



Product brochure

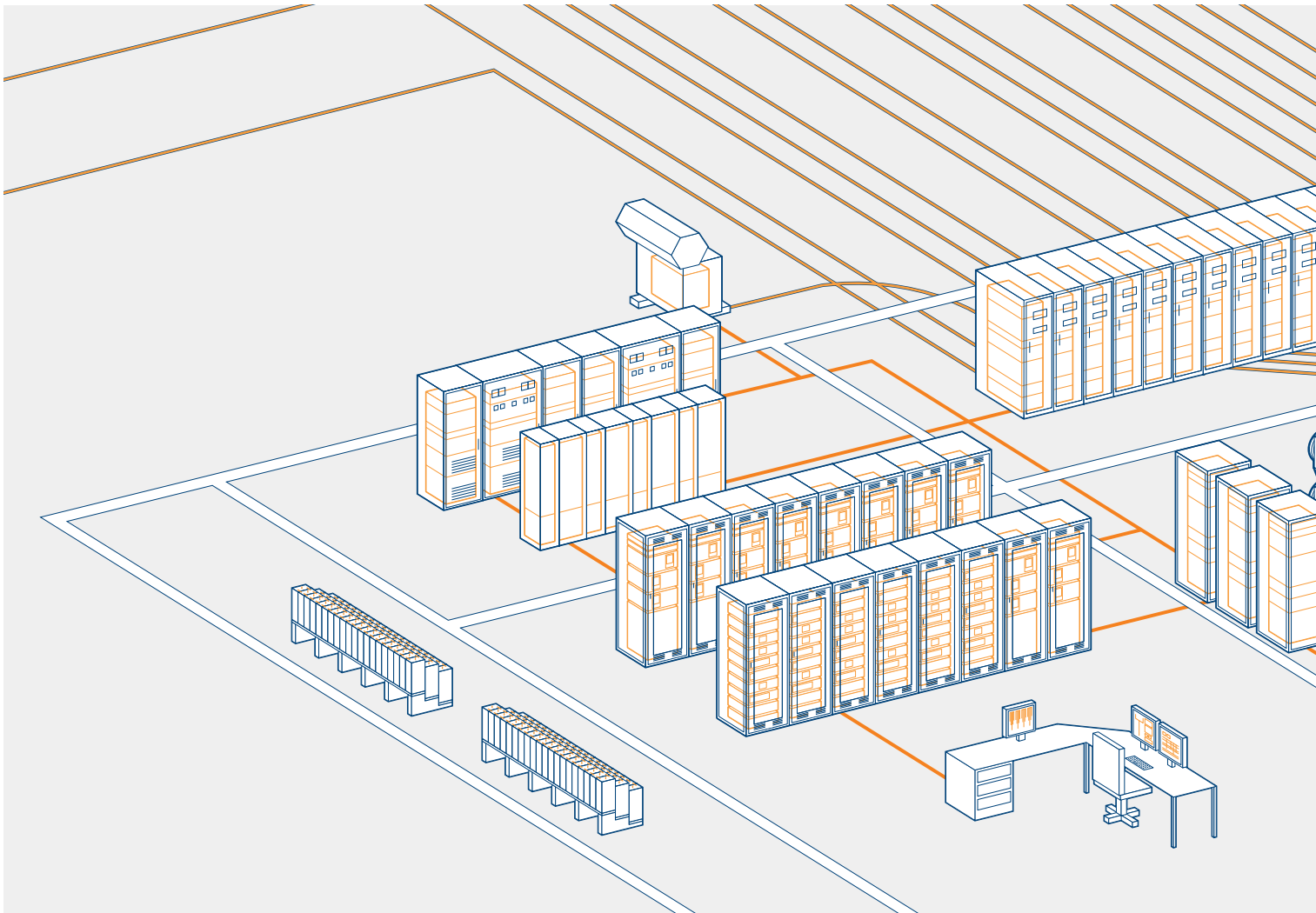
Integrated GIS technology up to 170 kV Modular switchgear in pre-fabricated housing

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.

