ABBACUS
Metal Enclosed Capacitor Bank
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1. Introduction

ABBACUS Metal Enclosed Capacitor Bank

ABB is the world’s leading capacitor manufacturer. This competence has led to a fully integrated ABB solution known as ABBACUS, for reactive compensation in medium voltage networks.

The ABBACUS combines primary components, and secondary control and protection, within a compact modular enclosure. The system can be either configured as a fixed or switched capacitor bank. The switched bank consists of single or multiple steps, automatically controlled to improve power factor.

The design of the ABBACUS provides compensation for both electrical distribution utilities and large industrial power users including mining, pulp and paper, chemical, petrochemical, wind farms, plastics and heavy industry.

The ABBACUS is available in a range of MECB (Metal Enclosed Capacitor Bank) models and is suitable for voltage ranges between 1 kV and 24 kV. For higher voltages contact ABB.

The ABBACUS is assembled and factory tested in an ISO 9001 and ISO 14001 environment.
## 2. Features and Benefits

### What does ABBACUS offer?

ABB has utilised its extensive experience both in component design and application engineering to design a superior solution. The ABBACUS offers the flexibility through its modular approach to meet the varying requirements and specifications of utility and industrial users.

The ABBACUS is a smart solution which aims to fulfill the needs identified through an extensive customer survey.

These needs are addressed in some of the benefits the ABBACUS offers;

- Reliability and Performance
- Commercial
- Safety
- Flexibility
- Easy to Use
- Real Estate Saving

A features and benefits analysis is outlined below.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABB’s experience and knowledge</td>
<td>Reliability and Performance</td>
</tr>
<tr>
<td>ABB’s premium range of components</td>
<td></td>
</tr>
<tr>
<td>- Consistency of quality</td>
<td></td>
</tr>
<tr>
<td>- Proven technology</td>
<td></td>
</tr>
<tr>
<td>- Leading capacitor manufacturer</td>
<td></td>
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<tr>
<td>- Type tested solution</td>
<td></td>
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<tr>
<td>Factory tested</td>
<td></td>
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<tr>
<td>Integrated design of primary and secondary equipment</td>
<td></td>
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<tr>
<td>Durable aluminium enclosure suitable for a variety of applications</td>
<td></td>
</tr>
<tr>
<td>Reduces operating costs</td>
<td>Commercial</td>
</tr>
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<td>Tangible return on investment</td>
<td></td>
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<td>Proven ABB design reducing life cycle costs</td>
<td></td>
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<tr>
<td>Fully enclosed design protecting live parts</td>
<td>Safety</td>
</tr>
<tr>
<td>Safety levels ranging from pad lockable doors through to interlocking with upstream devices</td>
<td></td>
</tr>
<tr>
<td>Explosion venting in each module</td>
<td></td>
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<tr>
<td>Modular in design</td>
<td>Flexibility</td>
</tr>
<tr>
<td>Expandable design to meet the needs of increased plant load</td>
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<tr>
<td>Relocatable asset, can be moved as plant demands change</td>
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<tr>
<td>Maximise factory assembly</td>
<td>Easy to use</td>
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<td>- minimise plant down time</td>
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<td>- simple installation</td>
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<tr>
<td>Ease of handling</td>
<td>Real estate saving</td>
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<td>Compact design</td>
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</table>
3. Power Factor

3.1 Why improve power factor?

- Reduce electricity charges
- Reduced energy losses
- Increase network capacity
- Economically plan new electrical infrastructure
- Reduce voltage drop
- Reduce the effects of starting large machines

3.2 How do you improve power factor?

A capacitor generates reactive power. When connected to an apparatus, which requires reactive power, the load on cables and transformers is relieved, thereby increasing the transmission capacity of active power.

Figure 1: Uncompensated Load
Shows the relationship between apparent (S), active (P) and reactive power (Q) at a certain power factor (\(\cos \phi\)) of the load. The load is uncompensated and if the conductor or the transformer is fully loaded the arc of the circle defines the maximum power output.

