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Low Voltage System

MNS 3.0 Low Voltage Switchgear

Technical Info

ABB is the global leader for low voltage switchgear with over 1.5 million MNS® switchgears delivered worldwide since the inception of this system in 1973.

MNS® is the registered trademark of the ABB low voltage switchgear system, which is the abbreviation of "Modulare Niederspannungs Schaltanlagen-System" in German.

ABB Xiamen Low Voltage Equipment Co., Ltd. is the only MNS® low voltage switchgear production base set up by ABB Group in China.

Our advantages:

- MNS® is the world's leading technology product platform which provides complete sets of low voltage equipment of high safety and reliability for customers in different industries.
- Diverse market and customer needs are met by the global R&D system. Our R&D teams are all over Germany, Sweden, Finland, India, China, the United States and Mexico.
- We have more than 30 MNS® manufacturing bases all over the world to provide globalized service and technical support following the same quality standards.

Content

MNS® Switchgear Overview

01 **Hofors Power Station& Rolling Mills, Sweden, 1890**

02 **Zoetermeer hospital, Netherlands**

03 **Xiamen China Construction Bank Dater Center**

ABB is the global leader for low voltage switchgear with over 1.5 million MNS® switchgears delivered worldwide since the inception of this system in 1973.ABB's history in switchgear can be traced back even further, to the 1890's when we first manufactured switchgear systems in Sweden.

With these credentials it is no surprise that the MNS® system is the benchmark for operational safety, reliability and quality.

ABB draws on this wealth of background knowledge in designing and manufacturing low voltage switchgear for its global and local customers. This together with the global service and support network established in over 30 manufacturing locations world wide ensures that the choice of MNS® will be the right decision.

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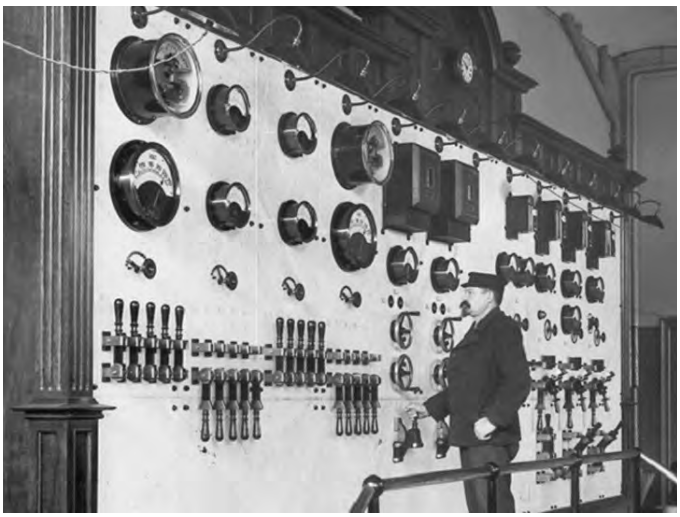

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Features & Applications

ABB Xiamen Low Voltage Equipment Co., Ltd. is the one and only MNS® low voltage switchgear in China owned by ABB Group, and introduced MNS® modular low voltage system which with the advanced technologies of the world from ABB Germany.

The ABB MNS® system is a low voltage switchgear assembly.Its design is verified in accordance with GB 7251./12-2013, IEC 61439 -1/2. The consistent application of the modular principle both in electrical and mechanical design as well as the use of standardized components allows its flexible and compact design. Depending on operating and environmental conditions different design levels are available.

Notable system advantages with regard to design aspects:

- The outstanding arc protection design and complete type tests effectively guarantee the safety of operators and the reliability of equipment operation.
- The draw-out design makes it available to replace the failed drawers without the necessity to shut off the power supply. Therefore, it features high continuity and reliability of the equipment operation thus to reduce the loss caused by unexpected downtime.
- It fully meets the requirements of earthquake resistance, vibration resistance and shock resistance in terms of mechanical structure and electrical components.
- The maintenance free busbar and frame structure effectively prolong the service life of the switchgear.
- The modularized design features compact structure which saves space for future upgrading and revamping.
- Flexible portfolios in terms of side outgoing, rear outgoing and back to back outgoing are available.
- Various digital and intelligent solutions are available.

Thus MNS® proves to have the approved solution for the following industries:

- oil & Gas, on and off shore
- petrochemical/coal chemical
- metal mining
- cement/glass
- semiconductor/photoelectricity
- automobile making
- paper
- food
- pharmaceutical
- marine
- water

As well as for infrastructure requirements:

- power stations
- rail
- airports
- data centers
- hospitals
- commercial buildings
- residence community

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01 **Typical Layout**

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Typical Layout

ABB's world wide competence is second to none, this is possible due to the global MNS® switchgear platform, and local ABB manufacturing facilities.

ABB ensures conformance to GB 7251.1/12-2013, IEC 61439-1/-2 throughout, these locations with a proprietary switchgear engineering tool. This tool provides a comprehensive database with predefined engineering solutions for MNS®. This database is then utilized with minimal engineering effort to provide customer specific solutions, thus meeting local specifications.

Where specific solutions are required on a global basis, these can easily be deployed throughout the ABB manufacturing facilities network, thus significantly reducing project lead times.

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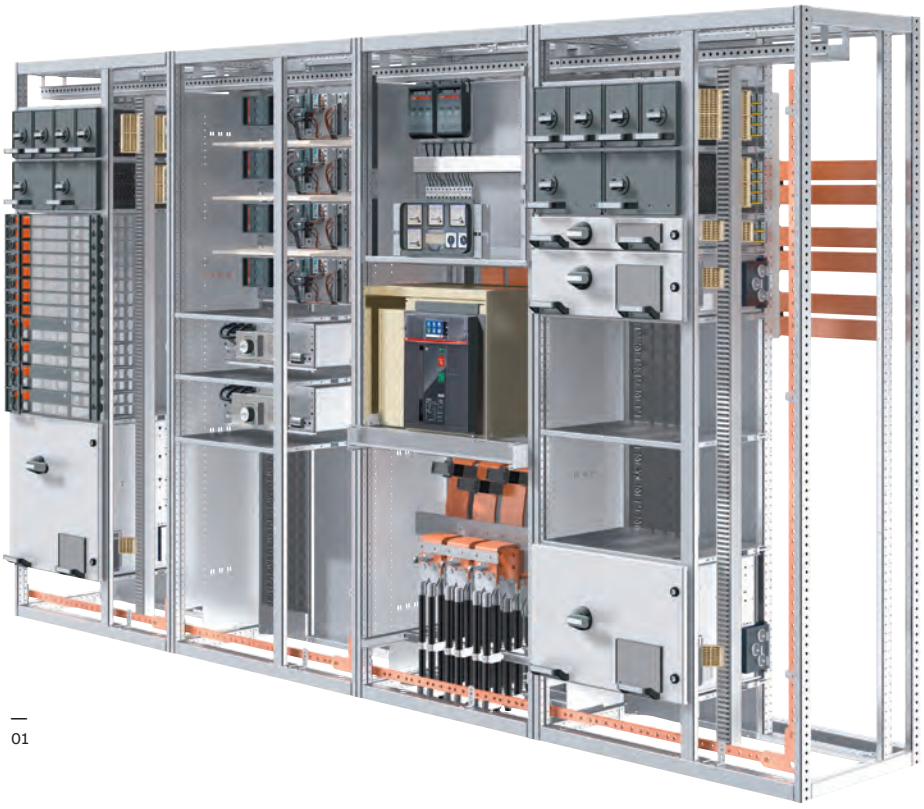
01 **Typical Layout**



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MNS Technical Data

Standards	Type-tested switchgear assembly (TTA)*			GB 7251.1/12-2013, IEC 61439-1/2 , EN 61439-1/2 ,DIN_VDE 0660 , Patr 500 of BS 5486 , UTE 63-412
Test certificates	China Compulsory Product Certification			China Quality certification centre
	Type test			China National Center for Quality Supervision an Test of Electrical Control and Distribution Equipment
	Short-circuit withstand strength test			Tianjin Reserch Institute of Electric Science
	Resist to accidental arcs			Low Voltage Apparatus Test Station of China Electrical Equipment Supervision Institute
	Resist to accidental arcs acc. to IEC 61641 and part 508 of VDE0660			ASTA,Great-Britain
	Classification Society Certification (shipping)			Gemanischer Lloyd
	Earthquake Test for Security Areas in Nuclear Power Stations			DRL German Research Institute
Electrical data	Rated voltages	Rated insulation voltage Ui		690V/1000V AC , 3P , 1500V DC**
		Rated operating voltage Ue		400V/690V AC , 3P , 750V DC
		Rated impulse withstand voltage Uimp		6/8/12kV
		Overvoltage category		II/III/IV
		Degree of pollution		3
		Rated frequency		up to 60Hz
	Rated currents	Busbars	Rated current Ie	up to 6300A
			Rated peak withstand current Ipk	up to 220kA
			Rated short-time withstand current Icw	up to 100kA
		Distribution bars	Rated current Ie	up to 2000A
			Rated peak withstand current Ipk	up to 220kA
			Rated short-time withstand current Icw	up to 100kA
		Arc proof	Rated operating current	690V
			Expected short-circuit current	100kA
			Duration of short-circuit	300ms
			Criterion	1 to 7
Mechanical characteristics	Dimensions	Sections and frames		DIN41488
		Standard height		2200mm
		Standard width		400, 600, 800, 1000, 1200mm
		Standard depth		800, 1000, 1200mm
		Basic grid size		E=25mm acc. to DIN 43660
	Surface protection	Frame		Alu-zinc coated
		Internal partitions and mounting plate		Alu-zinc coated
		Transverse section		Zinc coated
		Enclosure		Alu-zinc coated and Powder coated RAL 7035, light grey
	Degrees of protection Plastic components	IEC 529		up to IP54
		Halogen-free, self-extinguishing		DIN VDE0304 part 3
		flame retardant, CFC-free		IEC707
		Internal subdivision		up to Form 4
Extras	Busbar system	Busbars		Sheathed
				Silver galvanized
				Tin galvanized
	Special qualification	Test certificates		See test certificates listed above
	Paint finish	Enclosure		Special colours (standard RAL 7035)

* TTA is applied to verify type or series of low-voltage switchgear and controlgear assemblies. The discrimination, between TTA and stereotyped assembly which has passed the design verification in accordance with standards, is eliminated.

** Depending on the electrical equipment.

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MNS R Technical Data

Standards	Type-tested switchgear assembly (TTA)*			GB 7251.1/12-2013, IEC 61439-1/2 , EN 61439-1/2
Test certificates	China Compulsory Product Certification			China Quality certification centre
	Type test			Shanghai Testing & Inspection for Electrical Equipment
	Short-circuit withstand strength test			Shanghai Testing & Inspection for Electrical Equipment
	Resist to accidental arcs			Shanghai Testing & Inspection for Electrical Equipment
	EEMC(Electro magnetic compatibility)			Shanghai Testing & Inspection for Electrical Equipment
	Salt Spray Test			Shanghai Testing & Inspection for Electrical Equipment
	Seismic Test			China National Center for Quality Supervision and Test of Electrical Apparatus Products
Electrical data	Rated voltages	Rated insulation voltage Ui		up to 1000V AC , 3P , 1500V DC*
		Rated operating voltage Ue		up to 690V AC , 3P , 750V DC
		Rated impulse withstand voltage Uimp		6/8/12kV
		Overvoltage category		II/III/IV
		Degree of pollution		3
		Rated frequency		up to 60Hz
	Rated currents	Busbars	Rated current Ie	up to 6300A
			Rated peak withstand current Ipk	up to 220kA
			Rated short-time withstand current Icw	up to 100kA
		Distribution bars	Rated current Ie	up to 2000A
			Rated peak withstand current Ipk	176kA
			Rated short-time withstand current Icw	80kA
		Arc proof	Rated operating current	415V / 690V
			Expected short-circuit current	100kA / 65kA
			Duration of short-circuit	300ms
			Criterion	1 to 7
Mechanical characteristics	Dimensions	Sections and frames		DIN 41488
		Standard height		2300mm
		Standard width		400, 600, 800, 1000, 1200mm
		Standard depth		1000, 1200mm
		Basic grid size		E=25mm acc. to DIN43660
	Surface protection	Frame		Alu-zinc coated
		Internal partitions and mounting plate		Alu-zinc coated
		Transverse section		Alu-zinc coated or Zinc coated
		Enclosure		Alu-zinc coated and Powder coated RAL 7035, light grey
	Degrees of protection Plastic components	IEC 529		up to IP54
		Halogen-free, self-extinguishing		DIN VDE0304 part 3
		flame retardant, CFC-free		IEC 707
		Internal subdivision		up to Form 4
Extras	Busbar system	Busbars		Sheathed
				Silver galvanized
				Tin galvanized
	Special qualification	Test certificates		See test certificates listed above
	Paint finish	Enclosure		Special colours (standard RAL 7035)

* Depending on the electrical equipment

Operational Safety and Availability

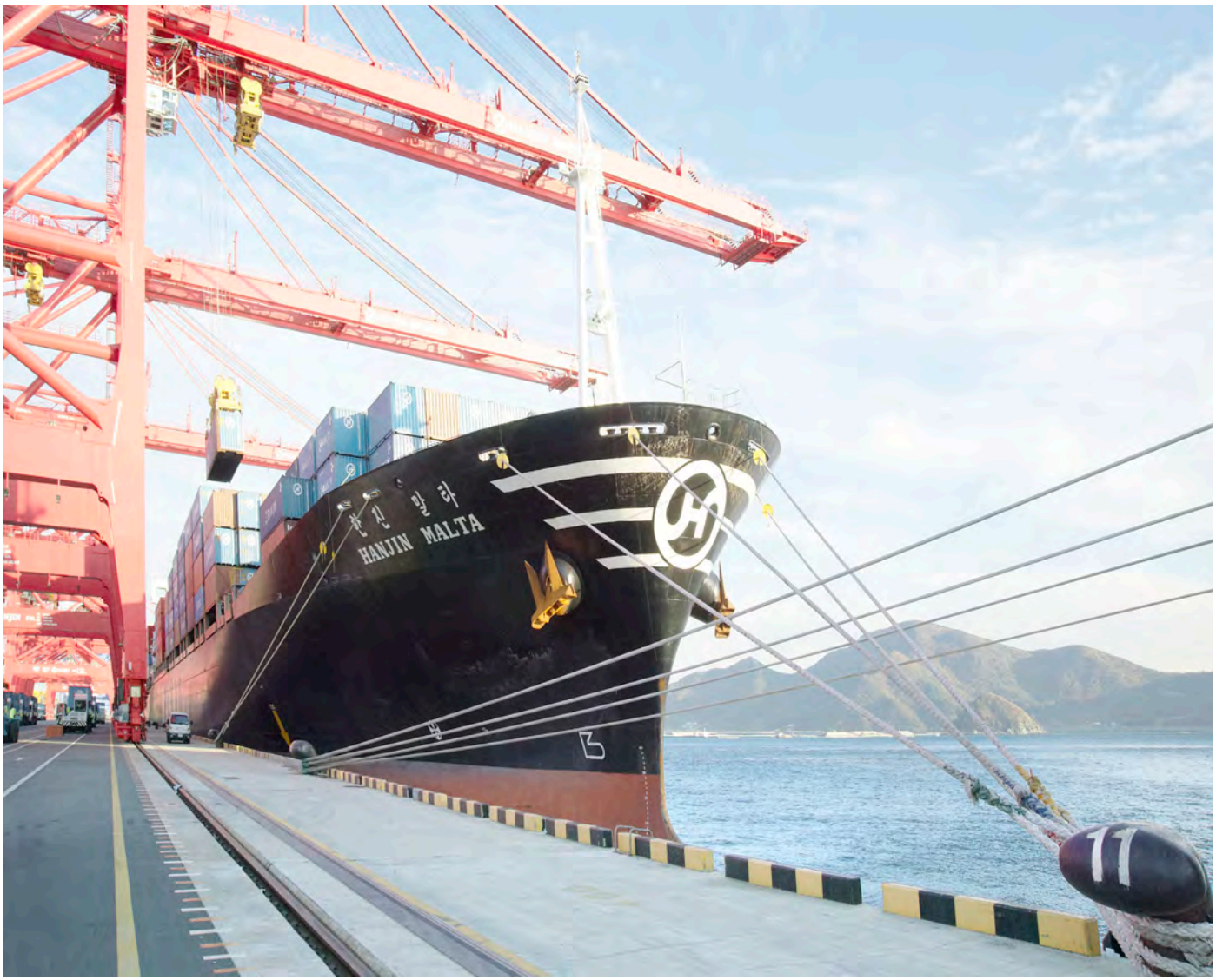
The fulfillment of all instructions of GB 7251.1/12-2013 and IEC 61439-1/2 standard for Low Voltage switchgear assures a basic level for personal and system protection.For MNS®, ABB has executed standards higher than that specified.

The MNS® low voltage switchgear system has been subjected to verification by testing in compliance with the standards. In order to ensure the highest possible degree of safety, ABB continues to conduct tests as per a continuous development program.These tests are based on the most critical representative application of the entire product or performance range of the switchgear with respect to the test standard.The results of these tests are applicable for all kinds of complete set of low voltage switches and control equipment (TTA) (According to GB 7251.1/12-2013, IEC 61439-1/2 and Part 500 of EN 61439-1/2 VDE 0660).

