

General brochure

Generator circuit-breakers Enhancing power plant availability

ABB, your reliable partner for GCB

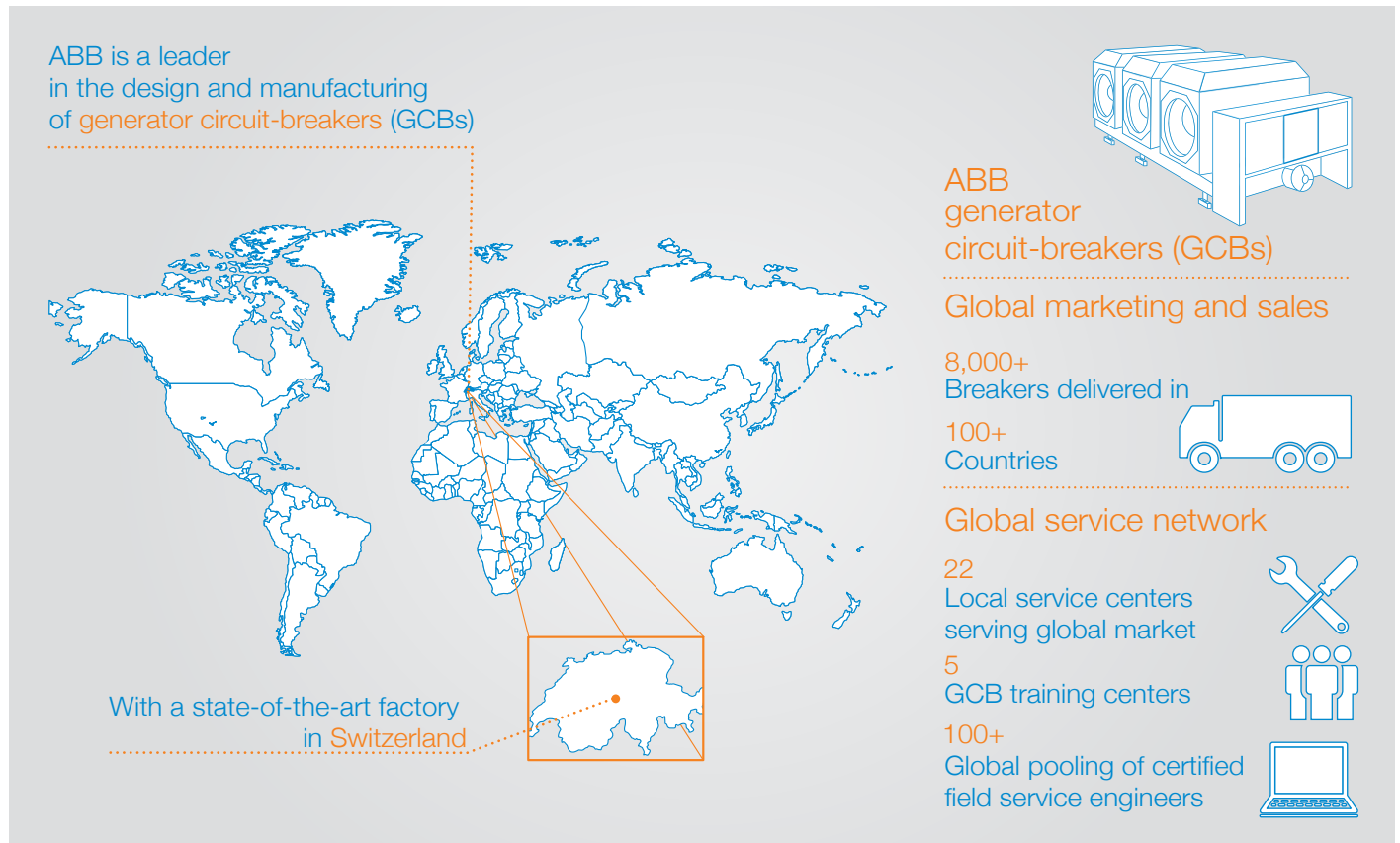


ABB is a leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 145,000 people.

ABB is a leader in the design and manufacturing of generator circuit-breakers (GCBs) since 1954 with more than 8,000 deliveries in over 100 countries. We offer the widest and most modern portfolio of GCBs in SF₆ and vacuum technology with a range of short-circuit ratings from 50 kA to 300 kA and nominal currents from 3,000 A to over 50,000 A to meet the demand of all types of power plants around the globe.

Continuous research and development has assured the most modern and largest portfolio with the highest value for customers.

GCB increases protection and flexibility in power plants

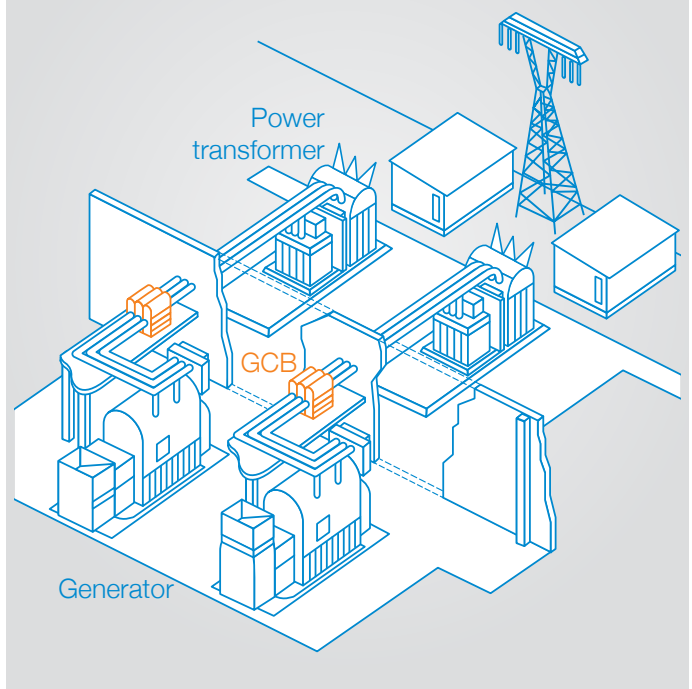


GCB plays an important role in switching the circuit between generator and transformer in a power plant.

It protects important assets in power plants by clearing potential harmful short-circuit faults in tens of milliseconds, preventing severe damages.

ABB's GCBs serve all types of power plants around the globe to increase both safety and flexibility. With world-leading technology, they meet customers' needs, to achieve the highest possible plant availability at the lowest possible cost.

Typical arrangement of a power plant



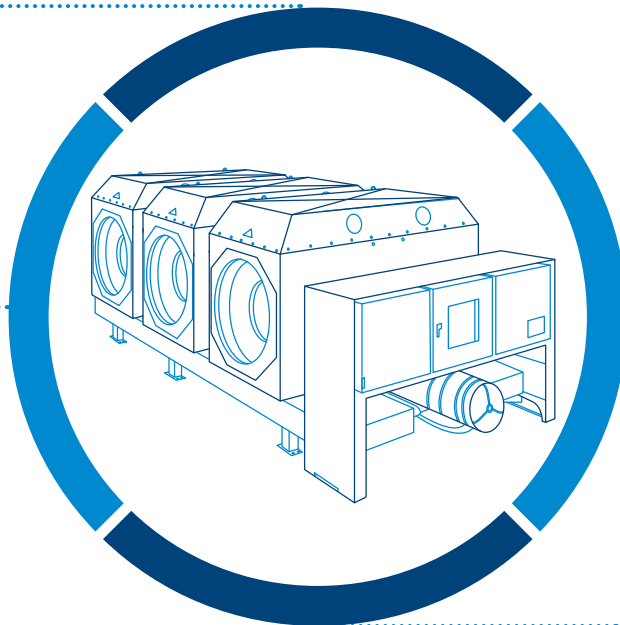
Wide range of technological and economic benefits

Simplified operational procedures

- Clear and logical plant arrangement
- Clearly defined responsibilities for the operation of the plant. GCB is operated by the power plant owner while high-voltage breaker is controlled by the grid operator
- No auxiliary supply changeover necessary. Only one circuit-breaker has to be operated during the starting-up or shutting-down of the generator

Economic advantages

- Disconnectors, earthing switches, instrument transformers, surge arresters etc. can be integrated into the GCB enclosure
- Station transformers and relevant high-voltage and medium-voltage connection equipment can be omitted
- Increased power plant availability means higher profits for the operator



Improved protection

- The differential protection zones of the generator and the transformers can be arranged to achieve the maximum selectivity
- More protection for transformers as generator-fed short-circuit faults are interrupted within a maximum of four cycles whereas the de-excitation equipment requires several seconds

Higher power plant availability

- Reduced possible costly damages of primary and secondary equipment in case of failure
- More reliable synchronization of the generator with the high-voltage transmission network
- Unit auxiliaries' supplies can be drawn directly from the high-voltage transmission network

ABB GCBs offer the best value in products and services

As a global leader for GCB, ABB strives for excellence in technology and processes, never compromising in quality.

State-of-the-art technology

- Continuous research and development ensures the most modern and functional portfolio for customers
- Lowest lifecycle cost and lowest maintenance requirement

Widest portfolio based in SF₆ technology

- Reliability proven by the largest installed base of more than 8,000 GCBs worldwide
- Widest ratings for short-circuit current ranging from 63 kA to 300 kA, and rated continuous currents from 6,300 A to more than 50,000 A
- Leading performance in switching currents exhibiting delayed zero crossing, for example in case of generator-fed or out-of-phase faults

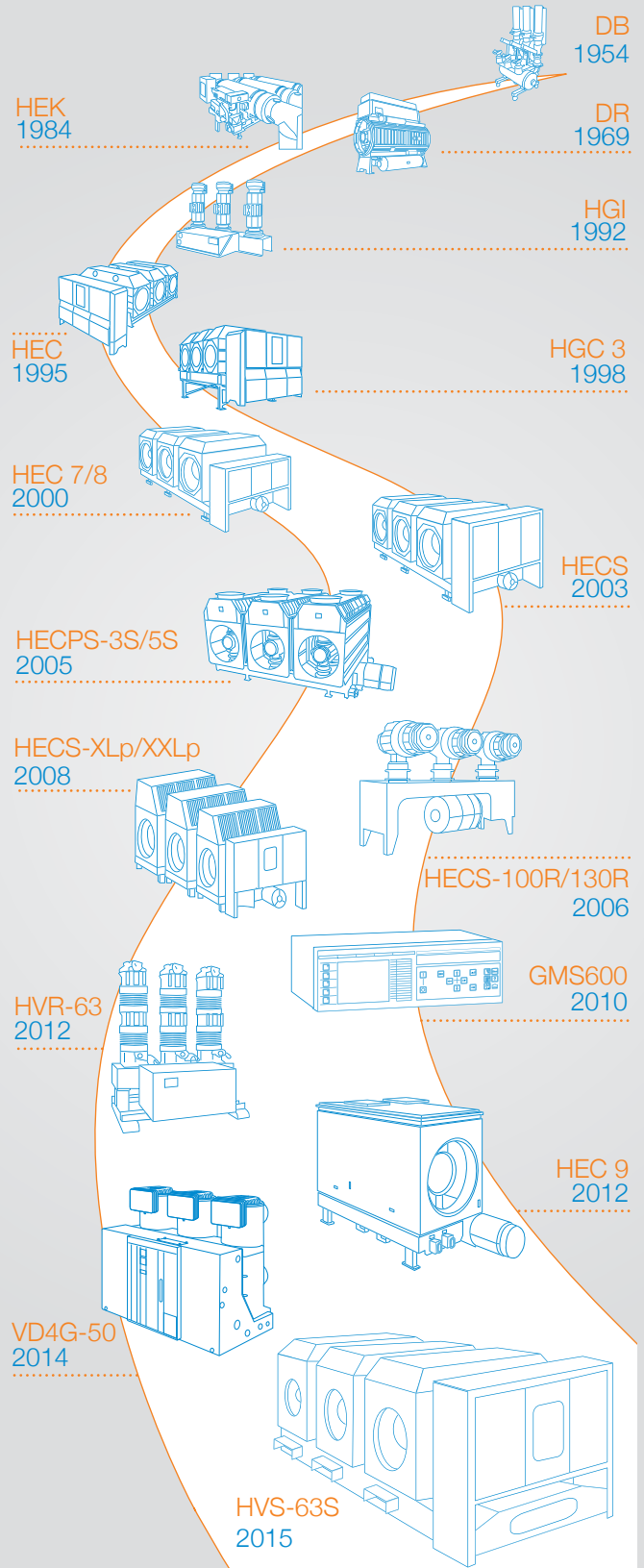
Award-winning production facility in Zurich, Switzerland

- Based on 'lean enterprise' principle, ABB GCB factory is able to achieve a production time reduced to 16 hours and assure stable ex-works delivery in only three months for standard GCBs
- Speed and performance assures a quick resolution of trouble-shooting in urgent cases

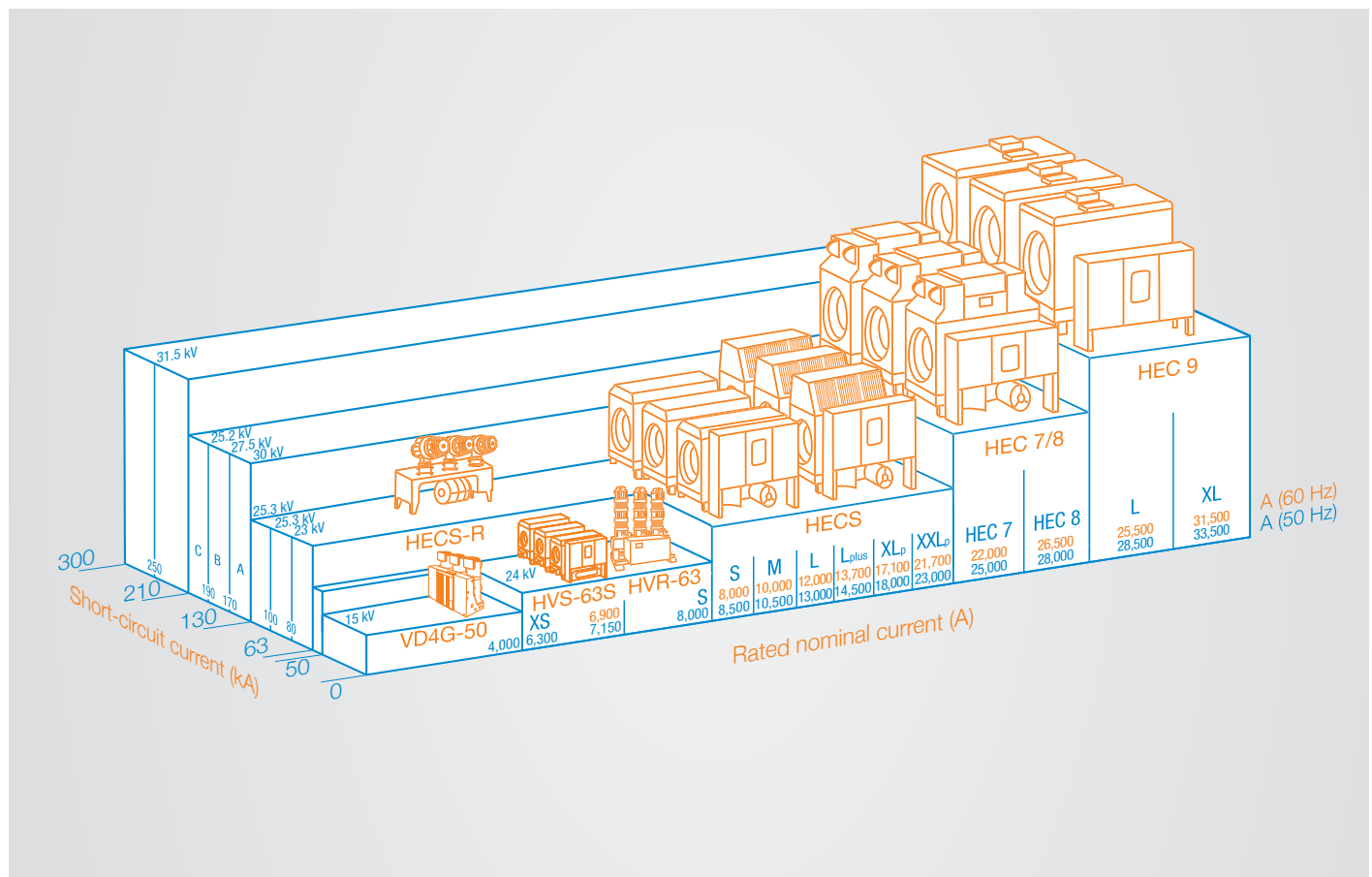
Sustainability

- Contribution to environmental protection by recycling of SF₆
- Involvement in renewable energy such as solar and pumped storage power plants

Pioneers in GCB development and innovation since 1954



Complete offering of GCBs and monitoring system



Based on standardized platforms



VD4G-50 up to 50 kA – 4,000 A

Cost-optimized solutions for generators up to 70 MW

ABB is the only manufacturer to offer GCBs with both vacuum and SF₆ switching technologies. Based on the well-proven and highly reliable VD4 platform, VD4G-50 is tested to meet the most stringent IEEE and IEC requirements for generator applications. VD4G-50 supports generators up to 70 MW and is able to clear generator-fed faults up to 50 kA.



