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MNS R Low Voltage Switchgear System Guide

Power and productivity
for a better world™

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Technical descriptions relate to MNS R.

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Content

MNS R System

System overview 5
Technical data 7
Certifications 8
Arc Proof version 9

MNS R Construction details

Switchgear frame 10
Earthing 10
Circuit-breaker compartment 11
Instrumentation compartment 11
Busbar Compartment 12
Main busbars 12
Distribution busbars 12
Surface treatment 12
Cable Compartment 13
Bus Duct 13
Segregation forms 14
MNS R form 3a, 3b and 4b construction solutions 15

Standardization

Typical configurations 16
Circuit-breakers modules 17
Main Busbars 17

Power Motor Control Center

Conventional PMCC 18
MCC Panel structure 18
Withdrawable modules 18
Withdrawable module positions 18
Intelligent PMCC 19
MNS iS Innovative design 19
MNS iS Condition Monitoring 19

Power Cables

Cables connections 20
Type of termination 20
Air circuit-breakers – Normal Lugs 20
Air circuit-breakers – Contained palm Lugs 21
Moulded case circuit-breakers 21

Dimensions

Switchgear depth 22
Foundations cubicles depth 1025 mm 23
Foundations cubicles depth 1200 mm 23
Foundations cubicles depth 1400 - 1600 mm 23

ABB Components

Emax Air circuit-breakers 26
Tmax Moulded Case circuit-breakers 30
Tmax XT Moulded Case circuit-breakers 34
Multifunction protection units 38
Flex Interfaces 40
Automatic transfer switches 42

ABB Low Voltage Systems

Factories always close to his customers 44

Annex

Items subject to agreement between manufacturer and the user 46

MNS® – Since 1975

Thirty years ago, ABB engineered MNS - the first modular Low Voltage Switchboard. The separa-ted functional areas combined with the arc containment design received immediate customer recognition. Since then, MNS is the synonym for personnel and operational safety.
MNS R is the rear access switchgear of the MNS platform designed to guarantee the guarantee the highest quality and safety standard for all the plants that require cable connections form the back side.
With MNS R ABB is delivering “add values” to his clients.

Low Installation cost

Due to the low foot print and easy access for power cables, set up and installation is short and effective.
Rear covers of power cable compartments are available in several configurations according to customer specification (hinges, handles, safety locks).

Flexibility in applications

Fully adaptable to customer needs with the wide range of possible configurations: cables or bus duct from top or bottom, degree of protection up to IP54, internal segregation up to form 4b.

Safety

Modular design, internal segregation and easy access ensuring highest safety for operation, inspection and maintenance. MNS R is internal arc tested according to IEC 61641 and guarantees highest level of personnel safety.

Low foot print and high technical performance

Multilevel Air Circuit-breaker layout reduce switchgear footprint.
Air Circuit-breaker up to 6300A without derating show high technical performance. Different busbar locations give maximum flexibility in order to optimize switchgear layout and dimensions.

Low meantime to repair and low maintenance cost

Withdrawable MCCB and ACB are available for all applications in order to minimize maintenance time for their replacement.
Due to easy access to power and control cables all related work can be done in an effective way; required maintenance time is shorter than usual.

System Overview

The MNS R main low voltage distribution switchgear with rear access had been studied for installation in large electrical plants, such as petrochemical plants, steel works, rolling mills, power stations, oil rigs, ships, etc.
The service conditions on these plants are often extremely severe: the high currents involved and the effective short-circuit levels require high performances switchgears.

Furthermore, must be guaranteed personnel safety, service continuity, easy inspection, maintenance, erection and installation. Easy extension applications as well as compact overall dimensions are a must. The Power Center MNS R switchgear fully complies with all these requirements. In addition to that, due to a perfect integration with all the latest generation of ABB apparatus, it easily meets all market requirements.

Technical data

Standards and Testing	
Standards	
Verification by testing *	IEC 60439-1, IEC61439-1/-2, EN60439-1, CEI 60439-1
Test Certificates	
	ABB SACE, ACAE LOVAG, SINAL, Cesi and Ismes
Electrical Data	
Rated Voltages	
Rated insulation voltage Ui	1000 V AC, 1500 V DC **
Rated operating voltage Ue	690 V AC, 750 V DC **
Rated impulse withstand voltage Uimp	Up to 6 / 8 / 12kV **
Overvoltage category	II / III / IV **
Degree of pollution	3
Rated frequency	50 - 60 Hz
Rated Currents	
Main busbars:	
Rated current Ie	Up to 6300 A
Rated peak withstand current Ipk	Up to 220 kA
Rated short-time withstand current Icw	Up to 100 kA
Distribution bars:	
Rated current Ie	Up to 4000 A
Rated peak withstand current Ipk	Up to 220 kA
Rated short-time withstand current Icw	Up to 100 kA
Arc Proof	
Test according IEC 61641	75 kA, 0,5 s at 690 V
	100 kA, 0,3 s at 415 V
Mechanical Characteristics	
Dimensions	
Height	2200 mm
Width	300, 400, 600, 800, 1000, 1200 mm
Depth	1025, 1200, 1400, 1600 mm
Basic grid size	E = 25 mm acc. to DIN 43660
Surface Protection	
Frame	Alu - Zinc coated
Internal subdivision	UNI EN 10130 Zinc coated
Transverse section	UNI ISO 4520 Zinc coated
Enclosure	Power coated RAL7035 (light grey)
Degrees of Protection (IEC 60529, EN 60529)	
With door open	IP 20
With door close	IP 30 standard up to IP 54
Normal Conditions	
Installation	Internal for service
Ambient temperature	min -5°C, max 40°C, average 24h 35°C
Relative umidity	max 50% at 40°C
Maximum altitude	≤ 2000 m
Extras	
Paint finish	
External protection	Special colour on request
Busbar system	
Main and branch busbars	Sheated busbars, treated busbars (Ag/Sn)
Form of separation	
According IEC 61439-2	Up to 4b
According BS 61439-2	Up to 4b type7

* Design verification by testing: where an Assembly has previously been tessted in accordance with IEC 60439-1, and the results fulfil the requirements of the IEC 61439-1/-2, the verification of these tests need not to be repetaed

** Depending on the electrical equipment

Type Tested

Type Test

In order to guarantee the highest quality and performances standard MNS R switchgear has been tested according the International Standard IEC. The tests simulate situations which occur very rarely or even never in the installations. For example, a short-circuit at the maximum current level for which the installation has been designed is rather unrealistic because of the presence of current-limiting components (such as the cables) and because the power available is normally lower than the rated one.
Here below the description of the main:

Short-time and peak withstand current

The test shows that the main power and the earthing circuits resist the stresses caused by the passage of the short-circuit current without any damage. It should also be noted that both the earthing system of the withdrawable apparatus and the earthing busbar of the switchgear are subjected to the test. The mechanical and electrical properties of the main busbar system and of the top and bottom branch connections remain unchanged even in the case of a short-circuit

Temperature rise

The temperature rise test is carried out at the rated current value of the switchgear unit and shows that the temperature does not become excessive inside of it. During the test, both the switchgear and the apparatus it may be fitted with are checked (circuit-breakers, contactors and switch-disconnectors). Apparatus subject to testing in free air is able to withstand higher rated currents than that inserted in a switchgear unit, therefore the rated current of the apparatus depends on the characteristics of the switchgear and on the relevant ventilation system (natural or forced).

Dielectric

These tests check that the switchgear has sufficient capability to withstand the lightning impulse and the power frequency voltage. The power frequency withstand voltage test is carried out as a type test, but is also routine on every switchgear unit manufactured.

Mechanical operations

The mechanical life tests of all the operating parts highlight the reliability of the apparatus. General experience in the electro-technical sector shows that mechanical faults are one of the most common causes of a fault in an installation. The switchgear and apparatus it contains are tested by carrying out a high number of operations - higher than those which are normally carried out in installations in service. Moreover, the switchgear components are part of a quality program system and are regularly taken up from the production lines and subjected to mechanical life tests to verify that the quality is identical to that of the components subjected to the type tests

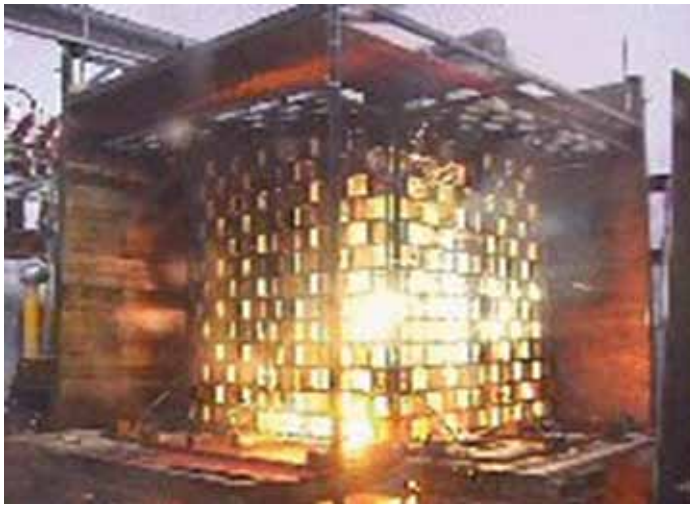
Routine Test

Apart from this, each switchgear unit is subjected to the routine tests in the factory before its delivery.

Special Test

In same case switchgears have to resist to external event that may create damaging or interrupt the service; is the case of the switchgear installed in seismic area.
The MNS R has been also submitted to anti seismic test with acceleration up to 0.5g.

Arc Proof version



Internal Arc Test

Safety of the personnel working on the plant is one of the key points considered by ABB when designing a low voltage switchgear.

According that the MNS R switchgear can be also supplied in arc proof version according the requirements of the IEC Technical Report61641

Here below the list of the requirements:

1 Properly secured doors, covers, etc must not open.
2 Parts (of the switchgears and controlgear assembly), which may cause a hazard, do not fly off.
3 No holes must form in the freely accessible external parts of the enclosure as a result of paint or stickers burning or other effects.
4 Vertically attached indicators must not ignite (indicators ignited as a result of paint or stickers burning are excluded from this assessment).
5 The protective conductor circuit for touchable parts of the casing must be functioning.

Test criteria for plant protection including system function protection:

6 The arc must be limited to the defined area and must not re-ignite in the adjacent areas.
7 An emergency operation of the switchgear and control gear assembly must be possible when the fault has been repaired and/or the functional units of the defined area have been isolated or removed. This requirement must be evidenced by an insulation test carried out at 1.5 times the rated operating voltage for 1 min.

MNS R Construction details

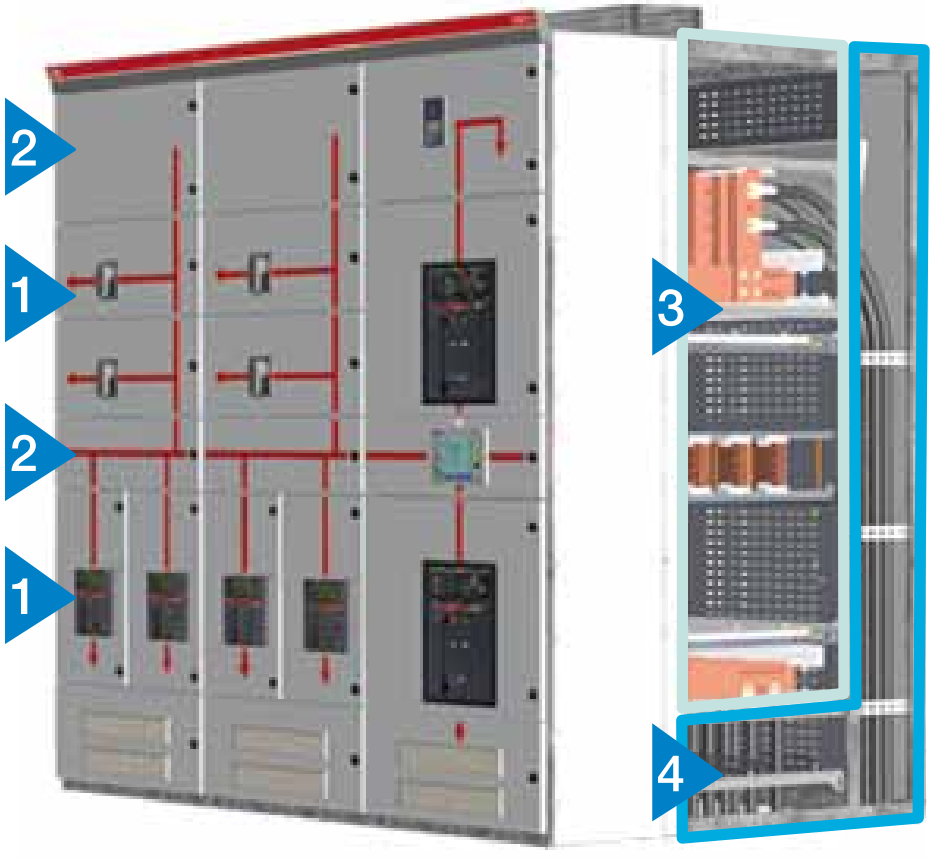
Switchgear frame

The MNS R frame is based on modular 2 mm thick still C sections, pre-drilled at a pitch of 25 mm. Each unit is based on modular elements and consists of:
1 circuit-breaker compartments;
2 instruments compartments;
3 busbar compartment;
4 cable compartment.
All compartments are meccanically segregated from the others.
The switchgear is pre set for easy extensions on both sides.

