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Innovating Energy Technology

SMBE Fuji Electric

Fuji SMBE Switchgear Group

Formerly known as SMB Electric Pte Ltd, the Company is a market leader in the design and manufacture of proprietary low voltage switchgear and controlgear solutions in Singapore. In December 2014, the Company was acquired by Fuji Electric Co., Ltd and renamed as Fuji SMBE Pte Ltd ("Fuji SMBE"). With a long operating history since 1973, Fuji SMBE has gained industry recognition for its expertise in motor and power control systems, switchgear manufacturing, electrical distribution systems to various market applications and OEM solutions.

Not one to rest on its laurels, the Fuji SMBE Switchgear Group has expanded overseas and set up manufacturing locations in countries such as Malaysia, Indonesia and Australia in order to target the growing demand for advanced switchgear solutions in the region. This foray has proved to be very beneficial as the switchgear group was able to achieve greater economies of scale through labour and cost savings. The switchgear group also distributes switchgear solutions overseas to Africa, the Middle East, India and other parts of Asia.

Over the years, the switchgear group has gained invaluable experience and expertise in a comprehensive array of power distribution products and application solutions for the Commercial, Residential, Industrial Process Plants, Infrastructural Developments, Food Processing, Pharmaceutical, and the Marine/ Oil & Gas applications as well as for the specialised industries such as Data Centres and other Mission Critical projects such as Hospitals. The group is continuously committed to introduce state-of-the-art equipment and technological upgrades to its product offerings.

The most valuable assets of this division are the people. The group breeds a culture of care, concern and learning for the employees, believing that the staff will be motivated to serve and in turn, create further value for the organisation.

More importantly, the group prides itself on its excellent service to customers. Besides the provision of excellent switchgear products, the sales consultants actively engage clients to understand their requirements in order to provide solutions that best meet their needs.

15 Senoko Avenue


15 Senoko Way


17 Senoko Avenue

Facilities and Capabilities

Production Capabilities

- 40,000 sq. metres production space
- Annual production of 10,000 fully equipped columns
- Fully Automated Busbar Cutting Machine
- In-House metal works and parts fabrication
- Fully / Semi Automated Gasket Foaming Machine
- Fluidised Epoxy Electrostatic Powder Coating and Recovery System (coat to 60µm thickness)
- Automated oven for coating processes (Annealing Oven)
- LVD Omega 1500 and Sienna S1225 Computer Numeric Controlled (CNC) Turret Punch Machine
- LVD HydrulicPressbrake Bending and Cutting Machines
- Amada Stamping and Pressing Machines for metal forming
- Networked Customised Computer Aided Design (CAD) Systems
- Computer Aided Manufacturing (CAM) Stations
- Automatic Coiling Machines
- Digital Controlled Torroidal Winding Machines
- Laser Cutting Machine
- Laser Engraving
- Robotic Welding
- Advanced Wiring Process

Manufacturing Facilities

- 3 plants in Singapore
- 2 plants in Malaysia
- 2 plants in Australia
- 1 plant in Indonesia

Service Support

- Strong R&D team
- Skilled Engineering/Production teams
- First In-house test bay station in Singapore – 1000kW, capable of performing full load tests
- Switchgear training
- Calibration support: Calibration facilities to modify and recalibrate products
- On-time delivery and quick commissioning


