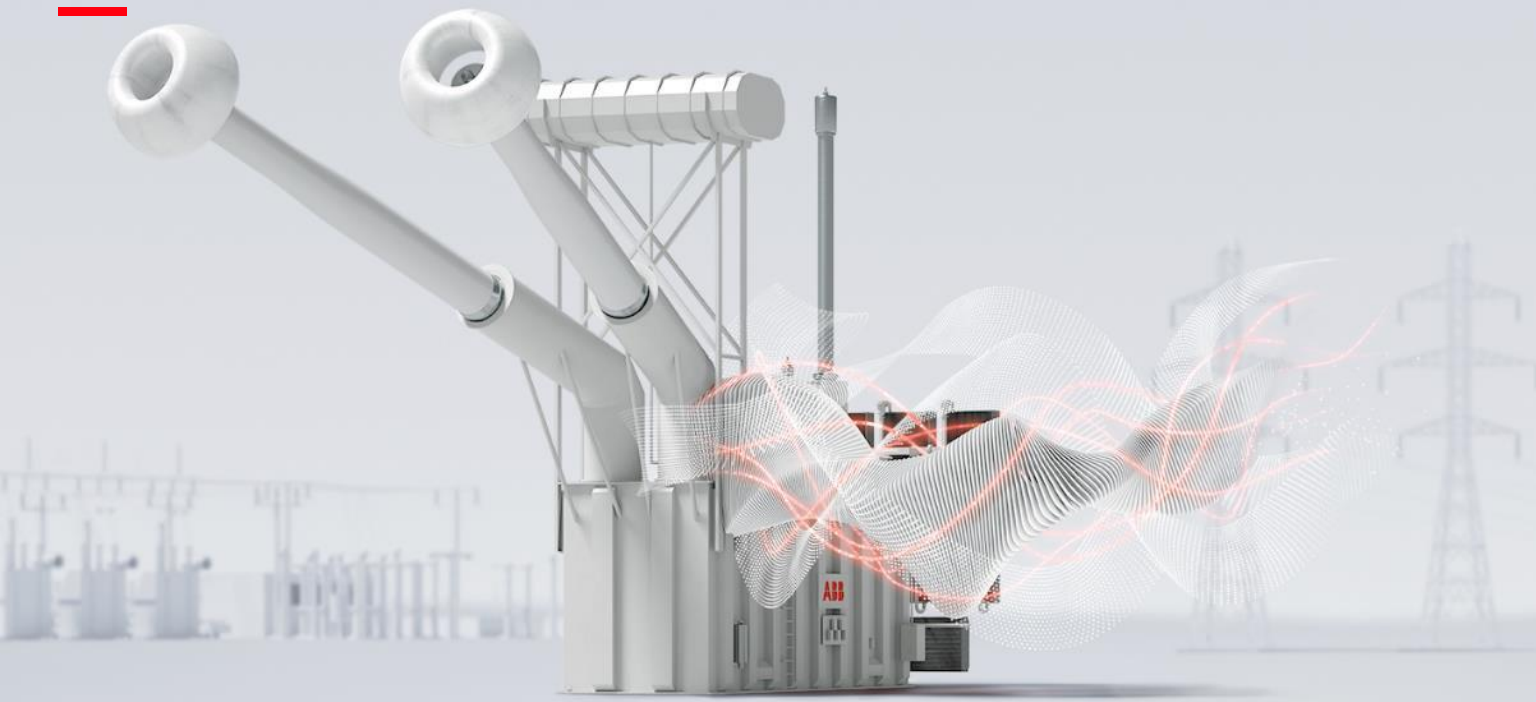

II JORNADAS TÉCNICAS - ABB EN PERÚ, 6 ABRIL, 2017

Subestaciones Híbridas encapsuladas y sus aplicaciones

Stefano Cervidi | Area Sales Manager, ABB S.p.A PG High Voltage Products UO Adda, Italy

Subestaciones Híbridas encapsuladas y sus aplicaciones
Agenda

1. What is PASS?
2. PASS Advantages
3. Success Stories and references
4. Conclusions

Subestaciones Híbridas encapsuladas y sus aplicaciones
Agenda

1. **What is PASS?**
2. PASS Advantages
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1. What is PASS? – Overall Description

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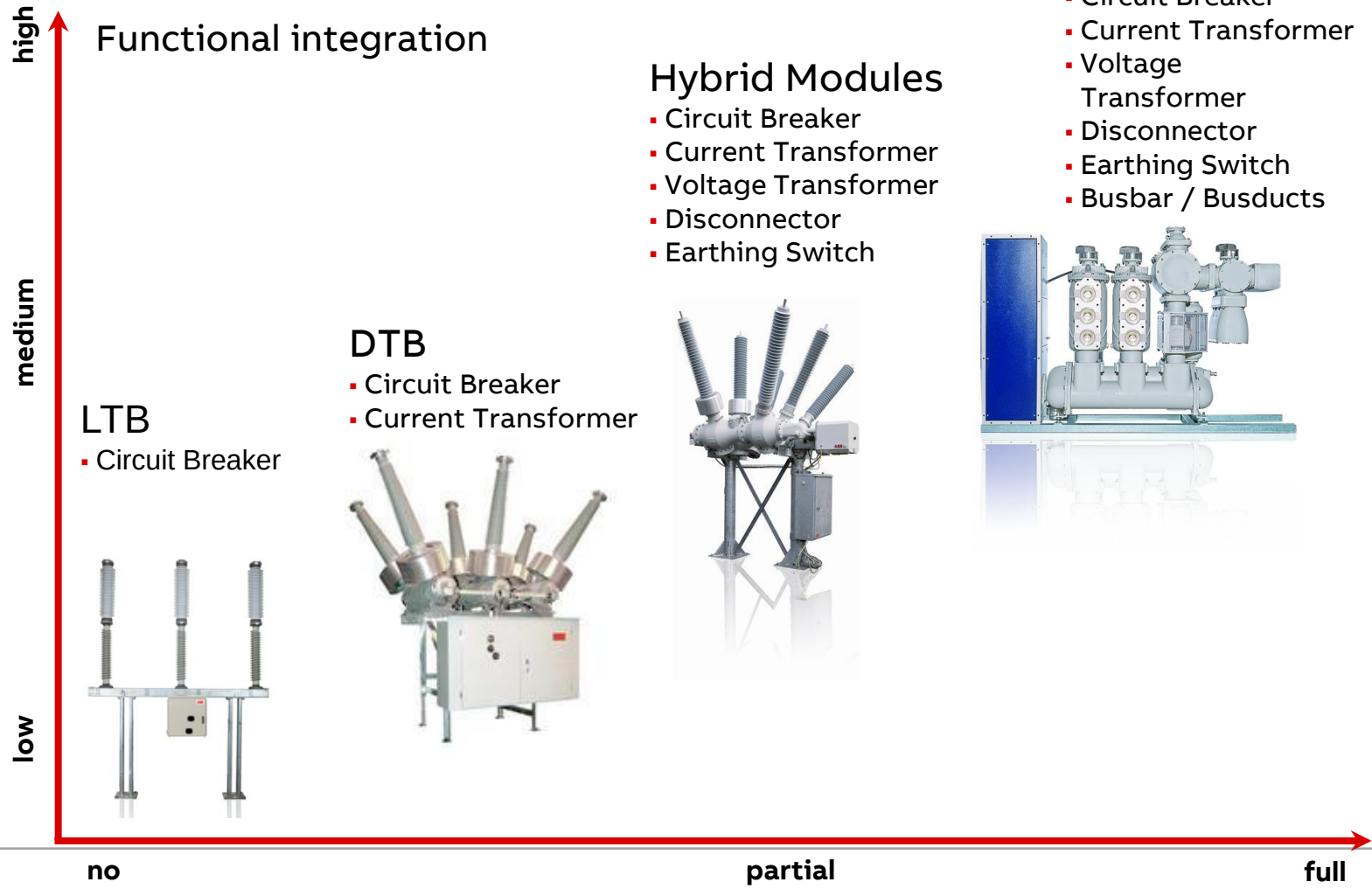

