

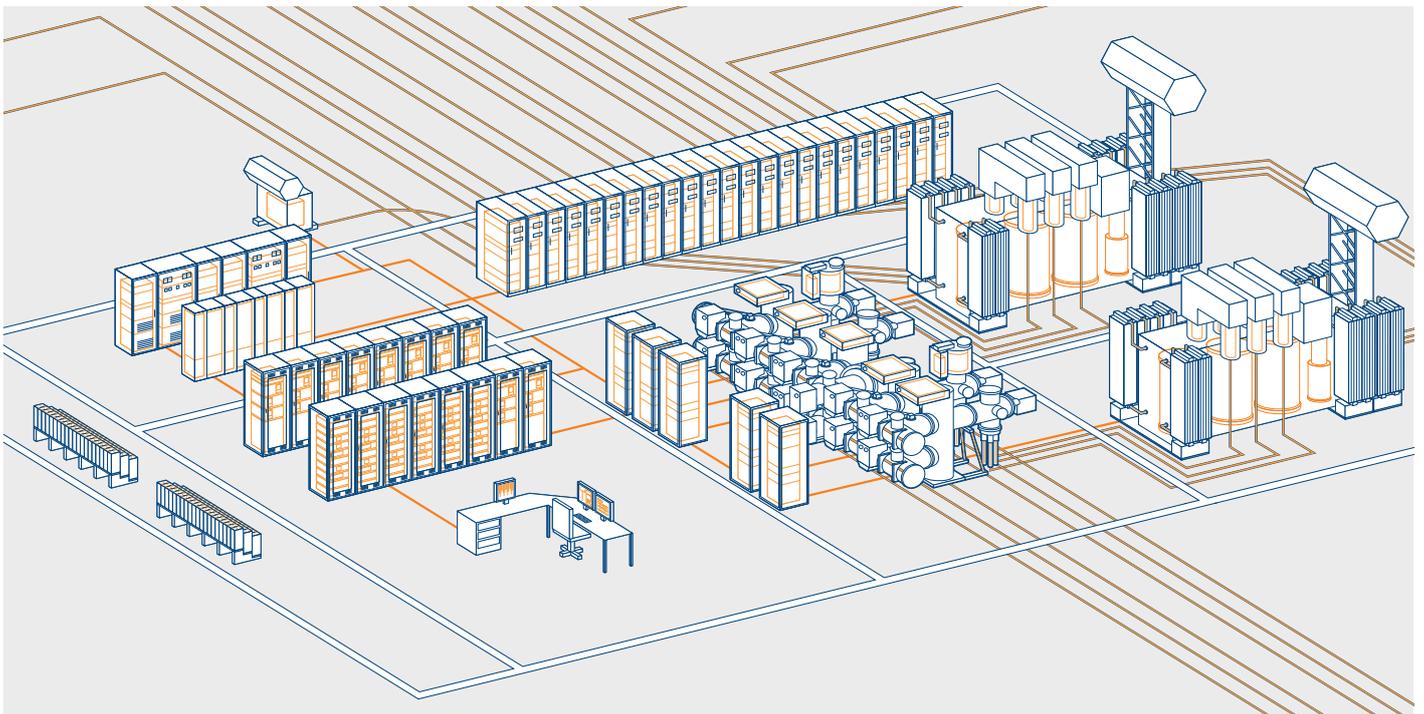
HV Substation Service

# Modular substations type ST7

# ABB and 45 years of GIS innovation

ABB is a leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 145,000 people. ABB offers a wide range of high-voltage products up to 1200 kV that help enhance the reliability, efficiency and quality of power in transmission and distribution grids, power plants and industries while minimizing environmental impact. The wide product range is complemented by a comprehensive service offering.

ABB is the global leader in high-voltage GIS technology with more than 20,000 bays installed around the world. In 2009, ABB commissioned a GIS rated to handle more than one million volts (1200 kV), with a transmission capacity of 6900 megawatts, reaching new heights in terms of global voltage levels. We pioneered high-voltage GIS in the mid-1960s and with the integrated GIS offering, we continue to drive technology and innovation. Our product portfolio comprises a full range of advanced GIS for voltages from 72.5 kV to 1200 kV.



