ABB Power Products High Voltage
Italy
ABB’s Hybrid Module “PASS”

History of ABB’s Lodi Unit

- Located Northern Italy
- 30 min south of Milan

PASS Module

General

Description / Components

Advantages

PASS 420 kV

PASS M0H

MFM

SSVT

1926 – Established
Oil insulated Current Transformers for more than 50 years.

1981 – SF6 Stand-alone Current Transformers

2005 – New Focus Factory for High Voltage Power Products
Worldwide success

GIS Technology 1974

Pioneering Spirit 1990's
Inventors the Hybrid Switchgear
ABB’s Hybrid Module “PASS”

HS&E

PASS Module

General

Description / Components

Advantages

PASS 420 kV

PASS M0H

MFM

SSVT
**ABB’s Hybrid Module “PASS”**
**ITABB PGHV – Lodi Portfolio**

ITABB PGHV has expanded its portfolio thanks to its increasing expertise and global market demand for innovative solutions.

<table>
<thead>
<tr>
<th>Family</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PASS Family</strong></td>
<td>72.5 kV to 420 kV</td>
</tr>
<tr>
<td></td>
<td>M0H – 3 to 5 Bay Switchyard Pre-Assembled and Tested in the Factory.</td>
</tr>
<tr>
<td></td>
<td>Improved and more environmental friendly PASS 145 kV.</td>
</tr>
<tr>
<td><strong>MFM Family</strong></td>
<td>MFM - Mobile Substation and other</td>
</tr>
<tr>
<td></td>
<td>SSCRI</td>
</tr>
<tr>
<td><strong>IT Family</strong></td>
<td>TG – Current Transformer insulated in SF6 Gas (Up to 420 kV)</td>
</tr>
<tr>
<td></td>
<td>TVI – Voltage Transformer insulated in SF6 Gas (Up to 420 kV)</td>
</tr>
<tr>
<td></td>
<td>SSVT – Small Power Transformer (HV to MV or HV to LV) for service station</td>
</tr>
<tr>
<td></td>
<td>voltage or rural electrification.</td>
</tr>
<tr>
<td></td>
<td>(Up to 550 kV)</td>
</tr>
<tr>
<td></td>
<td>Next Level integrated solutions for Substations.</td>
</tr>
</tbody>
</table>
ABB’s Hybrid Module “PASS”
Reference Map

More than 5500 modules installed at July 2012
More than 7500 equivalent bays*

PASS Module

General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

* SBB = 1 bay equivalent
   * DBB = 1.5 bay equivalent
   * DCB = 2 bays equivalent
ABB Power Products High Voltage
Hybrid Module “PASS”
ABB's Hybrid Module “PASS”

What is PASS?

Typical Switchgear:

- **AIS**: Simple in Operation
- **GIS**: Increased Reliability
ABB's Hybrid Module "PASS"
What is PASS?

PASS Switchgear:

- AIS
- PASS
- GIS

Best of Both in One
ABB's Hybrid Module “PASS”
What is PASS?

PASS Module

General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

Current transformer
Voltage transformer
Circuit breaker
Disconnected Earthing Switch
ABB’s Hybrid Module “PASS”
What is PASS?

PASS Module

General
- Description / Components
- Advantages
- PASS 420 kV
- PASS M0H
- MFM
- SSVT

Functional integration

High

GIS
- Circuit Breaker
- Current Transformer
- Voltage Transformer
- Disconnector
- Earthing Switch
- Busbar / Busducts

Hybrid Modules
- Circuit Breaker
- Current Transformer
- Voltage Transformer
- Disconnector
- Earthing Switch

DTB
- Circuit Breaker
- Current Transformer

LTB
- Circuit Breaker

Encapsulation

No
Partial
Full
## ABB’s Hybrid Module “PASS”

### What is PASS?

<table>
<thead>
<tr>
<th>PASS Module</th>
<th>General Description / Components</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS Module</td>
<td>PASS M00</td>
<td>PASS M0</td>
</tr>
<tr>
<td>General</td>
<td><img src="image" alt="PASS M00" /></td>
<td><img src="image" alt="PASS M0" /></td>
</tr>
</tbody>
</table>