1. What is PASS? – Portfolio

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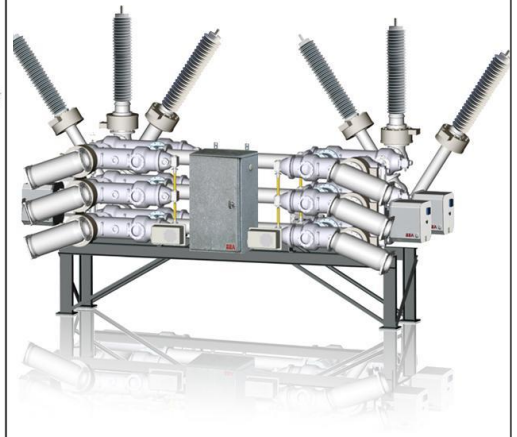
PASS M00	PASS M0	PASS M0S	NEW PASS M0 H
			
Up to 100 kV	**Up to 170 kV**	**252 and 420 kV**	**Up to 170 kV**
50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
2000 / 3150 A	3150 A	Up to 5000 A	2000 / 3150 A
31,5 / 40 kA	40 / 50 / 63 kA	50/ 63 kA	31,5 / 40 kA

1. What is PASS? – Components

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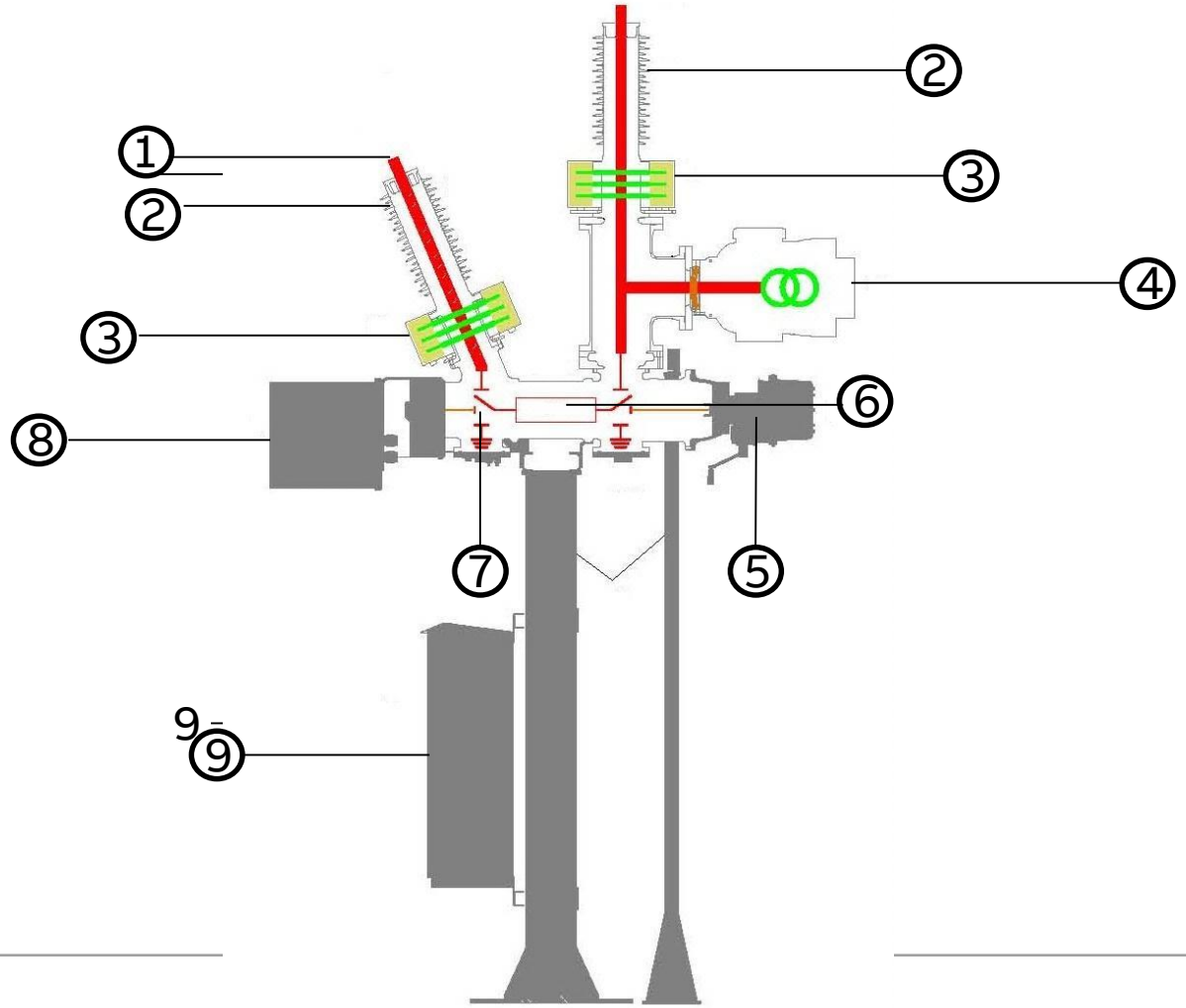

1. Stud for HV connection
2. Bushing
3. Current transformer
4. SF6 Voltage transformer inductive type
5. DS/ES Operating drive mechanism
6. Circuit breaker
7. Combined Disconnector/Earthing switch
8. BLK – Spring-type circuit breaker operating mechanism
9. Local control cubicle

1. What is PASS? – Circuit Breaker

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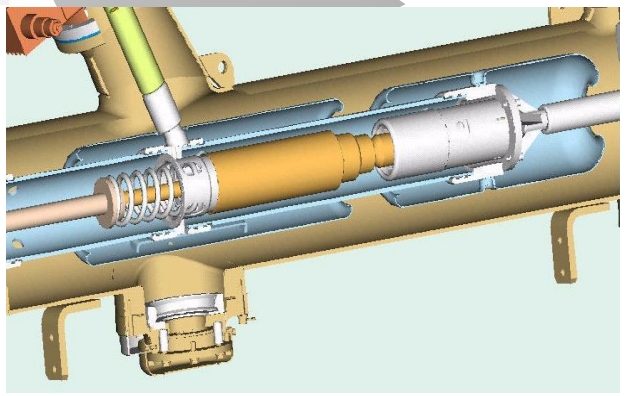

Self-blast or Auto-puffer™
Arc-assisted pressure generation leads to less need of interrupting energy

- Smaller operating mechanism
- Lower stresses on mechanical components

1. What is PASS? – BLK Spring Drive

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BLK spring drive

Simple optimized spring drive designs, based on years of experience: first delivery 1990.

- Extremely reliable
- Low power consumption
- Precise and stable operating times

1. What is PASS? – Motor Drive MD 1.4

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PASS M0 can be equipped as request with the innovative Motor Drive.

A motor drive is a digitally controlled motor that directly moves the circuit-breaker contacts. ABB has developed a servomotor system with digital control, able to directly drive the circuit breaker contacts in a highly accurate and reliable way.

- The motor drive is type tested in accordance with IEC and ANSI Standards.
- Each motor drive is pre-tested and shipped to the installation site in the form of a few pre-assembled units.

