Power^{IT} Compact Secondary Substations, CSS

Technical Brochure

Substations from ABB

Definitions
In accordance with the EN 61330 standard, Prefabricated Secondary Substations are defined as substations with type tested equipment comprising distribution transformer, medium voltage switchgear, low voltage switchboard, connections and associated equipment in an enclosed unit. Substations are located in places to which the general public has access, and hence must provide a high level of personal safety.

Solutions
In substations for outdoor use all components are housed in a building, which protects the equipment against climate effects and unauthorised access. The building will typically be divided into three rooms for the medium voltage switchgear, low voltage switchboard and distribution transformer. A substation may be operated from the inside (Walk-in) or from the outside (Non Walk-in or Compact). The electrical equipment is cooled by natural ventilation through ventilation louvers in the substation.

The Standard for Individual Solution
The Power^{IT} CSS substations represent a unique concept, which is introducing new standards with its product range with type tested solutions and shorter delivery times. All products are based on the latest technology and the result is a safe energy supply and a reduction in operating costs for the grid.

Content

The text and illustrations are intended as guidelines. Reservation for changes.

Electrical equipment in the substation

Medium voltage switchgear
The Power^{IT} CSS range has been designed and type tested with ABB's medium voltage switchgears.We can install the following models:

- SafeRing 12-24 kV
- SafePlus 12-24 kV
- NAL unit 12-24 kV
- Fuse-switch disconnectors

The range of medium-voltage switchgears includes both pre-configured and fully configurable solutions. A high level of personal safety is guaranteed by the use of type tested equipment. ABB offers gas-insulated and air-insulated medium voltage solutions. The options for gas-insulated switchgear comprise the SafeRing and SafePlus models. The options for air-insulated switchgear comprise units with air-insulated loadbreak switches with and without fuses and fused disconnector.

Low voltage switchboard
Power^{IT} CSS is designed to house the LVS low voltage switchboard. LVS is available in three types: LVS1, LVS2 and LVS3. The product range includes various types of busbars for fuse-switch disconnectors, load break switches and MCCBs. Equipment for measuring, metering and street lighting can be supplied to LVS2 and LVS3.

Distribution transformer
The Power^{IT} CSS stations are designed to house distribution transformers with various technologies up to 1600 kVA/24 kV:

- Oil-insulated model, hermetically sealed
- Oil-insulated with oil conservator
- Dry-insulated, vacuum coil cast
- Dry-insulated RESIBLOC

In most cases we can supply Power^{IT} CSS with a factory installed transformer. The possibility of lifting the substation with transformer depends on the type of station, the solution in question and the transformer size.

For further information about electrical equipment, order the relevant brochures or visit us at www.abb.com.

Corrosion protection and environment

ABB has introduced new raw material and assembly process with the development of Power^{IT} CSS with emphasis on quality and reduced environmental impact.
The use of advanced surface treatment systems combined with an optimal selection of raw material ensures that items exposed to the highest corrosion risk also have the highest corrosion protection.

Selection of raw material
At a compact secondary substation the foundation and the lower part of the enclosure are more exposed to corrosion than the upper part of the enclosure.
In order to ensure the optimal corrosion protection, concrete foundations as well as two types of raw material in the enclosure are used.

The thickness of zinc layer on the base frame and cable covers is twice that of other components. All surfaces, painted as well as unpainted, have high protection against corrosion, when using galvanized sheet steel. This has better properties than other metal-coated steel types with respect to protection of cutting edges as well as manufacturing of folded parts.

Surface treatment
In order to determine the optimal combination between raw material and surface treatment corrosion tests have been performed with various painting systems and sheet thickness. All tests were performed according to ISO 12944.

During these tests Oxidur® gave the best result. Oxidur® is delivered by Hempel A/S, which is very experienced within surface treatment in corrosive environment.

Oxidur® has some similarities to polyurethane, but is more environmentally friendly as it contains no isocyanate and has a high level of dry matter.

Assembly
With Power^{IT} CSS ABB has decided to introduce a new assembly process for compact substations, which is called clinching. This process is a type of press riveting developed for the automotive industry and is used for many purposes. Clinching technology has several advantages compared to conventional technology:

- Clinching ensures the electrical contact between each steel item and thereby a Faraday cage is created.
- The corrosion protection of galvanized steel is not damaged when using clinching.
- No other objects – screws, bolts etc., which can accelerate the corrosion process, are present when clinching.