HVR-63 up to 63 kA – 8,000 A

The first built-in mechanical erosion indicator for arcing contact

The innovative built-in direct contact erosion indicator offers a clear visualization of the remaining length of the arcing contact for the highest degree of safety and reliability. HVR-63 is especially suitable for power plants with frequent switching operations and unit power of up to 180 MW such as hydro power plants. It is highly reliable in case of seismic events, such as earthquakes, as tested according to IEC/TR 62271-300 standard.



GMS600 monitoring system

State-of-the-art monitoring for GCB

Enhanced GCB monitoring GMS600 offers unique features such as remaining time before service is needed, SF₆ gas monitoring and trending (GMS600-G) and temperature monitoring of primary conductors (GMS600-GT). GMS600 enables ABB to support power plant operators and maintenance engineers for the most cost-effective management of the equipment and the entire lifecycle.



HVS-63S up to 63 kA - 7,150 A

The most reliable system solution with the contact erosion indicator

The newly developed HVS-63S is a complete 3-phase system type, which is based on the highly reliable technology of HVR-63. HVS-63S offers a clear visualization of the remaining length of the arcing contacts for the highest degree of safety and reliability. It is best suited for retrofits and replacements in power plants with frequent switching operations and unit power of up to 200 MW.



HECS up to 130 kA – 23,000 A

Highest installed base worldwide

The wide range of ratings with short-circuit currents from 80 to 130 kA makes HECS the most used GCB in the world for power plants with a unit power of up to 800 MW. With small and standardized dimensions HECS is easy to install and highly suitable for replacements and retrofits in existing power plants. HECS has very low lifecycle cost with up to 20,000 close-open (CO) no-load operations or 20 years between main overhauls.



HEC 7/8 up to 210 kA – 28,000 A

One step ahead in SF₆ technology

HEC 7/8 is suitable for power plants up to 1,600 MW. Naturally cooled up to 25,000 A, its arc interrupting technology allows to clear fault currents exhibiting very high degree of asymmetry up to 130 percent. It is also recommended for retrofits or replacements of old generator circuit-breakers based on air-blast technology.



HEC 9 up to 300 kA – 33,500 A

The most powerful GCB in the world

HEC 9 has been developed for large sized power plants up to 2,000 MW such as nuclear and coal fired. It has the world's highest performance with short-circuit currents up to 300 kA and is also highly suitable for retrofits or replacements of old GCBs based on air-blast technology. It is highly reliable in case of seismic events, such as earthquakes, as tested according to IEC/TR 62271-300 standard.

We offer full consultancy, services and trainings to support our customers

Application study team

A highly competent team of GCB experts is available to support customers in the proper selection of GCB during all phases of power plant design. Competence is available to find the best solution for each customer, from the simplest question to the most complex analysis.

Service

We help customers to ensure the reliability and safety of their operations at optimized cost. ABB's service supports our customers over the entire lifetime of equipment covering all essential parts to give the GCB a longer life. A team of experts is available to deliver the following benefits:

- 24/7 hotline
- Certified GCB field service engineers located in our local service organizations around the globe
- Service agreements can be customized and can include risk assessments, warranty extensions diagnostics, consulting, and more
- Customized maintenance and retrofit solutions to extend the lifetime of GCBs
- Options to adapt your GCB to future requirements including rating upgrades and modernizations

Trainings

Fully-equipped training centers are available to all customers located in strategic areas. GCB training programs are available in the training centers or at the power plants covering a range of topics to enable customers to:

- Ensure safe operation of the investment
- Allow a cost-efficient performance of the breaker
- Guarantee a risk-free utilization
- Reduce risk of unexpected downtimes
- Minimize lifetime cost of the breaker



Service | Training | Study groups

Award-winning manufacturing facility

Setting the benchmark with lean enterprise

Our GCB factory has been awarded best factory of the year in Europe in 2010 for setting a benchmark on how the factory of the future should operate – with improved processes, enhanced products and best-in-class customer service.

The entire production process at the GCB factory is based on the 'lean enterprise' concept, where products and processes are continuously optimized to reduce key input requirements like time, space and capital. Flow production principles help optimize the use of space and time, and process efficiencies are built into the entire production and logistics chain, from suppliers to end users.

This approach leads to significantly shorter lead times, shorter cycle times and stock reduction, all contributing to improved efficiency and productivity. Since opening the factory ABB has cut the average production time for GCBs from 20 days to two days. The entire delivery time including engineering, manufacturing, testing and quality control takes just three months.

For the customer

Our short delivery time means longer time availability for the engineering of the power plant, with more flexibility of design changes to the requested GCB until the design freeze of up to two months before the estimated delivery. Since our GCBs are produced just-in-time, this improves project cash flow for our customers.

Understanding customers' needs

In addition to having efficient production process, our GCB factory also won the Manufacturing Excellence Award in the category of Customer Orientation in 2014. It highlights our ability to understand our customers' needs and to cater to them with on-time and on-quality solutions.



Anyone from anywhere can visit our factory



In our award-winning factory in Zurich, Switzerland, we have an open-door policy, where anyone can visit our facilities. We take pride in our relationships with our customers and provide full transparency in their projects. Customers are more than welcomed to attend the Factory Acceptance Test (FAT) at our factory. A quiet and comfortable room is made available to host our guests in the most efficient way to complete the test procedures and issue the relevant test protocols in the shortest possible time.

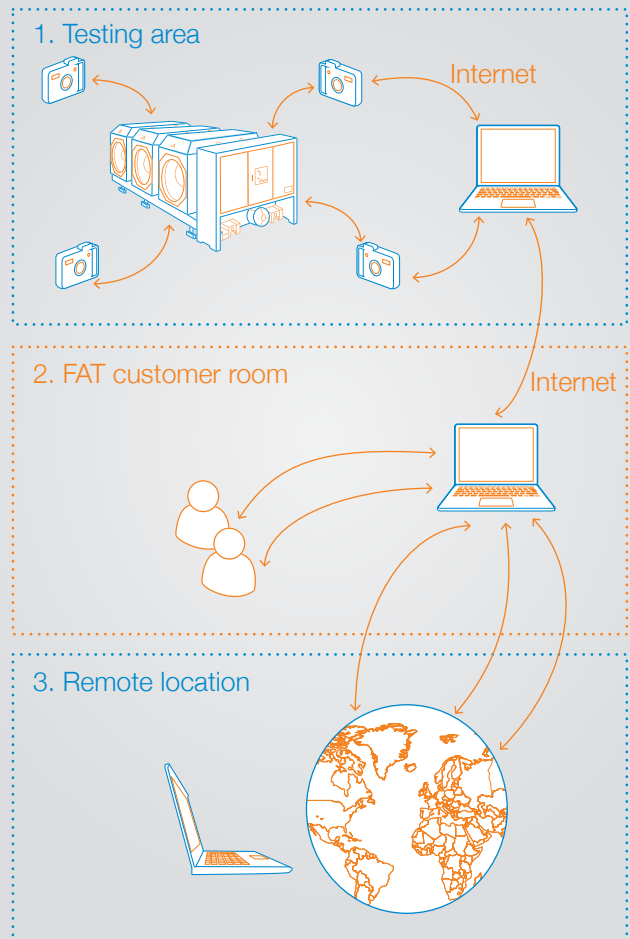
Making life easier for our customers with Remote Factory Acceptance Test (RFAT)

If customers are not able to join us in the factory, we bring the FAT to them. With only an internet connection, customers can witness the testing of their GCB in our factory without actually leaving their office premises. Using our unique RFAT tool enables us to virtually invite our customers into the GCB factory and provide them a real time customer event experience.

The test area is equipped with live cameras and computerized measuring system; therefore, streaming of test performance with measured test data is collected by web client application and made available on any internet browser.

The RFAT serves our customer better while saving time and resources. Overcoming geographical limitations and not restricting a number of attendees allow participation of as many relevant people as necessary. For orders with multiple deliveries the remote method brings about effective cost optimization and individual benefits to each customer.

How RFAT works

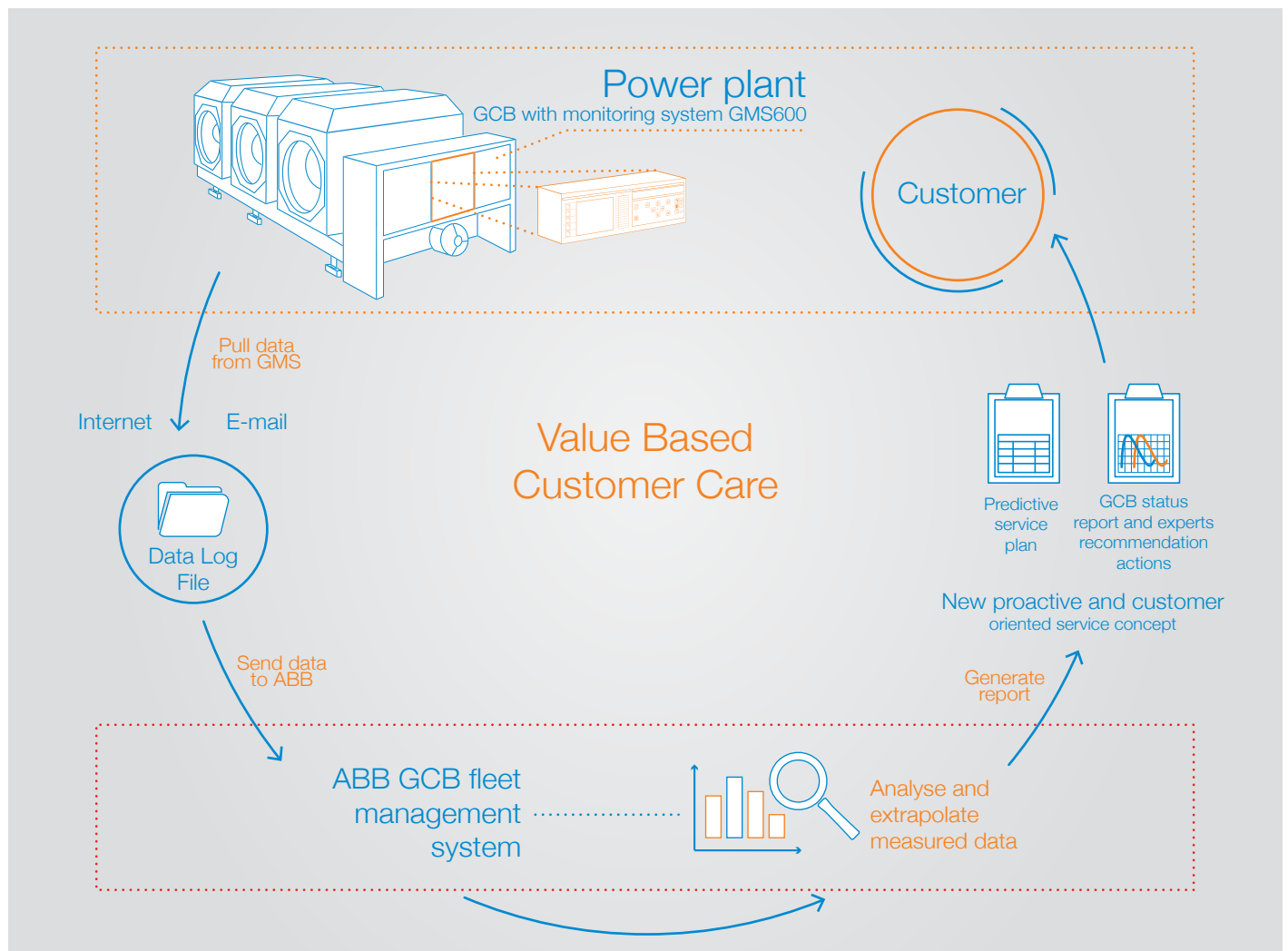


Value Based Customer Care (VBCC)

ABB experts at your fingertips

The innovative concept of VBCC enables ABB to support power plant operators and maintenance engineers to facilitate the highest operational availability of their GCB's over the entire lifecycle. ABB experts will provide valuable service recommendations according to customers' requirements based on data retrieved from the GCB monitoring system, GMS600. Through this, customized reports consist of overall condition of the breaker, time to service, prognostics of operational parameters trending and drive results.

Forecasts and recommendations are then generated to help customers better plan their maintenance activities, decrease maintenance costs and prolong the lifetime of the GCBs. VBCC supports power plant operators and maintenance engineers through a proactive and cost-efficient maintenance program. With improved diagnostic capacity, the reliability of a power plant is further increased.



Contact us

ABB Switzerland Ltd

High Voltage Products

Brown Boveri Strasse 5

CH-8050 Zurich / Switzerland

Phone: +41 58 588 34 24

Email: sales.gcb@ch.abb.com

www.abb.com/gcb

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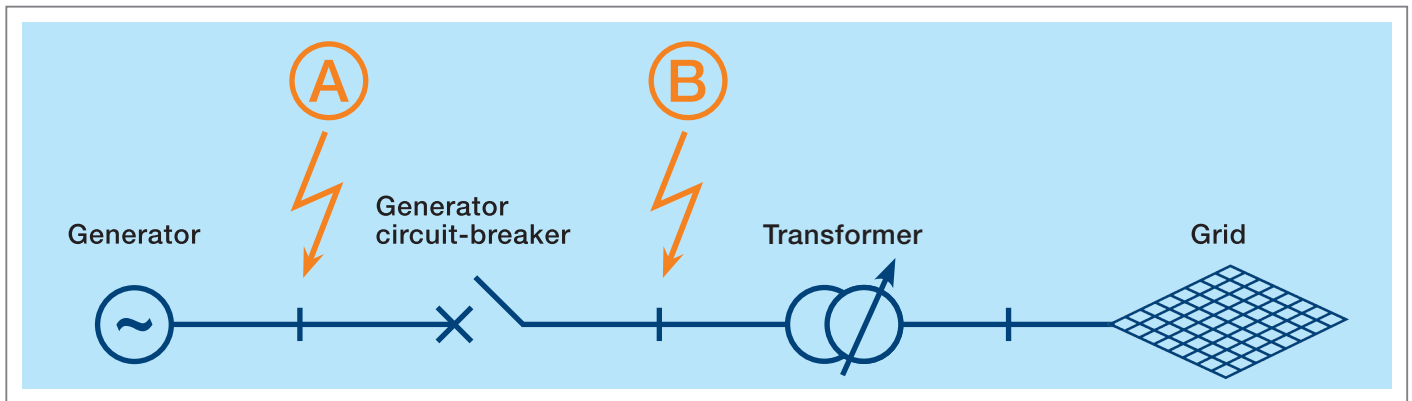
Medium Voltage Power Products | High Voltage Power Products

VD4G-50

Vacuum circuit-breaker for generator applications

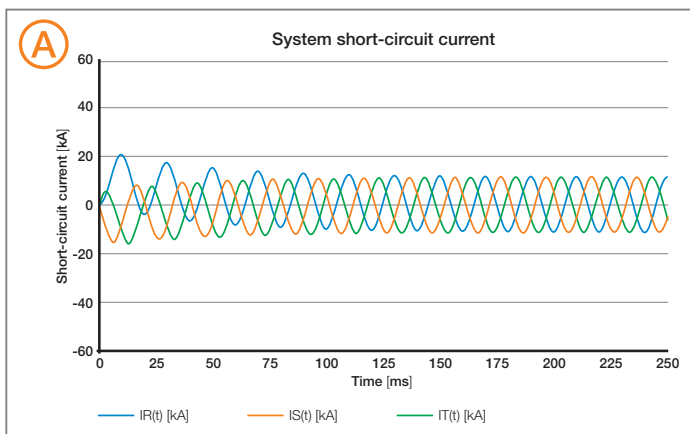
VD4G-50 – the new vacuum circuit-breaker for generator applications

The worldwide increasing energy demand is covered more and more by decentralized power plants and renewable resources of small unit size. As the generated energy is fed into the grid by step-up transformers and MV distribution boards, VD4G-50 offers a reliable and economical solution to protect the power plants assets.