1. What is PASS? – Combined Disconnector/Earthing Switch

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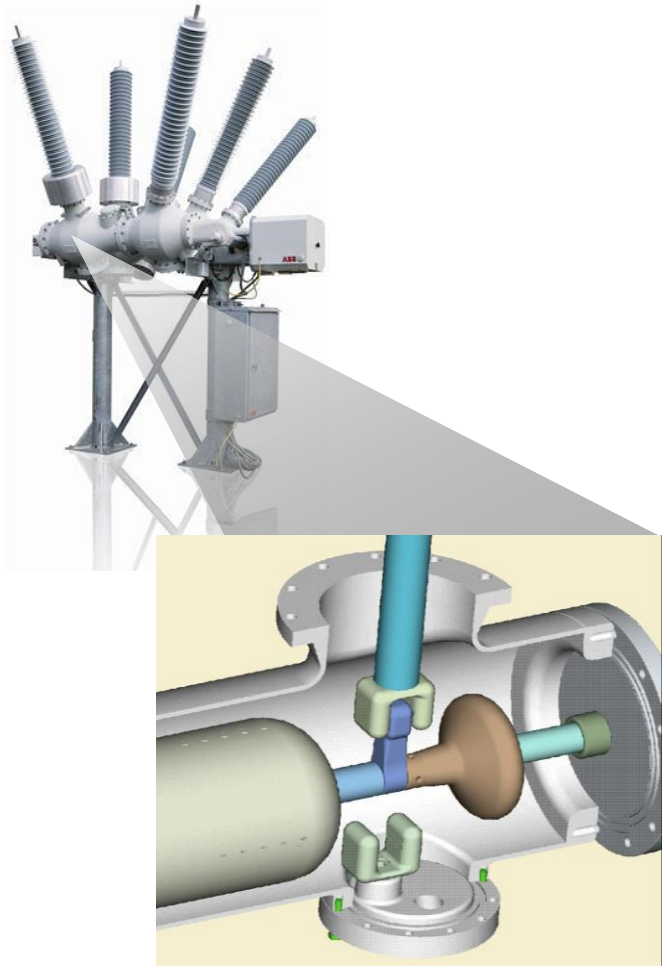

Integrated DS\ES

The mechanism has a minimal number of mechanical components, it is reliable and maintenance-free.

The position of the combined disconnector/earthing switch is clearly shown by an indicator mechanically coupled to the shaft. Moreover, visual confirmation can be obtained by means of an inspection window in the enclosure. The disconnector/earthing switch can also be operated manually by means of a crank.

1. What is PASS? – Inspection windows for safe earthing

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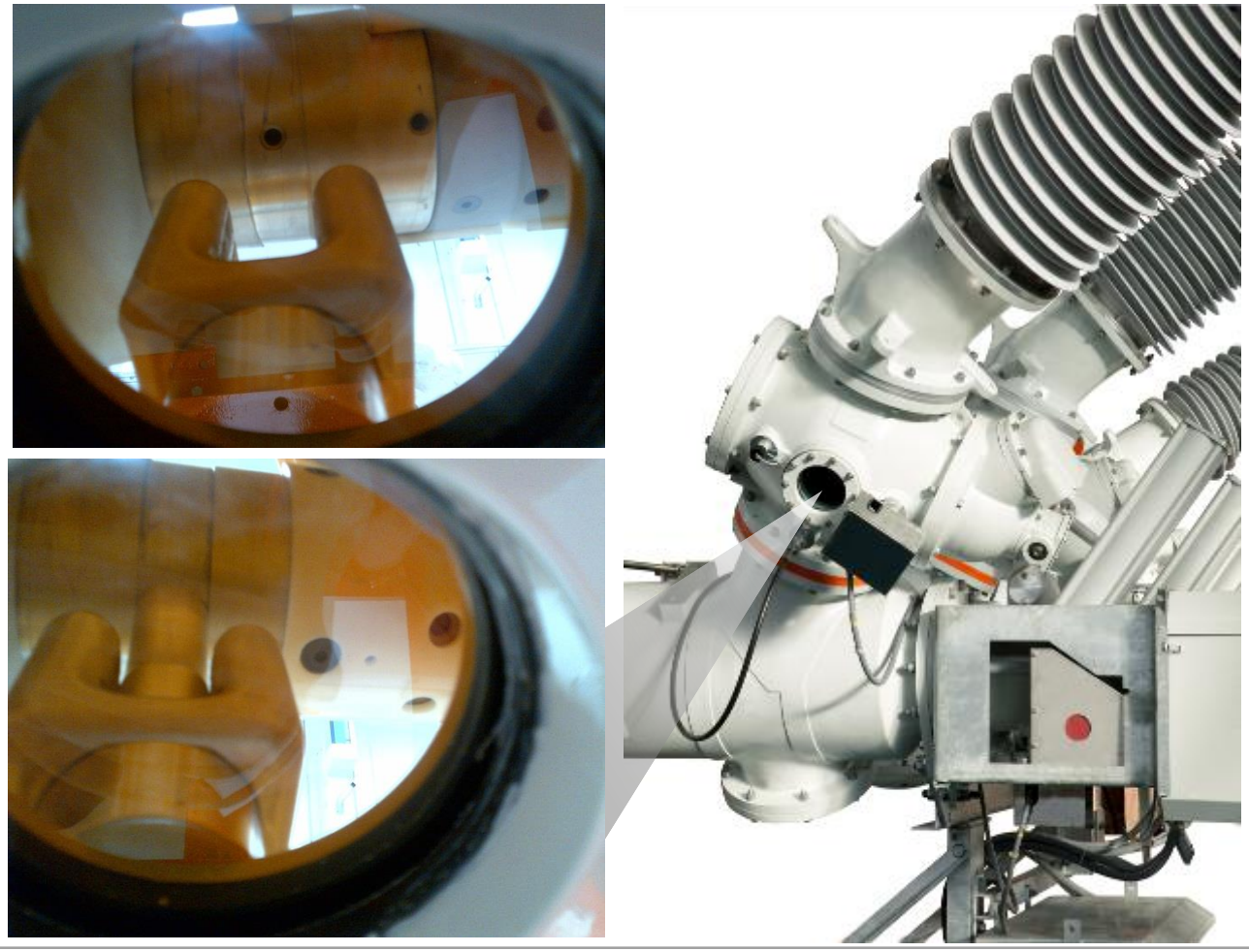

1. What is PASS? – DS/ES Indicator for increased safety

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Common operating mechanism for combined DS/ES with red/green flags on the drive.

1. What is PASS? – SF6 Gas density device

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Density monitor

Since the dielectrical strenght of the switchgear and the breaking capacity of the SF6 circuit-breaker depend on the density of the SF6 gas, a gas density relay is installed to control gas density and detect leakage.

1. What is PASS? – Inductive Voltage Transformers

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SF6 Insulated Voltage transformers

PASS can be equipped as request with conventional GIS inductive voltage transformers. Similarly to Current Transformers, several combinations of windings for protection and measurements with different loads are available.

