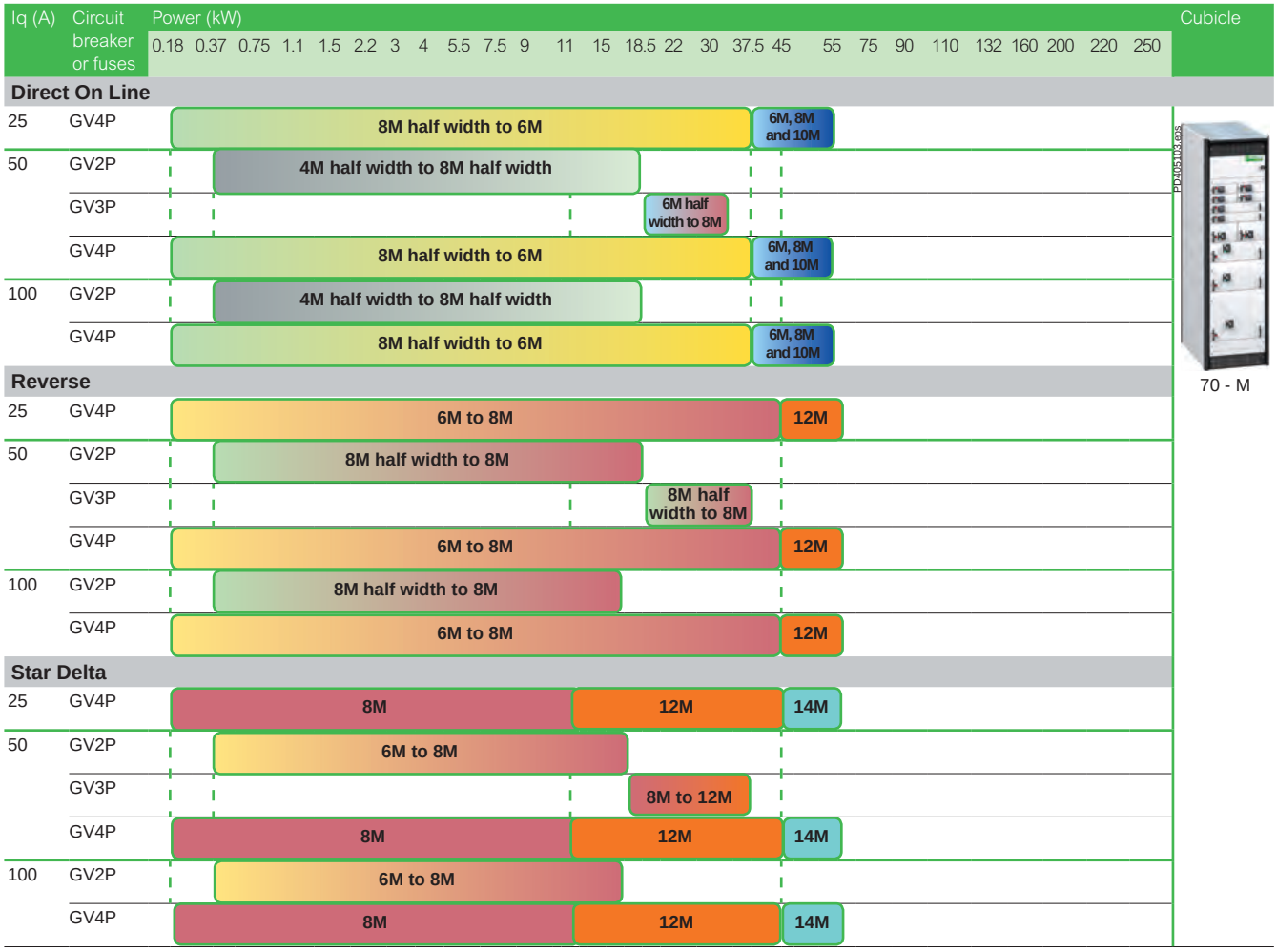
Schneider Electric recommended solutions

Selection of functional unit
P ⩽ 250kW

Selection of the functional unit with circuit breakers - MCC 1 component - Ue = 415 V - 50/60 Hz - IP31/35°C

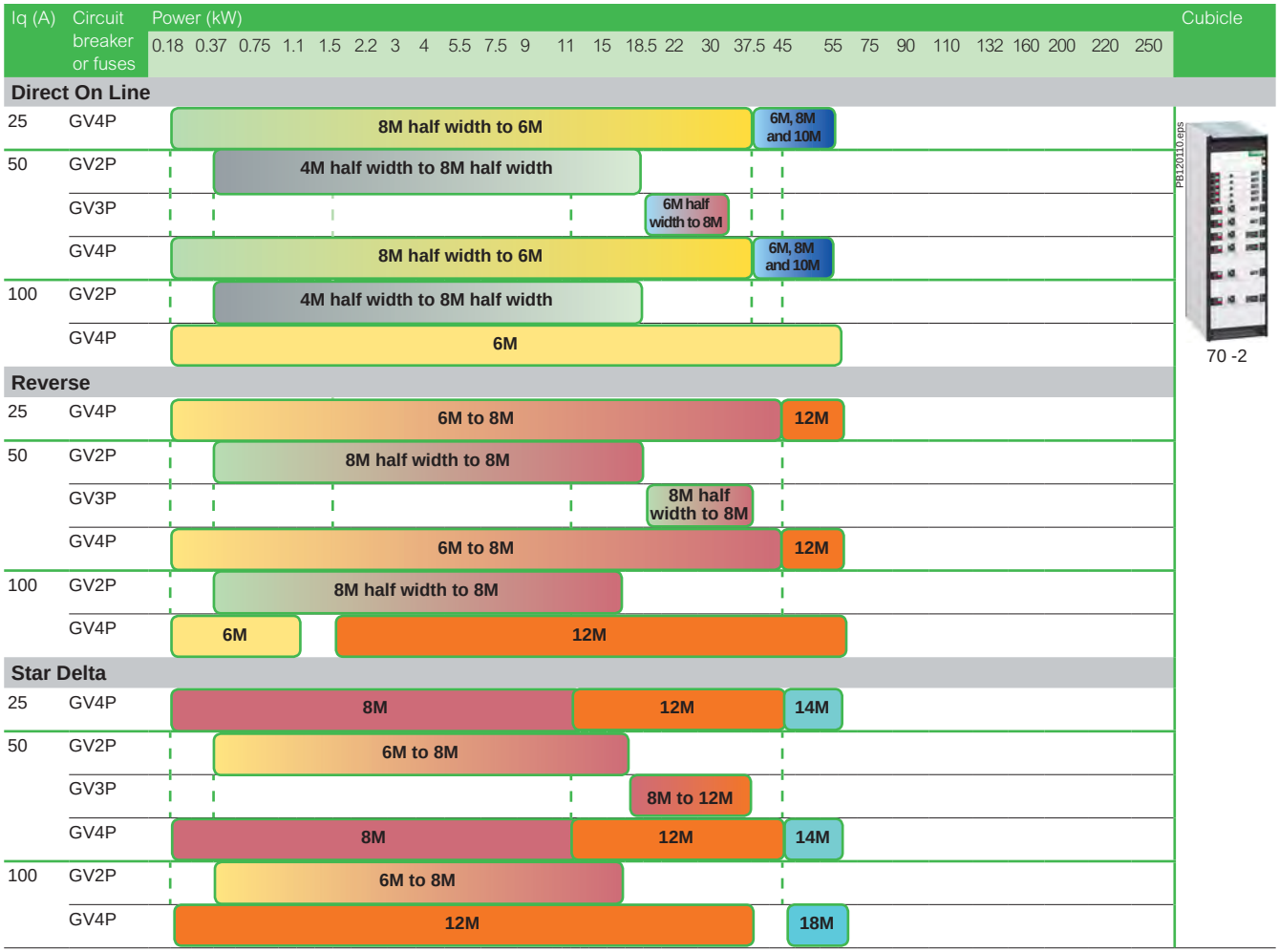


Selection of the functional unit with circuit breakers - MCC 2 components - rated 415 V - 50 /60Hz - IP31/35°C



Motor Control Centre
Selection of functional unit
P ⩽ 250kW

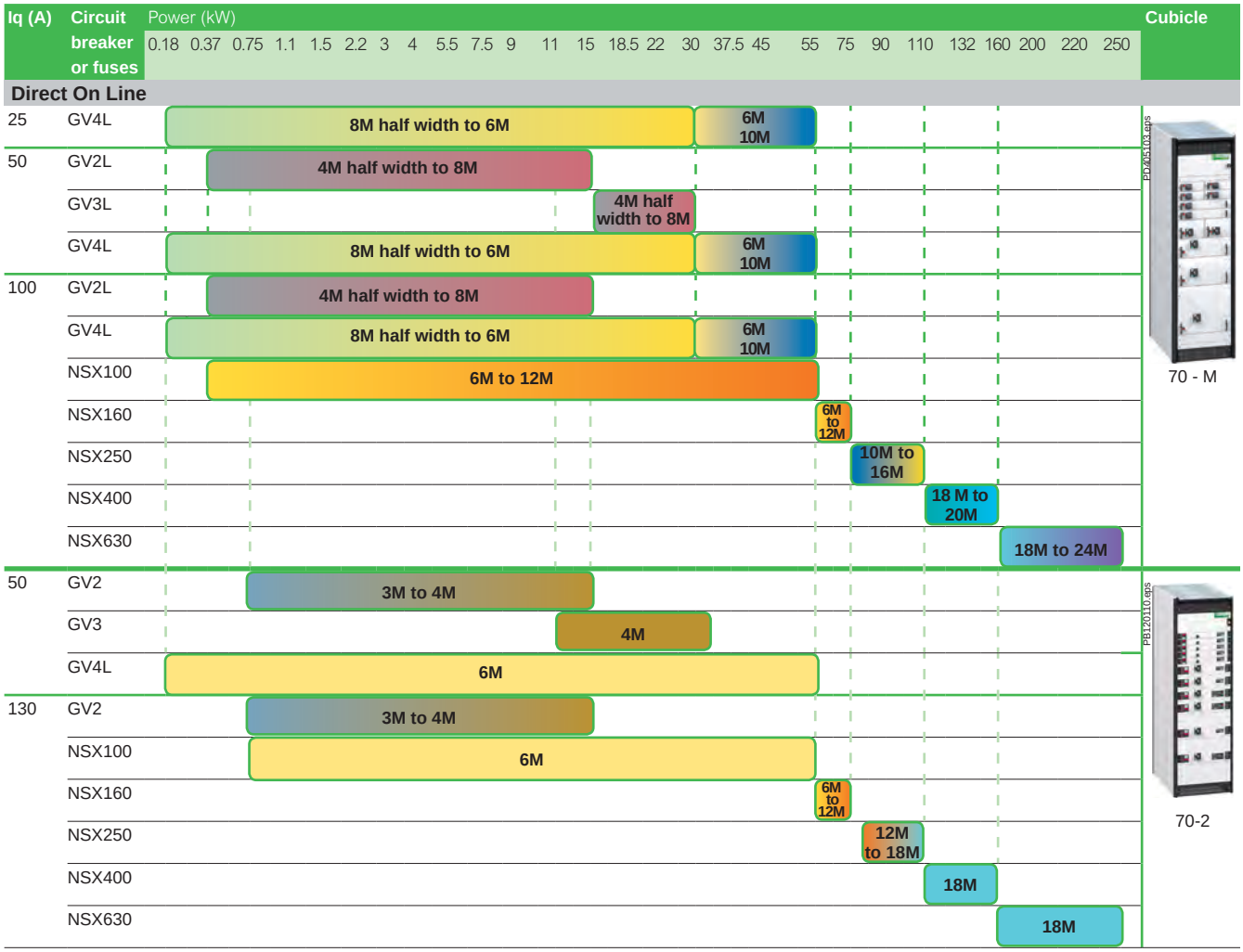
Selection of the functional unit with circuit breakers - MCC 2 components - rated 415 V - 50 /60Hz - IP31/35°C



E

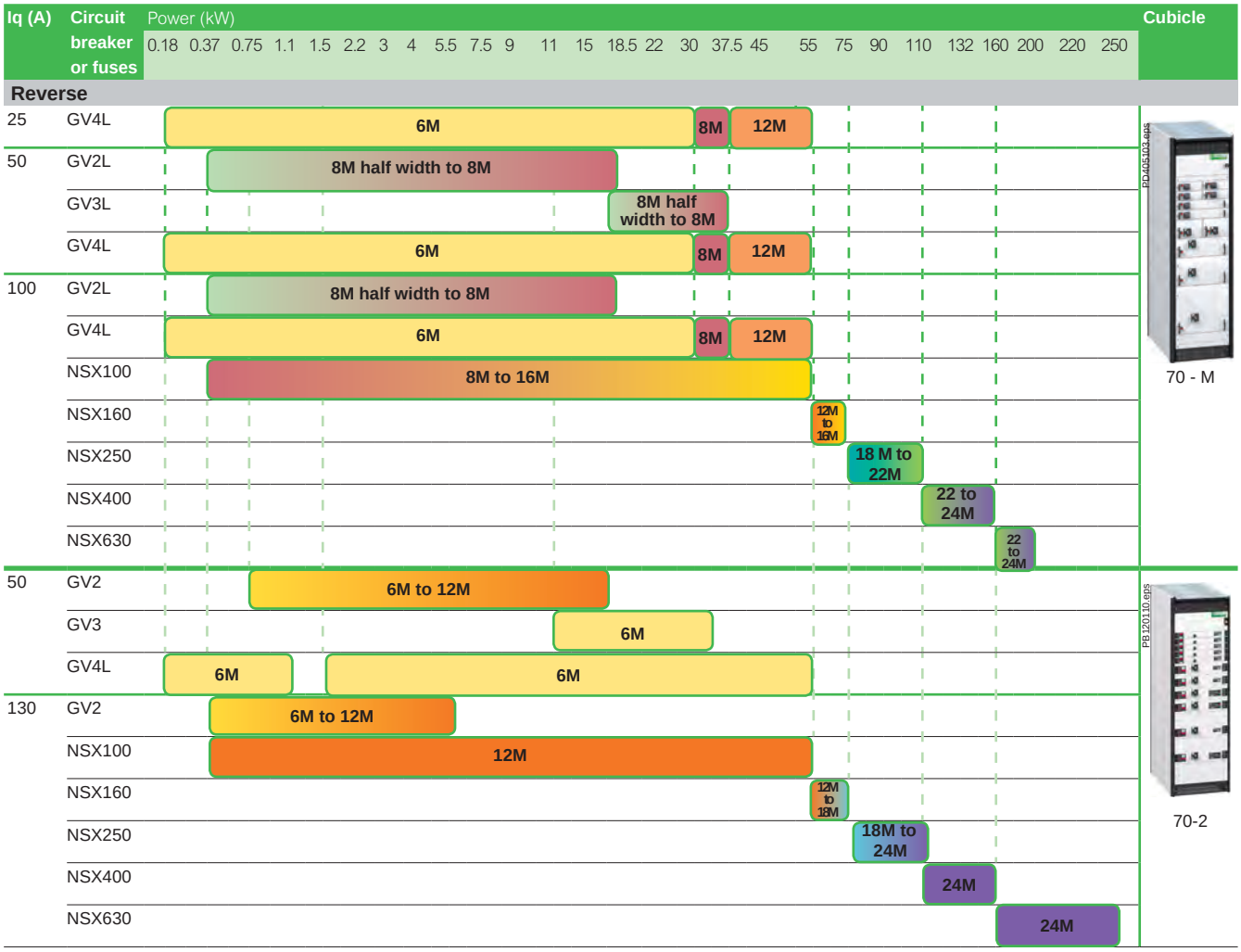
Selection of functional unit
P ⩽ 250kW

Selection of the functional unit with circuit breakers - MCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



Motor Control Centre
Selection of functional unit
P ⩽ 250kW

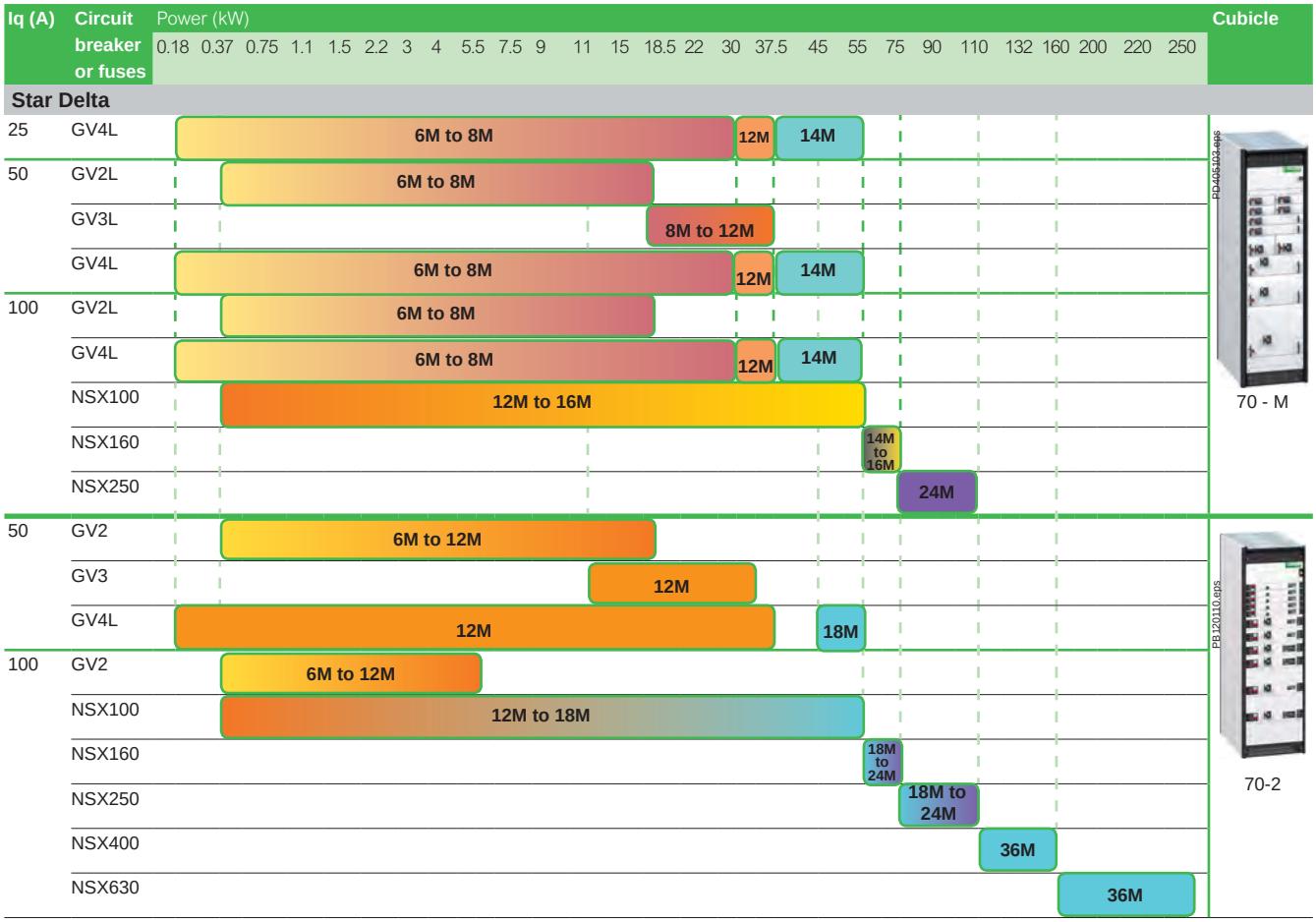
Selection of the functional unit with circuit breakers - MCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



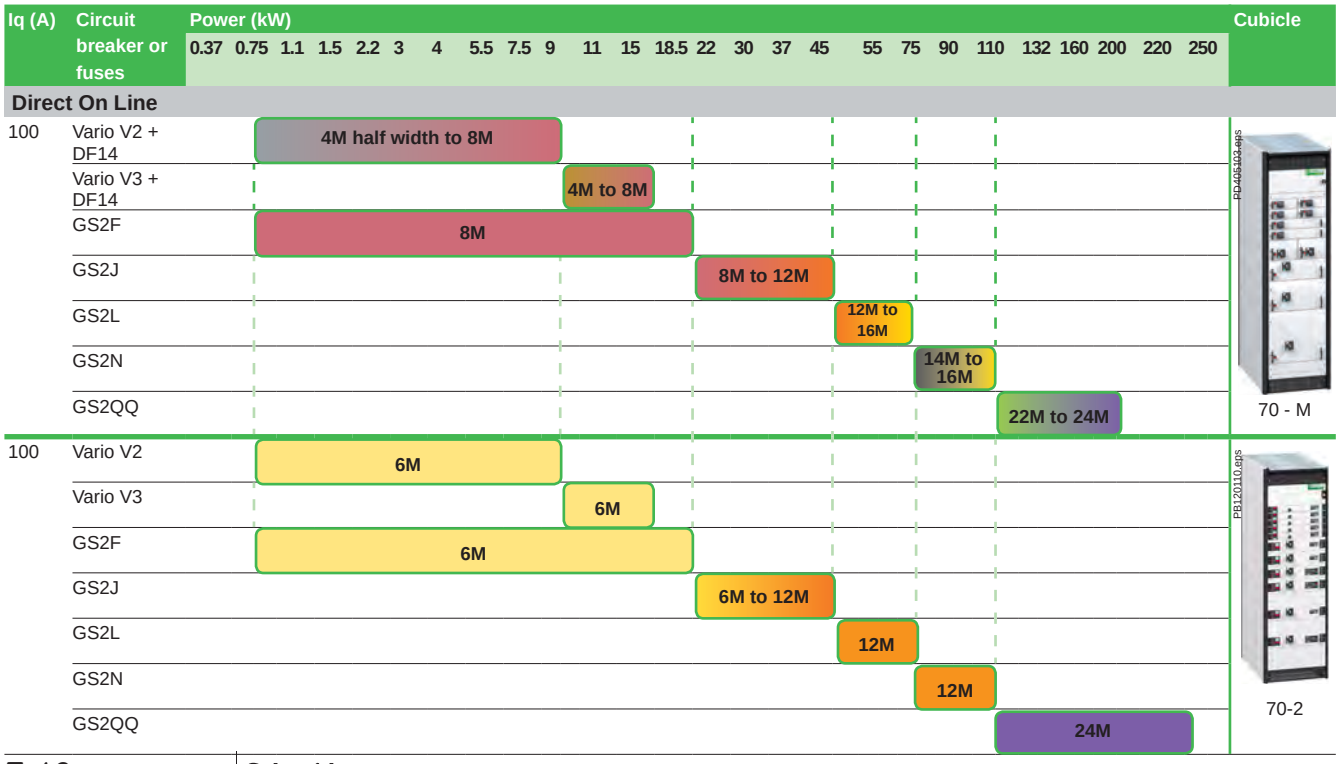
E

Selection of functional unit
P ⩽ 250kW

Selection of the functional unit with circuit breakers - MCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



Selection of the functional unit with fuses - MCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



Motor Control Centre
Selection of functional unit
P ⩽ 250kW

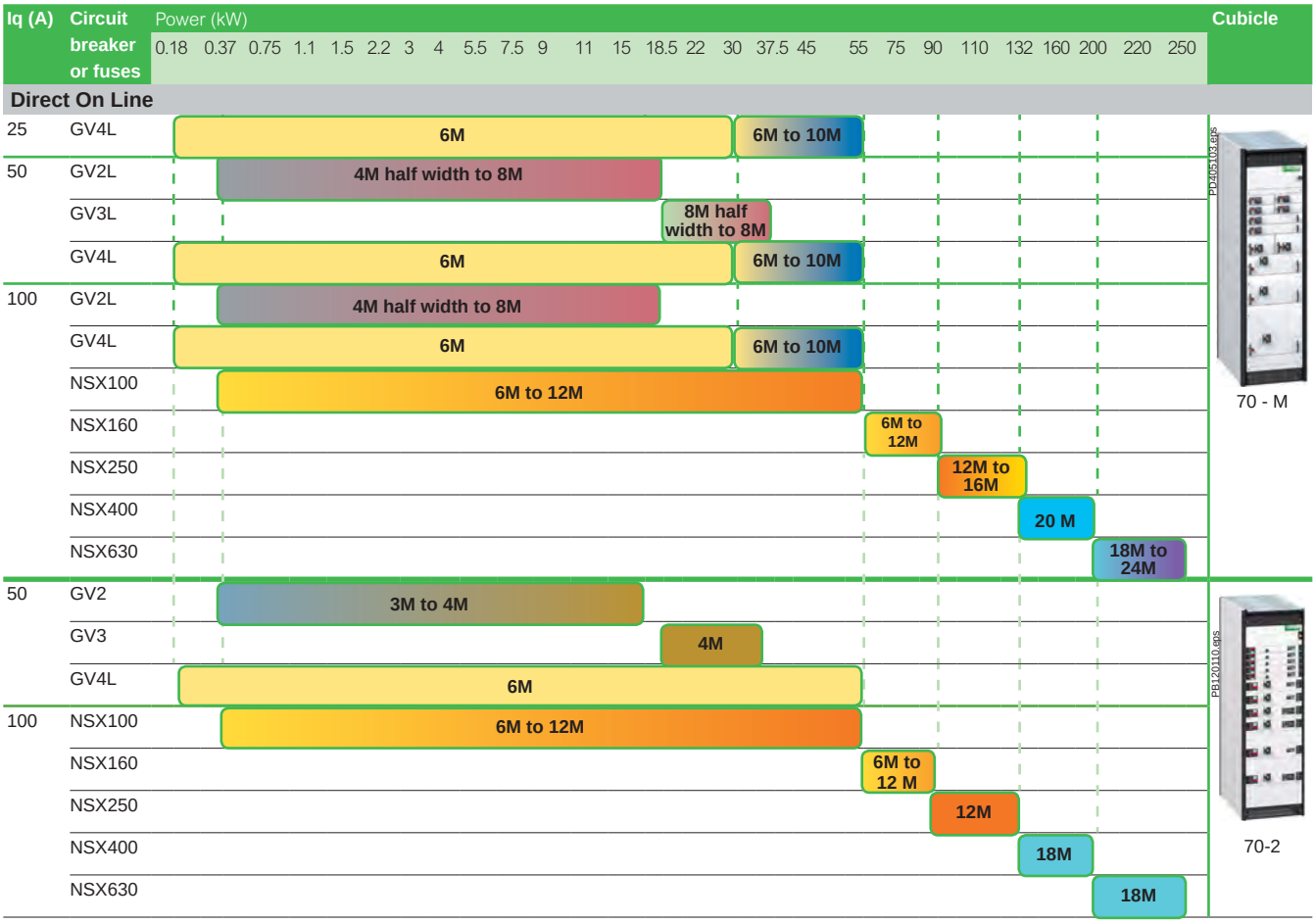
Selection of the functional unit with circuit breakers - iMCC 1 component - Ue = 415 V - 50/60 Hz - IP31/35°C

Iq (A)	Circuit breaker or fuses	Power (kW) 0.37 0.75 1.1 1.5 2.2 3 4 5.5 7.5 9 11 15 18.5 22 30 37 45 55 75 90 110 132 160 200 220 250	Cubicle
Direct On Line			
50	TeSys U	4M half width to 4M	 70 - M
100	TeSys U	4M half width to 4M	
50	TeSys U	3M to 4M	 70-2
Reverse			
50	TeSys U	3M to 4M	

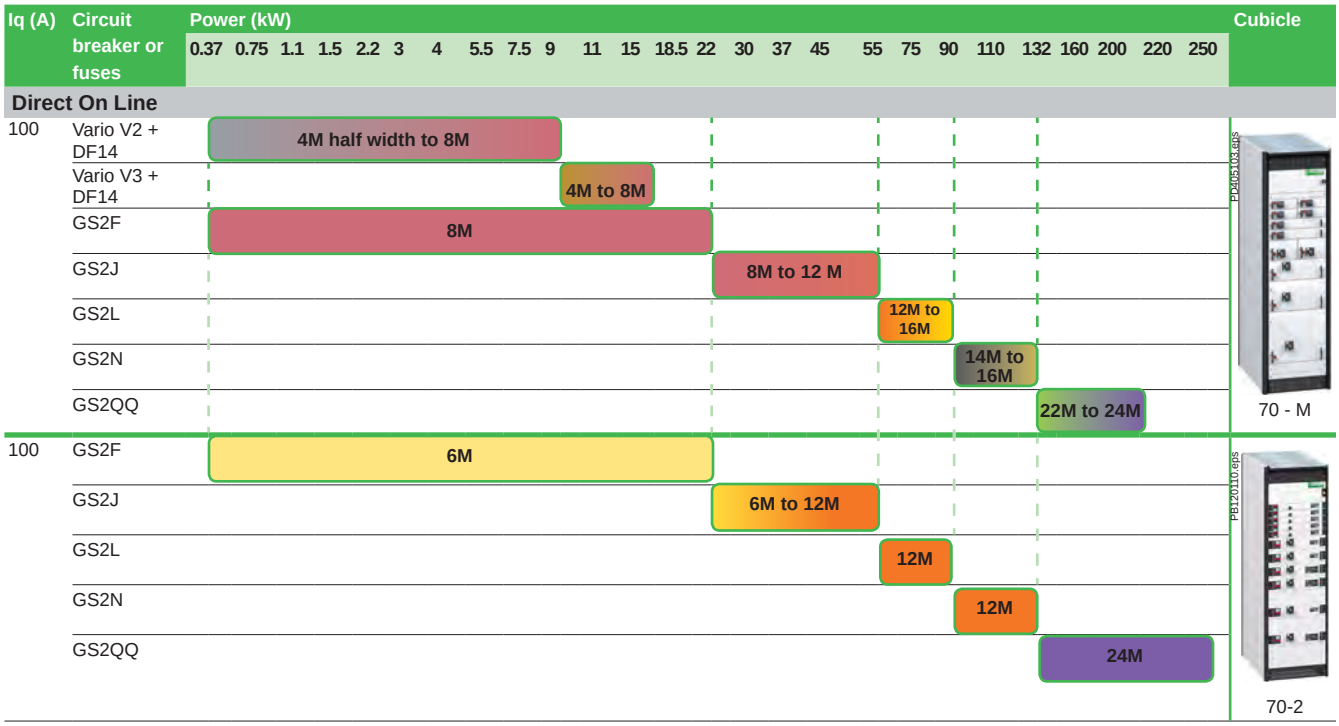
E

Selection of functional unit
P ⩽ 250kW

Selection of the functional unit with circuit breakers - iMCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C

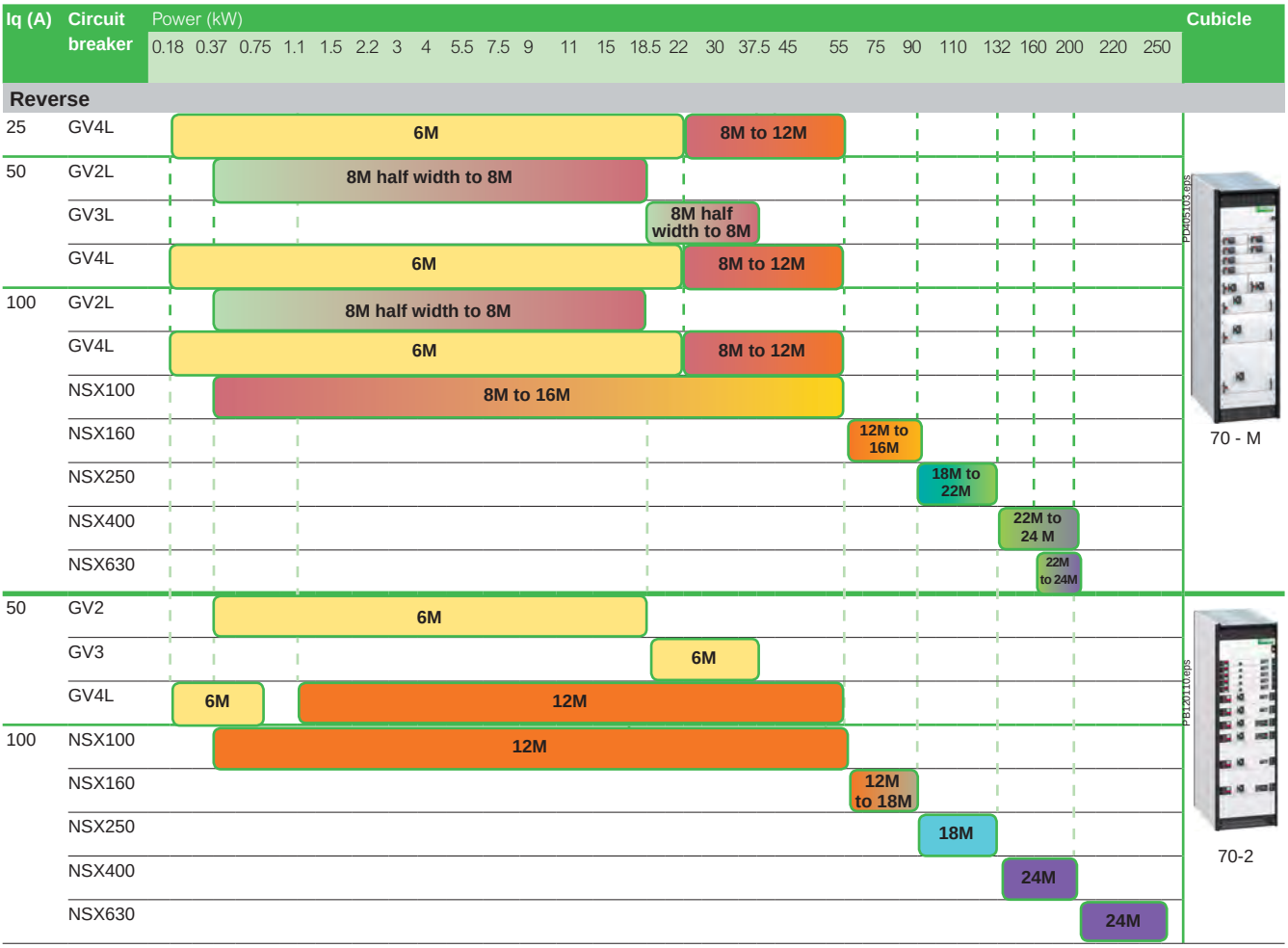


Selection of the functional unit with fuses - iMCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



Selection of functional unit
P ⩽ 250kW

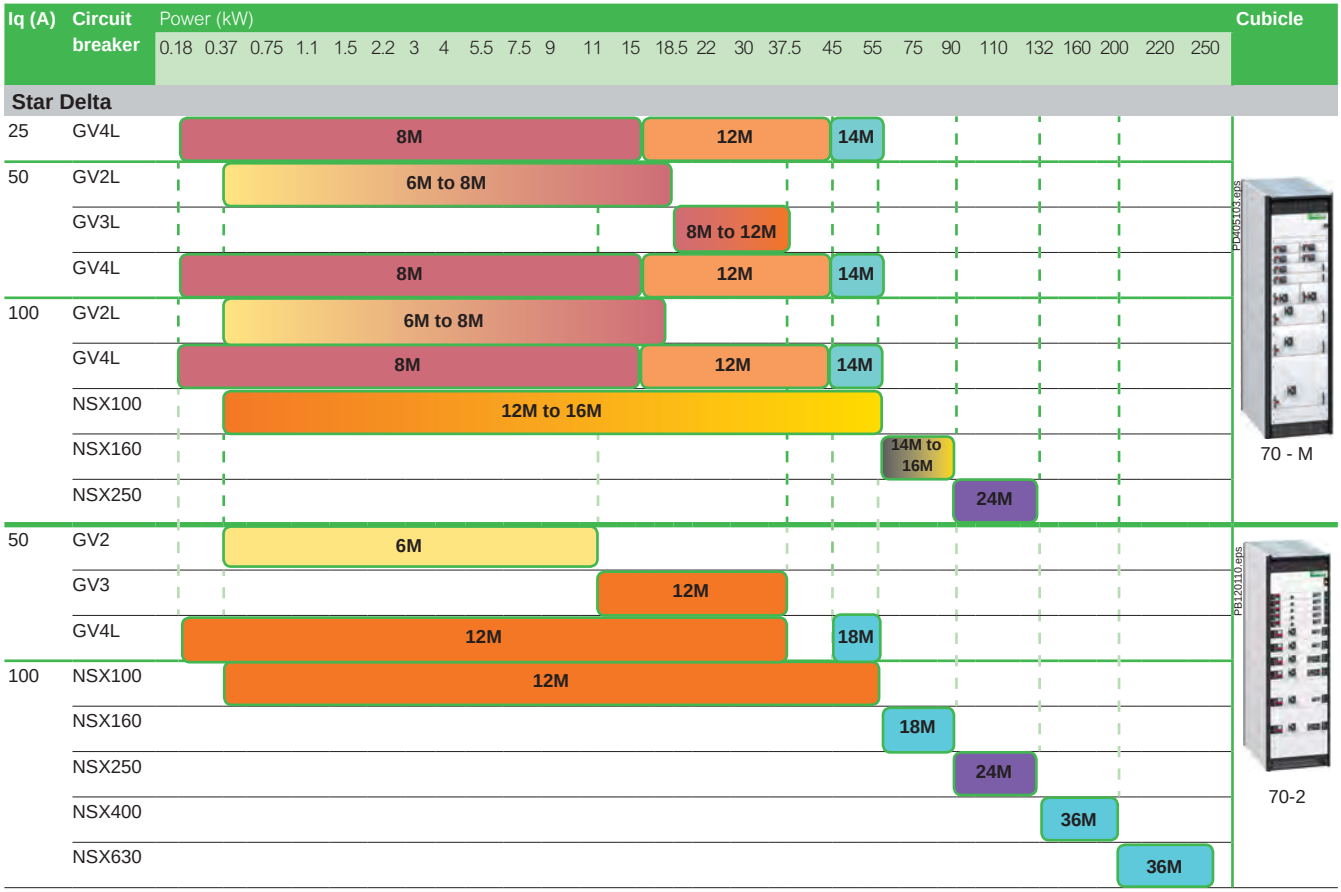
Selection of the functional unit with circuit breakers - iMCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



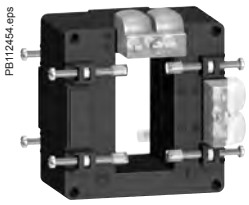
E

Selection of functional unit
P ⩽ 250kW

Selection of the functional unit with circuit breakers - iMCC 3 components - rated 415 V - 50/60 Hz - IP31/35°C



Type and installation of current transformers



METSECT5DA●●●

METSECT5DC●●●

METSECT5MA●●●

METSECT5CC●●●

Types of current transformers

Schneider Electric Power Logic catalogue (920068E) provide a wide choice of current transformers.
The choice depends on:
- the secondary rating (5 A): R,
- the form of the internal profile according to the type and the size of the conductor passing through: FF,
- the primary current (from 40A to 6000 A): XXX.