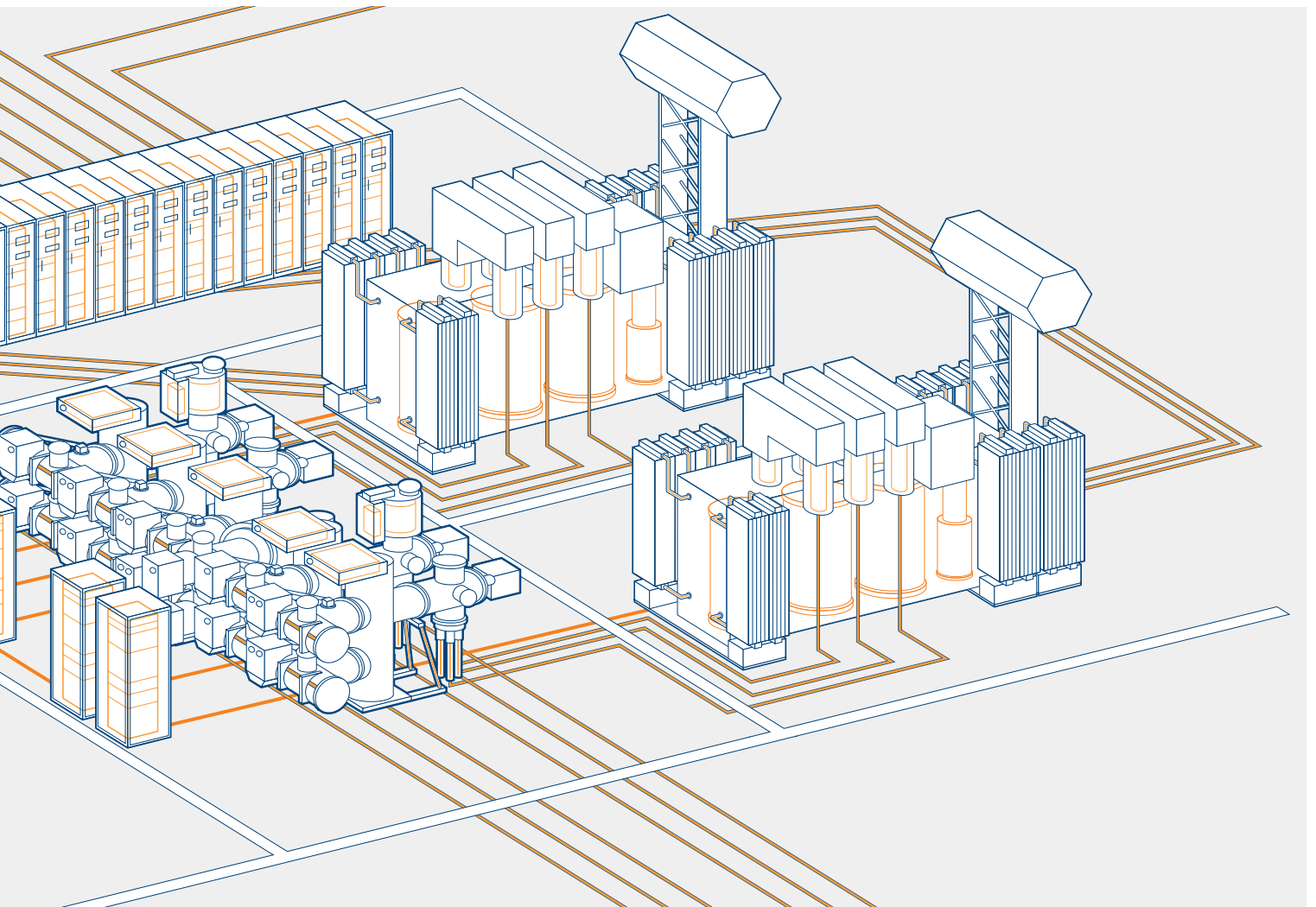
ABB offers a wide range of high-voltage products up to 1200 kV that help enhance the reliability, efficiency and quality of power in transmission and distribution grids, power plants and industries while minimizing environmental impact. The wide product range is complemented by a comprehensive service 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 72.5kV to 1200kV.