# Modular substations type ST7

Modular substations type ST7 are solutions being sold since 30 years. New offer includes all latest solutions available among ABB's portfolio in scope of connection techniques for LV, MV and HV as well as for automation. Applied equipment and modern solutions based on many years of experience guarantee satisfaction and full comfort of application for users of our solutions.

Compact solution is highlighting feature of our product, which allows us to offer significant simplification for our customers followed by shortened time of investment.

Our offer concerns equipment for voltages in the range between 0.4 kV and 170 kV what enable our modular solutions to be applied both for complete or only part of designed substation.

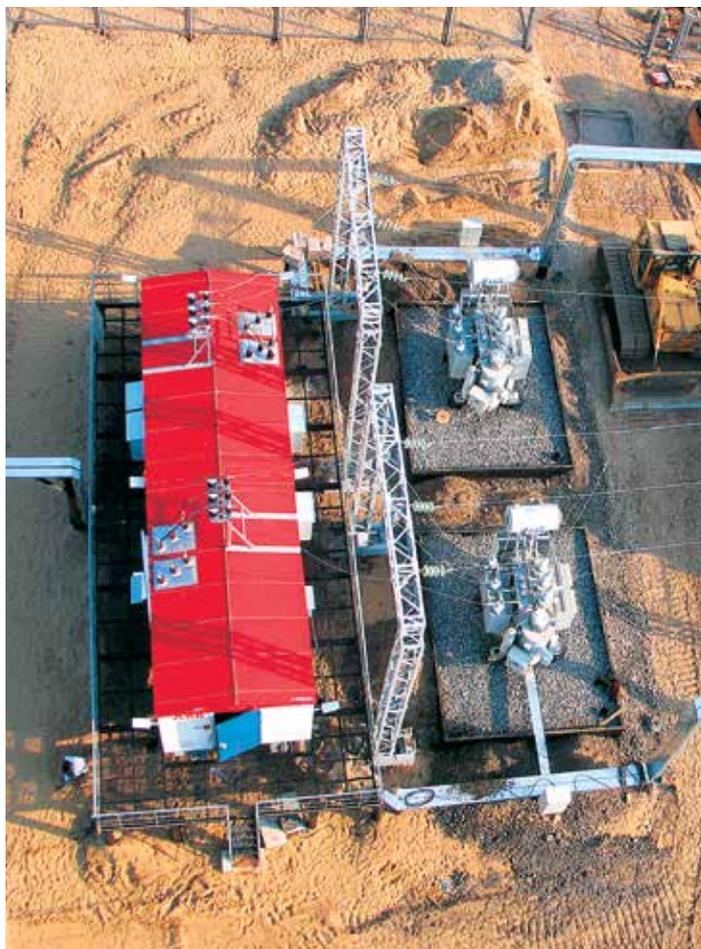
## Installations in difficult conditions

- Climatic (humidity, snowfall, icing, etc.)
- Temperature (from -70°C to +50°C)
- Environment (dustiness, salinity, explosion danger zones)
- Seismic
- Altitude: up to 1000 m – standard, above 1000 m – option

## Modular solutions with optimal dimensions

Advantages:

- fast installation (easy connection of primary and secondary circuits)
- Reduction of costs and transportation procedures due to limited width and height to 3.5 m
- Compact solution
- Shortening investment period
- Preparation of complete substations electrical projects for voltages from 0.4 kV to 170 kV





- Limitation of construction works on site
- Reduction of costs concerning not delivered energy due to fast development of new objects as well as fast modernization of already existing ones – replacement of outdoor apparatus for completely equipped container
- Adjustment to local requirements and standards
- Adaptation for road, rail, air or sea transportation

**Our offer includes:**

- Preparation of substation electrical project according to customer requirements
- Selection of switchgears and automation manufactured by ABB
- Project management
- Manufacturing and delivery of substation
- Assembling and commissioning supervision
- Repair services
- Retrofit (modernization of old container solutions and existing outdoor ones)



Our Integrated GIS units require very simple foundations. The exact type of foundation is usually dependent on actual soil conditions, on the usage duration and seismic requirements.