Earthing

The switchgear is provided with a continuous electrolytic copper earthing busbar, with a cross-section suitable for the proper switchgear shortcircuit rating and pre-set on both sides for connection to the earthing network.
Are connected to the earthing busbar:
- all the metallic structures of the individual units;
- all not live metallic parts of the circuit-breakers;
- all CTs and VTs secondary earthing connections.

All others not live metallic parts of the apparatus are connected to the earthing busbar by means of the unit metallic structure.
The doors with apparatus installed are connected to the structure by means of flexible copper braids. All the ground connections are made with screws or bolts provided with gripping washers.



Circuit-breaker compartment

The compartment is suitable to accept both air and moulded-case circuit-breakers and it is accessible from the front side by means of a locked hinged door. The circuit-breakers can be installed in all the available versions, fixed, plug-in and withdrawable. With all the widrawable circuit-breakers, in order do guarantee the maximum safety level to the operator, the apparatus handling can be carried out with the door closed.

Instrumentation compartment

The instrument compartment as well is located in the front side of the switchgear and it is accessible by means of a locked hinged door. It can be dedicated to each functional unit or be common to several ones. The measuring instruments, protection relays, control and signalling devices are normally mounted on the door, whereas any other auxiliary apparatus, such as miniature circuit-breakers, protection fuses and auxiliary relays are placed inside the compartment. Apparatus wiring is made with flexible copper cables and arranged in dedicated wiring channels.
Each circuit-breaker terminal blocks are separated from the others and properly identified.

MNS R Construction details

Busbar compartment

The busbar compartment is located in the middle section of the switchgear. Main busbars can be located at the top, in the centre or at the bottom of the panel depending on the selected design and they distribute the power to the various switchgear panels. In some of the existing configurations main busbars can be directly connected to a circuit-breaker as well.
Distribution busbars are located into the single column and positioned vertically to feed panel circuit-breakers.
The busbar system can be composed by 1, 2 or 3 busbars per phase, according to requested rated current, short-circuit level and operational ambient conditions in terms of temperature, altitude and humidity. Busbars are normally bare copper made, on request can be suitably treated with tinning, silver-plating and/or sheathing.

Main busbars

MNS R main busbars are available for currents up to 6300 A. Main busbars, as well as distribution busbars, can be completely segregated. Each MNS R panel can be fitted with three busbar systems at the same time (top-centre- bottom) each segregated from the others.

Distribution Busbar

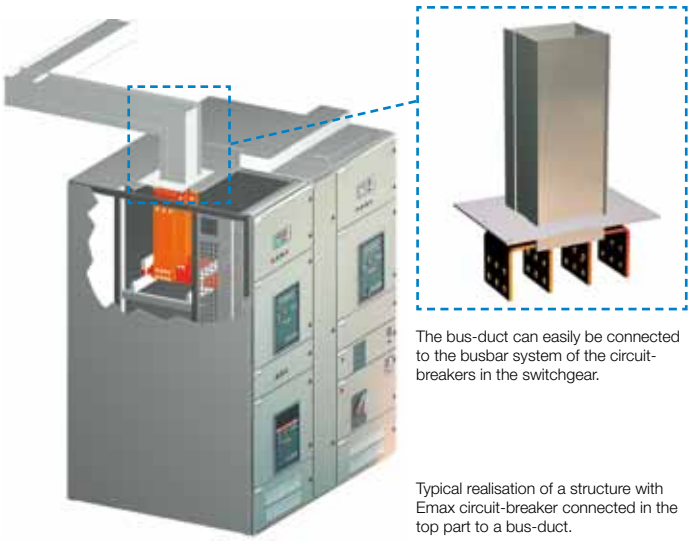
Distribution busbars MNS R distribution busbars are available for currents up to 4000 A. Distribution busbars, branched directly from main busbars, are vertically installed either on the right or on the left in the column. They are feeding outgoing circuit-breakers, and are connected to them by means of rigid or flexible copper busbars, or cables.
In any case, all the connections are suitably sized to withstand the thermodynamic stresses of the fault currents.

Surface treatment

On request special surface treatment are available so the busbar can be:
- tinned
- silvered
- sleeved

Cable compartment

The cable compartment is located in the rear side of the panel and and it is accessible by means of a locked hinged door or a removable bolted door.
Its purpose is to contain:
– power terminals
– outgoing cables
– current reducers
– auxiliary terminal blocks (if any).

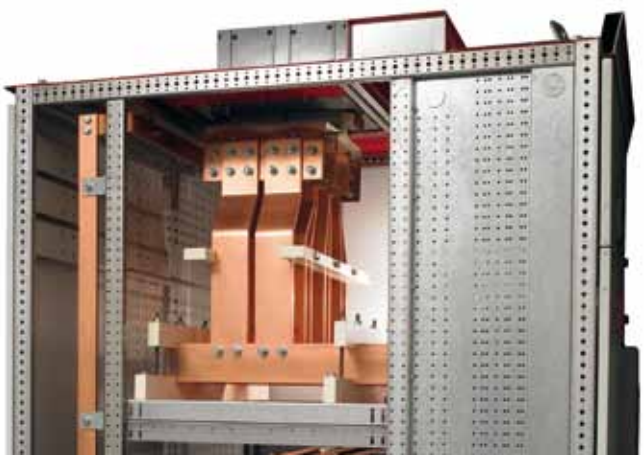


The bus-duct can easily be connected to the busbar system of the circuit-breakers in the switchgear.

Typical realisation of a structure with Emax circuit-breaker connected in the top part to a bus-duct.

Bus Duct

In case use high rated current often the traditional cables are replace bus Bus Duct.
This is a common application for the power center and MNS R has been designed in order to be connected directly to Power bus duct either from the bottom or from the top.
The switchgear busbars are made with copper but can be connected directly also to aluminum Bus duct.

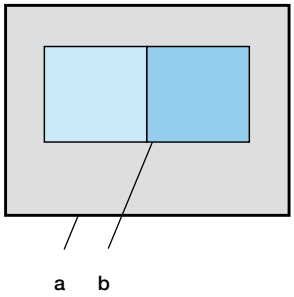


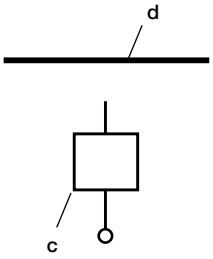
MNS R Construction details

Segregation forms

The MNS R segregation forms are compliant with the relevant standard IEC 61439-2 annex D; see table below for more details. The purpose of the segregations is mainly to allow safety access to the internal parts of the switchgear to operational personnel and to minimize propagation of any faults it may happen in the circuits and in the adjacent compartments, to the benefit of service continuity of the installation.

Simbol





Caption

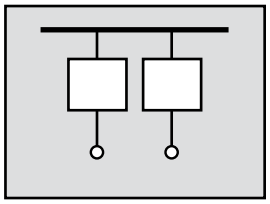
a Housing

b Internal segregation

c Functional units including the terminals for the associated external conductors

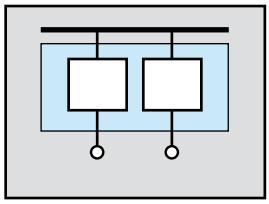
d Busbars, including the distribution busbars

Form 1
(no internal segregation)

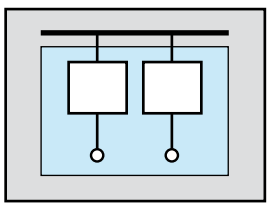


Form 2
(segregation of the busbars from the functional units)

Form 2a
Terminals not separated from the busbars

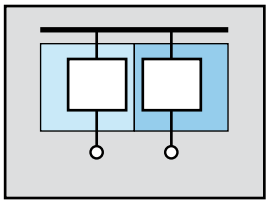


Form 2b
Terminals separated from the busbars

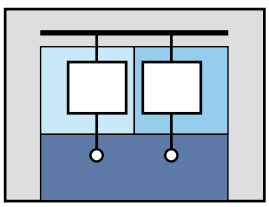


Form 3
(separation of the busbars from the functional units + separation of the functional units from each other)

Form 3a
Terminals not separated from the busbars

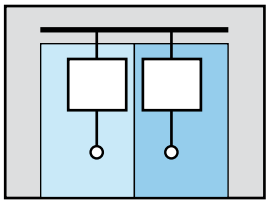


Form 3b
Terminals separated from the busbars

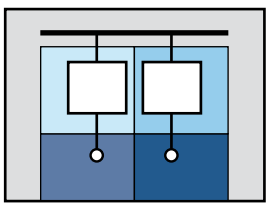


Form 4
(separation of the busbars from the functional units + separation of the functional units from each other + separation of the terminals from each other)

Form 4a
Terminals in the same compartment as the associated functional unit

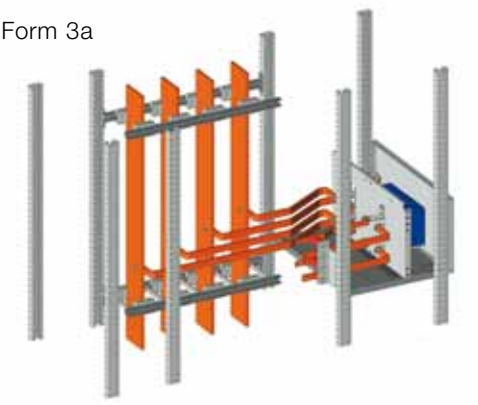


Form 4b
Terminals not in the same compartment as the associated functional unit

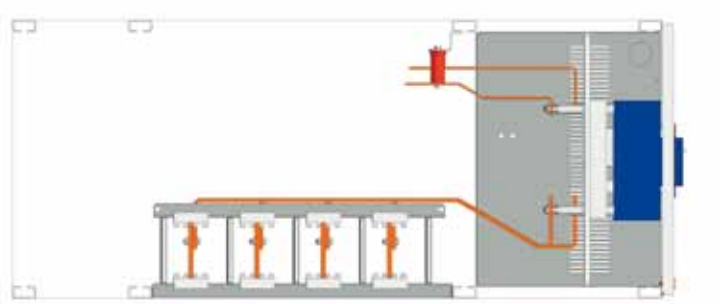


MNS R form 3a, 3b and 4b construction solutions

Form 3a

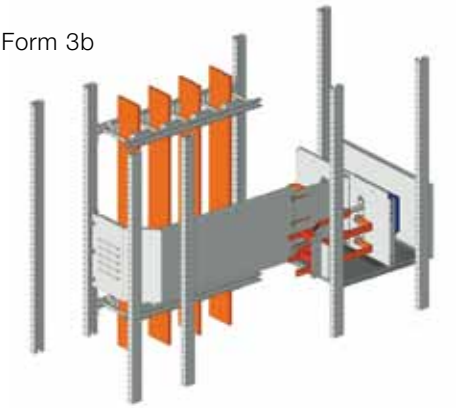


Construction solution of one unit with moulded-case circuit-breaker in form 3a

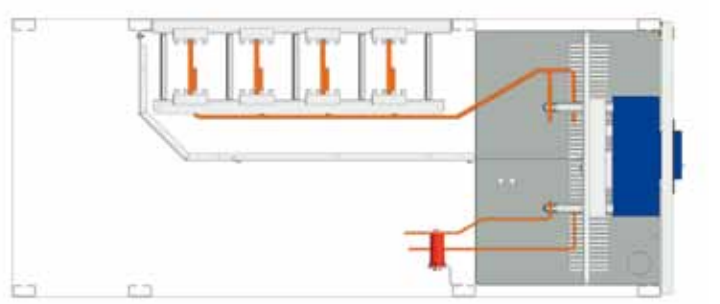


View from the top of a column with moulded-case segregated circuit-breaker in form 3a

Form 3b

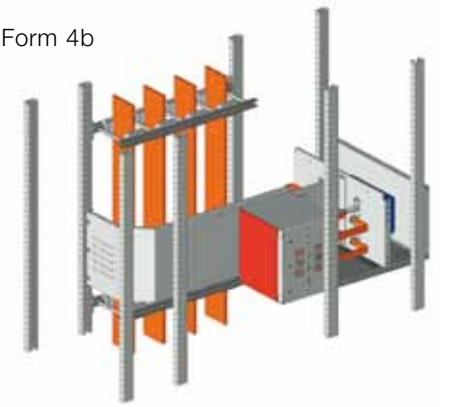


Construction solution of one unit with moulded-case circuit-breaker in form 3b



View from the top of a column with moulded-case segregated circuit-breaker in form 3b

Form 4b



Construction solution of one unit moulded-case circuit-breaker in form 4b

View from the top of a column with moulded-case segregated circuit-breaker in form 4b

Standardization

Typical configurations

The ABB MNS R switchgear has great application flexibility. Several assembly configurations are possible, for incoming, outgoing and bus-ties.
Some examples are given below:

Circuit-breakers modules

The dimensions of the modules per each breaker have been standardized in order to guarantee to the customers the most compact solutions but also a reasonable space for the cable compartment and the auxiliary instruments. The modules dimensions are defined using the E base unit equal to 25 mm according IEC standards.
In the table here below all the information about Air and Molded Case ABB circuit-breakers.