Australia


Malaysia


Indonesia

LVD Punching Machines


Gasket Foaming Machine

Metal working & fabrication machines

Fuji Electric

Innovating Energy Technology

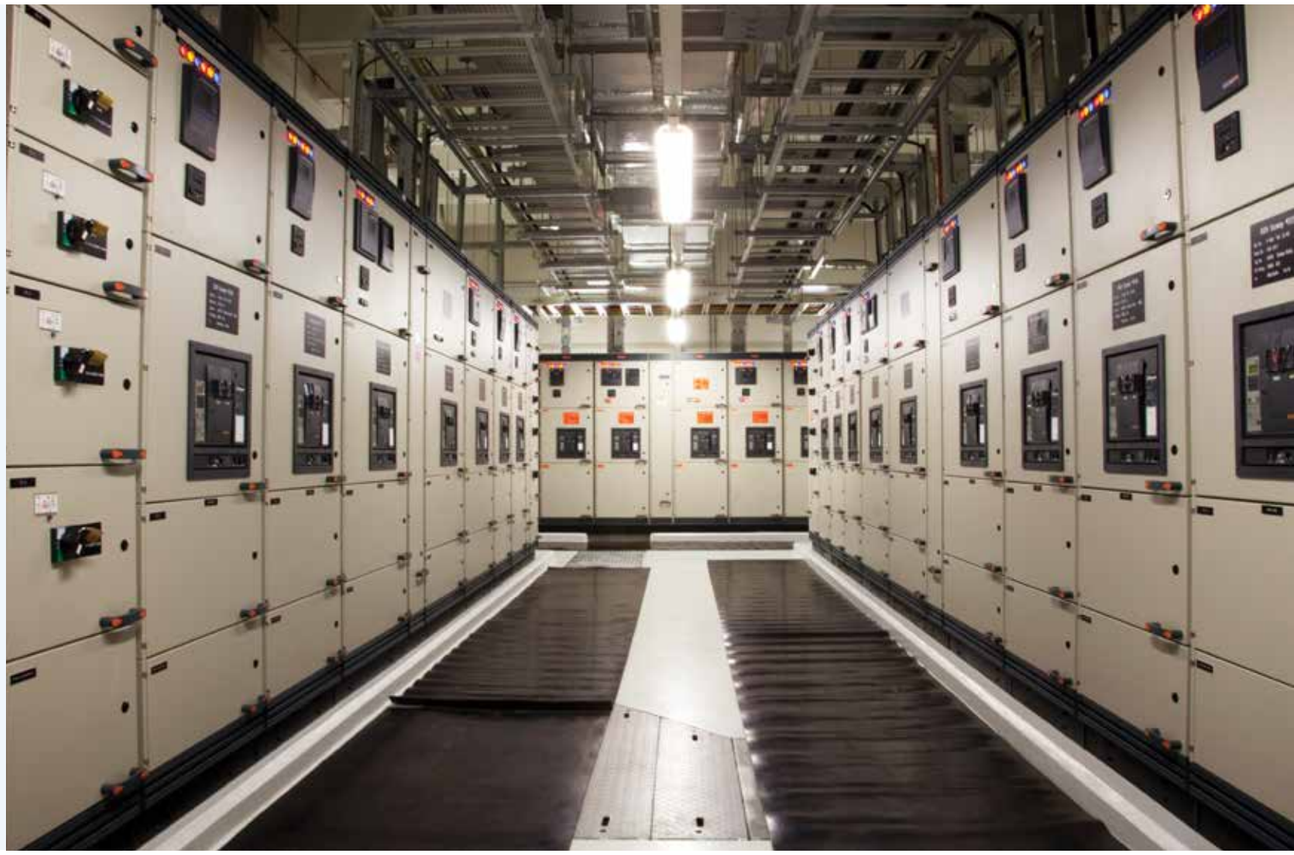
"Fuji Electric Manufacturing Co., Ltd." was established as a capital and technology alliance between Japan "Furukawa Electric Co., Ltd." and German "Siemens AG" in 1923. The company name derived from these two companies' first sound "Fu" and "Si"and the highest mountain in Japan, Mt. Fuji. In 1984, The company name was changed from Fuji Electric Manufacturing Co., Ltd to "Fuji Electric Co., Ltd." which is our current company name.

"Fuji Electric Singapore Private Ltd." (present Fuji Electric Asia Pacific Pte. Ltd.) was established in 1989.

As Fuji Electric's sales, marketing and engineering hub in South East Asia, Fuji Electric Asia Pacific is mainly focus on Drive & Automation, Uninterruptible Power Supply, Power Semiconductors, Cast Resin Transformers, Building management solutions, Energy management systems, Plant Engineering and Data Centre solutions in South East Asia, Oceania and Middle East market.

In 2012, Fuji Electric devised current brand statement "Innovating Energy Technology - Through our pursuit of innovation in electric and thermal energy technology, we develop products that maximize energy efficiency and lead to a responsible and sustainable society." Since our foundation in 1923, Fuji Electric has innovated energy technology to make broad contribution to the world in the fields of industrial and social infrastructure. Fuji Electric contributes to the creation of responsible and sustainable societies through its five business sectors: Power and Social Infrastructure, industrial Infrastructure, Power Electronics, Electronic Devices and Food and Beverage Distribution.

Today, Fuji Electric group is located in 104 locations at 21 countries, with almost 26,000 staff and its products are introduced in more than 50 countries. Through these business networks, we deliver products & solutions to customers around the world; contributing to the resolution of energy management problems. As a specialist in energy generation, energy savings and energy management, Fuji Electric's equipment and components provide total energy engineering solutions in the commercial and industrial sectors.



ELECTRICAL
- Short circuit performance able to achieve up to 125kA for 1 second (275kA peak)

HIGH PERFORMANCE
- Up to Form 4b form of internal separation (for more information, please refer to page 21)
- Ingress Protection up to IP44

MODULAR
- Compact and flexible modular design conserves maximum space
- Customisable to special dimensions according to customer preferences

REGULATORY COMPLIANCE
- ASTA certified and compliant to IEC standards 61439-1, -2; designed to meet local technical standards, practices and requirements

MECHANICAL STRENGTH
- High turn frequency of frame structure ensures greater mechanical strength and toughness