Contents

| | |
|---|----|
| Integrated gas-insulated switchgear (GIS) technology up to 170 kV | 04 |
| Benefits | 05 |
| Technology | 06 |
| System configuration | 08 |
| Housing units | 09 |
| Installation | 11 |
| ABB's commitment to service | 12 |
| Enhancing eco-efficiency over the life-cycle | 13 |
| Customer success story | 14 |
| Technical data | 15 |



Integrated gas-insulated switchgear (GIS) technology up to 170 kV

A pre-designed and integrated system for permanent and temporary installations

The growing demand for power in urban areas as well as in the mining, oil and gas industries requires a power supply that is both flexible and available on short notice. An interruption in power supply, no matter how short, can be costly to both utility companies and industries.

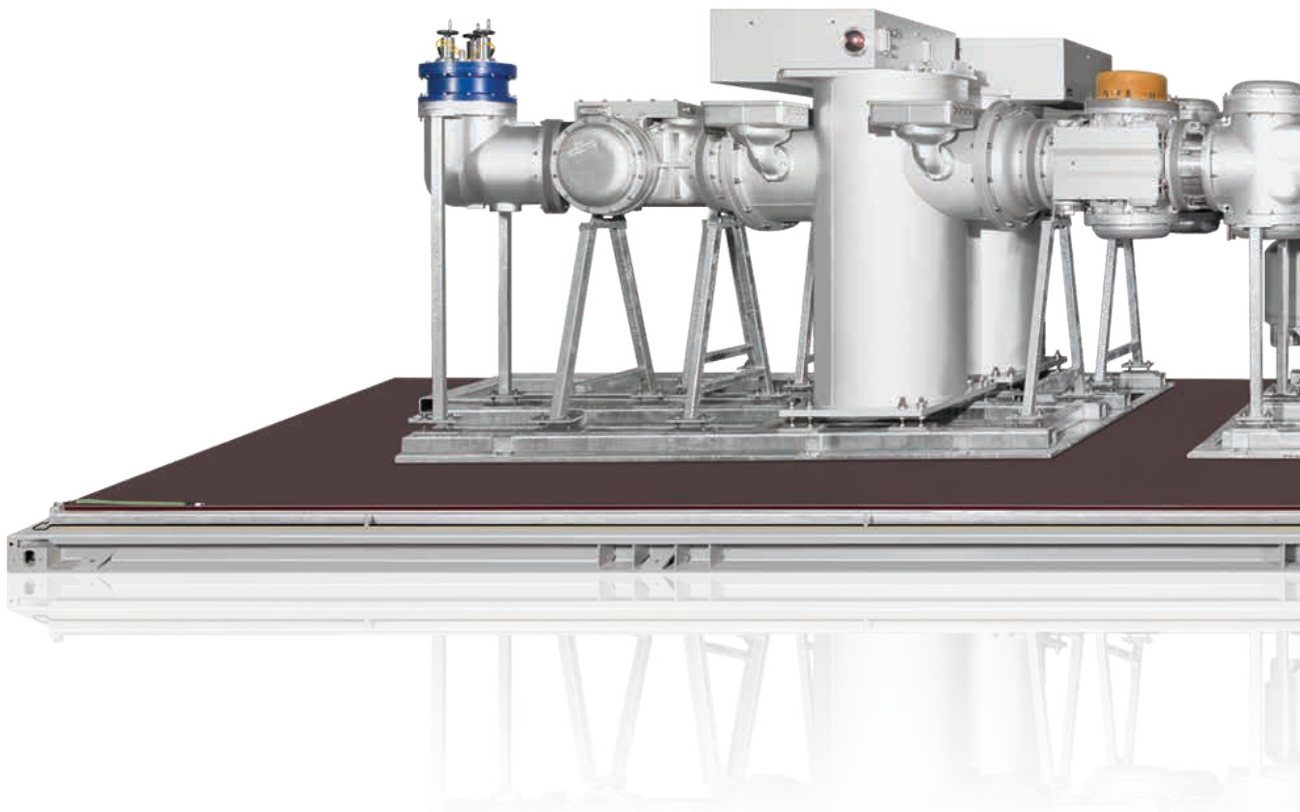
Applications

The integrated GIS is a prefabricated gas-insulated switchgear (GIS) installation based on ABB's well-proven GIS technology that can be produced and installed in approximately 50 percent less time than a conventional GIS substation. With a rating of 170 kV, 4000 A, 63 kA, it is the perfect solution for customers in need of a substation that can be quickly energized for grid expansions, for backup or emergency power needs and for short installation time requirements. Urbanization is a growing trend and the existing electrical

infrastructure is reaching end of its lifecycle in many parts of the world. In densely populated areas where an existing air insulated substation is being phased out, an integrated GIS can free up valuable land for other use. Its simplicity and easy handling is important as many utilities today are reducing their operations and maintenance staff.