Main Busbars

Also the dimensions of the modules where the main busbar are located have been standardized.

Breaker	Arrangment	Version	Minimum Module	Minimum cubicle Width
Emax E1	Vertical	3P or 4P	24E	600 mm
Emax E2	Vertical	3P or 4P	24E	600 mm
Emax E3	Vertical	3P	24E	600 mm
Emax E3	Vertical	4P	24E	800 mm
Emax E4	Vertical	3P or 4P	24E	800 mm
Emax E4	Vertical	4P (100% N)	24E	1000 mm
Emax E6	Vertical	3P	24E	1000 mm
Emax E6	Vertical	4P	24E	1200 mm
Emax X1	Vertical	3P or 4P	24E	600 mm / 800* mm
Tmax T2	Horizontal	3P or 4P	8E	600 mm
Tmax T3	Horizontal	3P or 4P	8E	600 mm
Tmax T4	Horizontal	3P or 4P	8E	600 mm
Tmax T5	Horizontal	3P or 4P	12E	600 mm
Tmax T6	Horizontal	3P	12E	600 mm
Tmax T6	Horizontal	4P	16E	600 mm
Tmax T6	Vertical	3P or 4P	24E	600 mm / 800* mm
Tmax T7	Horizontal	3P	16E	600 mm
Tmax T7	Horizontal	4P	20E	600 mm
Tmax T7	Vertical	3P or 4P	24E	600 mm / 800* mm
Tmax XT1	Horizontal	3P or 4P	6E	600 mm
Tmax XT2	Horizontal	3P or 4P	8E	600 mm
Tmax XT3	Horizontal	3P or 4P	8E	600 mm
Tmax XT4	Horizontal	3P or 4P	8E	600 mm

* Up to four breakers type Emax X1 or Tmax T6 or Tmax T7 in 800 mm wide panel; two in the upper position and two in the lower position.

Main busbars minimum module								
6300A	5000A	4000A	3200A	2500A	2000A	1600A	1250A	1000A
17E	11E	9E	9E	8E	8E	8E	8E	8E

Power Motor Control Center

Conventional PMCC

By means of a busbar transition panel, it is possible to make Power Motor Control Centers to supply widrawable motor control feeder units using the front access panel of type MNS3.0.

MCC Panel structure

The MNS Motor control center panel are composed by the following compartments:

1 ***Equipment compartment:*** All equipment, including the motor starter modules in withdrawable design, is situated therein. The compartment can be divided into horizontal and vertical sub compartments.

2 ***Cable compartment:*** Contains control cables and terminals, as well as power cables and connection units. Cable entry may be top or bottom.

3 ***Busbar compartment:*** Contains the MNS main busbar system. The distribution bars are embedded in the multifunction wall (MFW) which is located between the equipment compartment and the busbar compartment.

The distribution bars are fully phase segregated and insulated. This design makes it virtually impossible for an arc to pass between distribution bar phases or between main busbars and equipment compartment.

The insulation material is CFC and halogen free, it is also flame-retardant and self-extinguishing.

Contact openings are finger proof (IP 2X) so that personal safety is guaranteed even when modules are removed.

With the use of MNS specific power contact housings full single phase segregation is assured prior to the connection of the power contacts to the distribution bars.

Withdrawable modules

The withdrawable technique has proved to be the appropriate solution for use in industrial applications where requirements for high availability are a must particularly for motor feeders. Modules can be easily exchanged under operational conditions thus assuring maximum flexibility.

MNS modules are operated with the multifunction operating handle. This handle also activates the electrical and mechanical interlocking of the module and the module door. No further tools or unlocking devices are necessary to withdraw a module, thus replacing a module takes less than a minute. Replacement as well as retrofitting of modules can be performed under live conditions, should plant operating procedures allow.

Withdrawable module positions

All main and auxiliary connections are self locating, without the need of additional tools.

ON: Module is inserted, main switch closed, main and control circuit connected

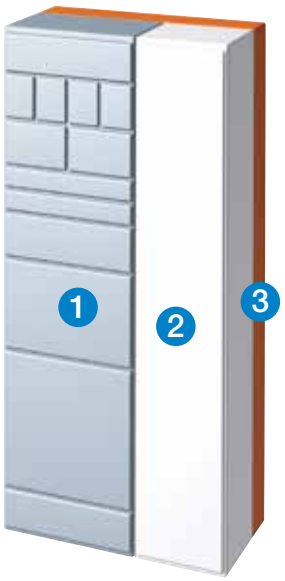
OFF: Module is inserted, main switch open, main and control circuit disconnected, padlocking possible.

TEST: Module is inserted, main switch open, main circuit disconnected, control circuit connected, padlocking possible.

ISOLATED: Module is withdrawn 30 mm from the inserted position, main switch open, main and control circuit disconnected, padlocking possible.

MOVE: Module may be completely withdrawn from the switchgear.

All positions/situations are clearly marked on the fixed section of the operation handle in accordance with relevant IEC.



Intelligent PMCC

MNS R can be also joint to the innovative MNS *i*S the Intelligent MCC.

MNS *i*S Innovative design

MNS *i*S retains the best of MNS technology and evolves it into the next level of operational handling benefits for customers' low voltage motor control center applications.
The distinct elements in MNS *i*S are:

Power and control part operational safety

Physically separated and independent operational handling of power and control parts.

Standard power modules

Fully assembled, ready to use and offered for a wide range of motor starter and energy distribution modules.

Flexible control modules

Scalable for basic to complex motor starter types, protection functions and field input/output signal requirements.

Integrated control schematics

All starter level interlocking scheme between control and power module is built in. No hardwiring or input/output assignment required. The control schematic is reduced to assigning field I/O signal contacts only.

Measurement variables

Selectable temperature, current and voltage measurement for various protection needs for both motor and the switchgear itself. No traditional transformers are utilized for any measurements.

Information distribution as required

Industry standard communication interfaces, such as Profibus DP, ProfiNet, Modbus RTU, Modbus TCP and OPC are available, enabling site wide distribution of information (operator, maintenance, management).

System accessibility with 'off the shelf' web browser based devices

With an inbuilt web server functionality, the user can select any web browser based device to interrogate the system.

User friendliness

Self supervision of module location, module type, power rating and automatic installation onto the communication network.

MNS *i*S Condition Monitoring

Maintenance expenditure is one of the largest forms of expenditure in a process plant of today. MNS *i*S facilitates a structured approach to maintenance and with this enables cost reduction in conjunction with a predictive maintenance procedure.
The MNS *i*S Condition Monitoring System continuously monitors the switchgear utilising real time information.
Any status change in the switchgear is monitored and analysed
converting data received into valuable system information.
This information is then provided in the following format:

- What is the problem?
- Where is the problem?
- What is the severity?
- What has caused the problem?
- Who should initiate the rectification?
- What actions are required to solve the problem?

Power Cables

Cables connection

MNS R is a Power Center with flexible configuration in order to match the plant's request.

One of the crucial items are the power cables that has to be connected to the switchgears.

Type of termination

	Normal Lugs		Contained Palm	
Cable Section (mm^2)	L Max	Screw	L Max	Screw
16	15	M8		
25	15	M6		
35	17	M8		
50	19	M8	11.5	M8
70	21	M8	11.5	M8
95	25	M10	15.5	M8
120	28.5	M10	19	M8
150	31.5	M10	19	M8
185	35.5	M12	24.5	M10
240	39	M12	31	M12
300	51	M12	31	M12
400	56.5	M16 (*)		
500	61.6	M16 (*)		
630	72	M16 (*)		
800	80	M16 (*)		

(*) it need to modify the standard hole diameter on the busbar from 13 mm to 17 mm

Air Circuit-breakers - Normal Lugs

	Breaker					
Cable Section (mm^2)	E1	E2	E3 <1600	E3 >2000	E4	E6
120	8	8	8	8	8	8
150	8	8	8	8	8	8
185	8	8	8	8	8	8
240	8	4	8	8	8	8
300	4	2	4	4	4	4
400	4	2	4	4	4	4
500	4	2	4	4	2	4
630	2	2	4	2	2	4
800	2	2	2	2	2	2

Air Circuit-breakers - Contained palm Lugs

Cable Section (mm^2)	Breaker					
	E1	E2	E3 <1600	E3 >2000	E4	E6
120	14	14	14	14	14	14
150	14	14	14	14	14	14
185	14	14	14	14	14	14
240	8	4	8	8	8	8
300	8	4	8	8	8	8

Moulded Case Circuit-breakers

Breaker	Copper Section	Cable Lugs	1 Cable x Phase	2 Cable x Phase	3 Cable x Phase	4 Cable x Phase
T2	15x5	Normal	25 mm^2	25 mm^2		
		Contained palm	50 mm^2	50 mm^2		
T3	20x5	Normal	70 mm^2	70 mm^2		
		Contained palm	150 mm^2	150 mm^2		
T4	20x5	Normal	70 mm^2	70 mm^2		
		Contained palm	150 mm^2	150 mm^2		
T4 320A	20x8	Normal	95 mm^2	70 mm^2		
		Contained palm	150 mm^2	150 mm^2		
T5 400A	25x8	Normal	185 mm^2	150 mm^2		
		Contained palm	240 mm^2	185 mm^2		
T5 630	40x8	Normal	240 mm^2	185 mm^2		
		Contained palm				
T6 630/800	40x10	Normal	240 mm^2	240 mm^2		
		Contained palm				
T7 / X1	(*)	Normal	240 mm^2	240 mm^2	240 mm^2 (**)	240 mm^2 (**)
		Contained palm				

(*) T7/X1 800/1000A - Copper section n. 1 Cu 50x10xF / 1 x N
(*) T7/X1 1250/1600A - Copper section n. 2 Cu 50x10xF / 1 x N
(**) Only for T7/X1 1250/1600A (to be verify case by case depending on depth/width)

Dimensions

Switchgear depth

The switchgear can have different depths. Selection mainly depends on the rated current of the main busbar system, on the short-time withstand current and on the space needed for feeder connections.