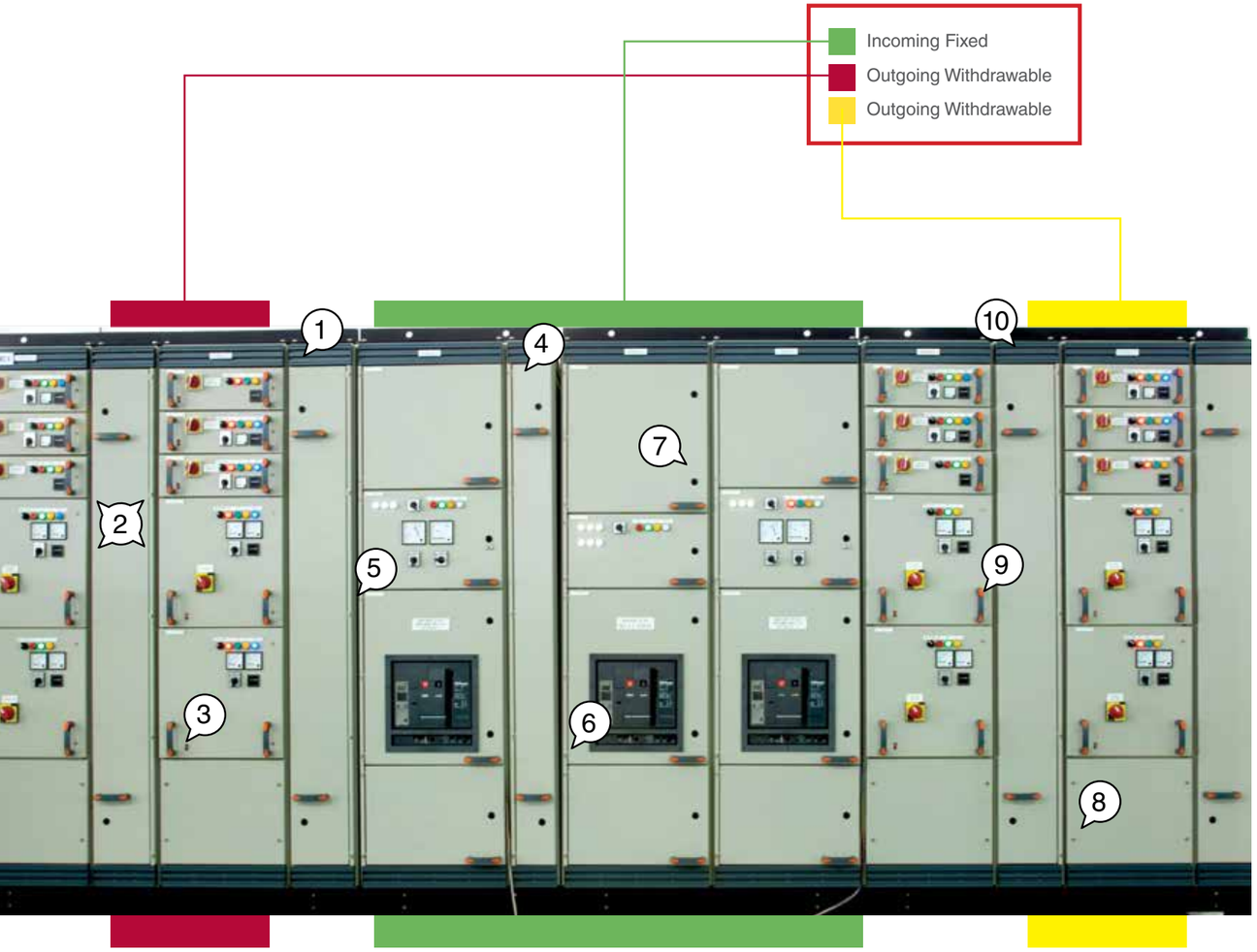
FULLY KNOCK-DOWN
- Allows for easy dismantling and assembly; parts are joined by bolts and nuts, which eliminates need for welding process

EFFICIENT SPACE UTILISATION
- Small footprint allows for compact and efficient space utilisation; facilitates front and back access

SAFETY
- Naturally ventilated, option to insert additional fans for greater heat dissipation
- 100% quality check before delivery
- Use of insulated copper busbars prevents risk of short-circuit

Main-Board

SMBE



Features

SMBE

1 

Ventilation:
- Excellent design for air passage flow & heat dissipation

2 

Withdrawable Modules:
- Easy control by operators
- Safe servicing through Interlock mechanism at withdrawable module

3 

Indicators:
- Simple and Clear IN / TEST / OUT withdrawable module indications

4 

Corner Joints:
- Strong zinc and aluminium alloy
- Patented base & joint design (SG Copyright: D2003/ 1456/ H)

5 

Frame Structure:
- Superior frame structure with high turn frequency
- Great strength and toughness
- Patented design (SG Copyright: D2003/ 1457/ D, D2003/ 1464/ J)

Material:
- 1.5mm Electrogalvanised Steel
- Option for 1.2mm Stainless Steel for use harsh & corrosive environment

6 

Hinges:
- Special 180° stainless-steel hinges
- Ideal in all harsh environments & prevents rust

7 

Key-Lock:
- Simple lock design to prevent forced access & unauthorised usage

8 

Polyurethane Gasket:
- Machine applied to prevent penetration by moisture or dust
- Continuous foam with no joints to ensure good IP rating

9 

Door Locks at Handle:
- Safe interlock mechanism
- Slots for up to 3 padlocks for security & safety
- Isolates operator from hazardous voltages

10 

Eye-Bolt Design:
- Direct lifting with use of sling

Customised Engineering Design:
- Flexibility in design to match customer preferences

Vertical Copper Busbars:
- High conductivity copper busbars designed to withstand effects of short circuit currents
- Specially designed Jaws to clamp withdrawable modules to busbars

SMBE

SMBE

Features:

Complete Knock-Down Form:
- Parts are fully joined by bolt and nuts
- Design facilitates ease of assembly and transportation

Bracket:
- Special bracket formed from aluminium that allows devices to be mounted in any designed dimension

Din Rail:
- Aluminium din rails allow for mounting customisation

Polyurethane Gasket:
- Door sealing with polyurethane gasket foam
- Machine applied to prevent penetration by moisture or dust
- Continuous foam with no joints to ensure good IP rating

Ventilation:
- Excellent design for air passage flow & heat dissipation

Design Versatility:
- Availability of wide range of M-Cube configurations prepared with various quality components
- Choice of top or bottom cable entry to suit installation requirements.
- Choice of single or double doors for front access