1. What is PASS? – Polymeric Bushings

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- **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

Subestaciones Híbridas encapsuladas y sus aplicaciones
Agenda

1. What is PASS?
2. **PASS Advantages**
3. Success Stories and references
4. Conclusions

2. PASS Advantages

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Philosophy

- Pre-fabricated
- Pre-tested
- Transportable
- No HV-test on site

PASS Main Features:

- Each PASS module is equivalent to a complete switchgear bay
- High customizability yet short delivery time, due to the modular design
- Fast erection and commissioning, due to fully-assembled modules delivered from factory.
- Lower life cycle cost compared to traditional technologies

2. PASS Advantages - Flexibility

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Single bus bar

Double bus bar

2. PASS Advantages - Flexibility

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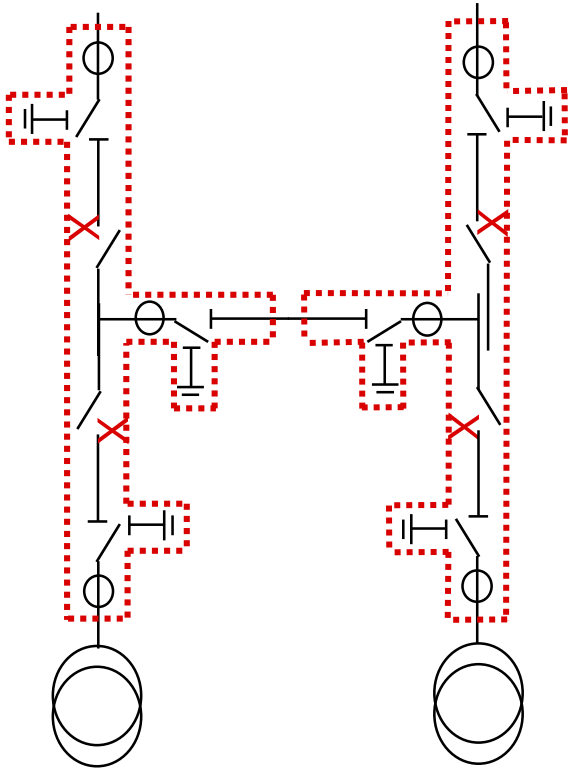
Double circuit breaker



2 PASS DCB are equivalent to 4 complete switchgear bays

2. PASS Advantages - Flexibility

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Cable terminal

In-out SS

2. PASS Advantages – Space Saving | H5 SS 145kV comparison

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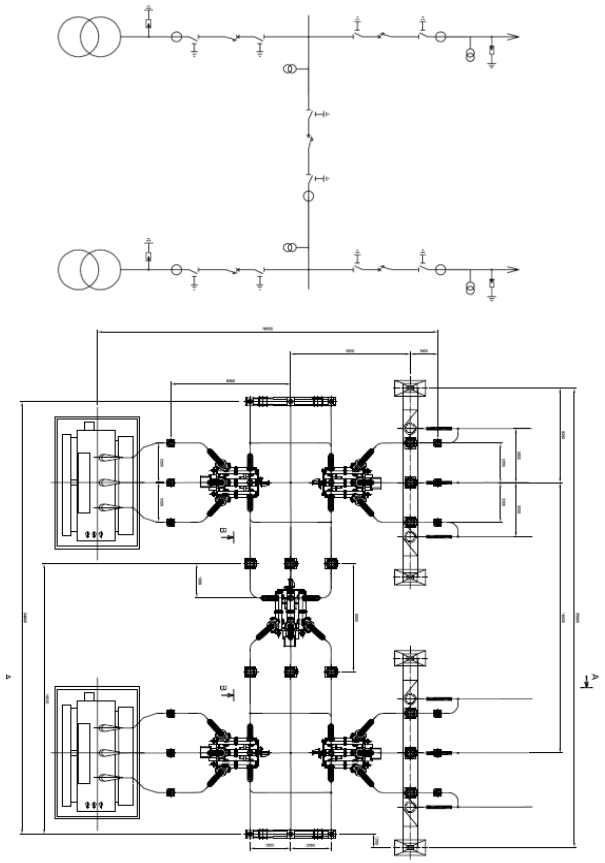
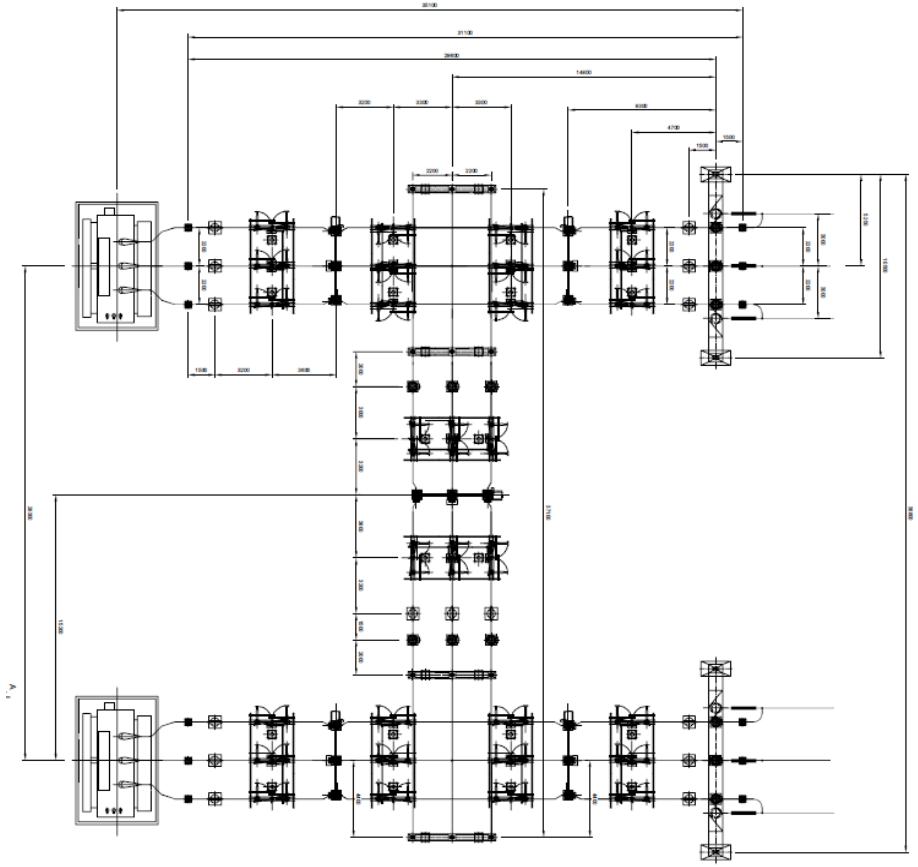


PASS solution: 18,5 m x 25, 5m



AIS solution: 35,1 m x 38,8 m

2. PASS Advantages – Space Saving | H5 SS 145kV comparison

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AIS

PASS M0

2. PASS Advantages – Space Saving | H5 SS 145kV comparison

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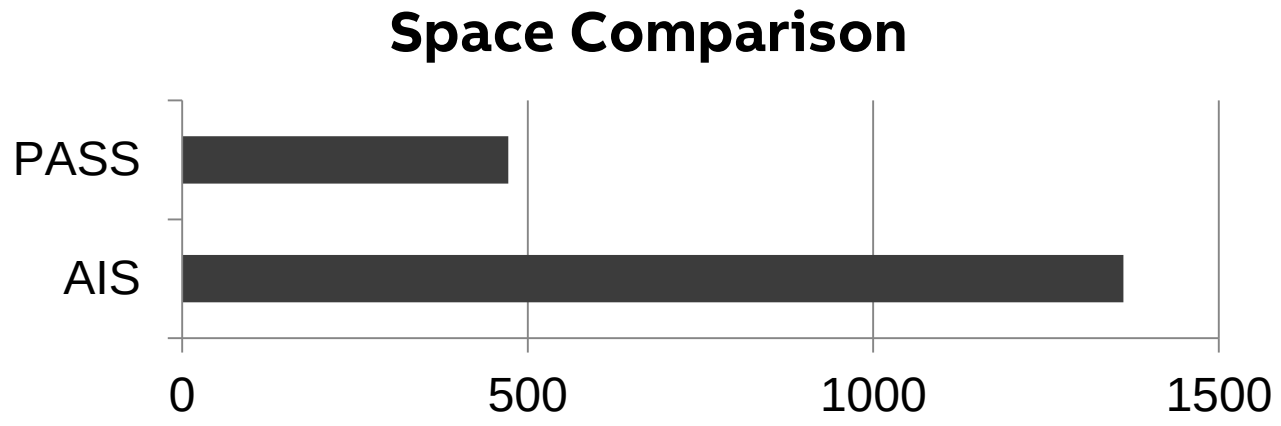