Figure 2: Compensated Load
Shows the reactive output (Q) from the power supply network reduced by the capacitor output (Q\(_c\)) to (Q\(_1\)) when applying power factor correction. The total load on the power supply network is reduced from (S) to (S\(_1\)) at an unchanged active power output.

Figure 3: Compensated Load where the load is increased
With the capacitor in service additional machines now may be connected, ie the load may be increased. Figure 3 shows an increase of active load from (P) to (P\(_'\)). The capacity of the conductor or the transformer is fully utilised when (S\(_2\)) equals (S).

3.3 Where to use power factor correction

Capacitors can be connected at different points in the network to improve the power factor of one or many loads. Each of these methods are a part of the ABBACUS solution.

Central Compensation
When the main purpose is to reduce reactive power purchased, due to power supplier’s tariffs, central compensation is preferable.

Group Compensation
Group compensation instead of central compensation is preferable if sufficiently large capacitors can be utilised. In addition to what is obtained at central compensation, load on cables is reduced and losses decrease.

Individual Compensation
The special advantage with individual compensation is that existing switching and protective devices for the machine to be compensated can also be utilised for switching and protection of the capacitors.
3.4 Harmonics

Harmonics are an important aspect when considering power factor correction. The ABBACUS range includes a number of options to overcome the effects of these harmonics.

Modern electrical equipment consists of nonlinear devices which generate harmonics. Examples of these devices include the following:

- Equipment containing electronics that control other apparatus, eg variable speed drives, soft starters, static compensators, rectifiers, etc
- Arc furnaces
- In certain cases, transformers, reactors and rotating machines
- Domestic appliances.

Harmonics are not only found in industrial networks, they can also spread into the distribution network and cause problems for other power users. Common problems that harmonics can produce include:

- Overloading of capacitors, leading to malfunctioning and premature aging
- Increased losses, eg machines will operate at increased temperatures
- Resonance problems between the inductive and capacitive parts of the network
- Malfunctioning of control systems
- Interference with telecommunication and computer equipment
- Disturbances in ripple control systems
- High currents in neutral conductors.

Harmonics distort the sine wave (50 Hz or 60 Hz signal) which becomes apparent when a distorted sine wave is mathematically analysed. The example below shows that the distorted wave consists both of the fundamental frequency (eg 50 Hz) and super-imposed 5th (250 Hz) and 7th (350 Hz) harmonic frequencies.

3.5 Resonance

Resonance can be a problem when capacitors for power factor correction are applied to networks with nonlinear loads that inject harmonic currents. With the ABBACUS solution this is no longer a problem.

Resonance is a special network condition in which the inductive reactance is equal to the capacitive reactance. All circuits have a resonant condition at some particular frequency, known as the natural frequency of the circuit. Capacitors may lower the resonant frequency of a network enough to create a resonant condition with the harmonic currents. As resonance is approached, the magnitude of harmonic current in the network and capacitor becomes much larger than the harmonic current generated by nonlinear loads. The higher current may be sufficient to damage capacitors.

A solution to this problem is to tune the circuit away from the resonant frequency. Tuning away from this resonant frequency is often referred to as ‘detuning’.
4. Product Modularity

4.1 Single Line Diagram

The ABBACUS design will consist of an incoming module and/or connecting power modules housing the primary equipment with optional secondary and ancillary equipment kits. The ABBACUS design is modular allowing future expandability.

4.2 Incomer Module

The incomer module facilitates connection to the customer network. It comprises of a high voltage compartment and a control cubicle allowing for a single point termination of power cables and control wiring. (Refer to Section 5 for technical aspects of the key components.)

4.2.1 Control Cubicle

The Control Cubicle for the ABBACUS depending on the MECB series can accommodate the following options:
- Power factor controller
- Modbus communication
- Safety interlock keys
- Over current/earth fault protection relay
- Unbalance protection relay
- Unbalance/overload protection relay
- Under/overvoltage protection relay
- Local/remote and manual/automatic switching
- Alarm indication
  - power factor not reached
  - over temperature
  - over pressure
  - fuse failure.