Due to its pre-fabricated design and fast deployment it is also ideal for applications in the oil, gas, and mining industries. The integrated GIS installation can easily be shipped and transported to the next oil or gas exploration project or mining site.

Pre-designed and standardized integrated GIS configurations ensure high quality and reliability. The substantial reduction of the installation time compared to conventional substations is achieved by performing all the planning, design, assembling, testing and quality control in our factories.



Benefits

Flexible power supply anytime, anywhere

Our Integrated GIS helps you address:

Fast substation deployments and expansions

- We can deliver a fully pre-fabricated GIS including all primary and secondary equipment, integrated control and protection and auxiliary equipment within five 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
- Pre-fabrication and equipment integration greatly reduces on-site work yielding 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

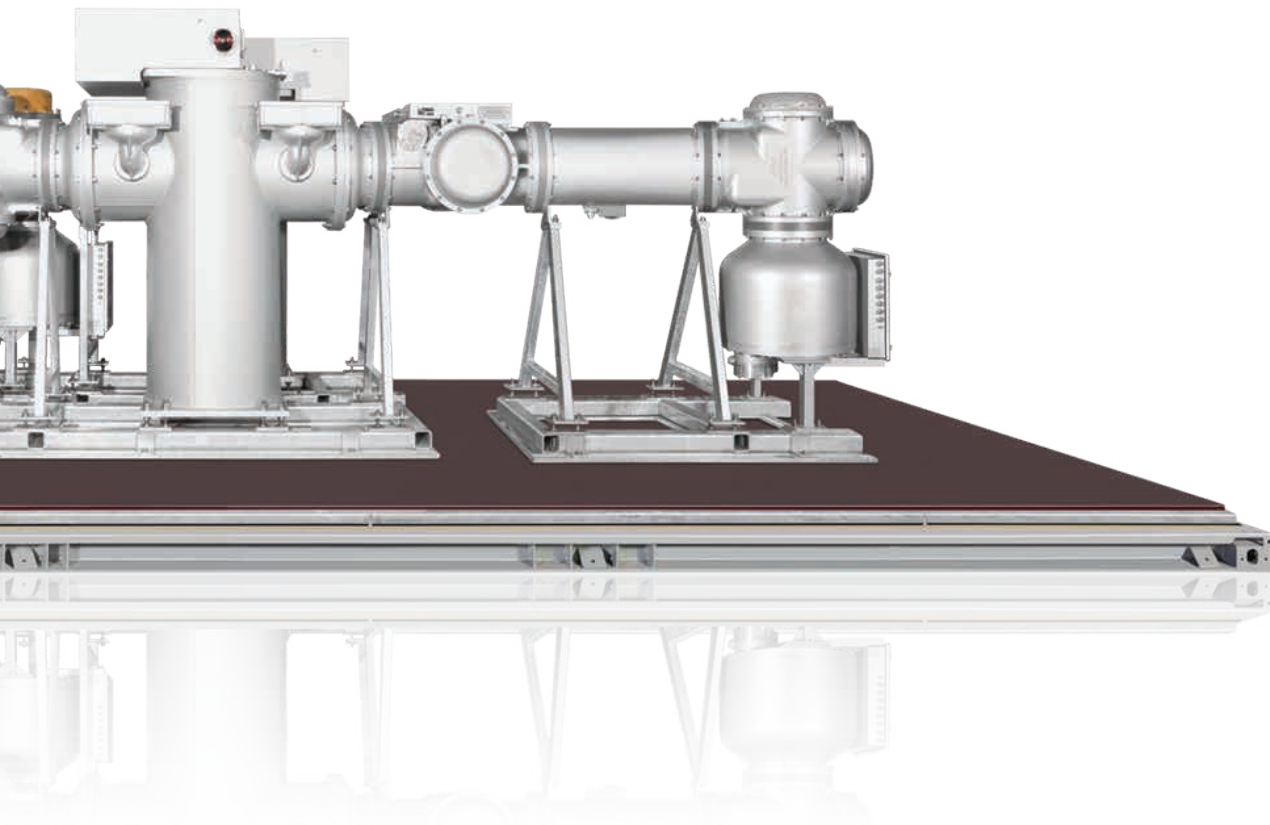
- Integration of the GIS into a suitable housing can enable lower temperature requirements such as operating temperatures below -30°C (-22°F), without using special SF_6 gas mixtures