Presentation of catalogue numbers

MET SE CT R FF XXX

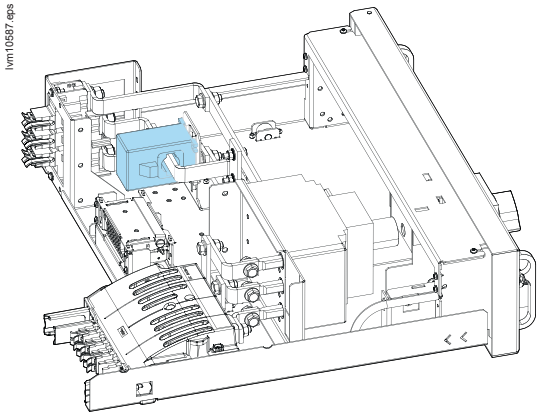
- R: First digit = secondary rating, R = 5 A mps
- FF: 2 letters = Form Factor
- XXX: Last 3 digits = primary rating / 10

Classes and power

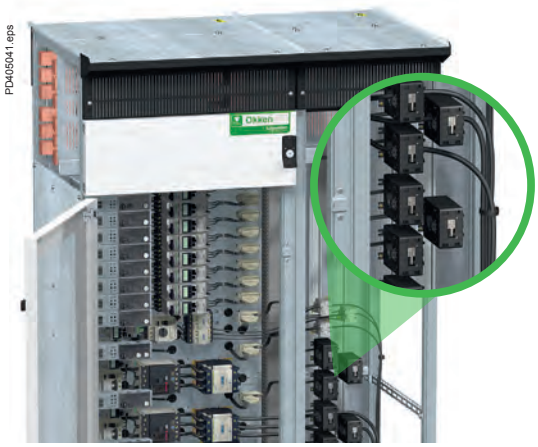
For measurement, Schneider Electric recommends class 1 CTs, rated output 5 VA.

E

Installing the current transformers



- In 70-M cubicle:
  - the CTs are in the drawer,
  - the CTs are choosen to optimize the size of the drawer.



- Distribution FUs ⩽ 630A :
  - NSX100/630 plug-in on Polyfast: on the fixed part's client connection pads
  - NSX100/630 disconnectable on Polyfast: in the late SC compartment
  - NSX100/630 Polyfast drawer: on the fixed part's client connection pads
  - ½-width drawer: in the connection compartment.

PB115988.eps

Principle

The drawer stop is a simple mechanism designed to block the drawer to avoid unintentional complete extraction.
This function is systematically integrated in 70-M cubicles.

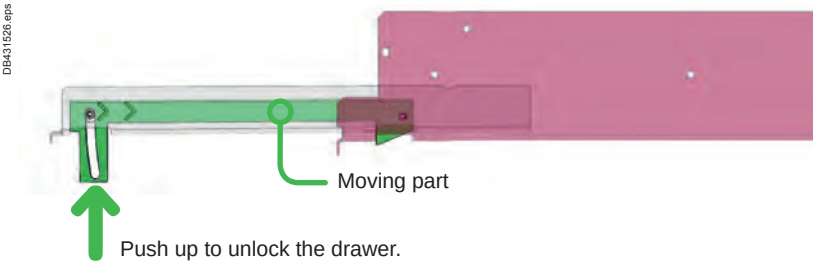
Drawer stop positions

Drawer plugged position

DB431525.eps

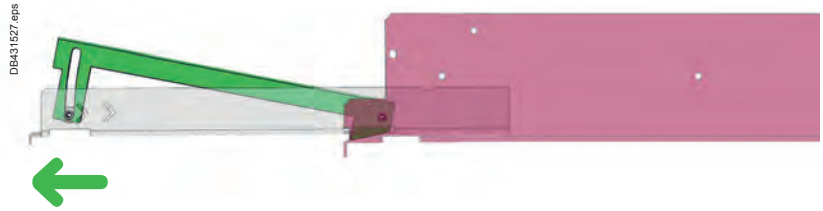
Drawer in test and draw-out position

DB431526.eps



Drawer extracted position

DB431527.eps



Motor Control Centre
MCC 1 component
TeSys U
70-2 disconnectable mounting plate
WFD - 0.37 to 15 kW

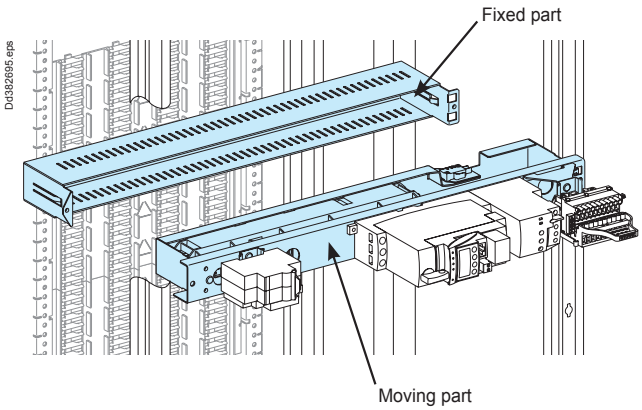
Functional unit description

- Type of cubicle:
  - SC
- Switchgear:
  - on rail or screwed
  - distribution terminal blocks support for power circuits
  - for auxiliary circuits: disconnectable contactor recommended
- Installating CTs :
  - in the lateral compartment
- front face:
  - feeders grouped behind a plain or transparent door.

Modularity :

- Add 1M above the disconnectable mounting plate when it is installed right:
  - under a horizontal busbar plate,
  - under a drawer.
- Add 1M under the disconnectable mounting plate when it is installed right:
  - at the bottom of the cubicle,
  - above a horizontal partition.

Typical drawing



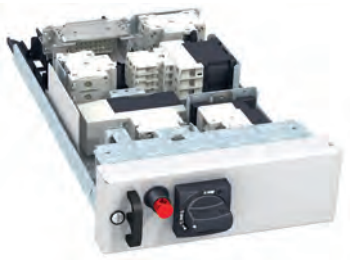
E

Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions					
	2M	3M	4M	6M	8M	12M
Direct on line						
Reverse						

Motor Control Centre
MCC 1 component
TeSys U
70-M drawer
WWW - 0.37 to 15 kW

PD405111.eps



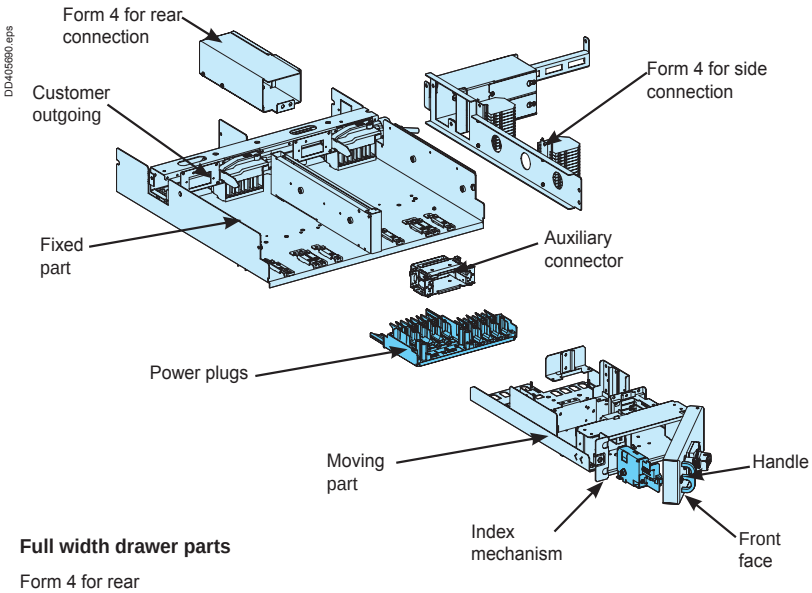
Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

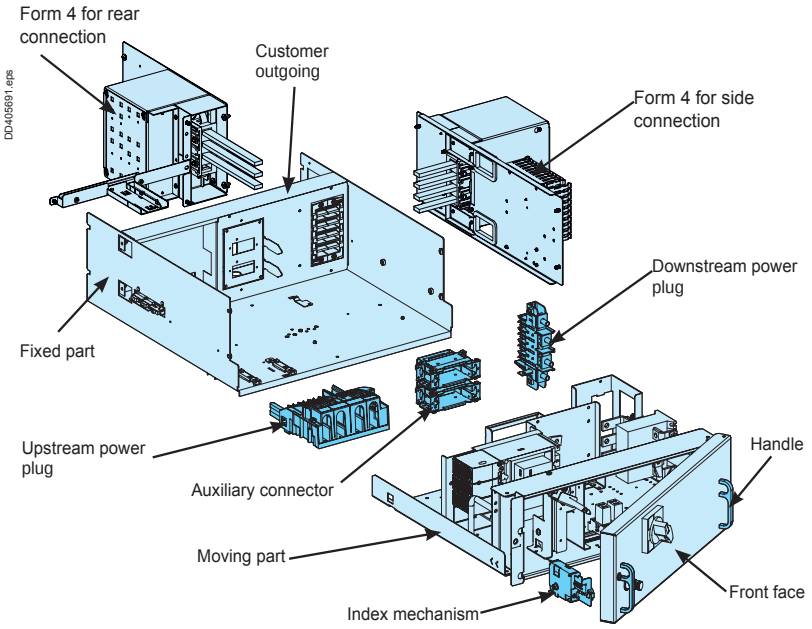
Half width drawer parts

DD405690.eps



Full width drawer parts

DD405691.eps



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions										
	4M ½	4M	6M ½	6M	8M ½	8M	10M	12M	16M	20M	24M
Direct on line											
Reverse											

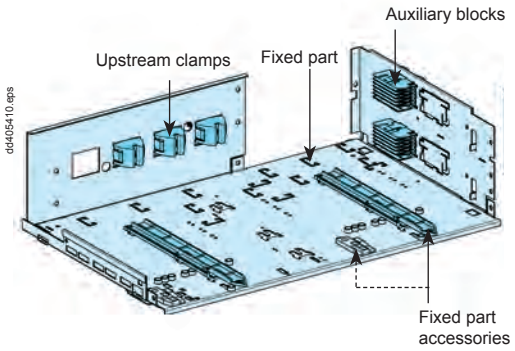
Motor Control Centre
MCC 1 component
TeSys U
70-2 drawer
WWW - 0.37 to 15 kW

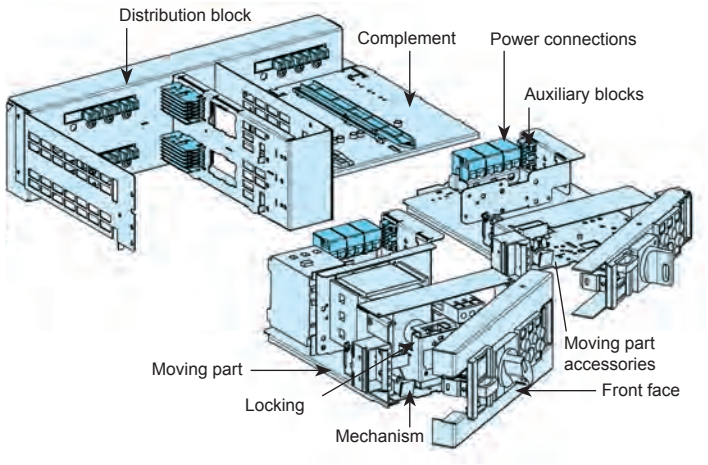
Functional unit description

70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

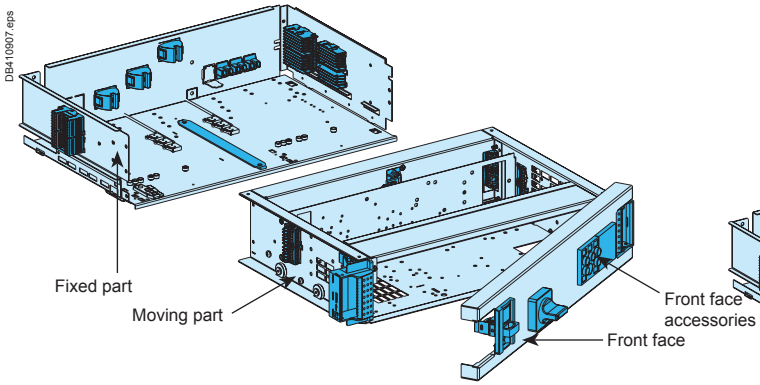
Typical drawing

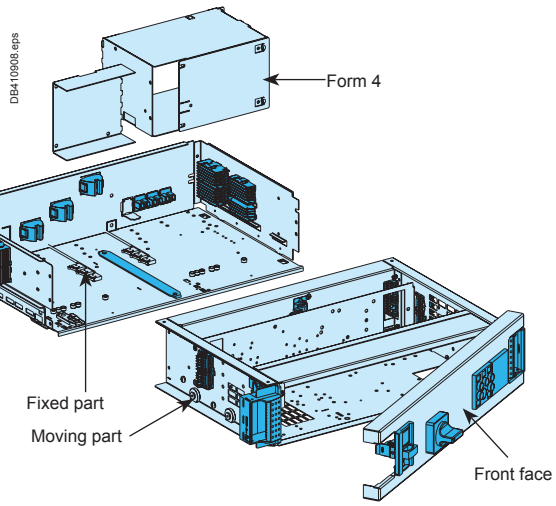
Half width drawer parts





Full width drawer parts





Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										

MCC 2 components
GV2P-GV3P
70-M drawer
WWW - 0.37 to 37 kW

PD405110.eps

Functional unit description

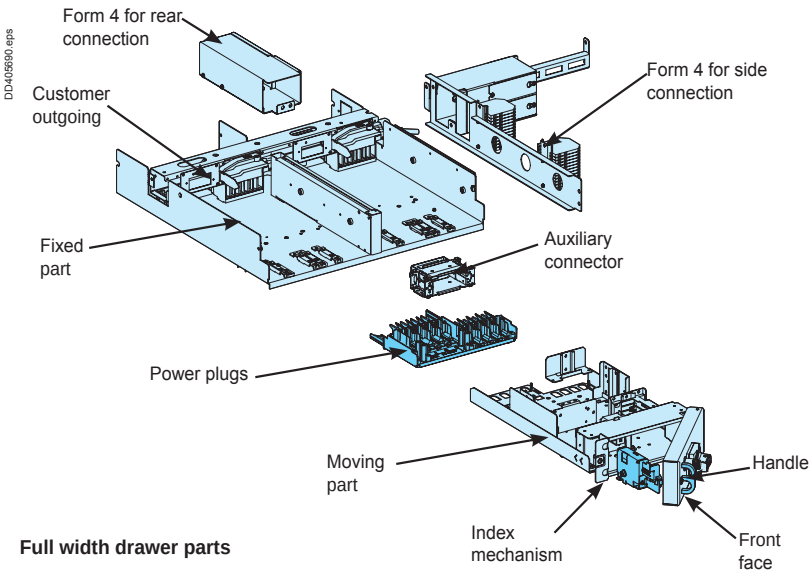
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

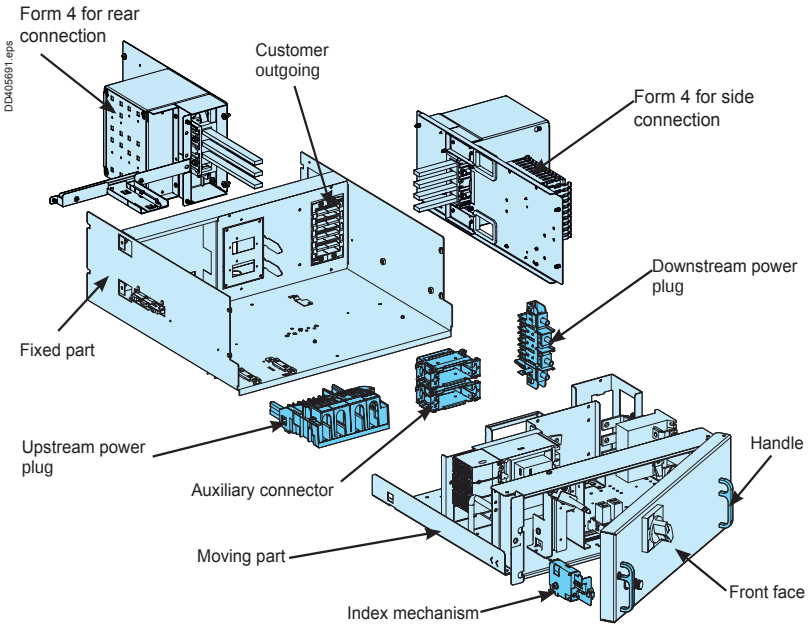
Half width drawer parts

DD405690.eps



Full width drawer parts

DD405691.eps



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions										
	4M ½	4M	6M ½	6M	8M ½	8M	10	12M	16M	20M	24M
Direct on line											
Reverse											
Star-Delta											

Motor Control Centre
MCC 2 components
GV4P
70-M drawer
WWW - 0.18 to 55 kW

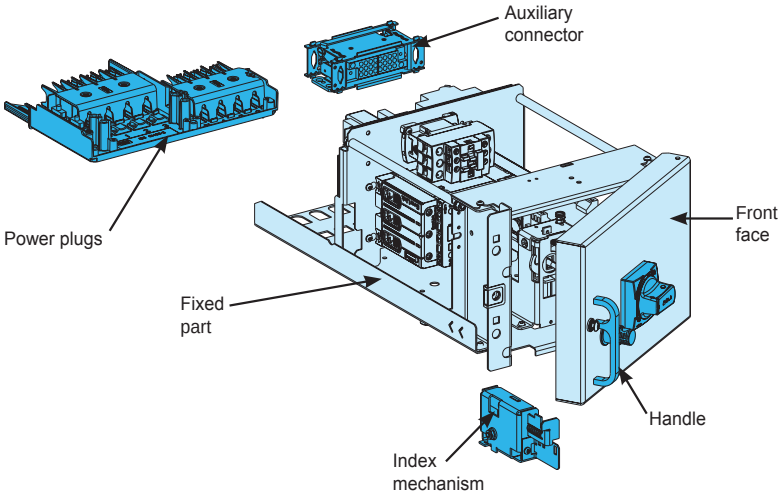
PB115587.eps

Functional unit description

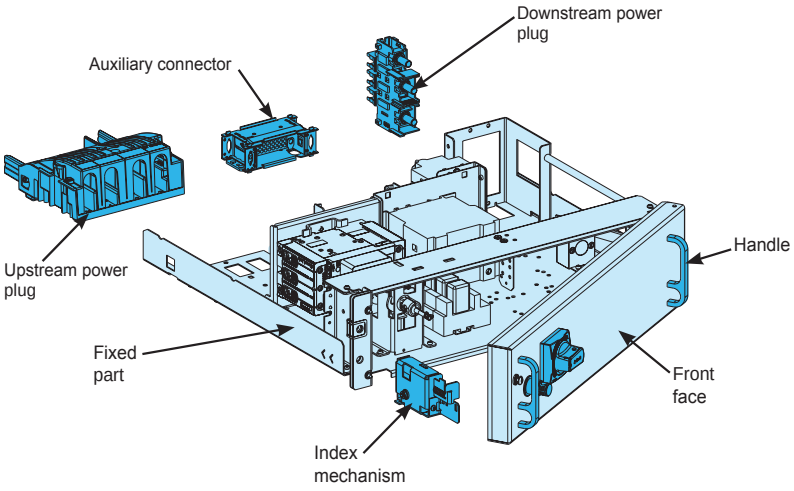
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts

Typical drawing

Half width drawer parts



Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions										
	4M	6M ½	6M	8M ½	8M	10M	12M	14M	16M	20M	24M
Direct on line											

Scheme	Dimensions								
	4M	6M	8M	10M	12M	14M	16M	20M	24M
Reverse									
Star-Delta									

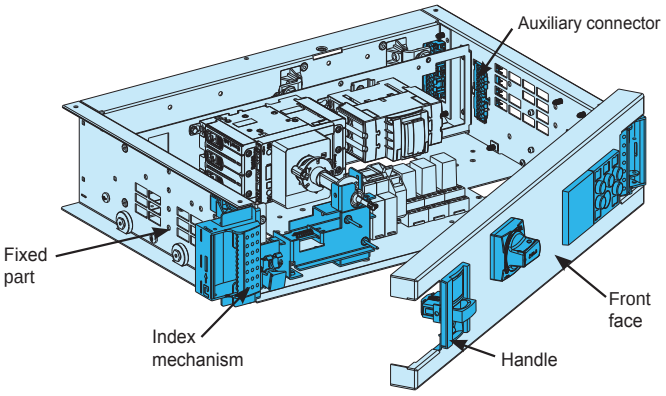
Motor Control Centre
MCC 2 components
GV4P
70-2 drawer
WWW - 0.18 to 55 kW

PB120821.eps

Functional unit description

70-2 drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24, 36 or 48 auxiliary contacts

Typical drawing



E

Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions										
	4M	6M ½	6M	8M ½	8M	10M	12M	14M	18M	20M	24M
Direct on line											

Scheme	Dimensions								
	4M	6M	8M	10M	12M	14M	18M	20M	24M
Reverse									
Star-Delta									

Motor Control Centre
MCC 3 components
GV2L
70-2 disconnectable mounting plate
WFD - 0.37 to 15 kW

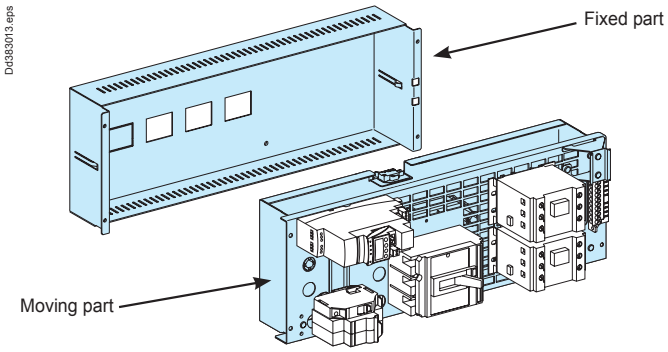
Functional unit description

- Type of cubicle:
  - SC
- Switchgear:
  - on rail or screwed
  - distribution terminal blocks support for power circuits
  - for auxiliary circuits: disconnectable contactor recommended
- Installating CTs :
  - in the lateral compartment
- front face:
  - feeders grouped behind a plain or transparent door.

Modularity :

- Add 1M above the disconnectable mounting plate when it is installed right:
  - under a horizontal busbar plate,
  - under a drawer.
- Add 1M under the disconnectable mounting plate when it is installed right:
  - at the bottom of the cubicle,
  - above a horizontal partition.

Typical drawing



E

Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions					
	2M	3M	4M	6M	8M	12M
Direct on line						
Reverse						
Star-Delta						

MCC 3 components
GV2L - GV3L
70-M drawer
WWW - 0.37 to 15 kW

PD405110.eps

Functional unit description

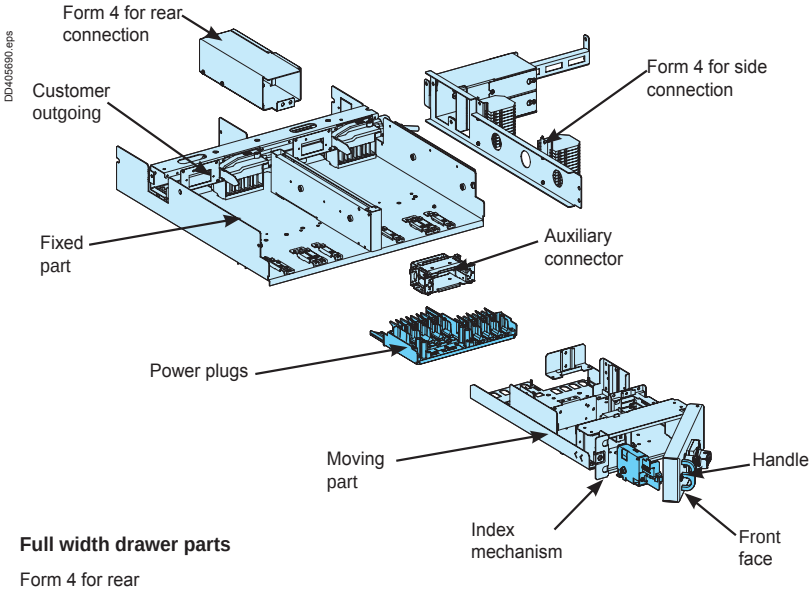
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

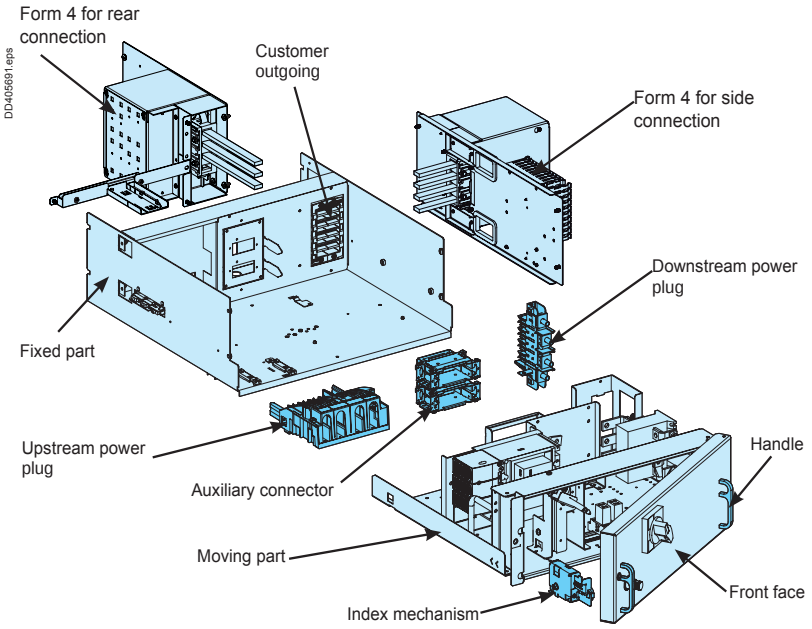
Half width drawer parts

DD405690.eps



Full width drawer parts

DD405691.eps



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions										
	4M ½	4M	6M ½	6M	8M ½	8M	10M	12M	16M	20M	24M
Direct on line											
Reverse											
Star-Delta											

Motor Control Centre
MCC 3 components
GV2L - GV3L
70-2 drawer
WWW - 0.37 to 30 kW

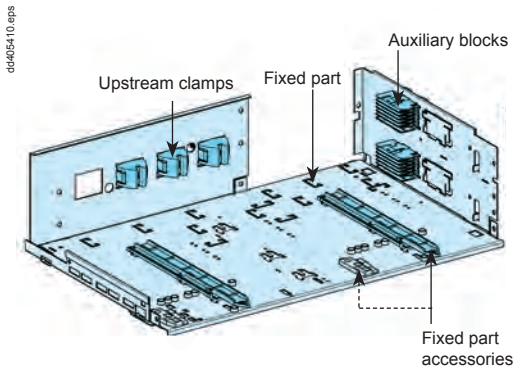
Functional unit description

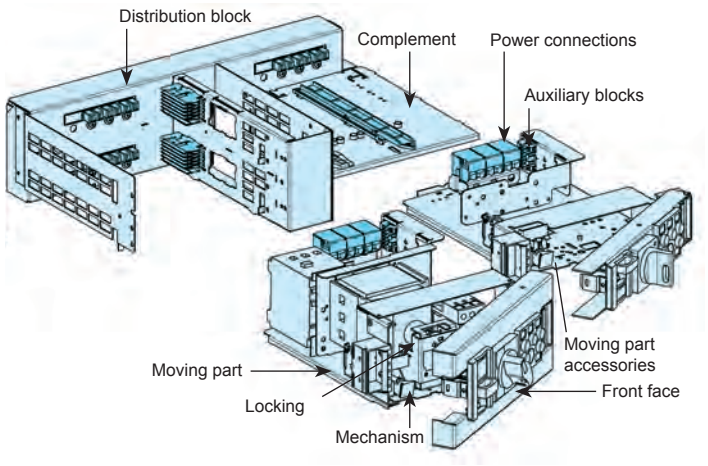
70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Note : Usage of trip indicator lamp is mandatory.

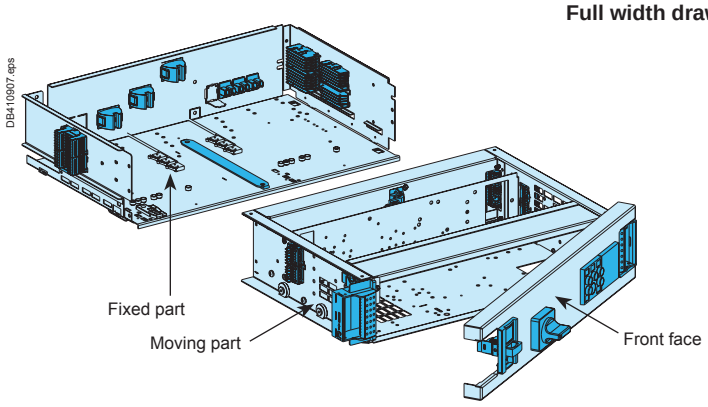
Typical drawing

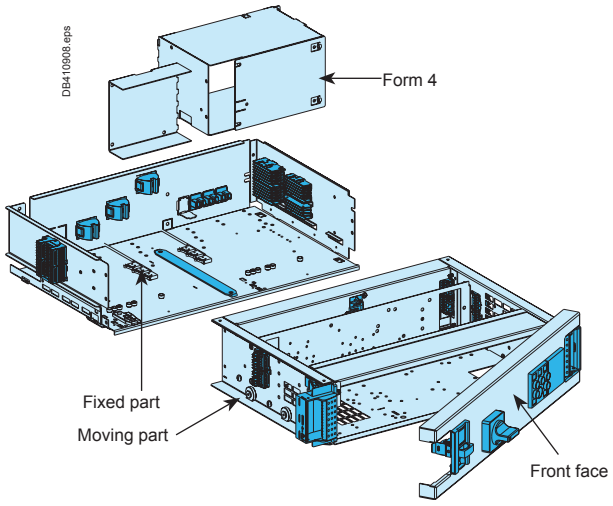
Half width drawer parts





Full width drawer parts





Note: Auxiliary contact on left is optional.

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

MCC 3 components
GV4L
70-M drawer
WWW - 0.18 to 55 kW

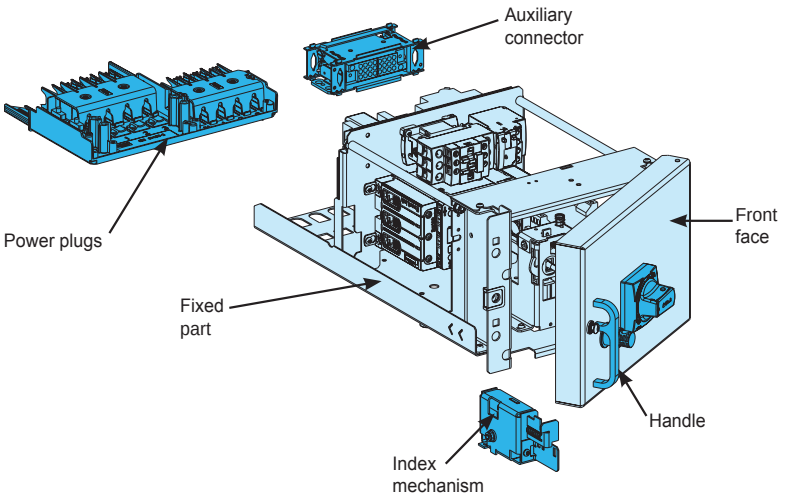
PB115577.eps

Functional unit description

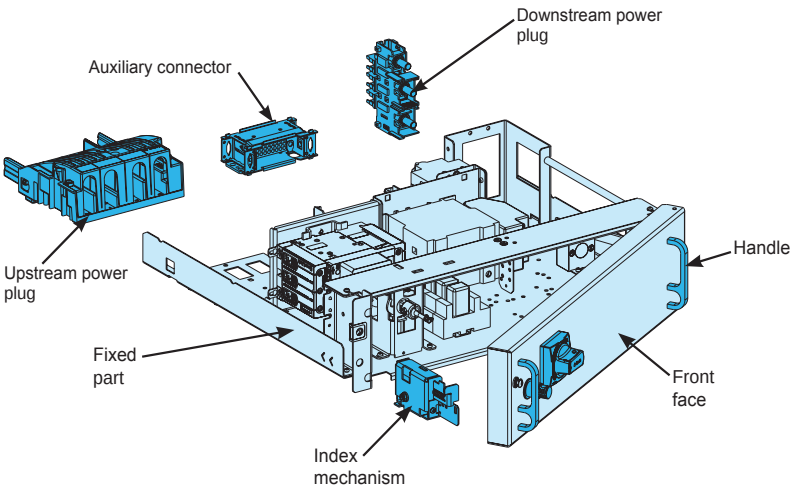
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts

Typical drawing

Half width drawer parts



Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions									
	4M	6M ½	6M	8M ½	8M	10M	12M	14M	16M	20M	24M
Direct on line											

Scheme	Dimensions								
	4M	6M	8M	10M	12M	14M	16M	20M	24M
Reverse									
Star-Delta									

Motor Control Centre
MCC 3 components
GV4L
70-2 drawer
WWW - 0.18 to 55 kW

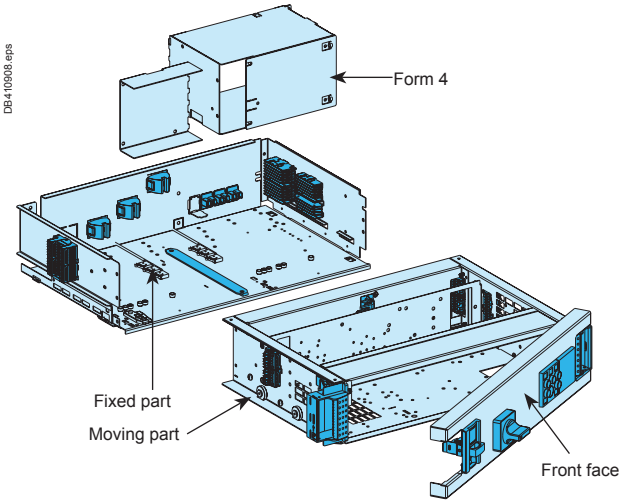
PD405058.eps

Functional unit description

70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Typical drawing

DB410908.eps



E

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions							
	2M	3M	4M	6M	8M	8M½	12M	18M
Direct on line								
Reverse								
Star-Delta								

Motor Control Centre
MCC 3 components
NSX100-630
70-M drawer
WWW - 0.37 to 250 kW

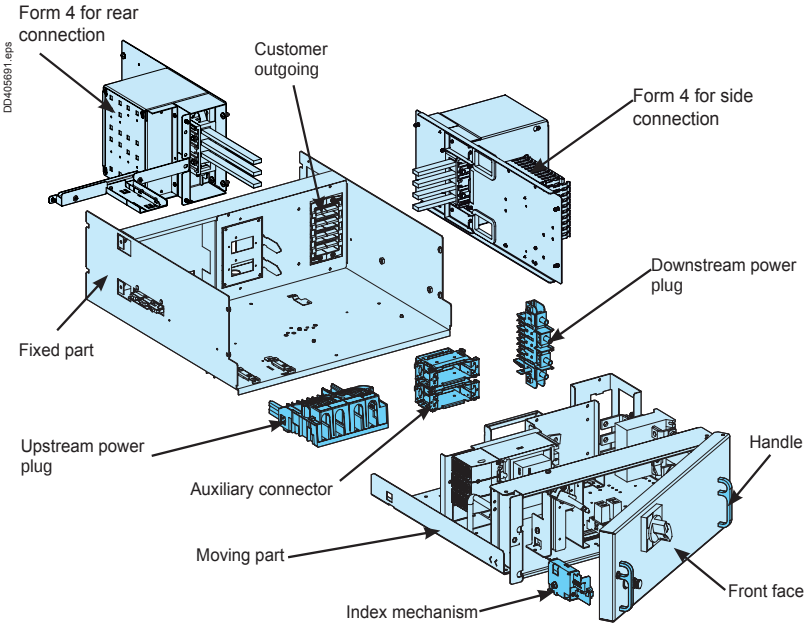
PD405113.eps

Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

DD405691.eps



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions										
	4M ½	4M	6M ½	6M	8M ½	8M	10M	12M	16M	20M	24M
Direct on line											
Reverse											
Star-Delta											

Motor Control Centre
MCC 3 components
NSX100-630
70-M closed door racking drawer
WWW

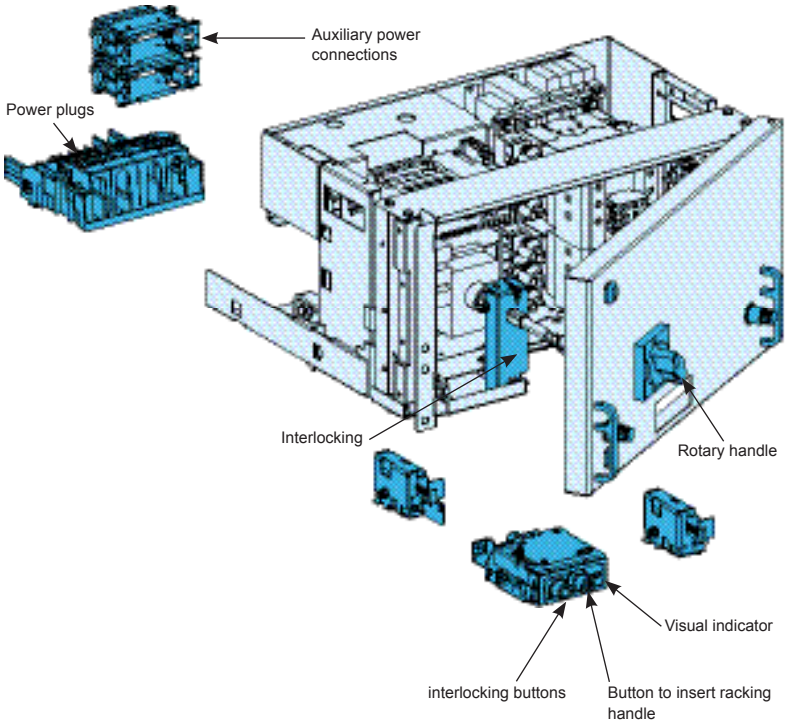
PB120143.eps

Functional unit description

- Type of connection
  - ☐ SC and RC.
- Connection
  - ☐ retractable stabs onto the busbar.
- Specific installation tools
  - ☐ cranking tool
  - ☐ remote racking device.