4.2.2 High Voltage Section

The High Voltage Section for the ABBACUS range can according to the options selected accommodate the following:
- Incoming cable termination busbars
- Isolator/earth switch
- Surge arrestors
- Circuit breakers
- Protection voltage transformers
- Line current transformers
- Control voltage transformers
- Live line indication.
4.3 Power Module

The Power Modules in the ABBACUS when energised generate the reactive power. These modules are designed to be interconnected to each other and the incomer module. (For most models, refer to Section 6 for more detail). Using the ABBACUS selection tree seen in Section 6, an appropriate power module can be chosen depending on the required application. In addition, Section 6.2, ABBACUS Options Guide highlights the standard and optional features of each MECB model.

The Power Modules for the ABBACUS range can accommodate the following (see Section 5 for technical aspects of the key components):
- Capacitors
- Inrush reactors or detuning reactors
- HRC fuses
- Contactors
- Unbalance current transformers
- Rapid discharge voltage transformers
- Pressure switches
- Earthing stick
- Safety interlocks
- Lights
- Anti condensation heaters
- Connecting busbars
- Cable entry box
- Cooling fans
- Thermostats.
5. Key Components

ABB has invested significant research into the design and specification of every key component in the ABBACUS to ensure maximum reliability and performance. A full list of technical specifications is available in Section 8.

5.1 The ABBACUS Enclosure

5.1.1 General

The ABBACUS enclosure is constructed from AA-grade corrosion resistant Aluminium mounted on a hot-dipped galvanized base frame.

Aluminium offers the following benefits:
- Suitable for applications across a wide range of ambient temperatures.
- Three times the thermal conductivity of steel and is able to transfer heat from within the enclosure. It also has high reflectivity to minimize the effects of solar radiation.
- No magnetic properties eliminating the risk of eddy-currents formed by closed magnetic loops.
- High strength-to-weight properties making it a lightweight enclosure design.

Design

The enclosure is designed and tested up to IP54, suitable for indoor and outdoor applications over a wide range of environmental conditions.

Safety

The enclosure is designed to exhaust hot gases safely away from the operator under fault conditions. This is achieved by having every module designed with roof vents to exhaust gases vertically up and door vents to direct hot gases vertically down away from personnel.

Handling

The enclosure base frame incorporates fork and crane lifting facilities. This assists with trouble-free handling and assembly of modules on site.

Note. ABBACUS models MECB 12 FI 00, 12 FI 01 and 12 SI 00 are manufactured using zinc-coated steel suitable for indoor IP31 applications only.
5.1.2 Internal Environment

**Ventilation**
The ABBACUS enclosure is designed and tested with a ventilation system up to IP54. The design incorporates natural convection or forced draft cooling according to the application.

Where natural ventilation is sufficient, the air is drawn in through door vents and exits through eave vents.

When the low-noise design cooling fans are fitted, the air passes through a synthetic fibre filter and is directed towards internal components. The air then discharges through door vents.

**Anti-Condensation Heater**
The ABBACUS enclosure is designed with anti-condensation heaters to assist in controlling the effects of fluctuating ambient temperatures and humidity.

5.1.3 Safety Interlocking

The ABBACUS range offers a mechanical/solenoid interlocking scheme. This eliminates the possibility of a technician accessing live equipment.

5.1.4 Busbars

The busbar support system used in the ABBACUS, is made from tinned copper, is mechanically rated to withstand an unconditional fault level of 25 kA and thermally rated to withstand 20 kA for 3 seconds.
5.2 Incomer Module

5.2.1 High Voltage Section

**ABB Isolator/Earth Switch**
The ABB NAL isolator and EB earth switch provides the capacitor bank with visual isolation from the incoming cables and general earthing for the capacitor bank. The isolator and earth switch, when used together are mechanically interlocked for safety.

**ABB Circuit Breaker**
The ABB VD4 circuit breaker is designed to protect medium voltage capacitor banks.

**ABB Surge Arresters**
The ABB MWD surge arrestors offer protection of medium voltage capacitor banks against multiple over voltage strikes. The maintenance free, explosion and shatter resistant design is stable against shock and vibrations.