In the table here below the details of each compartment
A = Apparatus compartment
B = Busbar Compartment
C = Cable compartment
D = Total Depth

D [mm]	A [mm]	B [mm]	C [mm]
1025*	450	575	-
1200*	450	525	225
1400	450	525	425
		650	300
1600	450	525	625
		650	500

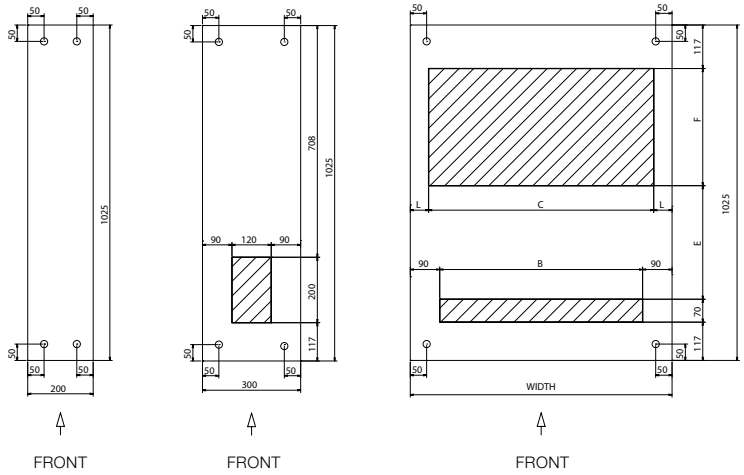
* Due to technical limitations panels with depth 1025 and 1200 mm can be proposed only after ABB technical approval

The Depth of the switchgear is also related to the main busbar rated current.

Switchgear depth in relation to the main busbars rated		
	Amperes	Depth [mm]
Up to 75kA	400	1025-1200
	630	1025-1200
	800	1025-1200
	1000	1025-1200
	1250	1025-1200
	1600	1025-1200-1400
	2000	1025-1200-1400
	2500	1025-1200-1400
	3200	1025-1200-1400-1600
Up to 100kA	3200	1400-1600
	4000	1400-1600
	5000	1400-1600
	6300	1400-1600

Foundations cubicles depth 1025 mm

Panel width 200 | Panel width 300 | Panel width ≥400



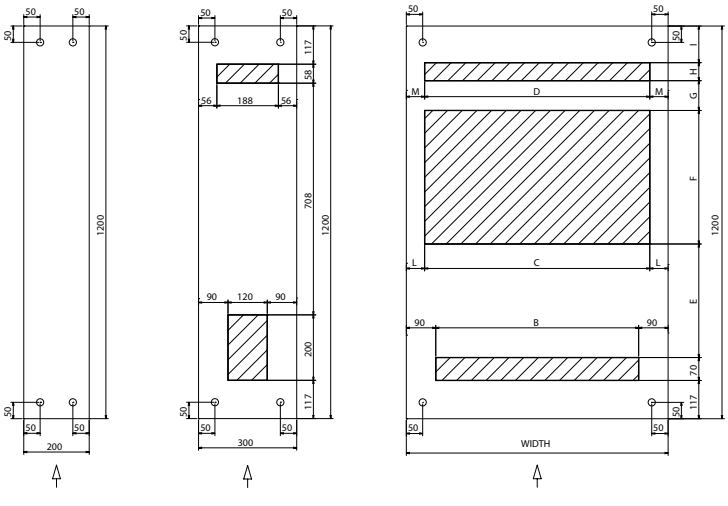
Dimensions in mm

Depth 1025

Width	Busbar compartment	B	C	E	F	L
200	525	-	-	-	-	-
300	525	-	-	-	-	-
400	525	220	240	336	385	80
600	525	420	488	347	374	56
800	525	620	688	347	374	56
1000	525	820	888	336	385	56
1025	525	1020	1088	336	385	56

Foundations cubicles depth 1200 mm

Panel width 200 | Panel width 300 | Panel width ≥400



Dimensions in mm

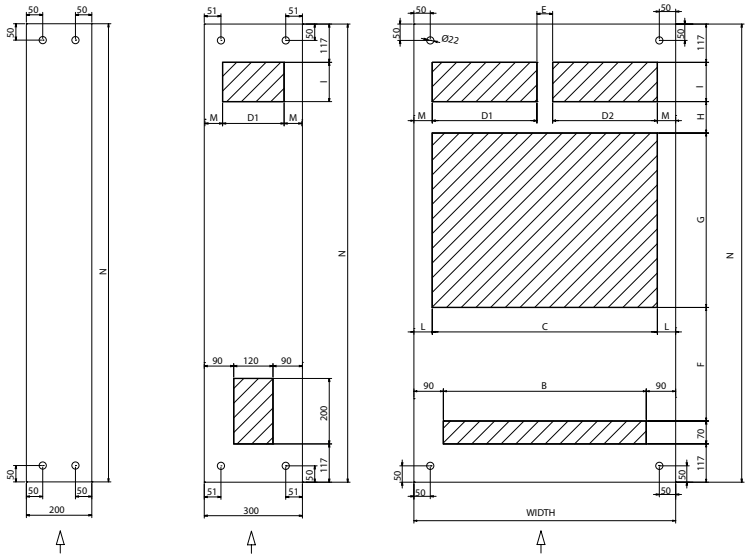
Depth 1200

Width	Busbar compartment	B	C	D	E	F	G	H	I	L	M
200	525	-	-	-	-	-	-	-	-	-	-
300	525	-	-	-	-	-	-	-	-	-	-
400	525	220	240	220	336	440	62	58	117	80	90
600	525	420	488	488	347	408	91	55	112	56	56
800	525	620	688	688	347	408	91	55	112	56	56
1000	525	820	888	820	336	440	62	58	117	56	90
1200	525	1020	1088	1020	336	440	62	58	117	56	90

Dimensions

Foundations cubicles depth 1400-1600 mm

Panel width 200 | Panel width 300 | Panel width ≥400



Dimensions in mm

Depth 1400

Width	Busbar compartment	B	C	D1	D2	E	F	G	H	I	L	M	N
200	525	-	-	-	-	-	-	-	-	-	-	-	1400
	650	-	-	-	-	-	-	-	-	-	-	-	1400
300	525	220	240	188	-	-	-	-	-	120	-	56	1400
	650	220	240	188	-	-	-	-	-	120	-	56	1400
400	525	220	240	220	-	-	340	440	76	240	80	90	1400
	650	220	240	220	-	-	392	508	76	120	80	90	1400
600	525	420	488	220	220	48	347	408	96	245	56	56	1400
	650	420	488	220	220	48	347	533	96	120	56	56	1400
800	525	620	688	320	320	48	347	408	96	245	56	56	1400
	650	620	688	320	320	48	347	533	96	120	56	56	1400
1000	525	820	888	420	420	48	340	440	76	240	56	56	1400
	650	820	888	420	420	48	392	508	76	120	56	56	1400
1200	525	1020	1088	520	520	48	340	440	76	240	56	56	1400
	650	1020	1088	520	520	48	392	508	76	120	56	56	1400

Depth 1600

200	525	-	-	-	-	-	-	-	-	-	-	-	1600
	650	-	-	-	-	-	-	-	-	-	-	-	1600
300	525	220	240	188	-	-	-	-	-	320	-	56	1600
	650	220	240	188	-	-	-	-	-	320	-	56	1600
400	525	220	240	220	-	-	340	440	76	440	80	90	1600
	650	220	240	220	-	-	392	508	76	320	80	90	1600
600	525	420	488	220	220	48	347	408	96	445	56	56	1600
	650	420	488	220	220	48	347	533	96	320	56	56	1600
800	525	620	688	320	320	48	347	408	96	445	56	56	1600
	650	620	688	320	320	48	347	533	96	320	56	56	1600
1000	525	820	888	420	420	48	340	440	76	440	56	56	1600
	650	820	888	420	420	48	392	508	76	320	56	56	1600
1200	525	1020	1088	520	520	48	340	440	76	440	56	56	1600
	650	1020	1088	520	520	48	392	508	76	320	56	56	1600

Dimensions in mm

ABB Components

ABB Components
Emax Air Circuit-breakers

Overview

MNS R is equipped with the new Emax air circuit-breakers which are the result of ABB's constant commitment to look for new solutions, and of the knowhow it has developed over the years. The Emax family covers a large range in terms of dimensions, rated current and breaking capacity with its circuit-breakers from the smaller new X1 by Emax to the more performing new Emax. This is an incredibly innovative high quality circuit-breakers range, designed to satisfy all application requirements. The innovation of the new Emax is really outstanding from all points of view: completely re-engineered releases fitted with latest generation electronics, improved performances with the same dimensions and new applications to fulfil the latest market needs. The new X1 by Emax completes the already flexible Emax family: X1 is really small, powerful and safe. In fact, the search for extremely compact dimensions has not in any way affected the reliability and safety standards. The new electronics open a window on a world of extraordinary solutions, with connectivity options never seen before in the market. The Emax range offers you a great advantage: with the increased performances, you can use the smaller circuit-breaker frames, obtaining considerable savings both in economic terms and in physical space within the switchgear. Where dimensions are an important and determining factor in the circuit-breaker selection, X1 by Emax is the best solution. X1 by Emax has extremely compact dimensions that offer enormous benefits in terms of easier installation and wiring – the space for bending the wires or for the busbar passage definitely becomes greater. Furthermore, the smaller dimensions allow optimisation of installations, making them decidedly slimmer, also thanks to new and extremely effective installation solutions.

Structure

The sheet steel structure of the Emax air circuit-breaker is extremely compact, considerably reducing overall dimensions. Safety is improved by using double insulation of the live parts and total segregation between phases. The sizes (from E1 to E6) have the same height and depth for all the circuit-breakers in each version.

Operating Mechanism

The operating mechanism is of the stored energy type, operated using pre-charged springs. The springs are charged manually by operating the front lever or using a geared motor, supplied on request. The opening springs are charged automatically during the closing operation. With the operating mechanism fitted with shunt closing and opening releases and the geared motor for charging the springs, the circuit-breaker can be operated by remote control and, if required, co-ordinated by a supervision and control system. The following operating cycles are possible without recharging the springs:

– starting with the circuit-breaker open (0) and the springs charged: closing-opening
– starting with the circuit-breaker closed (I) and the springs charged: opening-closing-opening.

The same operating mechanism is used for the entire series and is fitted with a mechanical and electrical antipumping device.

Trip Units

The new Emax are equipped with the new generation of protection trip units, with the latest advances in electronics, offering individual bespoke solutions for control and protection. The new trip units, which are amazingly versatile and simple to use, offer important innovations, such as the brand-new intuitive operator interface allowing complete control of the system with just a few simple keystrokes. Furthermore, there are new protections, new alarms and connection to handheld and laptop PCs using Bluetooth technology. The reengineered hardware architecture allows flexible and precise configuration. With the new Emax it is no longer necessary to completely replace the trip unit - simply add the module which satisfies your requirements: a great advantage, both in terms of flexibility and customisation. The overcurrent protection for AC installations uses three types of electronic trip unit series: PR121, PR122 and PR123. The basic series, PR121, offers the whole set of standard protection functions, complete with a user-friendly interface. It allows discrimination of which fault caused the trip by means of the new led indications. PR122 and PR123 trip units are of new concept modular architecture. It is now possible to have a complete series of protections, accurate measurements, signalling or dialogue functions, designed and customisable for all application requirements.

The overcurrent protection for AC installations uses three types of electronic trip unit series: PR331/P, PR332/P and PR333/P. The basic series, PR331/P, offers the whole set of standard protection functions, complete with a userfriendly interface. It allows discrimination of which fault caused the trip by means of the new led indications. PR332/P and PR333/P trip units are of new concept modular architecture. It is now possible to have a complete series of protections, accurate measurements, signalling or dialogue functions, designed and customisable for all application requirements.

The protection system is made up of:

- 3 or 4 new generation current sensors (Rogowsky coil);
- external current sensors (i.e. for external neutral, residual current or source ground return protection);
- a trip coil, which acts directly on the circuit-breaker operating mechanism (supplied with the protection unit).
- For Emax X1: a protection unit selected among PR331/P, PR332/P or PR333/P with optional communication module via Modbus or Fieldbus plug network (PR332/P and PR333/P only), as well as via a wireless connection;
- For Emax E1…E6: a protection unit selected among PR121/P, PR122/P or PR123/P with optional communication module via Modbus or Fieldbus plug network (PR122/P and PR123/P only), as well as via a wireless connection.

General specifications of the electronic trip units include:

- operation without the need for an external power supply
- microprocessor technology
- high precision
- sensitivity to the true R.M.S. value of the current
- trip cause indication and trip data recording
- interchangeability among all types of releases
- setting for neutral configurable:
  - OFF-50%-100%-200% of phase setting for circuit-breakers E1, E2, E3 and E4/f, E6/f full-size versions, and E4-E6 with external neutral protection;
  - OFF-50% for standard E4 and E6.
  - OFF-50%-100%-200% of phase setting for X1 by Emax.