For more information about performed tests and testing methods, please contact ABB.

Application

Substations are used in a large number of different areas.

Secondary Substation	Application
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 decentralised power plant to the public network
Satellite	Substations for the end of radial connections
Pylon feeder station	Smaller stations connected to overhead lines

Modular structure

The buildings in the CSS range consist of 300 mm wide modules (M) plus corner sections measuring 115 x 115 mm. The roof is supplied with two roof slopes, 6° and 18°. The doors are 2, 3 or 4 m wide, and are fitted as either single or double doors. The ventilation doors are 2 or 3 m wide.

Type designations

CSS-SC.5.7

Product type	CSS = Compact Secondary Substation
Materials	S = Steel C = Concrete
Layout	W = Walk-in N = Non Walk-in C = Compact
Width	5 = Number of modules wide
Length	7 = Number of modules long

Product overview

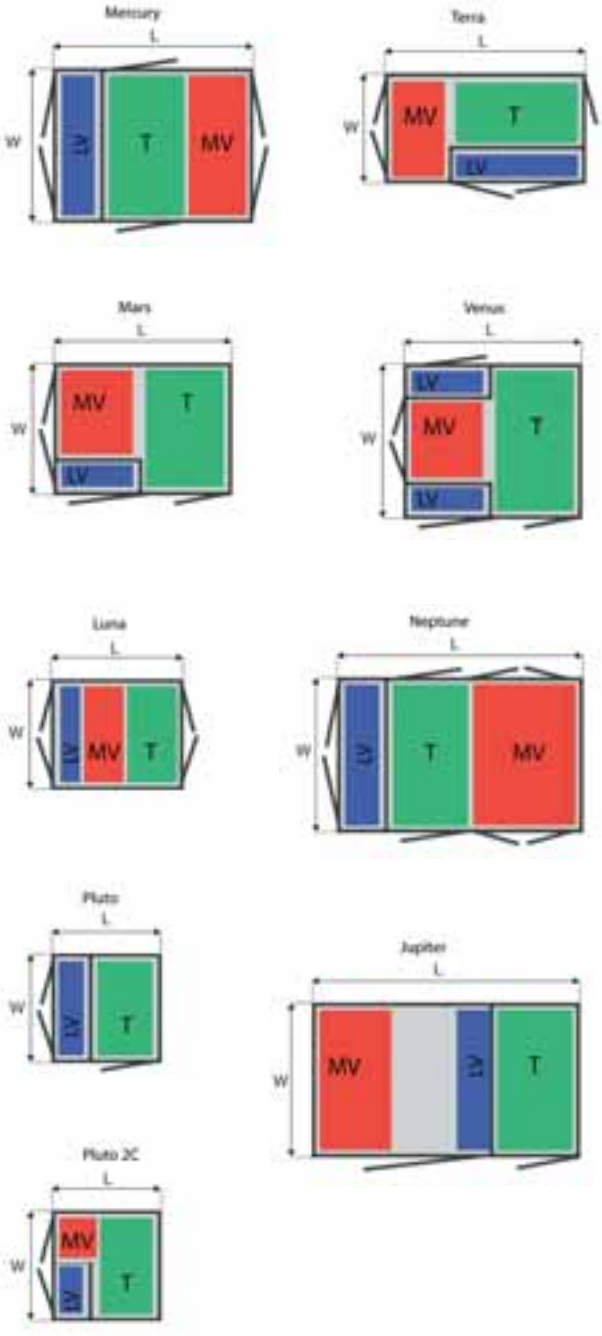
The Power^{IT} CSS range comprises three main types, which are supplied in a number of different layouts and various styling.

CSS-SC
Compact station. Operated from the outside and installed partly below ground level

CSS-SN
Non Walk-in station. Operated from the outside and surface mounted.

CSS-SW
Walk-in station. Operated from the inside and surface mounted.

Solutions available



The following layouts are available in the Power^{IT} CSS portfolio.

The name refers to the layout model, the number indicates the size of max transformer, and the letter the type of CSS.