Frame Structure:
- Superior frame structure with high turn frequency
- Greater strength and toughness
- Innovative tooling process requiring special profile

Material:
- Standard frame of 1.5mm Electrogalvanised Steel
- Option for 1.2mm Stainless Steel for use harsh & corrosive environment

Quality Control:
- Quality control check showing when its tested and manufactured with product reference

Hinges:
- Special 180° stainless-steel hinges
- Ideal in all harsh environments & prevents rust

MCU (Mission Critical Unit)

SMBE

Revolutionised M-Cube for PDU / RDU

- **Concurrent Maintainability**
- **Full Front Access**
- **Compact Construction**
- **Modular & Expandable**
- **Optimised Operation Performance**

Centralised Control Hub
- Consolidated Area for All Control Equipment
- Benefits Troubleshooting & Installation for PQMS / BMS personnel

Ventilation
- Engineered to allow excellent air passage flow
- Facilitate Heat dissipation

Dedicated Termination Compartment
- Well organised terminals
- Innovative design to alleviate cable termination works

1-Click Cover
- New Design to replace conventional screw-on cover
- Ideal for Thermal Scanning
- Individual modules for easy troubleshooting & maintenance

Cable Management System
- Compact & Structured Busbar & Cable
- Quality Differentiation

Specialised Door Mechanism
- Allows full 180° Swing
- 2-Step design

Aesthetic Outlook
- Superior finishing
- Well conceptualised design

Full Front Access
- Front mounted breakers for ease of replacement
- Back to Back Design

Current Transformer
- Rudolf Class 0.5s CT
- High accuracy at low rated burden
- Fully tested to IEC standards

Network & Server Standard
- Standard 600mm wide
- Modular design
- Ease of space planning

M-Cube for i-Cube / Intelligent

SMBE

Advanced power monitoring system using intelligent and web technologies

The rapid advances in technology have led to greater demands for access to power data such as online (real time) and historical information through the PDA, internet or the mobile phone via the establishment of mobile and wireless communications. Reports can also be generated by the host server through data mining. Users can access information such as load profiling, demand management, distribution system behavior, power quality, energy management and usage costs. The M-Cube's intelligent solutions facilitate network control and round-the-clock monitoring & control of customers' power systems at any-time and any-place. This is achieved through the use of i-Cube's supporting intelligent software system for web-enabled data transmission.

i-Cube is a high technology switchgear and controlgear assembly that provides not only power distribution and protection, but also allows the user to communicate with it. The use of i-Cube provides better facility management in system maintenance by establishing preventive and predictive maintenance schedules based on extracted historical and current information and prolongs the entire cycle-life of the system. The system provides not only monitoring control during normal operations, but it also has automated processing in the event of a power breakdown or outage, notifying the user if there is an alarm or fault in the system. This results in not only a more reliable and safer power distribution system that prevents unnecessary downtime during critical and normal operation, but also leads to lower operational costs with capital and labour savings.

Fixed-Type Switchgear

- Fixed-type modules that are able to distribute currents up to 6300Amps
- Structures are partitioned with individual doors for direct access with use of handles
- Fixed-type columns and modules are designed with breaker compartments that can be used to mount circuit breakers on horizontal plates
- Mounting of other switchgear components such as contactors, thermal relays, variable speed controls and starters
- Fixed-type MCC feeder column may be equipped with up to 18 modules each of 100mm height
- Option of 1000A/ 2000A dropper busbar

Withdrawable-Type Switchgear

- Fully withdrawable-type PCC/ MCC that are able to distribute currents up to 6300 Amps
- Structures are partitioned with individual pull-out modules – ease of installation and replacements
- Withdrawable-type PCC are designed with breaker compartments that can be used to mount circuit breakers on slide-out horizontal plates; MCC for mounting of starters
- Withdrawable-type columns may be equipped with up to 9 modules each of 175mm height given that 250mm (3 pole) or 425mm (4 pole) offset is reserved for the horizontal busbars
- Module heights can range from 175mm (1 module) for a starter rating of 37kW to 700mm (4 modules) for a starter rating of 250kW
- Use of 1000A dropper busbar
- Withdrawable modules consist of jaws which are clamped onto the vertical busbars for connection
- Disconnecting contacts for auxiliary connections
- Withdrawable modules are built in compliance with international standard IEC 61439-1 which regulates the drawer extraction and locking system
- Unique connection feature: IN/ OUT/ TEST

Power and Distribution Systems that support the building needs

High-rise commercial and residential buildings require specialised switchgear for power and distribution to meet business and household needs respectively. As buildings become more advanced with greater and newer technological features, the roles and pre-requisites for receiving and distributing power have progressed to include advanced features such as high quality insulation, connections and processes. The high efficiency and effectiveness of M-Cube would be able to allow building management to cut back on manpower requirements for system maintenance and equipment down-sizing. The M-Cube is capable of meeting the most demanding of commercial and residential building requirements; being the right technology at the right place.

The M-Cube switchboards are built ready-to-install, which reduces installation and commissioning time and is applicable for every field of use, with benefits such as easy application, maintenance, safety as well as space savings. They are also suitable for buildings with limited space, and cities that are increasingly becoming over populated.

Fixed-type PCC

Effective and Efficient in Protecting and Ensuring Stable Power Supply

Industrial uses such as operations in wafer-fabrication and renewable energy plants cannot afford a single margin of error. The larger the plant, the greater the need for reliable equipment. The M-Cube switchboards go through extensive, rigorous and strict FAT (factory acceptance tests), quality checks and control standards. The verification of type tests and certifications by ASTA is a strong testament of the quality of the M-Cube range of switchgear. This ensures that a reliable supply of electricity is available to meet industrial needs at all times.