			X1			E1	
Performance levels			B	N	L	B	N
Rated uninterrupted current		[A]	630	630	630	800	800
		[A]	800	800	800	1000	1000
		[A]	1000	1000	1000	1250	1250
		[A]	1250	1250	1250	1600	1600
		[A]	1600	1600			
		[A]					
		[A]					
Number of poles		[Nr]		3, 4		3, 4	
Portata del polo neutro per interruttori tetrapolari		[%Iu]				100	100
Rated service voltage Ue (AC) 50-60Hz		[V]		690		690	
Rated insulation voltage Ui		[V]		1000		1000	
Rated impulse withstand voltage Uimp		[kV]		12		12	
Rated ultimate breaking capacity under short-circuit, Icu							
220/230/380/400/415 V (AC)		[kA]	42	65	150	42	50
440 V (AC)		[kA]	42	65	130	42	50
500/525 V (AC)		[kA]	42	55	100	42	50
660/690 V (AC)		[kA]	42	55	60	42	50
Rated service breaking capacity under short-circuit, Ics							
220/230/380/400/415 V (AC)		[kA]	42	50	150	42	50
440 V (AC)		[kA]	42	50	130	42	50
500/525 V (AC)		[kA]	42	42	100	42	50
660/690 V (AC)		[kA]	42	42	45	42	50
Rated short-time withstand current, Icw	(1s)	[kA]	42	42	15	42	50
	(3s)	[kA]	-	-	-	36	36
Rated making capacity under short-circuit, Icm							
220/230/380/400/415 V (AC)		[kA]	88.2	143	330	88.2	105
440 V (AC)		[kA]	88.2	143	286	88.2	105
500/525 V (AC)		[kA]	88.2	121	220	88.2	105
660/690 V (AC)		[kA]	88.2	121	132	88.2	105
Utilisation category			B	B	A	B	B
Reference Standard IEC 60947-2				√		√	
Isolation behaviour				√		√	
Electronic trip units							
PR331				■			
PR332				■			
PR333				■			
PR121						■	
PR122						■	
PR123						■	
Direct current applications							
The circuit-breakers E2, E3, E4 and E6 equiped with electronic trip units PR122DC or PR123DC, are fitted to be used in direct current applications. For features and performanc							

(1) The performance at 600V is 100kA.

	E2				E3					E4			E6	
	B	N	S	L	N	S	H	V	L	S	H	V	H	V
	1600	1000	800	1250	2500	1000	800	800	2000	4000	3200	3200	4000	3200
	2000	1250	1000	1600	3200	1250	1000	1250	2500		4000	4000	5000	4000
		1600	1250			1600	1250	1600					6300	5000
		2000	1600			2000	1600	2000						6300
			2000			2500	2000	2500						
						3200	2500	3200						
							3200							
	3, 4				3, 4					3, 4			3, 4	
	100	100	100	100	100	100	100	100	100	50	50	50	50	50
	690				690					690			690	
	1000				1000					1000			1000	
	12				12					12			12	
	42	65	85	130	65	75	100	130	130	75	100	150	100	150
	42	65	85	110	65	75	100	130	110	75	100	150	100	150
	42	55	65	85	65	75	100	100	85	75	100	130	100	130
	42	55	65	85	65	75	85 (1)	100	85	75	85 (1)	100	100	100
	42	65	85	130	65	75	85	100	130	75	100	150	100	150
	42	65	85	110	65	75	85	100	110	75	100	150	100	125
	42	55	65	65	65	75	85	85	65	75	100	130	100	100
	42	55	65	65	65	75	85	85	65	75	85	100	100	100
	42	55	65	10	65	75	75	85	15	75	100	100	100	100
	42	42	50	–	65	65	65	65	–	75	75	75	85	85
	88.2	143	187	286	143	165	220	286	286	165	220	330	220	330
	88.2	143	187	242	143	165	220	286	242	165	220	330	220	330
	88.2	121	143	187	143	165	220	220	187	165	220	286	220	286
	88.2	121	143	187	143	165	187	220	187	165	187	220	220	220
	B	B	B	A	B	B	B	B	A	B	B	B	B	B
		√				√					√		√	
		√				√					√		√	
		■				■					■		■	
		■				■					■		■	
		■				■					■		■	

es of circuit-breakers refer to tecnical catalog “SACE Emax DC”

ABB Components
Tmax Moulded Case Circuit-breakers

Overview

The series of Tmax moulded-case circuit-breakers - complying with the IEC 60947-2 Standard – is divided into six basic sizes, with an application range up to 1600 A and breaking capacities from 16 kA to 200 kA (at 380/415 V AC).
For protection of alternating current networks, the following are available:

– T2, T3 and T4 (up to 50 A) circuit-breakers equipped with TMD thermomagnetic trip units with adjustable thermal threshold (I1 = 0.7…1 x In) and fixed magnetic threshold \ (I3 = 10 x In);
– T2, T3 and T5 circuit-breakers, fitted with TMG trip units for long cables and generator protection with adjustable thermal threshold (I1 = 0.7…1 x In) and fixed magnetic threshold (I3 = 3 x In) for T2 and T3 and adjustable magnetic threshold (I3 = 2.5…5 x In) for T5;
– T4, T5 and T6 circuit-breakers with TMA thermomagnetic trip units with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In);
– T2 with PR221DS electronic trip unit;
– T4, T5 and T6 with PR221DS, PR222DS/P, PR222DS/PD and PR223DS electronic trip units;
– the T7 circuit-breaker, which completes the Tmax family up to 1600 A, fitted with PR231/P, PR232/P, PR331/P and PR332/P electronic trip units. The T7 circuit-breaker is available in the two versions:
  with manual operating mechanism or motorizable with stored energy operating mechanism(*).

The field of application in alternating current of the Tmax series varies is up to 1600 A with voltages up to 690 V. The Tmax T2, T3, T4, T5 and T6 circuit-breakers equipped with TMF, TMD and TMA thermomagnetic trip units can also be used in direct current plants, with a range of application up to 800 A and a minimum operating voltage of 24 V DC, according to the appropriate connection diagrams. The three-pole T2, T3 and T4 circuit-breakers can also be fitted with MF and MA adjustable magnetic only trip units, both for applications in alternating current and in direct current, in particular for motor protection.
For all the circuit-breakers in the series, fitted with thermomagnetic and electronic trip units, the single-phase trip current is defined.

Double insulation

Tmax has double insulation between the live power parts (excluding the terminals) and the front parts of the apparatus where the operator works during normal operation of the installation. The seat of each electrical accessory is completely segregated from the power circuit, thereby preventing any risk of contact with live parts, and, in particular, the operating mechanism is completely insulated in relation to the powered circuits.
Furthermore, the circuit-breaker has oversized insulation, both between the live internal parts and in the area of the connection terminals. In fact, the distances exceed those required by the IEC Standards and comply with what is foreseen by the UL 489 Standard.

Positive operation

The operating lever always indicates the precise position of the moving contacts of the circuit-breaker, thereby guaranteeing safe and reliable signals, in compliance with the prescriptions of the IEC 60073 and IEC 60417-2 Standard (I = Closed; O = Open; yellow-green line = Open due to protection trip).
The circuit-breaker operating mechanism has free release regardless of the pressure on the lever and the speed of the operation. Protection tripping automatically opens the moving contacts: to close them again, the operating mechanism must be reset by pushing the operating lever from the intermediate position into the lowest open position.

Isolation behavior

In the open position, the circuit-breaker guarantees circuit in compliance with the IEC 60947-2 Standard. The oversized insulation distances guarantee there are no leakage currents and dielectric resistance to any overvoltages between input and output.

Versions and types

All the Tmax circuit breakers are available in fixed versions, T2, T3, T4 and T5 in the plug-in version and T4, T5, T6 and T7 also in the withdrawable one.
All the circuit breakers can be manually operated, by the operating lever or the rotary handle (direct or transmitted), and electrically operated. For this issue different solutions are available:
– The solenoid operator for T2 and T3
– The stored energy motor operator for T4, T5 and T6
– T7 with the stored energy operating mechanism, gear motor for the automatic charging of the closing springs and shunt opening and closing releases.

Thermomagnetic trip units

The Tmax T2, T3, T4, T5 and T6 circuit-breakers can be fitted with thermomagnetic trip units and are used in protection of alternating and direct current networks with a range of use from 1.6 A to 800 A. They allow the protection against overload with a thermal device (with adjustable threshold for T2, T3, T4, T5 and T6) realised using the bimetal technique, and protection against short-circuit with a magnetic device (with fixed threshold for T2 and T3 and T4 up to 50 A and adjustable threshold for T4, T5 and T6).
The four-pole circuit-breakers are always supplied with the neutral protected by the trip unit and with protection of the neutral at 100% of the phase setting for settings up to 100 A. For higher settings, the protection of the neutral is at 50% of the phase setting unless the protection of the neutral at 100% of the phase setting is required.
Furthermore, for Tmax T2, T3 and T5, the TMG thermomagnetic trip units with low magnetic trip threshold are available. For T2 and T3 the trip unit has adjustable thermal threshold (I1 = 0.7…1 x In) and fixed magnetic threshold (I3 = 3 x In), whereas for T5 the trip unit has adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 2.5… 5 x In). The thermomagnetic trip units can be used to protect long cables and for generator protection, both in direct current and in alternating current.

Electronic trip units

The Tmax T2, T4, T5, T6 and T7 circuit-breakers, for use in alternating current, can be equipped with overcurrent releases constructed using electronic technology. This allows protection functions to be obtained which guarantee high reliability, tripping precision and insensitivity to temperature and to the electromagnetic components in conformity with the standards on the matter.
The power supply needed for correct operation is supplied directly by the current sensors of the release, and tripping is always guaranteed, even under single-phase load conditions and in correspondence with the minimum setting.
For Tmax T2, T4, T5 and T6 the protection trip unit consists of:
– 3 or 4 current sensors (current transformers)
– external current sensors (e.g. for the external neutral), when available
– a trip unit
– a trip coil (for T2 housed in the right slot, for T4, T5 and T6 integrated in the electronic trip unit).

For Tmax T7 the protection trip unit consists of:
– 3 or 4 current sensors (Rogowski coils and current transformers)
– external current sensors (e.g. for the external neutral)
– interchangeable rating plug
– a trip unit
– a trip coil housed in the body of the circuit-breaker.
The current sensors supply the electronic trip unit with the energy needed for correct operation of the trip unit and the signal needed to detect the current.

ABB Components
Tmax Moulded Case Circuit-breakers

			Tmax T2			
Rated uninterrupted current		[A]	160			
Poles		[No.]	3/4			
Rated service voltage, Ue	(AC) 50-60 Hz	[V]	690			
	(DC)	[V]	500			
Rated insulation voltage, Ui		[V]	800			
Rated impulse withstand voltage, Uimp		[kV]	8			
Versions			Fixed, Plug-in			
Breaking capacities			**N**	**S**	**H**	**L**
Rated ultimate short-circuit breaking capacity, Icu						
(AC) 50-60 Hz 220/230 V		[kA]	65	85	100	120
(AC) 50-60 Hz 380/400/415 V		[kA]	36	50	70	85
(AC) 50-60 Hz 440 V		[kA]	30	45	55	75
(AC) 50-60 Hz 500 V		[kA]	25	30	36	50
(AC) 50-60 Hz 690 V		[kA]	6	7	8	10
(DC) 250 V - 2 poles in series		[kA]	36	50	70	85
(DC) 250 V - 3 poles in series		[kA]	40	55	85	100
(DC) 500 V - 2 poles in series		[kA]	–	–	–	–
(DC) 500 V - 3 poles in series		[kA]	36	50	70	85
(DC) 750 V - 3 poles in series		[kA]	–	–	–	–
Rated service short-circuit breaking capacity, Ics						
(AC) 50-60 Hz 220/230 V		[%Icu]	100%	100%	100%	100%
(AC) 50-60 Hz 380/400/415 V		[%Icu]	100%	100%	100%	75% (70 kA)
(AC) 50-60 Hz 440 V		[%Icu]	100%	100%	100%	75%
(AC) 50-60 Hz 500 V		[%Icu]	100%	100%	100%	75%
(AC) 50-60 Hz 690 V		[%Icu]	100%	100%	100%	75%
Rated short-circuit making capacity, Icm						
(AC) 50-60 Hz 220/230 V		[kA]	143	187	220	264
(AC) 50-60 Hz 380/400/415 V		[kA]	75.6	105	154	187
(AC) 50-60 Hz 440 V		[kA]	63	94.5	121	165
(AC) 50-60 Hz 500 V		[kA]	52.5	63	75.6	105
(AC) 50-60 Hz 690 V		[kA]	9.2	11.9	13.6	17
Utilisation category (IEC 60947-2)			A			
Reference Standard IEC 60947-2			√			
Isolation behaviour			√			
Mounted on DIN rail			DIN EN 50022			
Mechanical life		[No. operations]	25000			
		[No. Hourly operations]	240			
Electrical life @ 415 V (AC)		[No. operations]	8000			
		[No. Hourly operations]	120			
Trip units for power distribution						
TMD / TMA			■			
PR221DS			■			
PR222DS						
PR223DS						
PR231/P						
PR232/P						
PR331/P						
PR332/P						
Trip units for motor protection						
MF/MA			■			
PR221DS-I			■			
PR221MP			■			
PR222MP						
Trip units for generator protection						
TMG			■			
PR221GP			■			
Electronic trip units for zone selectivity						
PR223EF						
PR332/P						

(1) 75% for T5 630; (2) 50% for T5 630; (3) Icw = 5 kA; (4) W not available for T6 1000 A; (5) Icw = 7.6 kA (630 A) - 10 kA (800 A);

(6) Only for T7 800/1000/1250 A; (7) Icw = 20 kA (Versions S,H,L) - 15 kA (Version V); Note: T2 – T3 – T5 630 in P/W version the nominal current derated of 10%.

