UniPack® Compact Secondary Substation (CSS) Product Presentation
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UniPack Compact Secondary Substation Definition and Applications
What is a CSS?

**CSS - Compact Secondary Substation**

- CSS is a type tested assembly comprising an enclosure containing Medium Voltage switchgear, Distribution transformers, Low Voltage switchboards, 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.
- These substations are 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.
Common Types

A ”Walk In” type CSS is situated at ground level or partially buried and operated by entering the CSS.

A ”Non Walk In” type CSS is situated at ground level and operated from outside.

A ”Compact” type CSS is situated partially below ground level and operated from outside.

An ”Underground” type CSS is situated completely below ground level and operated by entering the CSS.
CSS – Typical Applications

Distribution -
Transformation and public distribution

Operation -
Operation at medium voltage level

Supply -
Supply to remote 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

MV network

Ring Main Unit

MV/LV Transformer

LV Switchboard

LV network to customer
CSS – Design Process

MV network

Ring Main Unit

MV/LV Transformer

LV Switchboard

LV network to customer

MV network

Electrical Design → Physical Layout → Final Assembly
UniPack Compact Secondary Substation
Main Components
CSS 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
- It can be Air insulated switches, such as SafeLink, NAL
- Air insulated switchgear type UniSwitch, UniMix or NAL Switchgear can be used
- In some cases - there is no MV switchgear, the MV cable is mounted directly on the transformer
Transformer

- 1 or 2 distribution transformers can be installed
- 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 3500kVA
  - Typical KVA’s: 200, 250, 315, 500, 630, 1000, 1600, 2000, 2500, 3500, 4000
- ABB CSS is designed to allow simple and easy transformer installation on site or integrated into the CSS in the factory
**LV Switchgear**

- Incoming feeder options can be direct connected, circuit breakers, fused disconnectors or Load Break Switches
- The LV bus bar 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
UniPack- Component

- Gas or air insulated MV switchgear up to 40.5 kV
- Dry or oil transformers up to 4000 kVA
- Various number and ratings of outgoing feeders depending

UniPack video:
CSS Applicable Standards

IEC 62271-202
High-Voltage/Low-Voltage Prefabricated Substations

Main CSS components:
- IEC 62271-200  Metal Enclosed switchgear
- IEC 60076  Power transformers
- IEC 61439-1  Low voltage switchgear

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

Mandatory Type tests on CSS:

✓ Dielectric tests
✓ Temperature rise tests
✓ Short time & peak withstand current of earthing circuits
✓ Functional tests on assembly
✓ IP tests (degree of protection)
✓ IK tests (mechanical impact tests) including lifting tests on complete CSS
✓ EMC compatibility tests
✓ Sound level test (to be agreed between manufacturer and user)
Special Tests - Internal Arc Fault

- 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

**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.
UniPack- IAC test

Safety

- Internal Arc Classified per IEC 62271-202 Ed. 2.0
  - Operator - A
  - Public – B
  - Unipack-S, G is rated AB, 20 kA for 1 sec
UniPack Steel – Design Benefits

✓ Double layer door designs
✓ Optional transformer maintenance doors
✓ Standard widths and heights of housing
✓ Standard 6 degree roof for rainy and partly snowy locations
✓ Special 18 degree roof available for heavy snowy areas
✓ Flexibility in equipment installation inside CSS
✓ Fully compartmented design between LV, MV & Transformer compartments to assure equipment reliability and operational environments.
✓ Higher level of safety for operators during operation and maintenance
UniPack Steel - Introduction

Self taping connection of wall elements together with foundation frame
- Prevents water penetration into CSS
- Prevents hot gas leakage to exterior
- Ensures IP protection of enclosure

Bolted assembly in Switchgear framework and Cable entries
- Allows simple and quick installation
- Allows easy maintenance, upgrading and replacement in the future
- Door hinges for simple maintenance of only moving part in CSS design

Oil Collection Pit
- Galvanized steel oil pit underneath CSS housing integrated with the housing
- Protection against oil pollution in case of a leaking transformer; minimizes environmental impact
UniPack Steel - Introduction

➢ Double layer door designs.
➢ Optional transformer maintenance doors.
➢ Standard widths and heights of housing.
➢ Standard 6 degree roof for rainy and partly snowy locations.
➢ Special 18 degree roof available for heavy snowy areas.
➢ Flexibility in equipment installation inside CSS.
➢ The enclosure is equipped hook lift to convenience transportation, installation and maintenance process.
➢ Earthing terminal is suitable for local requirement.
➢ There are no live touchable parts either in MV or LV compartments (safe access for operator).
➢ Cooling method: Natural cooling with optimal air-flow design, no need to use forced fan cooling. Temperature class: K10 /K15.