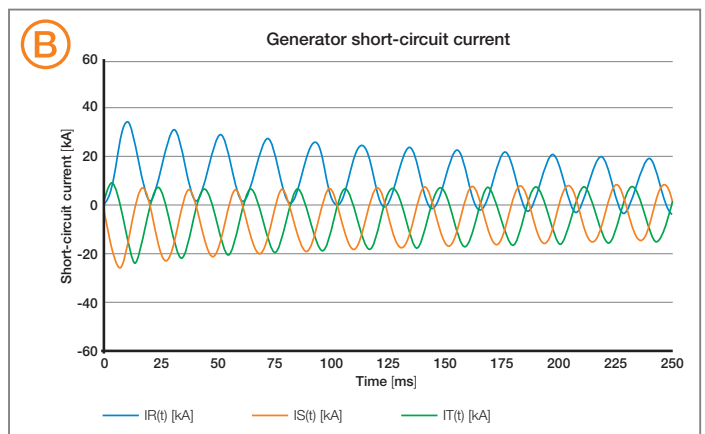


Typical schematic of generator circuit-breaker application

The challenge to protect the grid as well as the generator against failures makes generator circuit-breakers essential. Each generator has specific technical characteristics. A suitability analysis of the generator circuit-breaker application is indispensable. The system-fed fault (A) and the generator-fed fault (B) of a grid need to be reliably interrupted by the generator circuit-breaker.



Failure location A: System-fed fault
Fast decaying DC component



Failure location B: Generator-fed fault
Slowly decaying and raised DC component results in delayed current zero.

The new VD4G-50 is the next generation of VD4 vacuum circuit-breaker for generator circuit-breaker (GCB) applications. The VD4G-50 is suitable for the small power plants as well as for industrial, oil and gas applications in which generators are connected to the MV distribution of the plant.

Your benefit VD4G-50

Protection:

- Suitability analysis using grid calculation tool
- Optional system study for additional circuit-breakers in grid
- Fast interruption of system- and generator-fed short-circuit currents up to 50 kA
- Tested according to the latest edition of generator circuit-breaker standards including the IEC / IEEE 62271-37-013 (2014-01-24)

Availability:

- High TRV withstand capability
- Suitable for an increased DC component and longer arcing times
- More reliable synchronization
- More reliable supply for unit auxiliaries

Flexibility:

- Only one circuit-breaker shall be operated during the starting-up or shutting-down of generator
- Maintenance-free solution
- Compact solution
- Economical solution



Possible applications

- Renewable energy power plants
- Small energy power plants
- Networks with emergency power generator
- Process industry with own power generation
- Retrofit solutions

Special requirements for suitability analysis with grid calculation tool

ABB can provide you with adequate support for the suitability analysis and proper selection of GCB by providing the following information:

- Single Line Diagram
- Technical data sheet of generator, transformer and other grid equipment

Technical data

- System- and generator-fed faults tested up to 50 kA
- High TRV withstand capability
- Suitable for switching under delayed current zero conditions
- Type tested according to Dual Logo IEC/IEEE 62271-37-013 (2014-01-24) covering also IEEE C37.013

		VD4G-50	
Rated voltage U _r	kV	15	
Rated normal current (40° C) I _r	A	3150	4000 ¹⁾
Rated frequency f _r	Hz	50 / 60	
Withstand voltage at 50 Hz U _d (1 min)			
- common value	kV	38	
- across the insulating distance	kV	45	
Impulse withstand voltage U _p			
- common value	kV	95	
- across the insulating distance	kV	110	
Rated breaking capacity I _{sc}			
- symmetrical short-circuit current	kA	50	
- asymmetrical short-circuit current	kA	73	
- first pole-to-clear factor		1.5	
- rated operating sequence during short-circuit interruption		CO-30 min-CO ²⁾	
Making current I _p	kA	137 ³⁾	
Rated breaking current under out-of-phase conditions			
- symmetrical breaking current	kA	25	
- asymmetrical breaking current	kA	37	
Rated short-time withstand current I _k (4 s)	kA	50	
Maximum total breaking time (from tripping start to final arc extinction) (3 cycles)	ms	≤ 61	
Transient recovery voltage TRV			
- TRV rate for system-fed faults	kV / μs	3.5	
- TRV rate for generator-fed faults	kV / μs	1.6	
- TRV rate for out-of-phase faults	kV / μs	3.3	
Dimensions			
- Pole center distance	mm	275	
- Height	mm	636	
- Depth	mm	459	
- Width	mm	750	
Weight	kg	210	

1) On request

2) Other operating sequences on request.

3) Higher values on request.

Contact

ABB AG

General ABB website
www.abb.com

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DEABB 2537 14 gb (500-AMC)



Product Brochure

Generator Circuit-Breakers

HVR-63XS

HVR-63S

Power and productivity
for a better world™



Technical Data

Generator circuit-breaker type

HVR-63XS

HVR-63S

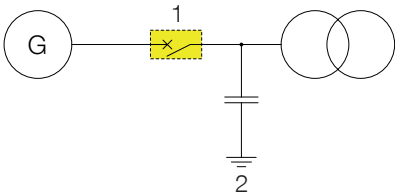
General			
Rated maximum voltage	kV	24	24
Rated frequency	Hz	50/60	50/60
Rated continuous current	A rms	up to 6300	up to 8000
Rated insulation level			
Rated power frequency withstand voltage			
to earth and across circuit-breaker/switch contacts	kV rms	60	60
Rated lightning impulse withstand voltage			
to earth and across circuit-breaker/switch contacts	kV peak	125	125
Circuit-breaker			
Rated peak withstand current	kA peak	190	190
Rated short-time withstand current	kA, 3s	63	63
Rated short-circuit making current	kA peak	190	190
Rated short-circuit breaking current	kA rms	63 ¹⁾	63 ¹⁾
Rated operating sequence		CO - 30min - CO	
Rated interrupting time	ms	47	47

¹⁾ Provided that surge capacitors of 130 nF on the transformer side are installed.

The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

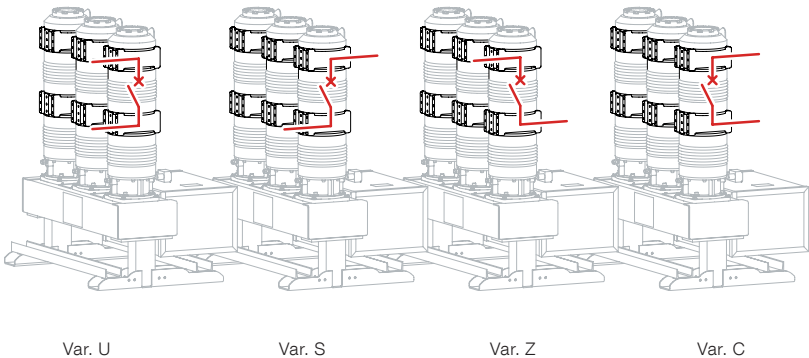
Single-line diagram

- 1 Generator circuit-breaker
- 2 Capacitor 130 nF



Terminal configurations

The terminal configurations as shown in adjacent Figure, can be selected:
With horizontal and vertical operating mechanism
Var. U, S, Z and C.



The new circuit-breaker HVR-63

Open design and small footprint offers maximum flexibility

The HVR-63 generator circuit-breaker (GCB) is the latest generation of ABB's well-proven HGI generator circuit-breaker series and it is best suited for retrofit in power plants with a unit power of up to 180 MW. The open design and small footprint make it perfect for systems with open busbar and short-circuit ratings up to 63 kA. Our innovative built-in direct contact ablation display offers the highest degree of

safety and reliability for power plants with frequent switching operations such as pumped storage power plants. The HVR generator circuit-breaker is available as HVR-63XS with rated continuous currents up to 6300 A or as HVR-63S with rated continuous currents up to 8000 A. Both variants offer flexible busbar connection. With this new HVR-63 GCB, ABB continues to lead the way in designing the most advanced GCBs.

Hydraulic spring operating mechanism

Advanced operating system delivers stability and dependability

The hydraulic spring operating mechanism combines the advantages of a hydraulic operating mechanism with those of spring energy storage system.

Energy storage is accomplished with the aid of a disk spring assembly, with the advantages of stability, reliability and resistance to temperature variability.

Tripping of the operating mechanism and energy output are based on proven design elements of the hydraulic operating technique, such as control valves and hydraulic cylinders.

The operating mechanism is based on the differential piston principle. For the closing operation the piston head side is isolated from the low pressure and simultaneously connected to the high pressure oil volume.

As long as the pressure is maintained, the piston remains in the "closed" position. A pressure controlled mechanical interlock prevents movement of the piston to the "open" position

in case of a pressure drop.

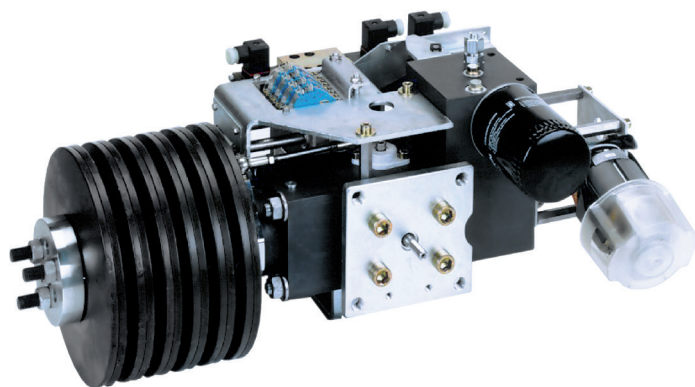
For the opening operation, the piston head side is isolated from the high pressure and simultaneously connected to the low pressure oil volume.

The charging state of the spring disk assembly is controlled by switching elements, actuating the pump motor to immediately maintain the oil pressure.

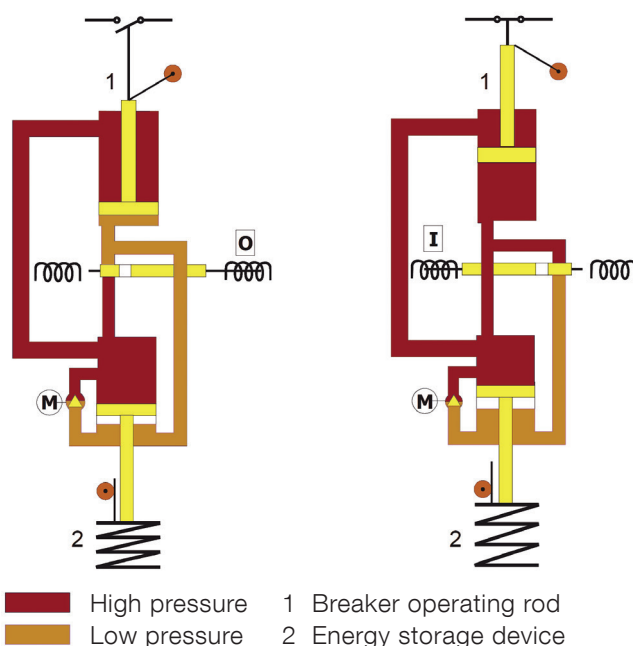
A non-return valve between pump and high-pressure oil volume prevents pressure loss in the event of a pump outage.

The hydraulic system is hermetically sealed against atmosphere. The mechanically operated position indicator provides reliable indication of the circuit-breaker position.

The drive operates all three circuit-breaker poles simultaneously by mechanical linkages, thus keeping the switching time difference between the poles to a minimum.



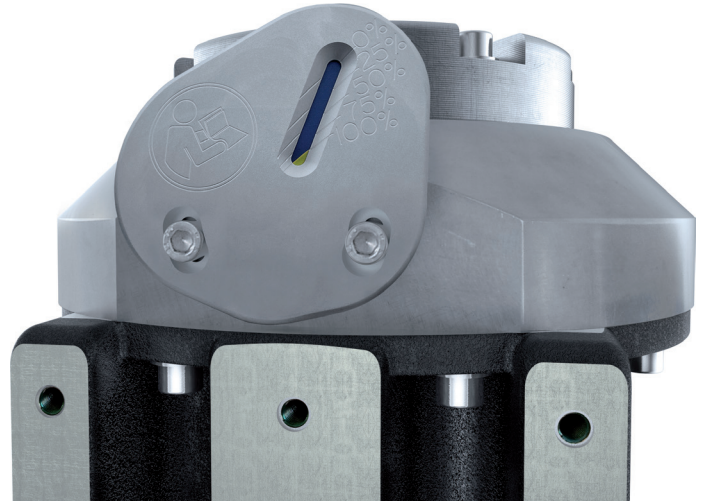
Hydro-mechanical spring operating mechanism type HMB-1.1



Mechanical Ablation Measurement

Promoting safety and reliability

The current carrying contacts (main contacts) are separated from the arcing contacts in order to ensure high current carrying capability in conjunction with low contact ablation. The main contact system consists of a moving part sliding inside a fixed concentric one. The arcing contacts are of “head-to-head” type. This solution provides a low contact resistance of the current carrying path and leads to a reduction of the energy required for contact commutation. Another advantage of the “head to head” solution is the very low stress on the contacts during operations which delivers a high level of safety and significant reduction of the energy required for the operating mechanism providing a more compact solution. The “head-to-head” arcing contact system also enables an innovative and highly reliable built-in mechanical solution for a direct measurement of contact ablation. A visual indication of the remaining lifetime of the arcing contact system is provided by the ablation indicator, which is directly connected to the upper arcing contact aiding you for the timely planning of maintenance.



The Ablation indicator show the end of the arcing contact lifetime

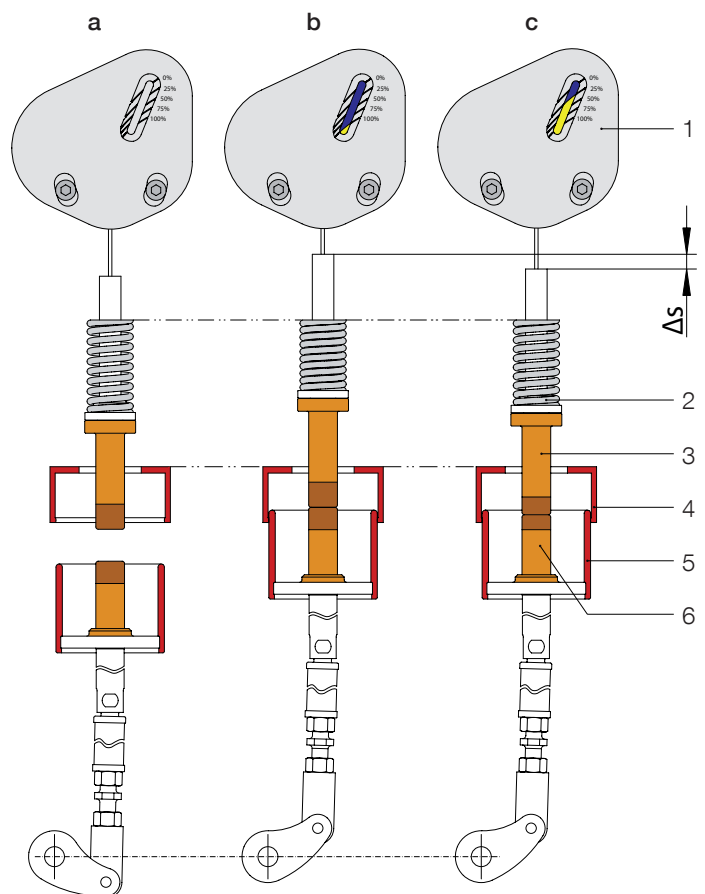
Schematic description:

Mode of operation of the interrupting chamber of the type HVR-63 circuit-breaker

- a** Circuit-breaker in the “OPEN” position; the spring is uncharged and the contacts are open
- b** Circuit-breaker in the “CLOSED” position; the spring is charged and the contacts are closed. Ablation indicator shows full contact length.
- c** Circuit-breaker in the “CLOSED” position; the spring is charged and the contacts are closed. Ablation indicator shows reduced contact length.

