COMPASS
COMpact Prefabricated Air-insulated SubStation

Matteo Ibatici, Marketing and Sales Department, 20 May. 2011.
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- Key values
  - Product Portfolio
- Why COMPASS?
  - COMPASS and COMPASS-I features
- Value based selling
- Erection and commissioning
- General comparison in terms of S/S space
- Economical comparison
- Reliability of COMPASS modules
- Worldwide reference
Our Key Values

1926
Technology
80 years in T&D

Pioneering Spirit
- First in the world
- We are not afraid of new challenges

2005
New Focus Factory
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Product portfolio
Multifunctional Equipments

- Two different solutions for the same ratings

<table>
<thead>
<tr>
<th></th>
<th>COMPASS</th>
<th>COMPASS-I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated Voltage (kV)</strong></td>
<td>110</td>
<td>170</td>
</tr>
<tr>
<td><strong>Rated Current (A)</strong></td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Breaking Current (kA)</strong></td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>AC Test Voltage (kV)</strong></td>
<td>275</td>
<td>325</td>
</tr>
<tr>
<td><strong>Impulse Test Voltage – BIL (kV)</strong></td>
<td>650</td>
<td>750</td>
</tr>
</tbody>
</table>
Product Portfolio
COMPASS – 110 kV up to 170 kV
Product Portfolio
COMPASS – 110 kV up to 170 kV
Product Portfolio
COMPASS – 110 kV up to 170 kV

Example of a substation with COMPASS
Product Portfolio
COMPASS-I – NEW module

- One Circuit Breaker with BLK drive (both single and three phase operations) (1)
- One Current Transformer (2)
- BLK (3)
- Local Control Cabinet (4)
- Supporting Structure (5)
- COMPASS-I is completely assembled and tested at the factory and can be wholly transported to the site for easy, reliable installation.
- This product, as COMPASS, can be furnished with both silicone or porcelain insulators.
- Thank to his reduced structure, this product is suitable for substations that need to save space. In addition, COMPASS-I contains less quantity of SF6 gas because the current transformer is integrated in the circuit breaker.
- Certified with ENEL Distribution.
Product Portfolio
COMPASS-I – NEW module
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Two main concerns:
- to minimize outages due to scheduled maintenance;
- to avoid blackouts and loss of connection due to failures.

Two solutions:
- equipment with low maintenance requirements;
- equipment with low failure rate and specific substation design.
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COMPASS, COMPASS-I
COMPASS and COMPASS-I features

- DISCONNECTOR FUNCTION
- How to open/close

CLOSE POSITION  OPEN POSITION
COMPASS, COMPASS-I
COMPASS and COMPASS-I NEW features

- New layout in order to have voltage transformer and surge arrester onboard
- Better weight distribution, that reduce the total weight of COMPASS (30% less) and improve its stability (lower gravity center)
- New disconnector motor mechanism
- NABLA System Self supporting Busbar
- Silicon bushings
COMPASS, COMPASS-I
NEW features NABLA

Self Supporting Busbar
COMPASS, COMPASS-I
COMPASS and COMPASS-I NEW features

- COMPASS Substation with TIP in Poland
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COMPASS
Value based selling
COMPASS, COMPASS-I
Value based selling

- Pre-fabricated & Pre-tested bay
- Reduced erection time commissioning
- Minor civil works
- Minor quantity of steel structures
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COMPASS, COMPASS-I
Erection and commissioning

EASY AND FAST erection and commissioning due to the fact that the modules are pre-assembled and pre-tested in the factory
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S/S space comparison

Comparison between AIS and COMPASS

Conventional configuration
- total area: 2600 m²
- switchyard: 930 m²

Compass configuration
- total area: 1200 m²
- switchyard: 300 m²

Small area for switchyard
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Economical comparison

- Maintenance cost 20 years
- Engineering cost
- Land acquisition
- Foundation, fence, groundings, roads, etc.
- LV cable connection
- Tubular aluminium connection & clamps
- Steel structure supply and erection
- HV apparatus erection

Comparison between COMPASS and AIS Conventional.
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Reliability of COMPASS modules
Preventive maintenance guide – key points

• The operational safety of main components CB, DS, ES, CT, is not affected by any external impact (such as dirt, humidity etc.) with the exception of the bushings.

• Bushings consist of an internal cylinder in glass fiber impregnated in epoxy resin: therefore are qualified for use in polluted environment and in presence of rain.

• A COMPASS module requires virtually no maintenance for a long time.
Reliability of COMPASS modules
Preventive maintenance guide – key points

a) Periodical Inspections
• Every one/two years
• With the module in service
• Consisting in just a visual inspection

b) Preventive Maintenance
• It has to be done when the first of the following is verified:
  • once reached 20 years of service
  • once reached 5000 mechanical operations
  • once reached 10 short circuit interruptions
• The module has to be out of service
• Consisting on an accurate check and the repetition of commissioning mechanical tests

c) Revision
• It has to be done when the first of the following is verified:
  • once reached 30 years of service
  • once reached 10000 mechanical operations
  • once reached 20 short circuit interruptions
• The revision activities as to be performed in ABB facilities
Reliability of COMPASS modules
Preventive maintenance guide – key points

AIS: Air Insulated Switchgear
MTS: Mixed Technology Switchgear (i.e. HGIS)
GIS: Gas Insulated Switchgear

<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

Source:
CIGRÉ – Working Group B3-20 – Evaluation of Different Switchgear Technologies (AIS, MTS, GIS) for Rated Voltages of 52 kV and above
November 2008
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.

Source:
CIGRÈ – Working Group B3-20 – Evaluation of Different Switchgear Technologies (AIS, MTS, GIS) for Rated Voltages of 52 kV and above
November 2008
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COMPASS – The ABB Hybrid Module
Reference Map

More than 4000 equivalent bays installed at June 2008