Typical drawing

Catalogue Okken - Tiroir.eps



E

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

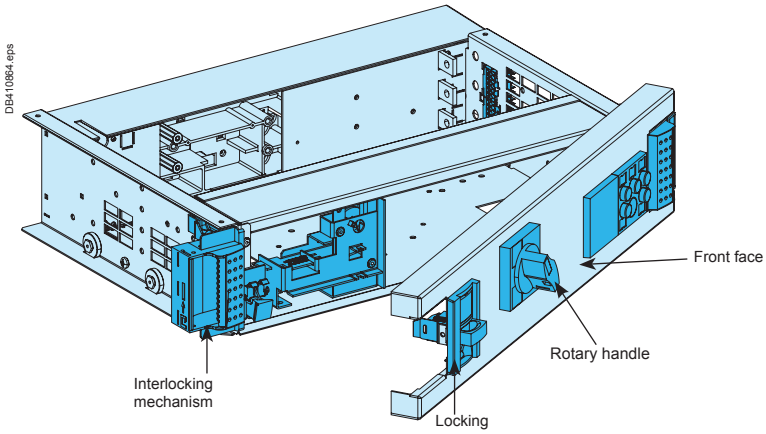
Scheme	Dimensions							
	6M	8M	10M	12M	16M	20M	24M	36M
Direct on line								
Reverse								
Star-Delta								

Motor Control Centre
MCC 3 components
NSX100-630
70-2 drawer
WWW - 0.37 to 250 kW

Functional unit description

70-2 drawers solutions:
- include 6 to 24 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Typical drawing



Example of functional unit modularityfor Ue = 415 V - IP31/35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

Motor Control Centre
MCC 3 components
Vario
70-M drawer
WWW - 0.37 to 15 kW

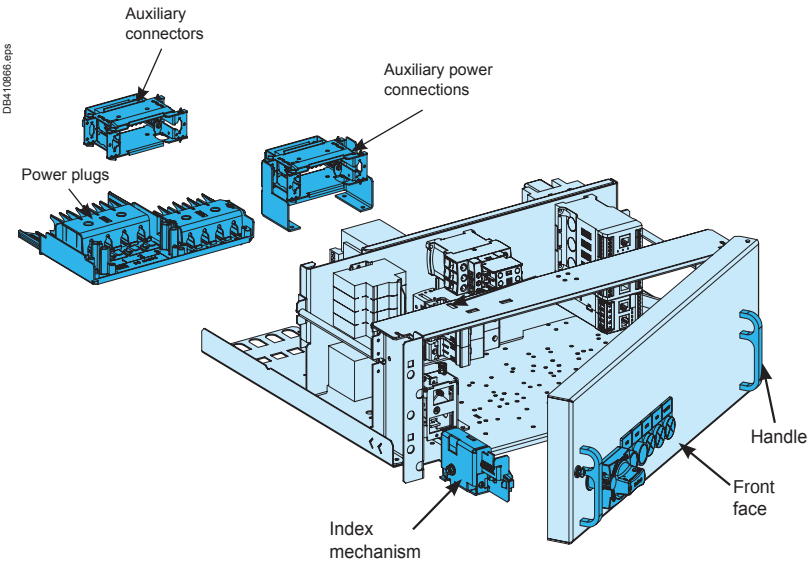
PB115593.eps

Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

DB410866.eps



E

Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions											
	4M ½	4M	6M ½	6M	8M ½	8M	10	12M	16M	20M	24M
Direct on line												
Reverse												
Star-Delta												

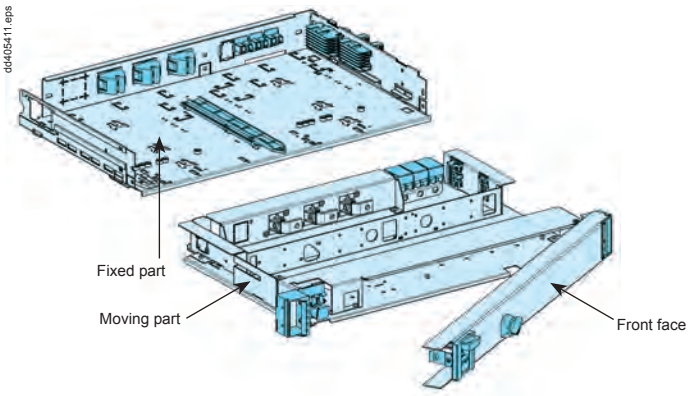
Motor Control Centre
MCC 3 components
Vario
70-2 drawer
WWW - 0.37 to 15 kW

Functional unit description

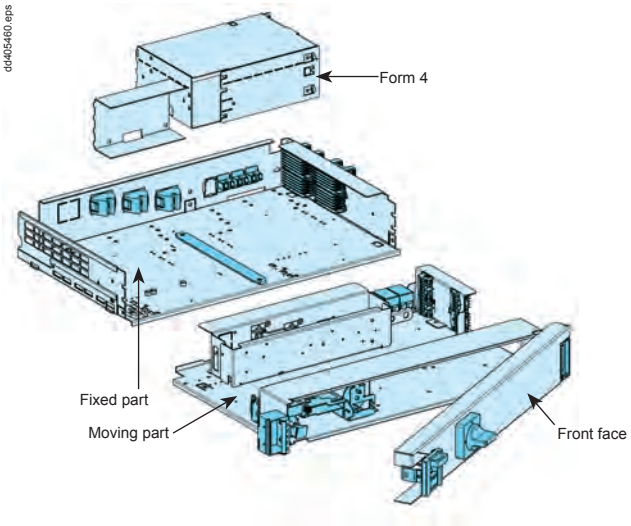
70-2 drawers solutions:
- include 6 to 24 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Typical drawing

Half width drawer parts



Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

Motor Control Centre
MCC 3 components
GS2
70-2 disconnectable mounting plate
WFD - 0.37 to 37 kW

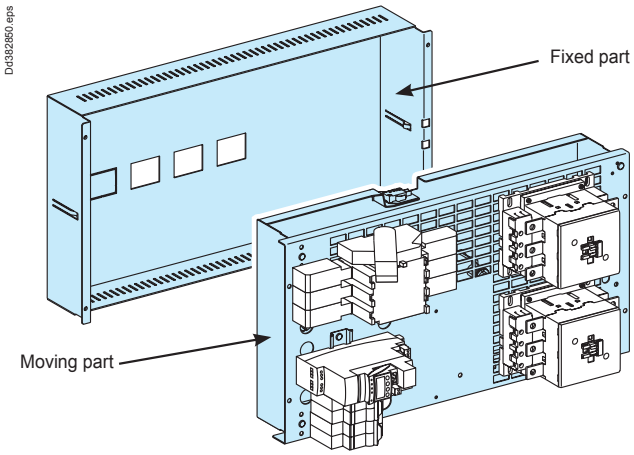
Functional unit description

- Type of cubicle:
  - SC
- Switchgear:
  - on rail or screwed
  - distribution terminal blocks support for power circuits
  - for auxiliary circuits: disconnectable contactor recommended
- Installating CTs :
  - in the lateral compartment
- front face:
  - feeders grouped behind a plain or transparent door.

Modularity :

- Add 1M above the disconnectable mounting plate when it is installed right:
  - under a horizontal busbar plate,
  - under a drawer.
- Add 1M under the disconnectable mounting plate when it is installed right:
  - at the bottom of the cubicle,
  - above a horizontal partition.

Typical drawing



E

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

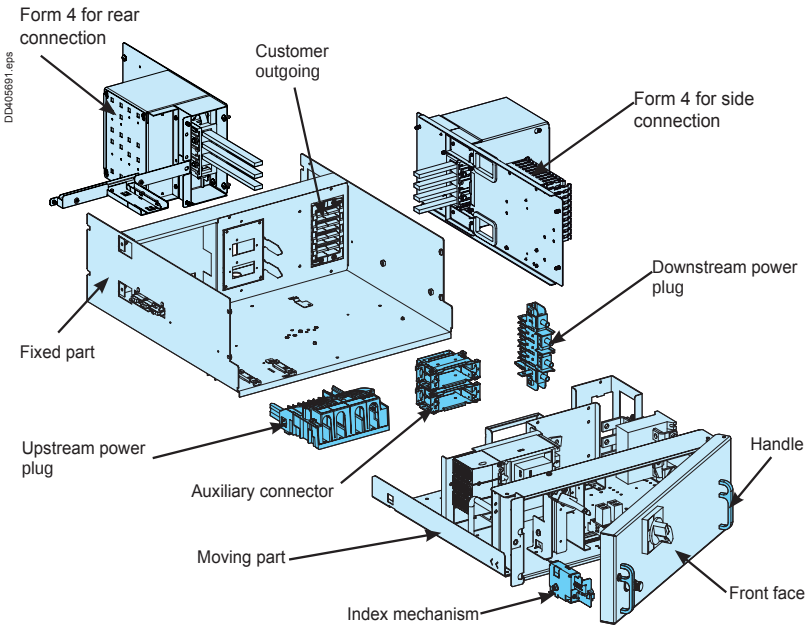
Scheme	Dimensions					
	2M	3M	4M	6M	8M	12M
Direct on line						
Reverse						
Star-Delta						

Motor Control Centre
MCC 3 components
GS2
70-M drawer
WWW - 0.37 to 200 kW

Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing



Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions										
	4M ½	4M	6M ½	6M	8M ½	8M	10M	12M	16M	20M	22M
Direct on line											
Reverse											
Star-Delta											

Motor Control Centre
MCC 3 components
GS2
70-2 drawer
WWW - 0.37 to 220 kW

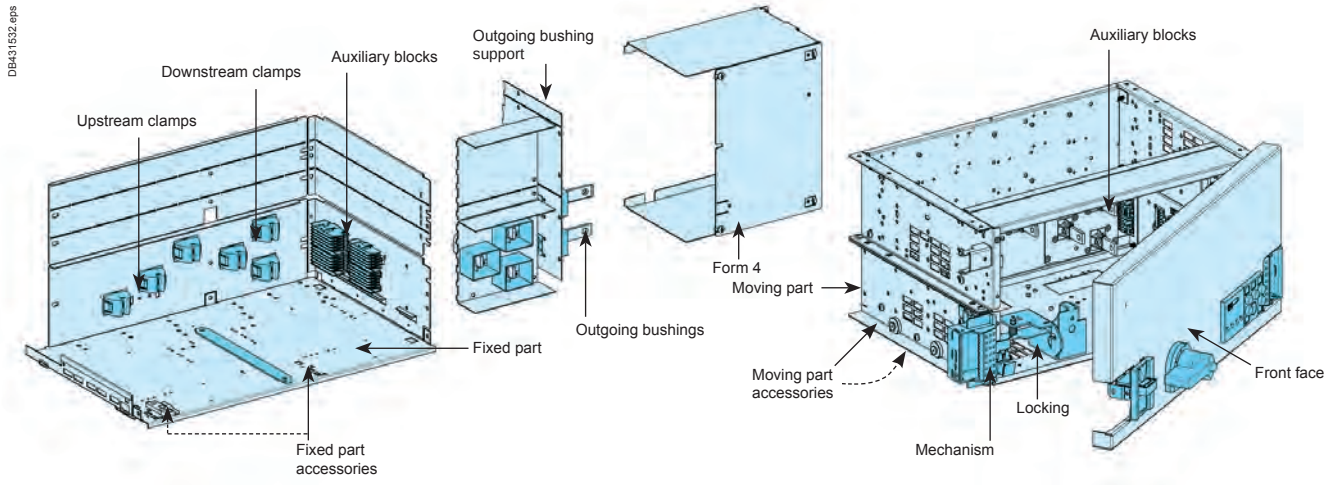
PB120150.eps

Functional unit description

70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain auxiliary transformer.

Typical drawing

DB431532.eps



E

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

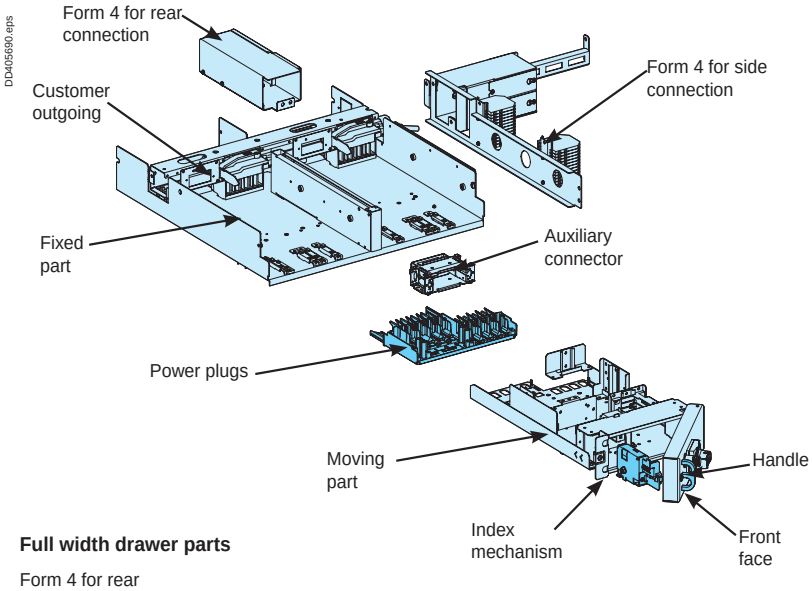
Motor Control Centre
iMCC 1 component
TeSys U
70-M drawer
WWW - 0.37 to 15 kW

Functional unit description

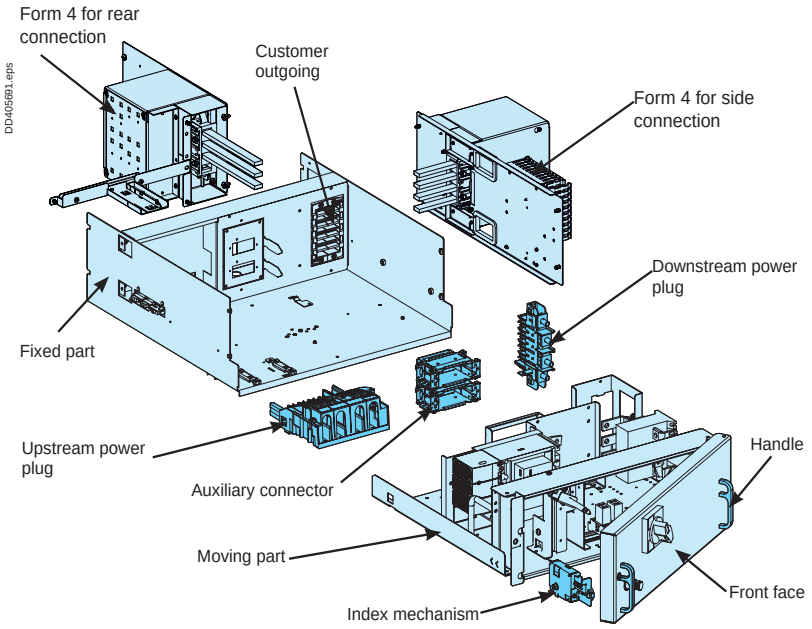
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

Half width drawer parts



Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions								
	4M ½ 4M	6M ½ 6M	8M ½ 8M	10M	12M	14M	16M	20M	24M
Direct on line									
Reverse									

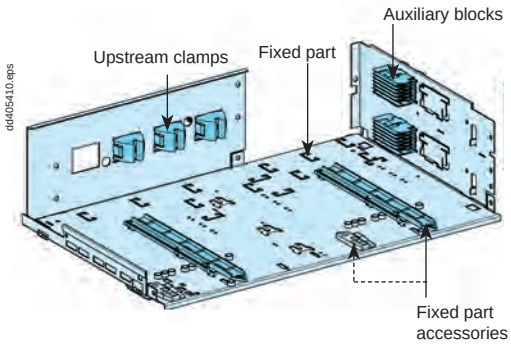
Motor Control Centre
iMCC 1 component
TeSys U
70-2 drawer
WWW - 0.37 to 15 kW

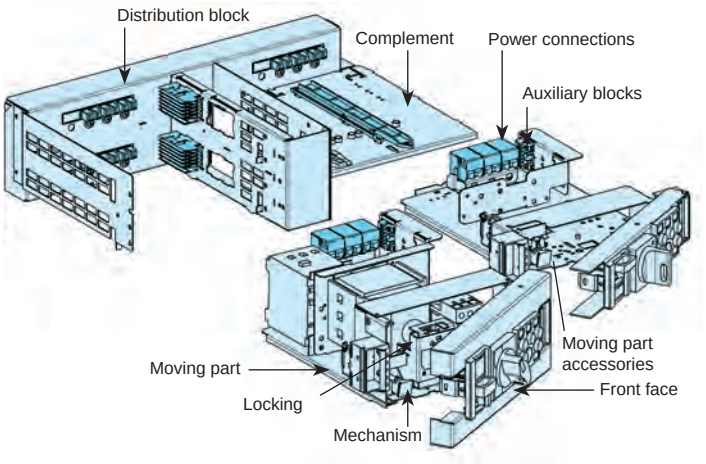
Functional unit description

70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

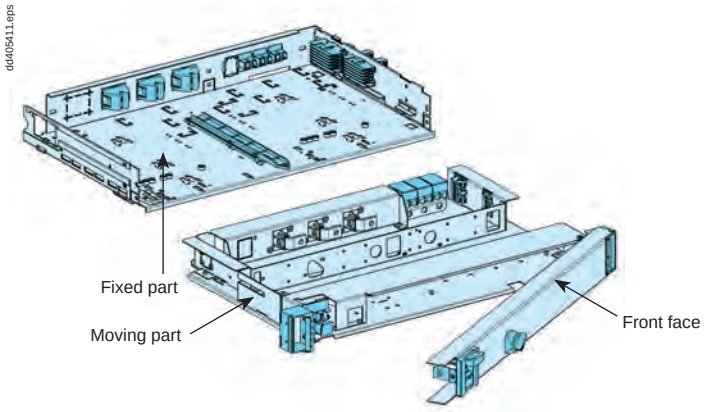
Typical drawing

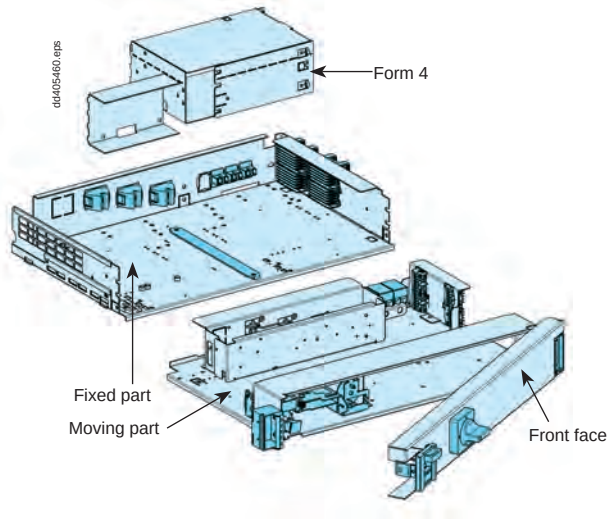
Half width drawer parts





Full width drawer parts



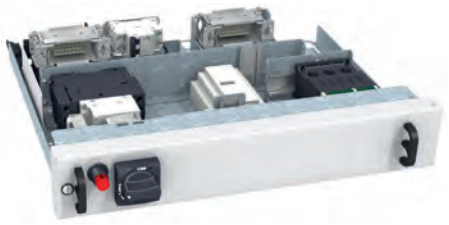


Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										

iMCC 3 components
GV2L-GV3L
70-M drawer
WWW - 0.37 to 15 kW

PD405112.eps



Functional unit description

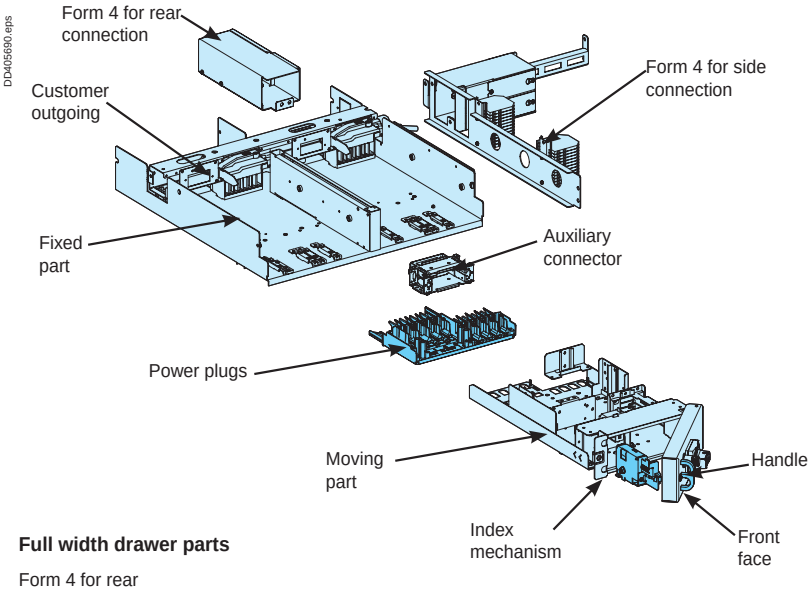
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

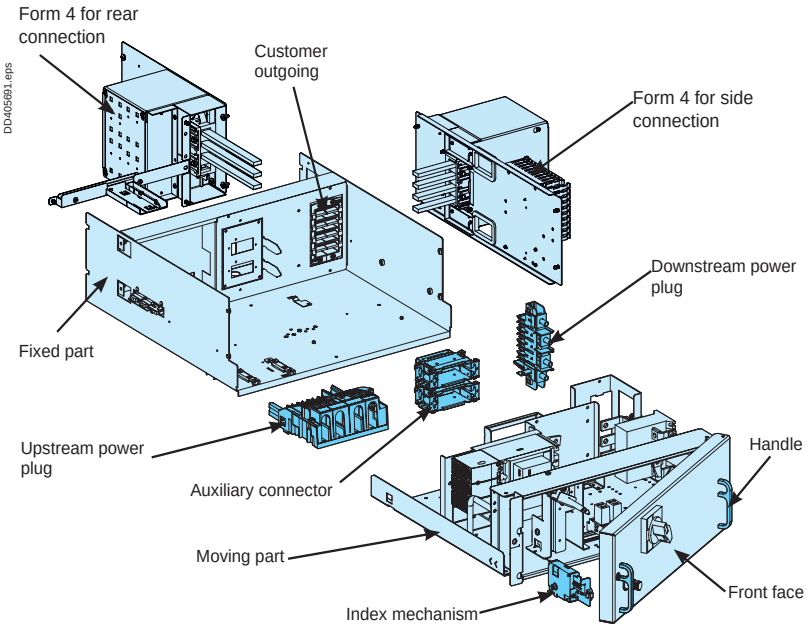
Half width drawer parts

DD405690.eps



Full width drawer parts

DD405691.eps



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions								
	4M ½ 4M	6M ½ 6M	8M ½ 8M	10M	12M	14M	16M	20M	24M
Direct on line									
Reverse									
Star-Delta									

Motor Control Centre
iMCC 3 components
GV2L-GV3L
70-2 drawer
WWW - 0.37 to 30 kW

PD405061.eps

Functional unit description

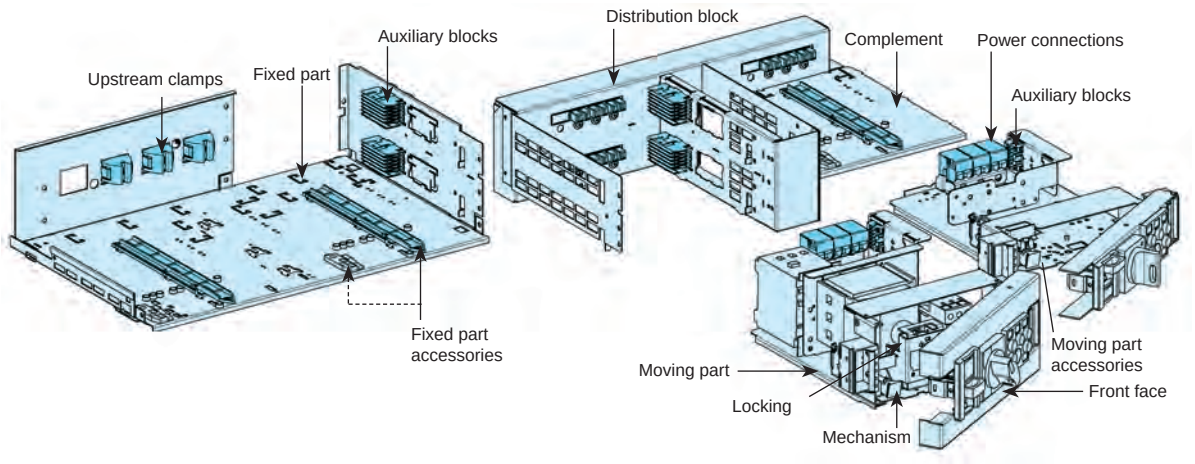
70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

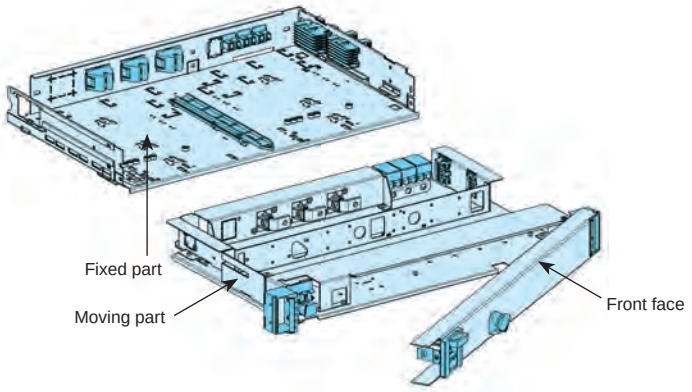
Half width drawer parts

dd405410.eps

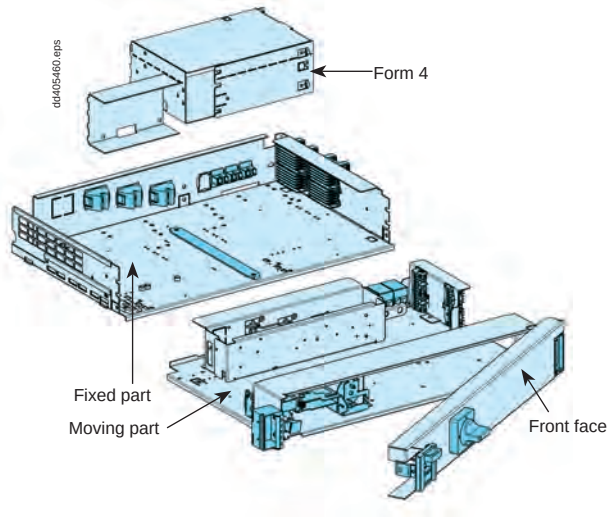


Full width drawer parts

dd405411.eps



dd405460.eps



Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

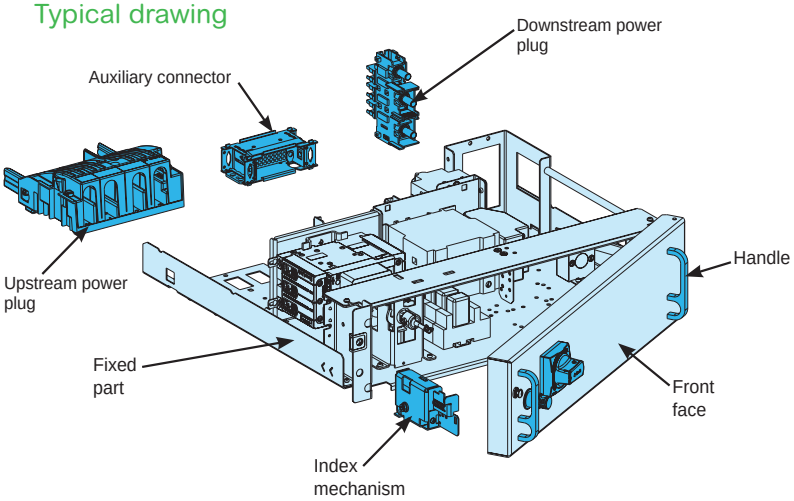
iMCC 3 components
GV4L
70-M drawer
WWW - 0.18 to 55 kW

PB115577.eps

Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts

Typical drawing



E

Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions								
	6M	8M ½	8M	10M	12M	14M	16M	20M	24M
Direct on line									

Scheme	Dimensions								
	4M	6M	8M	10M	12M	14M	16M	20M	24M
Reverse									
Star-Delta									

Motor Control Centre
iMCC 3 components
GV4L
70-2 drawer
WWW - 0.37 to 37 kW

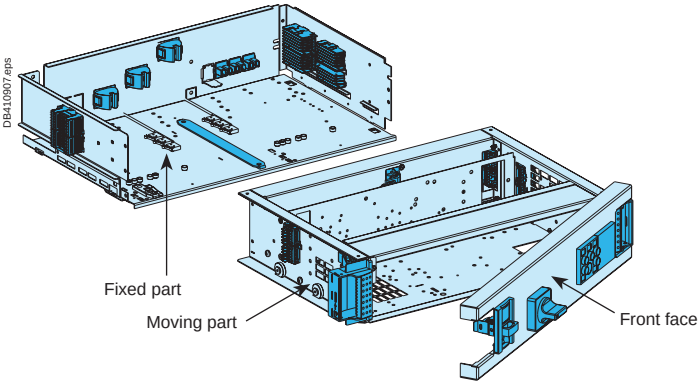
PD405058.eps

Functional unit description

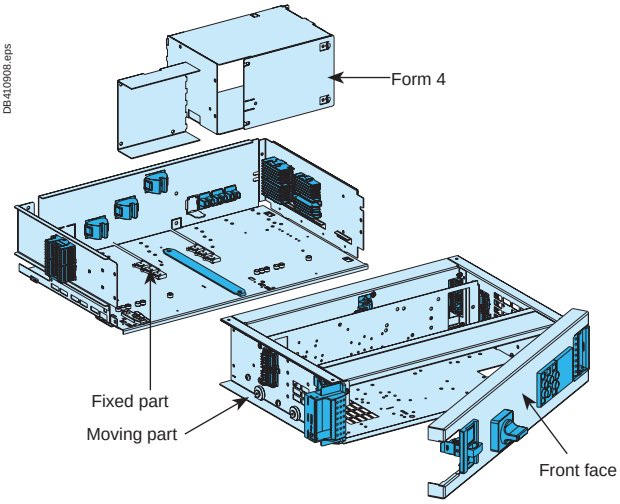
70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Typical drawing

DB410907.eps



DB410908.eps



E

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions							
	2M	3M	4M	6M	8M	8M½	12M	18M
Direct on line								
Reverse								
Star-Delta								

Motor Control Centre
iMCC 3 components
NSX100-630
70-M drawer
WWW - 0.37 to 250 kW

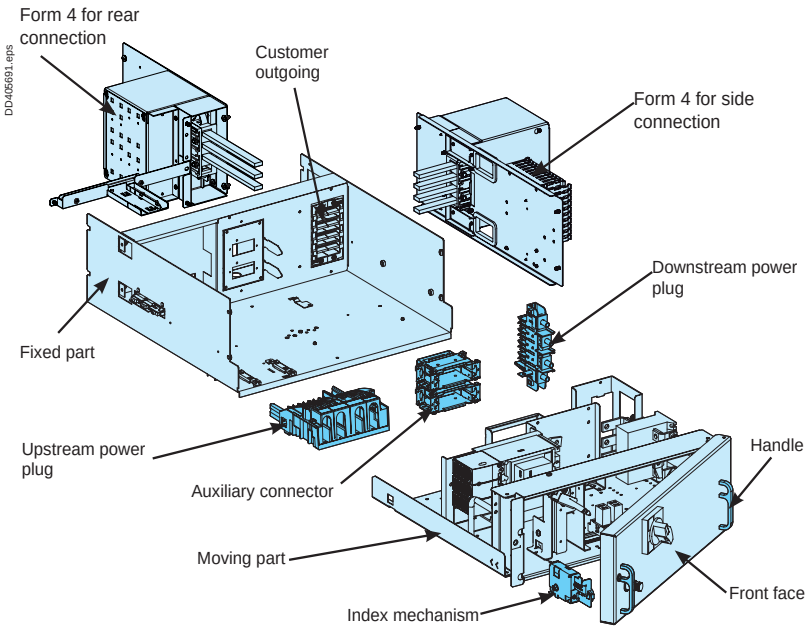
PD405113.eps

Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

DD405691.eps



Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions								
	4M ½ 4M	6M ½ 6M	8M ½ 8M	10M	12M	14M	16M	20M	24M
Direct on line									
Reverse									
Star-Delta									

Motor Control Centre
iMCC 3 components
NSX100-630
70-2 drawer
WWW - 0.37 to 250 kW

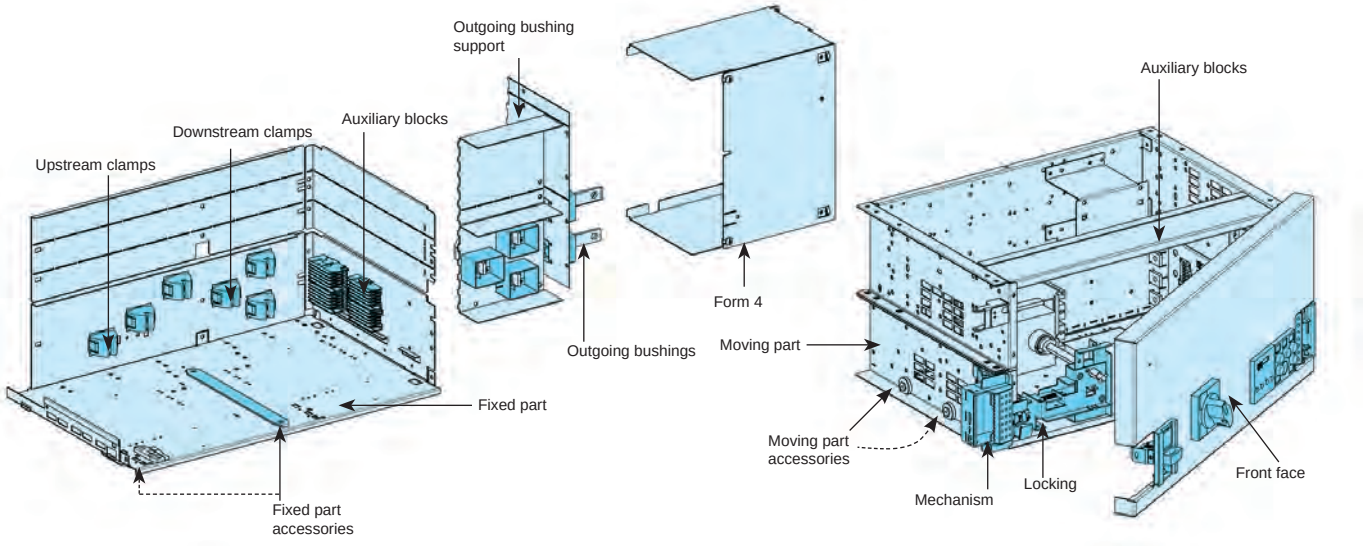
PD405067.eps

Functional unit description

70-2 drawers solutions:
- include 6 to 36 auxiliary contacts,
- are not intended to contain current transformers,
- are not intended to contain auxiliary transformer.