The M-Cube switchboard column is an assembly of prefabricated elements, which are available in a number of sizes and may be assembled to form columns of different configurations. The modular frames enable significant space savings over conventional models and reductions in equipment weight; and possesses built-in structural integrity required for years of dependable service, with the ability to withstand rigorous repetitive operations. Existing modules can be replaced at the installation site without any shut-down. Furthermore, the modular design makes it possible to rationalise installation costs.

Fixed-type MCC

Fixed motor control systems with an excellent reputation in public projects

The M-Cube switchgear is highly reliable, meeting the requirements expected from public sector projects. The compartments are well insulated from each other, ensuring minimal chances of short-circuit with a high level of isolation from hazardous voltage. Priding itself as the market leader in Singapore, the M-Cube switchgear is increasingly endorsed and recognised due to its advanced switchgear technologies over local competitors.

The M-Cube switchgear is highly adaptable and is able to accommodate any range of switchgear components such as standard relays and other instruments that are easily available in the market and customers have the luxury to choose their preferred equipment and components for installation. It is a system for all applications of electrical distribution and motor control requiring a high level of dependability and reliability. They are therefore ideal for use in any project.

Fixed-type MCC

Sustaining Incoming and Distributing Power for Important Operations

Important mission critical operations include hospital and power station needs for incoming and power distribution. Data centers such as banks and stock exchanges are so important in today's society that there is zero tolerance for electrical failure. There are heavy responsibilities in controlling the electricity for all the computing needs, the data servers and storage needs 24-hours round the clock.

Designed with intricate technical know-how, the M-Cube switchgear is able to respond to any need for power and electrical components available in the market. The M-Cube provides either fixed-type or withdrawable-type Motor Control Centers which contain high-end starters and inverters of various sizes. Customers will be satisfied at every stage, be it planning, operation or maintenance. Projects of this nature typically demand rapid delivery lead-time, on-time service response and guaranteed technical support. Speed is of the essence as time savings lead to cost savings. Enhanced by optimal quality control checks, the customer is therefore able to obtain a one-stop equipment supply package with the M-Cube switchgear system.

Fixed-type and Withdrawable-type PCC/MCC

Food Processing and Pharmaceutical

Power and Distribution System for the High Standards of the Food and Drugs Industry

The M-Cube system can also play a vital role for the food and drugs industry worldwide.
The high standards of hygiene and safety require excellent top-of-the-line equipment to support and ensure that food and drugs production is performed at the highest levels of hygiene and cleanliness. The robustness and quick reaction time of the M-Cube switchgear system fully supports these high-end operations. The use of withdrawable modules facilitates service continuity, ease of modification and trouble-free maintenance.

The use of stainless steel frames is in line with industry and regulatory requirements.
The M-Cube is a comprehensive system for maintaining safety as protection should be maintained at every stage of operation, whether it is during normal operation or at the time of a breakdown.

Withdrawal-type MCC

Marine / Oil and Gas Industries

Corrosion resistant switchgear-designed for maximum safety and reliability

The general trend of rising oil prices has boosted the demand for oil-related equipment where the environment is highly corrosive in nature. The M-Cube has achieved the level of competency for use in the oil and gas market sector through its designs to enhance safe operation. This ensures reliable and safe processes which are not only effective and efficient, but also reinforces the protection of life and property.

Besides up to type 4b form of insulation to prevent accidental short-circuit, the use of interlocking mechanism at the modules prevents errors from occurring during operations. The M-Cube withdrawable-type MCC is able to control the entire power and electrical network, from operational management to preventative maintenance, thereby offering a complete solution for both Electrical Power Distribution and Motor Control.

The withdrawable module is the ideal solution in applications where service continuity, ease of modification and maintenance are the primary requirements in a durable, high performance and cost effective system. The option to use stainless steel frames deter corrosion attacks to the structure. The M-Cube system requires less installation space due to its customisable modular design.

Withdrawable-type PCC and MCC in operation inside an oil rig

Measurements

M-Cube Main-Board

The table below comprises the dimensions of the standard M-Cube frames and doors:

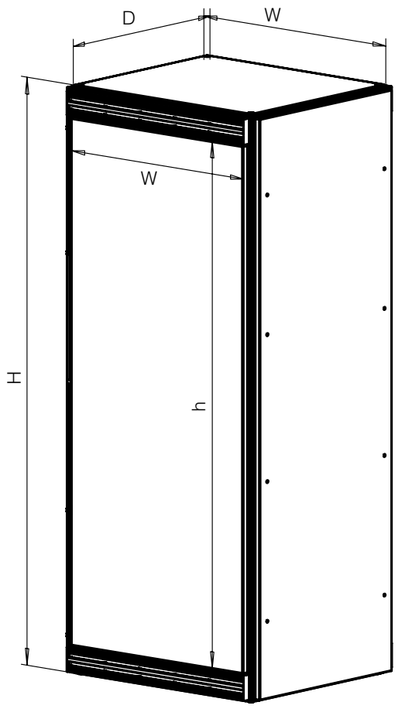
Height, H	Width, W	Depth, D	height, h	width, w
1800	200	400	100	200
2000	275**	600	200	275**
2200	300	700	250	300
	375**	900	300	375**
	400	1100*	400	400
	500	1300^	425^^	500
	600		500	600
	700		600	700
	800		700	800
	1200		800	1200
	1300		1000	1300
			1600	
			1800	
			2000	
Standard Frame Dimensions (mm)			**Standard Door Dimensions (mm)**	