	Tmax T3		Tmax T4					Tmax T5					Tmax T6				Tmax T7			
	250		250/320					400/630					630/800/1000				800/1000/1250/1600			
	3/4		3/4					3/4					3/4				3/4			
	690		690					690					690				690			
	500		750					750					750				–			
	800		1000					1000					1000				1000			
	8		8					8					8				8			
	Fixed, Plug-in		Fixed, Withdrawable, Plug-in					Fixed, Withdrawable, Plug-in					Fixed, Withdrawable				Fixed, Withdrawable			
	N	**S**	**N**	**S**	**H**	**L**	**V**	**N**	**S**	**H**	**L**	**V**	**N**	**S**	**H**	**L**	**S**	**H**	**L**	**V**[6]
	50	85	70	85	100	200	200	70	85	100	200	200	70	85	100	200	85	100	200	200
	36	50	36	50	70	120	200	36	50	70	120	200	36	50	70	100	50	70	120	150
	25	40	30	40	65	100	180	30	40	65	100	180	30	45	50	80	50	65	100	130
	20	30	25	30	50	85	150	25	30	50	85	150	25	35	50	65	40	50	85	100
	5	8	20	25	40	70	80	20	25	40	70	80	20	22	25	30	30	42	50	60
	36	50	36	50	70	100	150	36	50	70	100	150	36	50	70	100	–	–	–	–
	40	55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	25	36	50	70	100	25	36	50	70	100	20	35	50	65	–	–	–	–
	36	50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	16	25	36	50	70	16	25	36	50	70	16	20	36	50	–	–	–	–
	75%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%
	75%	50% (27kA)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%
	75%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%
	75%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%[1]	100%[2]	100%	100%	100%	75%	100%	100%	75%	100%
	75%	50%	100%	100%	100%	100%	100%	100%	100%	100%[1]	100%[2]	100%[2]	75%	75%	75%	75%	100%	75%	75%	75%
	105	187	154	187	220	440	660	154	187	220	440	660	154	187	220	440	187	220	440	440
	75.6	105	75.6	105	154	264	440	75.6	105	154	264	440	75.6	105	154	220	105	154	264	330
	52.5	84	63	84	143	220	396	63	84	143	220	396	63	94.5	105	176	105	143	220	286
	40	63	52.5	63	105	187	330	52.5	63	105	187	330	52.5	73.5	105	143	84	105	187	220
	7.7	13.6	40	52.5	84	154	176	40	52.5	84	154	176	40	46	52.5	63	63	88.2	105	132
	A		A					B (400 A)(3) - A (630 A)					B (630A - 800A)(5) - A (1000A)				B(7)			
	√		√					√					√				√			
	√		√					√					√				√			
	DIN EN 50022		-					-					-				-			
	25000		20000					20000					20000				10000			
	240		240					120					120				60			
	8000		8000 (250 A) - 6000 (320 A)					7000 (400 A) - 5000 (630 A)					7000 (630A) - 5000 (800A) - 4000 (1000A)				2000 (S, H, L versions) / 3000 (V version)			
	120		120					60					60				60			
	■		■					■					■ (4) up to 800A							
			■					■					■							
			■					■					■							
			■					■					■							
																		■		
																		■		
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																		■		
	■		■					■					■							
			■					■					■							
			■					■					■							
	■																			
			■					■					■							
																		■		

ABB Components
Tmax XT Moulded Case Circuit-breakers

Overview
The new SACE Tmax XT go everywhere and fear no tests as they are made to respond successfully to all plant engineering requirements, from the standard ones to the most technologically advanced ones, thanks to the extraordinary fullness of their range. A complete offer up to 250A for distribution, for motor protection, for generator protection, for oversized neutral, as switch-disconnectors and for any other needs. A new range of both thermomagnetic and electronic protection trip units, interchangeable right from the smallest frames. To say nothing of the new and large number of dedicated accessories available, even for special applications.
All that remains is for you to choose: XT1 and XT3 for building standard installations with ABB SACE's unquestioned reliability and safety, whereas XT2 and XT4 for building technologically advanced installations with top of market performance. New SACE Tmax XT, for any choice, always and in any case simply extraordinary

Trip Units
The trip units are interchangeable and guarantee absolute tripping reliability and precision. Apart from the continuous green LED, which indicates correct operation of the protection trip unit, all the Ekip trip units also have a LED to signal intervention of all the protection functions.
To allow the Ekip units to communicate and exchange information with the other devices, simply insert the Ekip Com module inside the circuit-breaker, leaving the space inside the electric panel free.

All the Ekip trip units can be fitted with a vast range of dedicated accessories. The main ones are:
– the Ekip Display, to be applied onto the front of the electronic trip unit for simpler setting and for better reading of information;
– the Ekip LED Meter, a device to be installed on the front of the trip unit to simplify current readings;
– the Ekip TT, the new trip test unit;
– the Ekip T&P, the extraordinary testing and programming unit.
Finally, for the first time ground fault protection G is also available on the 160A frame

Accessories
The first great novelty regards simplicity of installing the accessories: coils and auxiliary contacts no longer need screws for their installation. With the new rapid system, simply put a slight pressure on the circuit-breaker slot where the accessory is to be inserted in order to carry out correct and rapid installation.
Another novelty regards the new auxiliary contacts whose signals depend on the position inside the circuit-breaker they are installed in.
The new motor operators are available with direct operating mechanism for the new XT1-XT3 and with stored energy operating mechanism for XT2 and XT4.
Apart from their simple installation and compact dimensions, the new motor operators require low power values on inrush and during service. The new residual current releases for XT2-XT4 are available not only for the fixed version, but also for the plug-in and withdrawable versions.

Ekip Com

Ekip Com allows the MOE-E motor operator to be controlled, to determine the ON/OFF/TRIP state of the circuit-breaker and to connect the electronic trip unit to a Modbus communication line.
Ekip Com is available in two versions: one version for the circuit-breakers in the fi xed/plug-in version and a version complete with connector for the fi xed part and the moving part for circuit-breakers in the withdrawable version.

Main characteristics

Installation

The Ekip Com module is inserted in the special seat made in the right-hand pole of the circuit-breaker and fi xing is carried out automatically without any need for screws or tools. Connection to the trip unit is made using the special small cable which, for greater practicality and safety, is fi tted with a cable guide. The connection towards the Modbus line is made by means of the terminal box to which a 24V DC auxiliary power supply must also be connected, which activates both the module and the protection trip unit.

Functions

The Ekip Com module offers the possibility of acquiring the state of the circuitbreaker remotely and, in combination with the MOE-E motor operator, allows it to be opened and closed. If combined with a trip unit fi tted with communication (Ekip LSI, Ekip LSIG or Ekip M-LRIU), the Ekip Com module allows the trip unit to be connected to a Modbus network, offering the possibility of programming the protections and acquiring the measurements and alarms when it is connected to a control and/or supervision system. When it is connected to the HMI030 unit, it is possible to have these data locally on the front of the switchboard. For further details on the comunication systems which can be made by means of the Ekip Com module, refer to the “Communication Systems” paragraph in the “Ranges” chapter.

HMI030 interface on the front of the switchboard

HMI030 is an interface on the front of the switchboard only usable with protection trip units fi tted with Ekip Com.

Main characteristics

Installation

HMI030 can be fi tted into the hole in the door using the automatic click-in method. In situations where mechanical stress is particularly intense, it can also be installed by using the special clips supplied. It must be connected directly to the Ekip LSI, Ekip LSIG or Ekip M-LRIU protection trip unit with Ekip Com via the serial communication line. HMI030 requires a 24V DC power supply.

Functions

HMI030 consists of a graphic display and 4 buttons for browsing through the menus.
This accessory allows you to view:
– the measurements taken by the release to which it is connected;
– the alarms/events of the release.
Thanks to its high level of accuracy, the same as that of the trip unit protection, the device is a valid substitute for conventional instruments without any additional current transformers.

			XT1				
Rated uninterrupted current		[A]	160				
Poles		[Nr]	3, 4				
Rated service voltage, Ue	(AC) 50-60 Hz	[V]	690				
	(DC)	[V]	500				
Rated insulation voltage, Ui		[V]	800				
Rated impulse withstand voltage, Uimp		[kV]	8				
Versions			Fixed, Plug-in [2]				
Breaking capacities			**B**	**C**	**N**	**S**	**H**
Rated ultimate short-circuit breaking capacity, Icu							
Icu @ 220/230 V 50-60 Hz (AC)		[kA]	25	40	65	85	100
Icu @ 380 V 50-60 Hz (AC)		[kA]	18	25	36	50	70
Icu @ 415 V 50-60 Hz (AC)		[kA]	18	25	36	50	70
Icu @ 440 V 50-60 Hz (AC)		[kA]	15	25	36	50	65
Icu @ 500 V 50-60 Hz (AC)		[kA]	8	18	30	36	50
Icu @ 525 V 50-60 Hz (AC)		[kA]	6	8	22	35	35
Icu @ 690 V 50-60 Hz (AC)		[kA]	3	4	6	8	10
Icu @ 250 V (DC) 2 poli in serie		[kA]	18	25	36	50	70
Icu @ 500 V (DC) 3 poli in serie		[kA]	18	25	36	50	70
Rated service short-circuit breaking capacity, Ics							
Icu @ 220/230 V 50-60 Hz (AC)		[kA]	100%	100%	75%(50)	75%	75%
Ics @ 380 V 50-60 Hz (AC)		[kA]	100%	100%	100%	100%	75%
Ics @ 415 V 50-60 Hz (AC)		[kA]	100%	100%	100%	75%	50% (37.5)
Ics @ 440 V 50-60 Hz (AC)		[kA]	75%	50%	50%	50%	50%
Ics @ 500 V 50-60 Hz (AC)		[kA]	100%	50%	50%	50%	50%
Ics @ 525 V 50-60 Hz (AC)		[kA]	100%	100%	50%	50%	50%
Ics @ 690 V 50-60 Hz (AC)			100%	100%	75%	50%	50%
Ics @ 250 V (DC) 3 poli in serie			100%	100%	100%	100%	75%
Ics @ 500 V (DC) 3 poli in serie			100%	100%	100%	100%	75%
Rated short-circuit making capacity, Icm							
Icu @ 220/230 V 50-60 Hz (AC)		[kA]	52.5	84	143	187	220
Icm @ 380 V 50-60 Hz (AC)		[kA]	36	52.5	75.6	105	154
Icm @ 415 V 50-60 Hz (AC)		[kA]	36	52.5	75.6	105	154
Icm @ 440 V 50-60 Hz (AC)		[kA]	30	52.5	75.6	105	143
Icm @ 500 V 50-60 Hz (AC)			13.6	36	63	75.6	105
Icm @ 525 V 50-60 Hz (AC)			9.18	13.6	46.2	73.5	73.5
Icm @ 690 V 50-60 Hz (AC)			4.26	5.88	9.18	13.6	17
Utilisation category (IEC 60947-2)					A		
Reference Standard IEC 60947-2					√		
Isolation behaviour					√		
Mounted on DIN rail					DIN EN 50022		
Mechanical life		[No. operations]			25000		
		[No. Hourly operations]			240		
Electrical life @ 415 V (AC)		[No. operations]			8000		
		[No. Hourly operations]			120		
Trip units for power distribution							
TMD / TMA							
TMD					■		
Ekip LS/I							
Ekip I							
Ekip LSI							
Ekip LSIG							
Trip units for motor protection							
MA							
Ekip M-I							
Ekip M-LIU							
Ekip M-LRIU							
Trip units for generator protection							
TMG							
Ekip G-LSI							
Trip units for oversized Neutral Protection							
Ekip N-LS/I							
Ekip E-LSIG							
Interchangeable protection trip units							