Typical drawing

dd405412a.eps



E

Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

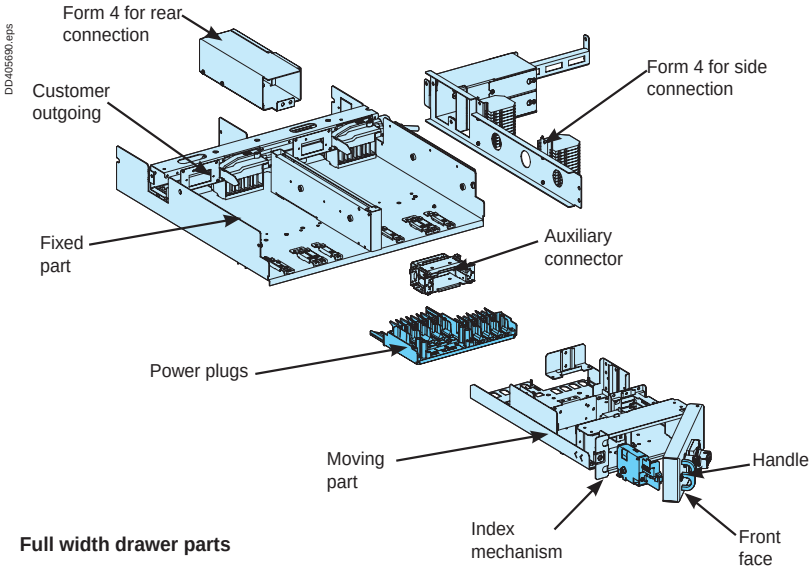
Motor Control Centre
iMCC 3 components
Vario
70-M drawer
WWW - 0.37 to 15 kW

Functional unit description

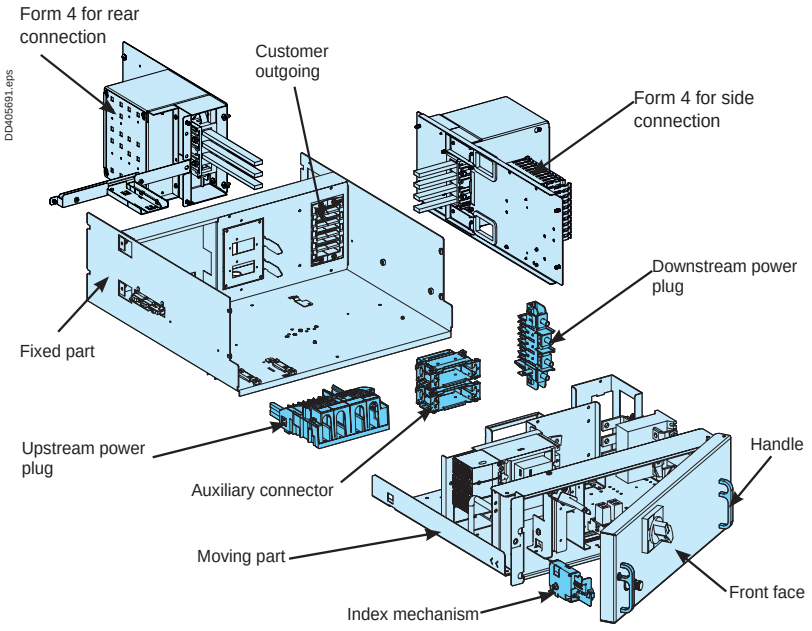
70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

Half width drawer parts



Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions								
	4M ½ 4M	6M ½ 6M	8M ½ 8M	10	12M	14M	16M	20M	24M
Direct on line									
Reverse									
Star-Delta									

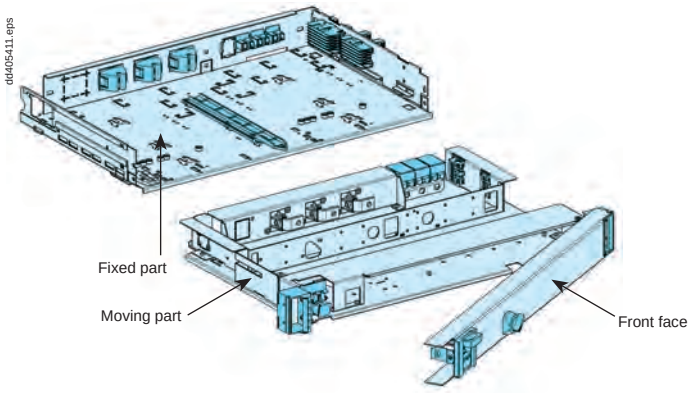
Motor Control Centre
iMCC 3 components
Vario
70-2 drawer
WWW - 0.37 to 15 kW

Functional unit description

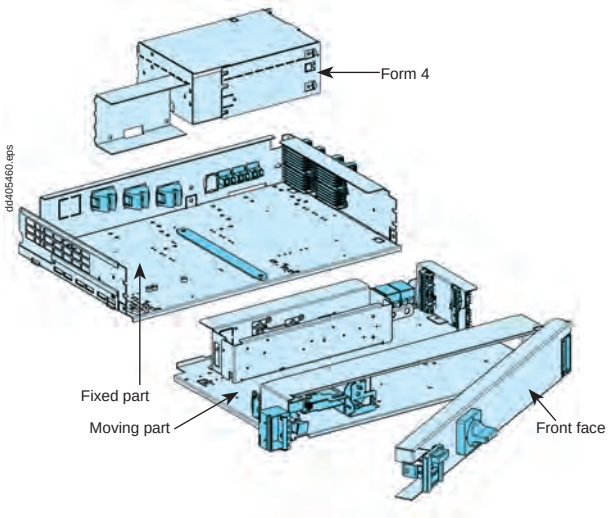
70-2 drawers solutions:
- include 6 to 24 auxiliary contacts,
- are not intended to contain auxiliary transformer.

Typical drawing

Half width drawer parts



Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

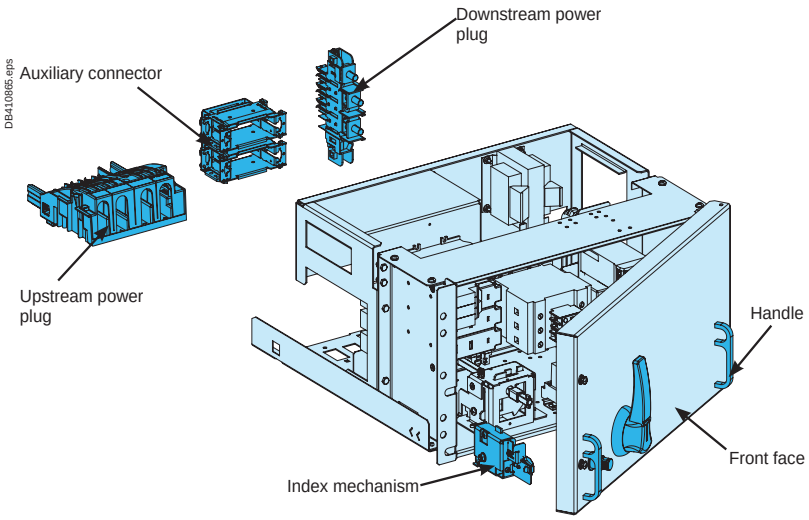
Motor Control Centre
iMCC 3 components
GS2
70-M drawer
WWW - 0.37 to 200 kW

Functional unit description

70-M drawers solutions include functional units equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Typical drawing

Full width drawer parts



Example of functional unit modularity for Ue = 415 V - IP31 / 35°C

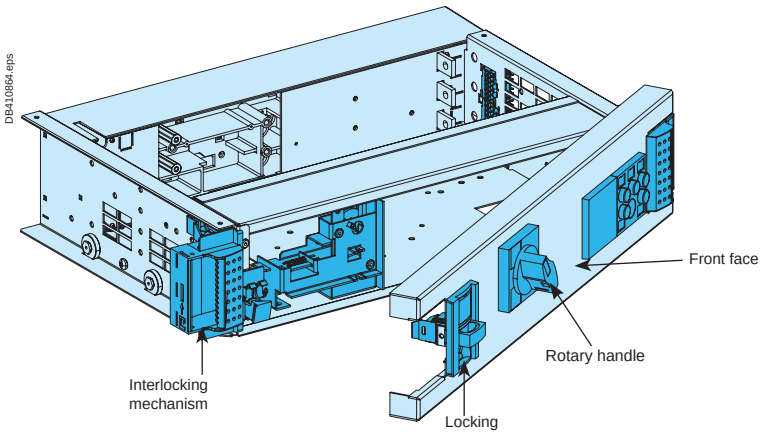
Scheme	Dimensions									
	4M ½ 4M	6M ½ 6M	8M ½ 8M	10M	12M	14M	16M	20M	22M	
Direct on line										
Reverse										
Star-Delta										

Motor Control Centre
iMCC 3 components
GS2
70-2 drawer
WWW - 0.37 to 220 kW

Functional unit description

70-2 drawers solutions:
- include 6 to 24 auxiliary contacts,
- are not intended to contain auxiliary transformer.

Typical drawing



E

Example of functional unit modularity for Ue = 415 V - IP31/35°C

Scheme	Dimensions									
	2M	3M ½	3M	4M	6M ½	6M	12M	18M	24M	36M
Direct on line										
Reverse										
Star-Delta										

Variable speed drives and soft starters

F

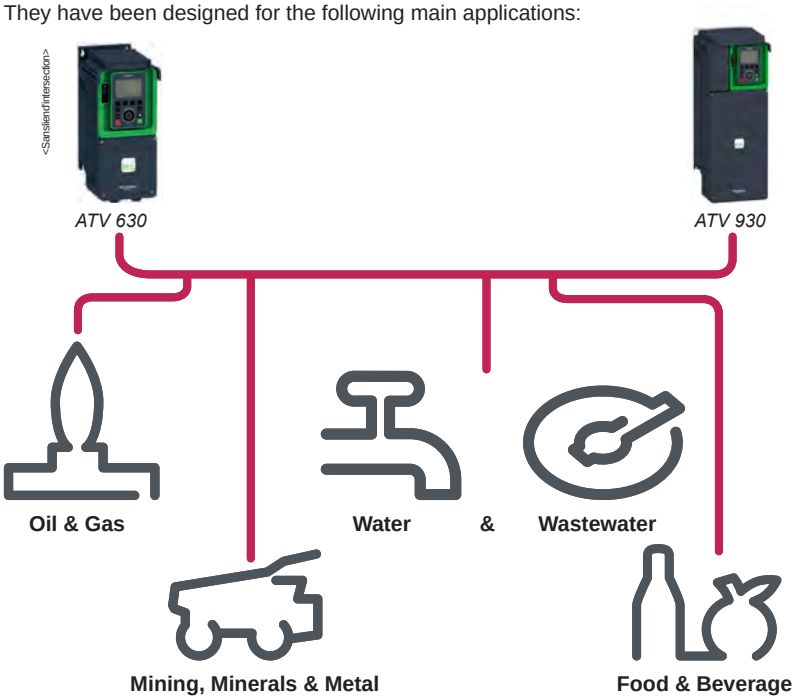
Introduction
Variable speed drives

Altivar ATV 630

Altivar ATV 930

Altivar ATV630 and 930

They have been designed for the following main applications:



Braking resistor

Braking resistor

■ The braking resistor enables the Altivar 630 drive to operate while braking to a standstill, by dissipating the braking energy.
It enables maximum transient braking torque.
■ The resistors are designed to be mounted on the outside of the enclosure, but should not inhibit natural cooling.
Air inlets and outlets must not be obstructed in any way.
■ The air must be free of dust, corrosive gas and condensation.

Application example: Inertia machines

Line choke

Line choke (optional)

A line choke can be used to provide improved protection against overvoltages on the line supply and to reduce harmonic distortion of the current produced by the drive.

Application examples :
The use of line chokes is recommended in particular under the following circumstances:

■ *close connection of several drives in parallel,*
■ *line supply with significant disturbance from other equipment (interference, overvoltages),*
■ *line supply with voltage imbalance between phases above 1.8% of the nominal voltage,*
■ *drive supplied by a line with very low impedance (in the vicinity of power transformers 10 times more powerful than the drive rating),*
■ *installation of a large number of frequency inverters on the same line,*
■ *reducing overloads on the cos φ correction capacitors, if the installation includes a power factor correction unit.*

Corrosive atmospheres

In standard atmospheres, the variable speed drivers comply with the IEC 721-3-3 standard (3C1 and 3C2).
In corrosive atmospheres (H_2S, SO_2), they comply with the IEC 721-3-3 standard (3SC2 maxi) if ordered with the additional catalogue number S337.

Altistart ATS U01

Altistart ATSU 01

■ Its choice criteria is the power of the motor to supply.
■ The Altistart U01 limits the starting torque and current peaks on starting, on machines which do not require a high starting torque.
■ The Altistart U01 is designed for the following simple applications:
conveyors,
conveyor belts,
pumps,
fans,
compressors,
automatic doors and gates,
small cranes,
belt-driven machines, etc ...

Altistart ATS 48

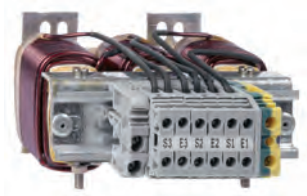
Altistart ATS 48

■ The Altistart 48 soft start - soft stop unit is a controller with 6 thyristors, which is used for the torque-controlled soft starting and stopping of three-phase squirrel cage asynchronous motors.
■ The Altistart 48 must be selected on the basis of 3 main criteria:
the power supply voltage range (this catalogue deals only whith the devices connected to a 415V or 690V network),
the power and the nominal current of the motor,
the type of application and the operating cycle.

To simplify selection, the applications are divided in 2 types:

■ **Standard applications:**
The Altistart 48 is designed to provide:
starting at 4 In for 23 seconds or at 3 In for 46 seconds from a cold state,
starting at 3 In for 23 seconds or at 4 In for 12 seconds with a load factor of 50 % and 10 starts per hour or any equivalent thermal cycle
Example : centrifugal pump.

■ **Severe applications:**
The Altistart 48 is designed to provide:
starting at 4 In for 48 seconds or at 3 In for 90 seconds from a cold state,
starting at 4 In for 25 seconds with a load factor of 50 % and 5 starts per hour or any equivalent thermal cycle.
Example : grinder.



Line choke

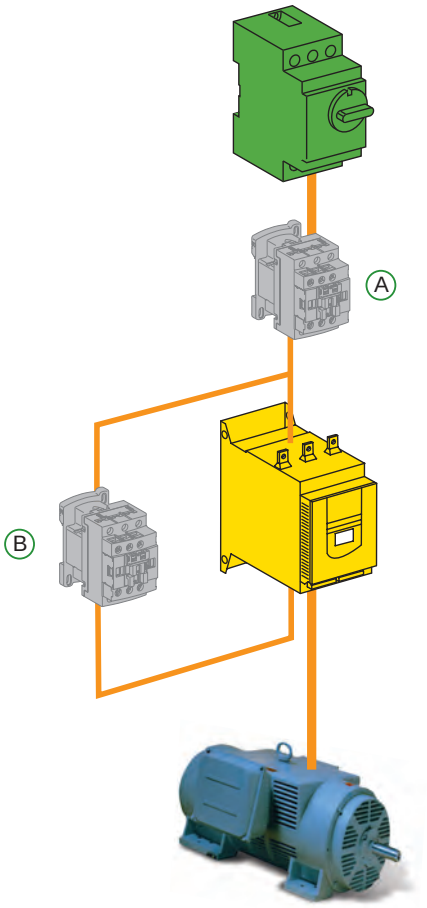
Line choke (optional)

■ The use of line chokes is recommended in particular when installing several electronic starters on the same line supply.
■ The values of the chokes are defined for a voltage drop between 3% and 5% of the nominal line voltage.
■ Install the line choke between the line contactor and the starter.

Corrosive atmospheres

Soft starters cannot be used in corrosive atmospheres.

DD405572.eps



Optimizing the choice of the devices associated to ATV 630-930 and ATS 48

Line contactor

The line contactor (A) allows power to be connected to the starter, that can also be performed by the ATS soft starter or the ATV variable speed drive. This line contactor is therefore optional: it has to be installed only on explicit customer request.

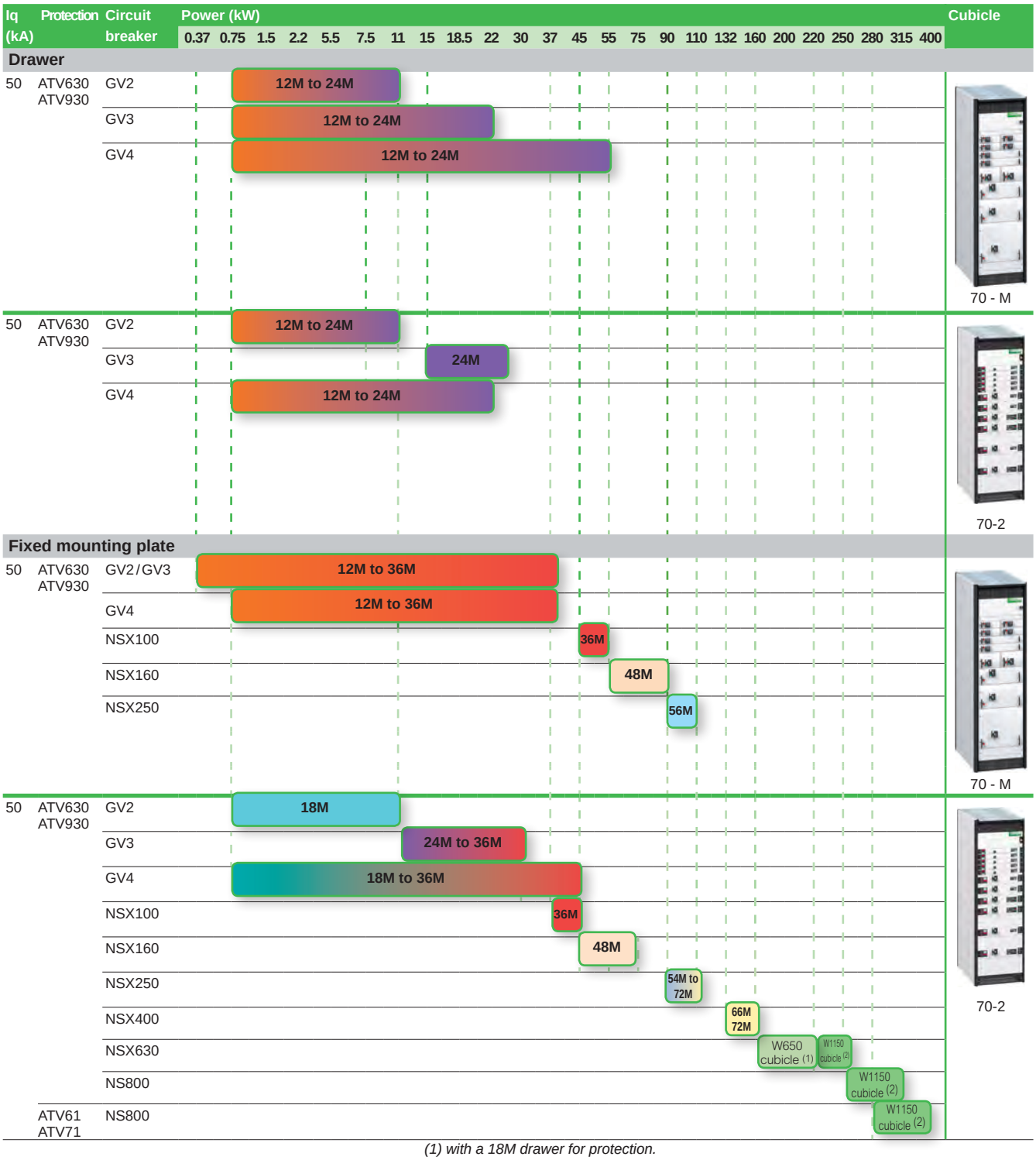
By-pass contactor for ATS soft starters

The by-pass contactor (B) allows to by-pass the starter at the end of the starting, while keeping the electronic protections.
As a consequence, a less expensive starter can be used.

device	ATV 630		ATV 930		Soft starter ATSU 01	Soft starter ATS 48	
	fixed	withdrawable	fixed	withdrawable	withdrawable	fixed	withdrawable
415V	●	●	●	●	●	●	●
690V	●		●			●	●

Variable speed drives and soft starters
Selection of functional unit

Selection of the functional unit with circuit breakers - rated 415 V - 50/60 Hz - IP31/35°C



(1) with a 18M drawer for protection.
(2) with a single NT/NS cubicle for protection.

F

Selection of functional unit

Selection of the functional unit with fuses - rated 415 V - 50/60 Hz - IP31/35°C

Iq (kA)	Protection	Fuse	Power (kW) 0.37 0.75 1.5 2.2 5.5 7.5 11 15 18.5 22 30 37 45 55 75 90 110 130 160 200 220 250 280 315 400	Cubicle
Drawer				
50	ATV630 ATV930	GS2	24M	
		Vario V2/V3	12M to 24M	
Fixed				
50	ATV630 ATV930	GS2	24M to 48M	
		Vario V2/V3	12M to 24M	

70 - M

Soft starter - rated 415 V - IP ⩽54/35°C

Iq (kA)	Protection	Circuit breaker	Power (kW) 1.5 5.5 7.5 11 15 18.5 22 30 37 45 55 75 90 110 132 160 200 220 250 280 400	Cubicle
Drawer				
50	ATS001	TeSys U	4M	
	ATS48	GV2L	18M	
		NS100	18M	
		NS160	18M	
Fixed mounting plate				
50	ATS48	GV2	18M	
		NSX100	36M	
		NSX160	36M	
		NSX250	48M	
		NSX400	W650 cubicle (1)	
		NSX630	W650 cubicle (1)	

70-2

(1) with a 18M drawer for protection.

F

Variable speed drives and soft starters
70-M drawer
ATV630 / ATV930
GV2 - GV3
0.75 to 22 kW

PB120133.eps

Functional unit description

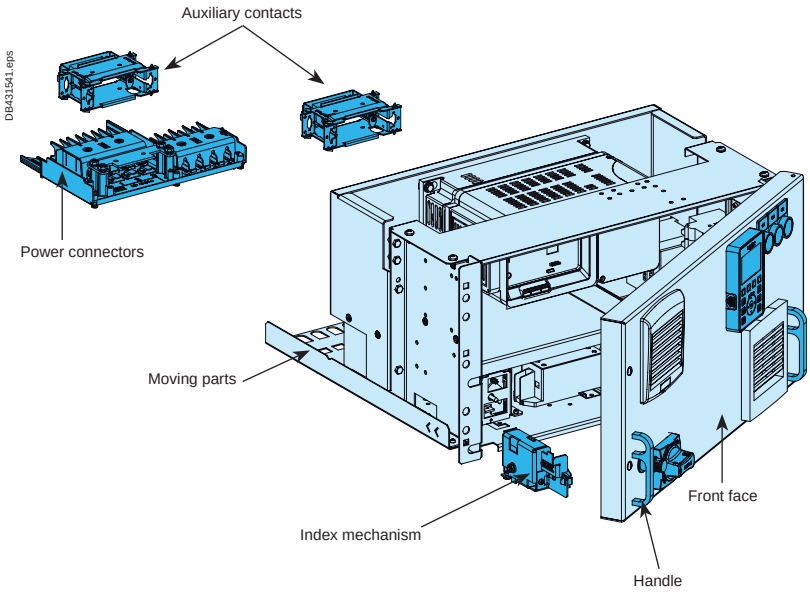
70-M drawers functional units can be equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

DB431541.eps



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22
GV2L	12M										
							16M				
GV3L									24M		

70-M drawer
ATV630 / ATV930
GV4
0.75 to 55 kW

PB120133.eps

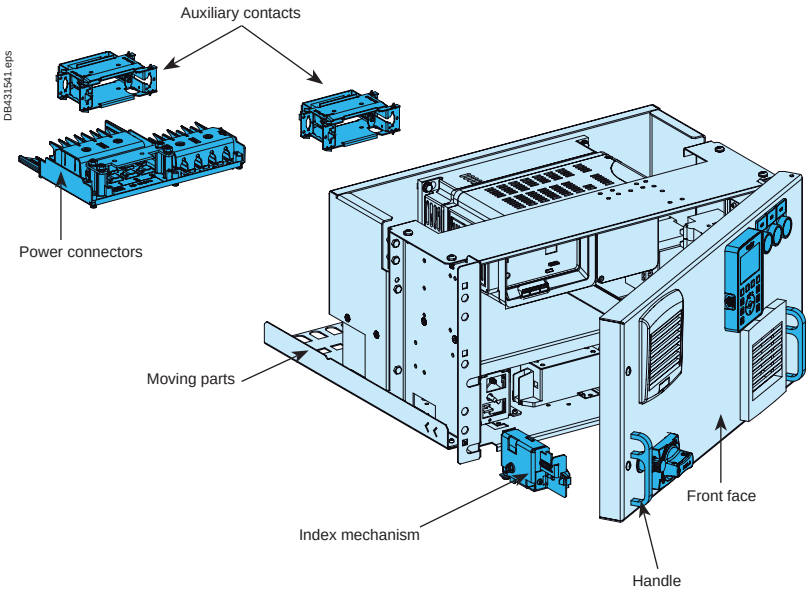
Functional unit description

70-M drawers functional units can be equipped with:
- current transformers,
- auxiliary transformer,
- 24 or 48 auxiliary contacts.

Each drawer unit is equipped with fans to avoid an excessive internal temperature.

Typical drawing

DB431541.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22
GV4	12M										
							16M				
										24M	

Variable speed drives and soft starters
70-2 drawer
ATV630 / ATV930
GV2-GV3
0.75 to 22 kW

Functional unit description

The variable speed drive functional units in drawer are mounted in a standard 70-2 cubicle.

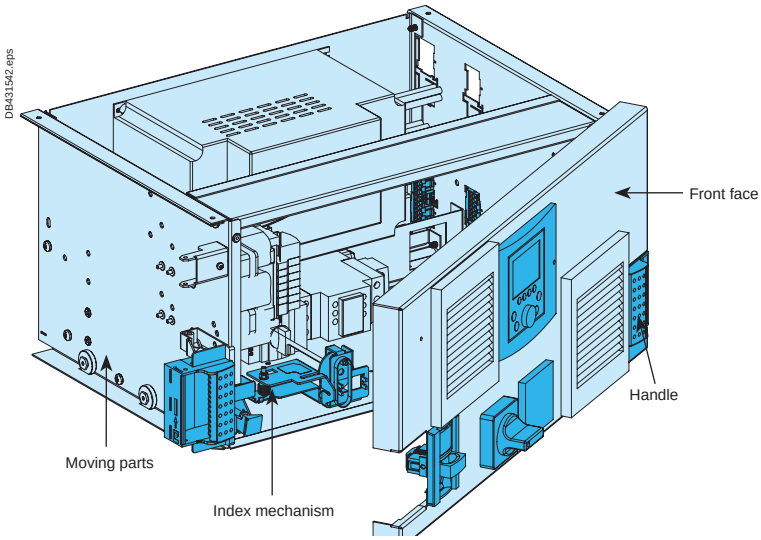
70-2 drawers functional units are not designed to include:
- current transformers,
- auxiliary transformer.

They are equipped with:
- 12 or 24 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	45
GV2	12M											
							24M					
GV3										24M		

70-2 drawer
ATV630 / ATV930
GV4
0.75 to 22 kW

PB120134.eps

Functional unit description

The variable speed drive functional units in drawer are mounted in a standard 70-2 cubicle.

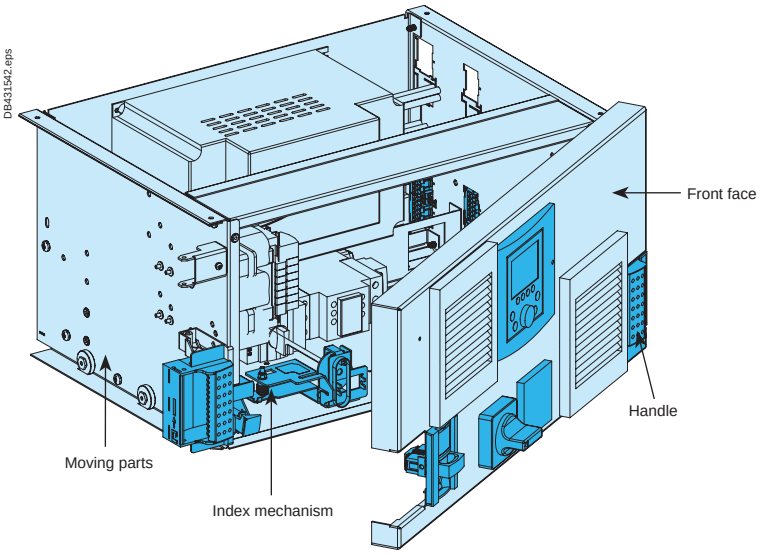
70-2 drawers functional units are not designed to include:
- current transformers,
- auxiliary transformer.

They are equipped with:
- 12 or 24 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Typical drawing

DB431542.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	45
GV4	12M											
							24M					

Variable speed drives and soft starters
70-2 drawer
ATSU 01
TeSys U
1.5 to 15 kW


Tiroir ATSU01_aav95104O1-0.eps

Functional unit description

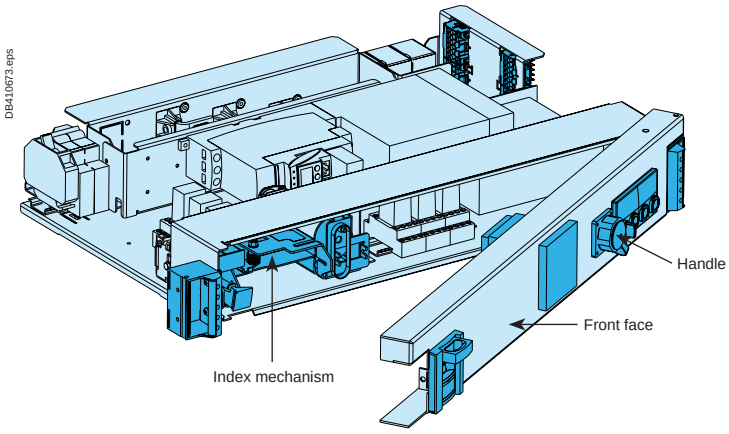
The soft starter functional units in drawer are mounted in a standard 70-2 cubicle.

70-2 drawers functional units are not designed to include:
- current transformers,
- auxiliary transformer.

They are equipped with:
- 12 or 24 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Typical drawing



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54/35°C

P (kW)	1.5	2.2	4	5.5	7.5	11	15
TeSys U	4M						

70-2 drawer
ATS48
GV2L
5.5 to 15 kW

PB115589.eps

Functional unit description

The soft starter functional units in drawer are mounted in a standard 70-2 cubicle.

70-2 drawers functional units are not designed to include:
- current transformers,
- auxiliary transformer.

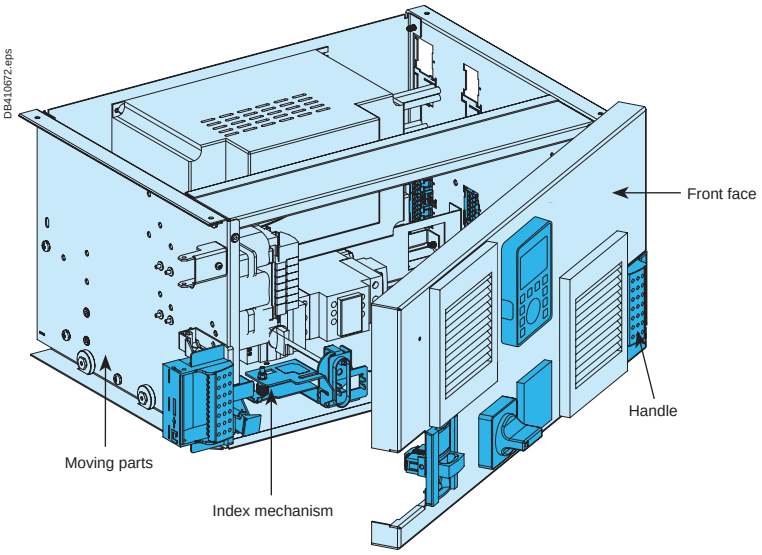
They are equipped with:
- 12 or 24 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

DB410672.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54/35°C

P (kW)	5.5	7.5	11	15
GV2L	18M			

Variable speed drives and soft starters
70-2 drawer
ATS48
GV4L
5.5 to 37 kW

PB115589.eps

Functional unit description

The soft starter functional units in drawer are mounted in a standard 70-2 cubicle.

70-2 drawers functional units are not designed to include:
- current transformers,
- auxiliary transformer.

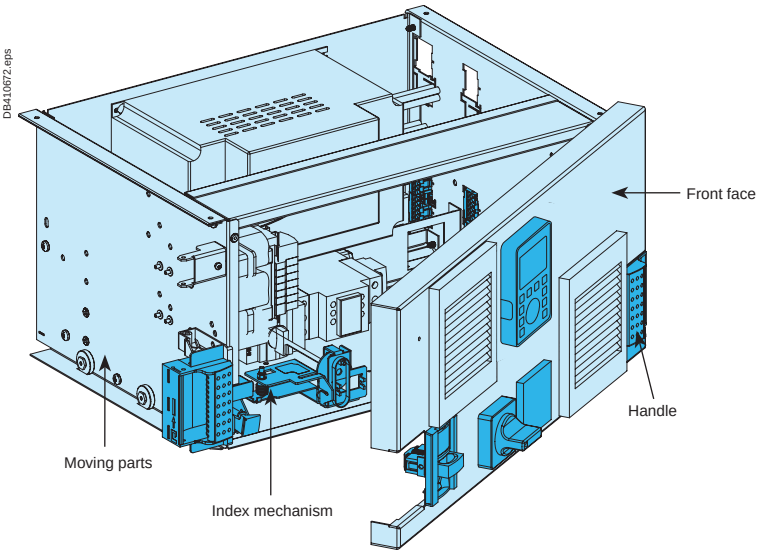
They are equipped with:
- 12 or 24 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

DB410672.eps



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54/35°C

P (kW)	5.5	7.5	11	15	18.5	22	30	37	45	55
GV4L	18M									

70-2 drawer
ATS48
NSX100-160
5.5 to 55 kW

PB115589.eps

Functional unit description

The soft starter functional units in drawer are mounted in a standard 70-2 cubicle.

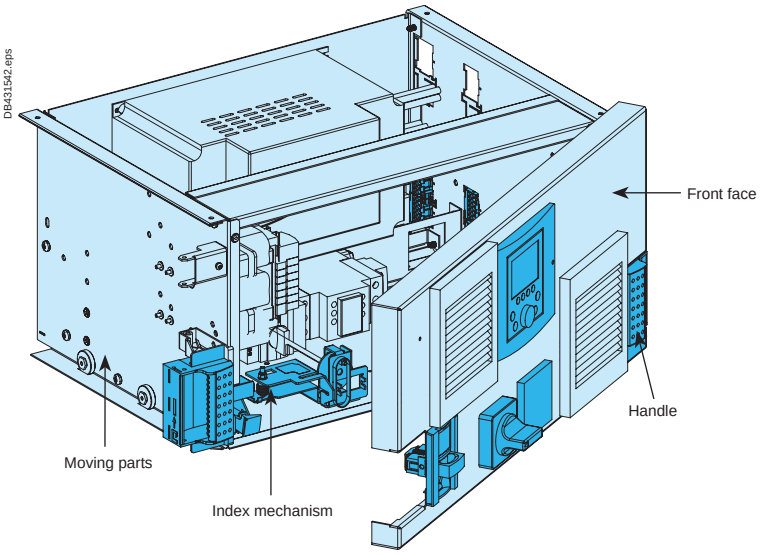
70-2 drawers functional units are not designed to include:
- current transformers,
- auxiliary transformer.

They are equipped with:
- 12 or 24 auxiliary contacts.

Each drawer is equipped with fans to avoid an excessive internal temperature.

Typical drawing

DB431542.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54/35°C

P (kW)	5.5	7.5	11	15	18.5	22	30	37	45	55
NSX100-160										18M

Variable speed drives and soft starters
Fixed variable speed drive / 70-M
ATV630 / ATV930
Vario V2-V3
0.75 to 22 kW

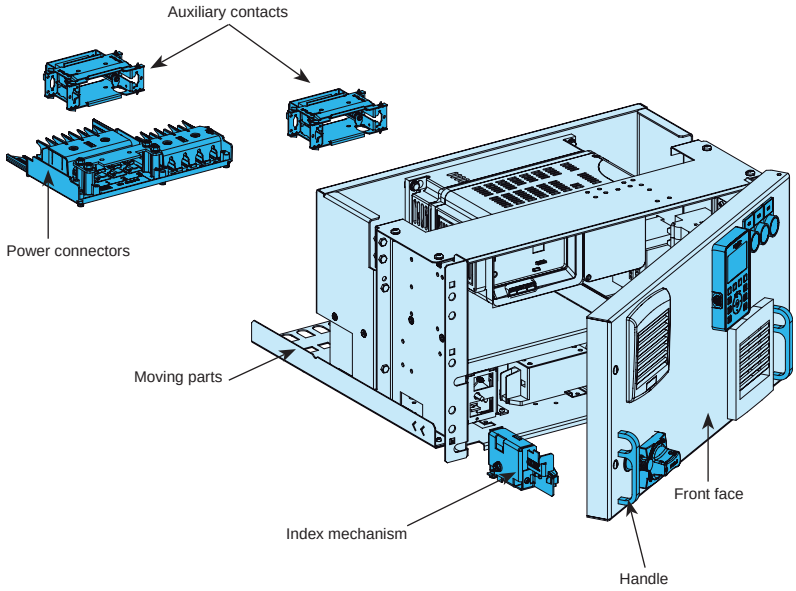
PB120133.eps

Functional unit description

ATV630 fixed functional units are mounting in a W600mm cubicle.
They can be equipped with:
- current transformers,
- auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

Typical drawing



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30
Vario	12M											
							16M					
									24M			

Fixed variable speed drive / 70-M
ATV630 / ATV930
GS2
15 to 75 kW

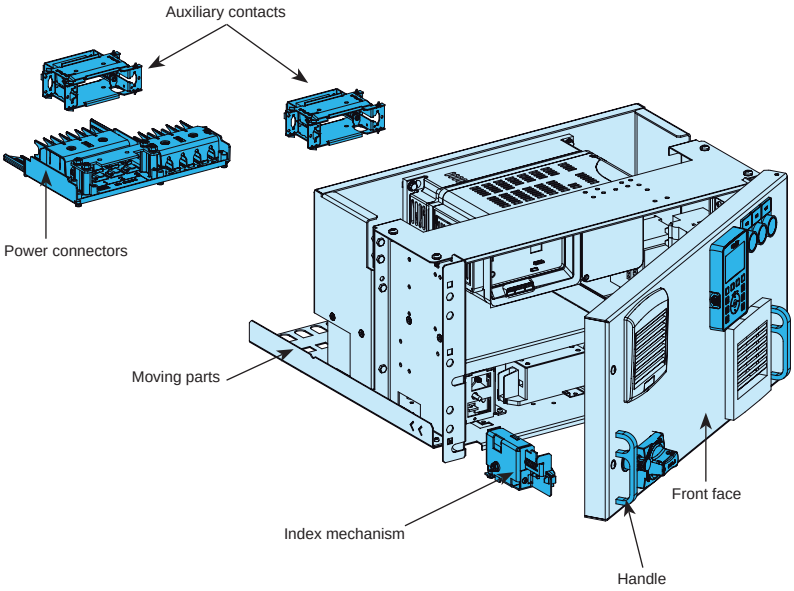
PB120133.eps

Functional unit description

ATV630 fixed functional units are mounting in a W600mm cubicle.
They can be equipped with:
- current transformers,
- auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

Typical drawing



Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
GS2			24M									
							36M					
										48M		

Variable speed drives and soft starters
Fixed variable speed drive / 70-2
ATV630 / ATV930
GV4
0.75 to 45 kW

PB120132.eps

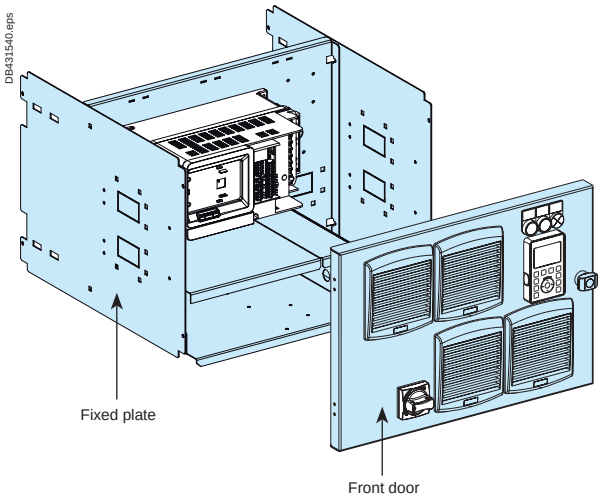
Functional unit description

ATV630 fixed functional units are mounting in a W600mm cubicle.
They can be equipped with:
- current transformers,
- auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

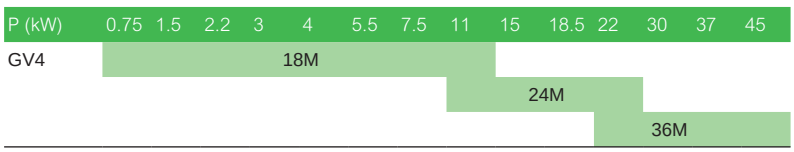
Typical drawing

DB431540.eps



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C



Fixed variable speed drive / 70-2
ATV630 / ATV930
NSX100-250
37 to 90 kW

PB120132.eps

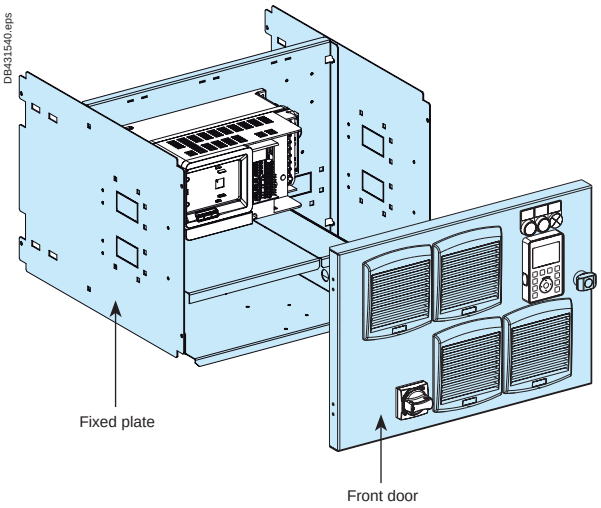
Functional unit description

ATV630 fixed functional units are mounting in a W600mm cubicle.
They can be equipped with:
- current transformers,
- auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

Typical drawing

DB431540.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	37	45	55	75	90
NSX100		36M			
NSX160				48M	
NSX250					54M

Variable speed drives and soft starters

Fixed variable speed drive / 70-2

ATV630 / ATV930

GV2-GV3

0.75 to 30 kW

PB120815.eps

Functional unit description

The fixed variable speed drive functional units are mounted in a cubicle W650 mm. A specific busbar at the top of the cubicle provides power through cables.