- Save in Land Acquisition thanks to reduced number of components
- Save time for burocracy related to Land Acquisition
- Reduces Civil Works for founding and basements
- Faster Erection & Commissioning

2. PASS Advantages – Space Saving | H3 SS 245kV comparison

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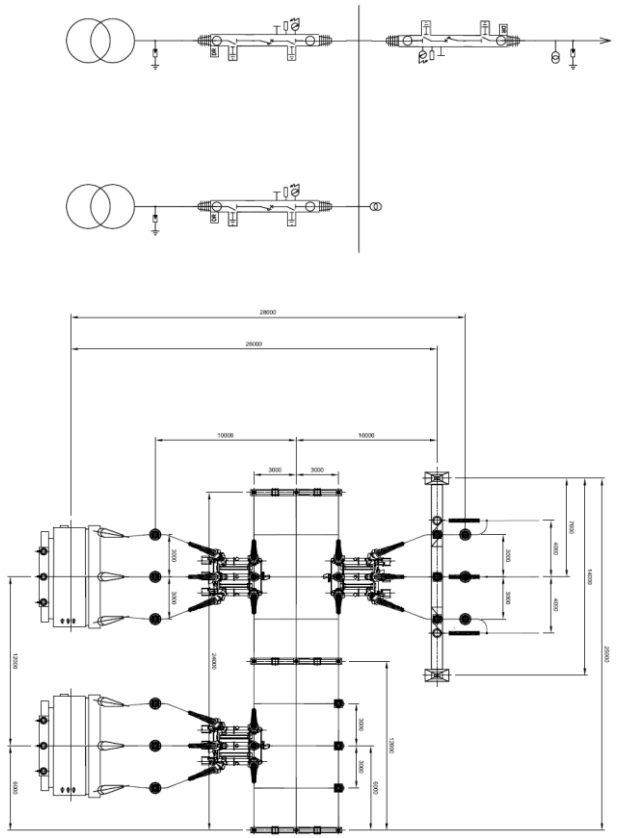
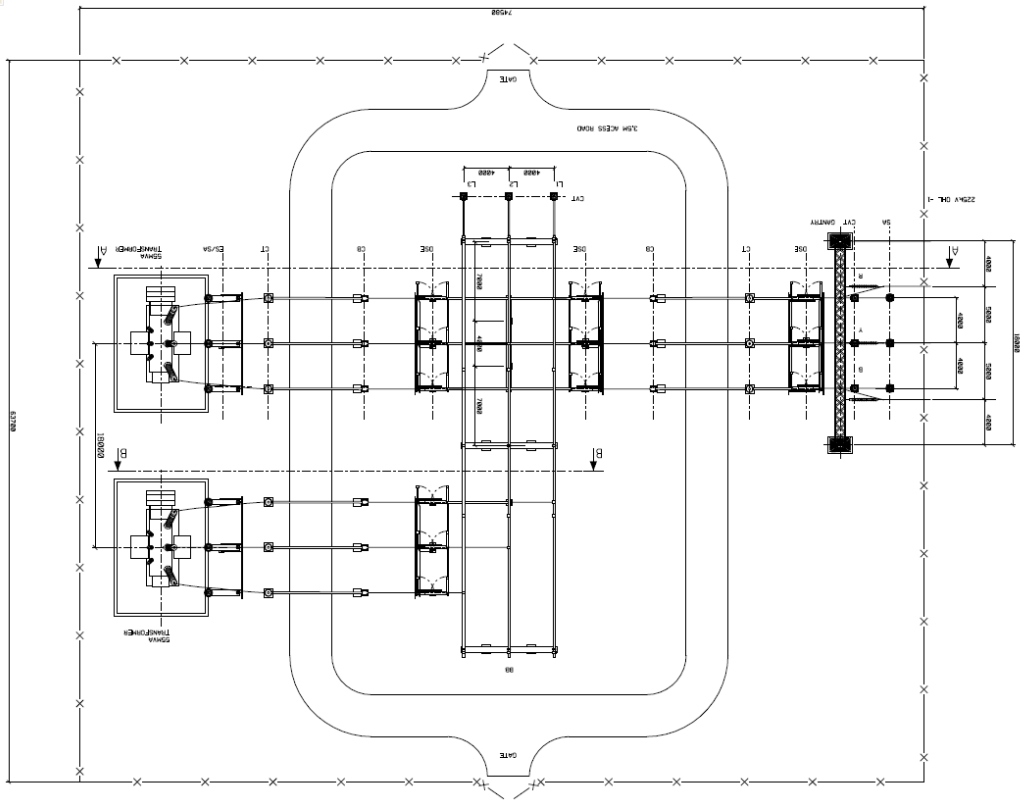


PASS solution: 25 m x 28 m



AIS solution: 63,7 m x 74,5 m

2. PASS Advantages – Space Saving | H3 SS 245kV comparison

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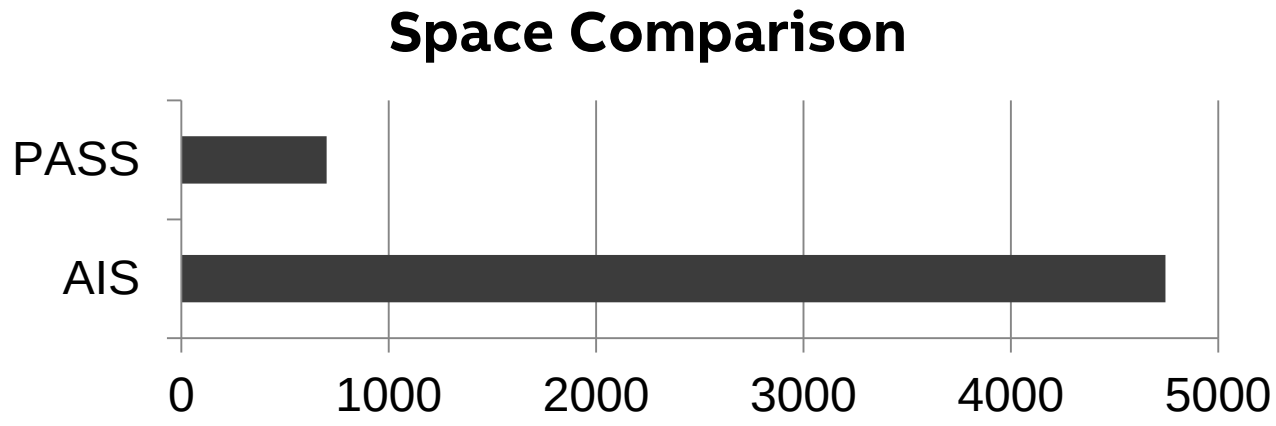


- Save in Land Acquisition thanks to reduced number of components
- Save time for burocracy related to Land Acquisition
- Reduces Civil Works for founding and basements
- Faster Erection & Commissioning

2. PASS Advantages – Innovation | M0H 145kV solution

II Jornadas Técnicas – ABB en Perú | April 6, 2017

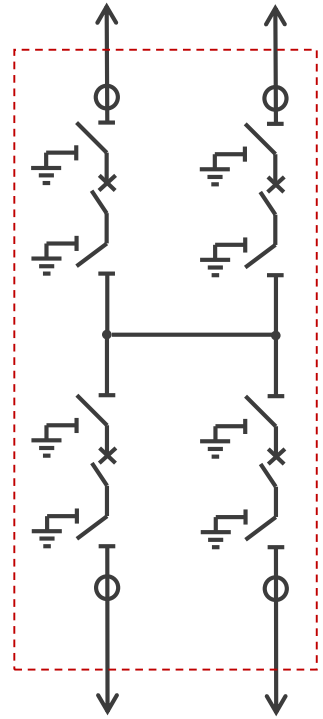
Pre-fabricated

Pretested

Transportable

No high voltage test on site

PASS M0H, H4-type



Advantages:

- Civil works reduced to the minimum
- Transportation fully assembled
- Electromechanical installation activities limited to the HV and LV connection and SF6 filling only
- Minimized site testing
- Reduced risks related to installation activities

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2. PASS Advantages – Innovation | M0H 145kV solution

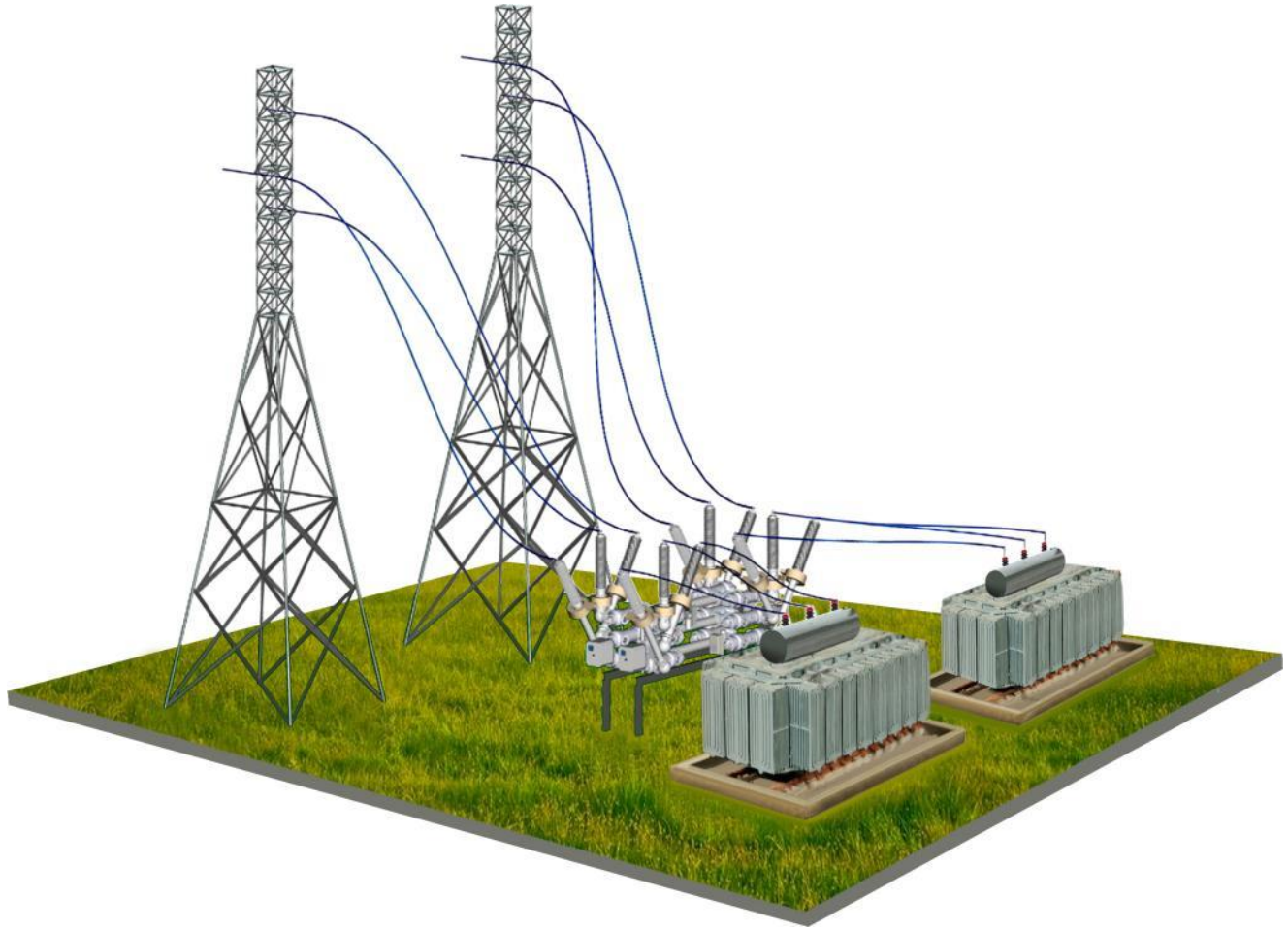
II Jornadas Técnicas – ABB en Perú | April 6, 2017