Δs = the ablation of the upper and lower arcing contacts

- | | |
|------------------------|------------------------|
| 1 Ablation indicator | 4 Fixed main contacts |
| 2 Spring | 5 Moving main contact |
| 3 Upper arcing contact | 6 Lower arcing contact |



Flexible Connection Kit

Flexible connections provide a detachable (bolted) connection between the generator circuit-breaker live part and the conductor of the adjacent phase bus.

The flexible connections are designed to:

- A)** Carry the rated continuous current and the rated short-time withstand current without exceeding the maximum permissible temperatures.
- B)** Ensure that the dielectric strength requirements are met.
- C)** Compensate expansion and contraction of the conductor due to temperature changes.
- D)** Offset vibrations and withstand the stress caused during switching operations.
- E)** Endure the mechanical stress resulting from electro-dynamic forces in case of short-circuit current.
- F)** Provide a low resistance, safe and stable electrical connection.

ABB recommended type and arrangement of flexible copper straps responds to these requirements as follows:

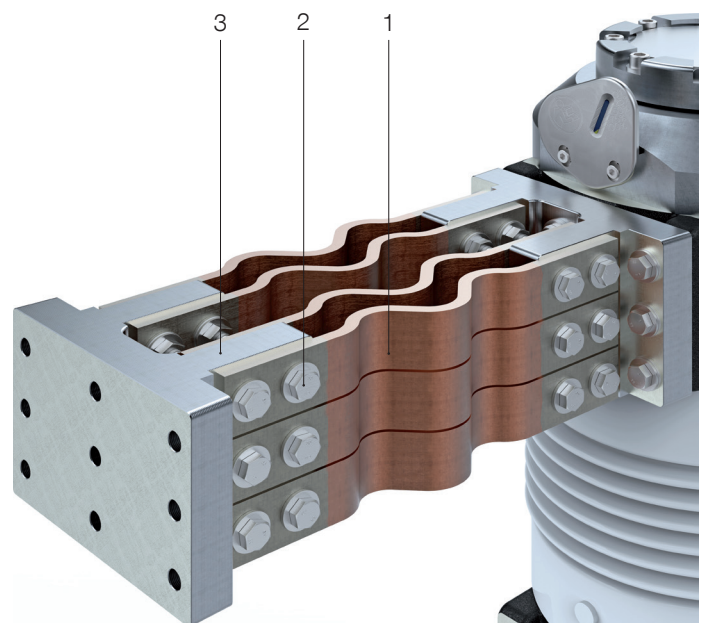
A), B) & E) Fully type tested together with the Generator Circuit-Breaker to prove that the stringent requirements imposed by the relevant IEC and IEEE Standards with regard to dielectric strength, hottest spot temperature and mechanical stress are fully met.

The special shape easily adapts to different distances between terminals ensuring that dielectric strength requirements are always met.

C), D) & E) Flexible type employing laminates with pressure-welded contact ends designed and tested for high mechanical stress.

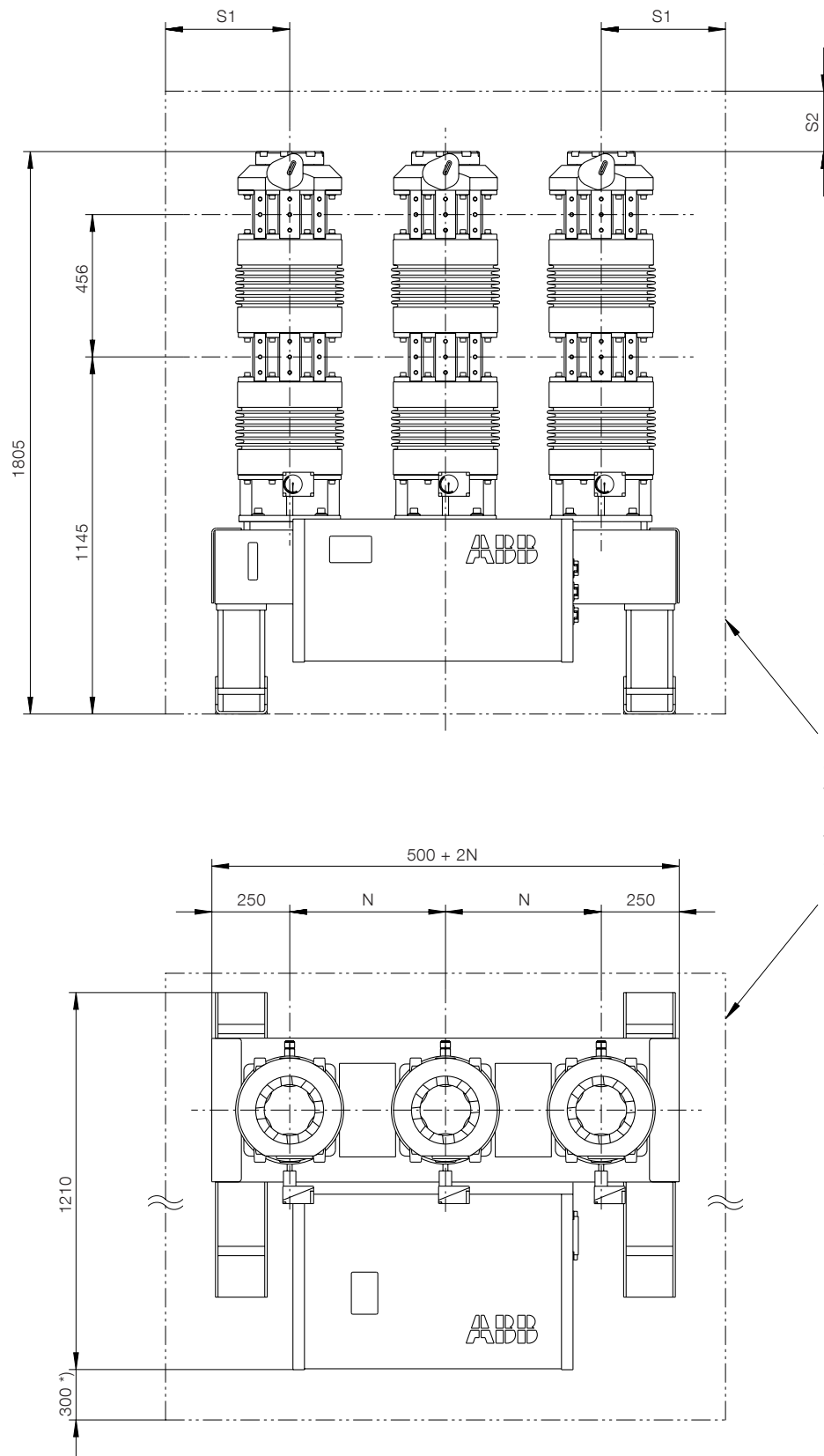
F) Silver plated contact ends with high requirements on contact surface evenness and material properties.

- 1 Flexible copper straps
- 2 Fastening and securing bolts & nuts
- 3 Terminal with silvered contact surfaces for welded connection to the conductor of the IPB or busbar



Dimension Drawing

HVR-63XS/63S horizontal



N = Phase distance: 500 or 800mm - other values for N are not available. Busbars need to be adjusted accordingly.

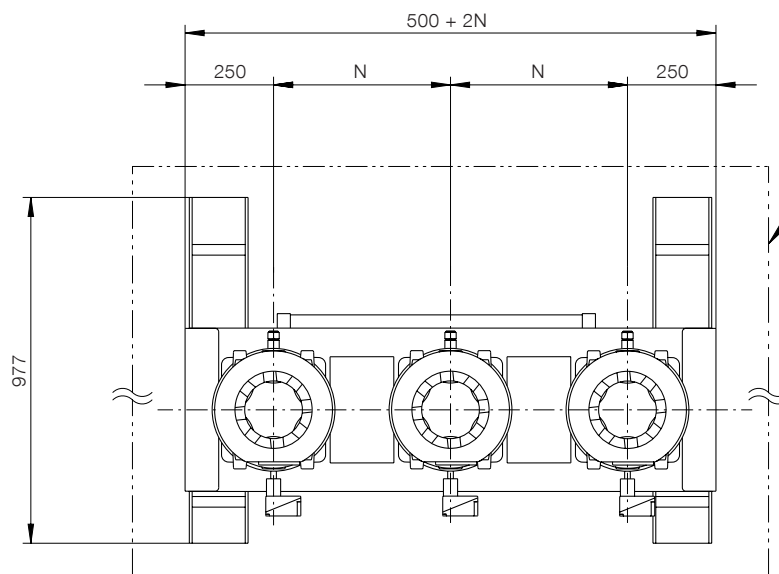
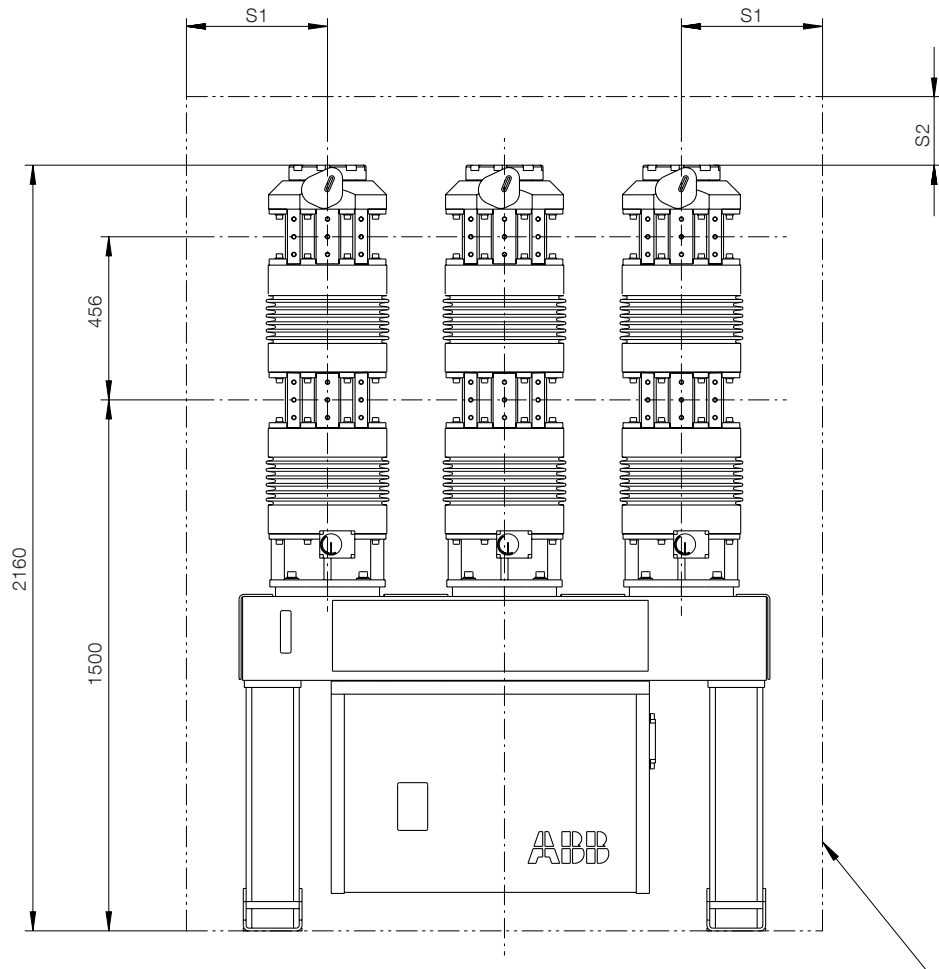
S1 = min. 360mm for BIL 110kV; min. 385mm for BIL 125kV (clearance to any object)

S2 = min. 190mm for BIL 110kV; min. 215mm for BIL 125kV (clearance to any object)

*) min. space required for operation and maintenance

Dimension Drawing

HVR-63XS/63S vertical



Clearance required for safety (protective barriers are excluded from ABB scope of supply)

N = Phase distance: 500 or 800mm - other values for N are not available. Busbars need to be adjusted accordingly.

S1 = min. 360mm for BIL 110kV; min. 385mm for BIL 125kV (clearance to any object)

S2 = min. 190mm for BIL 110kV; min. 215mm for BIL 125kV (clearance to any object)

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
www.abb.com/gcb

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Product Brochure

Generator Circuit-Breakers HECS-100R/130R

Power and productivity
for a better world™



Technical Data

Generator circuit-breaker system type	HECS-100R	HECS-130R
---------------------------------------	-----------	-----------

General			
Rated maximum voltage	kV	25.3	25.3
Rated frequency	Hz	50/60	50/60
Rated continuous current 50 Hz	A rms	up to 9000	up to 9000
Rated continuous current 60 Hz	A rms	up to 8600	up to 8600

Rated insulation level			
Rated power frequency withstand voltage			
to earth and across circuit-breaker/switch contacts	kV rms	60	60
Rated lightning impulse withstand voltage			
to earth and across circuit-breaker/switch contacts	kV peak	125	125

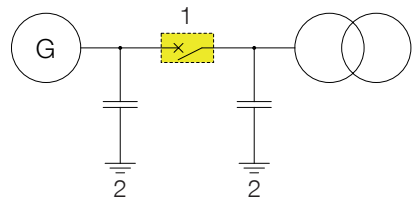
Circuit-breaker			
Rated peak withstand current	kA peak	300	360
Rated short-time withstand current	kA, 3s	100	130
Rated short-circuit making current	kA peak	300	360
Rated short-circuit breaking current ¹⁾	kA rms	100	130
Rated operating sequence		CO - 30min - CO	
Rated interrupting time	ms	68	68

¹⁾ Provided that surge capacitors of 130nF on the generator and transformer sides are installed

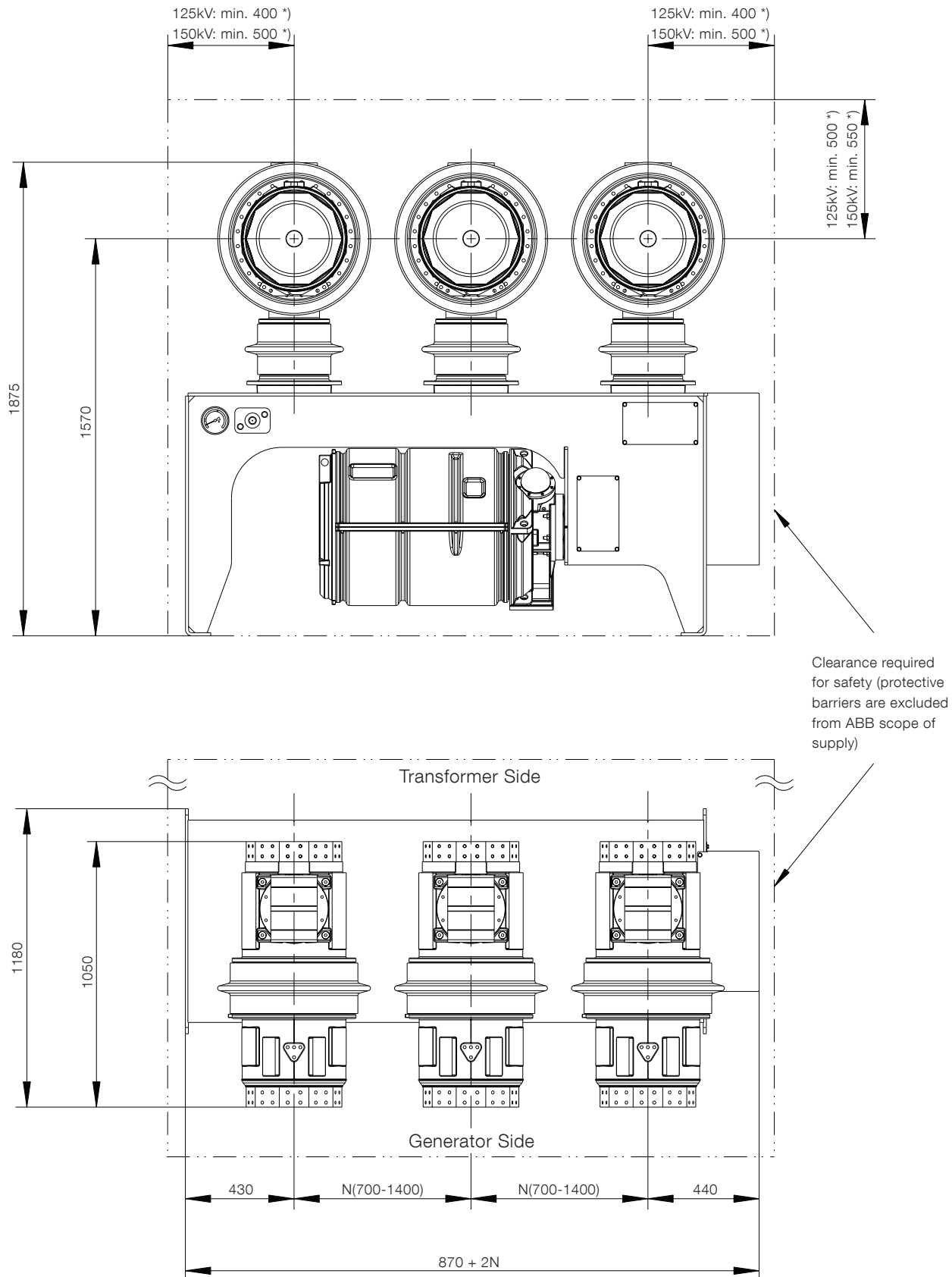
The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