# Benefits

## Flexible power supply anytime, anywhere

### Our Integrated GIS helps you address:

Fast substation deployments and expansions

- We can deliver a fully prefabricated GIS including all primary and secondary equipment, integrated control and protection and auxiliary equipment within eight months after order confirmation
- The installation time of the prefabricated units is reduced to two to three weeks with very little on-site work required

### Total system costs

- The single source of supply for a fully integrated substation solution saves on total project cost and minimizes risk
- Prefabrication and equipment integration greatly reduces on-site work fielding substantial cost savings
- Re-using substation designs facilitates both system operations and maintenance by reducing the need for staff training and spare part handling

### Space constraints and low temperature applications

- Our compact and optimized GIS design requires only 10 to 20 percent of a conventionally built AIS substation footprint
- Integration of the GIS into a suitable housing can enable lower temperature requirements such as operating temperatures below  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ), without using special SF gas mixtures

### Challenging site installation conditions

- Delivery in areas where access to qualified technical staff is limited and installation costs are high
- Installation in extreme or hazardous environmental conditions
- Locations where accessibility is limited or difficult such as offshore installations, for example at oil and gas platforms and wind farms



#### Mobile and modular requirements

- Transportable between sites
- No cable basement necessary
- Integrated control and protection with simple interfaces to station power supply and network control centers
- Removable walls, roofs and openings for easy maintenance

A 5-breaker H configuration with control cabinets will fit into two our standard containers. More than 5-breaker – min. three containers.



# Technology

## Modular switchgear system for a reliable energy supply

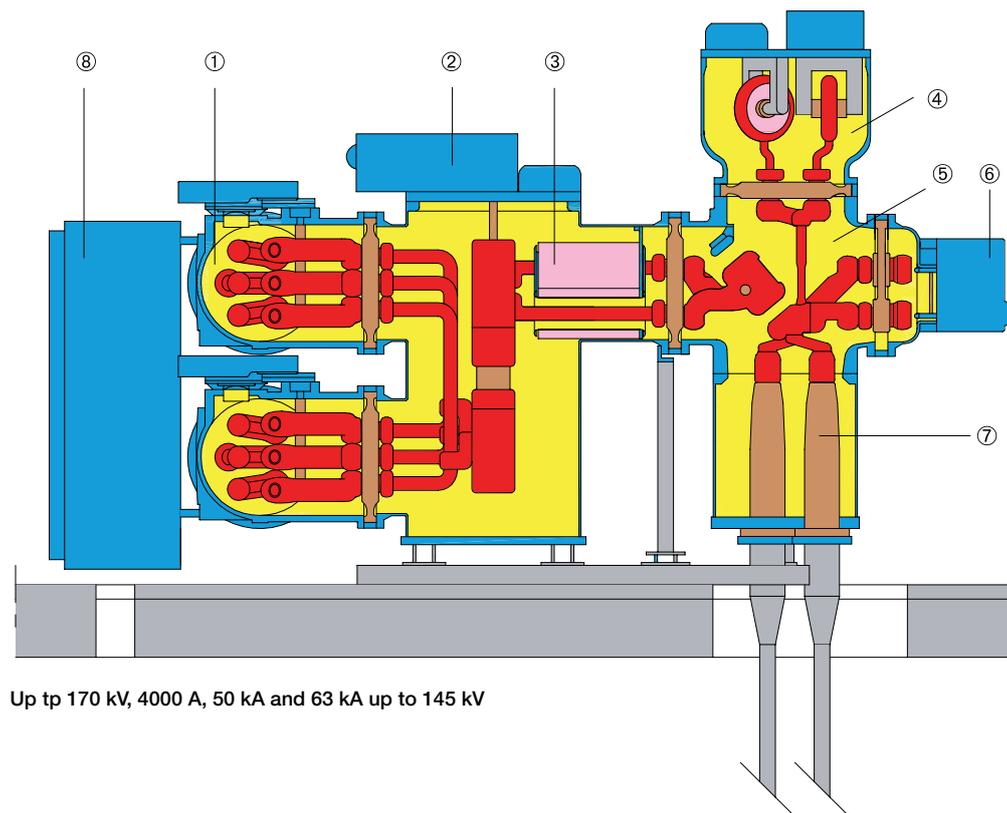
At the core of our integrated GIS is the ELK-04 which is the ideal solution for a reliable and environmentally-friendly energy supply up to a rated voltage of 170 kV, a rated normal current up to 4000 A and a rated short circuit current up to 50 kA.