In addition to the above specifications ABB adopted as a standard IEC 61641 for testing under conditions of arcing due to an internal fault. To meet the requirements of IEC 61641, the switchgear is connected and supplied corresponding to the normal service arrangement. An arc is then initiated within the switchgear, the point of ignition is chosen to produce the most stress on the assembly. There are five criteria observed for the test of personal protection. In line with its 'Safety Plus'statement ABB ensures that all five are met. In addition to these five criteria ABB also meets the additional plant protection criteria as detailed in IEC 61641.

For more information on arc fault containment the "MNS® Safety Aspects" brochure delivers essential considerations concerning plant and personal safety assured by MNS®, such as:

- Basic safety philosophy
- Switchgear assembly verified by testing
- Arc fault protection
- Degrees of protection (IP code)
- Internal separation
- Earthquake, vibration and shock
- Neutral conductor dimensioning



Technical Standards

The MNS® system is a type-tested switchgear assembly(TTA).

In accordance with: IEC 61439-1/2, EN 61439- 1/2, VDE 0660 Part 500, BS 5486 Part 1 and UTE 63-412, GB 7251.1/12-2013.The erection and connection of the switchgear system is governed by IEC 364 and DIN VDE 0105.

Operation and Environment Condition

MNS® low voltage switchgear is an electrical device suitable for indoor installation, the protection degree of the switchgear can be as high as IP54 under other operation environments.

Environment Temperature

Highest temperature in short-term	+40 ℃
The highest average temperature in 24 hours	+35 ℃
The lowest temperature	- 5 ℃

Equipment shall run with less load under environment temperature higher than those specified above.

The operation conditions for measuring and metering instrument as well as protection relay shall follow the vendor's instructions.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Environment Condition
Climatic environment under normal operation shall follow the specifications of GB 7251.1/12-2013, IEC 61439-1/2, EN 61439-1/2 and Part 500 of VDE 0660. The ambient relative humidity is 50% at 40℃.

The condition of the place of indoor installation of the switchgear shall be as per the requirements specified in the corresponding standards. Anti-condensation measures such as ventilation and heating shall be taken in the places where condensation may occur.

In case that the switchgear is installed at elevation higher than 2,000m, derating use of the equipment is needed.

The surface of the tropical type switchgear has to be coated with special paint.

With accessories and enhanced parts, MNS® can meet the safety requirements for switches in earthquake zones.

When the shock resistant separators are added, the switchgear with air circuit breakers or fuse disconnectors can meet the requirement of the federal civil defense equipment for civil military defense bunkers, shock resistance value is 0.63/6.3.

Standard type MNS® low voltage switchgear has passed the test for marine standards of German Lloyd's Register of Shipping with resistance against shock of 5-100 Hz.

Special Operating Environment Design
- Tropical
- The earthquake zone
- Shelter
- Ship
- Offshore marine use

Switchgear Design

— 01 **Incoming circuit breaker solution**

— 02 **Outgoing solution**

Functional Compartments and Segregation
The assembly is divided into compartments thus separating different functional areas.

Incoming circuit breaker solution

1 Equipment compartment
The equipment compartment is divided into 3 sub sections, each sub section having its own door.

The center sub section accommodates the circuit breaker and associated equipment in fixed or with drawable design.

Depending upon the option for cable entry, for example with top entry solution access to incoming connections is via the door in the upper sub section, the auxiliary compartment is then located behind the door in the lower sub section. For bottom entry the configuration is vice versa.

2 Busbar compartment
Contains the MNS® main busbar system. Connection to the main bus is via a 'Partition Plate' with gas seale connections.

Outgoing solution

1 Equipment compartment
All equipment, including the motor starter modules in with drawable 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 cablesand 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.

* Withdrawable solutions only

— 01

— 02

Switchboard Arrangements
MNS® switchgear can be arranged as follows: free standing, back-to-back or duplex.

01 **Free standing**

02 **Back-to-back**

03 **Duplex**

Switchboard Dimensions
MNS® switchgear have the following representative dimensions:

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01 **Frame construction**

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02 **Enclosure**

Mechanical Design

Frame construction

The basic elements of the MNS® frame construction are “C” shaped steel profiles with a 25 mm hole pitch according to DIN 43660. This 25 mm equals the dimension of 1E used in MNS® to define the area usage within the switchgear.

Each switchgear is precision constructed by bolting horizontal and vertical profiles together, to form a rigid modular structure.The assembly is maintenance free as a result of the construction method utilizing a combination of thread locking ESLOK screws with bolted pressure plates and thread forming screws.

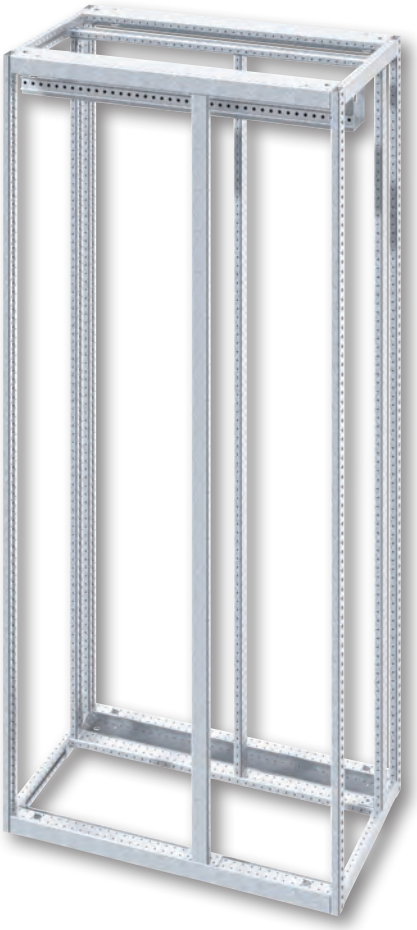
The profiles are galvanic protected (Zn or Al/ Zn) against corrosion.

Enclosure

MNS® switchboard enclosure is made of sheet steel protected by galvanic coating and powder coating for maximum durability.

The fixing of the enclosure with respect to doors, roof plates, rear and side walls is achieved with thread forming screws. Final construction varies depending upon the required degree of protection.

In accordance with the general safety philosophy followed with MNS® , each compartment and subcompartment which requires access for commissioning, operation or maintenance, has its own door.



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Busbar System

Main Busbars

The main busbar is located at the rear of the switchgear (in the busbar compartment).Dual layer main busbar system is located on the top and lower layer respectively, while the single layer main busbar system is located on the top layer or the lower layer. Sectional areas of the two layers of main busbar could be different.

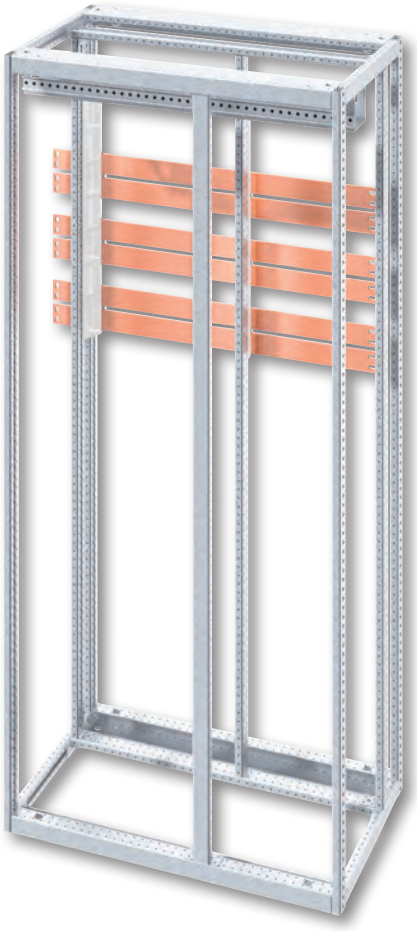
The main busbar is available in single, series and parallel connection. Each phase could be consisted of either 2 or 4 main busbars depending on the current in the busbar. Design of common busbar is adopted for the double front operating switchgears.

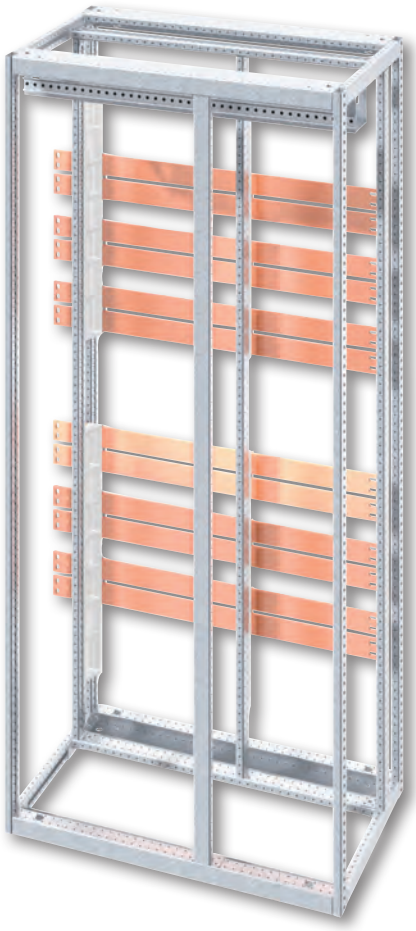
The busbars are separated according to their transport units. The material for busbars is copper (Cu) and they are available in four specifications of sectional areas including 20x10mm, 30x10mm, 40x10mm and 60x10mm. Busbars with different sectional areas can also be connected.

The MNS® main busbar system is arranged in the rear of the switchgear. This assures a maximum distance between the busbars and the operator and maintenance staff. The main busbar system is fully separated from the equipment compartment as well as from the cable compartment.

The busbar system is a maintenance free construction as a result of utilizing thread locking ESLOK screws together with conical spring washers. This technology remains relatively unchanged since the introduction of MNS® , and has been extensively supplied into the demanding industries.

The busbar system and all associated parts are manufactured from copper in accordance with DIN 40500. Options are available for tin/silver plating and/or a fully insulated solution utilizing heat shrinkable sleeving.





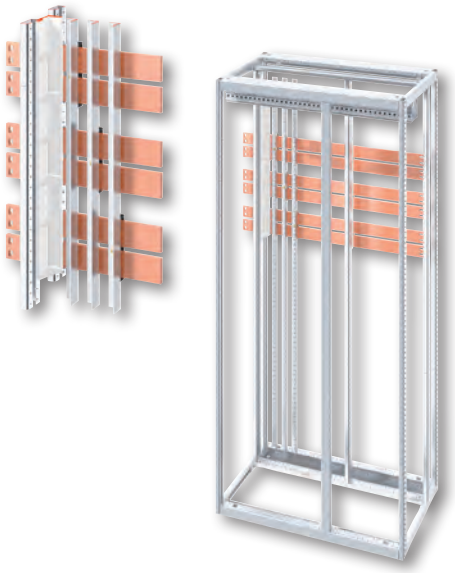
Protective Earth and Neutral Bars

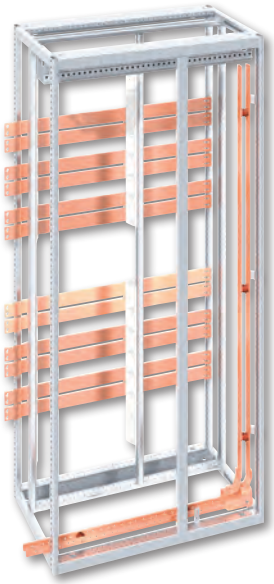
As a standard, protective earth and neutral bars run horizontally within the front of the switchboard just above the base. The PE bar is fastened to the frame to assure electrical continuity. Inside the cable compartment they run vertically, located on the front right hand side of the compartment.

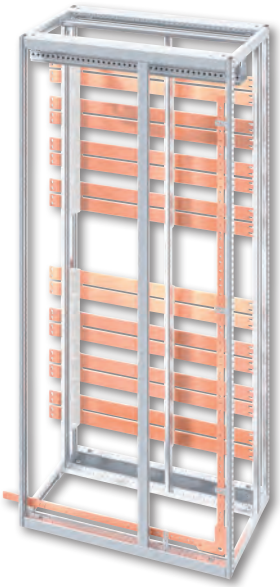
For applications where a 50% or 100% neutral size is required due to unbalance or harmonic distortion as well as for 4 pole switching, the neutral conductor can be arranged within the busbar compartment running in parallel with the main busbars.

Distribution bars

A fully phase segregated and encapsulated 3 or 4 pole distribution bar system runs the full height of the cubicle. The distribution bars are silver plated as standard.







Multifunction Wall

The multifunction wall (MFW) with the embedded distribution bars is a unique MNS® design. It constitutes a complete barrier between the main busbars and the equipment compartment.

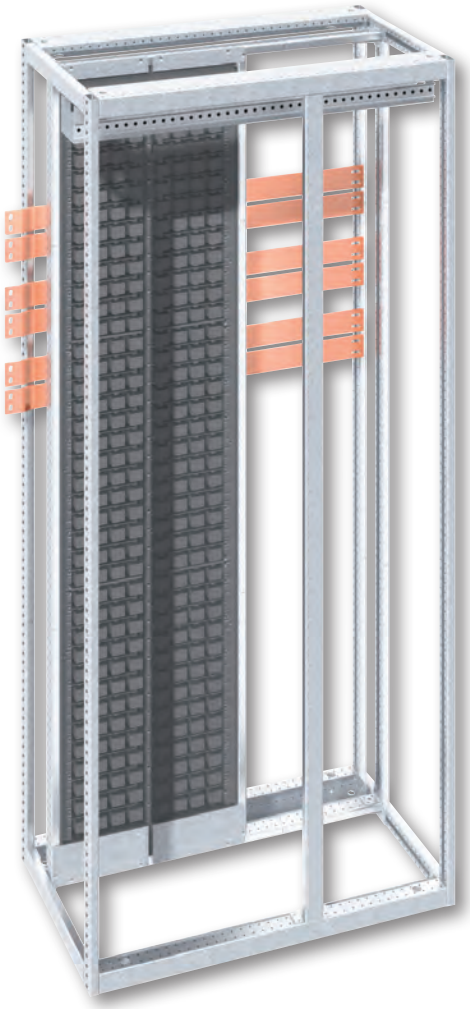
The distribution bars are fully phase segregated and insulated. This design makes it virtually impossible for an arc to pass between distribution bar phases or between main busbars and equipment compartment. The insulation material is CFC and halogen free, it is also flame-retardant and self-extin-guishing.

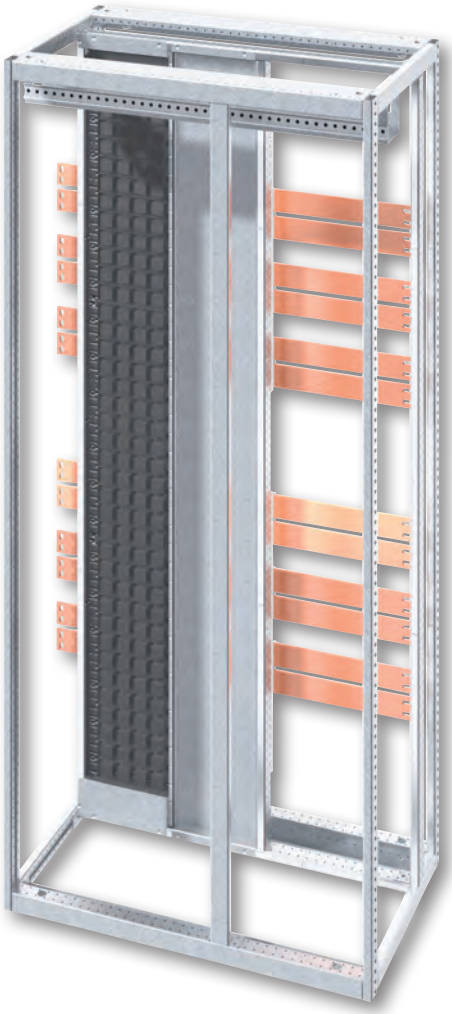
Contact openings are finger proof (IP 2X) so that personal safety is guaranteed even when modules are removed.

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.

System Highlights:

- Maintenance free bus bar construction
- Easy switchgear extension
- Main busbar arrangement at the rear thus assuring
  - maximum safety to personnel
  - effective withstand against highest stresses in case of short circuit
  - optimum heat dissipation
- Gas tight seals for connection from the equipment compartment to the main busbar system
- Option for Form 4 separation for both incoming and outgoing assemblies
- Active and passive arc fault prevention tested according to IEC 61641
- Isolating materials are free of CFC and halogens





Power Contact

Connection to the distribution bar is realized using the precision-engineered MNS® power contacts. The power contact is characterized by a turnable bearing, thus decoupling cable stress and electrical contact. Consequently any cable bending forces cannot affect the stability of the power contact.

The mechanical stabilisation is achieved by the supporting plate and the contact spring where the contact fingers ensure positive electrical contact. Contact fingers are silver plated or copper plated as standard.