### General

- **PASS M00**
  - Up to 100 kV
  - 50 / 60 Hz
  - 2000 / 3150 A
  - 31,5 / 40 kA

- **PASS M0**
  - Up to 170 kV
  - 50 / 60 Hz
  - 3150 A
  - 40 / 50 / 63 kA

- **PASS M0S**
  - 252 and 420 kV
  - 50 / 60 Hz
  - Up to 5000 A
  - 50 / 63 kA

- **NEW PASS M0 H**
  - Up to 170 kV
  - 50 / 60 Hz
  - 2000 / 3150 A
  - 31,5 / 40 kA
ABB’s Hybrid Module “PASS”
Description/Components

PASS Module
General

Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”
Description/Components

PASS Module
General

Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

Gas Insulated Switchgear (SF6) for Outdoor

In a «standard» PASS Modules:

- Nu. 3 Single phase Circuit Breaker
- Disconnect and Earthing Switch
- Current Transformer

Optional:

- Voltage Transformer
- Cable Box
- Fast Earthing Switch
- Surge Arrester
The circuit breaker is SF₆ gas insulated auto puffer self blast type, designed and fully type tested in accordance to the relevant IEC 62271-100, moreover the circuit breaker have the following characteristics:

- metal clad enclosed type;
- auto re-closing facility;
- very low re-strike probability class C2;
- mechanical endurance class M2, suitable for at least 10,000 satisfactory open and close mechanical operations;
- fitted with power spring drive mechanism (BLK or BLG) or servo-motor driven by capacitor banks (MD 1.4), both solutions three-pole or single-pole operating;
- including pressure relief device or bursting disk to relive any pressure rise developed during internal flashover.
ABB’s Hybrid Module “PASS”
Description/Components: Disconnector/Earthing Switches

- Minimal number of mechanical components
- Reliable
- Maintenance-free.
- The position of the indicator:
  - Mechanical Shaft / Drive Position indicator
- Inspection window in the enclosure.
- The DS/ES can also be operated manually by means of a crank.

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”

Description/Components: Disconnector/Earthing Switches

PASS Module
General

Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”
Description/Components: Disconnector/Earthing Switches

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS MGH
MFM
SSVT

DRIVE POSITION INDICATOR
ABB’s Hybrid Module “PASS”

Description/Components: Current Transformer

- Ring type (slip over) cores.
- Then the cores are housed in cases. The cores are insulated using resin.
- Each bushing of the hybrid module can accommodate one case of multi-core and multi-ratio current transformers.
- The module are able to accommodate CTs on every side.
- The CTs are located between disconnect/earthing switch and bushing but on request also between breaker and disconnect/earthing switch (but losing slip over feature)
- The bushing current transformers are in accordance to IEC 61869-2 standard.
ABB’s Hybrid Module “PASS”

Description/Components: Bushing

PASS Module
General

**Description / Components**

**Advantages**
- Explosion proof
  - Maximum safety of personnel and equipment
- Non-brittle
  - Reduced handling damage risk
- Low weight
  - Easier handling and reduced foundation loads
- Maintenance free
  - No cleaning in polluted environments
- Outstanding seismic performance
  - For best safety and reliability

**Components**
- Glass fiber reinforced epoxy resin tube
- Silicone rubber sheds
- Aluminum end fitting
ABB’s Hybrid Module “PASS”
Description/Components: Voltage transformer & Surge Arresters

SF6 Insulated Voltage transformers
- PASS can be equipped on request with conventional GIS inductive voltage transformers. Similarly to Current Transformers, several combinations of windings for protection and measurements with different loads are available. Maintenance-free.

