UniPack-G
Glass Fiber Reinforced Polyester Compact Secondary Substation
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News

1. New housing material
   - Platform for new CSS series and base for new advanced products
   - Suitable for most environmental conditions
   - Combines all existing CSS housings (Steel and Concrete) positive features in one product

2. Smart Grid ready
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Introduction
What is CSS?

- CSS is a type tested enclosure containing
  - Medium Voltage switchgear
  - Distribution transformers
  - Low Voltage switchboard
  - Connections and auxiliary equipment to supply low voltage energy from medium voltage systems

- CSS is for energy transformation in secondary distribution network from MV to LV or LV to MV

- CSS is typically installed in locations accessible to the public and should ensure protection for all people according to specified service conditions

- All CSS components shall be type and routine tested per their relevant product standards
What is GRP?

- GRP (Glass fiber Reinforced Polyester) is a composite material made of a polyester with high content of glass inside
- GRP is a lightweight, easily shapeable, extremely strong and robust material
- Proven material technology from several industries that have high demands on performance and strength
- GRP is a material with excellent properties for outdoor enclosures making it an ideal solution for CSS housing
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Introduction

- UniPack-G is new product in ABB Compact Secondary Substation portfolio
- UniPack-G is specially designed as CSS for housing electrical equipment
- New product includes high safety, compatibility with global standards, internal arc fault type tested design, suitability into demanding environmental conditions and flexibility in modular design
- UniPack-G offers customers all existing CSS values in one product with additional benefits of Smart Grid functionality
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Applications

- Distribution
  Transformation and public distribution

- Operation
  Operation at medium voltage level

- Supply
  Supply to satellite stations

- Customer supply
  Supply to major electricity customers

- Feeding
  Connection of decentralized power plant to the public network

- Networks
  Substations for radial and ring connections
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Segments

- Utility
- Industry
- Solar and Wind
- Smart Grid
- Energy Storage Modules
- Infrastructure
- Rail
- Water
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Main Components
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Main Components

MV Switchgear

- MV secondary switchgear including incoming feeder, outgoing feeder and transformer feeder
- The MV can be SF6 gas insulated type SafeRing or SafePlus switchgear and also air insulated UniSec or SafeRing Air switchgear, in full portfolio range
- In some cases - there is no MV switchgear, the MV cable is mounted directly on the transformer
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Main Components

Transformer

- Oil immersed hermetically sealed or Dry type transformers can be installed
- Transformer bushings can be located on top or side of transformer as per customer needs
- Wide range of transformer capacities up to 3500 kVA
- Typical KVA's: 200, 250, 315, 500, 630, 1000, 1600, 2000, 3500
- ABB CSS is designed to allow simple and easy transformer installation on site or integrated into the CSS in the factory
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Main Components

LV Switchboard

- Incoming feeder options can be directly connected, circuit breakers, fused disconnectors or Load Break Switches
- The LV busbar rating depends on the transformer rating
- Various number and ratings of outgoing feeders depending on transformer size and customer needs
- Equipment for metering, measuring and control available
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Applicable Standards
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Applicable Standards

High-Voltage/Low-Voltage Prefabricated Substations

- **IEC 62271-202**
  - It specifies the type test requirements for CSS products (“Prefabricated Substations”) up to 52 kV
  - It also specifies:
    - Service Conditions
    - Rated Characteristics
    - General Structural requirements
    - Test methods for Prefabricated Substations

- Internal CSS Equipment:
  - IEC 62271-200  Metal Enclosed switchgear
  - IEC 60076  Power transformers
  - IEC 61439-1  Low voltage switchgear
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Applicable Standards – According to IEC 62271-202

Mandatory type tests on CSS:
- Dielectric tests
- Temperature rise tests
- Short time & peak withstand current of main and earthing circuits
- IP tests (degree of protection)
- Mechanical stress tests (IK, roof load, wind pressure)
- Internal Arc fault test, where applicable
- EMC, where applicable

Optional type test on CSS:
- Sound level test (to be agreed between manufacturer and user)
- EMF (test or calculation)
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Applicable Standards – Internal Arc Fault Test

- Internal Arc Fault Tested CSS’s increase the safety for operators and the general public
- Internal Arc Classification (IAC) covers faults inside MV switchgear and MV interconnections
- Internal Arc Classified enclosure requires a specified testing procedure and evaluation
  - A (if protection to operator is proven)
  - B (if protection to public is proven)
  - AB (if protection to both operator and public is proven)
- ABB has passed IAC-AB according to latest IEC 62271-202 Ed. 2.0
- IAC-AB to be required by the end user for network with high population areas

ABB recommends to specify IAC-AB for the safety of operators and public
Internal Arc fault tests were made according to IEC 62271-202 Ed 2.0 standard (IAC-AB-20 kA/1s)