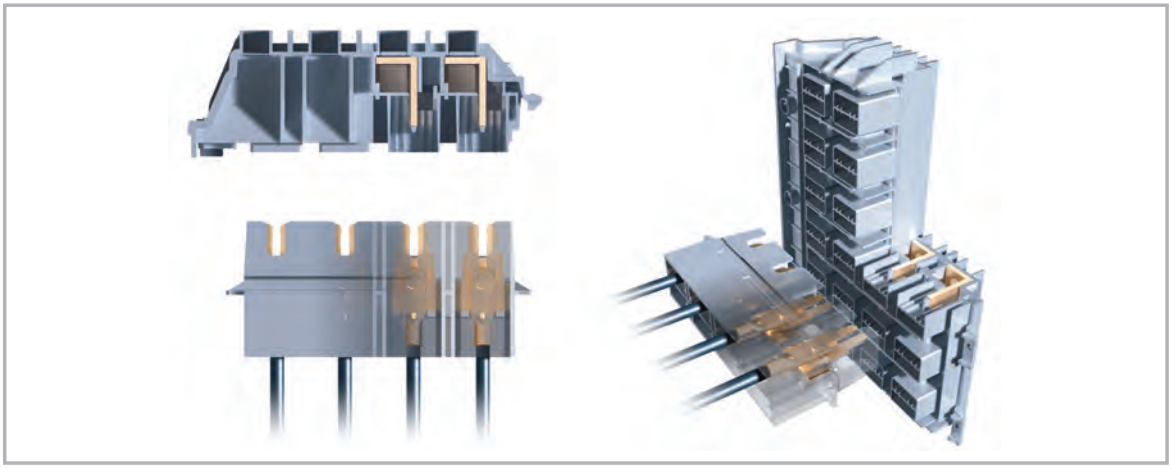
The contact has been subjected to several tests in order to prove the sophisticated design and the high quality, which provides a life cycle up to 1000 insertions.

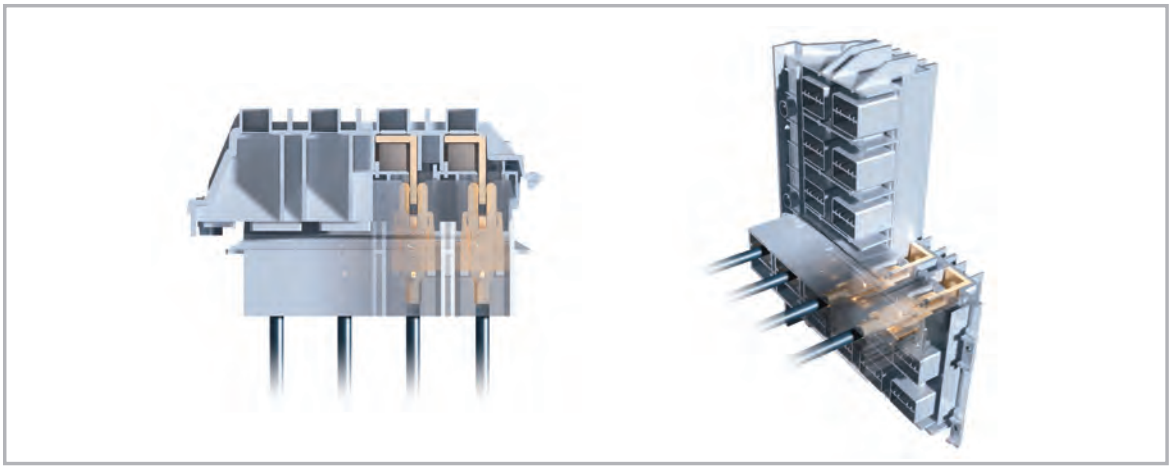
Tests:

- Design verification acc. GB 7251.1-2013, IEC61439-1/2
- Corrosion test acc. DIN 50017 and IEC 60068-2-60
- Crimping quality check acc. IEC 61238-1
- Vibration and shock test acc. IEC 60068-2-6 and IEC 60068-2-27

System Highlights:

- Operational life cycle up to 1000 insertions (independently certified)
- Bearing construction eliminating cable stress
- Full single phase segregation assured prior to the connection of the power contacts to the distribution bars





MNS R

Highlights

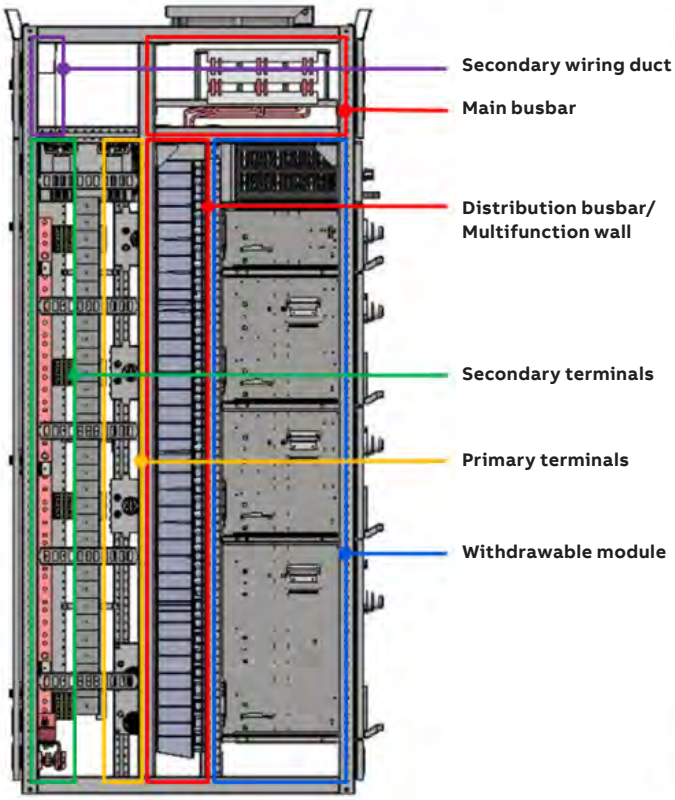
- The rated current of main busbar can be up to 6,300A and the depth of the cubicle needs only to be 1,200mm.
- The available installation height of the compartment is 64E when the main busbar current is 6300A.
- The structure of the main busbar array system are compatible for hard copper bar and facilitates field expansion.
- The separation inside the cubicle can reach Form4.
- Design of the cubicle satisfy the requirement for arc fault protection.
- With modularization design, the multi-function wall can form in different heights and separate the phases of branch busbars, where the Neutral phase busbar can bear 100% phase current.
- Multi-cubicle structure, cubicle (≥600) is available for single package.

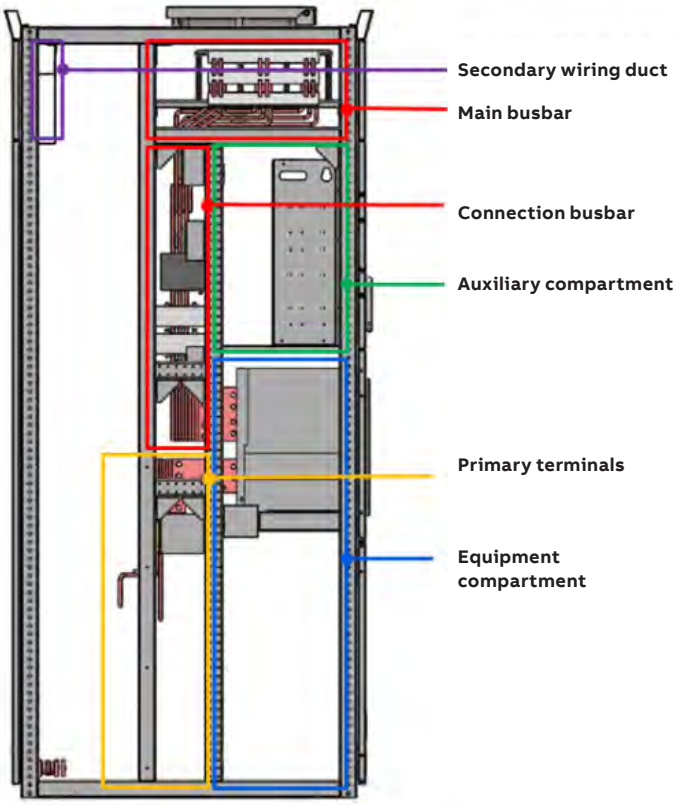
Switchgear Structure

The MNS® rear outgoing solution is designed to reduce the array width of switchgears. The main busbar of the rear outgoing switchgear is horizontally installed at the top of the switchgear. The rear part of the switchgear is cable compartment, where incoming and outgoing cables are connected here.The device compartment is at the front, where switches and other devices are installed as the function unit.The rear outgoing solution dramatically reduces the array width of switchgears, so as to fit the substation layout demands in a better way.

The feeder switchgear features width of 600mm and depth of 1,000/1,200 mm. Independent main busbar compartment is on the top part which is separated from the device compartment. The available installation height of 72 E (E = 25 mm) is designed for the front device compartment which is separated from the rear cable compartment via the multi-function board. Thus the installation space of the switchgear is fully utilized for a compact structure and flexible unit arrangement. The rear cable compartment is with a door for easy installation and maintenance.

The width of the incoming switchgear depends on the frame current, the recommended width switchgear 400/600/800/1,000/1,200mm. The cubicle depth is 1,000/1,200 mm.





Dimensions and Main Busbar systems Configuration

Main busbar Rated current	≤3200A	4000-5000A	6300A
Cubicle- top main busbar	Sigle busbar	Sigle busbar	Upper and lower dual busbar
Depth of Cubicle	1000mm	1200mm	1200mm
Height of Equipment compartment	72E(1800mm)	72E(1800mm)	64E(1600mm)

Busbar System

The main busbar system adopts rectangular copper busbar or copper/ aluminum composite busbar (CCA). The main busbar is installed horizontally in the busbar compartment on the top part of the switchgears. Each phase comprises busbar in the quantity of times of 2.

Special structural design is adopted for the main busbar system which optimizes the heat dissipation channel of the switchgears, meantime, no drilling is needed for the connection of the switchgear and feeder switchgears thus to facilitate the installation and field maintenance.

The main busbar system is divided into single and dual busbar with a maximum rated current of 5,000A for the single busbar and rated current of 6,300A for dual busbar.

Single package and transportation for the main busbar system is available for the maximum flexibility of field installation.

Vertical copper busbar installed in the multi-function wall constitutes the branch busbar system with a maximum rated current of 1,500A.

The vertical copper busbars are separated by the multifunction wall thus to minimize the occurrence of short circuit to the maximum extent.

Protective grounding bus bar is installed in the bottom of the cable compartment on the rear side of the switchgears.

The neutral busbar can be installed in the busbar compartment on the top part of the switchgears or together with the grounding busbar based on the requirements.

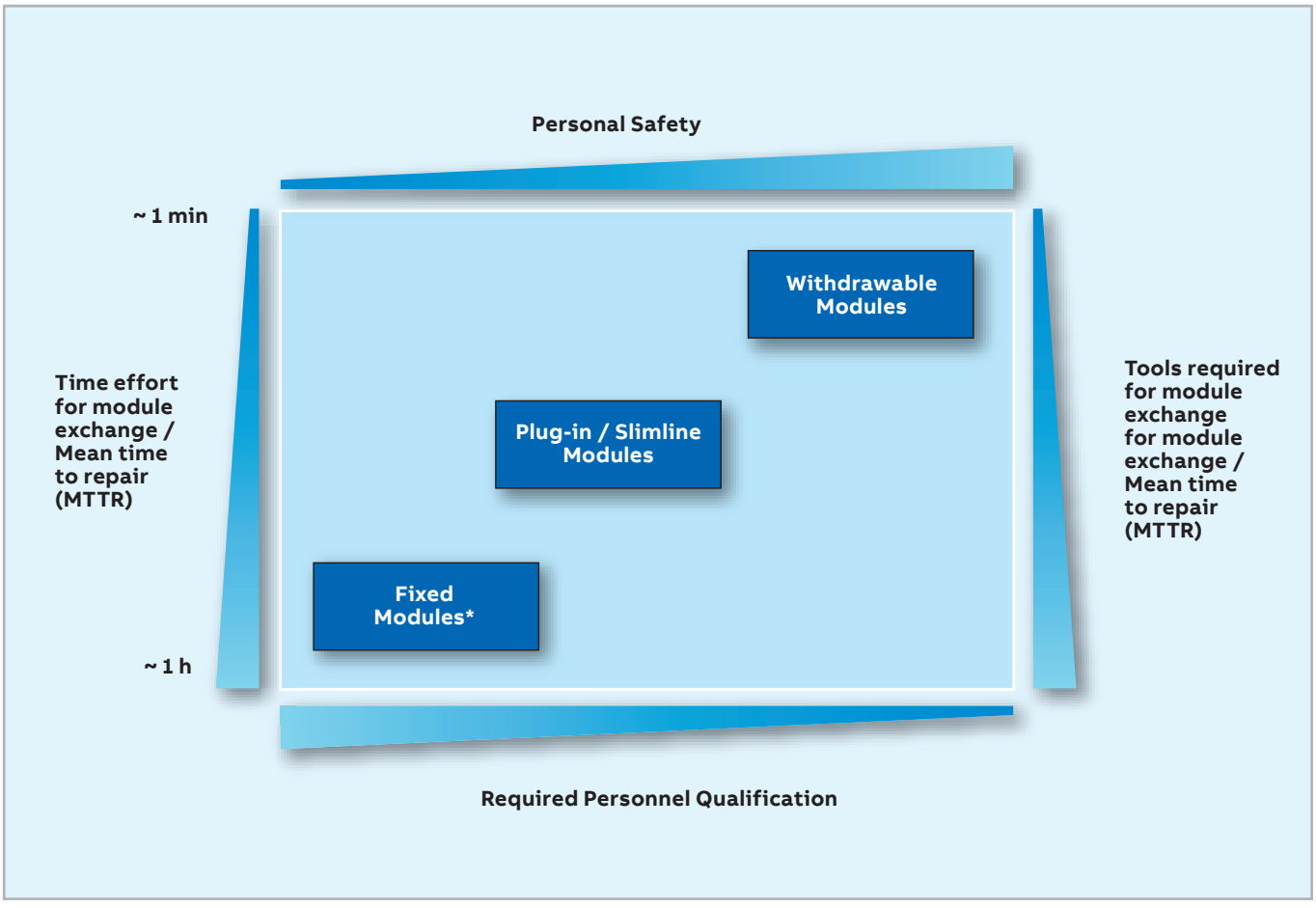
The PE/N busbar in the bottom of the cable compartment on the rear side of the switchgears are all with modulus holes for the connection of cables.

Outgoing Modules

The available module types have typical characteristics as shown in the graphic above. Where high process availability is essential and minimal time is required for module exchange the withdrawable solution has proved to be the definitive choice.In installations where internal access to the switchgear does not present an obstacle the plug-in option may be the practical solution.

Depending upon the choice of outgoing modules selected, the skill set of the personnel required to operate and maintain the switchgear may also differ.

Switchgear requirements differ from project to project. MNS® easily allows the assembly to be configured to suit all plant operational procedures.



Plug-in Modules

MNS® offer numerous alternatives for plug-in modules. When utilizing the multifunction wall, all modules have the ability to be exchanged without de-energizing the switchgear, should maintenance procedures allow.

The flexibility of the system allows power distribution and motor control to be offered in the most economical Form 2 solution. From this as a basis, options exist for internal/external operation and separation to Form 4.

The Slimline switch disconnector offers ABB's most compact form of fused energy distribution, and is available in 3 or 4 pole options. This design is available in standard modules sizes with a maximum rating of 630A.

Operation is performed via the handle on the front of the module which has an inbuilt padlocking facility and mechanical open/closed indication.

The following options are available:

- Ammeter
- Auxiliary contacts
- Fuse blown indication

The Slimline is also available as Intelligent Tier Switch enabling the following information to be sent via its fieldbus connection:

- Switch status
- Fuse indication
- Current
- Voltage
- Power & Power Consumption
- Power factor
- Temperature

AC Industrial Drives

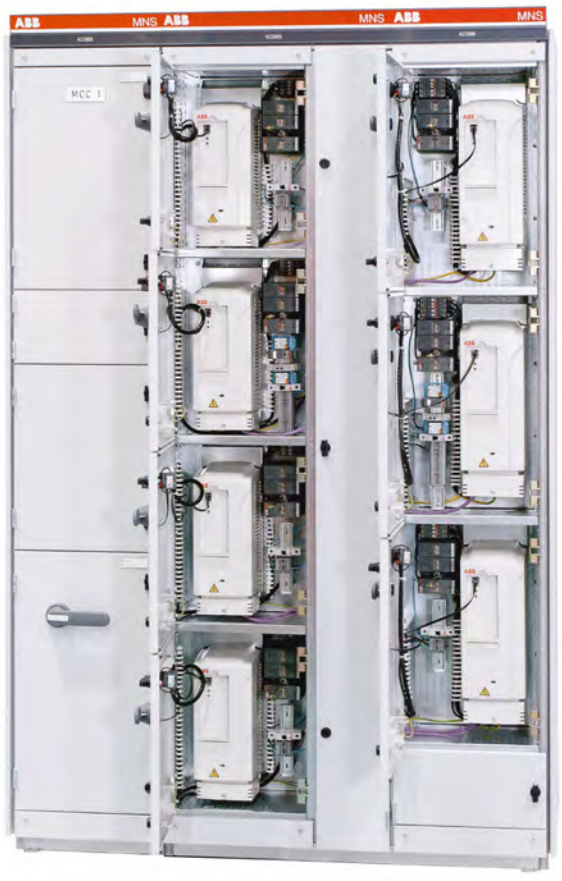
Due to its inherent modular design MNS® can easily be adapted to house the ABB range of AC Industrial Drives. The switchgear can accommodate multiple drives in a single section. Each drive compartment has an individual isolator, options are available for filters to be installed and for the drive control panel to be door mounted to enable interrogation and parameterization without the need to open the door. Full size switchgears are also available for the AC Industrial Drives solution. These are, however, of a fixed technique, enabling MNS to offer a complete range of drives all supplied from a common AC bus.