AIS Surge Arrester
- Air insulated surge arresters can be equipped on request.
ABB’s Hybrid Module “PASS”

Description/Components

LOCAL CONTROL CUBICLE

- Minimal number of mechanical components
- Standard IP44
- Different IP rating available
- Fixed on the Support Structure
- Pre-wired
- Hot dip galvanized steel or stainless steel
- Padlockable
ABB Power Products High Voltage Advantages
### ABB’s Hybrid Module “PASS”

#### Flexibility

<table>
<thead>
<tr>
<th>PASS Module</th>
<th>Description / Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td></td>
</tr>
</tbody>
</table>

- PASS is highly configurable and flexible
- The following are all PASS modules configured to the needs of our customers.

#### Advantages

- PASS 420 kV
- PASS M0H
- MFM
- SSVT
ABB’s Hybrid Module “PASS”

Flexibility

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”
Flexibility

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”

Flexibility

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”

Flexibility

PASS Module
General
Description / Components

Advantages
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MFM
SSVT
ABB’s Hybrid Module “PASS”

Flexibility

PASS Module
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ABB’s Hybrid Module “PASS”
Flexibility

PASS Module
General
Description / Components

Advantages
PASS 420 kV
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MFM
SSVT
ABB’s Hybrid Module “PASS”
Flexibility

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”
Transportability: 72.5 kV up to 245 kV Cases

TRANSPORTABLE

- Transport Configuration
- Service Position
ABB’s Hybrid Module “PASS”
Transportability: 420 kV Case

Advantages

- PASS 420 kV
- PASS M0H
- MFM
- SSVT

Transportable completely assembled!

DBB configuration

SBB configuration
ABB’s Hybrid Module “PASS”

Footprint

- Typical 132 kV Single Bus Bar (SBB) Substation - Side View
- Space (42.2 metres in length)
- Number of Components to Install & Commission (10)
- Number of Live contacts
ABB’s Hybrid Module “PASS”

Footprint

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

• Typical 132 kV Single Bus Bar (SBB) Substation - Side View
• Space (20 metres in length)
• Number of Components to Install & Commission (2)
• Number of Live contacts (minimized)
ABB’s Hybrid Module “PASS”

Footprint

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”

Footprint

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

- 80%
- 52%

AIS vs. PASS 420kV
- 40% Footprint

PASS Module
AIS
ABB’s Hybrid Module “PASS”
Life Cycle Cost

Full Economical Comparison for Each Substation Design

- Commissioning
- Structure Costs
- Equipment Costs
- Installation
- Connector, Busbar, Costs
- Civils Costs
- Land Costs
- Engineering Costs
- Maintenance Costs 20 years

Equipment Type: 20% saving compared to AIS

PASS Module
General
Description / Components

Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”

E&C

- Installation & Commissioning – at it’s simplest.
- Approximately **24 Hours**.
### ABB’s Hybrid Module “PASS”

About us: IEC 62271-205 and CIGRÈ 390 PAPER

<table>
<thead>
<tr>
<th>Description / Components</th>
<th>PASS Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>PASS Module</td>
</tr>
<tr>
<td>Advantages</td>
<td>PASS 420 kV</td>
</tr>
<tr>
<td></td>
<td>PASS M0H</td>
</tr>
<tr>
<td></td>
<td>MFM</td>
</tr>
<tr>
<td></td>
<td>SSVT</td>
</tr>
</tbody>
</table>

**INTERNATIONAL STANDARD**

**NORME INTERNATIONALE**

<table>
<thead>
<tr>
<th>High voltage switchgear and controlgear – Part 205: Compact switchgear assemblies for rated voltages above 52 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appareillage à haute tension – Partie 205: Ensembles d'appareillages compacts de tensions assignées supérieures à 52 kV</td>
</tr>
</tbody>
</table>

EVALUATION OF DIFFERENT SWITCHGEAR TECHNOLOGIES (AIS, MTS, GIS) FOR RATED VOLTAGES OF 52 V AND ABOVE

Working Group B5.20

August 2009
ABB’s Hybrid Module “PASS”
About us: Reliability - CIGRÈ studies

MTS: Mixed Technology Switchgear (i.e. HGIS)