**ABB Voltage Transformers (Protection and/or control)**
The ABB range of voltage transformers are designed to detect over/under voltages and provide a signal to a protection relay. The ABB TDC range of voltage transformers provide a control voltage.

**ABB Current Transformers (Protection)**
The current transformers are designed to detect overcurrents in capacitor banks and provide a signal to a protection relay.

**Live Line Indication**
The ABBACUS is designed to accommodate live line indication to ensure the safety of operating personnel.

**Door Micro Switches**
The ABBACUS enclosure has been designed with door micro switches. This mechanism isolates the capacitor bank in the event that doors are opened while the equipment is live.
5.2.2 Control Cubicle

The ABBACUS design incorporates a fully integrated control and protection scheme using ABB's range of premium products.

**ABB Power Factor Controller**

The ABB RVC and RVT power factor controllers are available in the ABBACUS.

The RVC is a user-friendly controller which includes the essentials required for automatic power factor control. The RVT offers a higher level of functionality including MODBUS communication, as well as monitoring and logging of network parameters.

**ABB Protection Relays**

The ABB SPAJ, SPAU and REU range of well-proven relays provide protection to meet the specific needs of capacitor banks.
5.3 Power Module

5.3.1 ABB Capacitors

The ABB capacitor unit type CHD is designed for heavy-duty operation in Fixed, Enclosed and Pole Mount Banks in all climatic conditions.

The capacitors are impregnated with a biodegradable, non-PCB fluid with high insulation strength to ensure excellent electrical performance. The edges of the foil electrodes are folded enabling higher electrical stress to withstand high transient currents and minimising partial discharge. This ABB feature is superior to all other methods employed. The ABB capacitors have an extremely low failure rate and high reliability.

The ABB capacitor tank is constructed from a high-grade stainless steel providing excellent corrosion resistance. The seams are fully welded providing superior weld quality compared with other welding processes, resulting in virtually no risk of leakage. The ABB capacitors provide greater reliability and a longer service life.

ABB capacitors are offered in single, three or split phase designs depending on the application.

The ABB power capacitor is an all film design, with very low dielectric losses, low partial discharge, resulting in an extended life time. Each capacitor has several elements that consist of a dielectric of polypropylene film and aluminium foil, which are connected in series and parallel groups, and star or delta connections depending on design.

The split-phase capacitor can be used in applications as an economic alternative. Three units can be used in a two-stage switched system, providing an economical and space saving alternative to utilising six conventional capacitors. Alternatively, it can be used as a dual tap capacitor or as a redundancy in critical applications.

**ABB Pressure Switches**

ABB capacitor units can be fitted with a pressure switch to provide a simple but effective means of isolation in the event of excessive pressures within the container.

The pressure switches are rated at 250V and set to 1 bar.
5.3.2 ABB Reactors

The ABBACUS is supplied with reactors, the type of which is determined by the application. The ABB reactors are designed and manufactured according to the highest standards to ensure maximum protection and lifespan of components.

**Inrush Reactors**
Inrush reactors reduce the current surge when switching capacitor stages in parallel, as defined by international standards. These inrush reactors are aluminum wound and resin encapsulated.

**Detuning Reactors**
Detuning reactors prevent series and parallel harmonic resonance which can occur when capacitors are connected to a network where high levels of harmonic currents are present. The reactors are tuned according to the application and are of an iron cored dry type design.

5.3.3 ABB Contactors and Switches

The ABB Contactors and Switches are designed and type tested for heavy duty capacitor switching.

ABB is the world leader in vacuum interrupter (VI) technology. The use of these VI’s in ABB contactors and switches provides heavy duty switching and increased life span.
5.3.4 ABB Protection

**ABB HRC Fuses**
The HRC (high rupturing capacity) fuse links are used to protect capacitor banks and associated equipment against short-circuits. They protect against thermal and electromagnetic effects of heavy short-circuit currents by limiting the peak current values and interrupting the currents in several milliseconds.

**Fuse Failure Indication**
The fuse failure indicator can be fitted to provide the customer with indication of fuse operation under fault conditions.