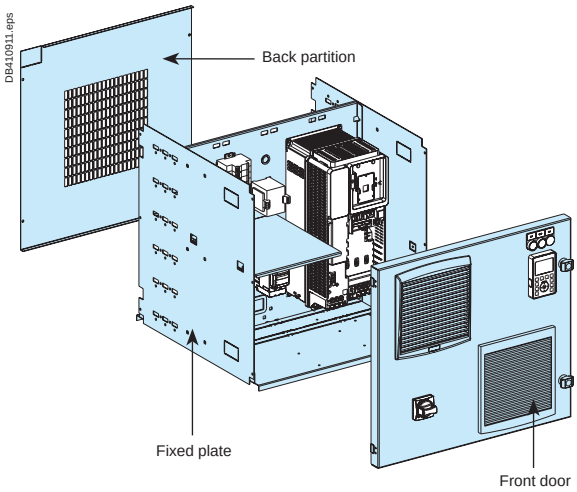
Functional units are designed to accept the auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

DB410911.eps



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30
GV2	18M											
GV3									24M			
												36M

Fixed variable speed drive / 70-2
ATV630 / ATV930
GV4
0.75 to 45 kW

PB115597.eps

Functional unit description

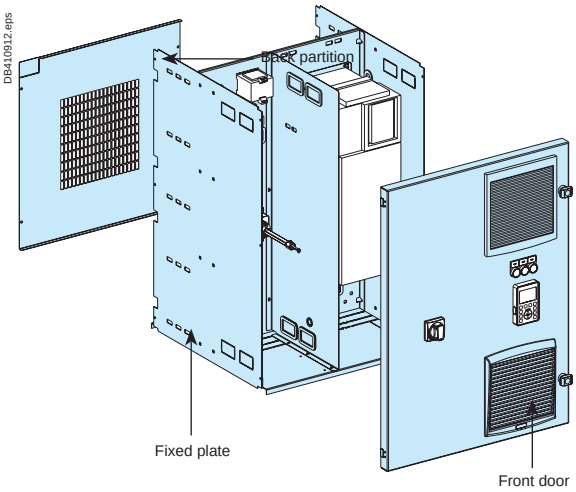
The fixed variable speed drive functional units are mounted in a cubicle W650 mm. A specific busbar at the top of the cubicle provides power through cables.

Functional units are designed to accept the auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

Typical drawing

DB410912.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	0.75	5.5	7.5	11	15	18.5	22	30	45
GV4	18M								
					24M				
								36M	

Variable speed drives and soft starters

Fixed variable speed drive / 70-2

ATV630 / ATV930
NSX100-250
45 to 110 kW

PB120135.eps

Functional unit description

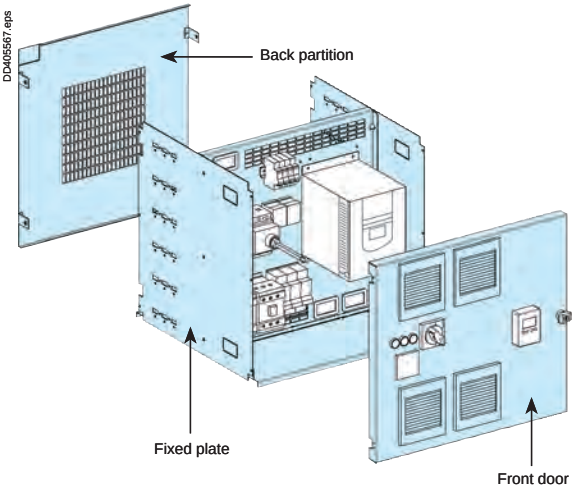
The fixed variable speed drive functional units are mounted in a cubicle W650 mm. A specific busbar at the top of the cubicle provides power through cables.

Functional units are designed to accept the auxiliary transformer.

Each functional unit is equipped with fans to avoid an excessive internal temperature.

Typical drawing

DD405567.eps

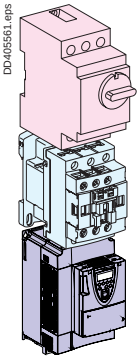


F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	22	45	55	75	90	110
NSX100		36M				
NSX160			48M			
NSX250				54M to 72M		

Fixed variable speed drive / 70-2
ATV630 / ATV930
NSX400
132 to 160 kW



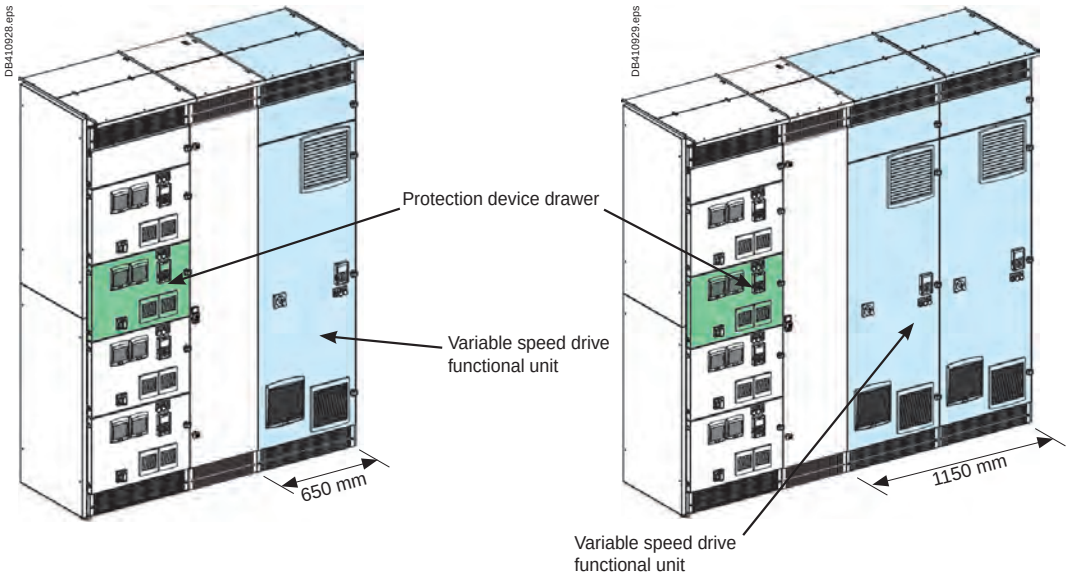
Functional unit description

The fixed variable speed drive is mounted in a W650 or W1150 mm cubicle depending on the ATV power.
A specific busbar at the top of the cubicle provides power through cables

Functional units are designed to accept the auxiliary transformer.

The functional unit cubicle is equipped with fans to avoid an excessive internal temperature.

Typical drawing

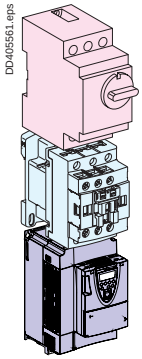


Example of functional unit modularity Ue = 415 V - IP ⩽ 54 / 35°C

Cubicle height

P (kW)	132	160	200	220	250
ATV cubicle	2200 and 2350 mm				

Variable speed drives and soft starters
Fixed variable speed drive / 70-2
ATV61 / ATV71
NS800
280 to 400 kW



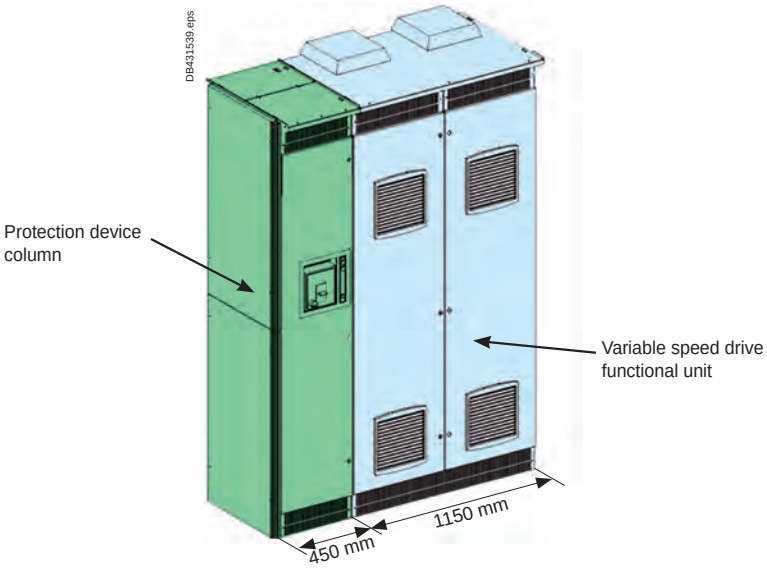
Functional unit description

The fixed variable speed drive is mounted in a W1150 mm cubicle depending on the ATV power.
A specific busbar at the top of the cubicle provides power through cables

Functional units are designed to accept the auxiliary transformer.

The functional unit cubicle is equipped with fans to avoid an excessive internal temperature.

Typical drawing



Example of functional unit modularity Ue = 415 V - IP ⩽ 54 / 35°C

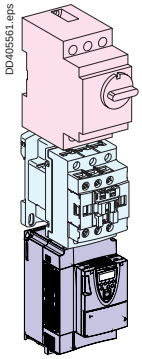
Protection device cubicle width

P (kW)	280	315	355	400
NS800	450 mm			

Cubicle width

P (kW)	280	315	355	400
ATV cubicle	1150 mm			

Fixed variable speed drive / 70-2
ATV630 / ATV930
NS800
250 to 315 kW



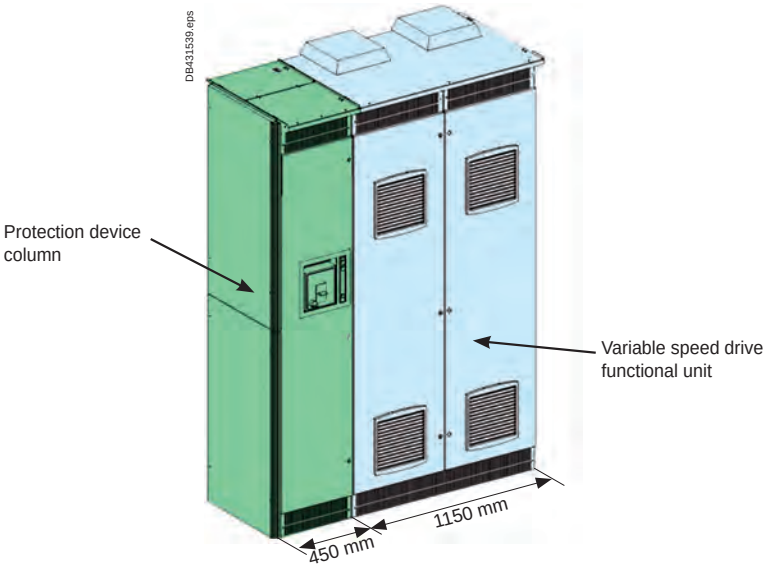
Functional unit description

The fixed variable speed drive is mounted in a W1150 mm cubicle depending on the ATV power.
A specific busbar at the top of the cubicle provides power through cables

Functional units are designed to accept the auxiliary transformer.

The functional unit cubicle is equipped with fans to avoid an excessive internal temperature.

Typical drawing



Example of functional unit modularity Ue = 415 V - IP ⩽ 54 / 35°C

Protection device cubicle width

P (kW)	250	280	315	355	400
NS800	450 mm				

Cubicle width

P (kW)	250	280	315	355	400
ATV cubicle	1150 mm				

Variable speed drives and soft starters
Fixed soft starter / 70-2
ATS48
GV2L
5.5 to 15 kW

PB120135.eps

Functional unit description

The fixed soft starter functional units are mounted in a cubicle W650 mm.
A specific busbar at the top of the cubicle provides power through cables.

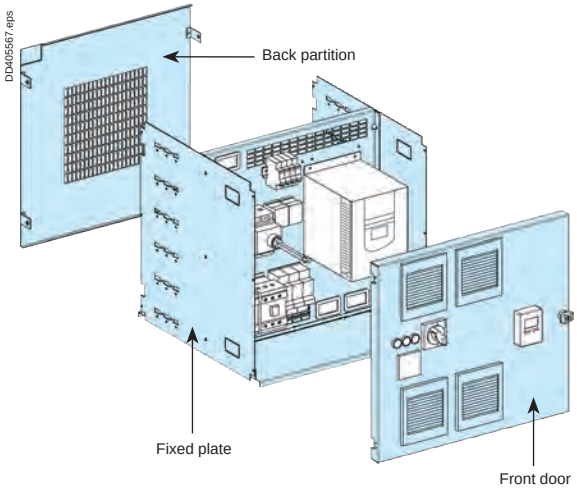
Functional units are designed to accept the auxiliary transformer.

Choosing functional unit with bypass allows not to equip it with fans so to use standard doors.

Note : Usage of trip indicator lamp is mandatory.

Typical drawing

DD405567.eps



F

Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	5.5	7.5	11	15
GV2L	18M			

Fixed soft starter / 70-2
ATS48
GV4
5.5 to 30 kW

PB120135.eps

Functional unit description

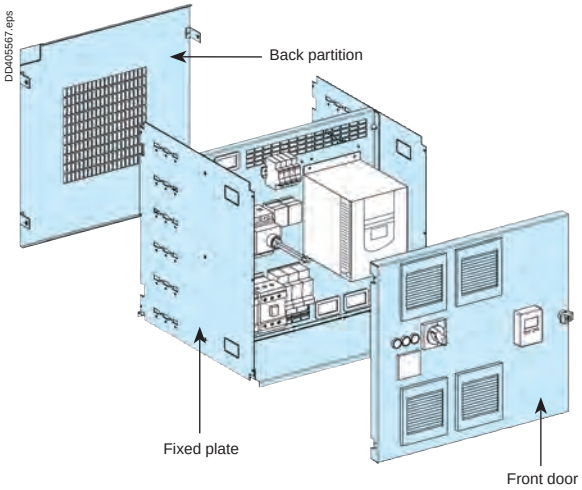
The fixed soft starter functional units are mounted in a cubicle W650 mm.
A specific busbar at the top of the cubicle provides power through cables.

Functional units are designed to accept the auxiliary transformer.

Choosing functional unit with bypass allows not to equip it with fans so to use standard doors.

Typical drawing

DD405567.eps



Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	5.5	7.5	11	15	18.5	22	30
GV4		18M					
						24M	

F

Variable speed drives and soft starters
Fixed soft starter / 70-2
ATS48
NSX100-250
37 to 90 kW

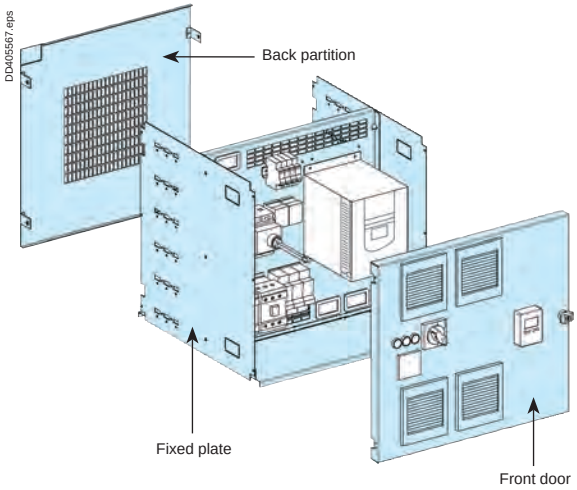
Functional unit description

The fixed soft starter functional units are mounted in a cubicle W650 mm.
A specific busbar at the top of the cubicle provides power through cables.

Functional units are designed to accept the auxiliary transformer.

Choosing functional unit with bypass allows not to equip it with fans so to use standard doors.

Typical drawing

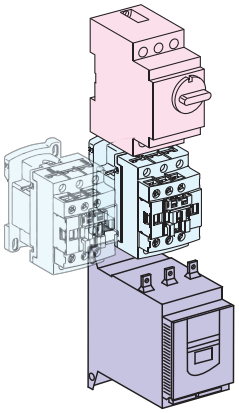


Example of functional unit modularity Ue = 415 V - IP ≤ 54 / 35°C

P (kW)	37	45	55	75	90
NSX100	36M				
NSX160		36M			
NSX250				48M	

Fixed soft starter / 70-2
ATS48
NSX250-630
75 to 220 kW

DD405569.eps



Functional unit description

The fixed soft starter functional units are mounted in a cubicle W650 mm.
A specific busbar at the top of the cubicle provides power through cables.

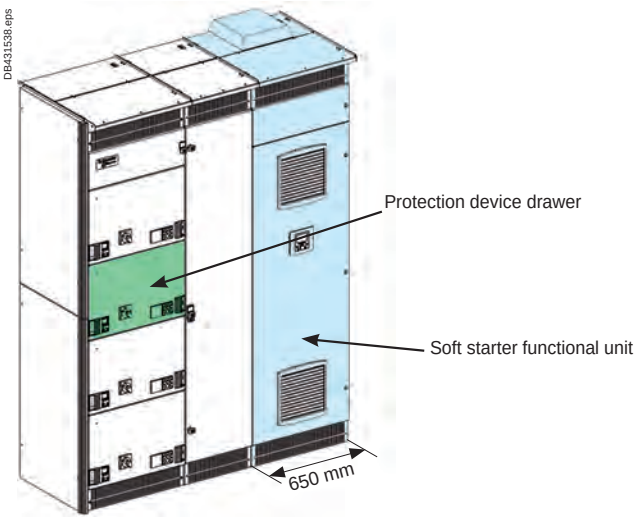
Functional units are designed to accept the auxiliary transformer.

Choosing functional unit with bypass allows not to equip it with fans so to use standard doors.

From 75 kW to 220 kW, the soft starter is powered through a drawer located in the 70-2 adjoining cubicle.

Typical drawing

DB431538.eps



Example of functional unit modularity Ue = 415 V - IP ⩽ 54 / 35°C

Protection device drawer height

P (kW)	75	90	110	132	160	220
NSX250		12M				
NSX400				18M		
NSX630						18M

Cubicle width

P (kW)	75	90	110	132	160	220
ATS48 cubicle				650 mm		

Enclosures

G

General presentation

Okken cubicles are available in 2 standard heights, 5 widths and 2 depths, in order to fit in any environment and allow an optimal installation modularity.

70-M offer has directly 3 widths for side connection cubicles and 1 depth for rear connection cubicles.

For an optimized footprint, 70-M side connection cubicles, W900 and W1000, can be mounted back to back.

All the cubicles are made of a particularly resistent galvanised steel, and the panelling elements are painted RAL 9003, and can also be delivered unpainted to be customized by the panelbuilder.

Specific frameworks equipments complete the standard range of products, to adapt Okken cubicles to special environmental constraints: seismic areas, corrosive atmospheres, Marine environment...

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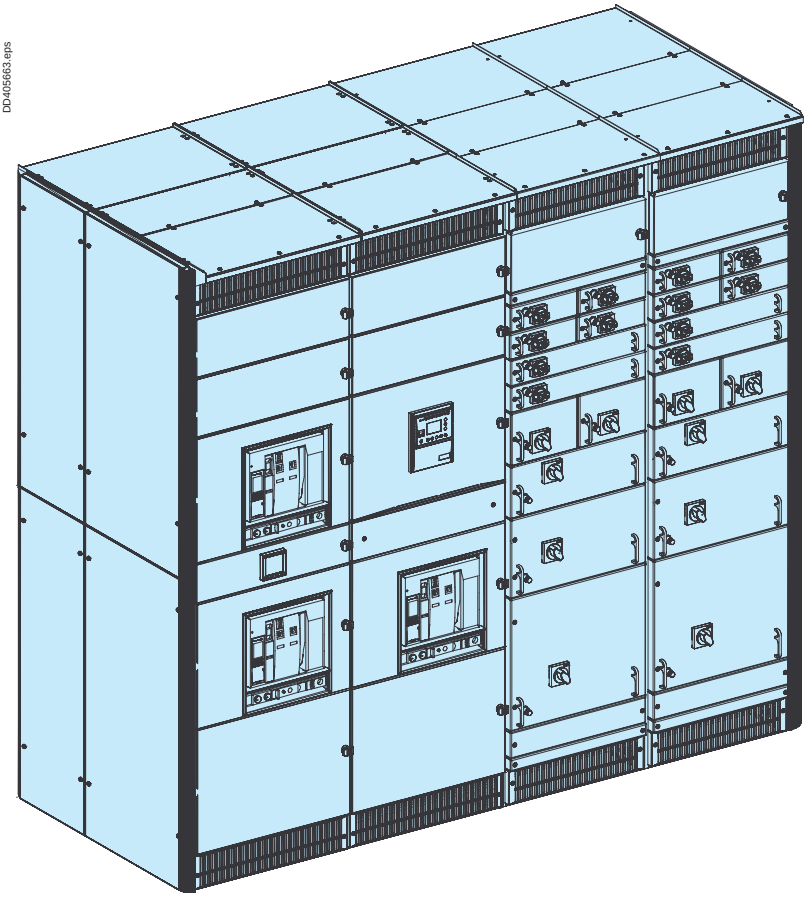
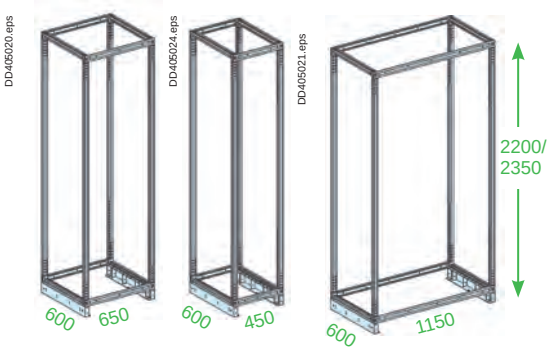


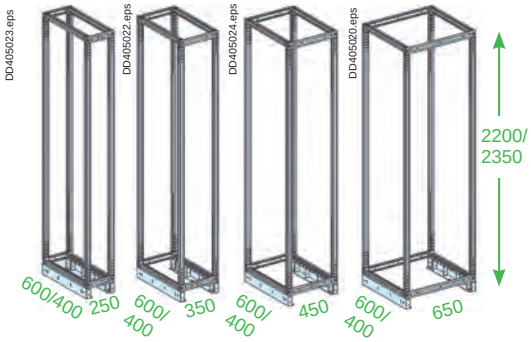
230, 115, 115-70, 70-F, 70-2 and 185 cubicles dimensions and functions

Device cubicle : an unique depth, 600 mm



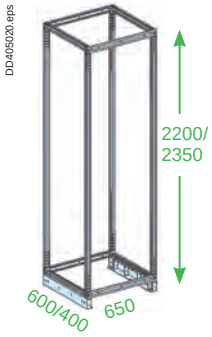
- Width 450 mm :
  - single device up to 1600A
  - installation with specific busbar.
- Width 650 mm :
  - devices up to 4000A
  - designed for installation with a 70, 115 or 185 vertical busbar
- Width 1150 mm :
  - dedicated to Masterpact NW40b up to NW63
  - designed for installation with a 230 vertical busbar.

Side cable compartment (SC):



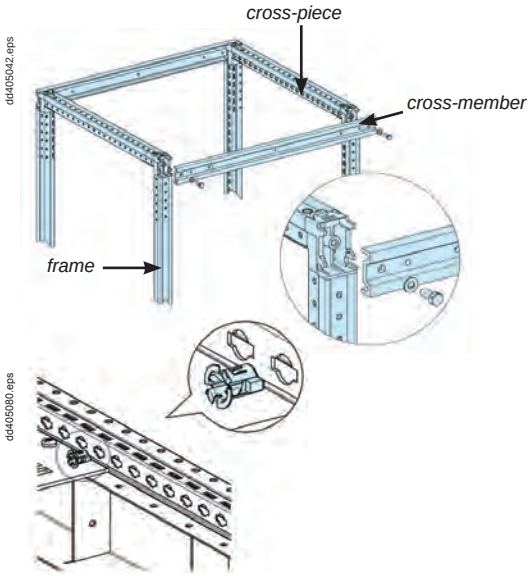
- 3 possible widths: 350, 450 or 650 mm
- 250 mm for the auxiliary devices compartment

Rear cable compartment (RC):



- 2 possible depths: 400 or 600 mm

Frameworks



- Okken cubicles are made of vertical frames, assembled prior to delivery, horizontal cross-members, and a transportation plinth, forming a rigid unit, indeformable and shock-resistant.

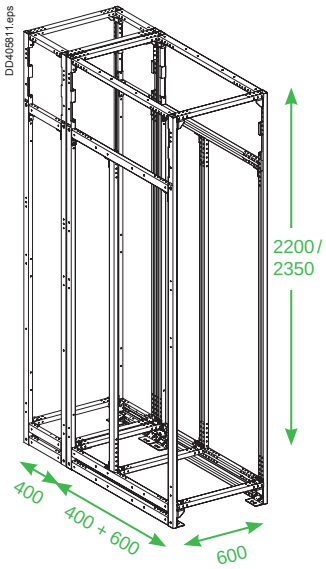
- Cross-members can be dismounted, even when the column is installed, in order to ease the fishplating operations and the cable connections (patented system).

- In order to facilitate fishplating operations, it is possible to order frames with removable cross-members.

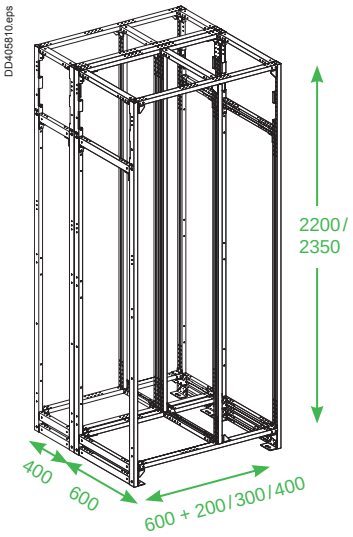
- Frames are pre-drilled with a pitch of 25 mm, allowing fixation with cage nuts.

70-M cubicle dimensions and functions

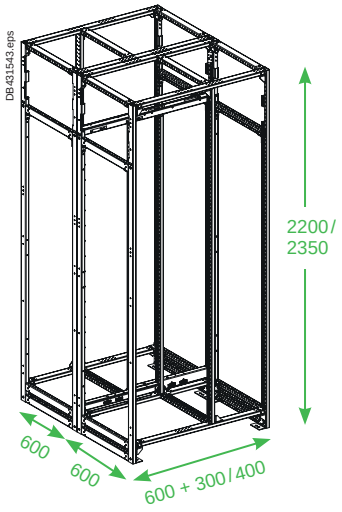
rear connection



side connection



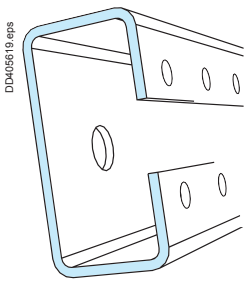
back to back connection



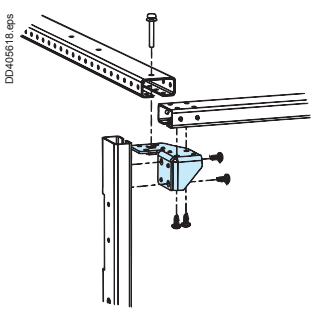
- The 70-M frameworks are composed of 2 areas:
  - the drawer area: 600 x 600 mm,
  - the power and auxiliary cables compartment:
    - 200, 300 or 400 x 600 mm for side connection cubicles,
    - 400 or 600 x 600 mm for rear connection cubicles,
    - twice 300 or 400 x 600 mm for back to back connection cubicles,
  - the rear additional compartment:
    - 800, 900 or 1000 x 400 mm for side connection cubicles,
    - 400 x 600 mm for rear connection cubicles.

G

Frameworks



- Framework is made with steel.
- The vertical parts of the frame are painted RAL7016.
- Its robustness is given by its 'C' shape.
- The framework is pre-drilled with a pitch of 25 mm.
- All the parts of the framework have predefined dimensions, allowing the frames assembly of the 70-M offer.

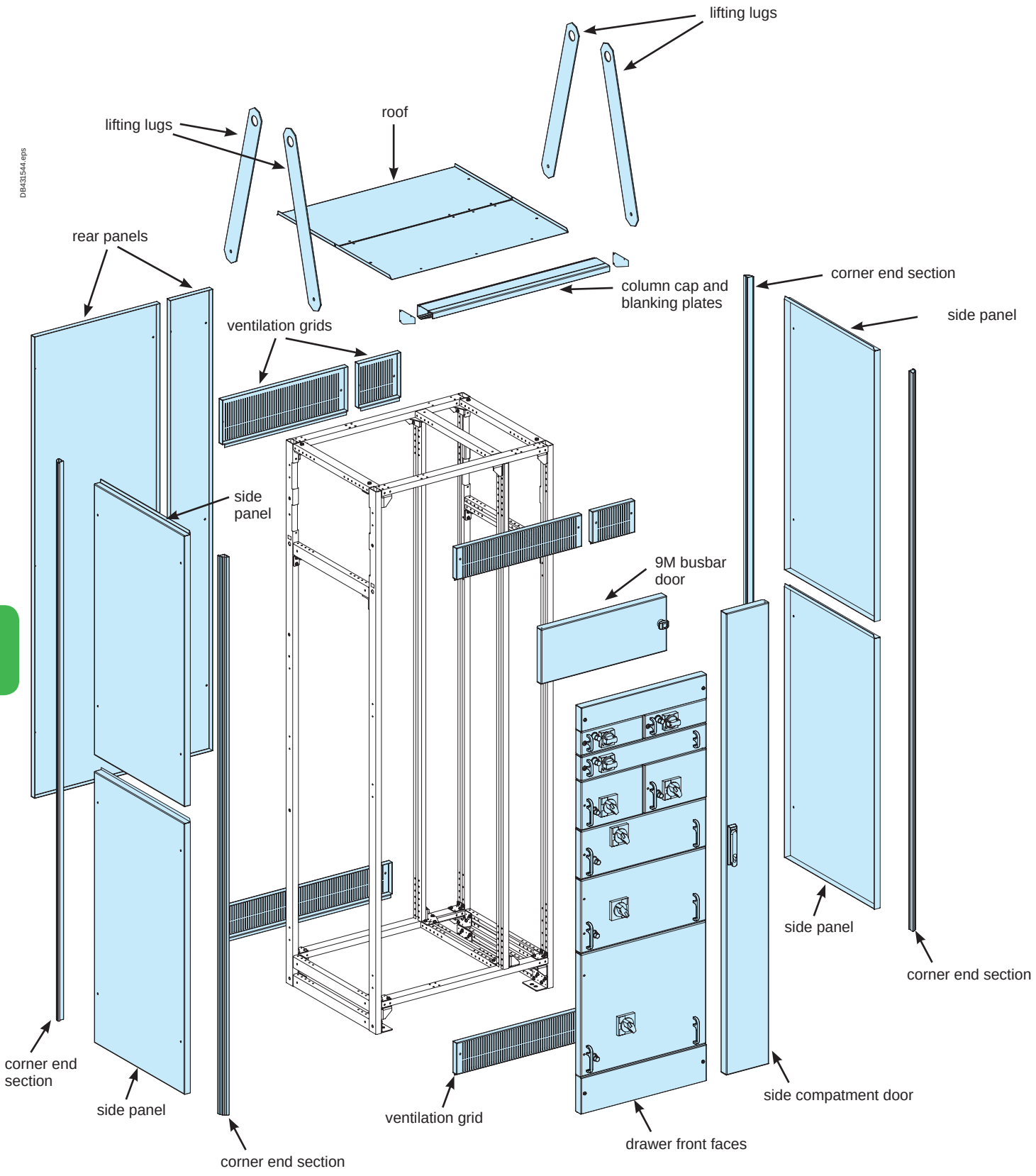


- The framework is assembled with angle-square parts (supplied with framework parts).

Notes

General presentation

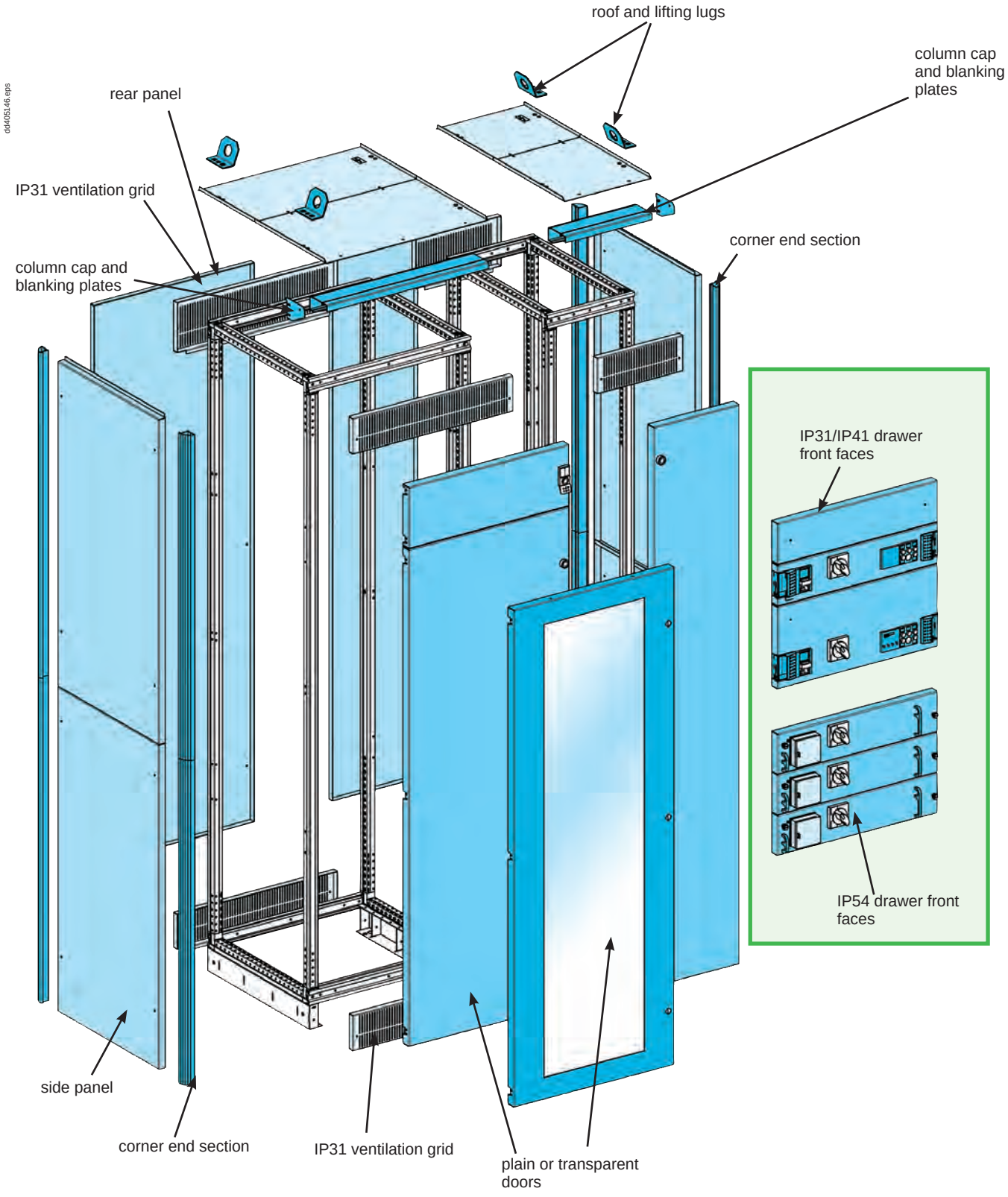
70-M cubicle panelling



General presentation
230, 115, 115-70, 70-F, 70-2 and 185 cubicles panelling

Cubicles panelling

Panelling elements for Okken switchboards: roof, rear and side panels, bottom plate, column caps, IP31 grids or IP41 front plates, plain or glassed doors, drawers front faces ...