[1] 90kA @ 690V only for XT4160A; [2] XT1 Plug-In In max = 125A; ■ Delivered already mounted; ▲ Trip unit only

	XT2					XT3		XT4				
	160					250		160/250				
	3, 4					3, 4		3, 4				
	690					690		690				
	500					500		500				
	1000					800		1000				
	8					8		8				
	Fixed, Withdrawable, Plug-in					Fixed, Plug-in		Fixed, Withdrawable, Plug-in				
	N	**S**	**H**	**L**	**V**	**N**	**S**	**N**	**S**	**H**	**L**	**V**
	65	85	100	150	200	50	85	65	85	100	150	200
	36	50	70	120	150	36	50	36	50	70	120	150
	36	50	70	120	150	36	50	36	50	70	120	150
	36	50	65	100	150	25	40	36	50	65	100	150
	30	36	50	60	70	20	30	30	36	50	60	70
	20	25	30	36	50	13	20	20	25	45	50	50
	10	12	15	18	20	5	6	10	12	15	20	25 (90) [1]
	36	50	70	85	100	36	50	36	50	70	85	100
	36	50	70	85	100	36	50	36	50	70	85	100
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50% (27)	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50% (27)	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	75%	75%	50%	100%	100%	100%	100%	75% (20)
	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%	100%
	143	187	220	330	440	105	187	143	187	220	330	440
	75.6	105	154	264	440	75.6	105	75.6	105	154	264	330
	75.6	105	154	264	330	75.6	105	75.6	105	154	264	330
	75.6	105	143	220	330	52.5	84	75.6	105	143	220	330
	63	75.6	105	132	154	40	63	63	75.6	105	132	154
	40	52.5	63	75.6	105	26	40	40	52.5	94.5	105	110
	17	24	30	36	40	8.5	13.6	17	24	30	40	52.5
	A					A		A				
	√					√		√				
	√					√		√				
	DIN EN 50022					DIN EN 50022		DIN EN 50022				
	25000					25000		25000				
	240					240		240				
	8000					8000		8000				
	120					120		120				
	■							■				
						■						
	■							■				
	■							■				
	■							■				
	■							■				
	■					■		■				
	■											
	▲							▲				
	▲							▲				
	■					■						
	▲							▲				
	▲							▲				
								■				
	√							√				

ABB Components
Multifunction Protection Units

Overview
The high level of automation requested by the modern product plant can be satisfy with multifunction units able to perform all the protection functions request together with the measurement ones. Communication is the other successful key point in order to transmit all the requested information to the control systems. Here some of the ABB products; for more information about the complete offer of ABB please visit www.abb.com

REF 542Plus
One of this Feeder Terminal is the REF542Plus, a compact protection, control, measurement and supervision terminal for power distribution systems. Distinguishing features of the terminal are its flexibility and configurability. The same unit can be used as a feeder, transformer or motor protection terminal, or as a control terminal alone. The REF542Plus terminal features a wide range of protection and Management functions readily available to satisfy your application's need for protection and control.

One Product with many possibilities
The REF542Plus feeder terminal offers all the essential functionality in one single package. The protection functionality required for a given application can be provided in standardized configuration solution. When necessary, the standardized terminals can be further tuned to meet specific requirement. The terminal's integrated condition monitoring system enables introduction of preventive maintenance to promote the long term asset management strategy.
The measurement and control function provide valuable power quality data as well as power system control and management. In addition, the built-in frequency relay functionality makes the terminal suited for load shedding applications.

Web Serve functionality
REF 542Plus comprises embedded web server functionality for monitoring and control purposes via Ethernet port on the main module. By using a PC provided with a web browser, the user gains access to the substation unit using web technology. All the information on the HMI and the switchgear overview will be displayed. After the required authorization control of switching devices and switching to change to other parameter set can be performed.

Protection Functions
Here a list of the main protection functions:
- Power factor Controller (55)
- Overcurrent directional high (67)
- Overcurrent instantaneous (50/51)
- Overcurrent IDMT (51)
- Earth fault overcurrent (51N)
- Earth fault directional high (67N)
- Earth Fault directional sensitive (67NS)
- Earth Fault IDMT (51N)
- Overvoltage (59)
- Undervoltage (27)
- Residual overvoltage high (59N)
- Thermal overload (49)
- Motor Start (51)
- Locked Rotor (51LR)
- Number of Starts (66)
- Differential protection (87T/G/N)
- Unbalance load (46)
- Directional Power (32)
- Low Load (37)
- Synchronisl check (25)
- Frequency Protection (81U/O)
- Autoreclosure (79)

Application	Type	670 series	650 series	630 series	615 series	610 series	605 series
Feeder protection	REF			■	■*	■*	■
Bay control	REC	■	■				
Transformer protection	RET	■	■	■	■*		
Line distance protection	REL	■	■				
Line differential protection	RED	■					
Motor protection	REM			■	■*	■	
Generator protection	REG	■					
Busbar protection	REB	■					
Voltage protection	REU				■*	■	

* Arc protection as an option

Relion Family

The Relion® product family offers the widest range of products for the protection, control, measurement and supervision of power systems. To ensure interoperable and future-proof solutions, Relion products have been designed to implement the core values of the IEC 61850 standard. With ABB's leading-edge technology, global application knowledge and experienced support network, you can be completely confident that your system performs reliably – in any situation.

Committed to protect

Thanks to ABB's extensive experience in this field, Relion products are able to provide ultimate grid reliability, dependability and selectivity. Combined with our knowledge and commitment, certified quality procedures and rigid testing is carried out at every stage of the development and manufacturing processes. For every one of us, this means full confidence in receiving energy – and being safe.

The best fit for every need

The Relion product family ranges from interconnected transmission grids to secondary distribution kiosks. It also offers reliable protection for the demanding power generation and industrial applications. We have utilized simplicity and ready-to-use solutions to provide maximum efficiency. Additionally flexibility and performance have been linked together to create specific, tailor-made applications. For every need, project and challenge, Relion products are able to provide the best possible solution.

Seeing things in a new light

ABB is the original source of many innovations. We will always deliver the highest quality standards, thus improving the reliability, availability and security of any protection and control system. Relion products incorporate our proven algorithms and substantial knowledge to take reliability to a new level.
The Relion family has been designed for IEC 61850 to provide the full benefits of the standard.

IEC 61850

Relion protection and control IEDs implement the core values of the IEC 61850 standard. These products interoperate with other IEC 61850-compliant IEDs, tools and systems. Their performance meets comprehensive communication tasks, for example, GOOSE messaging for horizontal communication. Additionally, they communicate seamlessly with other suppliers' IEC 61850-compliant products at any voltage level. These products also utilize ABB's unique connectivity package concept, which simplifies the IEC 61850 system engineering in ABB systems, and reduces the risks of errors in system integration. This package contains a complete description of the specific IED, consisting of data signals, parameters, addresses and IED documentation.

ABB Components
Flex Interface

Overview
ABB SACE Flex Interfaces are electronic devices for DIN rails, thought up for signalling and transmitting information between circuit-breakers and other devices, such as actuators, communication networks and measuring instruments.
Thanks to this function, it is possible to make applications simply and economically, such as:
- electrical signalling of events, alarms and circuit-breaker trips;
- transmission of electrical measurements to switchboard instruments, or remote control, by means of 4-20 mA signals;
- additional protection of the plant based on measurements of external values, such as pressure and temperature;
- non-priority load control.

According to the methods of connection to the moulded-case and air circuit-breakers, the devices in the Flex Interface family, are identified in:
- Accessory Devices (ADs) which are connected to the trip unit by means of an interfacing unit.
- Local Device (LD) which is connected directly to the trip unit.
- System Devices (SDs) which are connected to an external communication bus, to which a device, such as a Personal Computer, PLC or SCADA is connected.

To complete the Flex Interface range, the HMI030 switchboard multimeter is also available, which allows display of all the measurements managed by the trip unit it is connected to.
All the Flex Interface devices are the size of four modular units, with simple and immediate cabling, and require an auxiliary power supply at 24 V DC to function.

Accessory Devices – ADs
- AD030 DO: this module periodically receives signals from the trip unit, updates the eight digital outputs and the associated LEDs.
- AD030 AO: this unit is able to convert the measurement signals which come in from the trip unit into 4-20 mA electrical signals, such as currents, voltages, power, peak factor, energy and frequency. Four analog outputs are available.
- AD030 MI: on acquiring signals coming from the external field, this device can convert these into two analog and two digital inputs to be sent to the electronic trip unit in order to obtain protections and signalling.
- MM030: this device is always necessary when the Accessory Devices are present. This module is the interface between the circuit-breaker trip unit and the other ADs. It can be connected to all Emax trip units and to PR222DS/PD, PR223EF, PR223DS, PR331/P and PR332/P Tmax trip units.

System Devices – SDs
- SD030 DX: this is the main device in the System Devices family. It manages five digital inputs and three digital outputs. It allows remote supervision and activation of switch-disconnectors and circuit-breakers without the communication function by means of a SCADA or PLC.
- SD030 DO: the module receives data from a PLC and consequently activates the eight digital outputs.
- SD030 DI: the module receives data from the external field and transmits them to a main system connected by means of a system bus. Up to eight digital input signals are available.
- SD030 AO: the device acquires data from external devices and then activates the four analog outputs (4-20 mA or 0-20 mA electrical signalling).
- SD030 MI: the device acquires data from the external field and communicates them to a remote supervision system. Two analog inputs and two digital inputs are available.

Local Device - LD

- LD030 DO: this module, fitted with eight of digital outputs, can be connected to all the electronic trip units in the Emax circuit-breakers and PR222DS/PD, PR223DS, PR223EF, PR331/P and PR332/P trip units in the Tmax circuit-breakers, allowing signalling externally of a very wide range of information and events recorded by the trip unit.

Multimeter

- HMI030: the switchboard multimeter allows remote display of the electric measurements detected by the trip unit. The module can be configured using different methods: ammeter, voltmeter, wattmeter and, finally, “custom”. Apart from allowing display of currents, voltages and powers, the “custom” method it allows access to further information, among which frequency, power factor and energy.

Power Meter

Thanks to the Flex Interface devices coupled with trip units fitted with power measurement capability, it’s possible to measure the power in a three-phase system without by using the Aron insertion that requires two current transformers, two voltage transformers and a panel display to show the power measured.

In the easy case, it is possible to use the HMI030 connected directly to the trip units. This solution allows optimisation of space and simplifies cabling operations.

Furthermore, other measurements are available, for example:

- Power factor
- Frequency
- Energy
- Data of the latest trip

When the MM030 is present it is possible to choose between two further configurations:

- the first using the AD030 AO, which converts the signals coming from the trip unit into electrical signals from 4 to 20mA on output. These signals can be sent to a panel installed on the front of the switchboard.
- the second using the HMI030. The MM030 unit acquires the measurements from the trip unit and communicates these to the HMI030 which displays the powers. Further measurements are also available, like those already indicated for the first case above.

Activation of the cooling system

A possible solution to manage the ventilation system inside the switchboard can be implemented by means of a PLC which, when it receives the signal as an input from the thermostat, by means of a communication bus, it controls the action of an I/O module able to activate an air conditioning system.

By means of the Flex Interfaces, it is possible obtain a solution which does not envisage the use of a PLC

– trip unit communication bus, but only three Flex Interface units: MM030, AD030 MI and AD030 DO.

A 4-20mA thermometer is connected to the AD030 MI device. The trip unit, which receives the signal from the thermometer, passes into a state of alarm when the signal on input exceeds the set threshold. This changeover in state can be used to activate a contact of the AD030 DO unit in order to activate a cooling fan inside the switchboard.

ABB Components
Automatic Transfer Switches

Overview
ABB presents the new generation of Automatic Transfer Switch, the result of a worldwide experience on low voltage applications.
The new generation of ATS family – ATS021 and ATS022 offers the most advanced and comprehensive solution in power continuity.
Reliability, safety and intelligence are the top features of the brand new range of ATS family which is in compliance with world standards, simple to configure and fitting all application scenarios.
Moreover, the perfect integration with all ABB circuit-breakers and switchdisconnectors ensures a complete coordinated system.