<table>
<thead>
<tr>
<th>Title</th>
<th>AIS</th>
<th>MTS</th>
<th>GIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maintainability</td>
<td>-</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>• Meantime of maintenance</td>
<td>+</td>
<td>++</td>
<td>0</td>
</tr>
<tr>
<td>• Reliability (*indoor applications)</td>
<td>0</td>
<td>+</td>
<td>+ (+) *</td>
</tr>
<tr>
<td>• Mean time of repair</td>
<td>+</td>
<td>++</td>
<td>0</td>
</tr>
<tr>
<td>• Tools, gas handling</td>
<td>+</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Interpretation of symbols:

"++" denotes this technology confers Definite Advantage
"+"  denotes this technology confers Advantage
"0"  represents Neutral Status
"-"  denotes Disadvantage
"- -" denotes Definite Disadvantage

CIGRÈ – Working Group B3-20 – Evaluation of Different Switchgear Technologies (AIS, MTS, GIS)
for Rated Voltages of 52 kV and above.
W. Degen (Convenor), A. M. Sahazizian, D. Kopejkova, E. Duggan, J. Kunt, Z. Lefter, S. Guerra, T. Messinger,
On CIGRE analysis Hybrid module is considered as an advantageous trade-off solution between AIS and GIS. Mixed Technology Switchgear is considered to be the less expensive solution in term of ownership and the most available one.

CIGRE – Working Group B3-20 – Evaluation of Different Switchgear Technologies (AIS, MTS, GIS)
for Rated Voltages of 52 kV and above.
ABB’s Hybrid Module “PASS”
Maintenance Guide

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

Three Types:
- Periodical Inspections
- Preventive Maintenance
- Revision
ABB’s Hybrid Module “PASS”

Maintenance Guide

Three Types:
- Periodical Inspections
- Preventive Maintenance
- Revision

Periodical Inspection
- 1 / Year

PASS Module
General
Description / Components
Advantages
PASS 420 kV
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ABB’s Hybrid Module “PASS”
Maintenance Guide

Three Types:
- Periodical Inspections
- Preventive Maintenance
- Revision

Periodical Inspection
- 1 / Year

Preventative Maintenance
- After 5000 mechanical operations
- After 20 years of service.
- When the number of short-circuits is approaches a determined value
ABB’s Hybrid Module “PASS”
Maintenance Guide

Three Types:
- Periodical Inspections
- Preventive Maintenance
- Revision

Periodical Inspection
- 1 / Year

Preventive Maintenance
- After 5000 mechanical operations
- After 20 years of service.
- When the number of short-circuits is approaches a determined value

Revision
- After 10000 mechanical operations
- 40 years of service
Functional and visual inspections are carried out without opening the gas compartments.

Every year a visual inspection (with the module in service) of the following parts is recommended:

- Bushings
- SF₆ density device and relevant indication;
- Number of circuit breaker operations;
- Tightness of Local Control Cabinet door gaskets;
- General check of the compartments: position indicators, connectors, cables, equipotential connections, earthing circuit. None of the auxiliary equipment shall be worn or overheated and no vibration shall harm the relays.

At the end of the first year we recommend to retighten screw joints related to anchor bolts and earthing connection and check the absence of corrosion or deterioration of components.
# ABB’s Hybrid Module “PASS”