Colours and protection coating

■ Colour RAL 7016 half-dull for:
- □ plinths,
- □ ventilations grids or IPxx front plates,
- □ corner end sections,
- □ column caps.

■ Galvanised steel for:
- □ the frames,
- □ the rear panels,
- □ the roofs,
- □ the inside equipment (device installations, plates, partitioning, uprights, forms, door brackets,...).

■ Okken panelling elements can be ordered painted RAL9003, or unpainted electro-galvanized steel, to let you customize the colour of your equipment and proceed to the drillings and cutouts before painting.

Concerned panelling elements:
- □ side panels,
- □ doors, front plates and front faces.

Cubicles degree of protection

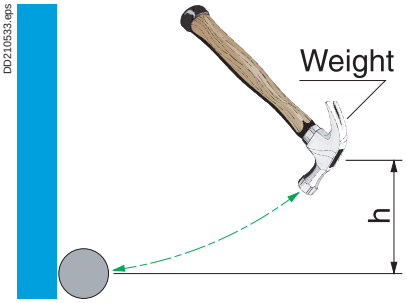
Okken cubicles provide basically IP31.
With additional parts, they reach IP41 or IP54.
The Marine version of Okken switchboards provide IP32.
Standard of reference: IEC60529.

1st characteristic numeral: corresponds to protection of equipment against penetration of solid objects and protection of persons against direct contact with live parts.

Protection of equipment	Protection of persons			
Non-protected	Non-protected	0		
Protected against the penetration of solid objects having a diameter greater than or equal to 50 mm	Protected against direct contact with the back of the hand (accidental contact)	1	DD210014	Ø 50 mm
Protected against the penetration of solid objects having a diameter greater than or equal to 12,5 mm	Protected against direct finger contact	2	DD210015	Ø12,5 mm
Protected against the penetration of solid objects having a diameter greater than or equal to 2,5 mm	Protected against direct contact with a 2,5 mm diameter tool	3	DD210016	Ø2,5 mm
Protected against the penetration of solid objects having a diameter greater than or equal to 1 mm	Protected against direct contact with a 1 mm diameter wire	4	DD210017	Ø1 mm
Dust protected (no harmful deposits)	Protected against direct contact with a 1 mm diameter wire	5	DD210018	

2nd characteristic numeral: corresponds to protection of equipment against penetration of water with harmful effects.

Protection of equipment			
Non-protected	0		
Protected against vertical dripping water (condensation)	1	DD210006	
Protected against dripping water at a maximum angle of 15°	2	DD210007	15°
Protected against rain at a maximum angle of 60°	3	DD210008	60°
Protected against splashing water in all directions	4	DD210009	
Protected against water jets in all directions	5	DD210010	

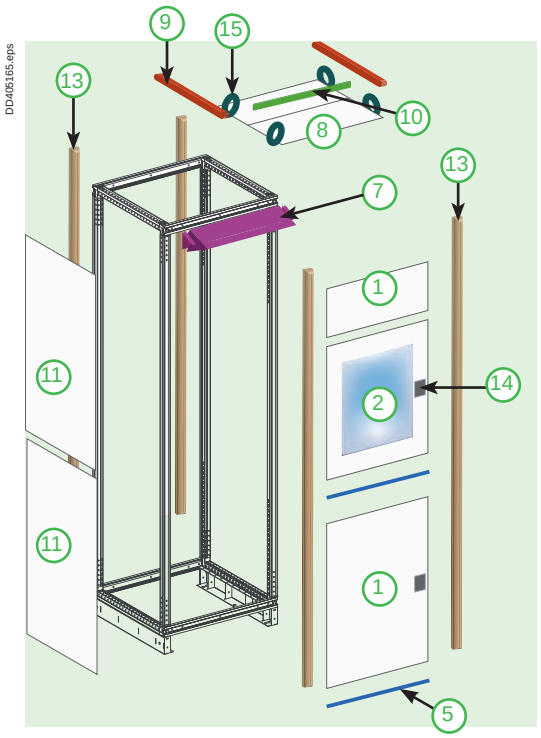


Whatever IP, the IK index of Okken cubicles is IK10, except if transparent doors are installed, in which case it becomes IK07.
Standard of reference: IEC62262.

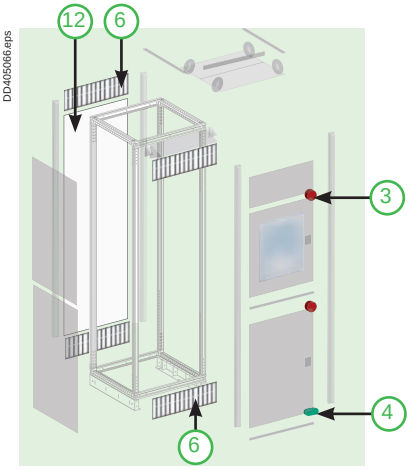
IK	Weight (kg)	Height (cm)	Energy (J)
00	Non-protected		
01	0.20	7.50	0.15
02		10	0.20
03		17.50	0.35
04		25	0.50
05		35	0.70
06	0.50	20	1
07		40	2
08	1.70	30	5
09	5	20	10
10		40	20

Notes

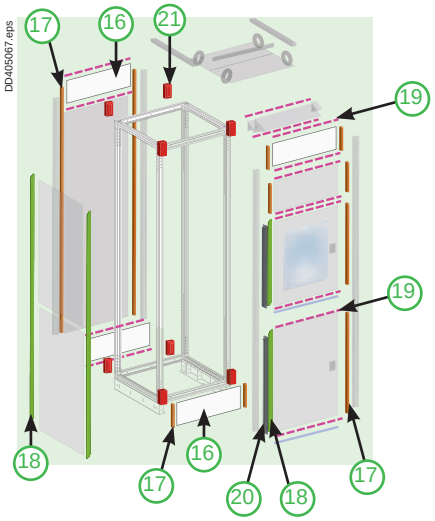
Common parts



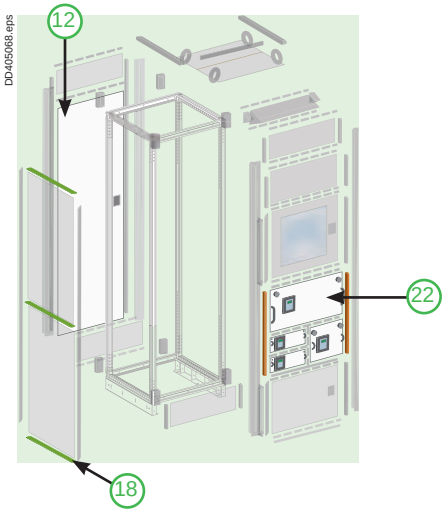
IP31 complements



IP41 complements



IP54 complements



	IP parts summary	Common	IP31	IP41	IP54
1	plain door	●			
2	transparent door	●			
3	door and front plate stoppers (replace with gasket 87199 for Sismic columns)	-	●	-	-
4	door bottom stoppers	-	●	-	-
5	door bottom brackets	●			
6	IP31 ventilation grids (top and bottom)	-	●	-	-
7	column cap and blanking plates	●			
8	roof (made up of 1 or several parts)	●			
9	roof gasket	●			
10	roof intermediate gasket	●			
11	side panel	●			
12	door or rear panel		●	●	-
12	rear door only		-	-	●
13	corner end section	●			
14	handle, operating insert or markable handle	●			
15	lifting lugs	●			
16	IP41 front plates (top and bottom)	-	-	●	●
17	gasket for vertical uprights (87199)	-	-	●	●
18	gasket for doors/panels(87119)	-	-	●	●
19	flat gasket (87120)	-	-	●	●
20	door gasket holder	-	-	●	●
21	cross-member blanking plates	-	-	●	●
22	drawer front faces with optimised drillings and specific operating devices *See chapters dealing with device equipment for further details on specific IP54 front faces.* *Painted doors are compulsory at the rear of IP54 columns.*	●	●	●	●

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Lateral panels for different depths cubicles association

■ These panels are manufactured according to drawing no. AAV62976.

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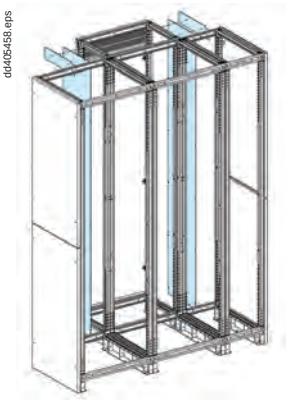

Standard drawers front faces

Refer to the chapters dealing with device equipment ("PCC FU's ⩽ 630A", and "MCC FU's ⩽ 630A Ue=415V")

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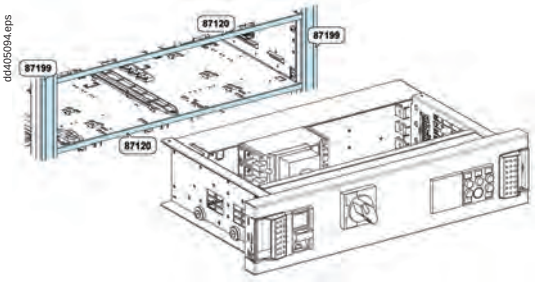
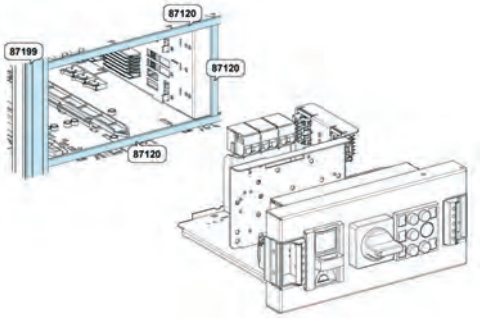


sticking the IP41/IP54 gasket for drawer front faces

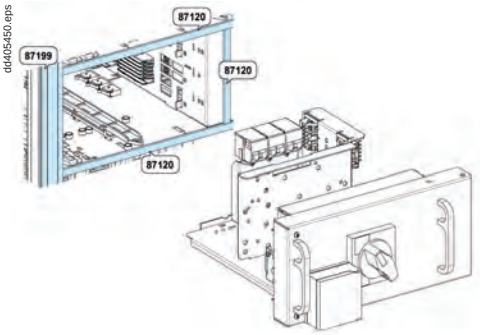
dd405040.eps



Specific IP54 drawer front faces

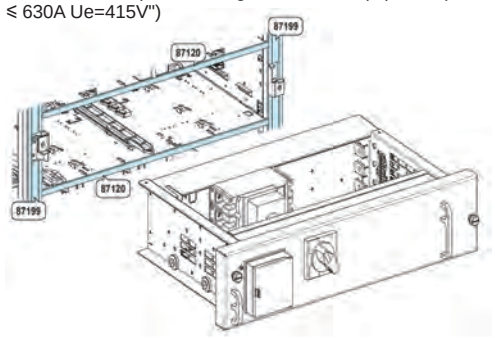
Refer to the chapters dealing with device equipment ("PCC FU's ⩽ 630A", and "MCC FU's ⩽ 630A Ue=415V")

dd405450.eps



sticking the IP41/IP54 gasket for drawer front faces

dd405451.eps



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Busbars

H

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Main busbar

Simple architecture and easy to connect, no additional drilling on site, top direct connection.

The original square-type layout of the bars offers 3 advantages:
- the best layout in terms of limitation of electromagnetic radiation.
- it frees the surface necessary for cable penetration from the top in front connection, while at the same time preserving a favourable thermal exchange at busbar level.
- it increases electrodynamic withstand of the busbar.

Note : Beyond 4000 A, the busbar is double and requires a minimum depth of 1000 mm.

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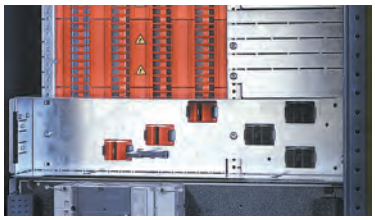

70-2 busbar

230, 115, 115-70, 70-F, 70-2 and 185 cubicles distribution busbar

Installed in a partitioned compartment to the rear of the switchgear zone, it consists of 10 mm thick bars.

Connections for power circuit-breakers Masterpact NW08-40, NT08-16 and Compact NS800-1600 Are screwed directly on the busbar.

Functional units up to 630A are connected to the busbar:
- either by clamps,
- or by screwed-on flexible connections.

Access to non-used busbar parts is protected at the front by covers or IP2X insulating grids.

70-M cubicle distribution busbar.eps

70-M cubicle distribution busbar

Installed in a partitioned compartment at the rear of the drawers area, it consists of 8 mm thick bars whose cross-section depend upon the current to be distributed in the cubicle.

- Functional units up to 630A are connected to the busbar by plug blocks.
- Specific door for tap-off outlets make the busbar unaccessible except for the plugs of the drawer.
- The 2 busbars are linked together at the bottom with the vertical busbars link system.
- This links are encapsulated in a metal sheet box with plastic covers.
- The busbar can be single when all the drawers in the cubicle are full width.

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Protection conductor

The protective conductor ensures equipotential bonding of frames.

It is made up in each cubicle of a horizontal conductor connecting column frames to one another and of a vertical conductor accomodating the power cables protective conductors and the earthing connections when devices so require.
Cross-section :
- 40 x 5 for Icw ⩽ 50 kA,
- 40 x 10 for 50kA < Icw ⩽ 100 kA,
- 80 x 10 for Icw > 150 kA.

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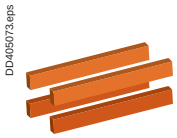
Auxiliary busducts

Auxiliary busducts ensure distribution of auxiliary supplies and reference voltages of monitoring circuits, as well as some communication buses.

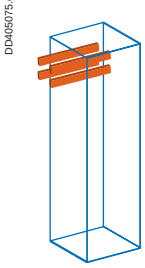
They are installed in the connection compartments throughout the useful height of the cubicle.

H

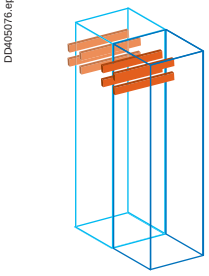
General presentation
Busbar types



Main busbar (horizontal busbar)

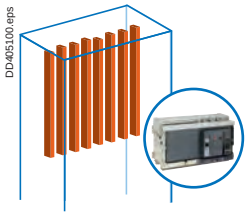


simple busbar
up to 4000A



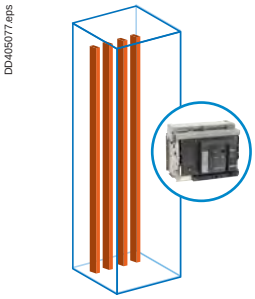
double busbar
up to 7300A

Distribution busbar (verticlal busbar)



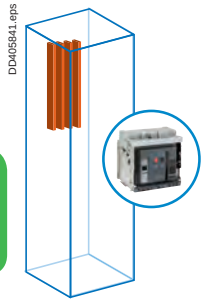
Busbar link for 230 cubicle for NW40b-63

- the 230 cubicle is dedicated to the installation of a NW40b-63
- height-reduced busbar



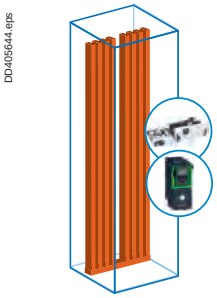
Vertical 115 busbar for NW08-40, NT08-16/NS800-1600

- mainly designed for high power columns
- allows the installation of NW08-40, NT08-16/NS800-1600 As incomers or feeders
- installed at the rear of the switchgear cubicle, throughout all its height



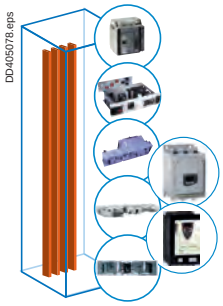
Single NW busbar for NW08-32

- designed for just one Masterpact NW08-32 installation
- height-reduced busbar



Vertical 70-M busbar

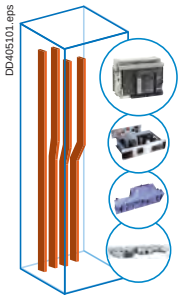
- allows the installation of Power Control and Motor Control functional units in drawer
- installed at the rear of the cubicle, it can be single or double
- bottom links joins the 2 vertical busbars



Vertical 70-2 busbar for NT08-16/NS800-1600

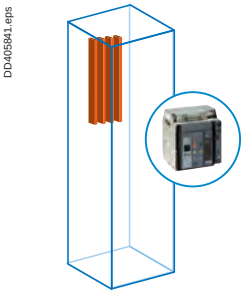
- allows the installation of NT08-16/NS800-1600 and all the distribution feeders and motor control feeders
- installed at the rear of the switchgear cubicle, throughout all its height

General presentation
Busbar types



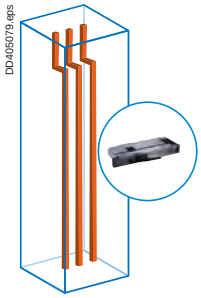
Vertical 115-70-2 busbar for NW08-32

■ enables mixing, in a single cubicle, a NW08-32 incomer and all the distribution and motor control feeders.



Single NT vertical busbar for NT08-16/NS800-1600

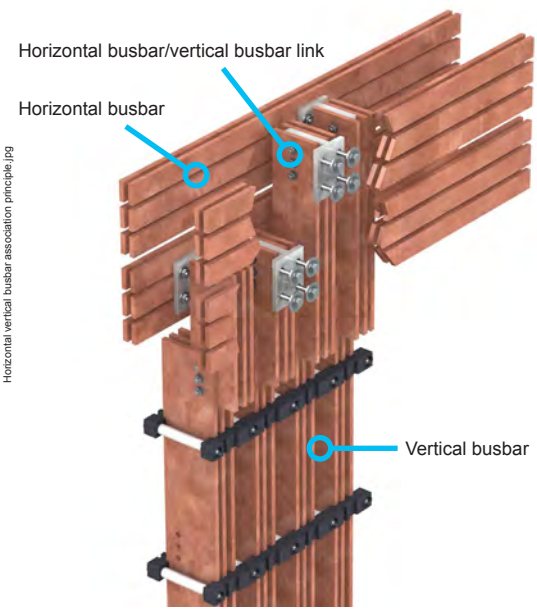
■ designed for just one Masterpact NT08-16 / NS800-1600 installation
■ height-reduced busbar



Vertical 185 busbar for Jean Müller fuse switches

■ dedicated to Jean Müller fuse-switches installation
■ installed at the rear of a H2200 mm switchgear cubicle, throughout all its height

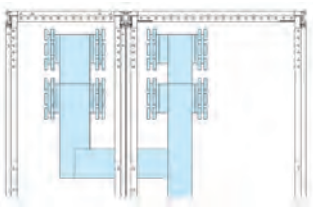
General presentation
Architecture and principle



Horizontal vertical busbar association principle.jpg

Horizontal / vertical busbar association principle

Connections to the distribution busbars and fishplating are made without drilling.
Sliding fishplates ensures the link between 2 horizontal busbars.
Angle brackets (or tees) secure the connection between the horizontal and the vertical busbar.
The tightening screw devices used to secure the connection go through the gap between the horizontal bars.



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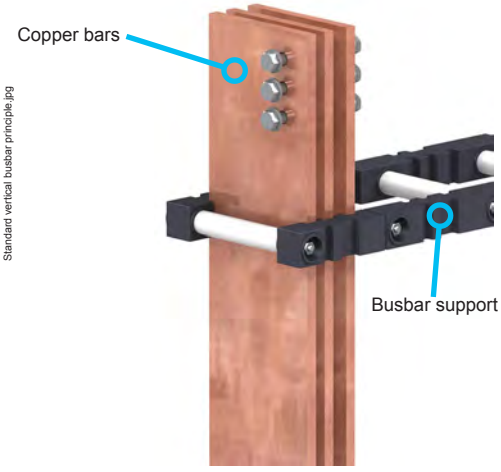
Link between rear horizontal busbar/vertical busbar 115/70-2/185

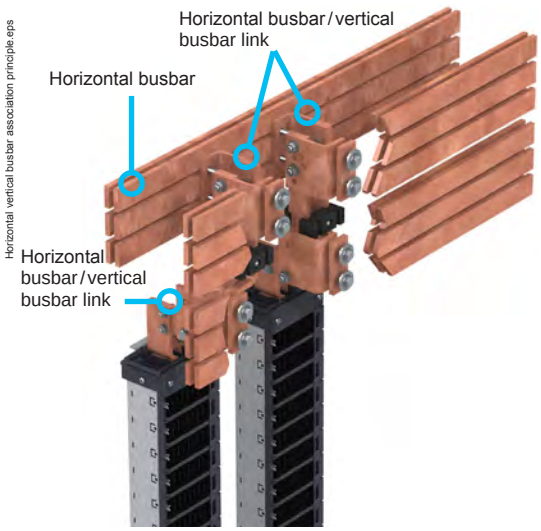
A rear / front horizontal busbar link is installed at the top of each 115 / 70-2 / 185 device cubicle.
This link may have an impact on the connection mode for the NW40 or NT08-16 / NS800-1600 devices, as on the installation capacity of the 70-2 device cubicles.



Standard vertical busbar principle.jpg

Vertical busbar principle

The vertical 70 busbar is made of 40, 50, 80 or 100 x 10 mm cross-section bars.
The 40 x 10 and 50 x 10 bars use the same busbar support, while the 80 x 10 and 100 x 10 bars use another one.
Different cross-sections of the bars lead to different fixing positions for the supports on the lateral flange.

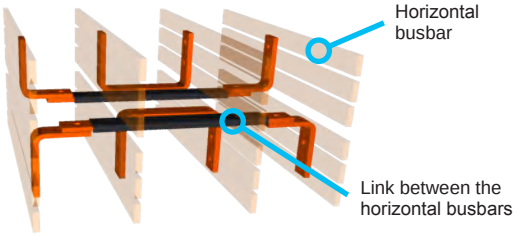


Horizontal / vertical busbar association principle

Connections to the distribution busbars and fishplating are made without drilling.

Sliding fishplates ensures the link between 2 horizontal busbars.
Angle brackets secure the connection between the horizontal and the vertical busbar.

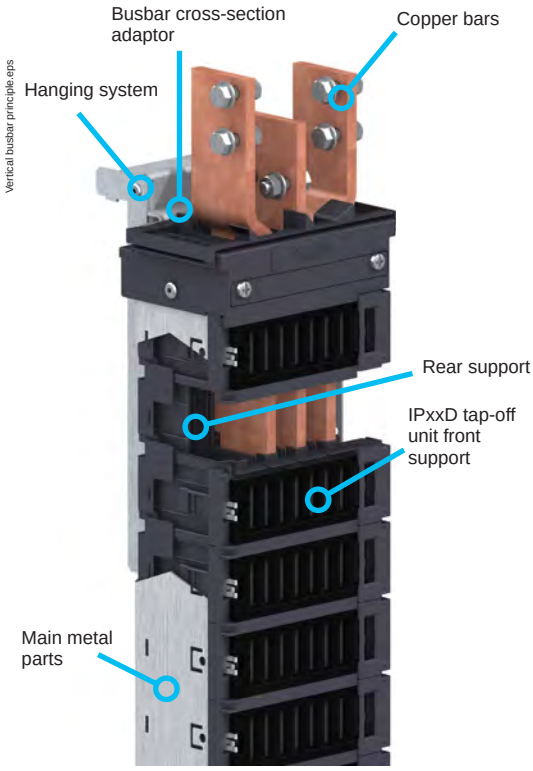
The tightening screw devices used to secure the connection go through the gap between the horizontal bars.



Double horizontal busbar principle

In case of double horizontal busbar, 70-M cubicle insure the equipotentiality between both busbars.

Specific links have been studied to connect the same phases together without modularity loss.



Vertical busbar principle

The vertical busbar and tap-off units are made of 20, 30, 40, 50 or 60 x 8 cross section copper bars.

- The bars are held between the tap-off unit and the rear support:
  - rear supports and tap-off units for all bars are identical,
  - IPxxD tap-off units front support (IPxxD: clearance from live parts with 1 mm diameter, 100 mm length probe).

The distance between the front of tap-off unit and the framework is fixed.

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Main busbar ⩽ 4000A

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- The horizontal busbar has an unique position at the top of the cubicle
- The bars have a constant cross-section (40 x 10), and don't need any drilling
- Their length is given in the drawings in the selection table.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:

- the rated short-time withstand current (Icw) and the number of bars per phase according to:
  - the rated current
  - the protection index (IP)
  - the temperature
- the number of busbar supports according to the cubicle's type and dimension

Icw max (kA)	Rated current In (A) for copper bars										No. of bars/phase
	IP31					IP41/54					
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C	
50	1900	1840	1780	1720	1670	1780	1720	1670	1610	1560	2 x 40 x 10
80	2520	2440	2360	2290	2210	2360	2280	2210	2140	2070	3 x 40 x 10
100	3200	3100	3000	2910	2810	3000	2910	2820	2730	2640	4 x 40 x 10
	4050	3920	3800	3680	3560	3800	3680	3570	3450	3340	6 x 40 x 10

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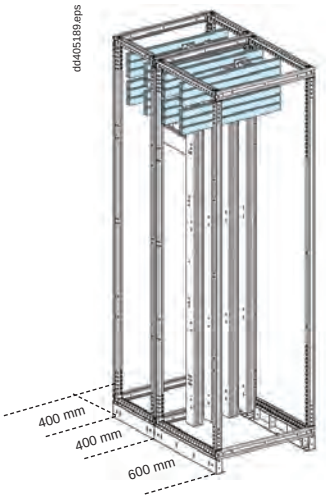
Double main busbar 4000A < In ⩽ 7300A



■ The 7300A horizontal busbar is made up by 2 standard busbars installed in parallel:
- □ the front busbar, located at the top of the device cubicle (and, if need be, of the lateral compartment)
- □ the rear busbar, installed at the top of the 400mm compartment(s).

■ The bars have a constant cross-section (40 x 10) and need no drilling.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:
■ the permissible short-time current (Icw) and the number of bars per phase, according to:
- □ the rated current
- □ the protection index (IP)
- □ the temperature

■ the number of busbar supports according to the type and dimensions of the cubicle.

Icw max (kA)	Rated current In (A) for copper bars										No. of bars/phase
	IP31					IP41/54					
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C	
100	4530	4390	4250	4120	3980	4250	4120	3990	3860	3740	2 x 3 x 40 x 10
100	5810	5630	5460	5280	5110	5460	5290	5130	4960	4800	2 x 4 x 40 x 10
150	7320	7100	6880	6660	6440	6880	6670	6460	6260	6050	2 x 6 x 40 x 10

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115 distribution busbar

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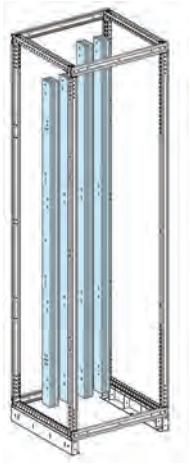

■ The 115 distribution busbar is intended for cubicles containing Masterpact NW08-40, Masterpact NT08-16 and Compact NS800-1600 high-current devices used as incomers or feeders.
■ The rated current of the busbar determines the type of 115 busbar selected and its installation limits:

Busbar type	Maximum current (A)	Maximum devices
115-1	3200	3 NW08-32, NT08-16 or NS800-1600
115-2	4000	3 NW08-32, NT08-16 or NS800-1600
115-3	4000	1 NW40

■ It is installed in the switchgear cubicle, at the rear and over its entire height.
■ In the case of a Single-NW cubicle, it is shorter.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:
■ the permissible short-time current (Icw) and the number of bars per phase, according to:
- □ the rated current
- □ the protection index (IP)
- □ the temperature

■ the number of busbar supports according to the type and dimensions of the cubicle.

Natural ventilation

Icw max (kA)	Rated current In (A)										No. of bars / phase	
	IP31					IP41 / 54					Multi- device	Single NW
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C		
50	1750	1 690	1 640	1 590	1 540	1 640	1 590	1 540	1 490	1 440	1 x 80 x 10	1 x 100 x 10
100	2780	2 690	2 610	2 520	2 440	2 610	2 530	2 450	2 370	2 290	2 x 80 x 10	2 x 100 x 10
	3200	3 100	3 000	2 910	2 810	3 000	2 910	2 820	2 730	2 640	3 x 80 x 10	3 x 100 x 10
	4090	3 960	3 840	3 720	3 590	3 840	3 720	3 600	3 490	3 370	3 x 120 x 10	-

Forced ventilation

Icw max (kA)	Rated current In (A)					No. of bars / phase	
	IP31 / 41 / 54					Multi- device	Single NW
	35°C	40°C	45°C	50°C	55°C		
50	1750	1750	1750	1750	1750	1 x 80 x 10	1 x 100 x 10
100	2780	2780	2780	2780	2780	2 x 80 x 10	2 x 100 x 10
	3200	3200	3200	3200	3200	3 x 80 x 10	3 x 100 x 10
	4090	4090	4090	4090	4090	3 x 120 x 10	-

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⚠ For forced ventilation, the cubicle must be adapted.

Number of busbar supports and cross-members				Quantity		
V-BB type	device and connection type	Icw (kA)	number of bars/phase and cross-section	Bar supports	115-1/115-2 cross-members	115-3 cross-members
115-1	NW08-32 TDC, BDC, SC, RC	50	1-2-3 x 80 x 10	4	3	
		100	2-3 x 80 x 10	7	6	
115-2	NW08-32 BDC, SC, RC	100	3 x 120 x 10	7	6	
	NW08-32 TDC	100	3 x 120 x 10	6	6	
115-3	NW40 TDC	100	3 x 120 x 10	5		2
	NW40 RC	100	3 x 120 x 10	5		3
	NW40 + coupling	100	3 x 120 x 10	4		3
Single NW	NW08-32 BDC, TDC, RC	100	1-2-3 x 100 x 10	2		

115/70-2 distribution busbar

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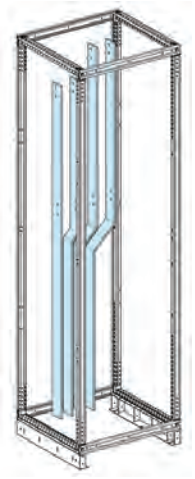

■ The 115/70-2 busbar allows installing a Masterpact NW08-32 circuit-breaker less than 630 A.
■ It is installed in the switchgear cubicle, at the rear and over its entire height, but a 8M (200 mm) area in the Centre of the cubicle, is reserved for the changing of the vertical busbar's DBA.
■ Due to the Masterpact's position, at the top of the cubicle, this type of busbar cannot be fitted in 5G seismic cubicles.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:
■ the permissible short-time current (Icw) and the number of bars per phase, according to:
  □ the rated current
  □ the protection index (IP)
  □ the temperature
■ the number of busbar supports according to the type and dimensions of the cubicle.

Natural ventilation

Icw max (kA)	Rated current In (A)										No. of bars / phase
	IP31					IP41/54					
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C	
Zone 115-1											
50	1750	1690	1640	1590	1540	1640	1590	1540	1490	1440	1 x 80 x 10
80	2780	2690	2610	2520	2440	2610	2530	2450	2370	2290	2 x 80 x 10
	3200	3100	3000	2910	2810	3000	2910	2820	2730	2640	3 x 80 x 10
Zone 70-2											
80	1750	1690	1640	1590	1540	1640	1590	1540	1490	1440	1 x 80 x 10

Forced ventilation

Icw max (kA)	Rated current In (A)					No. of bars / phase
	IP31					
	35°C	40°C	45°C	50°C	55°C	
Zone 115-1						
50	1750	1750	1750	1750	1750	1 x 80 x 10
80	2780	2780	2780	2780	2780	2 x 80 x 10
	3200	3200	3200	3200	3200	3 x 80 x 10
Zone 70-2						
80	1750	1750	1750	1750	1750	1 x 80 x 10

⚠ For forced ventilation, the cubicle must be adapted.

Number of busbar supports and cross-members			
Icw (kA)	bar number and cross-section	Supports	Cross-members
115-1 area			
50	1-2-3 x 80 x 10	2	1
80	2-3 x 80 x 10	3	2
70-2 area			
50	1 x 80 x 10	4	-
80	1 x 80 x 10	5	-

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70-2 distribution busbar

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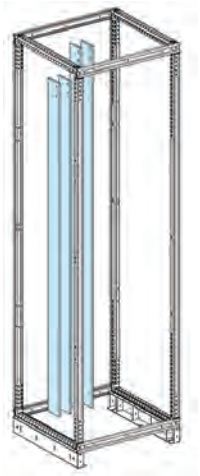

■ The 70-2 distribution busbar enables the installation of Masterpact NT08-16 or Compact NS800-1600 incomer or feeder circuit breakers and plug-in, disconnectable or withdrawable functional units less than 630 A.
■ It is installed in the switchgear cubicle, at the rear and over its entire height.
■ In the case of a single NT cubicle, it is shorter.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:
■ the permissible short-time current (Icw) and the number of bars per phase, according to:
  □ the rated current
  □ the protection index (IP)
  □ the temperature
■ the number of busbar supports according to the type and dimensions of the cubicle.

Natural ventilation

Icw max (kA)	Rated current In (A)										No. of bars / phase
	IP31					IP41 / 54					
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C	
50	1010	970	940	910	880	940	910	880	850	820	1 x 40 x 10
	1200	1 160	1 120	1 090	1 050	1 120	1 080	1 050	1 010	980	1 x 50 x 10
80	1750	1 690	1 640	1 590	1 540	1 640	1 590	1 540	1 490	1 440	1 x 80 x 10
100	2100	2 030	1 970	1 910	1 840	1 970	1 910	1 850	1 790	1 730	1 x 100 x 10

Forced ventilation

Icw max (kA)	Rated current In (A)					No. of bars / phase
	IP31 / 41 / 54					
	35°C	40°C	45°C	50°C	55°C	
50	1010	1010	1010	1010	1010	1 x 40 x 10
	1200	1200	1200	1200	1200	1 x 50 x 10
80	1750	1750	1750	1750	1750	1 x 80 x 10
100	2100	2100	2100	2100	2100	1 x 100 x 10

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⚠ For forced ventilation, the cubicle must be adapted.

Number of busbar supports			Quantity
Type of BB	Icw (kA)	bar number and cross-section	
70-2	50	1 x 40 x 10	7
		1 x 50 x 10	7
		1 x 80 x 10	6
		1 x 100 x 10	6
	80	1 x 80 x 10	8
		1 x 100 x 10	8
	100	1 x 100 x 10	10 (*)
Single NT	80	1 x 80 x 10	2

(*) : 9 supports in H2200 mm

70-F distribution busbar

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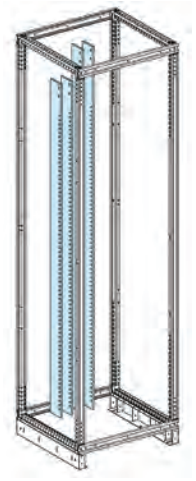


- The 70-F busbar is designed for the installation of fixed power distribution functional units (fixed PCC) up to 1600 A.
- It is drilled to correspond to the functional units in the column.
- It is installed in the switchgear cubicle, at the rear and over its entire height.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:
- the permissible short-time current (Icw) and the number of bars per phase, according to:
  - the rated current
  - the protection index (IP)
  - the temperature
- the number of busbar supports according to the type and dimensions of the cubicle.

Natural ventilation

Icw max (kA)	Rated current In (A)										No. of bars/phase
	IP31					IP41/54					
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C	
100	2100	2030	1970	1910	1840	1970	1910	1850	1790	1730	1 x 100 x 10

Forced ventilation

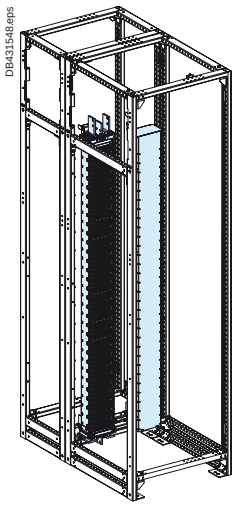
Icw max (kA)	Rated current In (A)					No. of bars/phase
	IP31/41/54					
	35°C	40°C	45°C	50°C	55°C	
100	2100	2100	2100	2100	2100	1 x 80 x 10

⚠ For forced ventilation, the cubicle must be adapted.

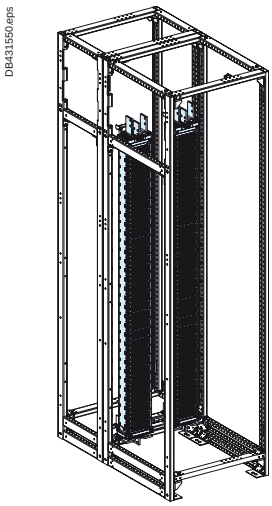
Number of busbar supports		Quantity
Icw (kA)	number and bars cross-section	
50	1 x 100 x 10	6
80	1 x 100 x 10	8
100	1 x 100 x 10	10 (*)

(*) : 9 supports for H2200 mm

70-M distribution busbar



Single busbar



Double busbar

- The 70-M distribution busbar can be double.
- It is available for 2200 mm and 2350 mm high cubicle.
- This busbar is made up with 2 separate units linked together with a vertical busbar links system.
- When the cubicle hosts only full width drawers, it is possible to use only the left unit.
- Each unit, 3 or 4 poles, is equipped with specific connection system adapted to 70-M drawers.
- Mounting in the 70-M cubicle is made easier, thanks to the innovating hanging system.