Note:
D - depth of structure
H - height of structure
W - width of structure
h - height of door
w - width of door
1100* is formed using a 700mm depth and paired with a 400mm extension
1300^ is formed using a 900mm depth and paired with a 400mm extension
275 & 375** is termination compartment for withdrawable M-Cube switchboard
425^^ is busbar compartment for withdrawable M-Cube switchboard

ACB		
Height (h)	**Width (w)**	**Breaker Rating (Max)**
700 mm	700 mm	630A to 2500A
700 mm	800 mm	3200
700 mm	900 mm	4000A
700 mm	1200 mm	6300A

M-Cube Fixed-type

The use of this column is for mounting ACB, MCB, MCCB, contactors, thermal relays, variable speed controls and starters onto vertical mounting plates.
M-Cube fixed-type consist of fixed modules of the components mentioned above and the height of each M-Cube Fixed-Type module is 100mm and a typical column would carry 18 modules.



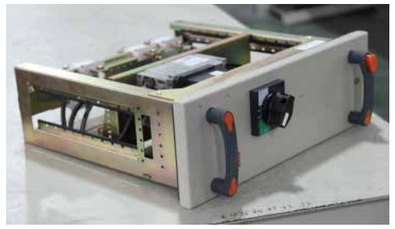
Horizontal Mounted MCCB		
Height (h)	**Width (w)**	**Breaker Rating (Max)**
400 mm	400 mm	100A
500 mm	400 mm	250A
600 mm	500 mm	400A

Vertical Mounted MCCB		
Height (h)	**Width (w)**	**Breaker Rating (Max)**
400 mm	400 mm	100A
500 mm	400 mm	250A
600 mm	500 mm	400A
600 mm	600 mm	630A
700 mm	600 mm	800A to 1600A

M-Cube Withdrawable-type

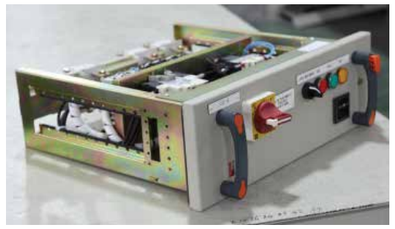
The M-Cube Withdrawable column may be outfitted with up to 9 modules with height of 175mm each. Larger contents can be installed into sizes of up to 4 withdrawable modules high and the starter rating may not exceed 250kW.

Feeders



Module Height (h)	Size	Breaker Rating (Max)
1 Module	175 mm	100A (3 Pole)
2 Module	350 mm	250A (4 Pole)
3 Module	525 mm	400A (4 Pole)/ 600A (3 Pole)
4 Module	700 mm	600A (4 Pole)

DOL Starters

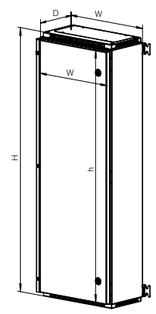


Module Height (h)	Size	Starter Rating (Max)
1 Module	175 mm	37 KW
2 Module	350 mm	55 KW
3 Module	525 mm	160 KW
4 Module	700 mm	250 KW

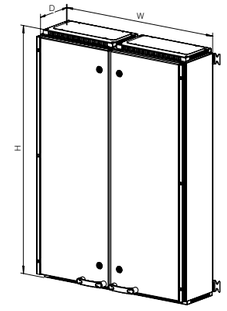
To accommodate the withdrawable modules, the cubicle requires an allocated busbar module in order to allow contact with the copper jaws. This slot comes in two sizes:

- 250mm (3 Pole)
- 425mm (4 Pole)

M-Cube Sub-Board



M-Cube Sub-board
(single compartment)



M-Cube Sub-board
(double compartments)

The following table is a summary of the standard frame and door dimensions for the M-Cube sub-boards. Sub-boards can be assembled as either a single compartment, or as double compartments. It is possible for double compartments to have differing widths. The M-Cube sub-boards have a current rating of up to 400A and are available as either floor stands or wall mounts.

Height	Width	Depth	height	width
400	400	200	200	400
500	500	250	250	500
600	600	300	400	800
700	800		500	900
800	900		600	
900			700	
1100			800	
			900	
			1100	
Standard Frame Dimensions (mm)			**Standard Door Dimensions (mm)**	

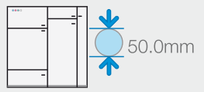
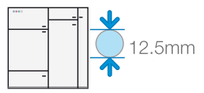
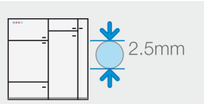
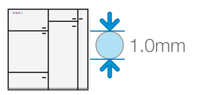
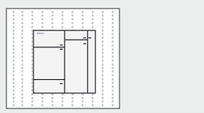
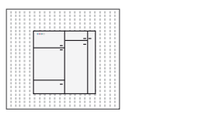
Note:
D - depth of structure
H - height of structure
W - width of structure
h - height of door
w - width of door

SMBE

Ingress Protection

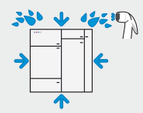
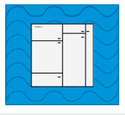
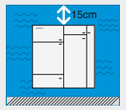
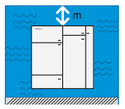
All switchgear enclosures are bounded by ingress protection levels set by BS EN 60529 which comprises the letters IP and 2 numerals:

First Digit

IP	Protection from solids	Description
0	Non-protected	No protection.
1		Protected against solids or large surface body > 50.0mm in diameter.
2		Protected against solids > 12.5mm in diameter; fingers ≤ 80.0mm in length.
3		Protected against solid objects or tools, wires, etc >2.5 mm in diameter.
4		Protected against solid objects or tools, wires, strips >1.0 mm diameter.
5		Dust protected - Dust ingress not totally prevented, but insufficient to interfere with equipment operation.
6		Dust tight - Totally no ingress of dust.