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 and openings for easy maintenance



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 63 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

- SF₆- encapsulation of active parts
- Minimum space requirements
- Built to withstand harsh environmental conditions

High energy efficiency

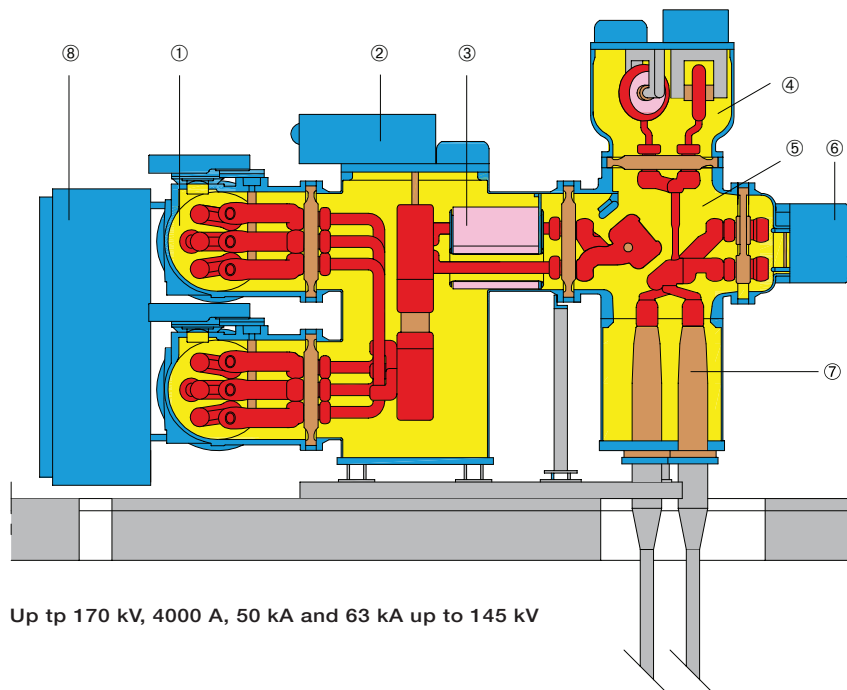
- Installation at point of power consumption
- Low electrical losses

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
- SF₆-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 SF₆ 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

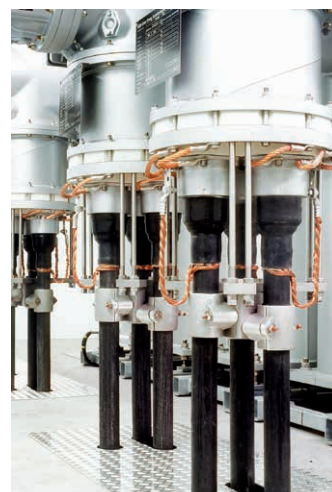
In addition to the essential functional modules, our Integrated GIS can be fitted with bushings for connection to overhead lines, cable connectors or transformer direct connections.



SF₆-gas-to-air bushing to connect overhead lines



Three-phase power transformer direct connection



Plug-in dry type cable connection

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. Keeping the shipping unit dimensions and weights close to standard values such as a 20-foot or 40-foot ISO container ensures a speedy delivery.