## Periodical Inspection

<table>
<thead>
<tr>
<th>Inspection type</th>
<th>Timing / tools / personnel</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual inspection of bushing</td>
<td>• Every year</td>
<td>Standing on land check on all sides the condition of sheds</td>
</tr>
<tr>
<td></td>
<td>• No Tools needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unskilled personnel</td>
<td></td>
</tr>
<tr>
<td>Check of SF6 density device</td>
<td>• Every year</td>
<td>Record the value seen on the device and compare it with the reference value</td>
</tr>
<tr>
<td></td>
<td>• Tools needed: reference values on Schematic Diagram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unskilled personnel</td>
<td></td>
</tr>
<tr>
<td>Recording the number of circuit breaker operations</td>
<td>• Every year</td>
<td>Record the number of circuitbreaker operations reported on counter located on LOC</td>
</tr>
<tr>
<td></td>
<td>• No Tools needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unskilled personnel</td>
<td></td>
</tr>
<tr>
<td>Tightness of door gaskets</td>
<td>• Every year</td>
<td>Open the door of LCC and check the gasket condition</td>
</tr>
<tr>
<td></td>
<td>• No Tools needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Skilled personnel or personnel certified by ABB Adda Service at level 3</td>
<td></td>
</tr>
<tr>
<td>General check of the components</td>
<td>• Every year</td>
<td>Check position indicators, connectors, cables, equipotential connections, earthing circuit. None of the auxiliary equipment must be worn or overheated and shall no vibration harm the relays.</td>
</tr>
<tr>
<td></td>
<td>• No Tools needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unskilled personnel</td>
<td></td>
</tr>
<tr>
<td>Retighten screw joints related to anchor bolts and earthing connection</td>
<td>• End of the first year</td>
<td>Check the tighten of anchor bolts and earthing connection and retighten if necessary.</td>
</tr>
<tr>
<td></td>
<td>• Tools needed: torque wrench, module layout</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unskilled personnel</td>
<td></td>
</tr>
</tbody>
</table>

Instruction Table with details of the operations (Page 5)
## Preventative Maintenance

- After 5000 mechanical operations
- After 20 years of service.
- When the number of short-circuits is approaches a determined value

<table>
<thead>
<tr>
<th>PASS 72.5 kV 31.5 kA</th>
<th>Number of Operations</th>
<th>3.000</th>
<th>1.200</th>
<th>160</th>
<th>40</th>
<th>20</th>
<th>10</th>
<th>8</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Circuit Current (kA)</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PASS 145 kV 40 kA</th>
<th>Number of Operations</th>
<th>5.000</th>
<th>800</th>
<th>200</th>
<th>89</th>
<th>50</th>
<th>32</th>
<th>20</th>
<th>13</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Circuit Current (kA)</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PASS 420 kV 63 kA</th>
<th>Number of Operations</th>
<th>10.000</th>
<th>1.000</th>
<th>650</th>
<th>300</th>
<th>150</th>
<th>25</th>
<th>50</th>
<th>20</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Circuit Current (kA)</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>20</td>
<td>80</td>
<td>35</td>
<td>50</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>
Preventative Maintenance

Most are visual checks or other checks such as:

- Check alarms, pressure gauge condition
- Check moisture level (connect hygrometer to PASS filling device)
- Check lubrication
- Retighten screws and bolts

More demanding operations:

- Repetition of commissioning mechanical tests
- Visual inspection of contacts and CB chamber condition
- Check contact resistance of main circuit

- Outage required
- Spares
- Requires different training levels
## ABB's Hybrid Module “PASS” Revision

<table>
<thead>
<tr>
<th>Description / Components</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS Module</td>
<td>After 10000 mechanical operations</td>
</tr>
<tr>
<td>General</td>
<td>40 years of service</td>
</tr>
<tr>
<td>Description / Components</td>
<td>Normally carried out with the replacement of the PASS Module.</td>
</tr>
<tr>
<td>Advantages</td>
<td>Complete module revision or replacement of the worn part.</td>
</tr>
</tbody>
</table>
ABB’s Hybrid Module “PASS”

Questions?

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

PASS 66 kV in Switzerland
ABB Power Products High Voltage
PASS 420 kV
ABB’s Hybrid Module “PASS”
PASS 420 kV

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

PASS 420 kV – GAS INSULATED OUTDOOR SWITCHGEAR (FULLY TRANSPORTABLE!)
© ABB
10/17/2016

| Slide 54 |

ABB’s Hybrid Module “PASS”
PASS 420 kV – Features

- High Flexibility and Fast erection and commissioning:
  - PASS M0S 420 kV is the only 420 kV device that arrive on site **COMPLETELY assembled**! Even AIS switchgear arrive at least in 2 parts!