Note: EN 60529 does not specify sealing effectiveness against the following:
- mechanical damage of equipment
- risks of explosions
- certain types of moisture conditions, eg condensation
- corrosive vapours
- fungus
- vermin

Second Digit

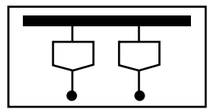
IP	Protection from liquids	Description
0	Non-protected	No protection.
1		Protected against vertical dripping / falling water drops.
2		Protected against dripping water, enclosure is tilted up to 15° from normal position.
3		Protected against spraying water greater than 60° from vertical.
4		Protected against splashing water from any direction.
5		Protected against water jets where water is projected by a nozzle against the enclosure from any direction.
6		Protected against the heavy seas or water jets.
7		Protected against effects of immersion under defined pressure and time.
8		Submersion protection. Suitable for continous underwater submersion.

Forms of Internal Separation

IEC Standards 61439-2 defines different means of separation, known as forms of dividing switchboard sections into separate compartments, essentially for the protection of life and property. This separation is achieved by barriers or partitions and distinguishable basically by 4 forms of separation.

Form 1 No separation of busbars from the functional units
No separation of the functional units from one another
No separation of terminals from the functional units
No separation of busbars from terminals

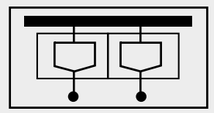
Form 1 encompasses general switchgear assemblies that are enclosed in order to protect from exposure to any inner live components, with no internal separation fitted for functional units or terminations.



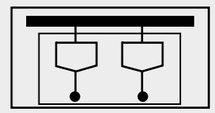
No internal separation

Form 2 Separation of busbars from the functional units
No separation of the functional units from one another

Form 2 outlines general switchgear assemblies that are enclosed in order to protect from exposure to any inner live components, with internal separation of the busbars from functional units.



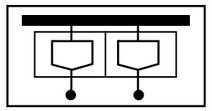
Form 2a
Terminals not separated from busbars or each other



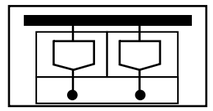
Form 2b
Terminals separated from busbars, but not from functional units or each other

Form 3 Separation of busbars from the functional units
Separation of the functional units from one another
Separation of terminals from the functional units
No separation of terminals from each other

Form 3 describes general switchgear assemblies that are enclosed in order to protect from exposure to any live components, with internal separation of the busbars from functional units and separation of all functional units from each other.



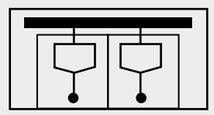
Form 3a
Terminals not separated from busbars or each other



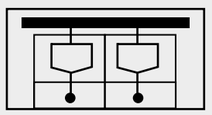
Form 3b
Terminals separated from busbars, but not from each other

Form 4 Separation of busbars from the functional units
Separation of the functional units from one another
Separation of terminals from functional units

Form 4 takes into account general switchgear assemblies that are enclosed in order to protect from exposure to any live components, with internal separation of the busbar system from functional units, separation of all functional units from each other and separation of terminals from the busbars and each other.

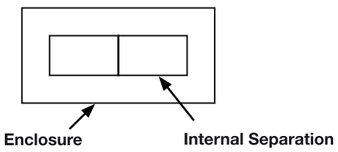


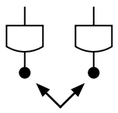
Form 4a
Terminals in same compartment as associated functional unit



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

Symbol Keys





SMBE

Verified by testing in accordance to IEC Standards

•	LV Switchgear & Controlgear	IEC 61439
•	Degree of Protection	IEC 529
•	Internal Arc Fault Containment	IEC 61641
•	Resistance to Salt mist	IEC 60068-2-11
•	Resistance to Damp heat	IEC 60068-2-30

* These tests apply to the full range of SMBE LV Switchgear up to 6300A (600A, 800A, 1000A, 1600A, 3200A, 4000A, 5000A, 6300A) with a short circuit rating up to 125kA, 1 sec, Peak 275A, 50 Hz/60 Hz
* Withdrawable column vertical busbar with rating of 1000A is tested to 85kA, 50 Hz/60 Hz
* Arc Fault Containment test:
  Fixed and Withdrawable columns are verified to a rating of 75kA rms 0.3 sec for both fixed and withdrawable switchgear systems.

List of Vertification Tests Performed on M-Cube

Strength of material and parts (clause 10.2)

Additional tests which were not included in the previous IEC 60439 type testing. They include corrosion resistance, properties of insulating materials, heat resistance, resistance to UV radiation, lifting, mechanical impact and marking. SMBE switchboards are verified by tests in accordance with IEC 61439 clause 10.2 and this qualifies the M-Cube switchboards for operating in all conditions and environments.