Reactive Power Compensation Solution

MNS3.0 can provide various compensation solutions for AC system with a maximum compensation capacity of 450kvar. Compensation with different reactance rates, dynamic compensation and individual phase compensation are available. For cubical size of 600 mm to 1,200 mm, centralized or modular solution are adopted.

Calculation of Reactive Power Compensation Capacity

Reactive power needed by sine AC system from cosϕ1, power factor before compensation, to cosϕ2, target power factor Qc = Q2 - Q1 = P * (tanϕ1 - tanϕ2):



- P is the active power.
- Q1, ϕ1 refers to the reactive power and phase angle before compensation.
- Q2, ϕ2 refers to the reactive power and phase angle after compensation.
- Qc refers to the reactive power for the power factor correction.

Normally, when “P” refers to themaximum value of system active power , the corresponding Qc refers to the maximum reactive power necessary to reach the target factor i.e. the required maximum capacity of the system reactive power compensation switchgears.

Harmonic suppression of the reactive power compensation device

The impedance of Capacitor, the main component in reactive power compensation switchgears, is inversely proportional to the harmonic frequency. Thus high current is resulted in case high frequency harmonic occurs. Due to the inherent inductive impedance in system, resonance may happen at specific frequency, which is worse. Resonance is generated due to presence of Inductive impedance thus bigger failure is generated. In this case, reactors are introduced to suppress the harmonic reactors are introduced to suppress the harmonic of the reactive power compensation device thus to protect the capacitor and avoid the occurrence of resonance when large amount of harmonics exists.

Dynamic Compensation

In case that reactive power compensation shall be provided within short time (less than 1s) at frequent variation of system power, voltage superposition will occur to breakdown the capacitor by switching with regular contactor due to the existence of residual voltage of the capacitor. Therefore, zero voltage switching and quick response shall be achieved with electronic components such as silicon controlled rectifier and thyristor together with the dedicated controller.

* The contact voltage drop of the electronic components is higher than that of the contactor therefore their own power consumption is higher than that of the mechanic components such as contactors.

the design of Withdrawable Module

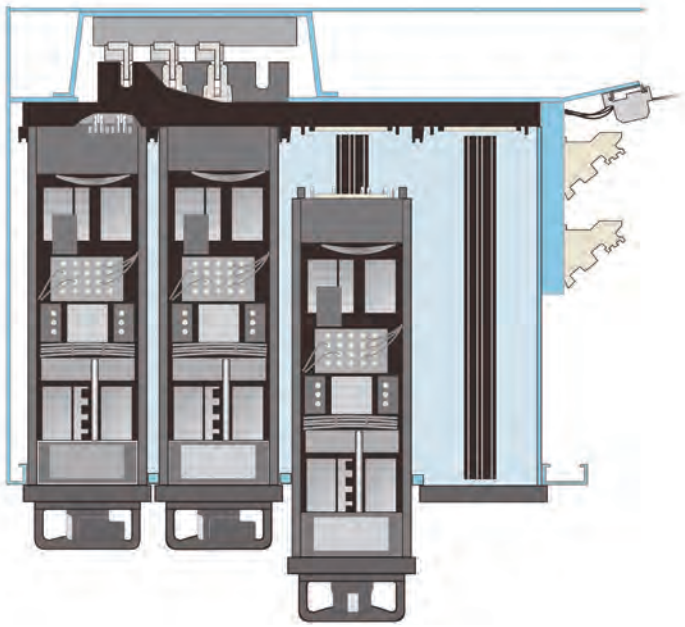
The withdrawable technique has proved to be the appropriate solution for use in industrial applications where requirements for high availability are a must particularly in Motor Control Centers (MCC).

Modules can be easily exchanged under operational conditions thus assuring maximum flexibility.

Small modules

Withdrawable technique is distinguished by its compact design where, with the smallest 8E/4 module it is possible to physically define a maximum of 36 modules in the equipment compartment. This modularity enables the assembly to maximize the usage of the available space, which in turn reduces the overall footprint of the switchgear.

The condaptor unit enables the horizontal distribution of power from the vertical distribution bars, this allows 2 modules (8E/2) or 4 modules (8E/4) to be located adjacently within the same horizontal position in the switchgears. Condaptors are available in 3 or 4 pole options. Cable connections for main and auxiliary circuits are integrated into the condaptor and are accessible from the cable compartment.

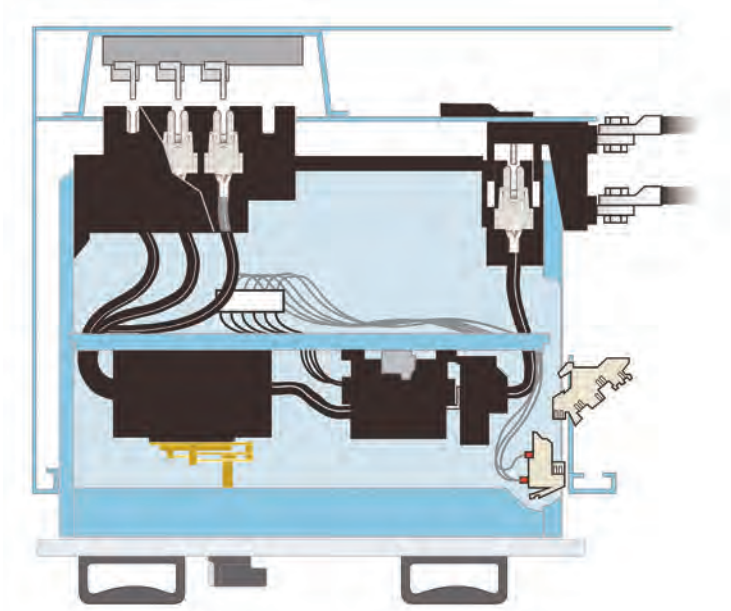


Full width modules

These modules are available ranging from 4E to 48E in physical sizes. The construction of the full modules differs slightly from that of the small modules in utilizing a full width hinged door which is mechanically interlocked to the isolator.

All operational procedures for the modules are possible without the need to open the door of the module.

Full width modules connect directly to the distribution bars through the multifunction wall. The design of the module enables auxiliary components to be located on both the vertical and horizontal mounting plates within the module, thus optimizing the available space usage within the module. Cable connections for main and auxiliary circuits are accessible from the cable compartment.



Module operation

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.

System Highlights

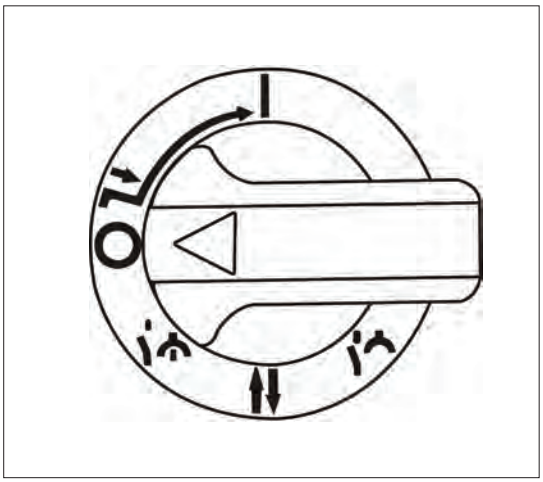
- High stacking density, resulting in a reduced footprint
- Complete phase isolation of main power contact prior to connection to the distribution bars
- Full module functionality with external operation
- Module replacement possible in less than 1 minute, no tools required

Withdrawable module positions
All positions/situations are clearly marked on the fixed section of the operation handle in accordance with GB 7251.1-2013,IEC 61439-1/2.

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

8E/48E/4 Withdrawable Module — 01

8E/2 Withdrawable Module — 02



Switch Handle — 03

The standard of Withdrawable Module

Standard Module Solution

- Fuse switch and molded case circuit breaker
- The motor starter with fuse
- The motor starter with molded case circuit breaker
- The motor starter with M101 and M102 motor control and protection device

Size of the modules:
8E/ 4,8E/ 2,4E,6E,8E,12E,16E,20E,24E

8E/4 and 8E/2 Withdrawable Module

The structure of 8E/4 and 8E/2 withdrawable module includes instrument panel, side plate of the insulation material, back plate with cable terminal, one or two installation parts with 20 core control wire terminal. And 8E/2 module can provide with 2 optional 20-core terminals according to different requirement.

Drilled holes are furnished on the panel for the installation of components of meters, operation device and indications.The operation of the main switch is achieved by the handle installed on the panel which is furnished with the function of electrical and mechanical interlocking. The interlocking is realized by a micro switch with one normally on and normally off for the other.

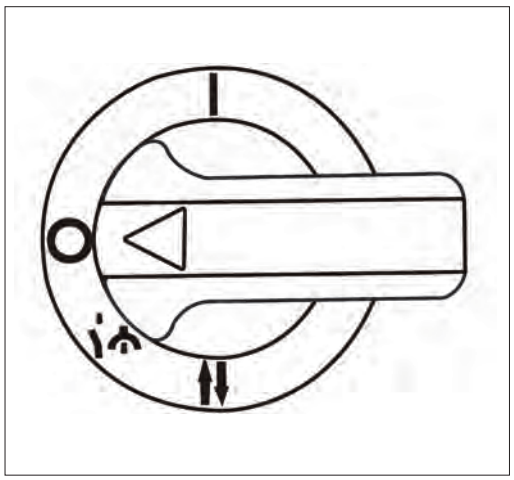
Position 0 to Position 1 can be achieved by pushing the operating handle inward. Padlocks are available in three positions of the operation handle in terms of opening, testing and isolation of the main switch for safety protection. Three padlocks are available to the maximum extent.

Instruction on Positions of the Switch Handle of 8E/4 and 8E/2

		ON position-Main and control circuits are closed. Module is locked.
		OFF position- Main circuit are disconnected, the control circuits are closed. Module is locked. Can be locked with 3 padlocks.
		TEST position-Main circuit are disconnected, the control circuits are closed. Module is locked. Can be locked with 3 padlocks.
		MOVE postion-Main and control circuits are disconnected.
		ISOLATED position-The module is 30 mm drawn out of the section.Main and control circuits are disconnected and the isolating distance is fulfilled. Can be locked with 3 padlocks.

4E Withdrawable Module — 01

8EWithdrawable Module — 02



Switch Handle — 03

Withdrawable Module of 4E, 6E, 8E, 12E, 16E, 20E and 24E

The withdrawable module of 4E to 24E include panel, rear insulation plate, front cover plant, metal side plate and wiring duct.

Module door facilitates the replacement of components from the front side (e.g. replacing the fuse) without drawing out the module. In case the module is in On or test position, the front door could only be opened with tools (such as screwdrivers. Double locks are available when the module is in isolation position.

There are openings in the front cover plate for the installation of the instrument panel. The instrument panel stay at the original place when the front cover open or close. Drilled holes are furnished on the panel for the installation of components of meters, operation device and indications.

The operating handle is furnished with the function of electrical and mechanical interlocking. The interlocking is realized by two contactor micro switches with one normally on and normally off for the other.

Instruction on Positions of the Switch Handles

		ON position-Main and control circuits are closed. Module is locked.
		OFF position- Main circuit are disconnected, the control circuits are closed. Module is locked. Can be locked with 3 padlocks.
		TEST position-Main circuit are disconnected, the control circuits are closed. Module is locked. Can be locked with 3 padlocks.
		MOVE postion-Main and control circuits are disconnected.
		ISOLATED position-The module is 30 mm drawn out of the section.Main and control circuits are disconnected and the isolating distance is fulfilled. Can be locked with 3 padlocks.

Incoming Solutions

All of the MNS® incoming solutions are verified in accordance with GB 7251.1/12-2013, IEC 61439-1/2, in addition to IEC 60947-1 required for the individual apparatus, and engineered to meet the requirements of IEC 61641. This ensures ABB's offering of 'Proven Safety Plus' for operators and plant.

Incoming options

All ACBs have as a minimum the following features:

- Manual charging lever and 'Charged' indication
- Manual Open/Close push buttons
- Mechanical 'Open'/'Closed' indication
- Mechanical signalling of 'Overcurrent' release
- 4 auxiliary contacts

Project Specific Options

- Gas sealed connections to the main busbars (separation wall)
- 3 or 4 pole solutions
- Withdrawable/fixed configuration
- Top or bottom cable entry/bus duct
- 50% or 100% neutral
- Shunt opening/closing release
- Undervoltage release
- Electrical signalisation of ACB status
- Key locking facilities
- Shutter locking facilities
- Mechanical indication 'Racked In'/ 'Racked Out'/'Test Isolated' position
- Locking in 'Racked In'/ 'Racked Out'/ 'Test Isolated' position
- Switch disconnector option
- ACB handling truck
- Configuration and test unit

In order to satisfy all requirements there are three main switch incoming options:

- Load break switches
- Moulded case circuit breakers (MCCBs)
- Air circuit breakers (ACBs)

Please refer to the technical reference section of this document for a list of related documentation. Further options available (but not limited to):

- Zone selectivity
- Dual protection settings
- Directional short circuit protection
- Reverse power
- Under-/overvoltage protection
- Annunciation of measured values, alarms
- Maintenance data
- Integration into a plant wide process control system (refer to page 34)

01 **Emax2_E1**

02 **Emax2_E2**

03 **Emax2_E4**

04 **Emax2_E6**

05 **Ekip Dip(D)**

06 **Ekip Touch(T)**

07 **Ekip Hi-Touch(H)**

08 **Ekip G Touch(GT)**

09 **Ekip G Hi-Touch(GH)**

In addition to the above ABB circuit breakers offer a series of integrated programmable releases (PRs), where combinations of protection functions maybe selected with:
– Overload protection - L
– Selective short circuit protection - S
– Instantaneous short circuit protection – I
– Earthfault protection - G

ACB withdrawable operation
In a withdrawable solution the ACB assembly consists of two components, the fixed part (cassette) and the moving part (ACB). This enables the ACB to be located in 3 positions:

CONNECTED: The moving part is fully inserted into the fixed part with the connection of both the power terminals and the auxiliary contacts. The circuit breaker is operational and the mechanical indicator shows 'CONNECTED'.

TEST/ISOLATED: The moving part is inserted into the fixed part without the connection of the power terminals, but with connection of the auxiliary terminals. The circuit breaker may be operated for offline tests. The mechanical indicator shows'TEST ISOLATED'.

DISCONNECTED: The moving part is inserted into the fixed part without any connection of the power and auxiliary terminals. In this position all electrical operation of the ACB is prevented. The mechanical indicator shows 'DISCONNECTED'. The switchgear compartment door can remain closed, therefore not compromising the IP rating of the switchgear.

The ACB cassette (fixed part) has shutters which are positively driven closed during the racking out process to prevent the possibility of contact with live parts.

System Integration
Emax 2 series circuit breakers can be perfectly integrated with all automation and electric energy management systems in order for efficiency improvement, energy consumption reduction and the implementation of remote monitoring.All circuit breaker can be configured with communication unit compatible with protocols of Modbus, Profibus and Devicenet as well as protocols of modernized Modbus TCP, Profinet and Ethernet IP.

In addition, the circuit breakers can be connected into the automation systems widely used in the medium voltage power distribution industry thus to construct intelligence power grid i.e. the smart power grid through the integrated communication modules (in accordance with IEC 61850).

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01 **Emax 2 series circuit breakers**

—
01

Intelligent Control System

System Connectivity Aspects
ABB's structure with respect to offering site wide information is that a field bus connection for process control information and switching commands is utilized. An additional interface, which is typically Ethernet is used to support functions such as parameterization, data distribution to electrical SCADA and/or asset optimization systems. This configuration is also continued through the ABB medium voltage product portfolio.

Configuring the structure as detailed above ensures that the critical process data path is not compromised by also being utilized for parameterization and additional data required for engineering and maintenance.