**ABB Current Transformers (Unbalance Protection)**
The current transformers are designed to detect unbalanced currents in capacitor banks and provide a signal to a protection relay.

**ABB Voltage Transformers (Rapid Discharge)**
The ABB TDC range of voltage transformers are used for rapid discharge of capacitors.
In selecting your MECB model, first decide whether the bank is fixed or switched. Secondly, decide on the type of reactor required. This then provides the model numbers you can select. The additional options/requirements will then define the exact model. Section 6.3 provides a table highlighting the list of standard features and the options for the models.

6.1 ABBACUS Selection Tree
### 6.2 ABBACUS Model Number Code

<table>
<thead>
<tr>
<th>Model Number Code</th>
<th>MECB</th>
<th>7</th>
<th>Rated Voltage 7.2 kV</th>
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<tbody>
<tr>
<td>12</td>
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<td>12</td>
<td>Rated Voltage 12 kV</td>
</tr>
<tr>
<td>17</td>
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<td>Rated Voltage 17.5 kV</td>
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**VARIANT NUMBER**

REFER TO SECTION 7 FOR LAYOUT VARIANT NUMBER
### 6.3 ABBACUS MECB Guide

#### Enclosure General Details

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>ABBACUS 12 FD 00</th>
<th>ABBACUS 17 FD 00</th>
<th>ABBACUS 24 FD 00</th>
<th>ABBACUS 12 FD 10</th>
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</table>

* Please refer to Section 6.4 for the graphical representation of the Maximum Power Module Capacity
** For other 'P' values contact ABB
S Standard
O Optional
– Not Applicable/Not Available
## Incomer Module Control Cubicle

<table>
<thead>
<tr>
<th>Feature</th>
<th>MECB12 FD 10</th>
<th>MECB12 FD 01</th>
<th>MECB12 FD 02</th>
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<th>MECB17 SD 10</th>
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## Protection Relays

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## Alarm Indication Signals (wired to contacts)

<table>
<thead>
<tr>
<th>Feature</th>
<th>MECB12 FD 10</th>
<th>MECB12 FD 01</th>
<th>MECB12 FD 02</th>
<th>MECB17 FD 010</th>
<th>MECB17 FD 10</th>
<th>MECB24 FD 010</th>
<th>MECB12 SF 010</th>
<th>MECB17 SF 10</th>
<th>MECB24 SF 10</th>
<th>MECB12 SD 10</th>
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<td>Power Factor Not Reached</td>
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<td>Fuse Failure</td>
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<td>Over Pressure</td>
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<td>Door Micro Switch</td>
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## LED Indication

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<tr>
<th>Feature</th>
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<th>MECB12 FD 01</th>
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<th>MECB24 FD 010</th>
<th>MECB12 SF 010</th>
<th>MECB17 SF 10</th>
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## Power Module

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</table>

| Standard S                            | O            | O            | O            | O            | O            | O            | O            | O            | O            | O            | O            | O            |
| Optional O                            | –            | –            | –            | –            | –            | –            | –            | –            | –            | –            | –            | –            |
| Not Applicable/Not Available –       | –            | –            | –            | –            | –            | –            | –            | –            | –            | –            | –            | –            |
6.4 Maximum Power Module Capacity

6.4.1 Maximum Power Module Capacity ≤12 kV

![Graphs showing maximum step output for different MECB models](image-url)
6.4.2 Maximum Power Module Capacity >12 kV – 17.5 kV

6.4.3 Maximum Power Module Capacity >17.5 kV – 24 kV
The MECB is available in a range of assembly configurations making the ABBACUS suitable for a wide array of applications. The modular, expandable and compact design of the ABBACUS is able to satisfy current customer needs, whilst maintaining the flexibility to meet increased future demands if required.

The MECB 12 Fl 00/12 Fl 01/12 Sl 00 models are designed for indoor use and are available in IP31 configurations. Connection to the customer network is facilitated by a cable entry box on the side of the cubicle, or from underneath the enclosure (if required).