Busbar dimensioning

The bars and its insulated supports are totally encapsulated by a metal sheet shield. The shield is attached to the framework.
The tables below indicate:
- the permissible short-time current (Icw) and the number of bars per phase, according to:
  - the rated current
  - the protection index (IP)
  - the temperature.

Icw max (kA)	Single busbar rated current In (A) Natural ventilation								Bars/phase
	IP31				IP41/54				
	35°C	40°C	45°C	50°C	35°C	40°C	45°C	50°C	
33	400	360	330	300	330	300	270	250	20 x 8
50	630	580	530	480	560	510	450	400	30 x 8
60	800	730	670	610	710	640	580	510	40 x 8
65	1000	920	850	760	860	800	730	640	50 x 8
65	1150	1060	970	880	1000	920	840	750	60 x 8

Single busbar fits with only full width drawers

Icw max (kA)	Double busbar rated current In (A) Natural ventilation								Bars/phase
	IP31				IP41/54				
	35°C	40°C	45°C	50°C	35°C	40°C	45°C	50°C	
65	800	720	640	600	660	600	550	500	20 x 8
80	1250	1140	1050	950	1100	1000	900	800	30 x 8
85	1600	1450	1350	1250	1400	1280	1160	1040	40 x 8
100	2000	1800	1700	1600	1720	1580	1440	1300	50 x 8

Double busbar fits with half width and full width drawers

185 distribution busbar

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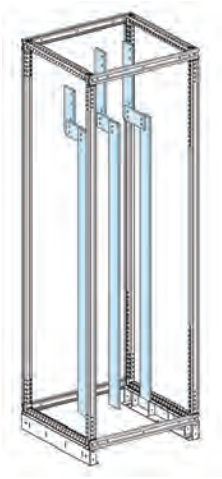

- This type of busbar is exclusively dedicated to the installation of Jean Müller fuse-switches.
- It is installed in the switchgear cubicle, at the rear and over its entire height.
- The cubicle has a unique height of 2200 mm.

Busbar calculation

The bars are secured by insulating supports, attached to the framework.
The tables below indicate:
- the permissible short-time current (Icw) and the number of bars per phase, according to:
  - the protection index (IP)
  - the temperature
  - the number of busbar supports according to :
- the permissible short-time current (Icw)

Natural ventilation

Icw max (kA)	Rated current In (A)										No. of bars / phase
	IP31					IP41 / 54					
	35°C	40°C	45°C	50°C	55°C	35°C	40°C	45°C	50°C	55°C	
80	630	610	590	570	550	590	570	550	530	510	1 x 40 x 10
	800	770	750	720	700	750	720	700	680	660	1 x 50 x 10
	1250	1 210	1 170	1 130	1 100	1 170	1 130	1 090	1 060	1 020	1 x 80 x 10
	1500	1 450	1 410	1 360	1 320	1 410	1 360	1 320	1 280	1 240	1 x 100 x 10

Forced ventilation

Icw max (kA)	Rated current In (A)					No. of bars / phase
	IP31 / 41 / 54					
	35°C	40°C	45°C	50°C	55°C	
80	630	630	630	630	630	1 x 40 x 10
	800	800	800	800	800	1 x 50 x 10
	1250	1250	1250	1250	1250	1 x 80 x 10
	1500	1500	1500	1500	1500	1 x 100 x 10

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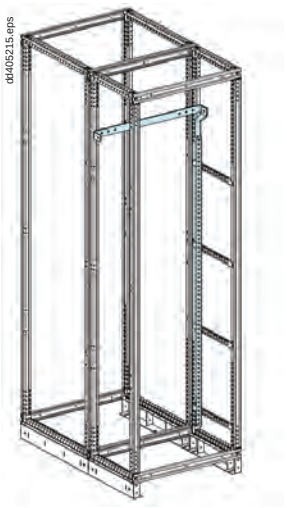
⚠ For forced ventilation, the cubicle must be adapted.

Number of busbar supports		Quantity
Icw (kA)	bar number and cross-section	
50	1 x 40/50/80/100 x 10	4
80	1 x 40/50/80/100 x 10	6



Protection bars

Bars cross-section according to Icw

Icw (kA)	PE cross-section
33 to 50	1 x 40x5
65 to 100	1 x 40 x 10
150	1 x 80 x 10

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Notes

Okken
specific applications

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Other chapters

Okken Marine
Introduction

Tableau Marine complet.eps

Overview

The Okken Marine switchboard is certified Det Noeske Veritas (DNV), under N° E6770.

The offer is composed with
- the 230, 115, 115/70-2, 70-2 and 70-M cubicles with some additional adaptation

Colonne Marine.eps

- a specific high density fixed PCC cubicle for 28 NSX100 3 poles functional units

Cubicle specificities

- Each device cubicle must be equipped with:
  - a hand rail, fixed on the front face of the cubicle
  - a lighting, fixed on the column cap.
- Each door must be equipped with a door stop.
- Each roof must be equipped with a rear roof complement.
- The areas without any device must be equipped with reserve covers.

Okken Marine
Main characteristics

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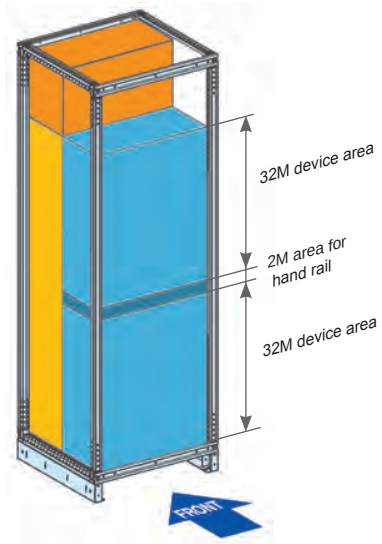

All cubicles except 70-M.

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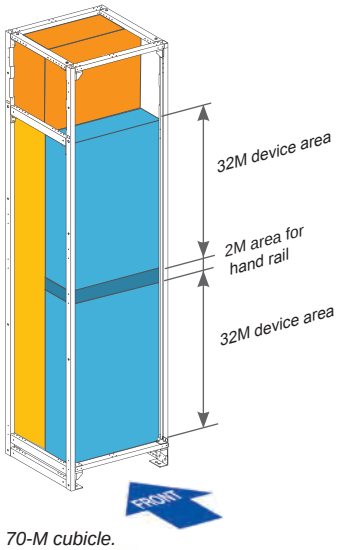

70-M cubicle.

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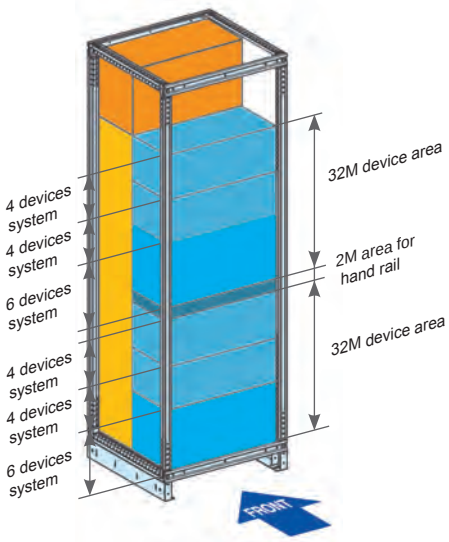


Specific fixed PCC

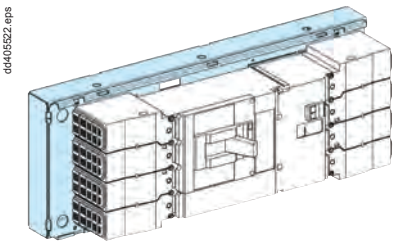
Characteristics

Common characteristics
- height: 2200 mm (66M)
- indice of protection: IP22, IP42, IP54.

Standard offer characteristics:
- available cubicles: 230, 115, 115/70-2, 70-2, 70-M, Single NT, Single NW and 70-F
- available type of connections: rear connection, side connection
- possible forced ventilation to increase busbars and devices performance.

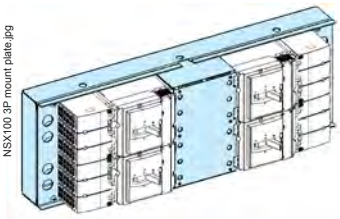
Specific fixed PCC characteristics
- number of possible functional units 28 (with 4 devices and 6 devices plates)
- available type of connection: rear connection
- cubicle depth: D1000 mm (600 mm + 400 mm)

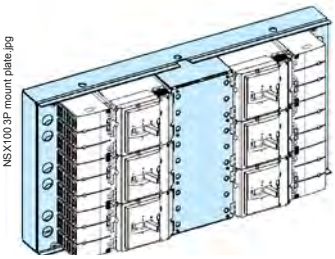
Okken Marine
Functional units



Standard offer

Choice
The marine functional units are the same as the standard offer.
Only the devices have a specific derating





NSX100 3P mounting plate

Choice
Only NSX100 3 poles can be mounted in the specific fixed PCC cubicle

IP	T (°C)	In (A).
31	35	70
	40	65
42	35	65
	40	60

Customer connection
- The customer loads are connected:
  - directly on the device terminals
  - on the terminal blocks in the cable compartment.
- Power cables cross section (incoming and outgoing): 35 mm² copper
- Installation of CTs can be done in the cable compartment.

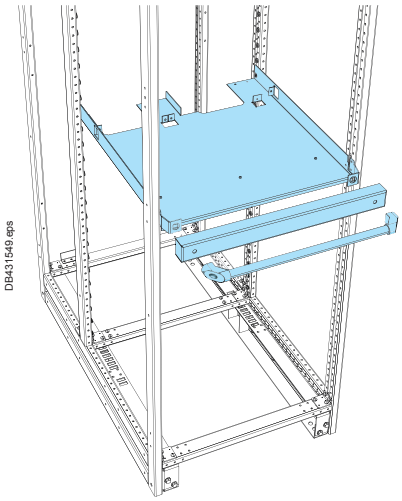
Mounting plates drawings

N° of devices	Modularity
4	9M
6	14M

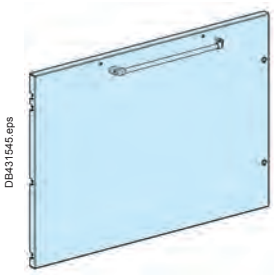
Okken Marine

Specific marine parts

Hand rails

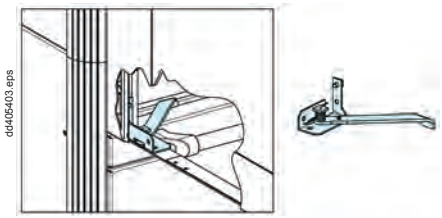


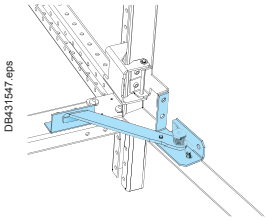
115, 115 / 70-2, 70-2 and specific fixed PCC.



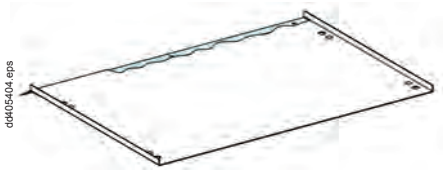
230.

Door stops

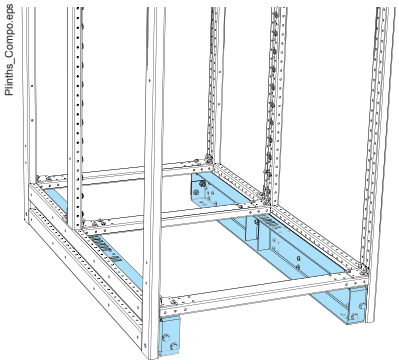




Roofs



Plinth



Okken Marine
Busbars
IP22

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Single main busbars

Rated current In (A)			No. of bars/phase
IP22			
35°C	40°C	45°C	
1900	1790	1680	2 x 40 x 10
2520	2380	2230	3 x 40 x 10
3200	3020	2840	4 x 40 x 10
4050	3820	3590	6 x 40 x 10

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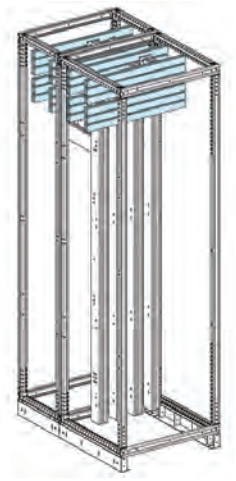

Double main busbars

Rated current In (A)			No. of bars/phase
IP22			
35°C	40°C	45°C	
4530	4350	4160	2 x 3 x 40 x 10
5810	5580	5330	4 x 4 x 40 x 10
7320	7060	6750	2 x 6 x 40 x 10

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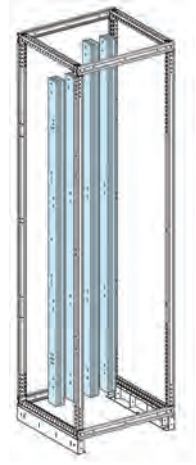
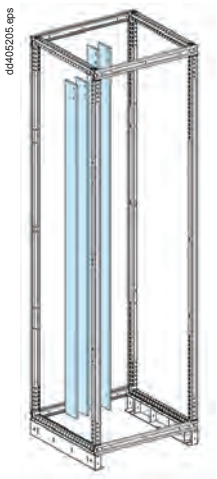


Vertical busbar 115

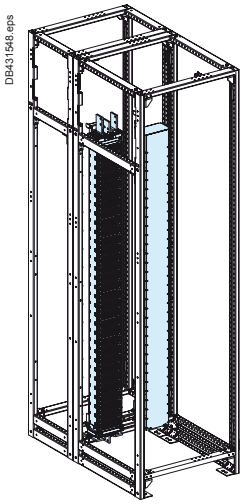
Rated current In (A)			No. of bars/phase
IP22			
35°C	40°C	45°C	
1750	1640	1530	1 x 80 x 10
2780	2620	2450	2 x 80 x 10
3200	3010	2810	3 x 80 x 10
4090	3840	3580	3 x 120 x 10

Okken Marine
Busbars
IP22



Vertical busbar 70-2

Rated current In (A)			No. of bars/phase
IP22			
35°C	40°C	45°C	
1010	950	880	1 x 40 x 10
1200	1130	1050	1 x 50 x 10
1750	1640	1530	1 x 80 x 10
2100	1970	1840	1 x 100 x 10



Vertical busbar 70-M

Single busbar rated current In (A) Natural ventilation			No. of bars/phase
IP31			
35°C	40°C	45°C	
400	360	330	20 x 8
630	580	530	30 x 8
800	730	670	40 x 8
1000	920	850	50 x 8
1150	1050	980	60 x 8

Double busbar rated current In (A)			No. of bars/phase
IP31			
35°C	40°C	45°C	
800	720	640	20 x 8
1250	1140	1050	30 x 8
1600	1440	1350	40 x 8
2000	1800	1700	50 x 8

Okken corrosive atmosphere
Introduction

Pollution

SO2 = Sulphur dioxide
H2S = Hydrogen sulphur

These atmospheric sulphuric polluting agents are mainly found in heavy industries: oil, metal, paper, mills, etc. Associated with humidity, they become extremely corrosive.

Bare copper and silver plated copper, commonly used in our applications, are particularly sensitive to those polluting agents.

The different effects encountered on site are:
- corrosion of silver plated withdrawable connections, leading to a high contact resistance, even to a non-contact (jaws whatever their rating)
- corrosion of the silver plated bars, and appearance of silver wires (whiskers effect),
- corrosion of bare copper leading to crumbling,
- corrosion of the switchgears live parts (auxiliaries, circuit-breakers, contactors, etc.) leading to non-operation on fault, operation, …
- corrosion of cables with bare areas (power or auxiliaries) leading to bursts, high resistance, etc.

It is then necessary to protect by other types of coating.

Choice of Okken standard / Okken corrosive atmosphere

The choice of Okken standard / Okken anti-corrosive configuration depends on:
- the type of pollution (sulphur dioxyde / hydrogen sulphide),
- the concentration of polluant elements given by the standard IEC 721-3-3,
- the management of the air regarding the pollution (cleaned air for no pollution management)

Conditions of use on a fixed workstation (as per standard IEC 60721-3-3)	Categories				
	3C1R	3C1L	3C1	3C2	
Concentration	maximum value	maximum value	maximum value	average value	Maximum value
> Sulphur dioxyde (mg/m³)	0,01	0,1	0,1	0,3	1
> Hydrogen sulphide (mg/m³)	0,0015	0,01	0,01	0,1	0,5
Places where atmosphere is stricly monitored and reguled («clean room» category)		**Okken Standard**		**Okken anticorrosive mandatory**	
Places where atmosphere is permanently monitored					
Places located in rural and urban areas where industrial activities are few and where traffic is moderate					
Places located in urban areas with industrial activities or considerable traffic		**Okken anticorrosive recommended**			

Okken corrosive atmosphere
Busbars coatings

Nickel-plating the busbars

Coating designation	
Standard	ISO 1456
Designation	Cu/Ni10
Coating thickness	
SI units	µm
Value	Min. 10 and max. 25
Type of coating	
Nickel electroplating on copper	

⚠ WARNING

HAZARD OF FIRE

Chemical nickel plating is strictly prohibited (electrical & thermal resistance is too important).

Failure to follow these instructions can result in death or serious injury.

Tin-plating the busbars

Coating designation	
Standard	ISO 2093
Designation	Cu/Sn15
Minimal coating thickness	
SI units	µm
Value	15
Type of coating	
Tin electroplating on copper	

⚠ WARNING

HAZARD OF FIRE

The use of tin for sliding contacts is prohibited to avoid fretting corrosion.

Failure to follow these instructions can result in death or serious injury.

Okken corrosive atmosphere
Busbars coatings

Derating rules

Horizontal busbar, fishplates, horizontal busbar / vertical busbar links, PE

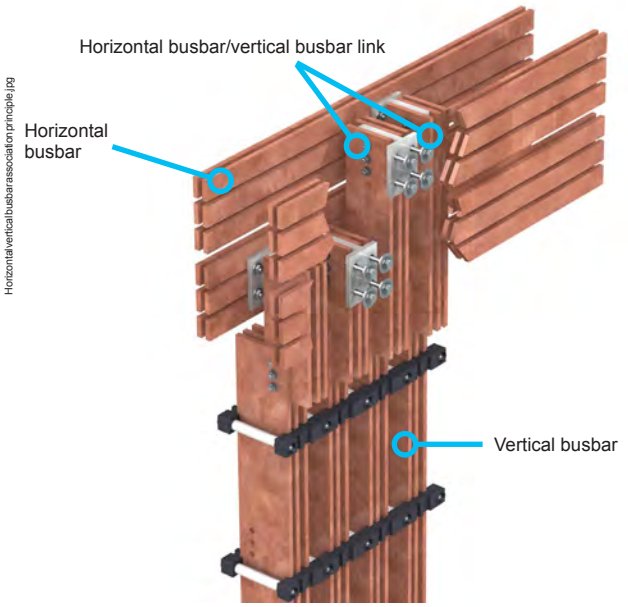
	Screwed contact
Protection	Cu / Sn30
Additional derating	no

Vertical busbar

	Screwed contact	Sliding contact
Protection	Cu / Sn30	Cu / Ni20
Additional derating	5 %	20%

Power connections

	Screwed contact	Sliding contact
Protection	Cu / Sn30	Cu / Ni20
Additional derating	no	no



The functional units
The software apply the correct derating and choose the adapted specific parts.

Okken corrosive atmosphere
Common parts

Steel sheet and frame

In general, the standard coating for Schneider Electric offers has a good withstand to sulphuric corrosive atmospheres:

EZ sheet steel + Epoxy paint or gloss paint	✓
Galvanized parts	✓
Bi-chromated parts Zn8c	✓
Screwing	✓ with standard screws and washers (Zn5c or Zn8c or Zn8b) are OK for this application.

Plastics parts

No special protection.

Accessories

For class 3C2, the following precautions must be taken:

- auxiliary relays:
  - waterproof relays with tin plated pins.
- auxiliary terminal blocks:
  - in general, these terminal blocks are equipped with their tin plated contacts.
  - otherwise, take terminal blocks with reinforced treatment (Sn).
- wiring:
  - tin plated copper wiring with PVC. Never tin plate the classical wiring.
  - if terminal ends are required (or clips), use the tin plated ones.
- control and measurement equipment:
  - specify the specific tin plated connection terminal ends.

Switchgear

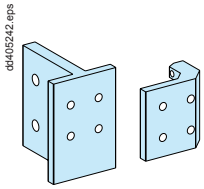
- withdrawable MASTERPACT NW, NT and Compact NSb circuit-breaker.
  - Special device with golden draw-out clamp.
  - For Masterpact NT / Compact NS, apply additional derating of 5 % on and above standard solution.
- withdrawable COMPACT NS / NSX and MASTERPACT NT circuit-breaker
  - The use of plug in and withdrawable functional units is FORBIDDEN.
- COMPACT NS / NSX circuit-breaker on Polyfast or fixed
  - The COMPACT circuit-breakers will be standard.

Canalis KT interface

No derating on the Canalis KT interface.

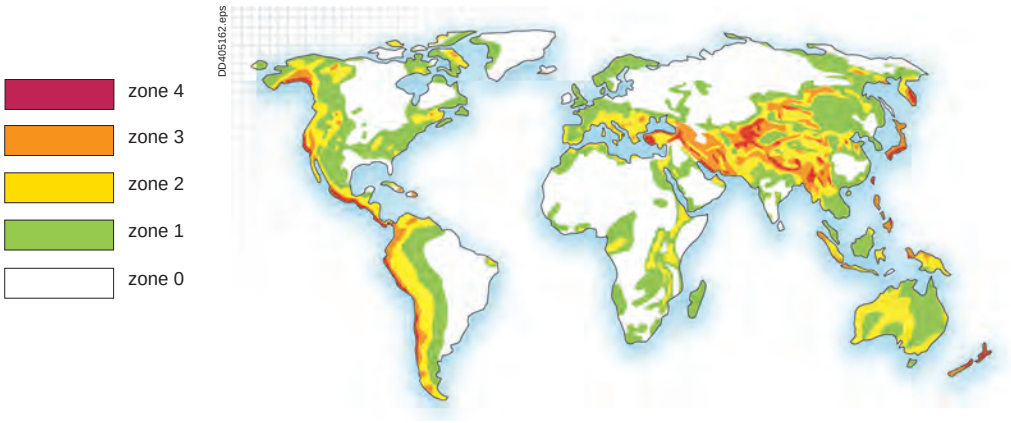
Power connection

Copper bar - By-pass
- The bars will be tin plated Cu/Sn30 According to the standard ISO 2093.
- No derating on the by-pass.



Okken Seismic
Introduction

Seismic zones around the world



Schneider Electric solutions

Okken 2.7G

Ground acceleration	Spectrum equivalence with Richter scale	Seismic zone
AG2	< 5.5	**0**
		1
AG3	5.5 to 7.0	**2**
		3
AG5	7.0 to 9.0	**4**

■ Standards compliance
- □ AS1170, EAK-2000, ENDESA-1986, GOST 17516.1-90, IEEE 693-1997.
- □ IBC 2006/AC 156 (site class B-C-D, floor level only).
- □ IEC68-3-3 (equivalent to Richter scale up to level 9).

Okken 5G

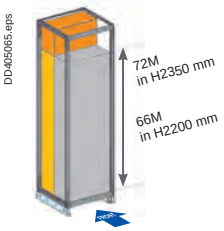
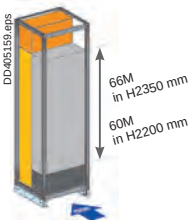
Spectrum equivalence with Richter scale
2 or 3 time the highest tremor level recorded

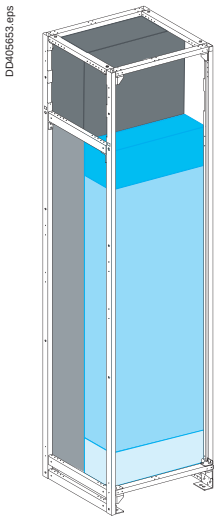
■ Okken 5G compliance
- □ EDF CRT 91 C 112 00.

Okken specific applications
Okken Seismic
Introduction

Available modularity in seismic cubicles

230, 115, 115/70-2, 70-2, 70-F | **115, 70-2, 70-F**

Okken 2.7G	Okken 5G
	



70-M - Okken 2.7G

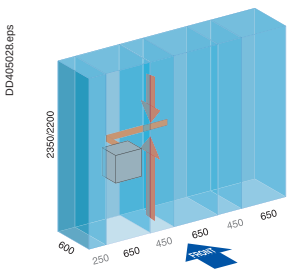
Single vertical busbar

		Vertical busbar cross-section					
		20x8 and 30x8			40x8, 50x8 and 60x8		
Cubicle height 2350 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		70	68	66	68	66	64
Cubicle height 2200 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		64	62	60	62	60	58

Double vertical busbar

		Vertical busbar cross-section					
		20x8 and 30x8			40x8 and 50x8		
Cubicle height 2350 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		70	68	64	70	68	64
Cubicle height 2200 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		64	62	58	64	62	58

Device connections



	Okken 2.7G	Okken 5G
■ Rear Connection	●	●
■ Side Connection	●	●
■ Top Direct Connection	●	-
■ Bottom Direct Connection	●	-
■ Back to back	●	-
■ By Busbar Trunking	-	-

Okken Seismic
Principle

PD405031.tif

PD405032.tif

Okken 2.7G principle

Okken offer up to 6300A can be installed in 2.7G seismic zones.
Only reinforced frames and plinths must be used to manufacture an Okken 2.7G.
The other parts of the switchboard are standards.

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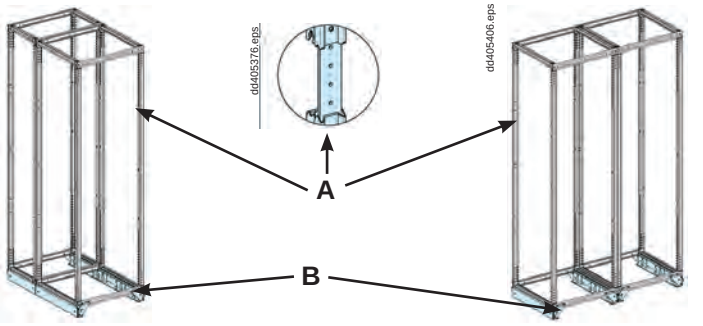

RC column (front view)

SC column (front view)

- reinforced frames and plinths (A)
- plinth reinforcement brackets (B)

70-M cubicles

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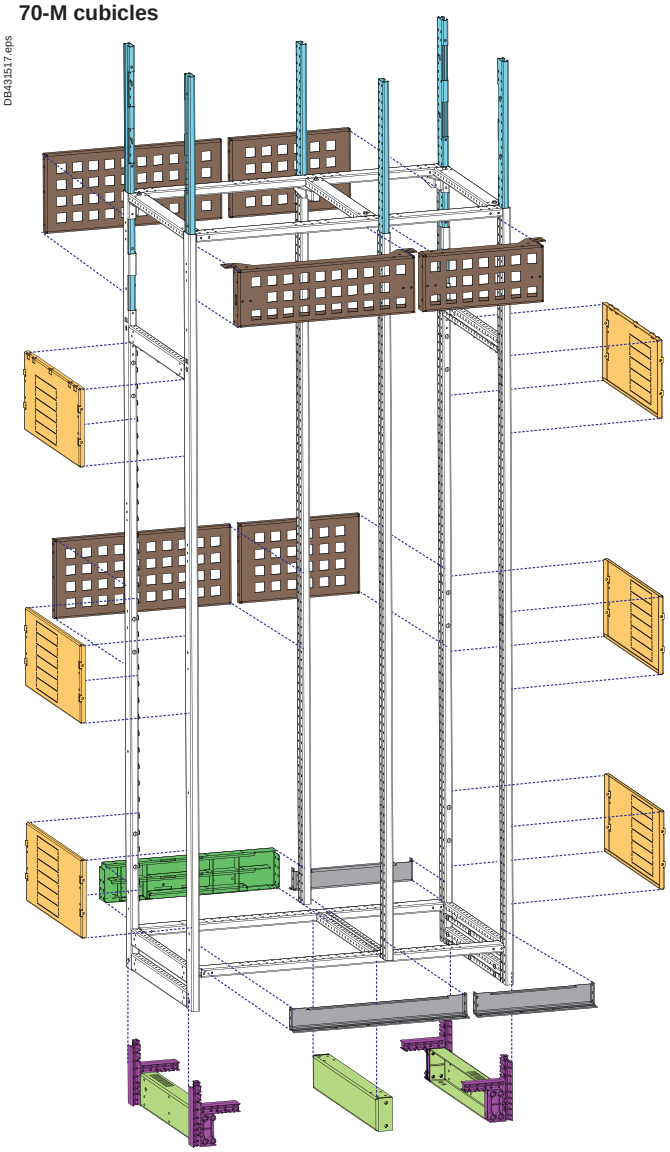

- Frame reinforcement
- Back plate + Upper front
- Lateral plate
- Lower back plate + front plate
- Busbar support
- Angle square
- Plinth

Okken specific applications
Okken Seismic
Principle

Okken 5G principle

All Okken offer except 230 and 70-M cubicles can be installed in 5G seismic zones. In addition to Okken 2.7G frames and plinths, Okken 5G is obtained by using additional reinforcements.

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PD405033.tif

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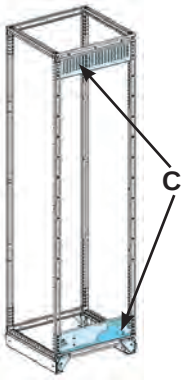

70-2 V-BB device cubicle / W650 mm compartment

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115 V-BB device cubicle

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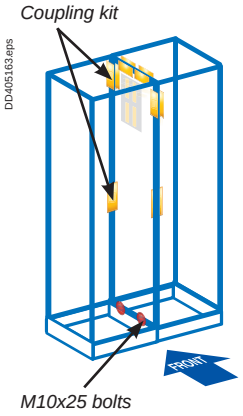
Rear compartment

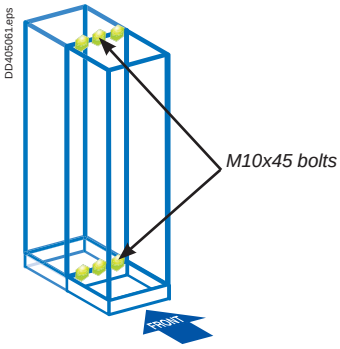
- top and bottom reinforcements (C)
- bottom additional front face plate (D)

Framework coupling

This association principle applies in the workshop as well as on the site.



Side association



Rear association

NOTICE
HAZARD OF STRUCTURAL FAILURE Seismic cubicles must have the same depth. **Failure to follow these instructions can result in equipment damage.**

Okken forced ventilation

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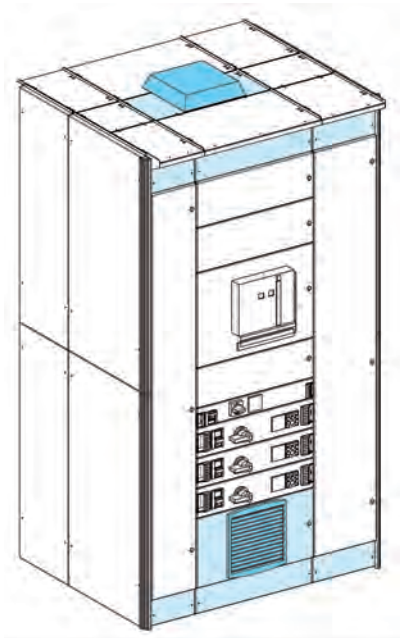


Reducing the temperature in a cubicle makes its nominal current to be optimized.
Forced ventilation, in the Okken offer, allows an approximately 15% gain on the busbars and devices rating.

The cubicle requires some additional elements:
- for air aspiration :
  - a fan on the roof,
  - a grid at the bottom of the cubicle,
- for air channelling:
  - horizontal busbar screens,
  - top and bottom covers,
  - gaskets and grommets.

Okken internal arc
Introduction

What is internal arc?

Un-intended shorting of two or more live conductors "Inside " the confined space of the switchboard leading to short circuit inside the switchboard.

What are the causes of internal arc ?

Internal arc occurs when the dielectric strength (insulation) between in the live conductor is reduced leading to the short circuit.
This happens mainly due to natural causes and / or human errors during operation and maintenance of equipment.

Some Natural Causes
- Ageing of insulation.
- Excessive moisture and / or dust in the conductor.
- Intrusion of rodents or animals inside switchboard.
- Oxidation of conductors leading bad joint.
- Wear and tear of moving parts inside switchboard eg.: plugs, contacts.

Some Human errors
- Forgotten metallic parts during installation / Maintenance.
- Under / overtightning of joints.
- Inaccurate system design and protection settings.
- Excessive overloading leading to overheating.

Consequences of internal arc

Explosion of very high magnitude creating shock waves that can be fatal for persons and damaging switchboards and nearby assets.
Extremely hot (up to 3,000 °C) projectiles of molten metal which can spread fire.

IEC TR 61641

Guide for testing under Internal Arc conditions: IEC TR 61641 Edition 3 -2014

Under Specified Arcing conditions switchboard must fullfil following seven acceptance criterions to receive agreement for internal arc

Personal Protection criterions

1. Correctly secured doors & covers do not open
2. Parts of assembly do not fly off
3. Arcing does not cause holes in the enclosure, below 2 meters.
4. Cotton indicators do not ignite
5. Protective circuit for accessible parts are still effective after the test.

In addition to above assembly protection criterion

6. The arc is confined to the defined area where it was initiated, there is no propogation of arc to other areas.

In addition to 1 to 6, personal and assembly protection, for limited emergency operation capability

7. Possibility of emergency operation of the remaining assembly, after clearing up or isolationg area affected by arc. To be verified with test voltage of 1.5 times rated operational voltage for 1 min.

Class A
Class B
Class C

Assembly providing a reduced risk of arcing faults solely by means of "**ARC IGNITION PROTECTED ZONES**" where initiation of arcing fault is remote possibility.

Class I

Okken specific applications
Okken internal arc
Internal arc solutions

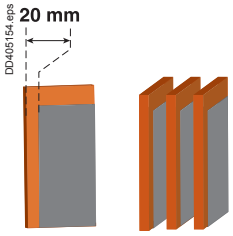
Okken solutions

Okken cubicles are class C tested and more than standards, withdrawable solutions are also tested in all the 3 operational positions (connected, test and withdrawn).

In addition to this it is possible to achieve Class I (Arc Ignition Protected Zones) ARC FREE ZONE - AFZ by choosing additional parts and coatings.
Available modularity and choices for Arc protected zones for withdrawable MCC.

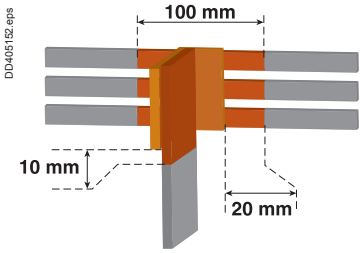
Vertical busbar

Withdrawable
115/70-2, 70-2 cubicles: epoxy coating

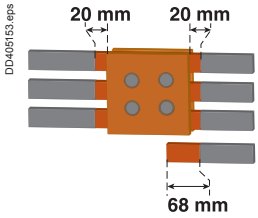


Horizontal busbar

Epoxy coating



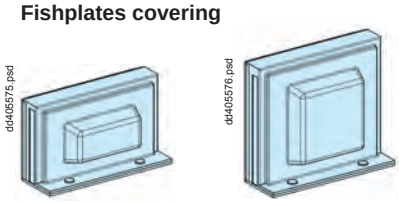
Epoxy protection on H-BB/V-BB links.



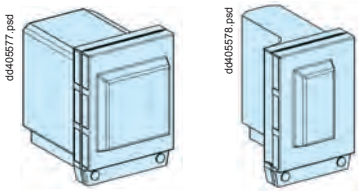
Epoxy protection of the fishplate link on the H-BB.

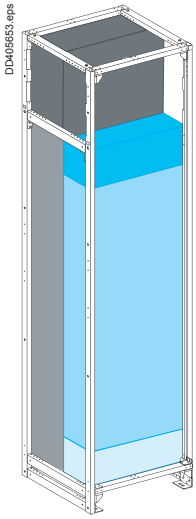
Screens

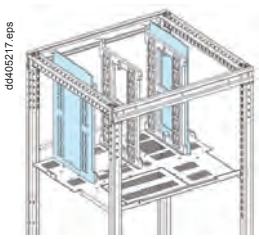
Fishplates covering



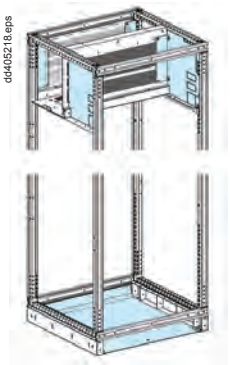
Horizontal / vertical busbars links covering







Screens to protect horizontal busbar.



Additional covers for top and bottom of the column.

Available modularity in arc free cubicles

Single vertical busbar

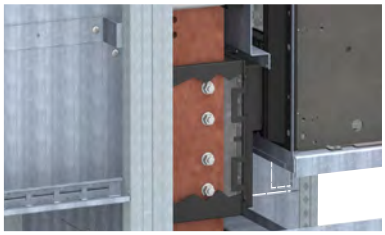
		Vertical busbar cross-section					
		20 x 8 and 30 x 8			50 x 8		
Cubicle height 2350 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		66	66	66	66	66	66
Cubicle height 2200 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		60	60	60	60	60	60

Double vertical busbar

		Vertical busbar cross-section					
		20 x 8 and 30 x 8			50 x 8		
Cubicle height 2350 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		62	62	62	62	62	62
Cubicle height 2200 mm							
No. of poles	H-BB	3P	4P		3P	4P	
	V-BB	3P	3P	4P	3P	3P	4P
No. of module (25 mm)		56	56	56	56	56	56

Okken internal arc
Arc free solutions

PB120127.eps

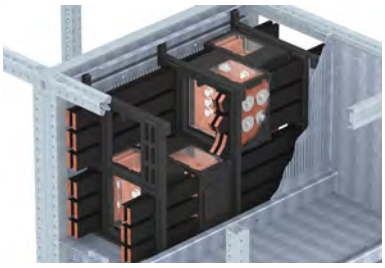


Masterpact upward connection.