Single-line diagram

- 1 Generator circuit-breaker
- 2 Capacitors 130 nF



Dimension Drawing



N = Phase distance

*) min. clearance to any object (dielectric dimensioning rules)

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
www.abb.com/gcb

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Product Brochure

Generator Circuit-Breaker Systems

HECS-100/130XLp

HECS-130XXLp

Power and productivity
for a better world™



Technical Data

Generator circuit-breaker system type	HECS-100XLp	HECS-130XLp	HECS-130XXLp
---------------------------------------	-------------	-------------	--------------

General				
Rated maximum voltage	kV	25.3	25.3	25.3
Rated frequency	Hz	50/60	50/60	50/60
Rated continuous current 50 Hz (naturally cooled)	A rms	up to 18000	up to 18000	up to 23000
Rated continuous current 60 Hz (naturally cooled)	A rms	up to 17100	up to 17100	up to 21700

Rated insulation level				
Rated power frequency withstand voltage				
to earth and across circuit-breaker/switch contacts	kV rms	60 (80)	60 (80)	60(80)
across isolating distance of disconnecter	kV rms	70 (88)	70 (88)	70 (88)
Rated lightning impulse withstand voltage				
to earth and across circuit-breaker/switch contacts	kV peak	125 (150)	125 (150)	125 (150)
across isolating distance of disconnecter	kV peak	145 (165)	145 (165)	145 (165)

Circuit-breaker				
Rated peak withstand current	kA peak	300	360	360
Rated short-time withstand current	kA, 3s	100	130	130
Rated short-circuit making current	kA peak	300	360	360
Rated short-circuit breaking current	kA rms	100	130	130
Rated operating sequence		CO - 30min - CO		
Opening time	ms	34 ± 5	34 ± 5	34 ± 5
Rated interrupting time	ms	68	68	68
Mechanical endurance life	CO	20000	20000	20000

Disconnecter				
Rated peak withstand current	kA peak	300	360	360
Rated short-time withstand current	kA, 3s	100	130	130
Operating time	s	2	2	2

Earthing Switch				
Rated peak withstand current	kA peak	300	360	360
Rated short-time withstand current	kA, 1s	100	130	130
Operating time	s	2	2	2

The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

Equipment Options

- 1

Generator circuit-breaker
- 2

Line disconnect switch
- 3

Earthing switch
- 4

Starting switch for SFC connection
- 5

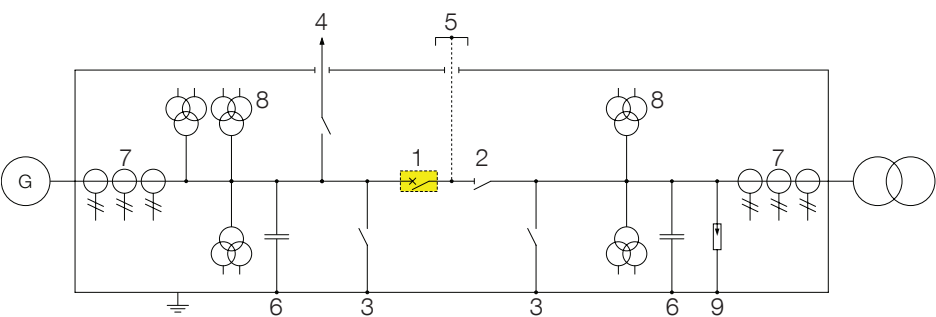
Manual short-circuiting connection
(by removal of cover)
- 6

Surge capacitor
- 7

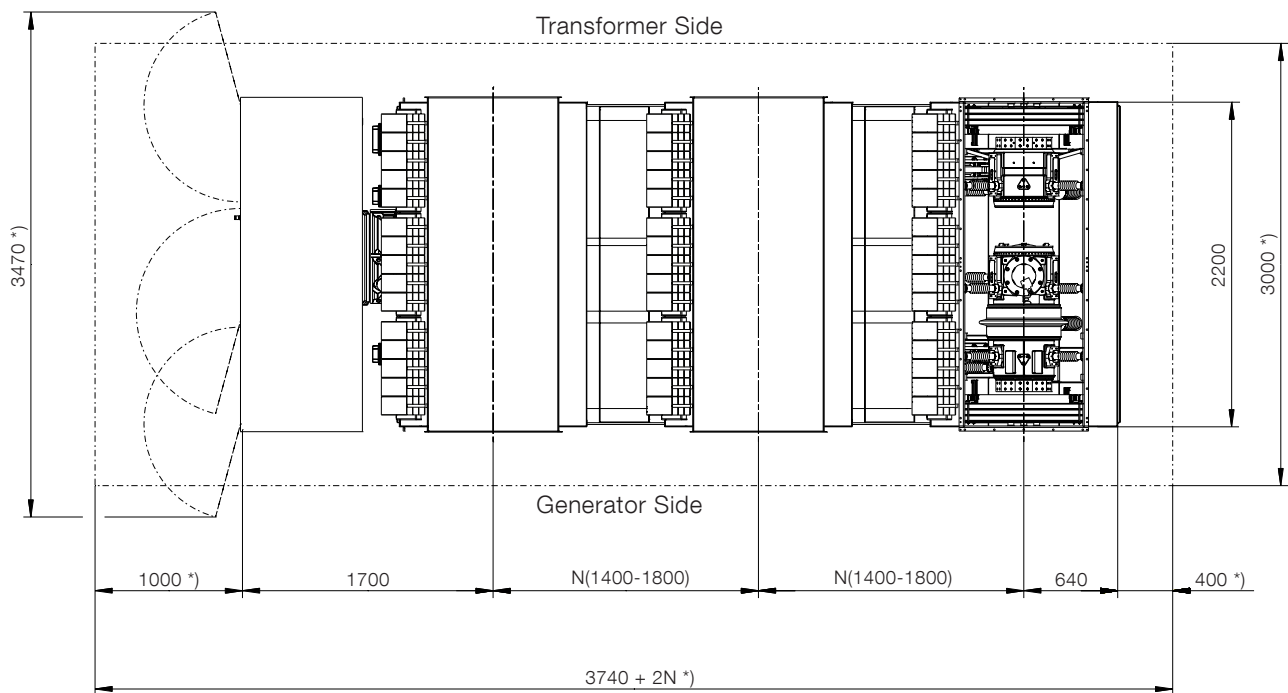
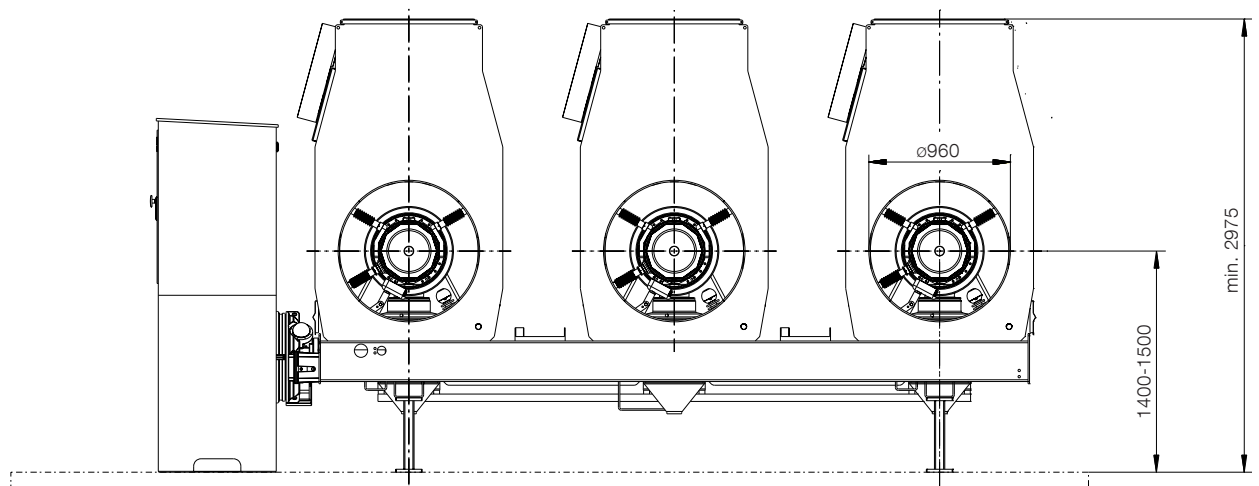
Current transformers
- 8

Voltage transformers
- 9

Surge arrester



Dimension Drawing HECS-XLp

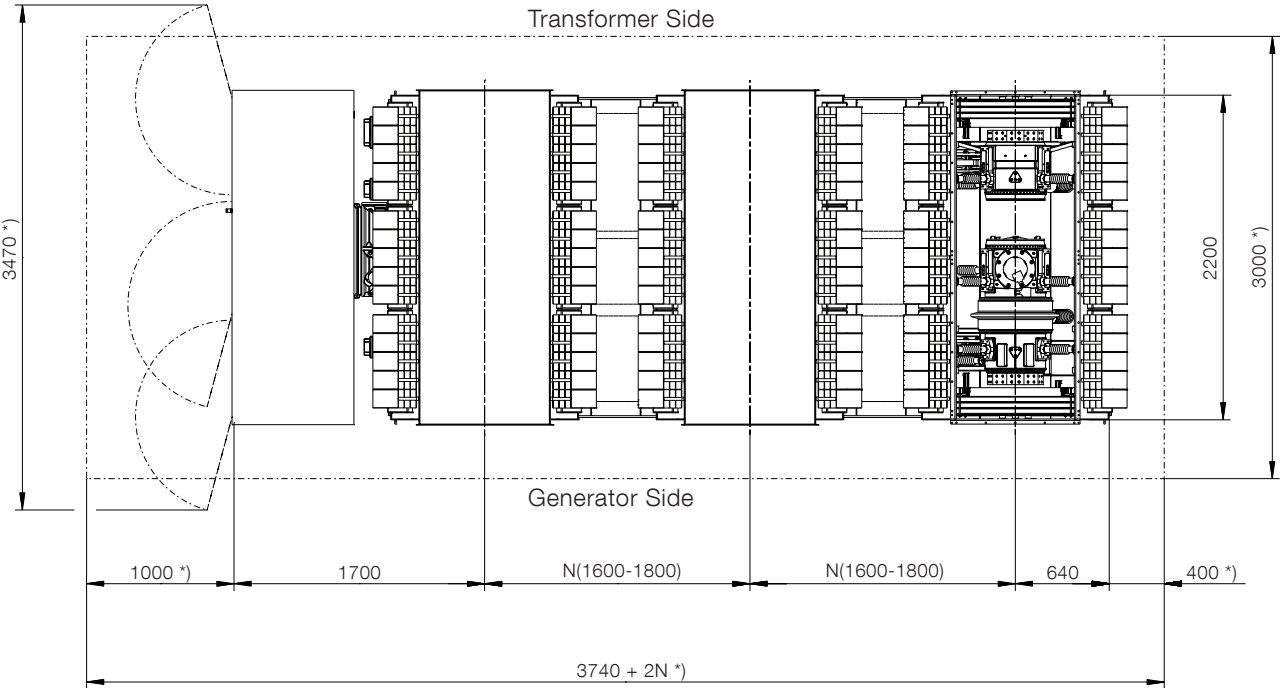
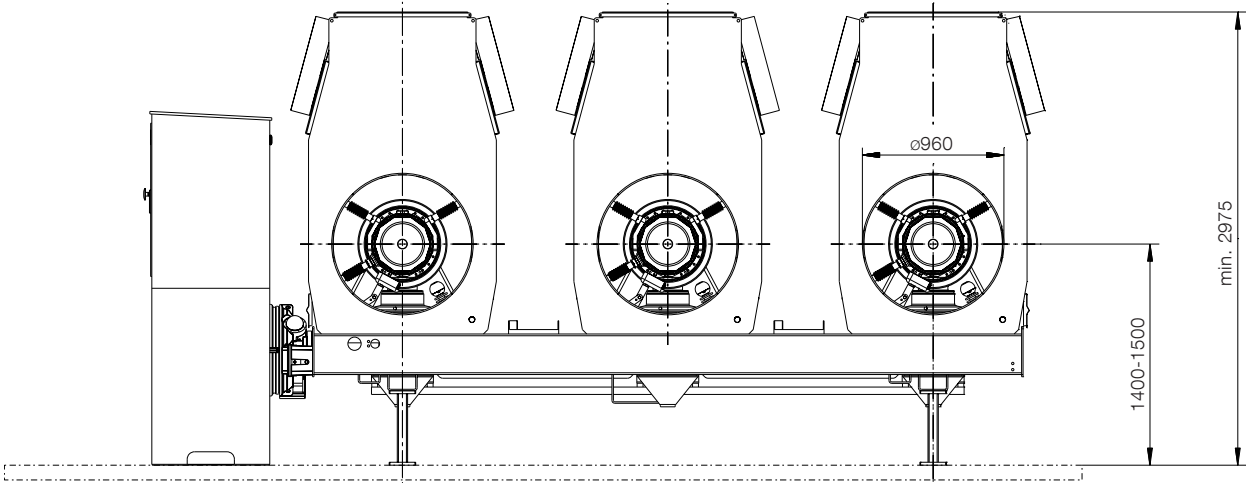


N = Phase distance

*) min. space required for erection and maintenance

Dimension Drawing

HECS-XXLp



N = Phase distance
 *) min. space required for erection and maintenance

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
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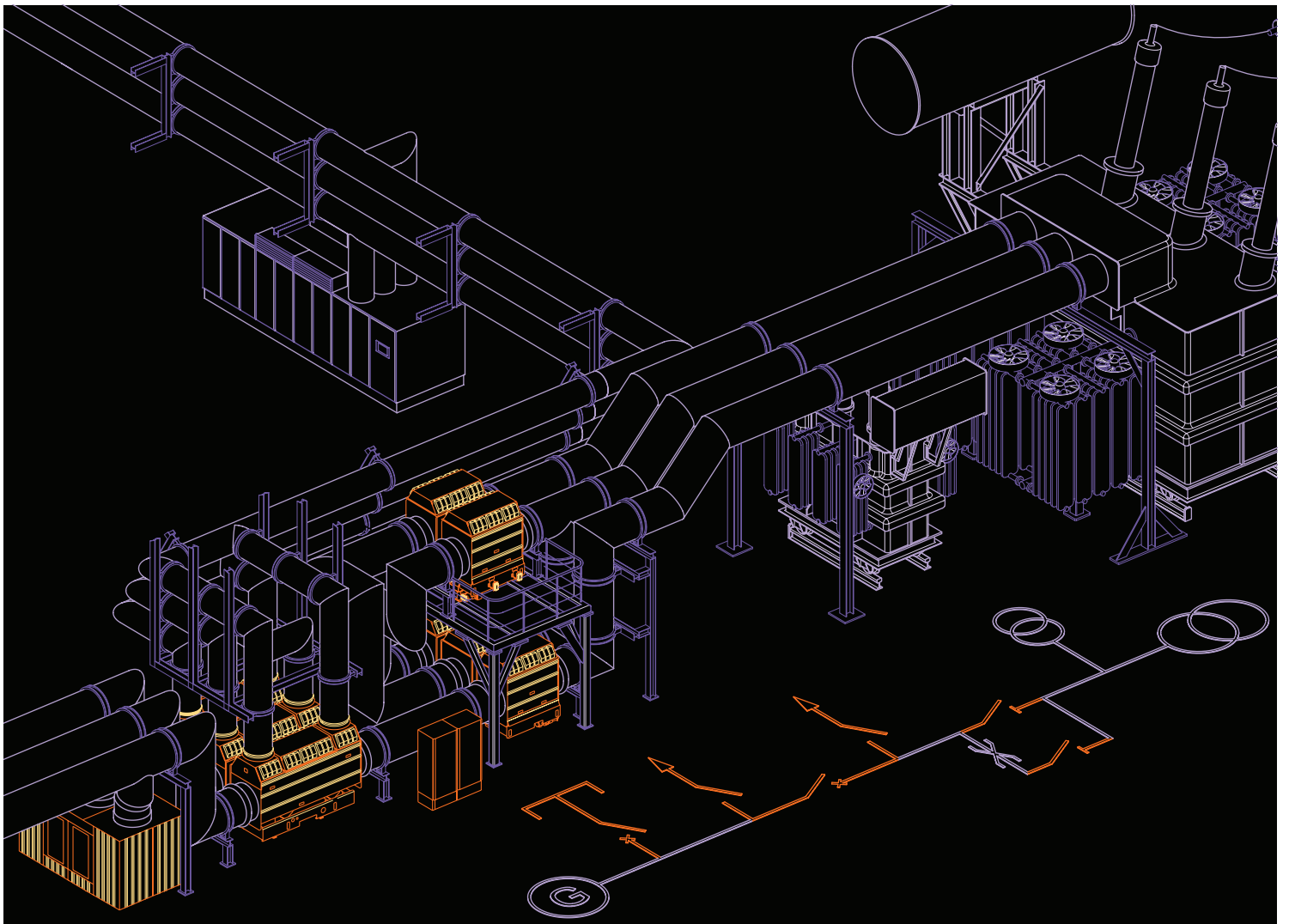
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Product Brochure

Generator Circuit-Breaker Systems HECPS

Application

The HECPS 3S/5S circuit-breaker integrated system is designed for the needs of pumped storage power plants. The system equipment is covering all basic and extended operational functions of most pumped storage power plants world wide. The single-line diagram shown on page 3 illustrates the features of the HECPS 3S/5S circuit-breaker system. The individual components can be installed in two modules, the circuit breaker and the disconnector modules.