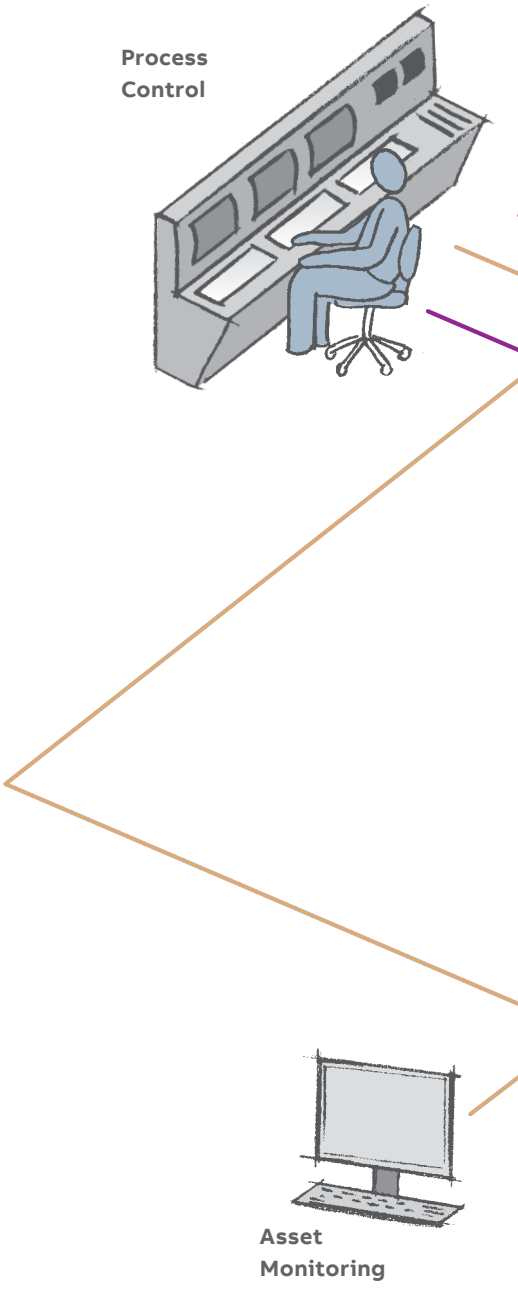
The continuous development of intellignet solutions

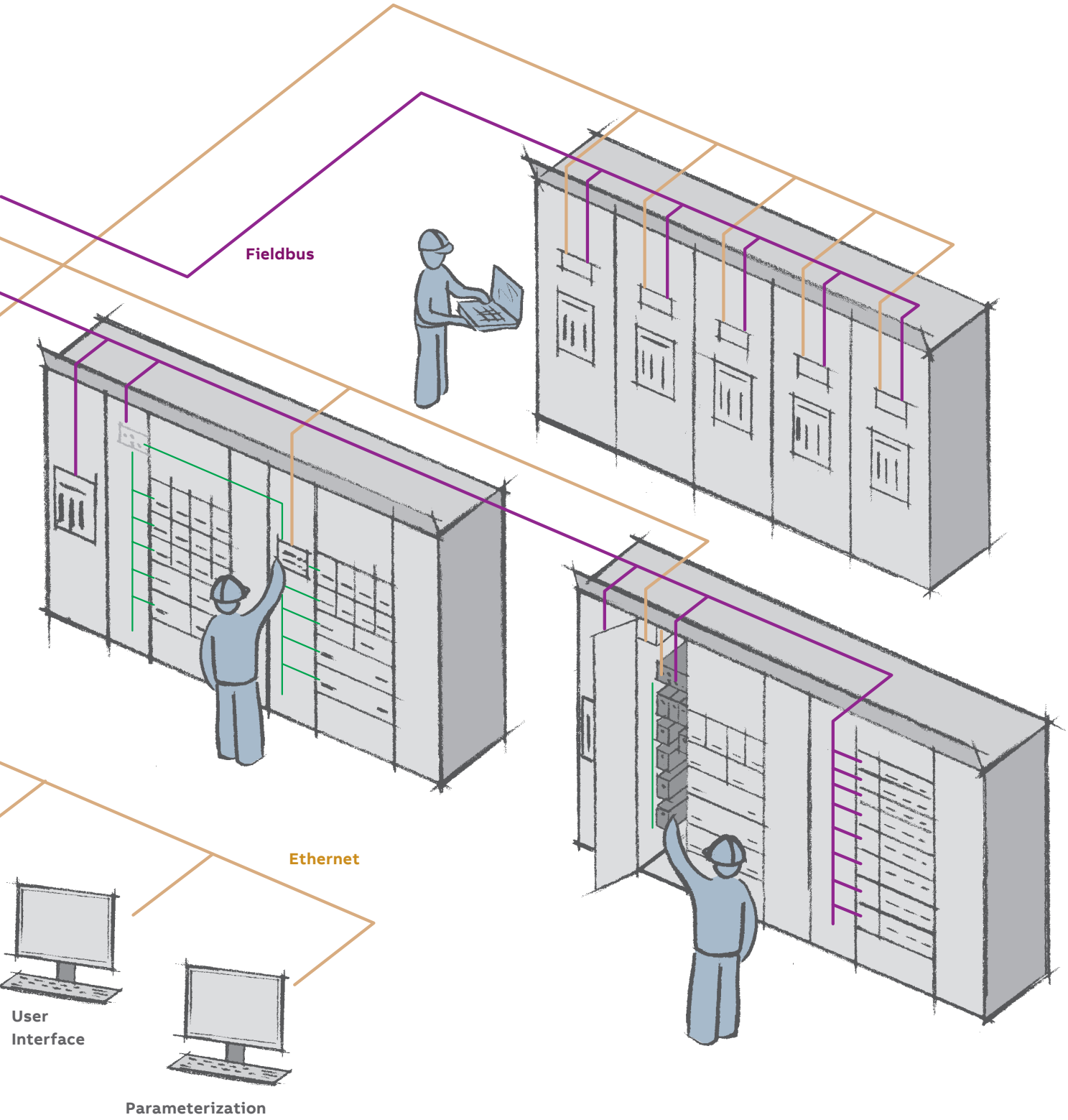
With the introduction of MNS® ABB has been providing market leading low voltage switchgear systems technology. In 1987 ABB installed the world's first intelligent low voltage motor control center, since then ABB has delivered over 100,000 intelligent motor controllers.

In 2005, MNS *i*S the world's first integrated low voltage switchgear platform was launched. MNS *i*S retained the core technology of MNS® , and pushed it to a higher level. It provided all functions for control, protection, and state monitoring of electrical machine and motor starter, it benefited the operation and management of the customer's low voltage motor control center.

MNS Digital Switchgear, with the integration of concept of system and digital intelligent technology, drives the conventional switchgear to keep pace with the technological front and be part of the intelligent Internet of Things. It can be widely used in all kinds of industrial applications, infrastructures, rail transportations and high-grade buildings, etc. to provide the users digital solutions and services in terms of safer and more reliable power supply:

- More efficient, flexible, safe and reliable Powerful Ethernet integration
- Pre-alarm against potential threat and predictive maintenance Advanced temperature measurement technology
- Superior intelligence and meet all your needs Comprehensive intelligent motor/ feeder management
- Cost reduction and life extension service Full lifecycle management




Fieldbus
Ethernet
User
Interface
Parameterization

Primary Solution

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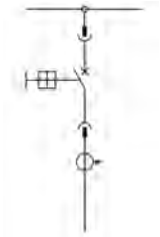
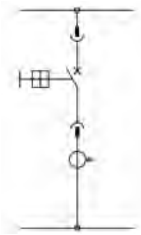
MNS R ACB - Incomer, feeder, bustie

Solution No.						**01**			**02**	
Singleline										
Application						Incomer, feeder			Bustie	
Switchgear type						MNS R				
Circuit breaker	IcuKA (400V)	IcuKA (690V)	Current transformer	Current carrying capacity (A)	Width (mm)	Depth (mm)	Height	Width (mm)	Depth (mm)	Height
E1.2C 800 3P	50	42	LN5 800/5	800	400	1000	85E	600	1000	85E
E1.2C 800 4P	50	42	LN5 800/5	800	600	1000	85E	600	1000	85E
E1.2C 1000 3P	50	42	LN5 1000/5	1000	400	1000	85E	600	1000	85E
E1.2C 1000 4P	50	42	LN5 1000/5	1000	600	1000	85E	600	1000	85E
E2.2N 1250 3P	66	66	LN5 1250/5	1250	400	1000	85E	600	1000	85E
E2.2N 1250 4P	66	66	LN5 1250/5	1250	600	1000	85E	600	1000	85E
E2.2N 1600 3P	66	66	LN5 1600/5	1600	400	1000	85E	600	1000	85E
E2.2N 1600 4P	66	66	LN5 1600/5	1600	600	1000	85E	600	1000	85E
E2.2N 2000 3P	66	66	LN5 2000/5	2000	400	1000	85E	600	1000	85E
E2.2N 2000 4P	66	66	LN5 2000/5	2000	600	1000	85E	600	1000	85E
E2.2N 2500 3P	66	66	LN7A 2500/5	2500	600	1000	85E	600	1000	85E
E2.2N 2500 4P	66	66	LN7A 2500/5	2500	600	1000	85E	600	1000	85E
E4.2N 3200 3P	66	66	ASK105.10 3000/5	3200	600	1000	85E	800	1000	85E
E4.2N 3200 4P	66	66	ASK105.10 3000/5	3200	800	1000	85E	800	1000	85E
E4.2N 4000 3P	66	66	ASK127.10 4000/5	4000	800	1200	85E	1000	1200	85E
E4.2N 4000 4P	66	66	ASK127.10 4000/5	4000	1000	1200	85E	1000	1200	85E
E6.2H 5000 3P	100	100	ASK129.10 5000/5	5000	1000	1200	85E	1200	1200	85E
E6.2H 5000 4P	100	100	ASK129.10 5000/5	5000	1200	1200	85E	1200	1200	85E
E6.2H 6300 3P	100	100	ASK129.10 6000/5	6300	1200	1200	85E	1200	1200	85E
E6.2H 6300 4P	100	100	ASK129.10 6000/5	6300	1200	1200	85E	1200	1200	85E

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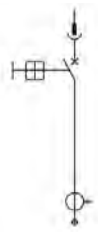
Feeder, lighting Tmax - Withdrawable / fixed module

Solution No.				**03**	**04**
Singleline					
Application				Feeder, lighting	
Width(mm)				1000(600[1])	
Module type				Withdrawable	Fixed
Rating(A)	Circuit breaker	Adjustable thermal threshold	CT	Height	
20	T2S160TMD20,3P	14-20	LNC2A	8E/4,6E	6E
32	T2S160TMD32,3P	22.5-32	LNC2A	8E/4,6E	6E
63	T2S160TMD63,3P	44-63	LNC2A	8E/2,6E	6E
80	T2S160TMD80,3P	56-80	LNC2A	6E	6E
100	T2S160TMD100,3P	70-100	LNC2A	6E	6E
125	T2S160TMD125,3P	88-125	LNC2A	6E	6E
160	T2S160TMD160,3P	112-160	LNC2A	6E	6E
250	T4S250TMD250,3P	175-250	LNC2	8E	8E
320	T5S400ln320,3P	128-320	LNC3	12E	12E
400	T5S400ln400,3P	160-400	LNC3	12E	12E
500	T5S630ln630,3P	252-500	LNC3	16E	16E
630	T6S630ln630,3P	252-630	LN3	16E	16E
20	T2S160TMD20,4P	14-20	LNC2A	8E/4	8E
32	T2S160TMD32,4P	22.5-32	LNC2A	8E/4	8E
63	T2S160TMD63,4P	44-63	LNC2A	8E/2	8E
80	T2S160TMD80,4P	56-80	LNC2A	8E	8E
100	T2S160TMD100,4P	70-100	LNC2A	8E	8E
125	T2S160TMD125,4P	88-125	LNC2A	8E	8E
160	T2S160TMD160,4P	112-160	LNC2A	8E	8E
250	T4S250TMD250,4P	175-250	LNC2	8E	8E
320	T5S400ln320,4P	128-320	LNC3	16E	16E
400	T5S400ln400,4P	160-400	LNC3	16E	16E
500	T5S630ln630,4P	252-500	LNC3	24E	16E
630	T6S630ln630,4P	252-630	LN3	24E	24E

Remark: dimension [1] is for MNS-R.

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Feeder Fix Module (XR-M)

Solution No.		**05**
Singleline		
Application		Feeder
Width(mm)		1000
Module type		Fixed
Rating(A)	Circuit breaker	Height
63	XR-M 00-50 3P	2E
125	XR-M 00-50 3P	2E
160	XR-M 00-50 3P	2E
200	XR-M 1-50 3P	4E
250	XR-M 1-50 3P	4E
400	XR-M 2-50 3P	8E
630	XR-M 3-50 3P	8E
63	XR-M 00-50 4P	4E
125	XR-M 00-50 4P	4E
160	XR-M 00-50 4P	4E
200	XR-M 1-50 4P	6E
250	XR-M 1-50 4P	6E
400	XR-M 2-50 4P	10E
630	XR-M 3-50 4P	10E

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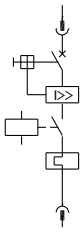
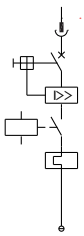
Motor Starter, Direct-on-line Starter, Withdrawable/ Fixed Module(MO)

Solution No.						**06**	**07**
Singleline							
Application						Motor Starter (Direct-on-line)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Withdrawable	Fixed
Power(kW)	Rating(A)	Circuit breaker	Contactor	Overload relay	Threshold	Height	Height
0.06	0.2	MO132-0.25	A9	TA25DU-0.25M	0.16-0.25	8E/2	8E
0.09	0.3	MO132-0.4	A9	TA25DU-0.4M	0.25-0.4	8E/2	8E
0.12	0.44	MO132-0.63	A9	TA25DU-0.63M	0.4-0.63	8E/2	8E
0.18	0.72	MO132-1.0	A9	TA25DU-1.0M	0.63-1.0	8E/2	8E
0.25	0.85	MO132-1.0	A9	TA25DU-1.0M	0.63-1.0	8E/2	8E
0.37	1.22	MO132-1.6	A9	TA25DU-1.4M	1.00-1.40	8E/2	8E
0.55	1.5	MO132-1.6	A9	TA25DU-1.8M	1.30-1.80	8E/2	8E
0.75	2	MO132-2.5	A9	TA25DU-2.4M	1.70-2.40	8E/2	8E
1.1	2.8	MO132-4.0	A9	TA25DU-4.0M	2.80-4.00	8E/2	8E
1.5	3.5	MO132-4.0	A12	TA25DU-5.0M	3.50-5.00	8E/2	8E
2.2	5	MO132-6.3	A26	TA25DU-6.5M	4.50-6.50	8E/2	8E
3	6.6	MO132-10	A26	TA25DU-8.5M	6.00-8.50	8E/2	8E
4	8.5	MO132-10	A26	TA25DU-11M	7.50-11.0	8E/2	8E
5.5	11.5	MO132-12	A26	TA25DU-14M	10.0-14.0	8E/2	8E
7.5	15.5	MO132-16	A26	TA25DU-19M	13.0-19.0	8E/2	8E
9	18.6	MO132-20	A26	TA25DU-25M	18.0-25.0	8E/2	8E
11	22	MO132-25	A30	TA25DU-25M	18.0-25.0	8E/2	8E

Remark: dimension [1] is for MNS-R.

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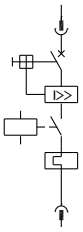
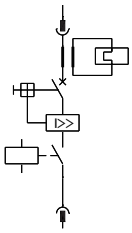
Motor Starter, Direct-on-line Starter, Withdrawable Module(Tmax)

Solution No.						**06**	**08**
Singleline							
Application						Motor Starter (Direct-on-line)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Withdrawable	
Power(kW)	Rating(A)	Circuit breaker	Contactor	Overload relay	Threshold	Height	
0.37	1.22	T2S160 MF1.6	A9	TA25DU-1.4M	1.00-1.40	8E/2, 6E	
0.55	1.5	T2S160 MF1.6	A9	TA25DU-1.8M	1.30-1.80	8E/2, 6E	
0.75	2	T2S160 MF2.5	A9	TA25DU-2.4M	1.70-2.40	8E/2, 6E	
1.1	2.8	T2S160 MF4	A9	TA25DU-4.0M	2.80-4.00	8E/2, 6E	
1.5	3.5	T2S160 MF4	A16	TA25DU-5.0M	3.50-5.00	8E/2, 6E	
2.2	5	T2S160 MF6.5	A26	TA25DU-6.5M	4.50-6.50	8E/2, 6E	
3	6.6	T2S160 MF8.5	A26	TA25DU-8.5M	6.00-8.50	8E/2, 6E	
4	8.5	T2S160 MF12.5	A30	TA25DU-11M	7.50-11.0	8E/2, 6E	
5.5	11.5	T2S160 MF12.5	A30	TA25DU-14M	10.0-14.0	8E/2, 6E	
7.5	15.5	T2S160 MA20	A30	TA25DU-19M	13.0-19.0	8E/2, 6E	
11	22	T2S160 MA32	A30	TA25DU-25M	18.0-25.0	8E/2, 6E	
15	30	T2S160 MA52	A50	TA75DU-32M	22.0-32.0	8E/2, 6E	
18.5	37	T2S160 MA52	A50	TA75DU-42M	29.0-42.0	8E/2, 6E	
22	44	T2S160 MA52	A50	TA75DU-52M	36.0-52.0	8E/2, 6E	
30	56	T2S160 MA80	A63	TA75DU-63M	45.0-63.0	6E	
37	68	T2S160 MA80	A75	TA25DU-4.0M + KORC 4SL 80/4	2.80-4.00		6E
45	83	T2S160 MA100	A95	TA25DU-4.0M + KORC 4SL 110/4	2.80-4.00		6E
55	98	T4S250 MA160	A110	TA25DU-4.0M + KORC 4SL 110/4	2.80-4.00		6E
75	135	T4S250 MA200	A145	TA25DU-4.0M + KORC 4SL 145/4	2.80-4.00		8E
90	158	T5S400 R400,PR221DS-I	A210	TA25DU-4.0M + KORC 4L 185/4	2.80-4.00		16E
110	193	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 235/4	2.80-4.00		16E
132	232	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 310/4	2.80-4.00		16E
160	282	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4N,310/4	2.80-4.00		16E
200	349	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4N,400/4	2.80-4.00		16E
250	430	T6S630 R630,PR221DS-I	AF580	TA25DU-4.0M + M42-4N,500/4	2.80-4.00		24E

Remark: dimension [1] is for MNS-R.