The ELK-04 meets your most demanding quality requirements. ABB quality standards assure you that all modules of the ELK-04 for 170 kV were tested according to IEC Standard 62271-203 and IEEE C37.122 requirements.

The ELK-04 is based on a well-defined modular building block design with standardized flange dimensions. The gas-insulated switchgear ELK-04 offers compactness and flexibility for an optimized layout.

Advantages at a glance

- SF<sub>6</sub> – encapsulation of active parts
- Minimum space requirements
- Built to withstand harsh environmental conditions
- High energy efficiency
- Installation at point of power consumption
- Low electrical losses
- Low life cycle costs
- Minimum maintenance requirements
- High reliability (reduced outages)
- High safety level
- Earthquake withstand capability
- Full insulation level at high altitudes



The essential modules of the ELK-04 building block system:

1. Busbar with disconnector and earthing switch
2. Circuit-breaker
3. Current transformer
4. Voltage transformer
5. Feeder disconnector and earthing switch
6. Make-proof earthing switch
7. Cable end unit
8. Local control cabinet

- Active parts under high voltage
- Enclosure
- SF<sub>6</sub>-Gas
- Insulation material
- Mechanical parts, structures
- Low voltage parts

### The circuit-breaker

ELK-04 circuit-breakers are equipped with self-blast interrupters, with one interrupter unit per pole. They require minimum maintenance and a low amount of switching energy allowing for compact and reliable operating mechanisms to be used. The breaker enclosure is designed for maximum layout flexibility and compactness.

### The disconnect and earthing switch

Two different types of enclosures are available to integrate the combined disconnect and earthing switch into the building block system. For maximum safety, both the disconnect and the earthing switch are equipped with separate control units preventing accidental mechanical or operational activation.

### The current and voltage transformers

Inductive single-phase current and voltage transformers with SF<sub>6</sub> gas as the primary insulation are used for measuring and protection relaying. The reliability of the transformers is inherently high because no aging of the insulation can occur and all parts are well protected inside the gas compartment. Parameter values for the instrument transformers can be customized to the need of the customer.

### The local control cubicle

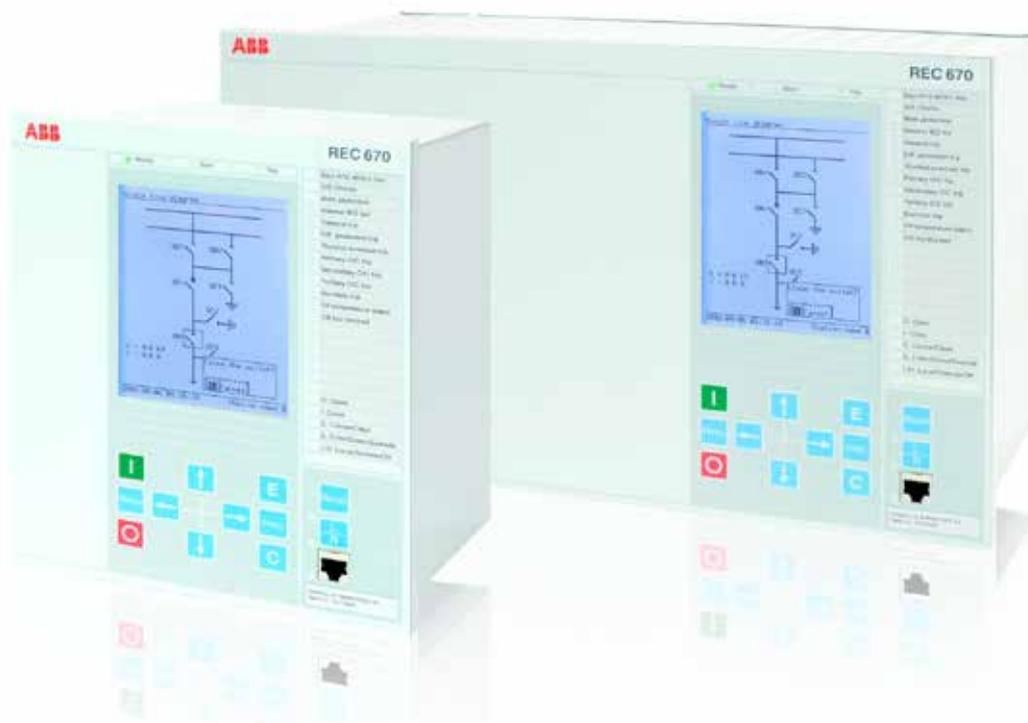
The local control cubicle includes all required functions for the control and supervision of the GIS bay. We offer both conventional and digital control and protection systems for maximum flexibility.