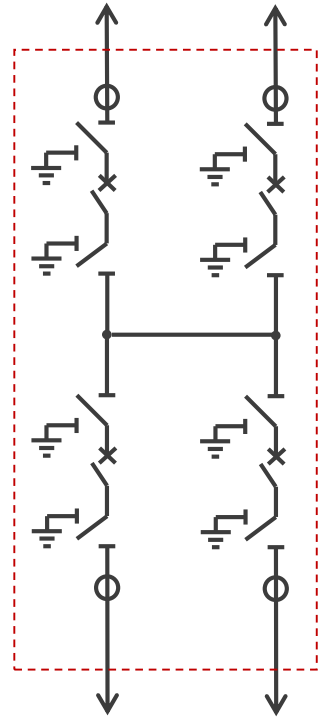
Pre-fabricated

Pretested

Transportable

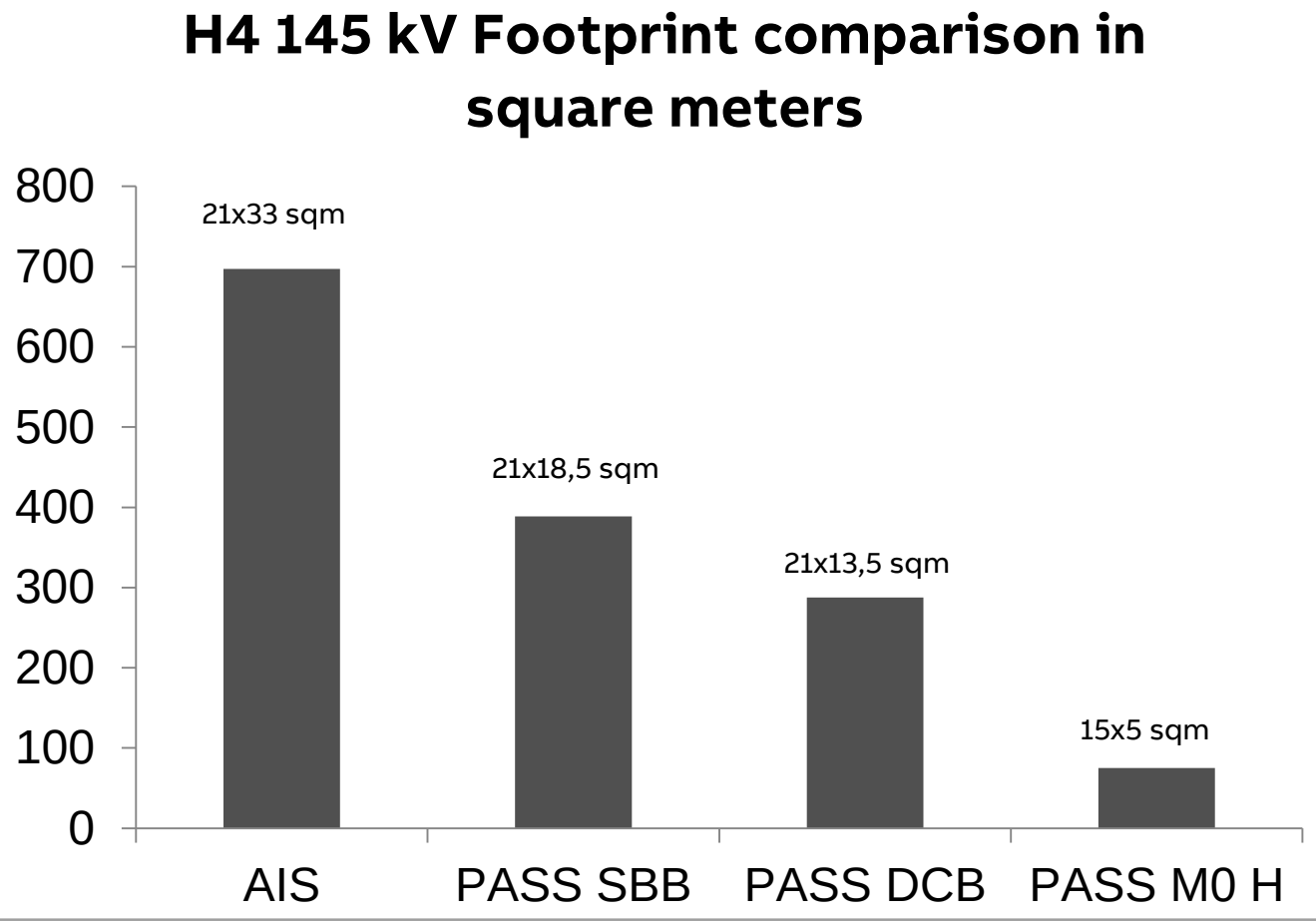
No high voltage test on site





2. PASS Advantages – Innovation | M0H 145kV solution

II Jornadas Técnicas – ABB en Perú | April 6, 2017



2. PASS Advantages – Easy Transportability

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PASS M00 and M0 in a container

2. PASS Advantages – Easy Transportability

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PASS M0 on mobile S\S

2. PASS Advantages – Easy Transportability

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PASS M0 on a skid

2. PASS Advantages – Easy Transportability

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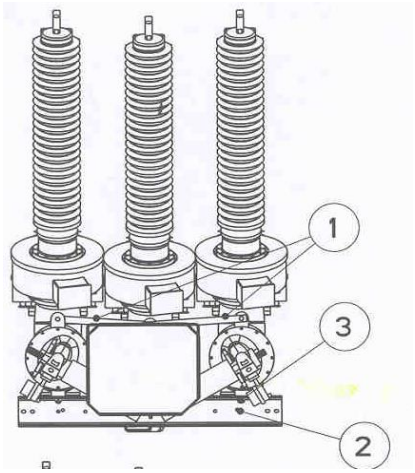
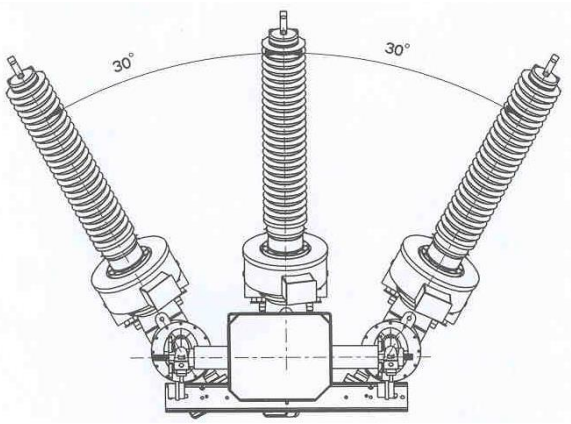
Transport configuration



Service configuration



2. PASS Advantages – Fast Erection & Commissioning

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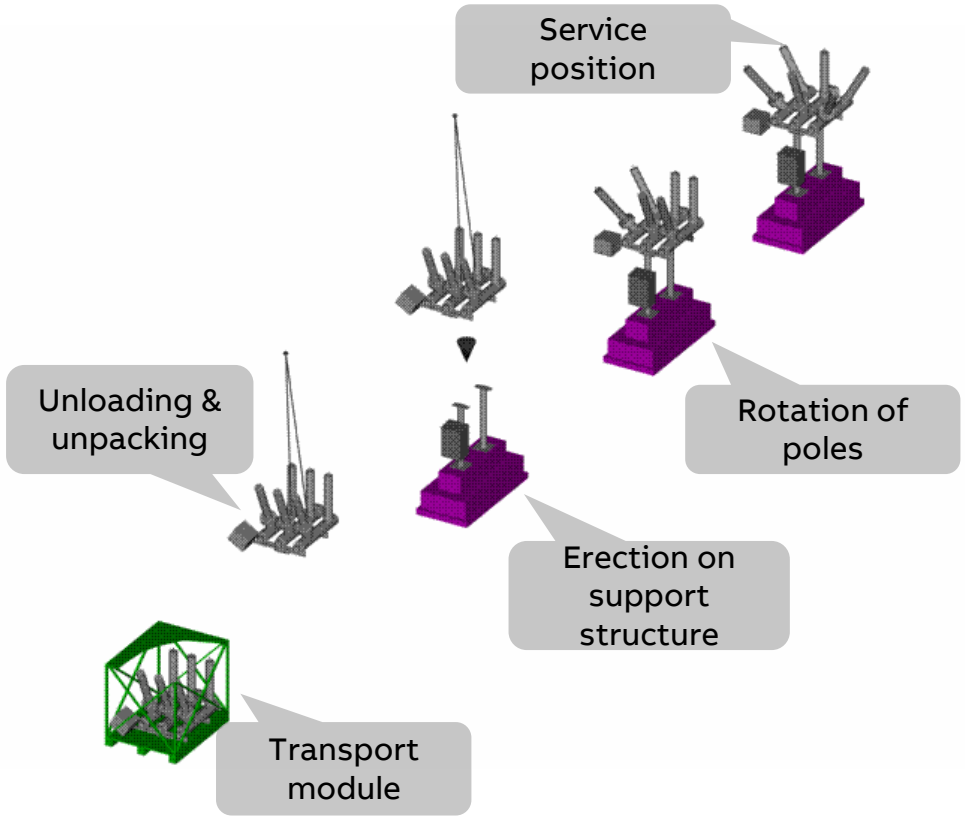
Total: 16 hours



2. PASS Advantages – Lower Life Cost Cycle

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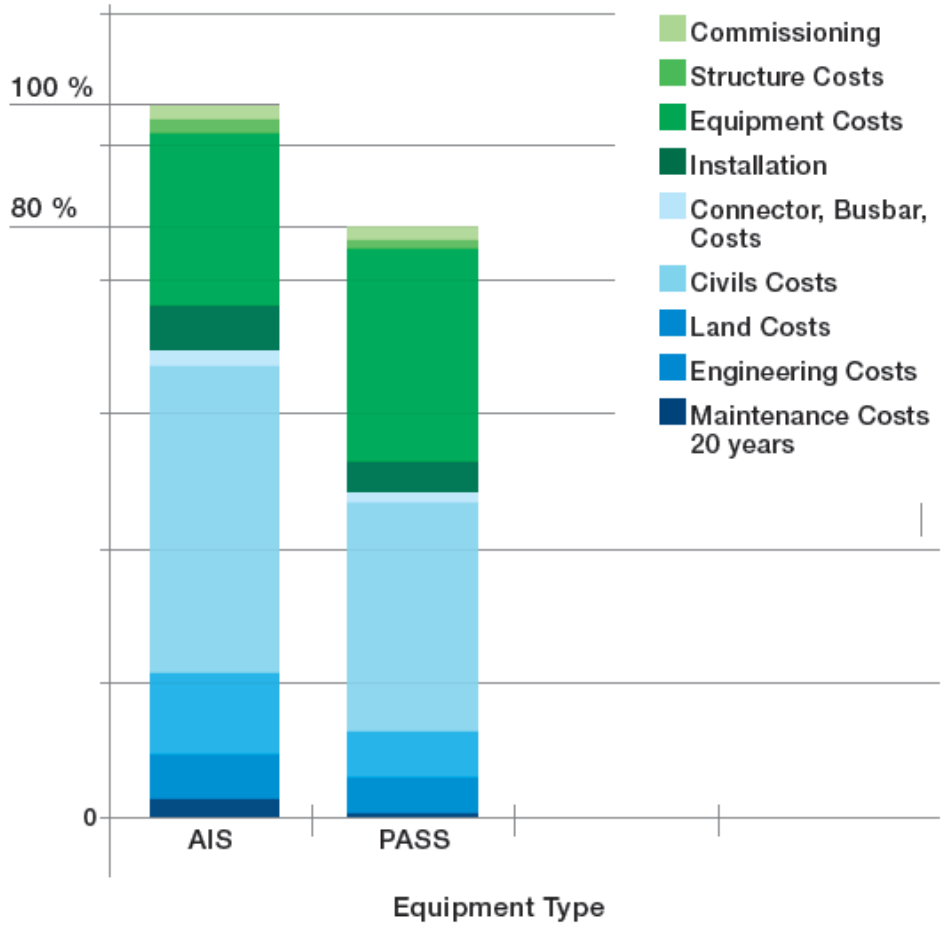