The remaining models in the ABBACUS range are suitable for both indoor and outdoor applications and are available in configurations up to IP54. The design consist of an incomer module (excluding MECB 12 FD 00/12 Fl 02/17 Fl 00/24 Fl 00) which facilitates connection to the customer network, assembled to one or up to four power modules (attached as needed) which generate the reactive power.

This section contains the available assembly configurations.
7.1 Mild Steel (Indoor Only) ABBACUS

7.1.1 Assembly Configurations ≤12 kV

FRONT VIEW: MECB 12 FI 00
FRONT VIEW: MECB 12 FI 01
SIDE VIEW: MECB 12 FI 00/01, MECB 12 SI 00

Cable entry box plus multiple power modules (up to 4 stages)

7.1.2 Power Modules ≤12 kV

MECB 12 FI 00
MECB 12 FI 01
MECB 12 SI 00
7.2 Aluminium (Indoor/Outdoor) ABBACUS

7.2.1 Assembly Configurations ≤12 kV

FRONT VIEW: MECB 12 FI 02 / MECB 12 FD 00
FRONT VIEW: MECB 12 FI 10 / MECB 12 FD 10
SIDE VIEW:
MECB 12 FI 02, MECB 12 FI 10,
MECB 7 SI 10, MECB 12 SI 10,
MECB 12 SI 11, MECB 12 FD 00,
MECB 12 FD 10, MECB 12 SD 10,

FRONT VIEW: MECB 7 SI 10, MECB 12 SD 10, MECB 12 SI 10, MECB 12 SI 11
Incomer plus multiple Power Modules (up to 4 stages)
7.2.1.2 Assembly Configurations >12 kV – 17.5 kV

FRONT VIEW: MECB 17 FI 00
FRONT VIEW: MECB 17 FI 10, MECB 17 FD 10
FRONT VIEW: MECB 17 SI 10
Incomer plus multiple power modules (up to 4 stages)
FRONT VIEW: MECB 17 SD 10
Incomer plus multiple power modules (up to 4 stages)
7.2.1.3 Assembly Configurations >17.5 kV – 24 kV

- FRONT VIEW: MECB 24 FI 00
- FRONT VIEW: MECB 24 FI 10
- FRONT VIEW: MECB 24 FD 10
- FRONT VIEW: MECB 24 SI 10
  Incomer plus multiple Power Modules (up to 4 stages)
- FRONT VIEW: MECB 24 SD 10
  Incomer plus multiple Power Modules (up to 4 stages)

SIDE VIEW:
- MECB 24 FI 10, MECB 24 SI 10
- MECB 24 FD 10, MECB 24 SD 10
7.2.2 Incomer Modules

7.2.2.1 Incomer Module ≤12 kV

7.2.2.2 Incomer Module >12 kV – 24 kV
7.2.3 Power Modules

7.2.3.1 Power Modules ≤12 kV
7.2.3.2 Power Modules >12 kV – 17.5 kV

MECB 17 FI 10

MECB 17 FI 00

MECB 17 SI 10

MECB 17 FD 10

MECB 17 SD 10
7.2.3.3 Power Modules >17.5 kV – 24 kV

ABBACUS General Arrangement | ABBACUS Metal Enclosed Capacitor Bank
8. Technical Specifications

The specification detailed below is for the standard ABBACUS. Contact ABB for solutions outside this specification.

### General
- **Voltage**: 1 – 24 kV
- **Control Voltage**: 230 – 240 V Standard
- **Maximum Output**: Up to 13.2 MVar
- **Frequency**: 50 or 60 Hz
- **Location**: Indoor or Outdoor
- **Ambient Temperature**: –10/+45°C #1
- **Altitude**: <1000 m above sea level
- **Humidity**: Maximum 90% RH non-condensing
- **Insulation Level**: ≤12 kV 28/75 kV BIL
  - >12 kV – 17.5 kV 38 / 95 kV BIL
  - >17.5 kV – 24 kV 50 / 125 kV BIL
- **Short Circuit Current**: Up to 50 kA for 1 second #
- **Bank Configuration**: Fixed, switched single or multistep
- **Standards**: IEC or equivalent