The single line diagram of the switchgear with embedded position indicators and related control switches are displayed on the front panel of a conventional control cabinet. The high voltage switching devices are connected to the control cabinet by control cables with coded heavy duty connectors. Our cabling design enables very fast connection between the primary and secondary GIS equipment.

Digital control devices provide the same functions as conventional control technology. In the case of digital control technology, the single line diagram with position indicators is replaced by a digital interface. Communication between bay devices and the device on the station level are connected by digital communication protocols as outlined in IEC 61850.

### Protection relays

Our Integrated GIS lends itself perfectly for integration of protection relays from the ABB Relion® product family providing a complete set of protection, control, measurement and supervisory functionality. To ensure interoperable and future-proof solutions, Relion products have been designed to implement the core values of the IEC 61850 standard. The IEDs from the Relion family provide optimum 'off-the-shelf', ready-to-use solutions equipped and configured with complete protection functionality and default parameters to meet the needs of a wide range of applications both in transmission and sub-transmission networks.



### Connection components

In addition to the essential functional modules, our Integrated GIS can be fitted with bushings for connection to overhead lines, cable connectors or transformer direct connections.



From production shop

# System configuration

## Shipping unit dimensions

The integrated GIS is designed to be shipped wherever it is needed on short notice. The substation configuration and layout govern the dimensions of the shipping units.

## Substation configuration

The following common configurations are well suited for space requirements and typical layouts

- Single feeder (in/out)
- 4 breaker ring (extendable) in one HV container
- 5 breaker double busbar in one HV container
- H-Arrangement (double feeder) – more than 5-breaker
- min. 2 HV containers

## Ring busbar arrangement

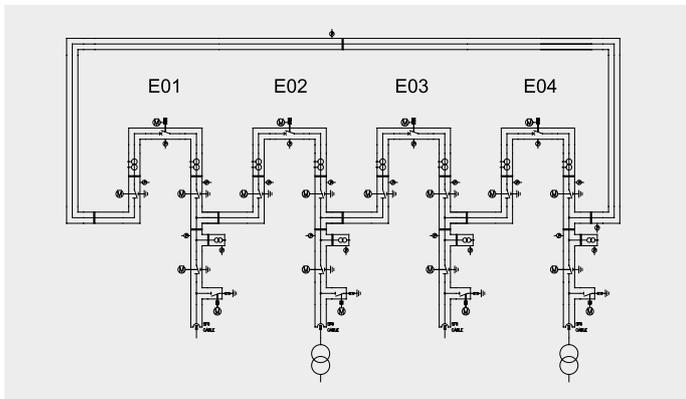
Similar to the 1½-breaker arrangement, even in case of circuit breaker maintenance, the ring busbar arrangement allows an

uninterrupted operation of all cable and line feeders. With this circuit, the number of circuit breakers and the cable as well as the feeders is equal. Consequently, in general this kind of arrangement is more inexpensive compared to a version based on 1½ breaker per feeder.