20% saving compared to AIS

Subestaciones Híbridas encapsuladas y sus aplicaciones
Agenda

1. What is PASS?
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3. **Success Stories and references**
4. Conclusions

3. Success stories and references – Tenaris Steel Factory Co-Generation PP (I)

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Customer need

- Sub-station solution with limited space availability at a hazardous material deposit

ABB response

- Outdoor substation made with PASS M0S DCB in a small area between two trafos

Customer benefit

- Space and environmental saving using a different area far from deposit

3. Success stories and references – Tauron Welnowiec retrofitting (PL)

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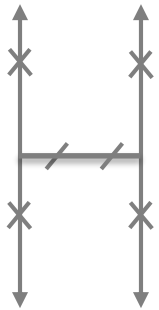

Customer need

- Old substation that needed to be retrofitted

ABB response

- Substation H4 on the roof of the building made with 2 PASS M0 DCB

Customer benefit

- Further reduction of switchgear overall dimension

3. Success stories and references – GEG Grenoble extension (F)

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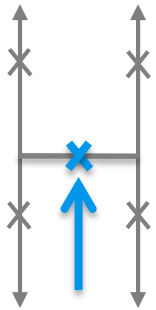

Customer need

- Additional bus tie to existing SBB configuration substation

ABB response

- Extention made without outage of the power transformer

Customer benefit

- No requirement of additional land using PASS M00 SBB or need repositioning existing equipments

3. Success stories and references – Saudi Aramco, Shaybah + Abquaiq revamping (KSA)

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Customer need

- Refurbishment of two old AIS S/S minimizing the outage and installation time
- Utilize pre-existing bus bar system and AIS equipments (PT, SA)

ABB response

- ABB supplied 10 completed HV bays made by Hybrid switchgears type PASS M0 in SBB and DBB configuration (132 kV)
- ABB optimized the PASS design to be suitable for aggressive environmental condition (Desert storm, +52 °C, High solar radiation)

Customer benefits

- Costs and time saving during erection and commissioning
- Reduced outage time during S/S revamping

3. Success stories and references – Lukoil, West Qurna Oil fields (IQ)

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Customer need

- High voltage solution to be installed easily and quickly.

ABB response

- Innovative pre-fabricated and pre-tested PASS module for H3 configuration substations with integrated protection & control.

Customer benefit

- The full H3 switchyard, mounted on skid, records a 32 hours erection and commissioning time.

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4. Conclusions

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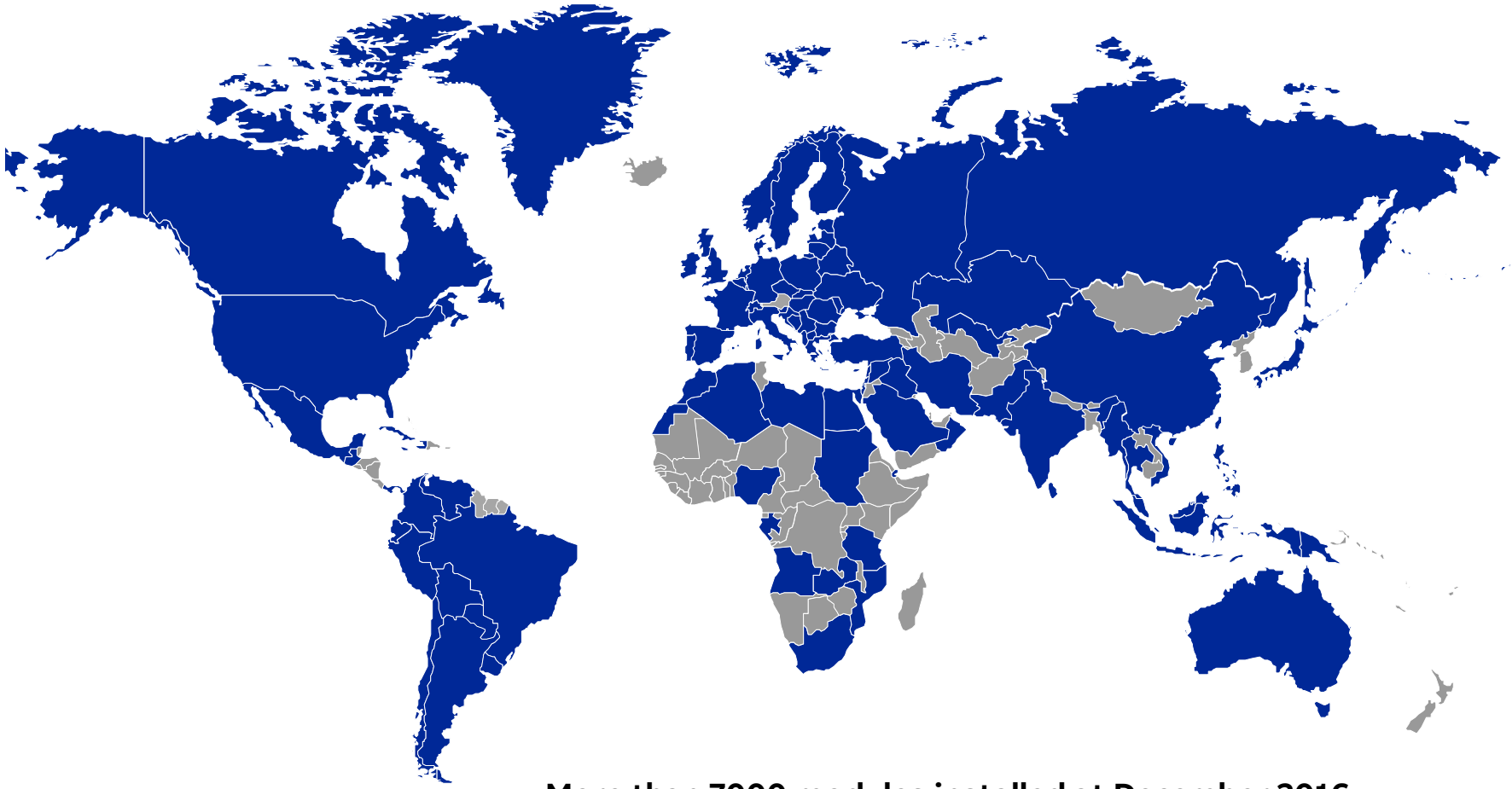

More than 7000 modules installed at December 2016