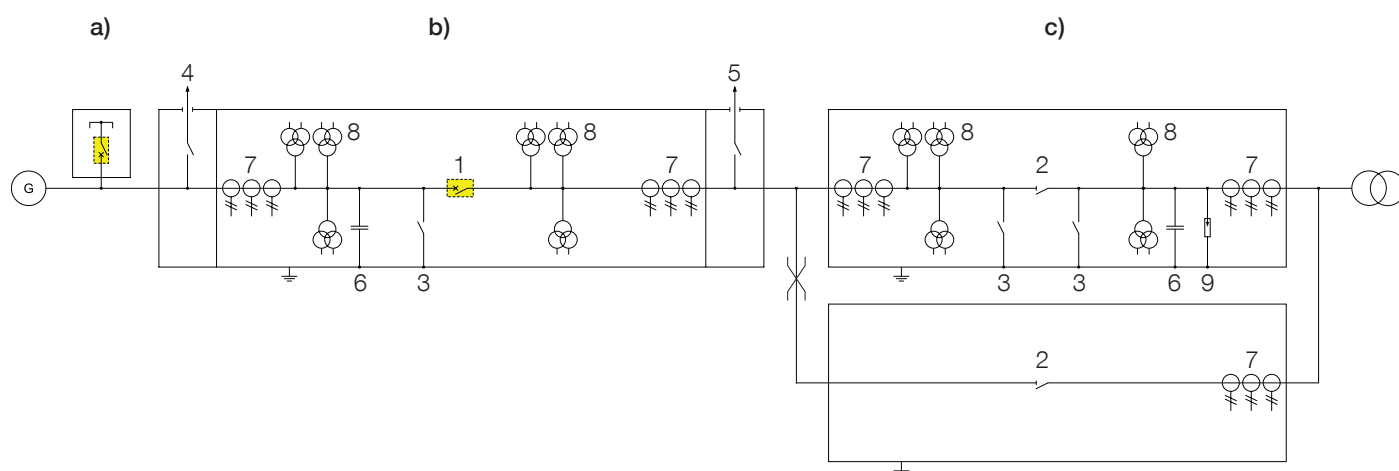
On request a separate module with braking switch is available. The HECPS 3S/5S is a fully integrated system, however the IPB for the connection between modules is not included in the scope of supply of the breaker system. The circuit-breaker module can optionally be equipped with extensions for an SFC starting switch and a back-to-back starting switch. The technical data of the generator circuit-breaker system type HECPS-3S/5S is listed below.

Technical Data

Generator circuit-breaker system type		HECPS-3S	HECPS-5S	HECPS-5Sp
General				
Rated maximum voltage	kV	25.3	25.3	25.3
Rated frequency	Hz	50/60	50/60	50/60
Rated continuous current 50 Hz	A rms	up to 13500	up to 13500	up to 17500
Rated continuous current 60 Hz	A rms	up to 12500	up to 12500	up to 16500
Rated insulation level				
Rated power frequency withstand voltage				
to earth and across circuit-breaker/switch contacts	kV rms	60 (80)	60 (80)	60 (80)
across isolating distance of disconnector	kV rms	70 (88)	70 (88)	70 (88)
Rated lightning impulse withstand voltage				
to earth and across circuit-breaker/switch contacts	kV peak	125 (150)	125 (150)	125 (150)
across isolating distance of disconnector	kV peak	145 (165)	145 (165)	145 (165)
Circuit-breaker				
Rated peak withstand current	kA peak	300	360	360
Rated short-time withstand current	kA, 3s	100	130	130
Rated short-circuit making current	kA peak	300	360	360
Rated short-circuit breaking current	kA rms	100	130	130
Rated operating sequence		CO - 30min - CO		
Opening time	ms	34 ± 5	34 ± 5	34 ± 5
Rated interrupting time	ms	68	68	68
Mechanical endurance life	CO	20000	20000	20000
Disconnector				
Rated peak withstand current	kA peak	300	360	360
Rated short-time withstand current	kA, 3s	100	130	130
Operating time	s	2	2	2
Earthing Switch				
Rated peak withstand current	kA peak	300	360	360
Rated short-time withstand current	kA, 1s	100	130	130
Operating time	s	2	2	2
Starting Switch				
Rated peak withstand current	kA peak	450	450	450
Rated short-time withstand current	kA, 3s	160	160	160
Operating time	s	2	2	2

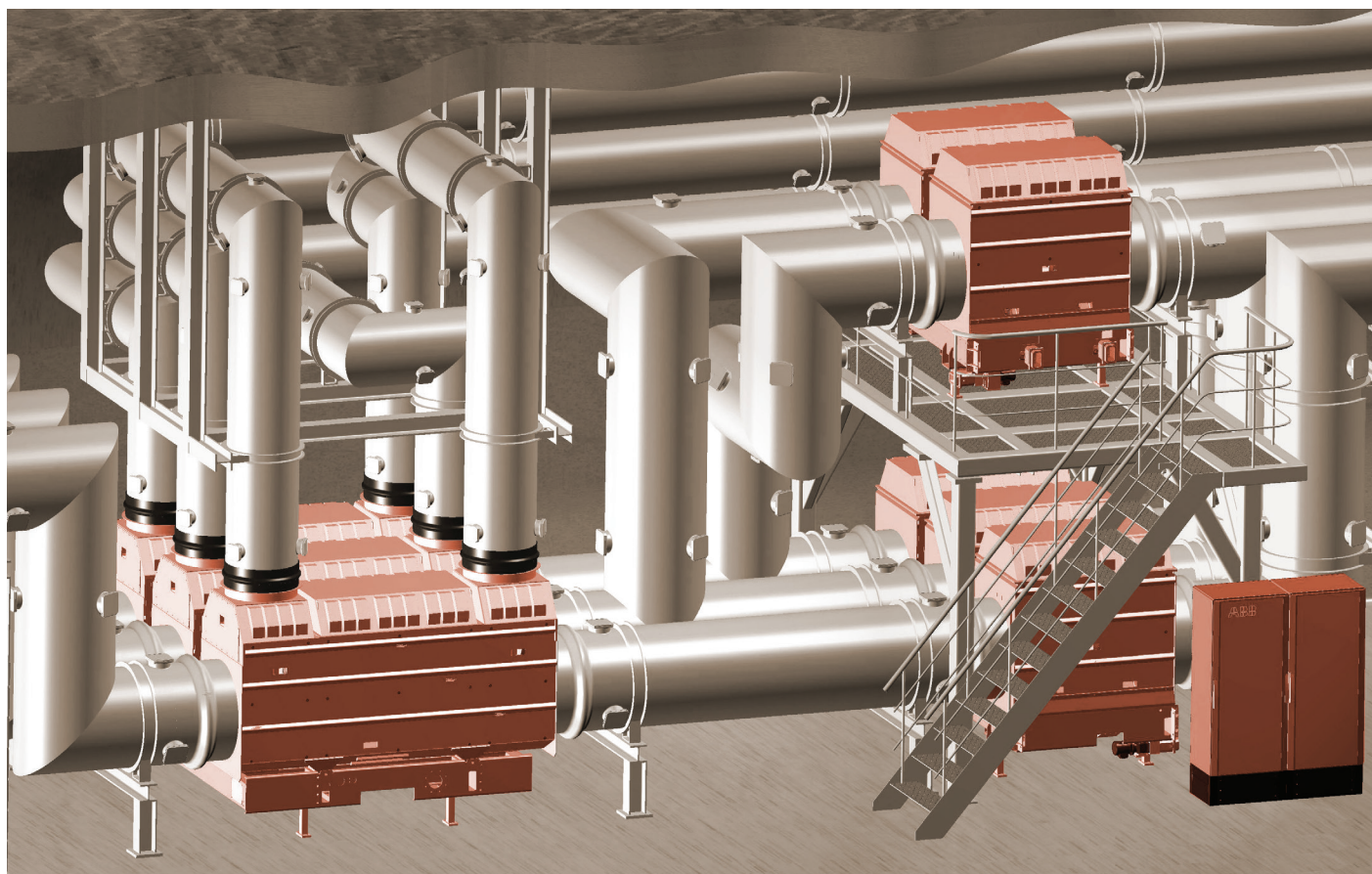
The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

Single Line Diagram



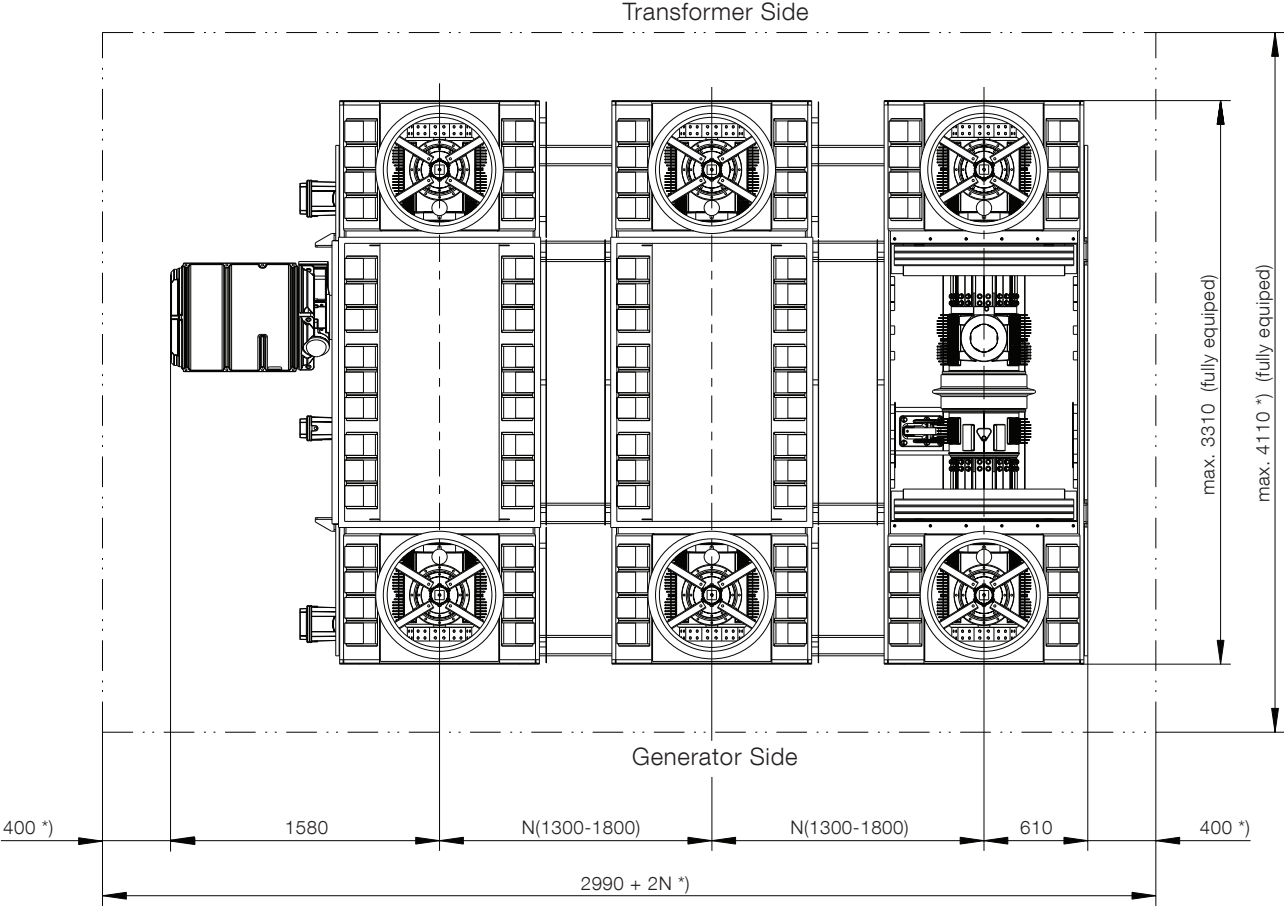
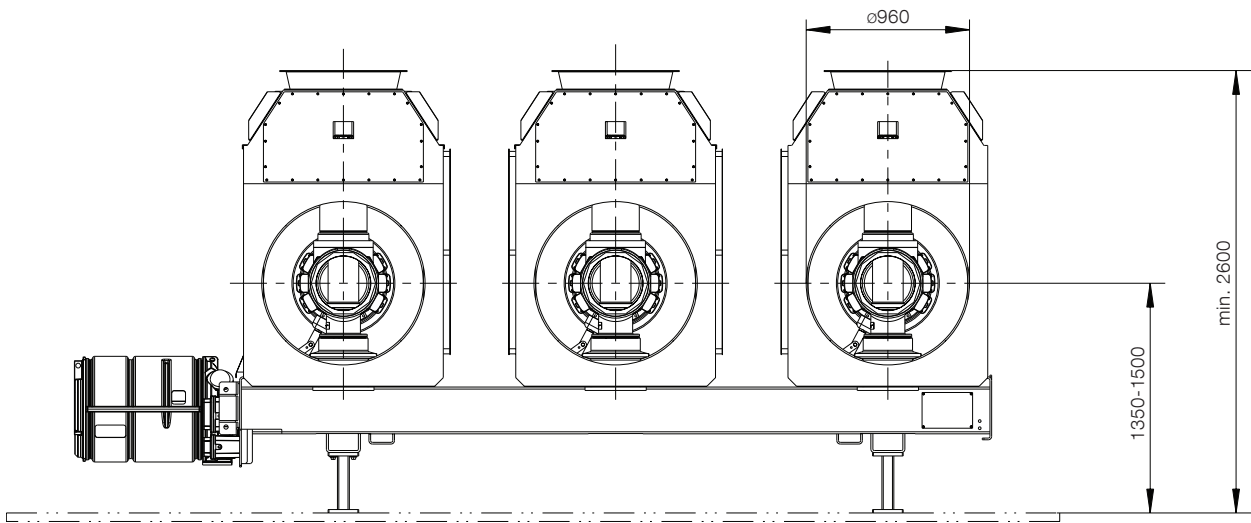
Equipment Options

- | | |
|--------------------------------------|--------------------------------|
| a) Braking Switch Module | 5 Back-to-back starting switch |
| b) Circuit-Breaker Module | 6 Surge capacitor |
| c) Disconnecter Module | 7 Current transformers |
| 1 Generator circuit-breaker | 8 Voltage transformers |
| 2 Line disconnect switch | 9 Surge arrester |
| 3 Earthing switch | |
| 4 Starting switch for SFC connection | |