PB120106.eps

Horizontal/vertical busbars connection

PB120125.eps

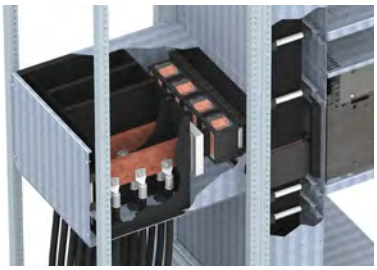


Incoming horizontal/vertical connection

PB120126.eps

Outgoing horizontal/vertical connection

PB120124.eps

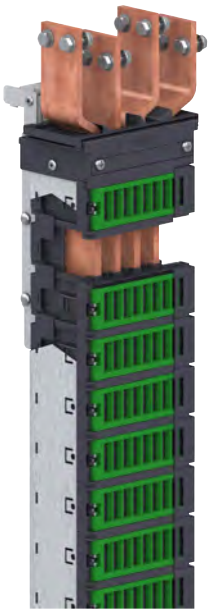


Customer connection

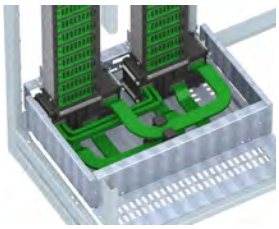
PB120107.eps

Horizontal/horizontal connection

PB120108.eps



Looping.eps



Arc free busbar looping.

Arc free vertical busbar in MCC

The busbar supports and the automatic shutter system.

For modularity in the arc free vertical busbar system, please refer to modularity section page I-10.

Tiroir partie mobile.eps

Closed Door Racking.

Optional features

Following optional features may be considered for early detection and prevention against internal arc.

Closed Door Racking

- It is a drawer option which:
  - makes it possible to do all drawer operations with its unit door remaining closed (rack in, test, rack out) ;
  - on disconnected position, drawer is mechanically blocked.
- Through a rotating racking mechanism, the stabs from the disconnect can be withdrawn from the busbar. This operation can be done through the use of a cranking tool through the front of the unit, with the door closed.
- With the retractable disconnect, the stabs will be disconnected from the busbar with enough clearance to perform maintenance without removing the drawer from the section.
- The inbuilt window will provide the status though a mechanical indication which will operate as the stabs are retracted.
- Degree of protection: IP31 to IP54.
- A removable front door can be fixed on 70-M frame with facility manager operation when drawer is removed.

It is internal arc resistant.

PB120129.tif

PB120128.tif

Vamp system solution

Arc Flash detection Device (Vamp Solution)
See page I-22.

PB120123.eps

Exertherm™ system

Thermal Monitoring Device
See page I-24.

Okken internal arc
Vamp system: arc flash protection

PB120128.tif

Vamp 321

PB120129.tif

Vam 4C

PB120130.tif

Vam 10 L

Vamp system option

The Vamp system is optional.
The arc protection units detects an arc flash in an installation and trips the feeding breaker.
Arc flash protection maximises personnel protection and minimises material damage to the installation in the most hazardous power system fault situation.

Advantages

Personnel protection
A fast and reliable arc protection unit may save human lives in the event of an arc fault occuring in the switchgear during work in or near an installation.

Reduces production losses
The shorter operating time of the arc flash protection unit, the smaller will be the damage caused by the arc fault and the shorter the possible power outage.

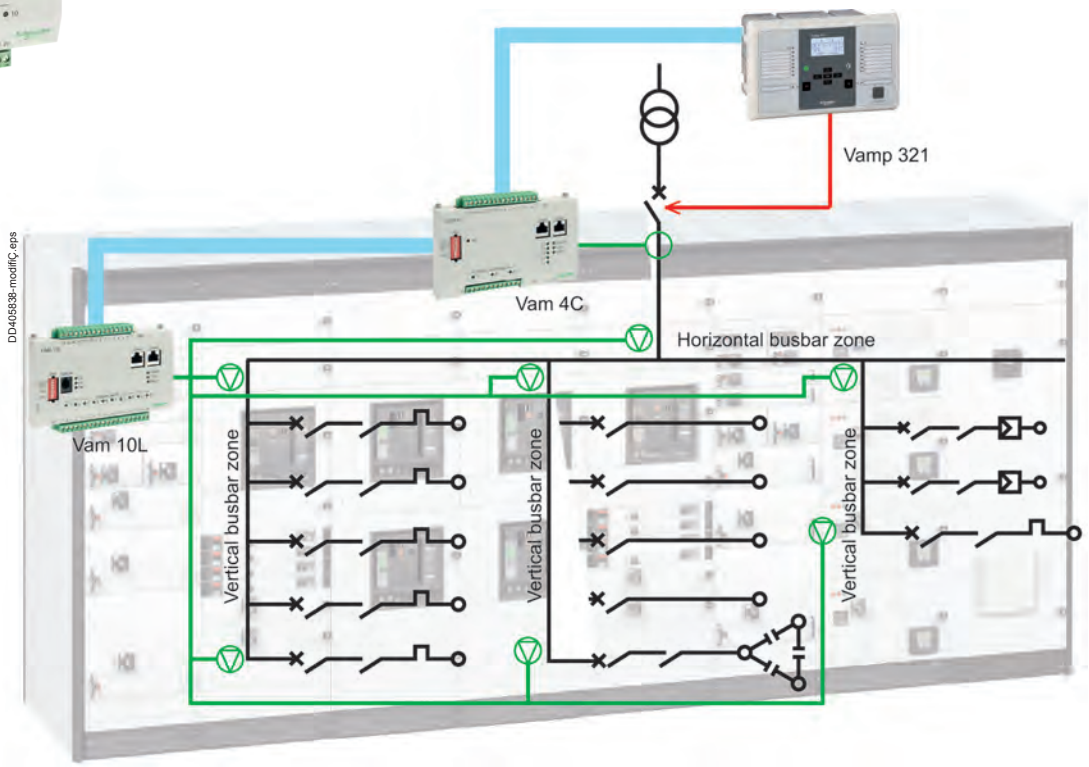
Extended switchgear life cycle
A modern arc protection unit increases the life-cycle expectancy of switchgear installations, so that decisions to invest in new switchgear installations can be postponed and money can be saved by re-vamping existing switchgear systems.

Reduced insurance costs
The faster and better the protection system of a power installations, the more generous will be the terms and costs of insurance.

Low investment costs and fast installation
A comprehensive arc protection system is characterised by low investment costs and fast installation and commissioning times.
One successful operation of the arc flash protection units provides an immediate investment payoff.

Reliable operation
Operation is based on the appearance of light or alternatively on the appearance of light and current from an external device.
Immune to nuisance trippings due to dual tripping criteria: light and current.

DD405838-modifiÇ.eps



Okken internal arc
Vamp system: arc flash protection

System features

- Current and light tripping criteria.
- Operating time 7 ms or less.
- Accurate location of arc fault utilising point sensors.
- Four selective protection zones per central unit.
- Self-supervision of the entire system.
- Easy interconnect using VX001 cables.
- Phase current measuring.
- Circuit breaker fail protection (CBFP).

Sensors

- Arc detection from Horizontal, Vertical busbar simultaneously.
- Self-monitored.
- Cable length adjustable (from 6 m to 20 m).

PB120123.eps

Exertherm™ system

Exertherm™ is a unique Permanent Thermal Monitoring System utilising small, plastic, non-contact, non-powered IR sensors.

Advantages

Increased Okken reliability and integrity
Via continual accurate thermal insight.

Optimise maintenance periods
The ability to move from a point in time snapshot to continual and pro-active approach enabling better use of resources and planning.

Potential asset life extension
Due to increased lifetime thermal data and better understanding of the Okken panels integrity and health.

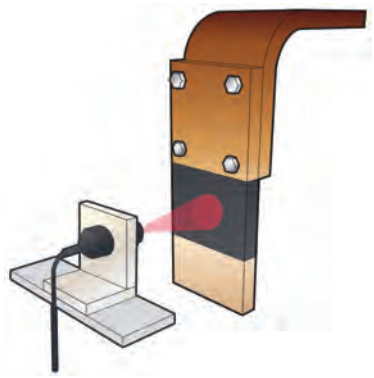
Arc flash mitigation (pre-control)
- Removal of human based intrusive maintenance.
- Identifies compromised joints at earliest thermal signature.
- Panels remain closed, maintaining environmental stability.
- Dielectric integrity management.

Production uptime
- Via extension / reduction in intrusive maintenance.
- Pro-active versus re-active management.

General risk mitigation
- From removal human dependant maintenance tasks in critical production environments as it relates to both personnel and facilities.
- Fire / major inspection incidents.
- No need to open panels or go near switchgear.

Optimised / lower lifetime maintenance cost
- Human and Opex capital cost reduction.
- Remote vs. On-site - Fewer hours required.
- Quickly detect early fault warning conditions, optimising remedy planning and costs.

Exertherm principle.eps



Functions

The Exertherm™ system is designed to provide continous 24 x 7 Thermal Monitoring detecting the exact location of the problem BEFORE the failure using optical sensors installed at the heart of the sensitive areas.

Exertherm presentation.eps

Thermal monitoring system

Exertherm HBB.eps

System features

- Integrated part of system.
- Suitable for new build of retrofit.
- Option of vision software with common alarm.
- Modbus protocol enables easy integration.
- Actual temp, not correlation.
- Global support.
- Vendor neutral.
- Not operator dependent.

Technical information

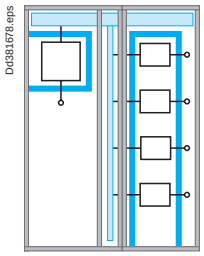
Other chapters

Forms of switchboards

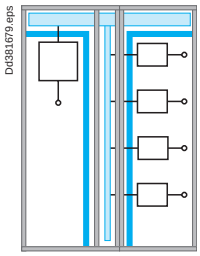
Partitions inside a switchboard are described in the 7.7 chapter of the standard IEC 60439-1.
They are a the subject of an agreement between the manufacturer and the user, and are defined as 4 different forms, in oder to ensure protection against direct contacts:

Form 1

No separation



Form 2a



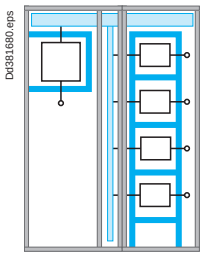
Form 2b

Form 2a

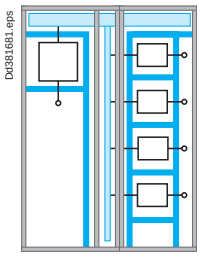
Functional units are separated from the busbars, but not the teminal blocks.

Form 2b

Functional units and terminal blocks are separated from the busbars.
Terminals are not separated from each other.



Form 3a



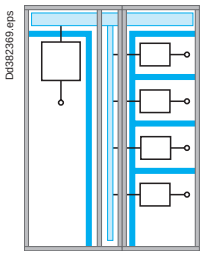
Form 3b

Form 3a

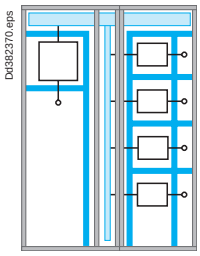
Functional units are separated from each other and from the busbars, but not the terminal blocks.

Form 3b

Functional units are separated from each other and from the busbars.
Terminals are separated from the busbars but not from each other.



Form 4a



Form 4b

Form 4a

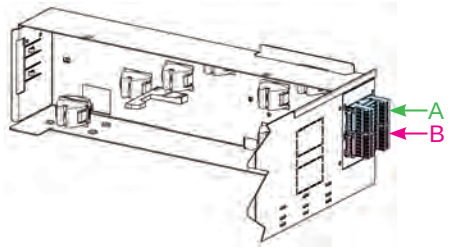
Functional units are separated from each other and from the busbars.
Terminals, which are part of the functional units, are separated from each other.

Form 4b

Functional units are separated from each other and from the busbars.
Terminals are separated from each other and from the functional units.

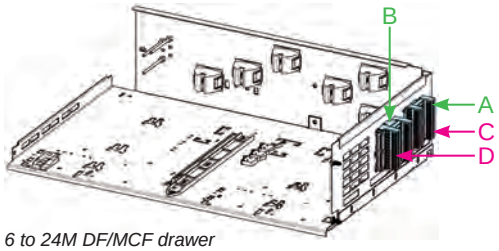
Auxiliary blocks: position

dd405395.eps



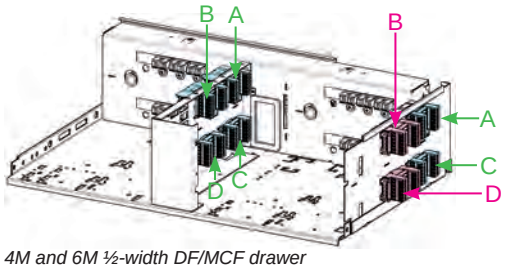
Polyfast plug-in and disconnectable DF

dd405393.eps



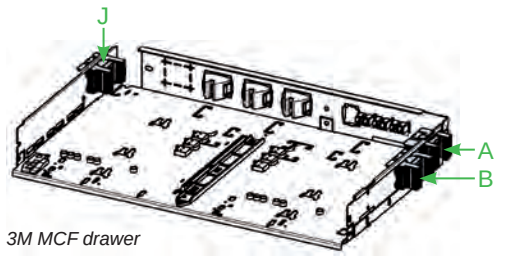
6 to 24M DF/MCF drawer

DD405430.eps



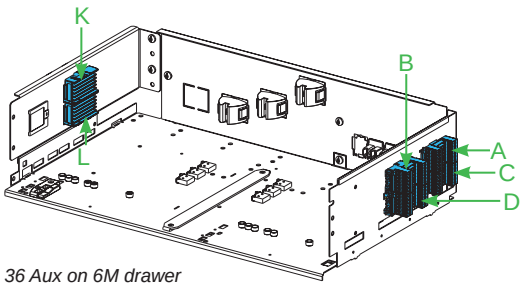
4M and 6M ½-width DF/MCF drawer

DD405431.eps



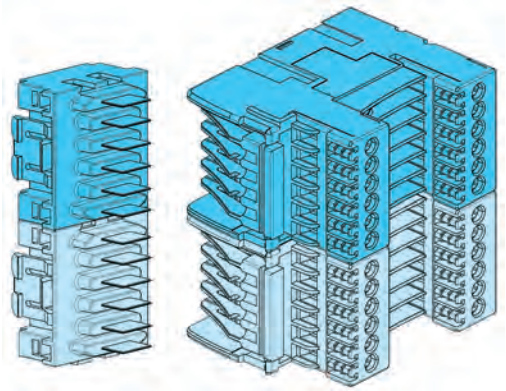
3M MCF drawer

DB410927.eps



36 Aux on 6M drawer

dd405392.eps

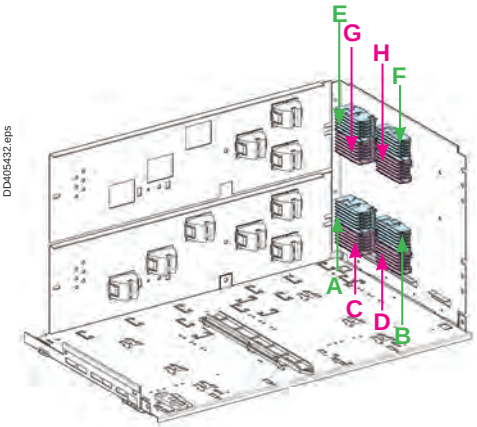


Standardisation of the auxiliary blocks position

Location of auxiliary blocks on the FP (green: pre-cutted / pink: to be cut out)	Left flange or vertical partition		Right flange	
Polyfast plug-in and disconnectable DF				A
				B
6 to 24M DF/MCF drawer			B	A
			D	C
4M and 6M ½-width DF/MCF drawer	B	A	B	A
	D	C	D	C
3M MCF ½-width drawer	B	A	B	A
12 to 24M MCF drawer, 8 auxiliary blocks			F	E
			H	G
			B	A
			D	C
3M MCF drawer	J		B	A
6M drawer with optional 36 auxiliaries		K	B	A
		L	D	C

■ auxiliary blocks must be installed following the A, B, C and D order, according to the needs

DD405432.eps

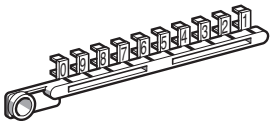


12 to 24M MCF drawer, 8 auxiliary blocks

Marking

■ The auxiliary blocks receive individual markings, type Schneider Electric AB1-G, with a pitch of 5 mm.

DF100416.eps

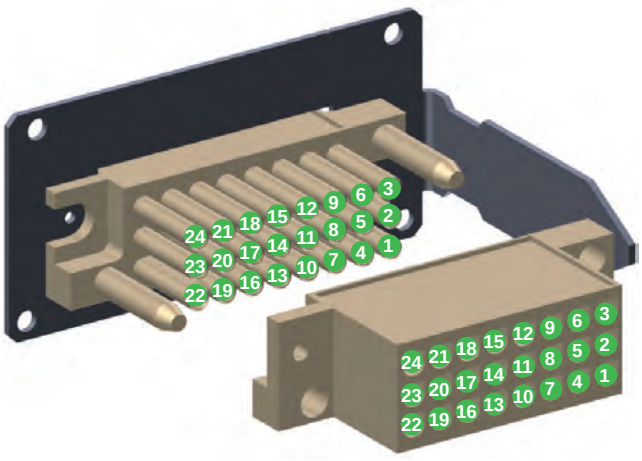


AB1-G markings

J

Control and communication connections (70-M cubicle)

PD405124.tif



Network wiring

Contact no.	24	21	18	15	12	9	6	3	
No network	-	-	-	-	-	-	-	-	3
	-	-	-	-	-	-	-	-	2
	-	-	-	-	-	-	-	-	1
Profibus	Bus	Ground	-	-	-	-	-	-	3
	Ground	Ground	-	-	-	-	-	-	2
	Bus	Ground	-	-	-	-	-	-	1
Modbus	Bus	Ground	-	-	-	-	-	-	3
	Ground	Ground	-	-	-	-	-	-	2
	Bus	Ground	-	-	-	-	-	-	1
DeviceNet	Bus	Ground	-	-	-	-	-	-	3
	Ground	Ground	-	-	-	-	-	-	2
	Bus	Ground	-	-	-	-	-	-	1
Modbus TCP-Star	Bus	Bus	Ground	-	-	-	-	-	3
	Ground	Ground	Ground	-	-	-	-	-	2
	Bus	Bus	Ground	-	-	-	-	-	1
Modbus TCP-Daisy chain	Bus	Bus	Ground	Bus	Bus	Ground	-	-	3
	Ground	Ground	Ground	Ground	Ground	Ground	-	-	2
	Bus	Bus	Ground	Bus	Bus	Ground	-	-	1

J

Notes

Connection capacity
Aluminium

Type of connec-tion	Dimension of cubicle	Pad length (RC)	Device type	Number of poles	Cables Al max	BBT	Type of V-BB
RC							
	D600+400 mm	250 mm	NT08-16/NS800-1600	3/4P	2 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	-	115-1/115-2
		400 mm	NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm² (*)	●	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	●	115-1/115-2
			NW20-25	3/4P	5 x 300 mm² (*)	●	115-1/115-2
	D600+600 mm	250 mm	NT08-16/NS800-1600	3/4P	2 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	-	115-1/115-2
		600 mm	NT08-16/NS800-1600	3/4P	7 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	6 x 300 mm² (*)	-	115-1/115-2
			NW08-16	3/4P	6 x 300 mm²	-	115-1/115-2
			NW20-25	3/4P	6 x 300 mm² (*)	-	115-1/115-2
	D600+400+400 mm	250 mm	NT08-16/NS800-1600	3/4P	2 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	-	115-1/115-2
		400 mm	NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm² (*)	●	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	●	115-1/115-2
			NW20-25	3/4P	5 x 300 mm² (*)	●	115-1/115-2
		800 mm	NT08-16/NS800-1600	3/4P	10 x 300 mm²	-	70-2
			NW08-16	3/4P	10 x 300 mm²	●	115-1/115-2
			NW20-25	3/4P	10 x 300 mm² (*)	●	115-1/115-2
TDC							
			NT08-16/NS800-1600	3/4P	5 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	3 x 300 mm² (*)	●	115-1/115-2
			NW08-20	3/4P	3 x 300 mm² (*)	●	115-1/115-2
BDC							
			NT08-16/NS800-1600	3/4P	5 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm² (*)	-	115-1/115-2
			NW08-25	3/4P	4 x 300 mm² (*)	-	115-1/115-2
SC							
	W650+350 mm		NT08-16/NS800-1600	3P	4 x 300 mm²	-	115-1
			NW08-16	3P	4 x 300 mm²	-	115-1
	W650+450 mm		NT08-16/NS800-1600	3/4P	3 x 240 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1
			NW08-16	3/4P	4 x 300 mm²	-	115-1
			NW20-25	3P	5 x 300 mm² (*)	-	115-1
	W650+650 mm		NT08-16/NS800-1600	3/4P	3 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1
			NW08-16	3/4P	4 x 300 mm²	-	115-1
			NW20-25	3/4P	5 x 300 mm² (*)	-	115-1

(*) : double the number of cables if the lugs are insulated with sleeves or screens

● : possible
- : impossible

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Technical information
Connection capacity
Copper

Type of connec-tion	Dimension of cubicle	Pad length (RC)	Device type	Number of poles	Cables Cu max	BBT	Type of V-BB
RC							
	D600+400 mm	250 mm	NT08-16/NS800-1600	3/4P	2 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	-	115-1/115-2
		400 mm	NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	●	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	●	115-1/115-2
			NW20-25	3/4P	10 x 300 mm²	●	115-1/115-2
			NW32	3/4P	10 x 300 mm²	●	115-1/115-2
	D1000 mm with simple H-BB		NW40b-63	3/4P	9 x 630 mm² (*)	-	230
	D600+600 mm	250 mm	NT08-16/NS800-1600	3/4P	2 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	-	115-1/115-2
		600 mm	NT08-16/NS800-1600	3/4P	7 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	12 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	12 x 300 mm²	-	115-1/115-2
			NW20-25	3/4P	12 x 300 mm²	-	115-1/115-2
			NW32	3/4P	12 x 300 mm²	-	115-1/115-2
			NW40	3/4P	12 x 300 mm²	●	115-3
	D600+400+400 mm	250 mm	NT08-16/NS800-1600	3/4P	2 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	-	115-1/115-2
		400 mm	NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	●	115-1/115-2
			NW08-16	3/4P	4 x 300 mm²	●	115-1/115-2
			NW20-25	3/4P	10 x 300 mm²	●	115-1/115-2
			NW32	3/4P	10 x 300 mm²	●	115-1/115-2
		800 mm	NT08-16/NS800-1600	3/4P	10 x 300 mm²	-	70-2
			NW08-16	3/4P	20 x 300 mm²	●	115-1/115-2
			NW20-25	3/4P	20 x 300 mm²	●	115-1/115-2
			NW32	3/4P	20 x 300 mm²	●	115-1/115-2
	D1400 mm with double H-BB		NW40b-63	3/4P	12 x 630 mm² (*)	-	230
TDC							
			NT08-16/NS800-1600	3/4P	5 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	6 x 300 mm²	●	115-1/115-2
			NW08-20	3/4P	6 x 300 mm²	●	115-1/115-2
BDC							
			NT08-16/NS800-1600	3/4P	5 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	8 x 300 mm²	-	115-1/115-2
			NW08-25	3/4P	8 x 300 mm²	-	115-1/115-2
			NW32	3/4P	8 x 300 mm²	-	115-1/115-2
	D1000 mm with simple or double H-BB		NW40b-63	3/4P	9 x 630 mm² (*)	-	230
SC							
	W650+350 mm		NT08-16/NS800-1600	3P	4 x 300 mm²	-	115-1
			NW08-16	3P	4 x 300 mm²	-	115-1
	W650+450 mm		NT08-16/NS800-1600	3/4P	3 x 240 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1
			NW08-16	3/4P	4 x 300 mm²	-	115-1
			NW20-25	3P	10 x 300 mm²	-	115-1
			NW32	3P	10 x 300 mm²	-	115-1
	W650+650 mm		NT08-16/NS800-1600	3/4P	3 x 300 mm²	-	70-2
			NT08-16/NS800-1600	3/4P	4 x 300 mm²	-	115-1
			NW08-16	3/4P	4 x 300 mm²	-	115-1
			NW20-25	3/4P	10 x 300 mm²	-	115-1
			NW32	3/4P	10 x 300 mm²	-	115-1

(*) : double the number of cables if the lugs are insulated with sleeves or screens

● : possible
- : impossible

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Cable cross-section for devices in drawers

Power Control Centre (PCC)

Ue = 415 V

Type of circuit breaker	Rating (A)	Cable size
iC60	25	10 mm²
NG125	32	10 mm²
	63	16 mm²
	80	25 mm²
	125	35 mm²
NSXm 100	16	10 mm²
NSX100	25	10 mm²
	32	10 mm²
	40	10 mm²
	50	16 mm²
	63	16 mm²
	80	25 mm²
	100	35 mm²
NSXm 160(1)	32	10 mm²
NSX160	40	10 mm²
	50	16 mm²
	63	16 mm²
	80	25 mm²
	100	35 mm²
	125	Bar
	160	Bar
NSX250	63	16 mm²
	80	25 mm²
	100	35 mm²
	125	Bar
	160	Bar
	200	Bar
	250	Bar
NSX400	400	Bar
NSX630	630	Bar

(1) For 70-2 drawer NSXm160A : cable size = 50 mm².

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Cable cross-section for devices in drawers

Motor Control Centre (MCC)

With TeSys U

Base	Protection module	Cable size
LUB12	LUC_1X	2.5 mm²
	LUC_05	2.5 mm²
	LUC_12	4.0 mm²
LUB32	LUC_18	6.0 mm²
	LUC_32	6.0 mm²

With GV2, GV3, GV4 NS and NSX

Contactor	Cable size	
	incoming	outgoing
LC1D09	2.5 mm²	2.5 mm²
LC1D18	4.0 mm²	4.0 mm²
LC1D25	4.0 mm²	4.0 mm²
LC1D32(1)	6.0 mm²	6.0 mm²
LC1D38	6.0 mm²	6.0 mm²
LC1D40A	10.0 mm²	10.0 mm²
LC1D50A	16.0 mm²	16.0 mm²
LC1D65	16.0 mm²	16.0 mm²
LC1D65A	16.0 mm²	16.0 mm²
LC1D80	25.0 mm²	25.0 mm²
LC1D115	Bar	35.0 mm²
LC1D150	Bar	50.0 mm²
LC1F185	Bar	Bar
LC1F225	Bar	Bar
LC1F265	Bar	Bar
LC1F330	Bar	Bar
LC1F400	Bar	Bar
LC1F500	Bar	Bar

(1) 15kW in 4M-half width - cable 10 mm².

Intermediate cable - between fixed outgoing support and terminal block

Outgoing support	Cable size
S	10 mm²
M in a drawer < 30 kW	16 mm²
M in a drawer = 30 kW	25 mm²

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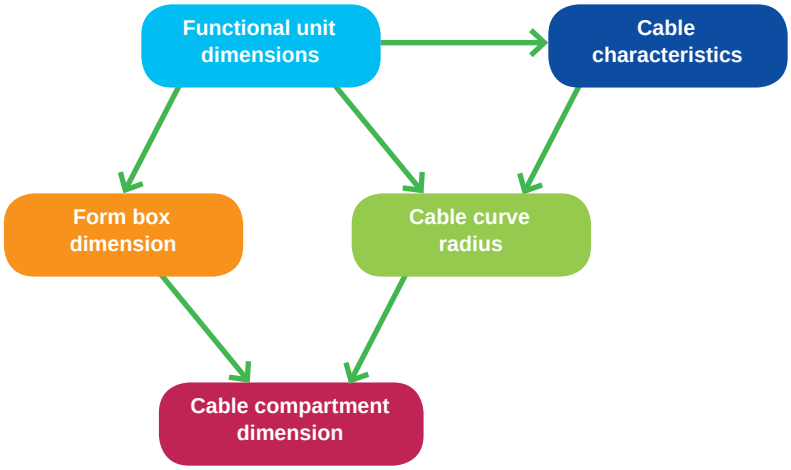
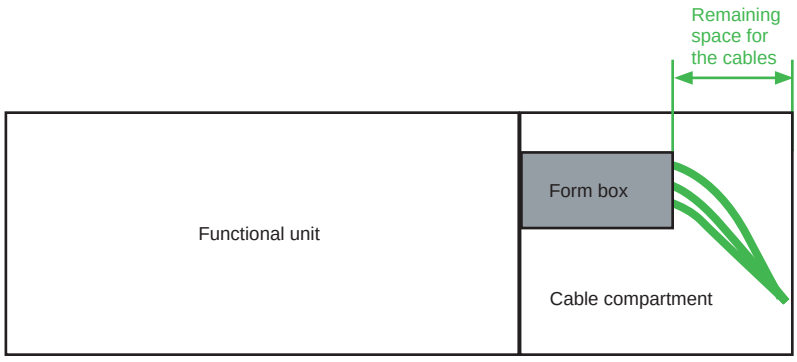
Connections in compartments and installation on door

Overview

The choice of the cable compartment size depends on:
- the functional unit dimensions (electrical and mechanical),
- the cable curve radius (deduced from its characteristics),
- the form box dimension (deduced from the functional unit).





Side compartment 70-M remaining space for cables

Functional unit height	Cable compartment width		Specificity
	300 mm	400 mm	
C100H, C100F	189 mm	289 mm	PCC - MCC
C200H, C200F	189 mm	289 mm	PCC - MCC
C200F	-	208 mm	PCC 4P
C300F	189 mm	-	PCC - MCC
	-	254 mm	PCC 3P - MCC
		208 mm	PCC 4P
		203 mm	PCC 3P - MCC
C400F	-	236 mm	PCC - MCC
		208 mm	PCC - MCC
C500F	-	236 mm	PCC - MCC
C600F	-	236 mm	PCC - MCC

For cable compartment 200mm width (W800 cubicle), no form 4 box is expected.
All the space is dedicated to the cables.
There is no size constraint for the curve radius of the cables.

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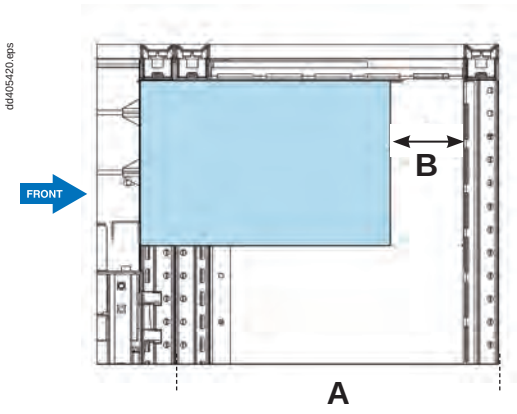
Connections in compartments and installation on door

Side compartment 70-2 remaining space for cables

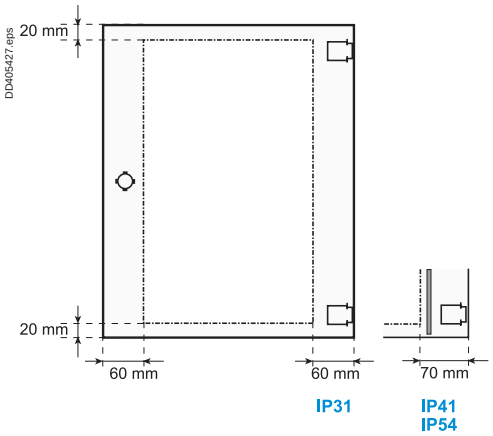


lateral compartment width A	B
350 mm	84 mm
450 mm	184 mm
650 mm	384 mm

- A: distance between the cable tie bar and the F4 box steel gland plate
- compartments W450 mm minimum are recomended in order to make the cable entry in F4 boxes easier

Device installation on door

Maximum weight of gear installed on door:
- door ⩽ 24M: 5 kg
- door ⩾ 26M: 10 kg



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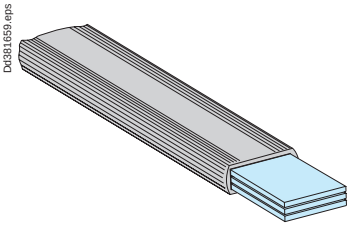
Copper type and cables



Copper type to use

■ Use exclusively Cu-ETP complying with the following specification:

Standard	Designation
Raw material designation	
EN 1652	Cu ETP R240
Standard international equivalent	
ISO 1634	Cu ETP HB

Cables and flexible insulated bars specifications

■ Cables :
- □ cable 750/1000V 105°C
- □ 105°C is a mandatory feature
- □ cables(*) with 1000 V insulation and temperature rating 105 °C can be used.

■ Flexible insulated bars, according to the following specification:
- □ raw insulated material

Mechanical properties				
Test method	Hardness NF ISO 868		Rm mini NF EN ISO 527-1➡5	
SI units			Mpa	
Value			19	
Electrical properties				
Test method	Insulation		Dielectric strength CEI 60243	
SI units	V		KV/mm	
Value	1000		>20	
Physical characteristics				
Test method	θ° utilisation			
SI units	°C			
Value	-40 / +105			
Flammability properties				
Test method	Glow wire resistance	Oven test	Ball pressure test	Fire behaviour
SI units	CEI 685-2-1	CEI 439-3	CEI 439-3	UL94
Value	960°C / 30 s	70°C time: 168 h	125°C	FV 0

□ **Copper strip** designation:

Standard	Designation
Raw material designation	
EN 1652	Cu ETP R200 mini
Standard international equivalent	
ISO 1634	Cu ETP O mini

(*) All cables must be RoHS and REACH certified. Schneider Electric recommends the use of PVC cables of type 10V2-K and Tri-Rated wire.

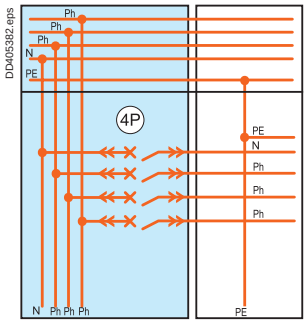
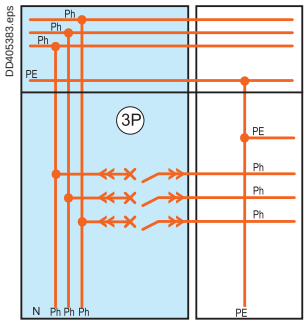
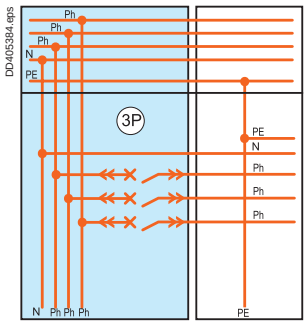
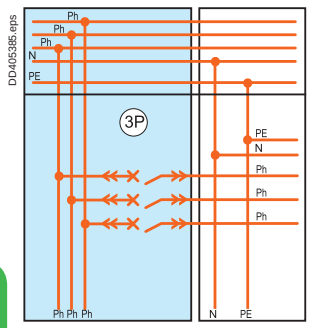
Links to the 70-F V-BB cross-section (flexible insulated bars)

Device	FIB cross-section
NSXm 100-160	20 x 3
NSX100-160	20 x 3
NSX250	20 x 5
NSX400	32 x 5
NSX630	32 x 8

Notes

PE-PEN bars conception and installation

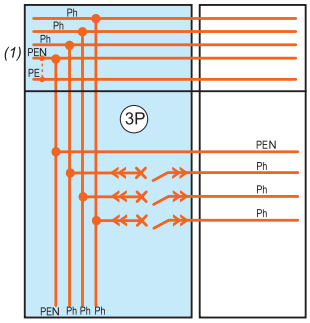
PE-PEN configurations

PE-PEN configuration	Neutral system				Neutral		No. of poles		No. of wire	Cubicle			
	IT	TT	TN-S	TN-C	distributed	switched	VBB	device		115	115/70-2	70-2	70-M
 DD405382.eps	■	■	■	-	■	■	4P	4P	5	■	■	■	■
 DD405383.eps	■	■	■	-	-	-	3P	3P	4	■	■	■	■
 DD405384.eps	-	-	■	-	■	-	4P	3P	5	■	-	-	■
 DD405385.eps	-	-	■	-	■	-	3P	3P	5	-	-	■	■

PE-PEN bars conception and installation

PE-PEN configurations (contd.)

DD405386.eps

PE-PEN configuration	Neutral system				Neutral		No. of poles		No. of wire	Cubicle			
	IT	TT	TN-S	TN-C	distributed	switched	VBB	device		115	115/70-2	70-2	70-M
	-	-	-	■	PEN	-	4P	3P	4	■	-	-	-

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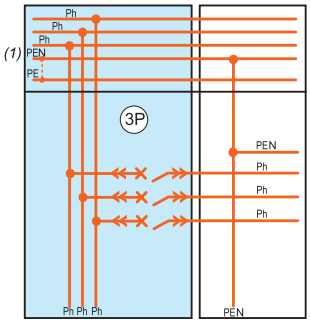	-	-	-	■	PEN	-	3P	3P	4	-	-	■	■

PE-PEN configurations (contd.)

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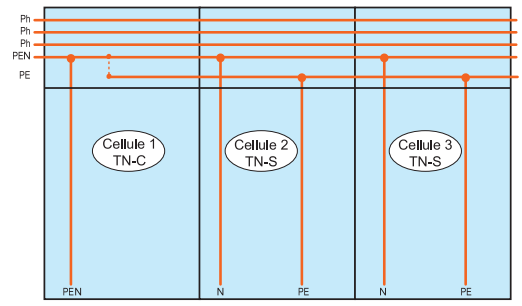

- Mixing TN-C/TN-S is possible in a switchboard.
- The horizontal PEN replaces the Neutral (the horizontal busbar is in TN-C).
- PE runs horizontally for earthing of the columns and the vertical PE connection (TN-S).
- PEN/PE link on each incomer (TN-C).

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