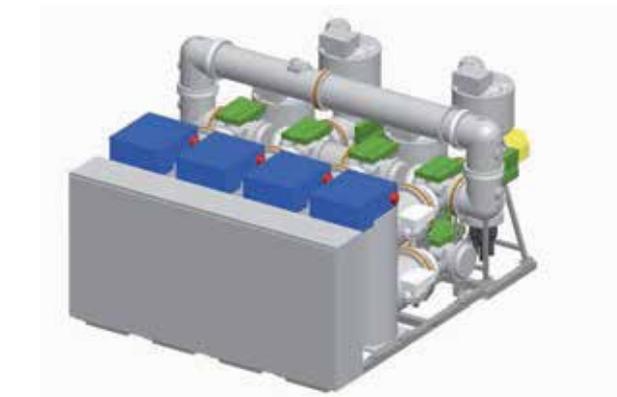
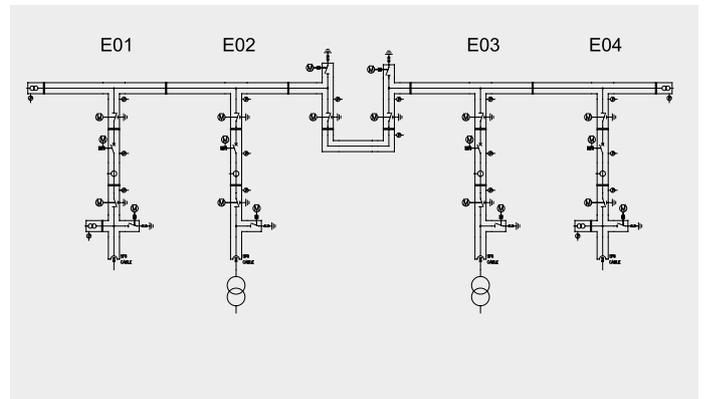
## H busbar arrangement

The H busbar arrangement is often used to supply industrial enterprises or smaller regions. With respect to supply reliability two feeding lines and two step-down transformers are optimal. The station can be operated as a double-feed station, with closed cross connection as a ring substation as well. If a subsequent extension of the substation is under consideration, a layout with single busbar and section coupling is selected. Later, this substation can be upgraded to double busbar arrangement and bus coupling. When further extensions are not planned, the compact version without busbar is selected.

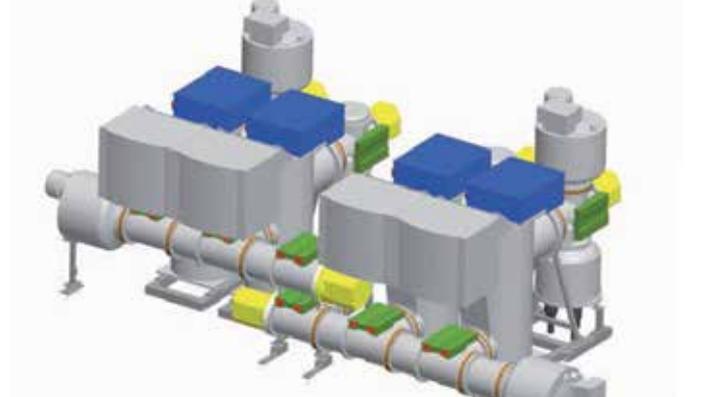
Gas scheme and single line for ring busbar arrangement



Gas scheme and single line for H-busbar arrangement



Isometric projection for double busbar arrangement with integrated local control cabinets



Isometric projection of an H-busbar arrangement with integrated local control cabinets

# Housing units

The housing units used have a standardized design but are modified slightly to accommodate the substation. For example, a double-feed station or “H-circuit” with five circuitbreakers can fit into a single 40-foot container. A 5-breaker H configuration with control cabinets will fit into two our standard containers. More than 5-breaker – min. three containers.

The housing units are specifically-designed to withstand rough handling during transportation and harsh on-site conditions. The base frame and racks are made of heat-galvanized rolled steel sections and the walls have smooth surfaces that can be painted to match surrounding infrastructure.