Multi-function logic to meet all requirements
ATS family provides the standard logic
- to monitor the normal and emergency line, sends the commands to the generator and controls the circuit-breakers which have to be switched
- Possibility to control a third circuit breaker on bus-tie with the ATS022
- Priority line selectable for the ATS022

No auxiliary power supply required
The new ATS family is designed to work without auxiliary power supply. Auxiliary power supply is only required when Dialogue Modbus RS485 is used or in networks with rated frequency of 16 2/3 Hz.

Compliance with IEC and EN 60947
The compliance with the standard guarantees the new ATS family to provide the quality and safety that meet all the requirements of automatic transfer.

Compatibility with ABB circuit-breakers and switch-disconnectors
The ATS family can be fit in perfectly with ABB circuit-breakers and switch-disconnectors, thereby ensuring availability of a complete and coordinated system.

Advanced Operator interface and Communication
ATS022 is equipped with a communication unit which allows the integration with supervision systems via Modbus RS485. Graphic display is also provided for ATS022.

Applications
ATS family is highly suited to use in all emergency power supply systems where a ready-to-install, easy to use and reliable solution is required. Some of its main applications are listed therefore:
- Power supply of UPS groups in general
- Operating theatres and primary hospital services
- Emergency power supplies for civil building, hotels and airports
- Data banks and telecommunication systems
- Power supply of industrial line for continuous processes.

Technical Characteristics

			ATS021	ATS022
General	Auxiliary Power Supply		Not Required	Not Required (24-110 VDC is required only for Modbus dialogue and 16 2/3 Hz system)
	Rated Voltage, Un		Max 480 VAC	Max 480 VAC
	Frequency, fn		50, 60 Hz	16 2/3, 50, 60, 400 Hz
	Dimensions	H mm	96	96
		L mm	144	144
		D mm	170	170
	Type of installation		DIN-rail mounting - Door mounting	Door mounting - DIN-rail mounting
	Operating Mode		Auto/Manual	Auto/Manual
Features	Monitoring of the Normal and Emergency lines		■	■
	Controlling CBs of the Normal and Emergency lines		■	■
	Generator set startup		■	■
	Generator set shutdown with adjustable delay		■	■
	Bustie		-	■
	No-priority Line		-	■
	Modbus RS485 Dialogue		-	■
	Display		-	■
Environmental conditions	Degree of protection		IP20	IP20
	Operating temperature		-20 ... +60 °C	-20 ... +60 °C
	Maximum humidity		5% - 90% without condensation	5% - 90% without condensation
Operating thresholds	Minimum voltage		-30% ... -5% Un	-30% ... -5% Un
	Maximum voltage		+5% ...+30% Un	+5% ...+30% Un
	Fixed frequency thresholds		-10% ... +10% fn	-10% ... +10% fn
Test	Test Mode		■	■
Compliance with standards	Electronic equipment for use in power installations		EN-IEC 50178	EN-IEC 50178
	Electromagnetic compatibility		EN 50081-2	EN 50081-2
			EN 50082-2	EN 50082-2
	Environmental conditions		IEC 68-2-1	IEC 68-2-1
			IEC 68-2-2	IEC 68-2-2
			IEC 68-2-3	IEC 68-2-3

ABB Low Voltage Systems
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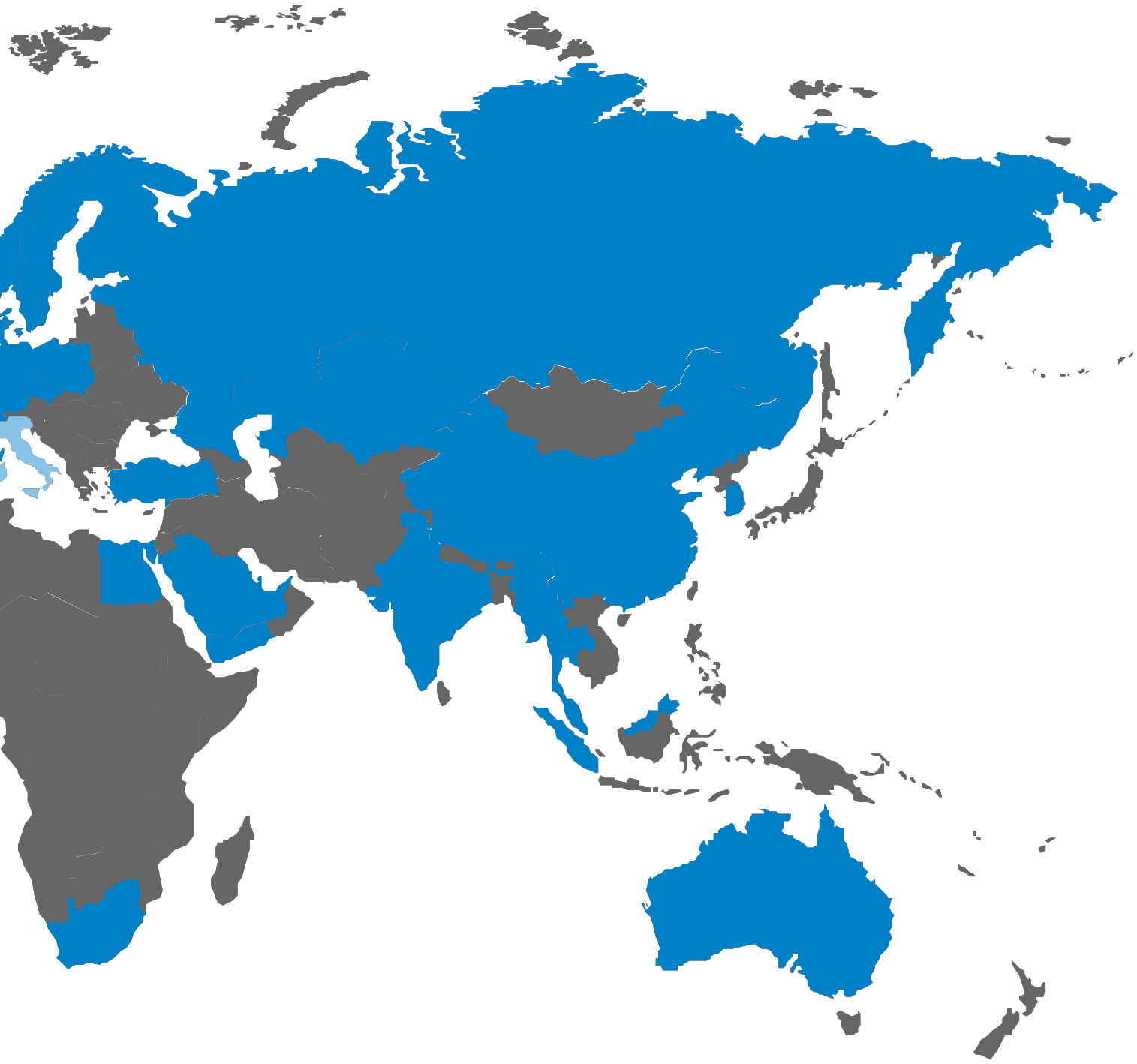
Italy MNS R Technology Center



Annex

Items subject to agreement between manufacturer and user

Extract from IEC 61439 series

The following details are intended as a checklist for the specification of low voltage switchgear.

User defined functions and characteristics	Reference clause (IEC 61439 series)
Electrical system	
Earthing system	5.5, 8.4.3.2.3, 8.6.2, 10.5, 11.4
Rated voltage U_n (Volts)	3.8.8.1, 5.2.1, 8.5.3
Overvoltage category	5.2.4, 8.5.3, 9.1, Annex G
Unusual voltage transients, voltage stresses, temporary overvoltages	9.1
Rated frequency f_n (Hz)	3.8.11, 5.4, 8.5.3, 10.10.2.3, 10.11.5.4
Additional on site testing requirements: wiring, operational performance and function	11.10
Short circuit withstand capability	
Prospective short circuit current at supply terminals Icp (kA)	3.8.6
Prospective short circuit current in the neutral	10.11.5.3.5
Prospective short circuit current in the protective circuit	10.11.5.6
SCPD in the incoming functional unit	9.3.2
Co-ordination of short-circuit protective devices including external short-circuit protective device details	9.3.4
Data associated with loads likely to contribute to the shortcircuit current	9.3.2
Protection of persons against electric shock in accordance with IEC 60364-4-41	
Type of protection against electric shock - Basic protection (protection against direct contact) NOTE: This type of protection is intended to protect against electric shock due to direct contact within the ASSEMBLY during normal service conditions.	8.4.2
Type of protection against electric shock - Fault protection (protection against indirect contact) NOTE: These types of protection are intended to protect against the consequences of a fault within the ASSEMBLY.	8.4.3
Installation environment	
Location type	3.5, 8.1.4, 8.2
Protection against ingress of solid foreign bodies and ingress of liquid	8.2.2, 8.2.3
External mechanical impact (IK) NOTE: IEC 61439-1 does not nominate specific IK codes.	8.2.1, 10.2.6
Resistance to UV radiation (applies for outdoor assemblies only unless specified otherwise)	10.2.4
Resistance to corrosion	10.2.2
Ambient air temperature – lower limit	7.1.1
Ambient air temperature – upper limit	7.1.1
Ambient air temperature – daily average maximum	7.1.1
Maximum relative humidity	7.1.2
Pollution degree	7.1.3
Altitude	7.1.4
EMC environment	9.4, 10.12, Annex J
Special service conditions (e.g. vibration, exceptional condensation, heavy pollution, corrosive environment, strong electric or magnetic fields, fungus, small creatures, explosion hazards, heavy vibration and shocks, earthquakes)	7.2, 8.5.4, 9.3.3, Table 7

User defined functions and characteristics	Reference clause (IEC 61439 series)
Installation method	
Type	3.3, 5.5
Portability	3.5
Maximum overall dimensions and weight	6.2.1
External conductor type(s)	8.8
Direction(s) of external conductors	8.8
External conductor material	8.8
External phase conductor, cross sections, and terminations	8.8
External PE, N, PEN conductors cross sections, and terminations	8.8
Special terminal identification requirements	8.8
Storage and handling	
Maximum dimensions and weight of transport units	6.2.2, 10.2.5
Methods of transport (e.g. forklift, crane)	6.2.2, 8.1.7
Environmental conditions different from the service conditions	7.3
Packing details	6.2.2
Operating arrangements	
Access to manually operated devices	8.4, 8.5.5
Isolation of load installation equipment items	8.4.2, 8.4.3.3, 8.4.5.2
Maintenance and upgrade capabilities	
Requirements related to accessibility in service by ordinary persons; requirement to operate devices or change components while the ASSEMBLY is energised	8.4.5.1
Requirements related to accessibility for inspection and similar operations	8.4.5.2.2
Requirements related to accessibility for maintenance in service by authorized persons	8.4.5.2.3
Requirements related to accessibility for extension in service by authorized persons	8.4.5.2.4
Method of functional units connection NOTE: This refers to the capability of removal and reinsertion of functional units.	8.5.1, 8.5.2
Protection against direct contact with hazardous live internal parts during maintenance or upgrade (e.g. functional units, main busbars, distribution busbars)	8.4
Method of functional units connection NOTE: This refers to the capability of removal and reinsertion of functional units.	8.5.101
Form of separation	8.101
Capability to test individual operation of the auxiliary circuits relating to specified circuits while the functional unit is isolated	3.1.102, 3.2.102, 3.2.103, 8.5.101, Table 103
Current carrying capability	
Rated current of the ASSEMBLY InA (Amps)	3.8.9.1, 5.3, 8.4.3.2.3, 8.5.3, 8.8, 10.10.2, 10.10.3, 10.11.5, Annex E
Rated current of circuits Inc (Amps)	5.3.2
Rated diversity factor	5.3.3, 10.10.2.3, Annex E
Ratio of cross section of the neutral conductor to phase conductors: phase conductors up to and including 16 mm^2 NOTE: Current in the neutral may be influenced where there are significant harmonics, unbalanced phase currents, or other conditions in the load that will necessitate a larger conductor.	8.6.1
Ratio of cross section of the neutral conductor to phase conductors: phase conductors above 16 mm^2 Current in the neutral may be influenced where there are significant harmonics, unbalanced phase currents, or other conditions in the load that will necessitate a larger conductor.	8.6.1

Contact us

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