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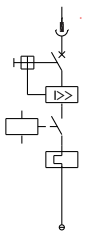
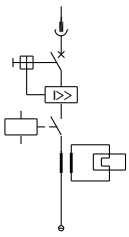
Motor Starter, Direct-on-line Starter, Fixed Module(Tmax)

Solution No.						**07**	**09**
Singleline							
Application						Motor Starter (Direct-on-line)	
Cubicle type						MNS	MNS R
Width(mm)						1000(600[1])	
Module type						Fixed	
Power(kW)	Rating(A)	Circuit breaker	Contactor	Overload relay	Threshold	Height	
0.37	1.22	T2S160 MF1.6	A9	TA25DU-1.4M	1.00-1.40	8E	
0.55	1.5	T2S160 MF1.6	A9	TA25DU-1.8M	1.30-1.80	8E	
0.75	2	T2S160 MF2.5	A9	TA25DU-2.4M	1.70-2.40	8E	
1.1	2.8	T2S160 MF4	A9	TA25DU-4.0M	2.80-4.00	8E	
1.5	3.5	T2S160 MF4	A16	TA25DU-5.0M	3.50-5.00	8E	
2.2	5	T2S160 MF6.5	A26	TA25DU-6.5M	4.50-6.50	8E	
3	6.6	T2S160 MF8.5	A26	TA25DU-8.5M	6.00-8.50	8E	
4	8.5	T2S160 MF12.5	A30	TA25DU-11M	7.50-11.0	8E	
5.5	11.5	T2S160 MF12.5	A30	TA25DU-14M	10.0-14.0	8E	
7.5	15.5	T2S160 MA20	A30	TA25DU-19M	13.0-19.0	8E	
11	22	T2S160 MA32	A30	TA25DU-25M	18.0-25.0	8E	
15	30	T2S160 MA52	A50	TA75DU-32M	22.0-32.0	12E	
18.5	37	T2S160 MA52	A50	TA75DU-42M	29.0-42.0	12E	
22	44	T2S160 MA52	A50	TA75DU-52M	36.0-52.0	12E	
30	56	T2S160 MA80	A63	TA75DU-63M	45.0-63.0	12E	
37	68	T2S160 MA80	A75	TA75DU-80M	60.0-80.0	12E	
45	83	T2S160 MA100	A95	TA110DU90	63.0-90.0	12E	
55	98	T4S250 MA160	A110	TA110DU110	77.0-110	12E	
75	135	T4S250 MA200	A145	TA25DU-4.0M + KORC 4SL 145/4	2.80-4.00		16E
90	158	T5S400 R400,PR221DS-I	A210	TA25DU-4.0M + KORC 4L 185/4	2.80-4.00		24E
110	193	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 235/4	2.80-4.00		24E
132	232	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 310/4	2.80-4.00		24E
160	282	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4N,310/4	2.80-4.00		24E
200	349	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4N,400/4	2.80-4.00		24E
250	430	T6S630 R630,PR221DS-I	AF580	TA25DU-4.0M + M42-4N,500/4	2.80-4.00		32E

Remark: dimension [1] is for MNS-R.

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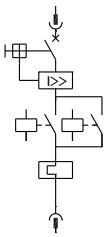
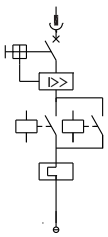
Motor Starter, Reversing Starter, Withdrawable/ Fixed Module(MO)

Solution No.						**10**	**11**
Singleline							
Application						Motor Starter (Reversing)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Withdrawable	Fixed
Power(kW)	Rating(A)	Circuit breaker	Contactor*2	Overload relay	Threshold	Height	
0.06	0.2	MO132-0.25	A9	TA25DU-0.25M	0.16-0.25	8E/2	8E
0.09	0.3	MO132-0.4	A9	TA25DU-0.4M	0.25-0.40	8E/2	8E
0.12	0.44	MO132-0.63	A9	TA25DU-0.63M	0.40-0.63	8E/2	8E
0.18	0.72	MO132-1.0	A9	TA25DU-1.0M	0.63-1.00	8E/2	8E
0.25	0.85	MO132-1.0	A9	TA25DU-1.0M	0.63-1.00	8E/2	8E
0.37	1.22	MO132-1.6	A9	TA25DU-1.4M	1.00-1.40	8E/2	8E
0.55	1.5	MO132-1.6	A9	TA25DU-1.8M	1.30-1.80	8E/2	8E
0.75	2	MO132-2.5	A9	TA25DU-2.4M	1.70-2.40	8E/2	8E
1.1	2.8	MO132-4.0	A9	TA25DU-4.0M	2.80-4.00	8E/2	8E
1.5	3.5	MO132-4.0	A12	TA25DU-5.0M	3.50-5.00	8E/2	8E
2.2	5	MO132-6.3	A26	TA25DU-6.5M	4.50-6.50	8E/2	8E
3	6.6	MO132-10	A26	TA25DU-8.5M	6.00-8.50	8E/2	8E
4	8.5	MO132-10	A26	TA25DU-11M	7.50-11.0	8E/2	8E
5.5	11.5	MO132-12	A26	TA25DU-14M	10.0-14.0	8E/2	8E
7.5	15.5	MO132-16	A26	TA25DU-19M	13.0-19.0	8E/2	8E
9	18.6	MO132-20	A26	TA25DU-25M	18.0-25.0	8E/2	8E
11	22	MO132-25	A30	TA25DU-25M	18.0-25.0	8E/2	8E

Remark: dimension [1] is for MNS-R.

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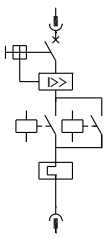
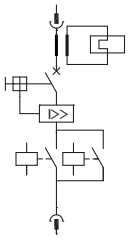
Motor Starter, Reversing Starter, Withdrawable Module(Tmax)

Solution No.						**10**	**12**
Singleline							
Application						Motor Starter (Reversing)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Withdrawable	
Power(kW)	Rating(A)	Circuit breaker	Contactor*2	Overload relay	Threshold	Height	
0.37	1.22	T2S160 MF1.6	A9	TA25DU-1.4M	1.00-1.40	8E/2, 6E	
0.55	1.5	T2S160 MF1.6	A9	TA25DU-1.8M	1.30-1.80	8E/2, 6E	
0.75	2	T2S160 MF2.5	A9	TA25DU-2.4M	1.70-2.40	8E/2, 6E	
1.1	2.8	T2S160 MF4	A9	TA25DU-4.0M	2.80-4.00	8E/2, 6E	
1.5	3.5	T2S160 MF4	A16	TA25DU-5.0M	3.50-5.00	8E/2, 6E	
2.2	5	T2S160 MF6.5	A26	TA25DU-6.5M	4.50-6.50	8E/2, 6E	
3	6.6	T2S160 MF8.5	A26	TA25DU-8.5M	6.00-8.50	8E/2, 6E	
4	8.5	T2S160 MF12.5	A30	TA25DU-11M	7.50-11.0	8E/2, 6E	
5.5	11.5	T2S160 MF12.5	A30	TA25DU-14M	10.0-14.0	8E/2, 6E	
7.5	15.5	T2S160 MA20	A30	TA25DU-19M	13.0-19.0	8E/2, 6E	
11	22	T2S160 MA32	A30	TA25DU-25M	18.0-25.0	8E/2, 6E	
15	30	T2S160 MA52	A50	TA75DU-32M	22.0-32.0	8E	
18.5	37	T2S160 MA52	A50	TA75DU-42M	29.0-42.0	8E	
22	44	T2S160 MA52	A50	TA75DU-52M	36.0-52.0	8E	
30	56	T2S160 MA80	A63	TA75DU-63M	45.0-63.0	8E	
37	68	T2S160 MA80	A75	TA25DU-4.0M + KORC 4SL 80/4	2.80-4.00		8E
45	83	T2S160 MA100	A95	TA25DU-4.0M + KORC 4SL 110/4	2.80-4.00		16E
55	98	T4S250 MA160	A110	TA25DU-4.0M + KORC 4SL 110/4	2.80-4.00		16E
75	135	T4S250 MA200	A145	TA25DU-4.0M + KORC 4SL 145/4	2.80-4.00		16E
90	158	T5S400 R400,PR221DS-I	A210	TA25DU-4.0M + KORC 4L 185/4	2.80-4.00		24E
110	193	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 235/4	2.80-4.00		24E
132	232	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 310/4	2.80-4.00		24E
160	282	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4N,310/4	2.80-4.00		24E

Remark: dimension [1] is for MNS-R.

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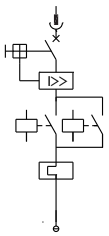
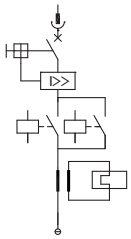
Motor Starter, Reversing Starter, Fixed Module(Tmax)

Solution No.						**11**	**13**
Singleline							
Application						Motor Starter (Reversing)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Fixed	
Power(kW)	Rating(A)	Circuit breaker	Contactor*2	Overload relay	Threshold	Height	
0.37	1.22	T2S160 MF1.6	A9	TA25DU-1.4M	1.0-1.4	12E	
0.55	1.5	T2S160 MF1.6	A9	TA25DU-1.8M	1.3-1.8	12E	
0.75	2	T2S160 MF2.5	A9	TA25DU-2.4M	1.7-2.4	12E	
1.1	2.6	T2S160 MF4	A9	TA25DU-4.0M	2.2-3.1	12E	
1.5	3.5	T2S160 MF4	A16	TA25DU-5.0M	2.8-4.0	12E	
2.2	5	T2S160 MF6.5	A26	TA25DU-6.5M	4.5-6.5	12E	
3	6.6	T2S160 MF8.5	A26	TA25DU-8.5M	6.0-8.5	12E	
4	8.5	T2S160 MF12.5	A30	TA25DU-11M	7.5-11	12E	
5.5	11.5	T2S160 MF12.5	A30	TA25DU-14M	10-14	12E	
7.5	15.5	T2S160 MA20	A30	TA25DU-19M	13-19	12E	
11	22	T2S160 MA32	A30	TA25DU-25M	18-25	12E	
15	30	T2S160 MA52	A50	TA75DU-32M	22-32	12E	
18.5	37	T2S160 MA52	A50	TA75DU-42M	29-42	12E	
22	44	T2S160 MA52	A50	TA75DU-52M	36-52	12E	
30	56	T2S160 MA80	A63	TA75DU-63M	45-63	12E	
37	68	T2S160 MA80	A75	TA75DU-80M	60-80	12E	
45	83	T2S160 MA100	A95	TA110DU90	63-90	16E	
55	98	T4S250 MA160	A110	TA110DU110	77-110	16E	
75	135	T4S250 MA200	A145	TA25DU-4.0M + KORC 4SL 145/4	2.8-4		24E
90	170	T5S400 R400,PR221DS-I	A210	TA25DU-4.0M + KORC 4L 185/4	2.8-4		32E
110	193	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 235/4	2.8-4		32E
132	232	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + KORC 4L 310/4	2.8-4		32E
160	282	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4N,310/4	2.8-4		32E

Remark: dimension [1] is for MNS-R.

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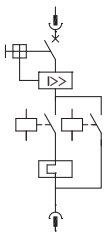
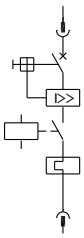
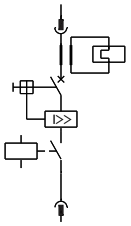
Motor Starter, Heavy Duty Starter, Withdrawable Module(Tmax)

Solution No.						**14**	**06**	**08**
Singleline								
Application						Motor Starter (Heavy duty)		
Cubicle type						MNS MNS R		
Width(mm)						1000(600[1])		
Module type						Withdrawable		
Power(kW)	Rating(A)	Circuit breaker	Contactor	Overload relay	Threshold	Height		
0.37	1.22	T2S160 MF1.6	2*A9	TA25DU-1.4M	1.00-1.40	8E/2, 6E		
0.55	1.5	T2S160 MF1.6	2*A9	TA25DU-1.8M	1.30-1.80	8E/2, 6E		
0.75	2	T2S160 MF2.5	2*A9	TA25DU-2.4M	1.70-2.40	8E/2, 6E		
1.1	2.6	T2S160 MF4	2*A9	TA25DU-4.0M	2.80-4.00	8E/2, 6E		
1.5	3.5	T2S160 MF4	2*A16	TA25DU-5.0M	3.50-5.00	8E/2, 6E		
2.2	5	T2S160 MF6.5	2*A26	TA25DU-6.5M	4.50-6.50	8E/2, 6E		
3	6.6	T2S160 MF8.5	2*A26	TA25DU-8.5M	6.00-8.50	8E/2, 6E		
4	8.5	T2S160 MF12.5	2*A30	TA25DU-11M	7.50-11.0	8E/2, 6E		
5.5	11.5	T2S160 MF12.5	A30	TA450SU60(4)	42-60		8E/2, 6E	
7.5	15.5	T2S160 MA20	A30	TA450SU60(3)	42-60		8E/2, 6E	
11	22	T2S160 MA32	A30	TA450SU60(2)	42-60		8E/2, 6E	
15	30	T2S160 MA52	A50	TA450SU80(2)	55-80		8E/2, 6E	
18.5	37	T2S160 MA52	A50	TA450SU80(2)	55-80		8E/2, 6E	
22	42	T2S160 MA52	A50	TA25DU-4.0M + KORC 4S 60/4	2.80-4.00			6E
30	56	T2S160 MA80	A63	TA25DU-4.0M + KORC 4S 60/4	2.80-4.00			6E
37	68	T2S160 MA80	A95	TA25DU-4.0M + KORC 4S 80/4	2.80-4.00			6E
45	83	T2S160 MA100	A110	TA25DU-4.0M + KORC 4S 105/4	2.80-4.00			6E
55	98	T4S250 MA160	A145	TA25DU-4.0M + KORC 4S 105/4	2.80-4.00			8E
75	135	T4S250 MA200	A185	TA25DU-4.0M + KORC 4S 140/4	2.80-4.00			8E
90	158	T5S400 R400,PR221DS-I	A210	TA25DU-4.0M + KORC 4S 185/4	2.80-4.00			16E
110	193	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + M42-4H,235/4	2.80-4.00			16E
132	232	T5S400 R400,PR221DS-I	A300	TA25DU-4.0M + M42-4H,310/4	2.80-4.00			16E
160	282	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4H,310/4	2.80-4.00			24E
200	349	T5S630 R630,PR221DS-I	AF460	TA25DU-4.0M + M42-4H,400/4	2.80-4.00			24E
250	430	T6S630 R630,PR221DS-I	AF750	TA25DU-4.0M + M42-4H,500/4	2.80-4.00			24E

Remark: dimension [1] is for MNS-R.

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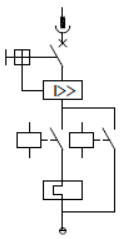
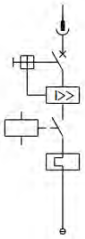
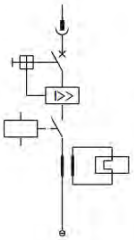
Motor Starter, Heavy Duty Starter, Fixed Module(Tmax)

Solution No.						**15**	**07**	**09**
Singleline								
Application						Motor Starter (Heavy duty)		
Cubicle type						MNS MNS R		
Width(mm)						1000(600[1])		
Module type						Fixed		
Power(kW)	Rating(A)	Circuit breaker	Contactor	Overload relay	Threshold	Height		
0.37	1.22	T2S160 MF1.6	2*A9	TA25DU-1.4M	1.00-1.40	12E		
0.55	1.5	T2S160 MF1.6	2*A9	TA25DU-1.8M	1.30-1.80	12E		
0.75	2	T2S160 MF2.5	2*A9	TA25DU-2.4M	1.70-2.40	12E		
1.1	2.6	T2S160 MF4	2*A9	TA25DU-4.0M	2.80-4.00	12E		
1.5	3.5	T2S160 MF4	2*A16	TA25DU-5.0M	3.50-5.00	12E		
2.2	5	T2S160 MF6.5	2*A26	TA25DU-6.5M	4.50-6.50	12E		
3	6.6	T2S160 MF8.5	2*A26	TA25DU-8.5M	6.00-8.50	12E		
4	8.5	T2S160 MF12.5	2*A30	TA25DU-11M	7.50-11.0	12E		
5.5	11.5	T2S160 MF12.5	A30	TA450SU60(4)	42-60		12E	
7.5	15.5	T2S160 MA20	A30	TA450SU60(3)	42-60		12E	
11	22	T2S160 MA32	A30	TA450SU60(2)	42-60		12E	
15	30	T2S160 MA52	A50	TA450SU80(2)	55-80		12E	
18.5	37	T2S160 MA52	A50	TA450SU80(2)	55-80		12E	
22	42	T2S160 MA52	A50	TA450SU60	42-60		12E	
30	56	T2S160 MA80	A63	TA450SU80	55-80		12E	
37	68	T2S160 MA80	A95	TA450SU80	55-80		12E	
45	83	T2S160 MA100	A110	TA450SU105	70-105		12E	
55	98	T4S250 MA160	A145	TA25DU-4.0M + KORC 4S 140/4	2.80-4.00			16E
75	135	T4S250 MA200	A185	TA25DU-4.0M + KORC 4S 140/4	2.80-4.00			16E
90	158	T5S400 R400,PR221DS-I	A210	TA25DU-4.0M + KORC 4S 185/4	2.80-4.00			24E
110	193	T5S400 R400,PR221DS-I	A260	TA25DU-4.0M + M42-4H,235/4	2.80-4.00			24E
132	232	T5S400 R400,PR221DS-I	A300	TA25DU-4.0M + M42-4H,310/4	2.80-4.00			24E
160	282	T5S630 R630,PR221DS-I	AF400	TA25DU-4.0M + M42-4H,310/4	2.80-4.00			24E
200	349	T5S630 R630,PR221DS-I	AF460	TA25DU-4.0M + M42-4H,400/4	2.80-4.00			24E
250	430	T6S630 R630,PR221DS-I	AF750	TA25DU-4.0M + M42-4H,500/4	2.80-4.00			32E

Remark: dimension [1] is for MNS-R.