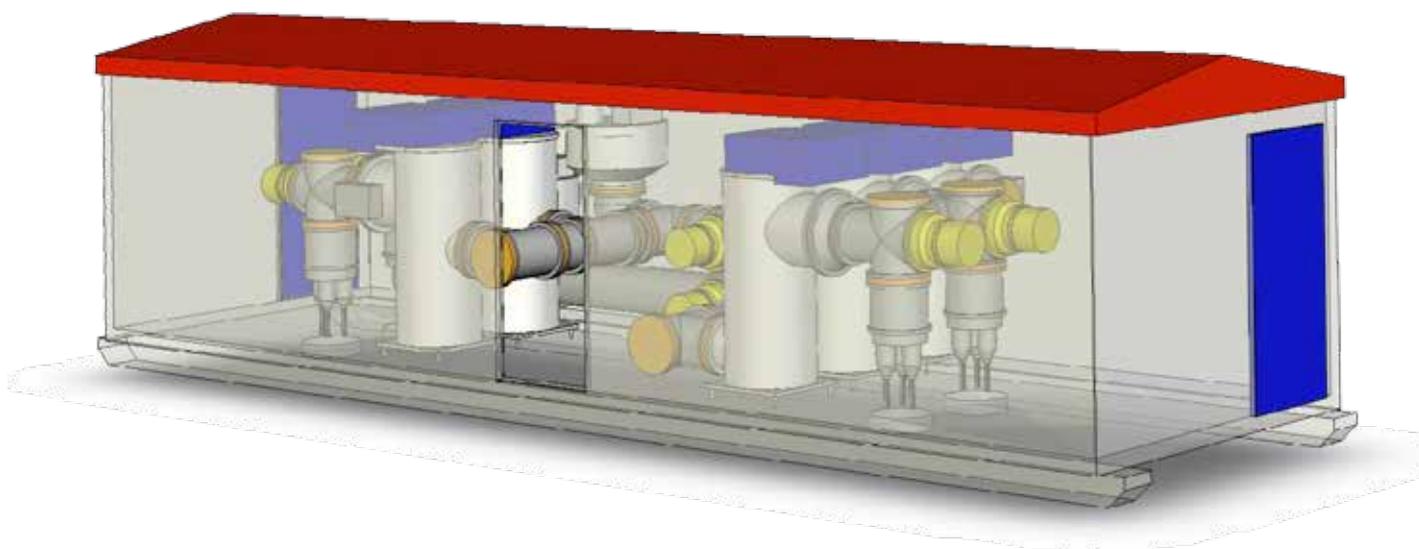
## Housing design

The housing top and the base frame are bolted to each other, enabling the substation components to be installed unhindered before shipping final unit assembly. Single walls parts of roof can be removed or the enclosure can be raised to gain easy and quick access to the equipment during maintenance work. Access doors are installed according to customer requirements.

The housing is designed both to protect the electrical equipment and provide the highest degree of personal safety taking into consideration the differences between an Integrated GIS and a conventional GIS. Among others, the housing features ventilation shutters that provide a pressure relief function.

Depending on the type of application for which the substation is intended to be used, it is fitted with a suitable heating and ventilation unit. Lighting, electrical distribution including battery power supply as well as a fire protection system are also included.

Our Integrated GIS units require very simple foundations. The exact type of foundation is usually dependent on actual soil conditions, on the usage duration and seismic requirements. Sleepers or prefabricated foundations are usually preferred for temporary installations. For more permanent installations, locally constructed strip-type foundations or foundation slabs are used. Preparations of the foundations are performed prior to arrival of the housing units according to your specifications.



Isometric projection of a H-busbar arrangement without integrated local control cabinets

# More information

## **ABB Contact Center**

Phone: +48 22 22 37 777  
e-mail: kontakt@pl.abb.com

## **ABB Sp. z o.o.**

### **Headquarter**

1 Zeganska St.  
04-713 Warszawa, Poland  
Phone: +48 22 22 37 000

Rafał Płatek

Phone: +48 601 895 272  
e-mail: rafal.platek@pl.abb.com  
e-mail: serwis.stacji@pl.abb.com

**[www.abb.pl](http://www.abb.pl)**

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