Degree of protection (clause 10.3)

Tests carried out to prove that the assembly achieves its specified degree of protection. SMBE switchboards have achieved an external rating up to IP44 and Form 4b internal separation. In spite of the high degree of protection, the M-Cube switchboards do not lead to de-rating and increased cost.

Clearance and creepage distances (clause 10.4)

SMBE switchboards provide greater clearance and creepage distances than the distances laid down by the standard and they are verified in accordance with IEc 61439 clause 10.4.

High degree of protection for foreign particles and water : IP44

Forms of Internal Separation : Form 4b

Protection against electric shock and integrity of protective circuits (clause 10.5)

Protective circuits play a major role in providing protection against indirect contact, as such verifying their effectiveness in the assemblies is vital.

The exposed conductive parts of M-Cube switchboards were inspected for the effectiveness of the connection to the protective circuit. The framework and all the panels and doors are effectively connected to the frame. A continuous protective copper bar conductor is bolted to the frame at the bottom of the assembly. The effectiveness of the protective circuit for external faults and its short circuit withstand current are tested and verified in accordance with IEC 61439 clause 10.5.

Dielectric properties (clause 10.9)

The test may be performed either with an impulse withstand voltage, or with a power frequency withstand voltage. Both forms of test had been carried out on SMBE switchboards in accordance with IEC61439 clauses 10.9.2 and 10.9.3, with conformance without sign of puncture flashover.

Temperature-rise Limits (clause 10.10)

SMBE switchboards are verified in accordance with IEC 61439 to prove that the temperature rise inside the switchboards did not exceed the values specified in the standard.

Short-circuit withstand strength (clause 10.11)

The performance of an assembly under short-circuit conditions is one of the most important factors affecting its safety. Short-circuit withstand tests check two distinct aspects of the assembly's design and construction, namely mechanical strength and thermal capability.

Factors which testing verifies, and which further complicate attempts at extrapolation, include:

1. Conductor positioning and enclosure strength:
2. Correct mounting for devices and cables; and
3. The effect of arc emissions of circuit breakers.

SMBE switchboards are tested to withstand for both 1 second and 3 seconds duration with the following criteria:

- The conductors and busbars did not show any undue deformation;
- The insulation of the conductors and the supporting insulation parts did not show any significant signs of deterioration and had proven that the mechanical and dielectric properties satisfy the requirement of IEC 61439 clause 10.11;
- No loosening of parts used for connection of conductors and conductors did not separate from the outgoing terminals;
- Enclosure did not show undue deformation and had proven that the degree of protection is not impaired.

Electromagnetic compatibility (clause 10.12)

It is important to know if the switchboards causes radio interference in which case the user may be required to take adequate measures especially in a radioactive environment. SMBE switchboards are verified in accordance with IEC 61439 clause 10.12 to be free from EMC emission and immune to EMC disturbance.

Mechanical operation (clause 10.13)

Each circuit breaker was operated 200 times. And each withdrawable air circuit breaker withstood 200 cycles of mechanical operation from connected to disconnected position and back to the connected position. The breakers used in the switchboards are verified by the above tests and had not impaired and had practically the same effort for operation as before the test.

The M-cube switchboards which have a current rating up to 6300A, have successfully undergone the above tests in full compliance with IEC 61439, SMBE switchboards undoubtedly offer a full designed, engineered and proven solution which minimise risk, and maximise reliability.

Designation	Current Rating (A)	Short Time Withstand Current (Main Power Distribution System)		Ingress Protection (IP)	Form of Separation
M-Cube 06	600A	-	36kA rms 3sec	IP44	Form 4b
M-Cube 08	800A	-	36kA rms 3sec	IP44	Form 4b
M-Cube 10	1000A	65kA rms 1sec	43kA rms 3sec	IP44	Form 4b
M-Cube 16	1600A	65kA rms 1sec	50kA rms 3sec	IP44	Form 4b
M-Cube 25	2500A	100kA rms 1sec	65kA rms 3sec	IP44	Form 4b
M-Cube 32	3200A	100kA rms 1sec	65kA rms 3sec	IP44	Form 4b
*M-Cube 40 Compact	3700A	100kA rms 1 sec	65kA rms 3sec	IP43	Form 4b
M-Cube 40	4000A	100kA rms 1sec	85kA rms 3sec	IP44	Form 4b
M-Cube 50	5000A	100kA rms 1sec	100kA rms 3sec	IP44	Form 4b
M-Cube 63	6300A	125kA rms 1sec	100kA rms 3sec	IP43	Form 4b
*M-Cube 25 WD	2500A	75kA rms 1 sec	75 kA rms 1sec (Vertical Dropper)	IP44	Form 4b

* Compact: Compact Switchgear Design
* WD: Withdrawable System
* Verified with Arc Fault Containment to IEC 61641

Certification

SMBE had been awarded the “Singapore Green Building Council Certification” on achieving Green Mark for Switchgear. Being a Singapore Green Building Product means being able to promote sustainability in the built environment & raise environment awareness. In Singapore, only 840 buildings have been awarded the Green Mark as of 2013.

In our aim to be at the forefront as a Global Energy Solution Leader, SMBE LV Switchgear has been awarded with Green Mark of **2 out of 3 ticks** for all our switchgear range. The points are then used in the **Green Mark Assessment section** to achieve additional value to acquire the various tiers in the Green Award.