CSS Name	**L** (mm)	**W** (mm)	**H*** (mm)
Mercury 3C	2434	1534	1997
Mercury 6C	2434	1834	2013
Mercury 10C	2734	2134	2427
Mercury 16C	3034	2434	2893
Mercury 16N	2734	2434	2558
Mars 2N	1834	1534	2050
Mars 5C	2434	1834	2411
Mars 8C	2434	2134	2427
Luna 2C	1834	1534	2385
Pluto 2C	1534	1534	1987
Pluto 3C	1534	1534	1997
Pluto 8C	2134	1834	2411
Terra 4N	2134	1834	2076
Terra 6C	2734	1534	1997
Venus 6C	2434	2134	2427
Nepture 10C	3334	2134	2427
Neptune 16C	3934	2434	2693
Jupiter 10W	3634	2134	2342
Jupiter 16W	3634	2434	2558

** With 6 degrees roof*

For further details on each layout we refer to our product data sheets.

Design

Building

The building is typically divided into three rooms for the medium voltage and low voltage switchboards and distribution transformer. The roof can be selected with either 6° or 18° slope, and is secured to the corner sections by bolts. The entire roof is detachable, and is supported by a beam with ventilation openings.

As standard the doors are fitted with handles for padlocks and closed by means of a two-point device, securing them to the top and base frame. The doors are fitted with stainless steel hinges and equipped with door stoppers.

The wall and roof modules are assembled by means of a self-locking design, hence the use of sealant is not necessary. Clinching technology is used to assemble walls, roof and base frame. Lifting fittings, corner sections, bearing sections, base plates and cable covers are assembled using bolts. The low voltage switchboard and the medium voltage switchgear are bolted to the building.

Walls, roof and doors are made from 1.5 mm galvanized sheet steel. The building is painted with a coat of Oxidur® wet paint. The corrosion category corresponds to C4 H according to ISO 12944. Corrosion protection in the form of hot-dipped galvanized base frames guarantees a long mechanical service life.

Base frame and foundation

All steel Power^{IT} CSS are mounted on a base frame made of 2 mm galvanized steel. Non Walk-in CSS is mounted on a concrete slab with recesses for cables to the medium voltage and low voltage compartments. Concrete slab can also be selected for Walk-in CSS. For the Compact type the base frame is placed on a concrete foundation with an integrated oil collection pit. All foundations and base frames have detachable panels in front of the medium voltage and low voltage rooms to allow the easy insertion of cables.

Oil collection pit

Power^{IT} CSS solutions of type Compact with concrete foundation are fitted as standard with an integrated oil collection pit. A separate oil collection pit of 1.5 mm galvanized steel for Non Walk-in and Walk-in stations can be supplied as an add on. The transformer is fitted in the oil collection pit, which has a volume of 20 % - 100 % of the transformer's oil volume. The oil collection pit provides protection against oil pollution in case of transformer leakage.

Ventilation
Natural ventilation is provided by means of ventilation louvers for air intake in the lower part of the ventilation doors or ventilation wall elements. The air is extracted at the top of the roof. Natural air circulation ensures sufficient cooling of the transformer. The ventilation louvers are of the labyrinth type. As standard Power^{IT} CSS is classified and type tested in accordance with temperature class K20. Temperature class K10 can be achieved for all surface mounted substations by increasing the ventilation area for the transformer room.

Protection against internal condensation
To avoid any condensation dripping on to the low voltage switchboard, an additional cover can be installed over the low voltage room.

Sectional roof
The standard roof of up to 3.8 m in length can be detached in one piece. A sectional roof can be supplied for stations over 3 m.

Doors
The standard doors are designed for padlocks but can also be fitted with a cylinder lock. Substations operated from the inside can be supplied with an internal emergency handle, to ensure that the door can be opened if it has been locked from the outside. A panic handle with horizontal opening bar is also available.

Snow panel below door
Snow panels make it easier to open the doors after heavy snowfall. The snow panel replaces the lower third of the door, and is secured to the wall. It can be removed once the door is open. Normal switching operations are not blocked by the snow panel. This option is not available to all solutions.

Door gaskets
To provide protection against dust being drawn into the medium voltage and low voltage compartments, the doors can be fitted with gaskets that increase the degree of protection.