Door Locks

➢ Lock into top and bottom frame.
➢ Wide door opening angle of 180 degrees for easy access.
➢ Fitted with handle for padlock or cylinder lock.
➢ Prevent unauthorized access to substation
UniPack Steel – Roof

➢ Transformer roof has detachable facility to enable easy installation and maintenance without affecting other equipment.
  - Easy handling of roof during transformer installation.
  - Fixing bolts also used for securing the CSS lifting lugs for additional safety.
➢ MV & LV compartments roofs are separated from transformer roof for simplified handling.
➢ Improves self-cooling.
➢ Standard roof slope of 6 degrees for water runoff. Special slope of 18 degrees for unusual weather conditions.
UniPack Steel – Ventilation

➢ Air intake in bottom of doors for natural chimney effect and smooth air flow.
➢ Air circulation secures sufficient self cooling of transformer.
➢ Labyrinth type ventilation openings into transformer compartment to prevent foreign materials from entering.
➢ Transformer compartment IP class – IP 23D as recommended by IEC standard. Higher IP class degrades transformer cooling and derating factor must be applied to the transformer kVA.
➢ Customized cooling calculations based on rigorous R&D.
➢ MV & LV compartments have IP class - IP 54 – good for outdoor (and indoor) installations as recommended by IEC standard. Higher temperature class of enclosures are available upon request.
➢ Double roof layer to reduce solar radiation inside LV and MV compartments.
UniPack Steel – Safety Features

Protection against internal condensation
- Hot dipped galvanized base frame in addition to pre-galvanized sheet steel housing with good pre-painting treatment process will allow CSS to withstand humid environment
- To avoid any condensation dripping on the Low-voltage switchboard, an additional cover is installed over the Low-voltage compartment
- Also an anti-condensation space heater can be installed for additional protection

Anti Corrosion Paint
- Paint of CSS housing can be either wet or powder coated according to market requirements available in multiple colours.
UniPack Steel – Safety Features For Touchable Parts

- All busbars are covered for protection against unintentional contact
- A 1.5 mm galvanized steel cable cover is provided for surface mounted CSS to protect the LV cables and grounding system from any damage and to restrict access for personnel safety
- Extra ventilation design to keep busbar ratings within limits available for high temperature environments
- There are no live touchable parts either in MV or LV compartments (safe access for operator)
- LV incoming breaker connections are covered for safety
- Touch proof components are available that guarantee high level of safety
Unipack G – Glass fiber Reinforced Polyester (GRP)

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 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
   • 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.

➢ Low thermal conductivity
➢ Tolerates quick and big temperature fluctuations
➢ Internal temperature close to constant
➢ Minimal impact from solar radiation
➢ Insulation between the layers
➢ Fully type tested per latest IEC standard 62271-202.
➢ High level of safety for personnel & equipment. Arc tested A&B for 20kA/1s.
➢ Enclosure is made of galvanized sheet steel with powder coating, 1.5mm thick, ensure anticorrosion even hot and humid operating condition, coastal or chemical factory, industrial zone, etc...
➢ Walls, roof, doors and other components are made of 1.5mm thick galvanised sheet steel with at least 20 µm zinc layer.
➢ All rivets are made of stainless steel material to avoid corrosion.
➢ Other thicknesses available on request.
➢ Enclosure surface to be painted anticorrosion, antirust reach class C4 or C5 according to ISO 12944 standard.
➢ Base frame is made of 4mm SPHC steel with hop dip galvanized surface and detachable cover plates are made of 2mm galvanised sheet steel to avoid corrosion due to direct contact with foundation & ground.
➢ Wide range of ratings & capacities with standard widths & heights.
➢ Complete ABB components portfolio.
➢ Global leader with huge installed base, global service coverage and high level of engineering capabilities.
➢ The enclosure is designed at assembly structure and it can be disassemble for convenience of installation and maintenance process.