### Capacitors
- **Type**: Single, three or split-phase
- **Fusing**: Internal or unfused
- **Discharge Resistor**: Built-in
- **Losses**: <0.2 W / kVar including resistors
- **Dielectric**: Polypropylene film
- **Impregnant**: Faradol 810 non PCB
- **Container**: Stainless steel
- **Bushings**: Grey porcelain one, two or three

### Inrush Reactors
- **Type**: Single phase, air core
- **Inductance**: Specific to application
- **Continuous current**: 1.43 x capacitor current
- **Temperature class**: Max T55/F

### Detuning (Filter) Reactors
- **Type**: Single or three phase, iron core
- **Inductance**: Specific to application
- **Continuous current**: Specific to application
- **Harmonic loading**: Specific to application
- **Limit of linearity (95%)**: ≥1.7 x Nominal Current
- **Temperature class**: Max. T55/F

### Contactors and Switches

#### ABB Model VSC Electrically Latched
- **Voltage**: 7.2 kV
- **Type**: Vacuum
- **Phase**: Three
- **Continuous current rating**: 230 A capacitive
- **Mechanical endurance**: 100,000+ CO
- **Auxiliary contacts**: Available
- **Mechanism**: Magnetic actuator

#### ABB Model V-contact Electrically Latched
- **Voltage**: 7.2, 12 kV
- **Type**: Vacuum
- **Phase**: Three
- **Continuous current rating**: 230 A capacitive
- **Mechanical endurance**: 100,000+ CO
- **Auxiliary contacts**: Available
- **Mechanism**: Magnetic actuator

#### ABB Model PS15, PS25 Electrically Latched
- **Voltage**: 15, 25 kV
- **Type**: Vacuum
- **Phase**: Single
- **Continuous current rating**: 200 A capacitive
- **Mechanical endurance**: 25,000+ CO
- **Auxiliary contacts**: Available
- **Mechanism**: Magnetic actuator

### Circuit Breaker
- **ABB Model VD4**: Vacuum
  - **Phase**: Three
  - **Current rating**: 630 A
  - **Short time current**: 25 kA for 1 sec #
  - **Auxiliary contacts**: Available
  - **Mechanism**: Motor
  - **Interlocking**: Optional

### Isolator
- **ABB Model NAL**: Air insulated
  - **Phase**: Three
  - **Current rating**: 630 A
  - **Short time current**: 25 kA for 1 sec #
  - **Mechanism**: Snap action spring (hand operated)
  - **Interlocking**: Optional
Earth Switch

**ABB Model**

- **Type**: E, EB
- **Phase**: Air insulated
- **Short time current**: Three
- **Auxiliary contacts**: 25 kA for 1 sec
- **Mechanism**: Available
- **Snap action spring (hand operated)**: where fitted
- **Interlocking**: Optional

**Fuses**

**ABB Model**

- **Type**: CEF, CMF
- **Rated current**: HRC up to 315 A
- **Short time Current**: 50 kA (max)
- **Striker pin**: Fitted
- **Fuse clips**: Retaining type
- **Mounting**: Horizontal

**Surge Arresters**

**ABB Model**

- **Nom. Discharge current**: MWD 10 kApk (8/20 s)
- **Class**: 2
- **Energy capability**: 20 kA for 0.2 sec
- **Material**: 5.5 kJ / kV of Uc
- **Silicon rubber

**Cooling Fan**

- **Type**: Centrifugal
- **Volume**: 2960 m³/hr
- **Noise level**: 67dBA
- **Power**: 290 W

**Capacitor Unit Pressure Switch**

- **Pressure setting**: 1 bar
- **Contact rating**: 10 A, 240 VAC
- **Mechanical life**: 106 operations at 50 bar
- **Contact Type**: Changeover

**Anti-condensation Heater**

- **Heat output**: 800 W

**Busbars**

- **Type**: Hard drawn copper
- **Surface finish**: Tinned
- **Size**: 40 mm x 10 mm, 50 mm x 10 mm, 100 mm x 10 mm

**Voltage Transformer (rapid discharge)**

**ABB Model**

- **Type**: TDC4
- **Primary**: Epoxy resin cast
- **Secondary**: Specific to application
- **Discharge capability**: Not applicable
- **4 Mvar at rated voltage down to 50 V in 20 sec**