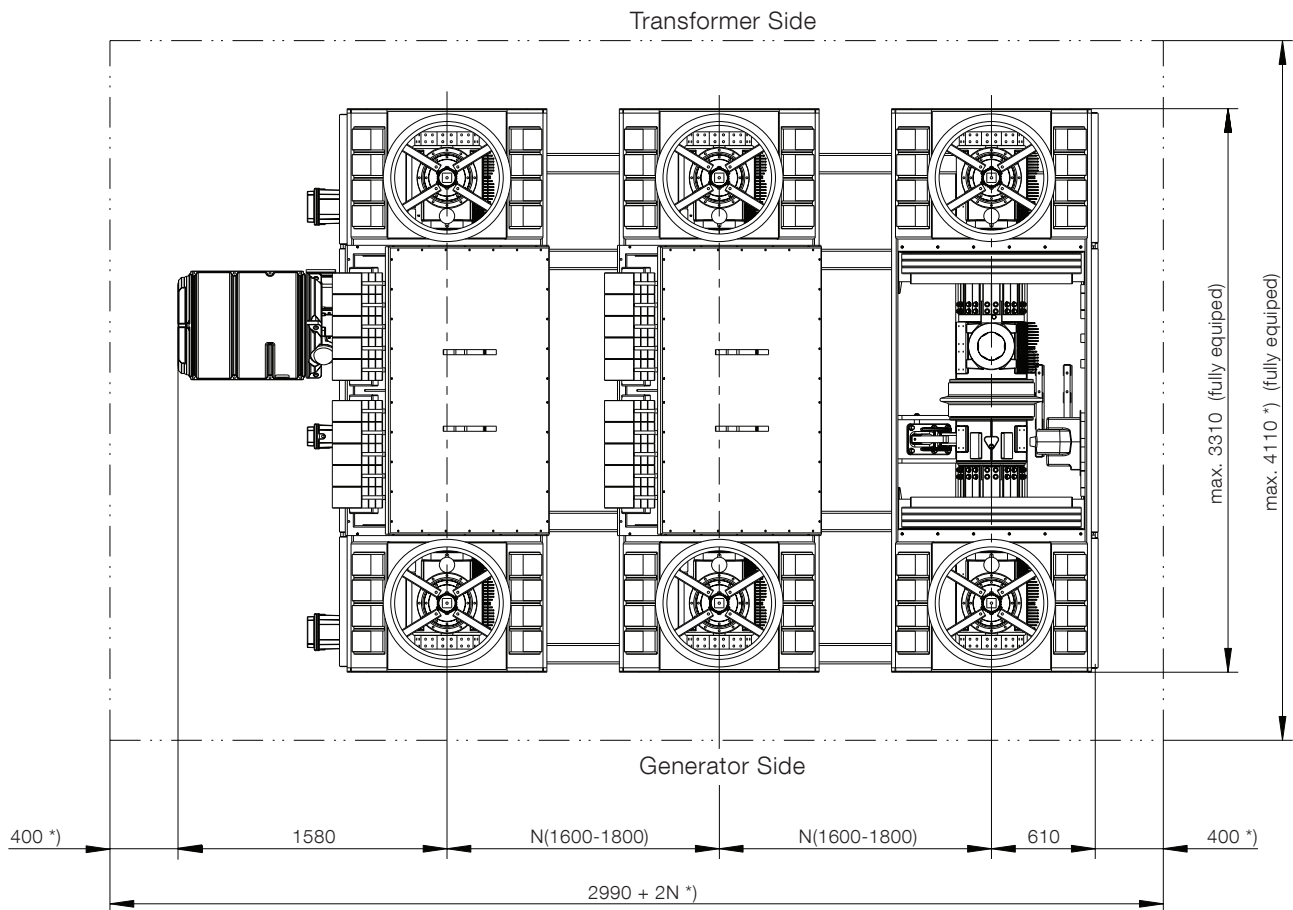
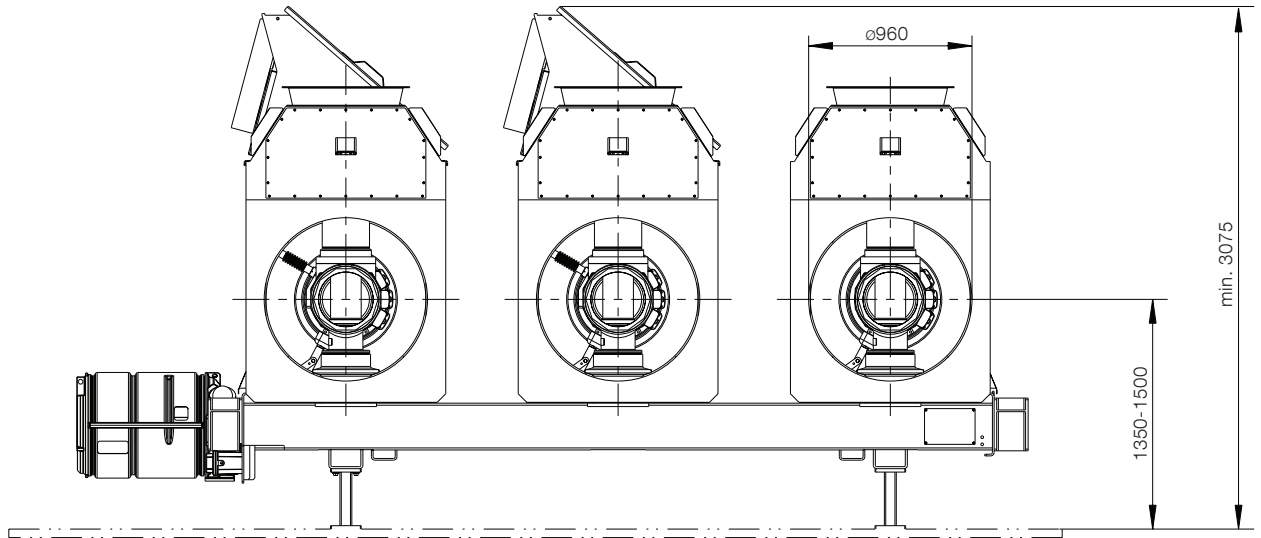
Dimension Drawing HECPS-3S/5S

Circuit-Breaker Module



N = Phase distance
 *) min. space required for erection and maintenance

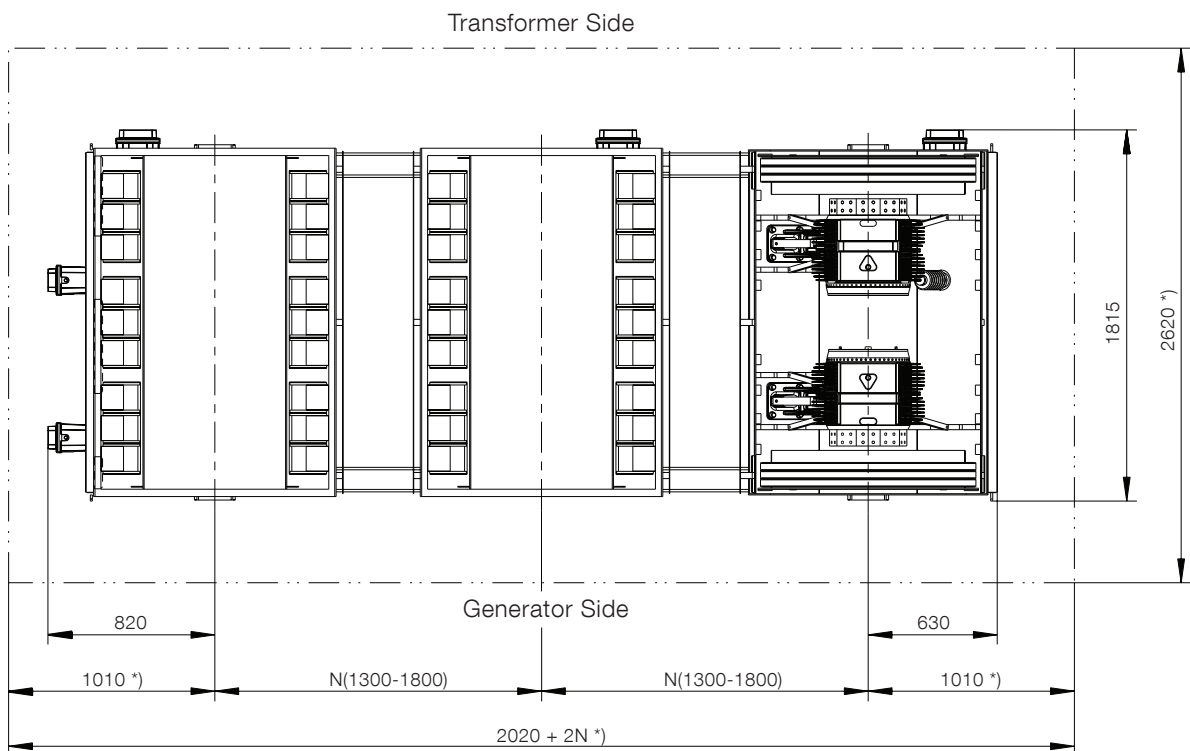
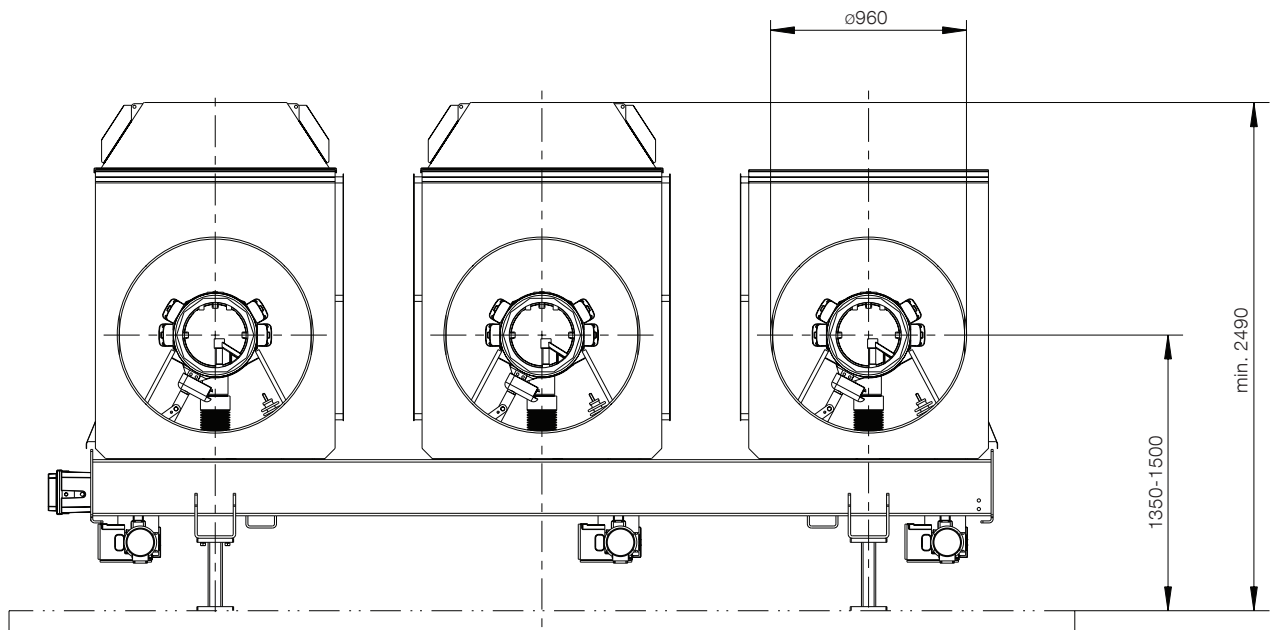
Dimension Drawing HECPS-5Sp Circuit-Breaker Module



N = Phase distance

*) min. space required for erection and maintenance

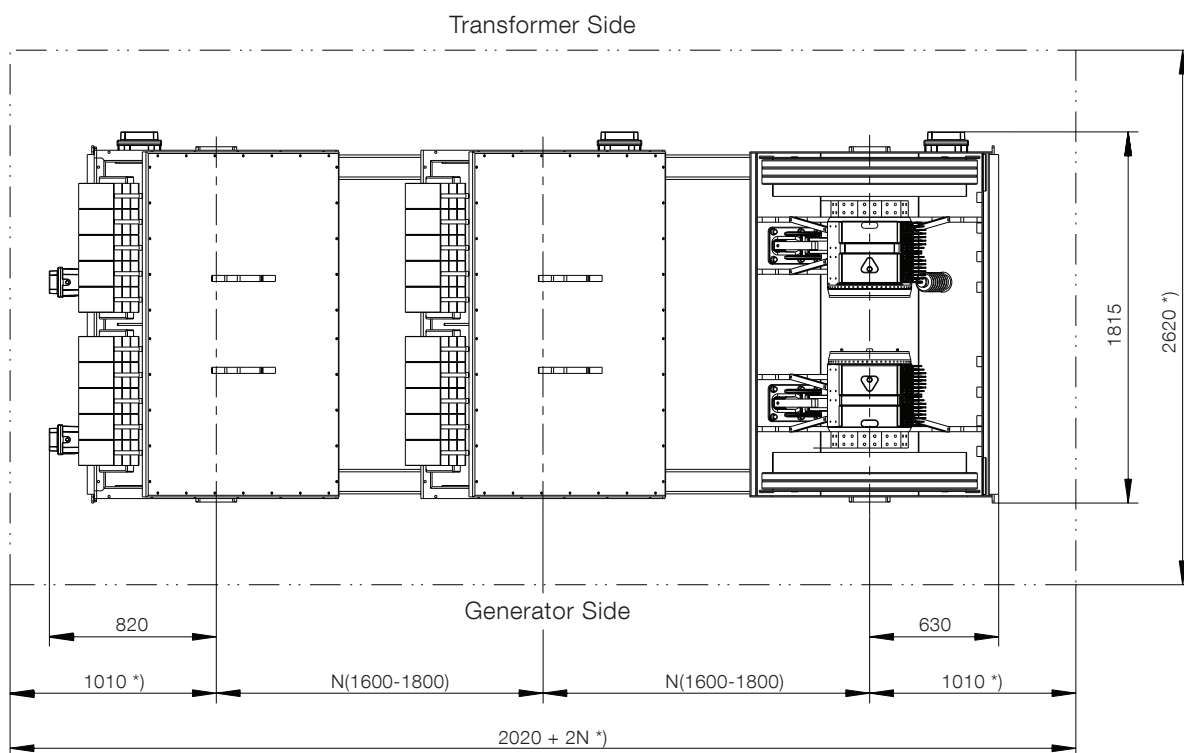
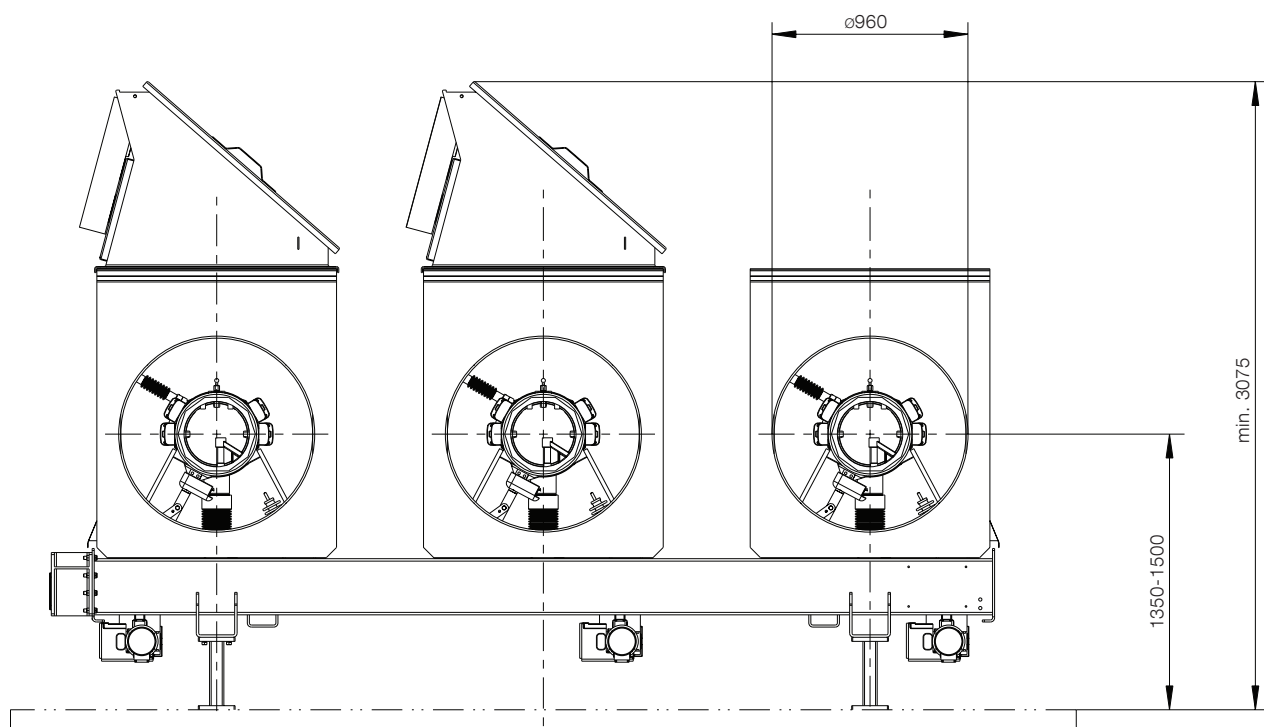
Dimension Drawing HECPS-3S/5S Disconnecter Module