Additional options available

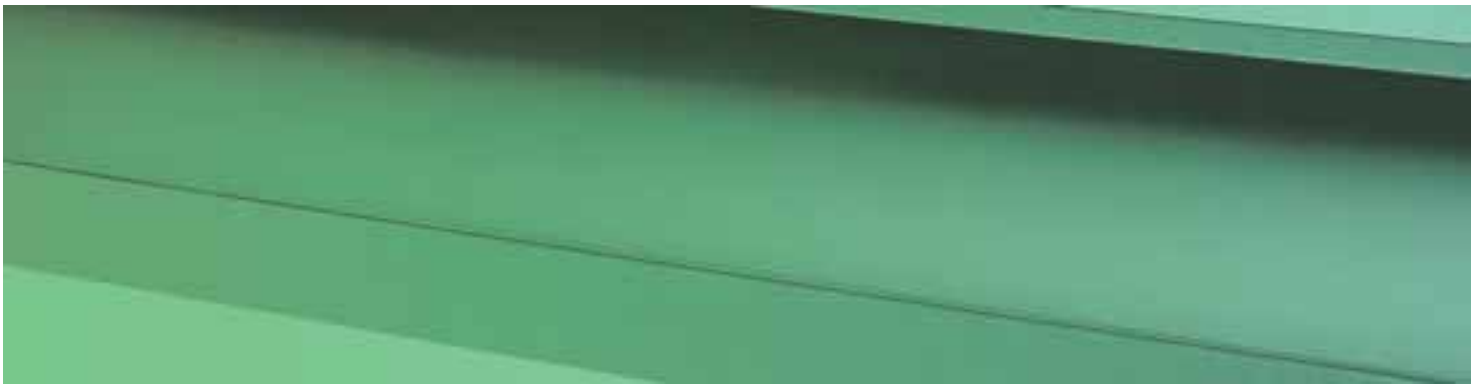
The standard buildings can be fitted with a broad range of additional options, so that the individual substation can meet individual, functional and aesthetic requirements. These options include various modifications and accessories, which make the operation, installation and use of the substation easier. There are also several options to vary the substation's appearance.

Option	CSS-SW	CSS-SN	CSS-SC
Internal emergency handle	X		
Panic handle	X		
Separate oil collection pit	X	X	
Door gaskets	X	X	X
Earthing system to 20 kA	X	X	X
Cylinder lock in doors	X	X	X
Ventilation filters	X	X	X
Wooden panels on walls	X	X	X
Alternative colours and surface structure	X	X	X
Increased roof slope 18 degrees	X	X	X
Alternative roof cladding	X	X	X

Cables and cable accessories
Power^{IT} CSS is supplied with cables and cable terminations:

- Medium voltage cables from medium voltage switchgears to distribution transformers
- Low voltage cables from low voltage switchboards to distribution transformers

SF_6 gas-insulated medium voltage switchgears are connected using elbow connections. The cable termination to the transformer is provided by means of regular cable adapters or, if required, elbow connections. The low voltage cable between the distribution transformer and the low voltage switchboard is fitted with the necessary cable lugs. The number of wires and their cross section are dependent on the rating of the transformer.



Exterior styling

Walls

Standard wall colours

CSS can be painted in the following standard colours:

Colour	Colourcode
Brown grey	NCS 7005Y20R - RAL7013
Slate grey	NCS 7005R80B - RAL7015
Grey beige	NCS 4010Y30R - RAL1019

Alternative exterior colour

In addition to the standard finish, the substation can be painted with a textured paint containing fine sand. This provides extra texture to the painted surface.

Falun red	NCS S5030R
Moss green	NCS S6005G20Y

Alternative wall styling

Power^{IT} CSS can be cladded using wooden panels that consist of impregnated boards mounted in metal rails, which are secured to the walls. The wooden panels cover all walls and doors. The wooden panels can be painted in various colours.

Light green	NCS S5010-G70Y
Red	NCS 4060-Y80R
Dark green	NCS S8010-G50Y
Dark brown	NCS S8005-Y20R
White	NCS 1005-G80Y

Roof

Standard roof colour

The standard roof colour is the same as the wall colour.