- The only 420 kV switchgear able to be mounted and transported on trailer or skid as a complete mobile solution from factory

- **No HV test on site**, SF6 is already inside. PASS M0S is pre-tested in the factory.

- **Footprint reduction** roughly 60% vs AIS S/S

- **Reduced quantity of foundations**, ducting, primary and civil design

- Reduction of steel structure and civil works

- Quick installation on site:
  - Reduced time for energization, less than 1 week for a 420 kV bay

- **Minimized maintenance time**

- Complete pole as spare completely assembled on site to reduce outage of service
ABB’s Hybrid Module “PASS”

PASS 420 kV

PASS Module
General
Description / Components
Advantages

PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”
PASS 420 kV – Easy Installation on rails

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB Power Products High Voltage
PASS M0H
Most demanding and complex part of a substation – the switchyard.
ABB’s Hybrid Module “PASS”

H Substation

<table>
<thead>
<tr>
<th>TYPE</th>
<th>AREA (m²)</th>
<th>REDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS</td>
<td>1361.88</td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>471.75</td>
<td>65%</td>
</tr>
</tbody>
</table>
ABB’s Hybrid Module “PASS”

H Substation

H4 145 kV Footprint comparison in square meters

- AIS: 21x33 sqm
- PASS SBB: 21x18,5 sqm
- PASS DCB: 21x13,5 sqm
- PASS M0 H: 15x5 sqm
ABB’s Hybrid Module “PASS”
H Substation

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT
ABB’s Hybrid Module “PASS”
PASS M0H

PASS Module
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Description / Components
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PASS M0H

PASS Module
General
Description / Components
Advantages
PASS 420 kV
PASS M0H
MFM
SSVT

• PASS M0H - Making execution simpler and faster
### ABB’s Hybrid Module “PASS”
### PASS M0H

- Fully Transportable – Completely assembled
EASE OF INSTALLATION ON SITE

- The module can be easily positioned thanks to the use of landing legs which raise the module from the truck.
- The civil works involved for this is minimized and simplified.
ABB’s Hybrid Module “PASS”
PASS M0H

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ABB’s Hybrid Module “PASS”
PASS M0H

Safety condition for the operator are ensured thanks to a security distance from the dangerous areas indicated with blue spheres.

PASS Module
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MFM
SSVT
ABB’s Hybrid Module “PASS”

Questions?

PASS Module
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PASS 420 kV
PASS M0H
MFM
SSVT

PASS 66 kV in Switzerland
ABB's Multi-Functional Module “MFM”

General

Single Trailer or Skid:

- Surge Arrester
- Disconnector and Earthing Switch
- Current Transformer
- Circuit Breaker
- Power Transformer
- Control & Protection
ABB's Multi-Functional Module “MFM”

General

Typical Ratings:

- Voltage Rating: 66 to 145 kV
- Power Rating: 25 to 60 MVA

- HV Switchgear – Gas Insulated Switchgear for Outdoor type «PASS»
# ABB's Multi-Functional Module “MFM”

## General

<table>
<thead>
<tr>
<th>PASS Module</th>
<th>General</th>
<th>Description / Components</th>
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<th>PASS 420 kV</th>
<th>PASS M0H</th>
<th>MFM</th>
<th>SSVT</th>
</tr>
</thead>
</table>

### Considerations in the design:

- Weight
- Dimensions
ABB's Multi-Functional Module “MFM”

General

- Control & Protection: ABB REF 615, ABB RET 630
- Power Transformer: ODAF Cooling, OLTC
- High Voltage Bay: Circuit Breaker, Disconnector / Earthing, Current Transformer, Voltage Transformer
- Surge Arrester
There is the possibility to have a direct SF6/Oil connection between the High Voltage Bay and the Power Transformer.
Did you know?
ABB Manufactured the first 60 MVA 230 kV Mobile Substation
Power and productivity for a better world™