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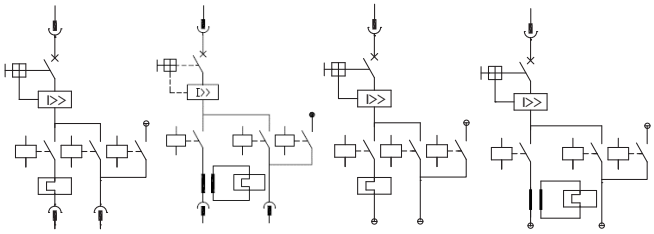
Motor Starter, Star-delta Starter, Withdrawable/ Fixed Module(Tmax)

Solution No.						**16**	**18**	**17**	**19**
Singleline									
Application						MotoMotor Starter (Star-delta)			
Cubicle type						MNS MNS R			
Width(mm)						1000(600[1])			
Module type						Withdrawable		Fixed	
Power (kW)	Rating (A)	Circuit breaker	Contactor	Overload relay	Threshold	Height			
18.5	36	T2S160 MA52	2*A50+A26	TA75DU-25M	18.0-25.0	8E		16E	
22	42	T2S160 MA52	2*A50+A26	TA75DU-32M	22.0-32.0	8E		16E	
30	56	T2S160 MA80	2*63+A30	TA75DU-42M	29.0-42.0	8E		16E	
37	68	T2S160 MA80	2*A75+A30	TA75DU-52M	36.0-52.0	8E		16E	
45	83	T2S160 MA100	2*A75+A30	TA75DU-63M	45.0-63.0	8E		16E	
55	98	T2S160 MA100	2*A75+A40	TA75DU-63M	45.0-63.0	8E		16E	
75	135	T4S250 MA160	2*A95+A75	TA110DU90	65.0-90.0	16E		24E	
90	158	T4S250 MA200	2*A110+A95	TA110DU110	80-110	16E		24E	
110	193	T4S250 MA200	2*A145+A95	TA200DU135	100-135	16E		24E	
132	232	T5S400 R400, PR221DS-I	2*A145+A110	TA25DU-4.0M + KORC 4L 185/4	2.8-4.0		24E		32E
160	282	T5S400 R400, PR221DS-I	2*A210+A145	TA25DU-4.0M + KORC 4L 185/4	2.8-4.0		24E		32E

Remark: dimension [1] is for MNS-R.

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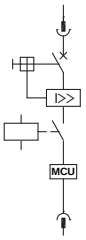
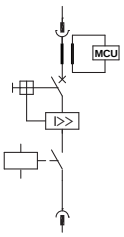
Motor Starter, Direct on line Starter with M102

Solution No.						**20**	**21**
Singleline							
Application						Motor Starter (M102 Direct on line)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Withdrawable	
Power(kW)	Rating(A)	Circuit breaker	Contactor	M102	Protective CT	Height	
0.37	1.22	T2S160 MF1.6	A9	M102		8E/2, 6E	
0.55	1.5	T2S160 MF1.6	A9	M102		8E/2, 6E	
0.75	1.9	T2S160 MF2.5	A9	M102		8E/2, 6E	
1.1	2.8	T2S160 MF4	A9	M102		8E/2, 6E	
1.5	3.6	T2S160 MF4	A16	M102		8E/2, 6E	
2.2	4.9	T2S160 MF6.5	A26	M102		8E/2, 6E	
3	6.5	T2S160 MF8.5	A26	M102		8E/2, 6E	
4	8.5	T2S160 MF12.5	A30	M102		8E/2, 6E	
5.5	11.5	T2S160 MF12.5	A30	M102		8E/2, 6E	
7.5	15.5	T2S160 MA20	A30	M102		8E/2, 6E	
11	22	T2S160 MA32	A30	M102		8E/2, 6E	
15	29	T2S160 MA52	A50	M102		8E/2, 6E	
18.5	35	T2S160 MA52	A50	M102		8E/2, 6E	
22	42	T2S160 MA52	A50	M102		8E/2, 6E	
30	56	T2S160 MA80	A63	M102		6E	
37	68	T2S160 MA80	A75	M102	PCT 3L 200/5R		8E
45	83	T2S160 MA100	A95	M102	PCT 3L 200/5R		8E
55	98	T4S250 MA160	A110	M102	PCT 3L 200/5R		8E
75	135	T4S250 MA200	A145	M102	PCT 3L 200/5R		16E
90	158	T4S250 MA200	A185	M102	PCT 3L 200/5R		16E
110	193	T5S400 R400,PR221DS-I	A260	M102	PCT 4L 300/5R		16E
132	232	T5S400 R400,PR221DS-I	A260	M102	PCT 4L 300/5R		16E
160	282	T5S400 R400,PR221DS-I	A300	M102	PCT 4L 300/5R		16E
200	349	T5S630 R630,PR221DS-I	AF400	M102	PCT 5L 500/5R		24E
250	430	T6S630 R630,PR221DS-I	AF460	M102	PCT 5L 500/5R		24E

Remark: dimension [1] is for MNS-R.

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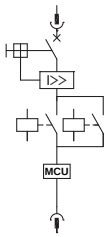
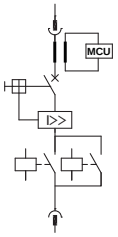
Motor Starter, Reversing Starter with M102

Solution No.						**22**	**23**
Singleline							
Application						Motor Starter (M102 Reversing)	
Cubicle type						MNS MNS R	
Width(mm)						1000(600[1])	
Module type						Withdrawable	
Power(kW)	Rating(A)	Circuit breaker	Contactor*2	M102	Protective CT	Height	
0.37	1.22	T2S160 MF1.6	A9	M102		8E/2	
0.55	1.5	T2S160 MF1.6	A9	M102		8E/2	
0.75	1.9	T2S160 MF2.5	A9	M102		8E/2	
1.1	2.8	T2S160 MF4	A9	M102		8E/2	
1.5	3.6	T2S160 MF4	A16	M102		8E/2	
2.2	4.9	T2S160 MF6.5	A26	M102		8E/2	
3	6.5	T2S160 MF8.5	A26	M102		8E/2	
4	8.5	T2S160 MF12.5	A30	M102		8E/2	
5.5	11.5	T2S160 MF12.5	A30	M102		8E/2	
7.5	15.5	T2S160 MA20	A30	M102		8E/2	
11	22	T2S160 MA32	A30	M102		8E/2	
15	29	T2S160 MA52	A50	M102		8E	
18.5	35	T2S160 MA52	A50	M102		8E	
22	42	T2S160 MA52	A50	M102		8E	
30	56	T2S160 MA80	A63	M102		8E	
37	68	T2S160 MA80	A75	M102	PCT 3L 200/5R		8E
45	83	T2S160 MA100	A95	M102	PCT 3L 200/5R		16E
55	98	T4S250 MA160	A110	M102	PCT 3L 200/5R		16E
75	135	T4S250 MA200	A145	M102	PCT 3L 200/5R		16E
90	158	T4S250 MA200	A185	M102	PCT 3L 200/5R		24E
110	193	T5S400 R400,PR221DS-I	A260	M102	PCT 4L 300/5R		24E
132	232	T5S400 R400,PR221DS-I	A260	M102	PCT 4L 300/5R		24E
160	282	T5S400 R400,PR221DS-I	A300	M102	PCT 4L 300/5R		24E
200	350	T5S630PR221-I In630	AF400	M102	PCT 5L 500/5R		24E
250	430	T6S630PR221-I In630	AF460	M102	PCT 5L 500/5R		24E

Remark: dimension [1] is for MNS-R.

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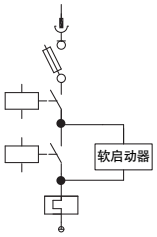
Motor Starter, PSS Soft Starter

Solution No.								**25**
Singleline								
Application								Motor Starter (soft starter)
Cubicle type								MNS MNS R
Module type								Fixed
Power(kW)	Rating(A)	Circuit breaker	Fuse(aR)	Main contactor	Pass-by contactor	Overload relay	Soft starter	Height
7.5	18	OS 32GD12P	50	A30	A30	TA25DU-19M	PSS18/30	
15	30	OS 32GD12P	80	A30	A30	TA25DU-32M	PSS30/52	
18.5	37	OS 63GD12P	125	A40	A40	TA42DU-42M	PSS37/64	
22	44	OS 63GD12P	160	A50	A50	TA75DU-52M	PSS44/76	
25	50	OS 63GD12P	160	A50	A50	TA75DU-52M	PSS50/85	
30	60	OS 63GD12P	200	A63	A63	TA75DU-63M	PSS60/105	
37	72	OS 125GD12P	250	A75	A50	TA75DU-80M	PSS72/124	
45	85	OS 125GD12P	315	A95	A75	TA110DU90	PSS85/147	
55	105	OS 250D12P	400	A110	A95	TA110DU110	PSS105/181	
75	142	OS 400D12P	450	A145	A110	TA200DU150	PSS142/245	
90	175	OS 400D12P	500	A185	A185	TA200DU175	PSS175/300	
110	210	OS 400D12P	700	A260	A260	TA450DU235	PSS250/430	
132	250	OS 400D12P	700	A260	A260	TA450SU310	PSS250/430	
160	300	OS 400D12P	900	A300	A300	TA450SU310	PSS300/515	

Remark: dimension [1] is for MNS-R.

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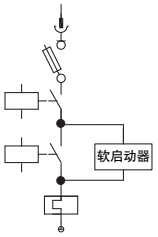
Motor Starter, PST Soft Starter

Solution No.							**26**
Singleline							
Application							MotorMotor Starter (soft starter)
Cubicle type							MNS MNS R
Module type							Fixed
Power(kW)	Rating(A)	Circuit breaker	Fuse(aR)	Main contactor	Pass-by contactor	Soft starter	Height
15	30	OS32GD12	100	A30	Built-in	PSTX30	24E
18.5	37	OS63GD12	125	A40	Built-in	PSTX37	24E
22	45	OS63GD12	160	A50	Built-in	PSTX45	24E
30	60	OS63GD12	160	A63	Built-in	PSTX60	24E
37	72	OS125GD12	250	A75	Built-in	PSTX72	24E
45	85	OS125GD12	315	A95	Built-in	PSTX85	24E
55	106	OS250D12	400	A110	Built-in	PSTX105	32E/400x2200(2300[1])
75	143	OS400D12	500	A145	Built-in	PSTX142	400x2200(2300[1])
90	171	OS400D12	630	A185	Built-in	PSTX170	400x2200(2300[1])
110	210	OS400D12	630	A210	Built-in	PSTX210	400x2200(2300[1])
132	250	OS400D12	700	A260	Built-in	PSTX250	400x2200(2300[1])
160	300	OS630D12	800	A300	Built-in	PSTX300	600x2200(2300[1])
200	370	OS630D12	900	AF400	Built-in	PSTX370	600x2200(2300[1])
250	470	OS630D12	900	AF460	Built-in	PSTX470	600x2200(2300[1])
315	570	OS630D12	1000	AF580	Built-in	PSTX570	600x2200(2300[1])
400	720	OT800D12	1250	AF750	Built-in	PSTX720	800x2200(2300[1])
450	840	E2N1600	1,500	AF1350	Built-in	PSTX840	1000x2200(2300[1])
560	1050	E2N2000	1,800	AF1650	Built-in	PSTX1050	1000x2200(2300[1])
710	1250	E2N2000	2,000	-	Built-in	PSTX1250	1000x2200(2300[1])

Remark: dimension [1] is for MNS-R.

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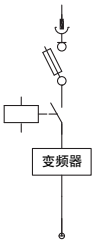
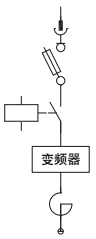
Motor Starter, Variable Frequency Driver ACS510

Solution No.							**27**	**28**
Singleline								
Application							Motor Starter (Variable Frequency Driver)	
Cubicle type							MNS MNS R	
Module type							Fixed	
Power (kW)	Rating(A)	Circuit breaker	Fuse(aR)	Main contactor	Variable Frequency Driver	Filter(optional)	Height	Height (with output filter)
1.1	3.3	OS32GD12P	20	A9	ACS510-01-03A3-4		24E	24E
1.5	4.1	OS32GD12P	20	A9	ACS510-01-04A1-4		24E	24E
2.2	5.6	OS32GD12P	20	A9	ACS510-01-05A6-4		24E	24E
3	7.2	OS32GD12P	20	A9	ACS510-01-07A2-4		24E	24E
4	9.4	OS32GD12P	20	A9	ACS510-01-09A4-4		24E	24E
5.5	11.9	OS32GD12P	25	A9	ACS510-01-012A-4		24E	24E
7.5	17	OS32GD12P	40	A9	ACS510-01-017A-4	NOCH0016-60	32E	32E
11	25	OS32GD12P	50	A12	ACS510-01-025A-4		32E	32E
15	31	OS63GD12P	63	A26	ACS510-01-031A-4		32E	32E
18.5	38	OS63GD12P	63	A30	ACS510-01-038A-4	NOCH0030-60	32E	32E
22	46	OS63GD12P	80	A30	ACS510-01-046A-4		32E	32E
30	60	OS63GD12P	80	A50	ACS510-01-060A-4		400*2200(2300[1])	400*2200(2300[1])
37	72	OS125GD12	100	A50	ACS510-01-072A-4		400*2200(2300[1])	400*2200(2300[1])
45	88	OS125GD12	125	A75	ACS510-01-088A-4	NOCH0070-60	400*2200(2300[1])	400*2200(2300[1])
55	125	OS250D12P	315	A95	ACS510-01-125A-4	NOCH0120-60	400*2200(2300[1])	400*2200(2300[1])
75	157	OS250D12P	315	A145	ACS510-01-157A-4		400*2200(2300[1])	600*2200(2300[1])
90	180	OS250D12P	400	A145	ACS510-01-180A-4		400*2200(2300[1])	600*2200(2300[1])
110	195	OS250D12P	400	A145	ACS510-01-195A-4		400*2200(2300[1])	600*2200(2300[1])
132	245	OS400D12P	500	A185	ACS510-01-246A-4	FOCH0260-70	400*2200(2300[1])	600*2200(2300[1])
160	290	OS400D12P	550	A210	ACS510-01-290A-4	FOCH0320-50	400*2200(2300[1])	600*2200(2300[1])

Remark: dimension [1] is for MNS-R.

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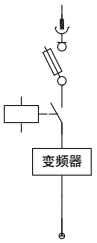
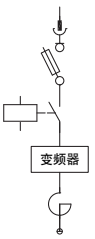
Motor Starter, Variable Frequency Driver ACS550

Solution No.							**27**	**28**
Singleline								
Application							Motor Starter(Variable Frequency Driver)	
Cubicle type							MNS MNS R	
Module type							Fixed	
Power (kW)	Rating(A)	Circuit breaker	Fuse(aR)	Main contactor	Variable Frequency Driver	Filter(optional)	Height	Height (with output filter)
1.1	3.3	OS32GD12P	20	A9	ACS550-01-03A3-4		24E	24E
1.5	4.1	OS32GD12P	20	A9	ACS550-01-04A1-4		24E	24E
2.2	5.4	OS32GD12P	20	A9	ACS550-01-05A4-4		24E	24E
3	6.9	OS32GD12P	20	A9	ACS550-01-06A9-4		24E	24E
4	8.8	OS32GD12P	20	A9	ACS550-01-08A8-4		24E	24E
5.5	12	OS32GD12P	25	A9	ACS550-01-012A-4		24E	24E
7.5	15.4	OS32GD12P	40	A9	ACS550-01-015A-4	NOCH0016-60	32E	32E
11	23	OS63GD12P	50	A12	ACS550-01-023A-4		32E	32E
15	31	OS63GD12P	63	A26	ACS550-01-031A-4		32E	32E
18.5	38	OS63GD12P	63	A30	ACS550-01-038A-4	NOCH0030-60	32E	32E
22	45	OS63GD12P	80	A30	ACS550-01-045A-4		32E	32E
30	59	OS63GD12P	80	A50	ACS550-01-059A-4		400*2200(2300[1])	400*2200(2300[1])
37	72	OS125GD12P	100	A50	ACS550-01-072A-4		400*2200(2300[1])	400*2200(2300[1])
45	87	OS125GD12P	125	A75	ACS550-01-087A-4	NOCH0070-60	400*2200(2300[1])	400*2200(2300[1])
55	125	OS250D12P	315	A95	ACS550-01-125A-4	NOCH0120-60	400*2200(2300[1])	400*2200(2300[1])
75	157	OS250D12P	315	A145	ACS550-01-157A-4		400*2200(2300[1])	600*2200(2300[1])
90	180	OS250D12P	400	A145	ACS550-01-180A-4		400*2200(2300[1])	600*2200(2300[1])
110	195	OS250D12P	400	A145	ACS550-01-195A-4		400*2200(2300[1])	600*2200(2300[1])
132	245	OS400D12P	500	A185	ACS550-01-246A-4	FOCH0260-70	400*2200(2300[1])	600*2200(2300[1])
160	290	OS400D12P	550	A210	ACS550-01-290A-4	FOCH0320-50	400*2200(2300[1])	600*2200(2300[1])

Remark: dimension [1] is for MNS-R.