**Voltage Transformer (protection)**

**ABB Model**

- **Type**: SADTEM, Y12P
- **Primary**: Epoxy resin cast
- **Secondary**: Specific to application
- **Class**: 3P
- **Burden**: Up to 30 VA

**Current Transformer (unbalance)**

**ABB Model**

- **Type**: TPU 40.11
- **Primary**: Epoxy resin cast
- **Secondary**: Specific to application
- **Class**: 1 A
- **Burden**: 15 VA
- **Short Time Current**: 2 kA for 1 sec

**Current Transformer (protection)**

**ABB Model**

- **Type**: TPU 40.11
- **Primary**: Epoxy resin cast
- **Secondary**: 5 A
- **Class**: 5P20
- **Burden**: 15 VA
- **Short Time Current**: 25 kA for 1 sec

**Voltage Transformer (control)**

**ABB Model**

- **Type**: TDC4
- **Primary**: Epoxy resin cast
- **Secondary**: Specific to application
- **Class**: 1.0 M
- **Burden**: Up to 150 VA

**Live Line indication**

- **Voltage Rating**: 3 kV to 75 kV
- **Indication Type**: LED
- **Connection method**: Busbar clamp
- **Viewing**: Enclosure window

**Door Micro Switches**

- **Contact Rating**: 5 A, 240 VAC
- **Mechanical endurance**: 10,000,000 CO
- **Contact type**: Changeover
Enclosure

Material 'AA' Grade Corrosion Resistant Aluminium or Zinc-coated steel*
Base frame Hot dipped galvanized steel
Protection IP31 indoor, IP44/IP54 outdoor
Paint system Powdercoat RAL 7035
Door locking Front: Three point lockable handle. Side and Rear: Blind ¼ turn locks
Safety Interlocking Optional
Installation Base fixing
Handling Fork and crane lifting via base forklift or lifting brackets
Cable entry Bottom or optional side wall

Under/Over-Voltage Protection Relay

ABB Model REU610
Measuring System Microprocessor-based
Control Voltage 80 VAC to 265 VAC
Burden 15 VA
Current input 1 or 5 A
Alarm/Trip signal Volt-free contacts

Safety Interlocking
Type Mechanical or solenoid
Scheme Specific to application
Mounting Single and double door
Keys Supplied
Options Key exchange box
Time delay units

Power Factor Controller

ABB Model RVC, RVT
Measuring System Microprocessor-based system for single or three phase system Insensitive to harmonics
Control Voltage 110 VAC to 440 VAC
Burden 15 VA
Current input 5 A
Alarm Contact Normally closed 1.5 A, 250 VAC
Power Factor Setting 0.7 inductive to 0.7 capacitive
Communication MODBUS (RVT only)

Fuse Failure Indication
Contact Rating 6 A, 250 VAC
Contact type Changeover

Over Current/Earth-Fault Protection Relay

ABB Model SPAJ140C
Measuring System Microprocessor-based
Control Voltage 80 VAC to 265 VAC
Burden 15 VA
Current input 1 or 5 A
Alarm/Trip signal Volt-free contacts

Earthing Sticks
Stick Fibreglass rod, 1.8 m
Application Method Removable bayonet
Earthing Braid to main earth bar
Fault Level 13.1 kA for 0.5 sec
No of Phase Cables 3
Cable Lengths 3 m

Unbalance Protection Relay

ABB Model SPAJ141C
Measuring System Microprocessor-based
Control Voltage 80 VAC to 265 VAC
Burden 15 VA
Current input 0.2 or 1 A
Alarm/Trip signal Volt-free contacts

Unbalance/Overload Protection Relay

ABB Model SPAJ160C
Measuring System Microprocessor-based
Control Voltage 80 VAC to 265 VAC
Burden 15 VA
Current input 1 or 5A
Alarm/Trip signal Volt-free contacts

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Contact us

Please contact your local sales representative for further information

www.abb.com/powercapacitors
www.abbaustralia.com.au

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