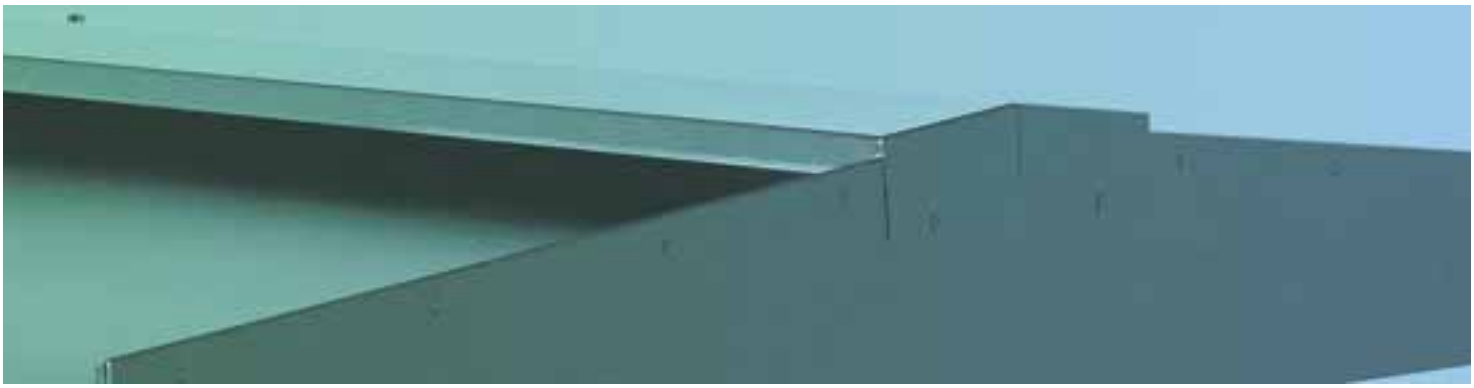
Alternative exterior colour

The roof is available with a textured finish in the same colours as the walls. We can also supply the roof with a black textured finish.

Black roof	NCS S9000N - RAL 9005

Alternative roof cladding

The roof can be cladded using black pantiles made of sheet steel. This requires a roof slope of 18°. The pantiles are painted in black NCS S9000N.



Type test

The Power^{IT} CSS range is designed and type tested in accordance with EN 61330, which covers the following test programs:

- Control of insulation level
- Control of temperature rise in the main components in the substation
- Rated short-time current test (earthing system)
- Function tests on mechanical parts
- Control of internal protection class
- Control of the building's resistance to mechanical effects
- Internal arc fault tests
- Noise test

Furthermore, EMC test is performed.

The main components are type tested in accordance with their individual standards.

Medium voltage switchgear
- EN 60265: High voltage switches
- EN 60298: Metal enclosed high-voltage switchgear
- EN 60694: High voltage switchgear

Low voltage switchboard
- EN 60439: Low voltage switchgear and control gear

Distribution transformer
- EN 60076: Power transformers

Quality

The Power^{IT} CSS range is produced in accordance with ABB's stringent quality and environmental procedures. ISO 9001 and ISO 14001 certification guarantees quality and environmental considerations.

Personal safety
All live parts in the Power^{IT} CSS range are protected against unintentional contact by means of lockable doors. The ventilation openings to the transformer room are of the labyrinth type. Cable connections and fuses in the medium voltage room are also protected against unintentional contact. Anti-contact protection is tested in accordance with EN 61330. Clinched or screwed connections form electrical connections with all of the station's metal parts.

Degree of protection
The standard degree of protection for CSS is IP23D in accordance with EN 60529. If required, CSS can be delivered with doors of higher IP class, by including gaskets and omitting the ventilation openings in the doors.

Protection against climate effect
The climate in substations can be extreme, due to moisture, condensation and dirt. In coastal locations sea salt on the surface of open, insulated surfaces can cause leaking current, which can result in flashover. It is strongly recommended that equipment used can withstand harsh climate service conditions.

Environment
ABB works to develop and supply products and solutions that do not have any unnecessary impact on the environment, are safe to use and can be recycled, reused or disposed of safely. In our research and development we aim to produce sustainable technologies, systems and products.

ABB A/S

Head office:
Meterbuen 33
DK-2740 Skovlunde
Telefon: +45 4450 4450
Fax: +45 4450 4450

Manufacturing site:
Håndværkervej 23
DK-7000 Fredericia
Telefon: +45 4450 4450
Fax: +45 7594 4321

www.abb.dk
E-mail: abb.dk@dk.abb.com

Schultz Grafisk