- **Accessibility A:** The arc is ignited inside the SF6 tank of the SafeRing switchgear between all the phases. The MV doors are opened and indicators type A are installed in front of the switchgear and around the substation where gas can exhaust. The test current is 20 kA/1s

- **Accessibility B:** The arc is ignited inside the SF6 tank of the SafeRing switchgear between all the phases. All doors are closed and indicators type B are placed around the substation where gas can exhaust. The test current is 20 kA/1s
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Technical characteristics & Typical layouts
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Technical characteristics – Spica 10N

- Up to 1000 kVA
- Up to 24 kV
- Available with dry or oil transformers
- Can be provided with different options of MV Switchgear from our SF6 insulated compact secondary SWG portfolio. Also available with Air insulated SWG
- Various number and ratings of outgoing feeders depending on transformer size and customer needs. Special low voltage equipment available upon request
- ABB components used for safe and reliable operation
<table>
<thead>
<tr>
<th>Description</th>
<th>UniPack-G Compact Secondary Substation – Spica layout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max power</td>
<td>1000 kVA</td>
</tr>
<tr>
<td>Type of layout</td>
<td>Spica 10N</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>Up to 24 kV</td>
</tr>
<tr>
<td>Short circuit withstand current of internal earthing network</td>
<td>20 kA/1s</td>
</tr>
<tr>
<td>Overall dimensions (LxWxH)</td>
<td>3000 X 2470 X 2460 mm</td>
</tr>
<tr>
<td>Weight of substation excluding transformer (approximate)</td>
<td>2 tons</td>
</tr>
<tr>
<td>Transformer compartment dimension (LxWxH)</td>
<td>1400 X 2180 X 2100 mm</td>
</tr>
<tr>
<td>Maximum transformer load losses to be installed</td>
<td>11600 W</td>
</tr>
<tr>
<td>Transformer compartment IP protection degree</td>
<td>IP 23D / IP 35D / IP 45</td>
</tr>
<tr>
<td>MV/LV compartment IP protection degree</td>
<td>IP 54</td>
</tr>
<tr>
<td>CSS enclosure thermal class</td>
<td>15K with IP 23D transformer compartment</td>
</tr>
<tr>
<td>MV compartment</td>
<td>5-Way SafeRing / SafeRing Air</td>
</tr>
<tr>
<td>LV compartment</td>
<td>Max space for outgoing feeders 1900 mm. Kabeldon, InLine, Tmax, Emax 2 on request</td>
</tr>
<tr>
<td>MV cabling</td>
<td>The connecting cables can be from Al or Cu according to customer request. If not specified, then the cross section is selected to fulfill short circuit requirement of the arrangement</td>
</tr>
<tr>
<td>MV terminations</td>
<td>The connecting cables can be equipped with pre-molded/ cold shrink/heat shrink cable heads upon customer request</td>
</tr>
<tr>
<td>LV connection to transformer</td>
<td>Busbar or double insulated cable sized according to the rated power of transformer</td>
</tr>
<tr>
<td>Rated current of LV panel</td>
<td>Up to 1600 A</td>
</tr>
<tr>
<td>Rated short circuit withstand capacity of LV busbar system</td>
<td>50 kA/1s</td>
</tr>
</tbody>
</table>
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CSS Typical layouts

Pluto

Spica

Vega

Polaris

Castor

Capella
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Smart Grid Compatibility
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Smart Grid Compatibility

- All Smart Grid functional levels available in ABB UniPack-G offering
  - Situational awareness
  - Fault isolation
  - Power flow management
  - Protection selectivity

- Local and remote monitoring and commands available
Automating secondary substations can improve fault detection, isolation and restoration, voltage regulation, load balancing in the network through line switching, protection of secondary substation assets and field personnel. ABB offers a range of solution levels (additive) from monitoring of MV switches to full protection of equipment.

- **Level 1** is the basic solution, including monitoring of the entire secondary substation and current and voltage and energy measurement on the low-voltage side.
- **Level 2** comprises all functions of the level 1 with the additional control of medium and low voltage primary apparatus.
- **Level 3** rises all functions of the level 2 with the addition of accurate current, voltage & energy measurement on MV side.
- **Level 4** comprises all functions of the level 3 with the addition of protection functions with breakers in incoming and / or outgoing feeders. This is the most technically complete solution.
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Smart Grid Compatibility

- Additional benefits for utilities and energy consumers are
  - Improved quality of the power supply
  - Less and shorter outages and improved voltage quality
  - Enhanced operational efficiency and network stability
  - Improved tools for the network operators and the field crews
  - Less need to travel to locations with difficult access