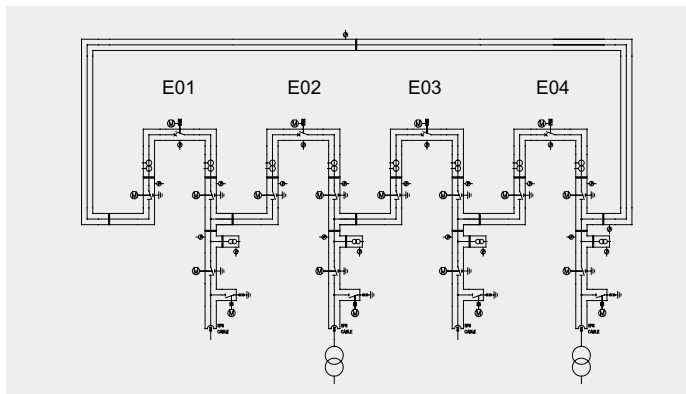
Substation configuration

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

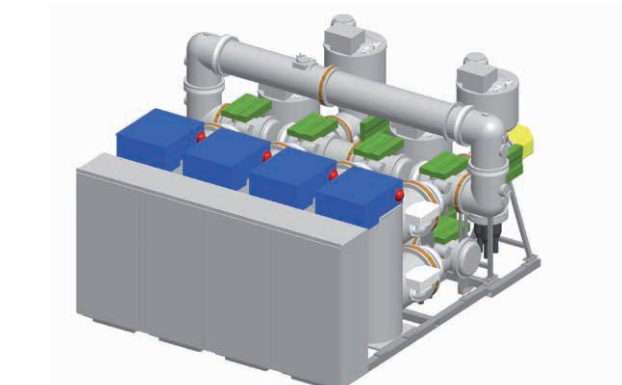
- Single feeder (in/out)
- 4 breaker ring (extendable)
- 4 breaker double busbar
- H-Arrangement (double feeder)

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.



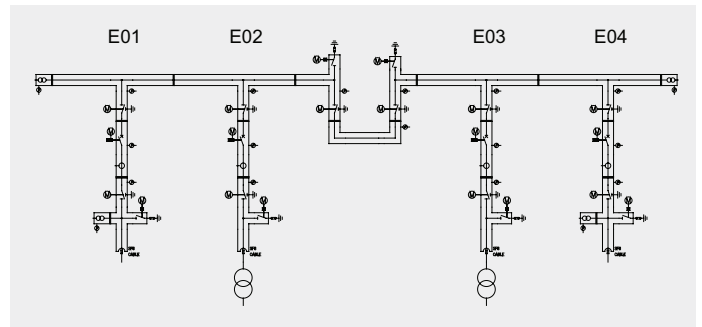
Gas scheme and single line for ring busbar arrangement



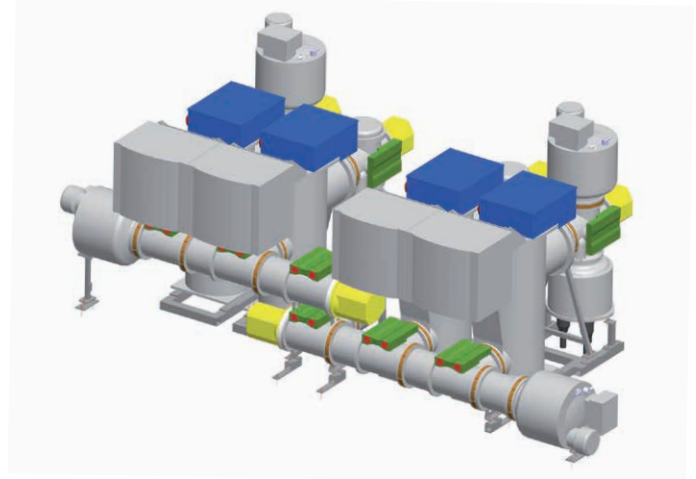
Isometric projection for double busbar arrangement with integrated local control cabinets

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 H-busbar arrangement



Isometric projection of a 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 circuit-breakers can fit into a single standard 40-foot container. A 4-breaker ring configuration with control cabinets will fit into two standard 40-foot 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 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.