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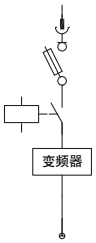
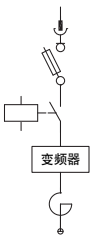
Motor Starter, Variable Frequency Driver ACS880

Solution No.							**27**	**28**
Singleline								
Application							Motor Starter (Variable Frequency Driver)	
Cubicle type							MNS MNS R	
Module type							Fixed	
Power (kW)	Rating (A)	Circuit breaker	Fuse(aR)	Main contactor	Variable Frequency Driver	Filter(optional)	Height	Height (with output filter)
0.75	2.4	OS32GD12	25	A9	ACS880-01-02A4-3		24E	24E
1.1	3.3	OS32GD12	25	A9	ACS880-01-03A3-3		24E	24E
1.5	4	OS32GD12	25	A9	ACS880-01-04A0-3		24E	24E
2.2	5.6	OS32GD12	25	A9	ACS880-01-05A6-3		24E	24E
3	7.2	OS32GD12	25	A9	ACS880-01-07A2-3		24E	24E
4	9.4	OS32GD12	25	A9	ACS880-01-09A4-3		24E	24E
5.5	12.6	OS32GD12	25	A9	ACS880-01-12A6-3	NOCH0016-6x	24E	24E
7.5	17	OS32GD12	40	A26	ACS880-01-017A-3		24E	24E
11	25	OS32GD12	40	A26	ACS880-01-025A-3	NOCH0030-6x	24E	24E
15	32	OS63GD12	63	A30	ACS880-01-032A-3		32E	32E
18.5	38	OS63GD12	63	A30	ACS880-01-038A-3		32E	32E
22	45	OS125GD12	80	A50	ACS880-01-045A-3		36E	36E
30	61	OS125GD12	100	A50	ACS880-01-061A-3	NOCH0070-6x	36E	36E
37	72	OS125GD12	125	A63	ACS880-01-072A-3		400*2200(2300[1])	400*2200(2300[1])
45	87	OS125GD12	125	A63	ACS880-01-087A-3		400*2200(2300[1])	400*2200(2300[1])
55	105	OS160GD12	160	A75	ACS880-01-105A-3	NOCH0120-6x	400*2200(2300[1])	400*2200(2300[1])
75	145	OS160GD12	200	A110	ACS880-01-145A-3		400*2200(2300[1])	600*2200(2300[1])
90	169	OS250D12	315	A145	ACS880-01-169A-3		400*2200(2300[1])	600*2200(2300[1])
110	206	OS250D12	315	A145	ACS880-01-206A-3		400*2200(2300[1])	600*2200(2300[1])
132	246	OS400D12	350	A185	ACS880-01-246A-3		600*2200(2300[1])	800*2200(2300[1])
160	293	OS400D12	400	A210	ACS880-01-293A-3	FOCH0260-70	600*2200(2300[1])	800*2200(2300[1])
200	363	OS400D12	550	A300	ACS880-01-363A-3		800*2200(2300[1])	1000*2200(2300[1])
250	430	OS630D12	630	AF400	ACS880-01-430A-3	FOCH0320-50	800*2200(2300[1])	1000*2200(2300[1])
250	505	OS630D12	800	AF460	ACS880-04-505A-3		1200*2200(2300[1])	1200*2200(2300[1])
315	585	OS800D12	1000	AF580	ACS880-04-585A-3		1200*2200(2300[1])	1200*2200(2300[1])
355	650	OS800D12	1000	AF580	ACS880-04-650A-3		1200*2200(2300[1])	1200*2200(2300[1])
400	725	OT1000E12P	1250	AF750	ACS880-04-725A-3	FOCH0610-70	1200*2200(2300[1])	1200*2200(2300[1])
450	820	OT1000E12P	1600	AF750	ACS880-04-820A-3	FOCH0875-70	1200*2200(2300[1])	1200*2200(2300[1])
500	880	OT1000E12P	1600	AF750	ACS880-04-880A-3	FOCH0875-70	1200*2200(2300[1])	1200*2200(2300[1])

Remark: dimension [1] is for MNS-R.

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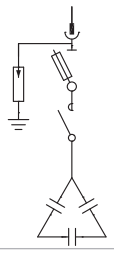
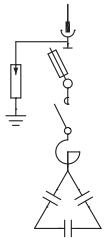
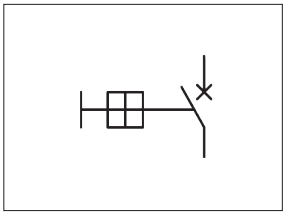
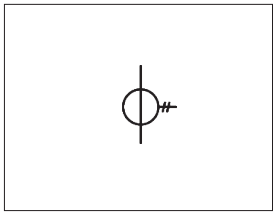
Reactive Power Compensation

Solution No.			**30**	**31**	**32**
Singleline					RVC
Application			Reactive Power Compensation	Reactive Power Compensation (with reactor)	Controller
Cubicle type				MNS MNS R	
Cubicle Width(mm)				600 (800、1000)	
Module type				Fixed	
Compensation capacity(kW)	Fuse switch	Contactor	Capacitor	Reactor	Controller
15kVAR	XLP00	UA30-R	CLMD33 430-17.3		
30kVAR	XLP00	2*UA30-R	2*CLMD33 430-17.3		
45kVAR	XLP00	2*UA50-R	2*CLMD33 430-26.8		
60kVAR	2*XLP00	4*UA30-R	4*CLMD33 430-17.3		
90kVAR	2*XLP00	4*UA50-R	4*CLMD33 430-26.8		
105kVAR	3*XLP00	4*UA30-R+2*UA50-R	4*CLMD33 430-17.3+2*CLMD33 430-26.8		
120kVAR	4*XLP00	8*UA30-R	8*CLMD33 430-17.3		
150kVAR	4*XLP00	4*UA30-R+4*UA50-R	4*CLMD33 430-17.3+4*CLMD33 430-26.8		
180kVAR	4*XLP00	8*UA50-R	8*CLMD33 430-26.8		
200kVAR	5*XLP00	4*UA30-R+6*UA50-R	4*CLMD33 430-17.3+6*CLMD33 430-26.8		
225kVAR	5*XLP00	10*UA50-R	10*CLMD33 430-26.8		
240kVAR	6*XLP00	4*UA30-R+8*UA50-R	4*CLMD33 430-17.3+8*CLMD33 430-26.8		
270kVAR	6*XLP00	12*UA50-R	12*CLMD33 430-26.8		
315kVAR	7*XLP00	14*UA50-R	14*CLMD33 430-26.8		
360kVAR	8*XLP00	16*UA50-R	16*CLMD33 430-26.8		
400kVAR	9*XLP00	18*UA50-R	18*CLMD33 430-26.8		
275kVAR	6*XLP00	1*UA50+5*UA95	2*CLMD33/16.7kVAR 480V+15*CLMD33/22.5kVAR 480V	1*7%,25kVAR,400V+5*7%, 50kVAR,400V	
300kVAR	6*XLP00	6*UA95	18*CLMD33/22.5kVAR 480V	6*7%,50kVAR,400V	
Controller					RVC-12
Controller					RVT2-12
Controller					RVC-6
Controller					RVT2-6

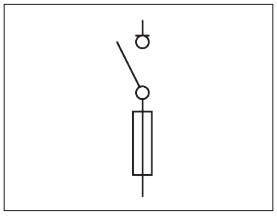
Legends



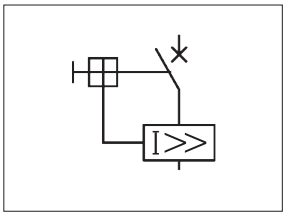
Circuit Breaker



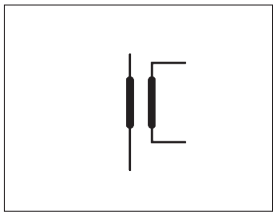
Current Transformer



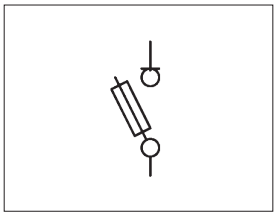
Fuse Switch Disconnector (strip type, single breakpoint)



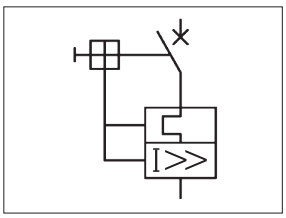
Circuit Breaker (without thermal over load protection)



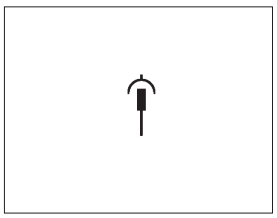
Current Transformer



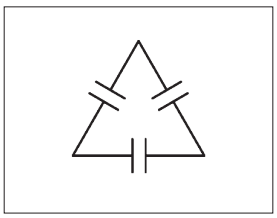
Fuse Switch Disconnector (single breakpoint)



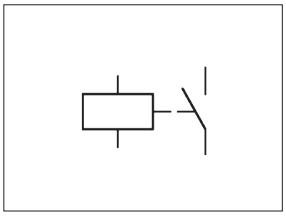
Circuit Breaker (with thermal overload protection)



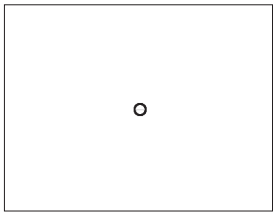
Cable Plug



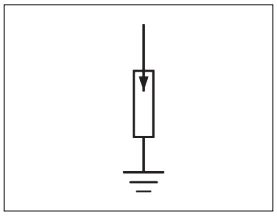
Capacitor



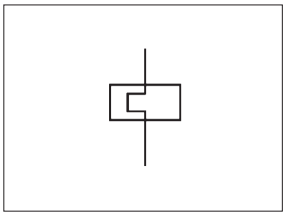
Contactor



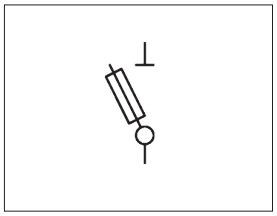
Fixed Connection



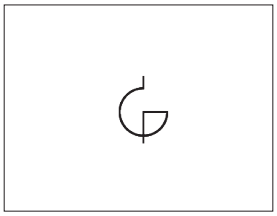
Arrester



Thermal Relay



Fuse Switch Disconnector (square)



Reactor

After Sales and Service

ABB's goal is to ensure the assets' maximum performance and availability.ABB has supplied over 1.4 million MNS® switchgears from its world wide manufacturing locations. Each of these locations operates with an After Sales and Service department, offering unparalleled global support.

On completion of commissioning, the switchgear is at the peak of its performance. To maintain this condition it is essential to adopt a service and maintenance plan for this asset. If the switchgear does not receive maintenance, this could result in downtime. In production the availability of the switchgear ensures productivity, and any down time is a lost opportunity for profit. Down time can be attributed to the following maintenance practices.

- Reactive maintenance is costly for both production and unplanned downtime.
- Preventive or Continuous maintenance is usually performed on an annual basis, during a scheduled shutdown.
- By evaluating information from the intelligent switchgear it is possible to adopt a Predictive maintenance schedule.

Utilizing an ABB expertise can help to increase the life cycle of the switchgear.

Regular Services

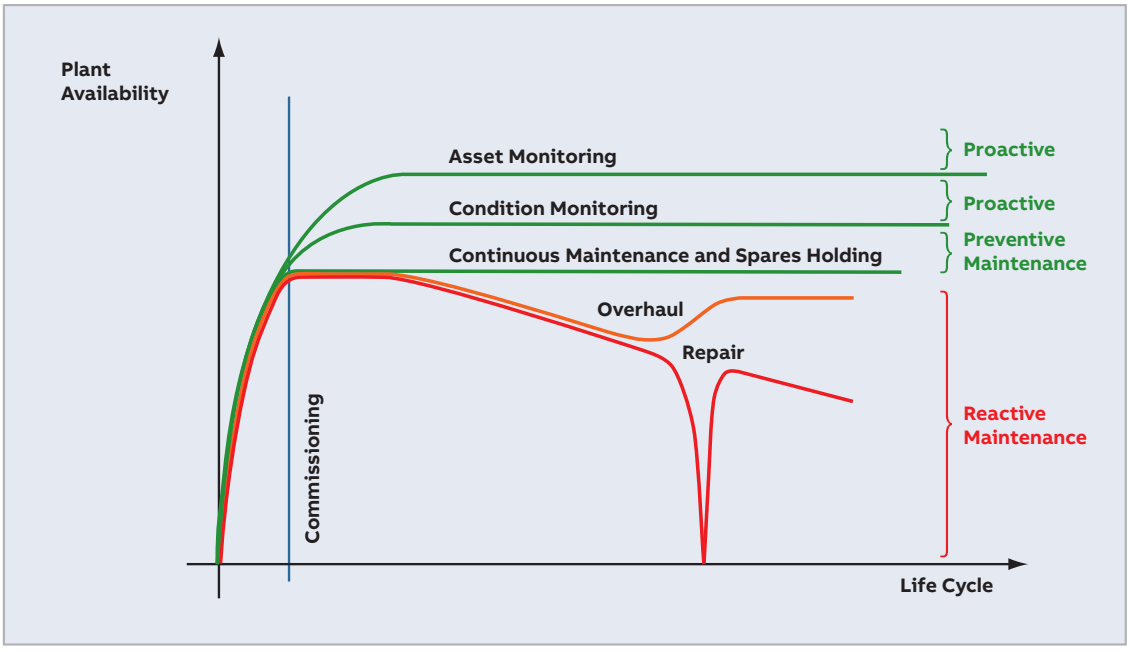
ABB offers comprehensive service and support during the whole life time of the switchgear:

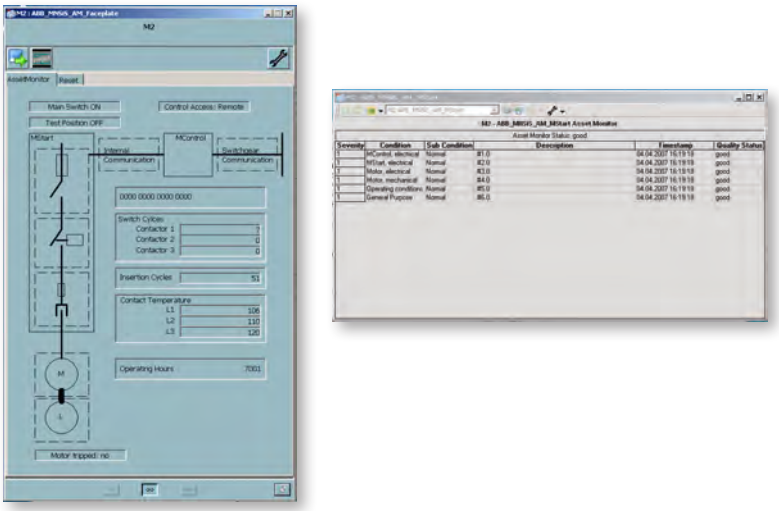
- Engineering assistance
- Product training
- Spares holding
- Installation and commissioning
- Service planning
- Hardware and software support
- Upgrades, expansions and modifications

Contract Services

ABB can offer comprehensive maintenance contracts designed specifically for each particular process. Through preventive maintenance programs unscheduled outages can be reduced and maintenance workflows are streamlined.

Utilization of integrated switchgear enables the maintenance to be taken into an even predictive maintenance practice, where information available from the switchgear can further assist with maintenance workflow.





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01 **Asset Monitoring**

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01

Asset Monitoring
In a further step of improving maintenance practices ABB's service technology is a fully self supervising switchgear that can eliminate costs for assets that do not require attention.

The asset monitor system evaluates all events, alarms and trips for predictive maintenance planning and essential working issues. The conditions are monitored and entered into groups; electrical, mechanical and plant associated. Each condition has a cause and suggested action for problem resolution.

Asset monitoring sets the next standard for integrated main-tenance procedures enabling higher switchgear availability through Proactive maintenance.

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Product names of other products are registered trademarks of their manufacturers or owners.
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DeviceNet® and Ethernet/IP® is Open DeviceNet Vendor Association's registered trademark.

Technical descriptions relate to MNS 3.0.

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《MNS 3.0 Low Voltage Switchgear Technical Info》
The brochure is associated with other MNS® Low Voltage Switchgear publications, such as:
《MNS® Low Voltage Switchgear Service Manual-Installation, operation and debugging》
《MNS *i*PDU (Intellingent Power Distribution Unit) Technical Info》
《MNS Distribution Board and Power Cabinet Technical Info》
《MNS® & MNS *i*S Low Voltage Switchgear Safety Solution》

About Intelligent Low Voltage Switchgear more information :
《NEW MNS Digital System Technical Info》
《MNS *i*S Motor Control Center System Guide》
《MNS *i*S Condition Monitoring-Enhanced availability through innovative design》
《MNS *i*S Switchgear System - Your Platform to success Values for End Users》
《MNS *i*S Switchgear System - Your Platform to success Values for EPCs》
《MNS with M10x—Intelligent motor mangement》

1SXH900001C0201 03-2018

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