- No need to install vulnerable external antennas for reliable remote communication
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GRP Housing Features
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GRP Housing Features

- New UniPack-G housing has next features to provide high safety and additional values to existing CSS offering:
  - Internal arc fault type tested
  - Increased corrosion resistance – longer maintenance free lifetime and suitable for harsh environments
  - Lightweight – easy to transport for long distances, easy to relocate with no heavy cranes or other expensive handling equipment needed
  - Material will not dampen radio waves – an ideal enclosure for Smart Grid substations without having a need to install vulnerable external antennas for reliable remote communication
  - Double layer design – self supporting structure providing extra strong mechanical strength with high impact resistance and very low thermal conductivity making it suitable simultaneously for warm and cold climate, with minimal impact from ambient temperature
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GRP Housing Features

- High thermal capabilities
  - Low thermal conductivity
  - Tolerates quick and big temperature fluctuations
  - Internal temperature close to constant
  - Minimal impact from solar radiation
  - Insulation between the layers

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside wall temperature</td>
<td>+80°C</td>
</tr>
<tr>
<td>Inside ambient temperature</td>
<td>+40°C</td>
</tr>
<tr>
<td>Steel inside temperature</td>
<td>+79°C</td>
</tr>
<tr>
<td>GRP inside temperature</td>
<td>+56°C</td>
</tr>
<tr>
<td>90 mm concrete inside temperature</td>
<td>+66°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside wall temperature</td>
<td>-20°C</td>
</tr>
<tr>
<td>Inside ambient temperature</td>
<td>+30°C</td>
</tr>
<tr>
<td>Steel inside temperature</td>
<td>-19°C</td>
</tr>
<tr>
<td>GRP inside temperature</td>
<td>+15°C</td>
</tr>
<tr>
<td>90 mm concrete inside temperature</td>
<td>-5.6°C</td>
</tr>
</tbody>
</table>
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Customer Values
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Customer Values

- High safety
  - Designed to applicable standards to provide safety to equipment, personnel and environment
  - Internal arc fault tested
  - Fire retardant enclosure
  - No access to live parts
  - Electrically non-conductive
  - Locking system for all doors to prevent un-authorized entry of personnel
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Customer Values

- Easy and fast installation, commissioning and relocation
  - Pre-designed, fully assembled and factory tested units
  - Lightweight product saves cost on renting heavy crane
  - Lower handling equipment requirements
  - Can be lifted with transformer inside
  - ABB installation service and technical support available
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Customer Values

- Long life cycle
  - Corrosion resistant enclosure material
  - Will not lose visual appearance during the life cycle
  - Additional equipment can easily be added with introduction of Smart Grid
  - Can use the same enclosure even if internal equipment will be changed
- **Minimal maintenance costs**
  - Thermal characteristics of enclosure offer safe working condition for installed equipment
  - Salt, humidity or other harsh environmental conditions does not influence enclosure materiel external finish
  - No need to paint or refurbish appearance
  - Housing elements are replaceable, in case of serious damage
  - Remote monitoring available
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Customer Values

- Robust and simple design
  - Tolerates impacts without breaking and deformation
  - One enclosure type for all environments
  - Wide range of ratings & capacities in housing layouts
  - Modular design, allowing customer to order the enclosure in right size for right applications
  - Combines all steel and concrete CSS positive features in one product
  - Specifically designed for electrical equipment
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Customer Values

- **Product quality and reliability**
  - Designed to applicable standards
  - Internal arc fault tested
  - Factory tested
  - State-of-art equipment
  - All major equipment from one supplier
  - Very high environmental capabilities and weather resistant finish
  - Safe to house temperature sensitive equipment
  - Standard product designed for special conditions
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Customer Values

- Smaller environmental impact
  - Oil collection pit under transformer to avoid any leakage to environment
  - Reduced carbon footprint due to smaller transportation and installation equipment
  - Recyclable enclosure material
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Global Presence
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Global Presence

ABB CSS factories at 12 sites in 12 countries

US, Orlando
BR, Sao Paulo
ZA, Johannesburg

NO, Skien
EE, Tallinn
CH, Zuzwil

EG, Cairo
SA, Riyadh

IN, Nashik
VN, Hanoi

CN, Beijing
AU, Sydney

Contact Your local FES representative
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Conclusion

- UniPack-G represents the traditional ABB CSS with new material and production concept
- Designed considering latest IEC 62271- 202 which results in internal arc fault type tested solution with respect to highest safety for equipment and personnel
- Easy transportation and installation procedures as well as long life cycle in harsh environments due to robust double layer design and material properties
- UniPack-G concept is based on our long term experience in substations business and provides combination of proved ABB products with the latest technologies into one advanced solution
Power and productivity for a better world™