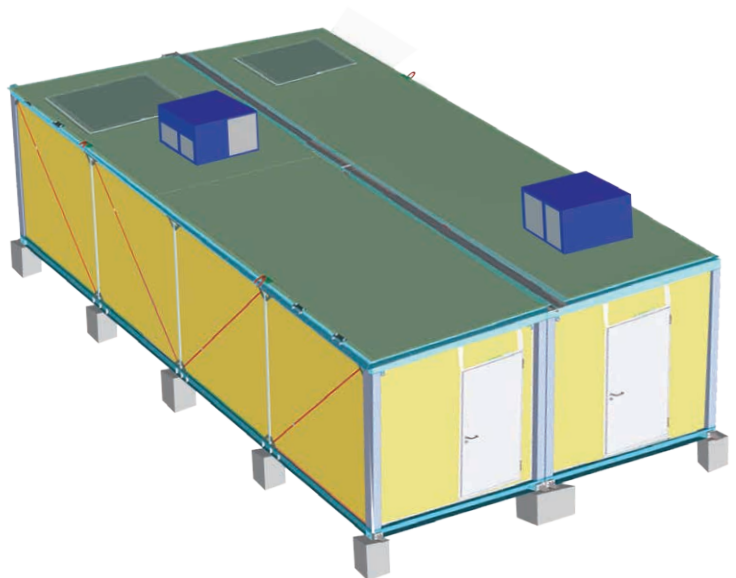
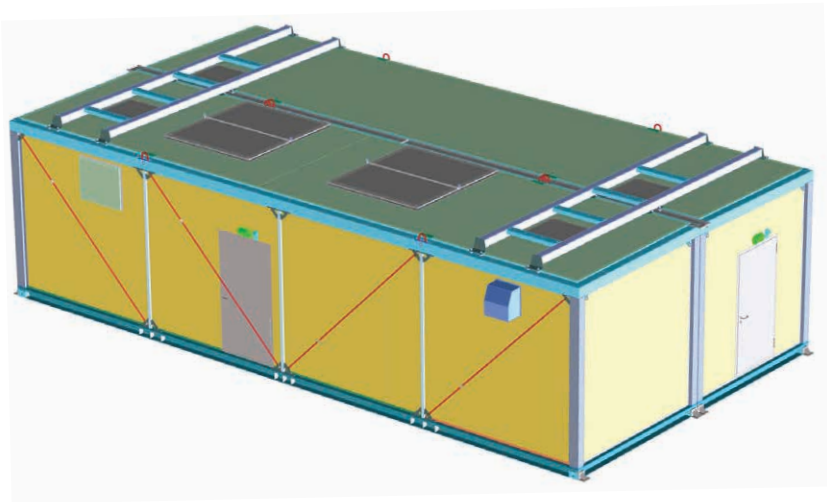
Our Integrated GIS units require very simple foundations. The exact type of foundation is usually dependent on actual soil conditions, on the usage duration and seismic requirements. Sleepers or prefabricated foundations are usually preferred for temporary installations. For more permanent installations, 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.



Foundations

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Installation of integrated GIS

Design, engineering and manufacture

Your request is dealt with by our engineers who design and integrate the selected equipment into the housing units. Functional tests and routine tests can be performed on all installed equipment before the units leave the factory.



Transportation

The housing units are very well suited for all types of long distance transportation by ship, air or road. The units are also furnished with removable and standardized lifting aids to facilitate shipping and handling in harbor.



Installation and commissioning

Once the units arrive on site all that remains is the installation on the foundations, fitting the electrical bushing or cable connections.



Energize

After a very short installation time the self-contained GIS substation is ready to be energized and becomes operational.



ABB's commitment to service

As one of the leading global manufacturers of power and automation technologies, we complement our products with a comprehensive spectrum of round-the-clock service support capabilities. Our aim is to increase systems availability on a lasting basis. Our service organizations are located close to the customers to allow the fastest possible response time worldwide.

Our commitment to service begins from the first customer meeting to commissioning and beyond. Our capabilities range from consulting, planning, engineering, maintenance, spare parts supply, and hardware and software upgrades.

Our switchgear requires minimal maintenance and service. Under normal operational conditions, more than 40 years of fault-free operation is assured with periodic visual checks. The fully-integrated design of the integrated GIS ensures minimal maintenance and the self-contained construction guarantees easy and convenient serviceability anywhere and under any weather condition.



Enhancing eco-efficiency over the life-cycle

Low environmental impact

For ABB, sustainability is about balancing economic success, environmental stewardship and social progress to benefit all our stakeholders.

Sustainability considerations cover how we design and manufacture products, what we offer customers, how we engage suppliers, how we assess risks and opportunities, and how we behave in the communities where we operate and towards one another, while striving to ensure the health, safety and security of our employees, contractors and others affected by our activities. In line with our business practices, we publish environmental product declarations for each product we manufacture.

The life cycle phases

The life cycle of the ELK-04 product consists of three phases: manufacture, use and disposal. The manufacture scenario includes materials used, transport of components and SF₆ leakage rates. The usage scenario includes transport of products to customers as well as SF₆ leakage rates and energy losses assuming a 40-year life time. The disposal phase refers to SF₆ leakage rates and the energy for making recycled metals reusable.

Manufacturing phase

- Continuous improvement in product design resulted in a more compact footprint that uses less aluminum and other metals
- Low thermal losses due to innovative designs and material choices
- Full system shipment due to self-contained design reduces the environmental impact of transportation dramatically
- ABB's factory is ISO 14001 certified for environment best practices and we also conduct regular environment audits at our suppliers' facilities

Use phase

- Online monitoring for preventive maintenance
- The low operating energies used by ABB's modern interrupters combined with the efficient mechanical spring drives result in lower auxiliary power supply consumption
- Type tested for 0.1 percent SF₆ gas leakage rate per year
- Minimized SF₆ gas leakage rates due to well proven sealing systems

End of life phase

- Use of material which is easy to recycle or dispose
- Improved maintenance processes that avoid the release of gases and oil
- Improved recycling and disposal through clear declarations adjusted to different global boundary conditions

Customer success story

Customer: City of Anchorage, Alaska, U.S.A.

Integrated GIS for extreme climate conditions

In 2009, the City of Anchorage in Alaska wanted a new substation quickly to address the growing demand for power. In addition to the time constraint, the customer also required the substation to be as unobtrusive as possible as the space allocated for the project was in close proximity to a shopping center. Needless to say, the solution also needed to withstand Alaska's freezing climate and frequent seismic activities.

ABB responded by providing an ELK-04 / 170 kV GIS substation that was installed and energized in a few weeks. The substation consists of a 4-breaker ring integrated into two 40-foot containers. The local control cubicles were also fully integrated inside the containers.

The housing was built according to IP55 standard with doors and pressure release flaps.

Reasons for choosing a pre-fabricated self-contained integrated GIS solution.

- Unobtrusive and compact substation.
- High site installation costs yielding request for short installation time.
- Difficult environmental conditions with very cold climate and high seismic requirements.

The Integrated GIS solution was the perfect answer for all the requirements. Based on the success of the first project, the customer has now ordered the next substation using a standardized layout.

Our Integrated GIS and similar installations have been delivered to customers in Australia, Denmark, Ecuador, Germany, United Kingdom, Greece, Luxembourg, Malaysia, Saudi Arabia, Singapore, Taiwan and the U.S.A.



Technical data

| Rated values tested according to the latest IEC and IEEE/ANSI standards | | | | | |
|---|-----|-------|--|-------|---------|
| Operating voltage | kV | 72.5 | 123/126 | 145 | 170 |
| Operating frequency | Hz | 50/60 | 50/60 | 50/60 | 50/60 |
| Lightning impulse withstand voltage against earth | kV | 325 | 550 | 650 | 750 |
| across isolating distance | kV | 375 | 630 | 750 | 860 |
| Power frequency withstand voltage against earth | kV | 140 | 230 | 275 | 325 |
| across isolating distance | kV | 160 | 265 | 315 | 375 |
| Normal current | A | | 1250–4000 | | |
| Peak withstand current | kA | | 80–164 | | 80–130 |
| Short circuit breaking current | kA | | 31.5–63 | | 31.5–50 |
| Minimum insulating gas pressure at 20 °C | kPa | | 520/600 | | |
| Minimum quenching gas pressure at 20 °C | kPa | | 600/630 | | |
| Permissible ambient temperature | °C | | -30/+40 | | |
| Encapsulation | | | three-phase | | |
| Location of installation | | | indoor/outdoor | | |
| Dimensions | m | | 1.0 x 3.6 x 2.7 – 1.2 x 5.3 x 3.2 (for double busbar bay with integrated local control cabinet and voltage transformer) | | |
| Weight | kg | | 2400–3800 (for double busbar bay) | | |
| Circuit breaker operating mechanism | | | hydromechanical, with energy storage in spring | | |

The above data should not be understood as limiting values. Further data upon request.

Contact us

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