N = Phase distance

$^*)$ min. space required for erection and maintenance

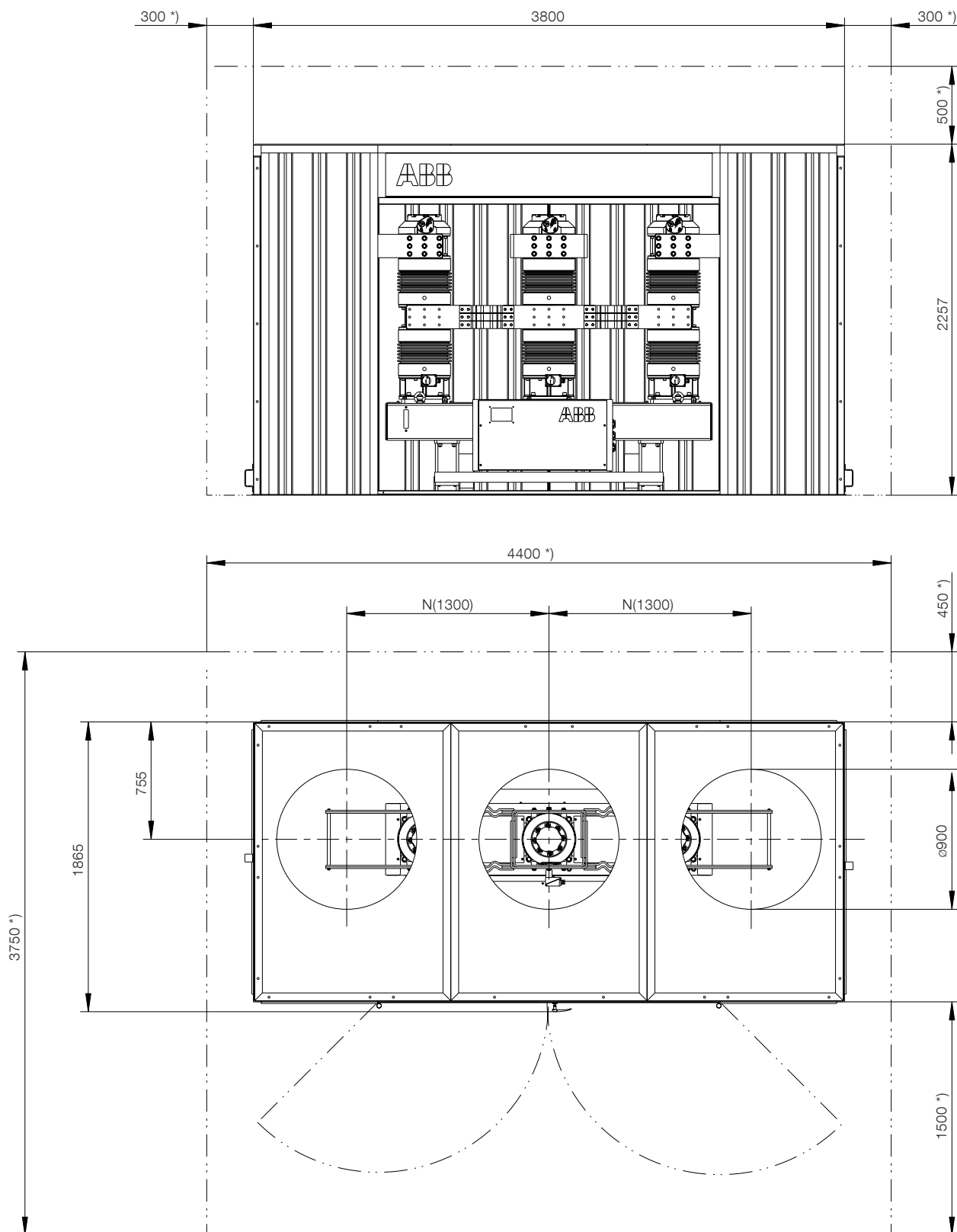
Dimension Drawing HECPS-5Sp Disconnecter Module



N = Phase distance

*) min. space required for erection and maintenance

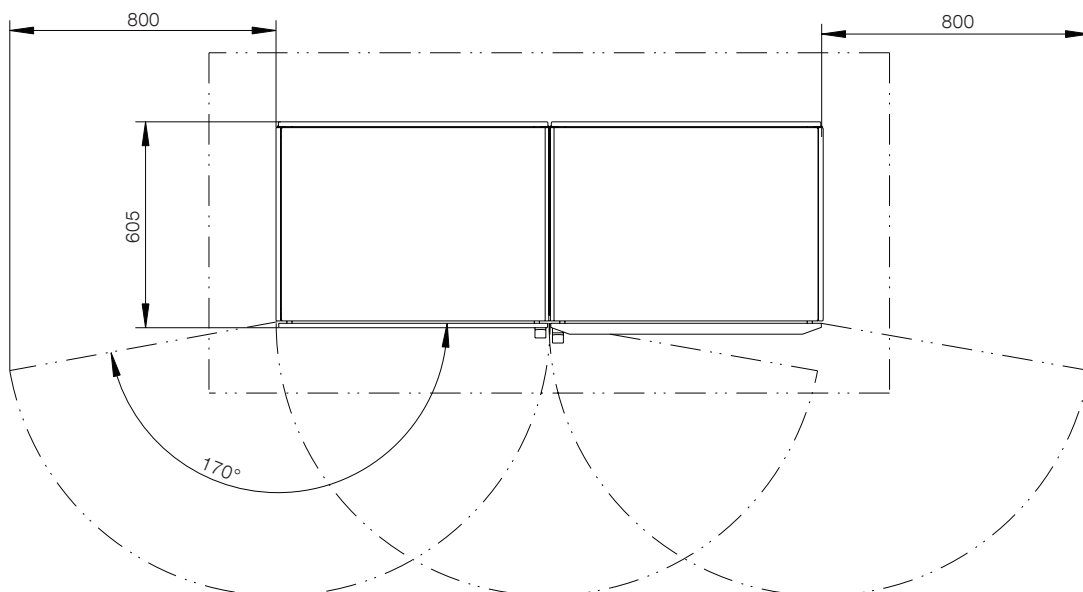
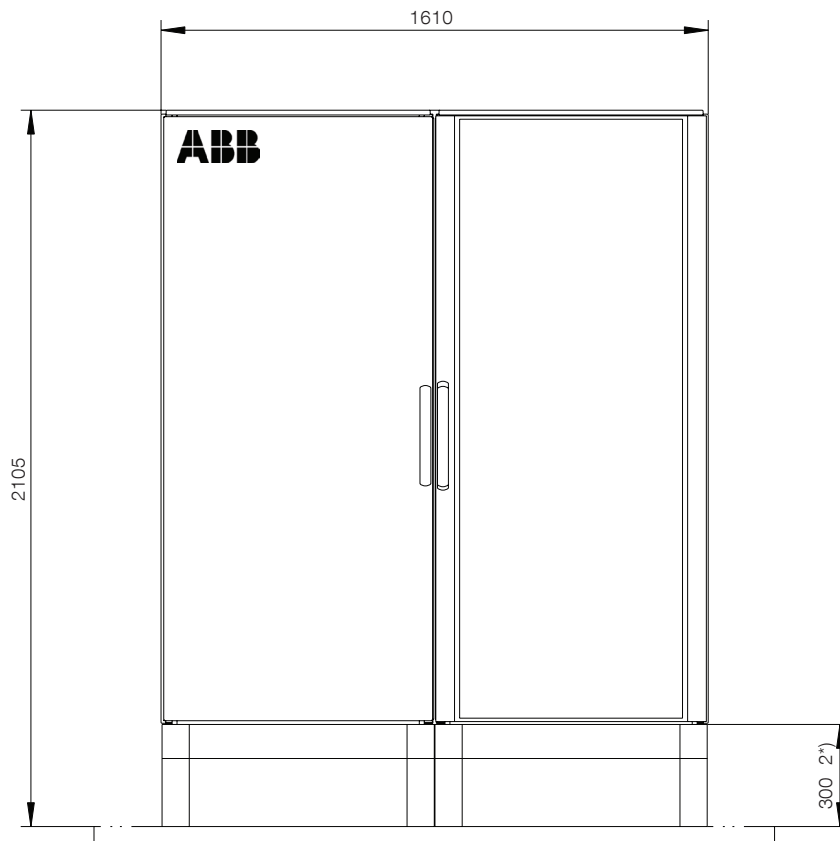
Dimension Drawing HECPS-3S/5S/5Sp Braking Switch Module (HVR-EBCB)



N = Phase distance

*) min. space required for erection and maintenance

Dimension Drawing HECPS-3S/5S/5Sp Control Cubicle



2*) 200mm is possible if the customer supply cable conduit

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
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Product Brochure

Generator Circuit-Breaker Systems HEC 7/8

Technical Data

Generator circuit-breaker system type		HEC 7A/8A	HEC 7B/8B	HEC 7C/8C
---------------------------------------	--	-----------	-----------	-----------

General				
Rated maximum voltage	kV	30	27.5	25.2
Rated frequency	Hz	50/60	50/60	50/60
Rated continuous current 50 Hz	HEC 7 naturally cooled	A rms	up to 25000	up to 25000
	HEC 8 naturally cooled (enhanced convection)	A rms	up to 28000	up to 28000
Rated continuous current 60 Hz	HEC 7 naturally cooled	A rms	up to 22000	up to 22000
	HEC 8 naturally cooled (enhanced convection)	A rms	up to 26500	up to 26500

Rated insulation level				
Rated power frequency withstand voltage				
to earth and across circuit-breaker/switch contacts	kV rms	80	80	80
across isolating distance of disconnecter	kV rms	88	88	88
Rated lightning impulse withstand voltage				
to earth and across circuit-breaker/switch contacts	kV peak	150	150	150
across isolating distance of disconnecter	kV peak	165	165	165

Circuit-breaker				
Rated peak withstand current	kA peak	466	521	575
Rated short-time withstand current	kA, 3s	170	190	210
Rated short-circuit making current	kA peak	466	521	575
Rated short-circuit breaking current	kA rms	170	190	210
Rated operating sequence			CO - 30min - CO	
Opening time	ms	33 ± 3	33 ± 3	33 ± 3
Rated interrupting time	ms	58	58	58
Mechanical endurance life	CO	10000	10000	10000

Disconnecter				
Rated peak withstand current	kA peak	466	521	575
Rated short-time withstand current	kA, 3s	170	190	210
Operating time	s	2	2	2

Earthing Switch				
Rated peak withstand current	kA peak	466	521	575
Rated short-time withstand current	kA, 1s	170	190	210
Operating time	s	2	2	2

The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

Equipment Options

- 1

Generator circuit-breaker
- 2

Line disconnect switch
- 3

Earthing switch
- 4

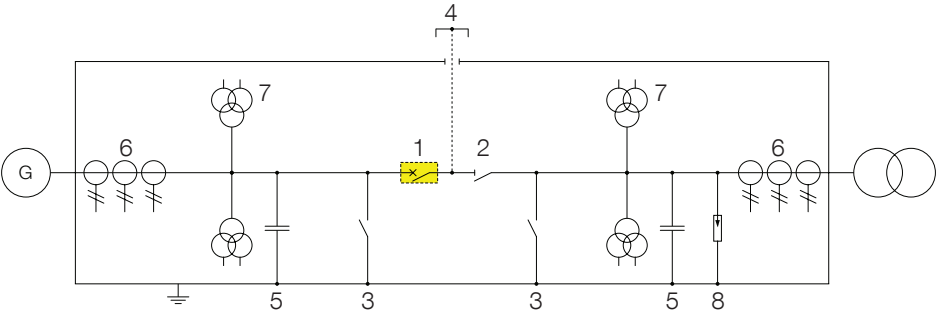
Manual short-circuiting connection
(by removal of cover)
- 5

Surge capacitor
- 6

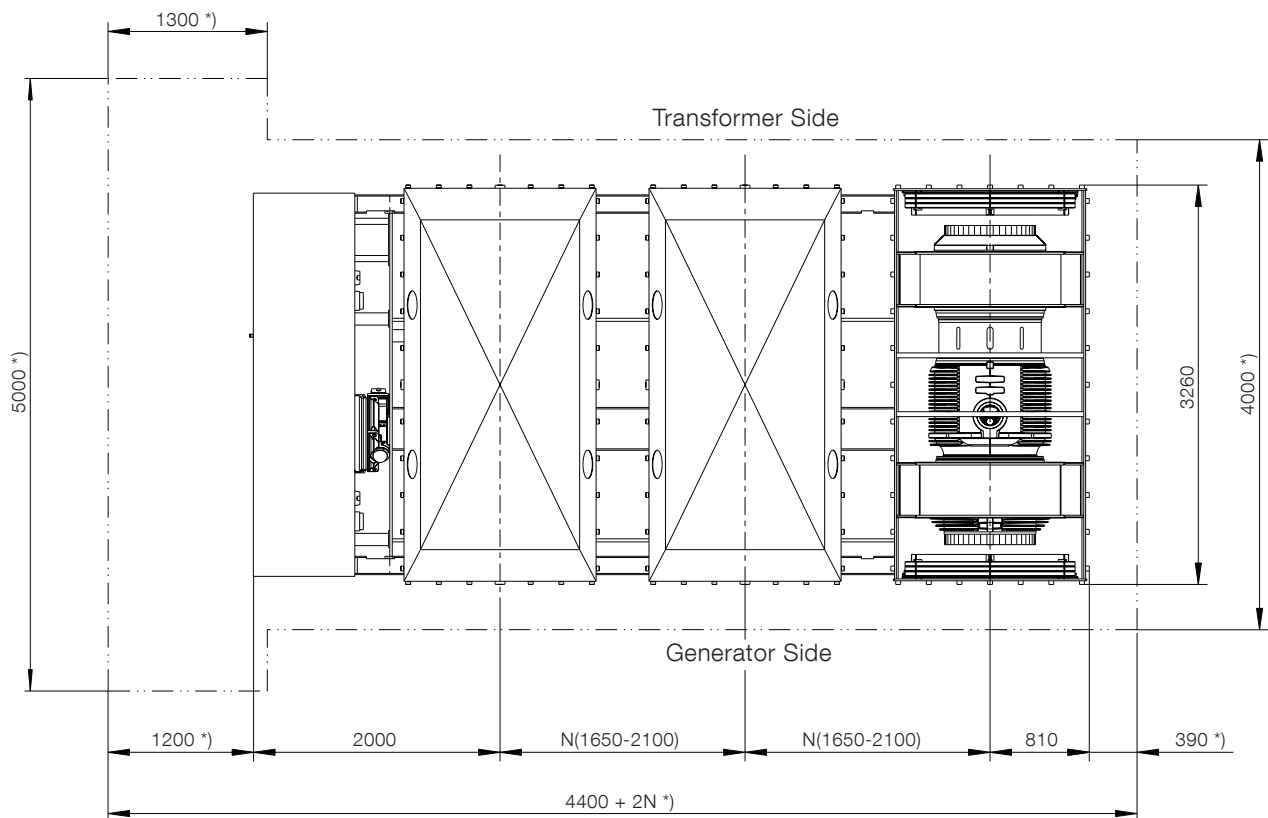
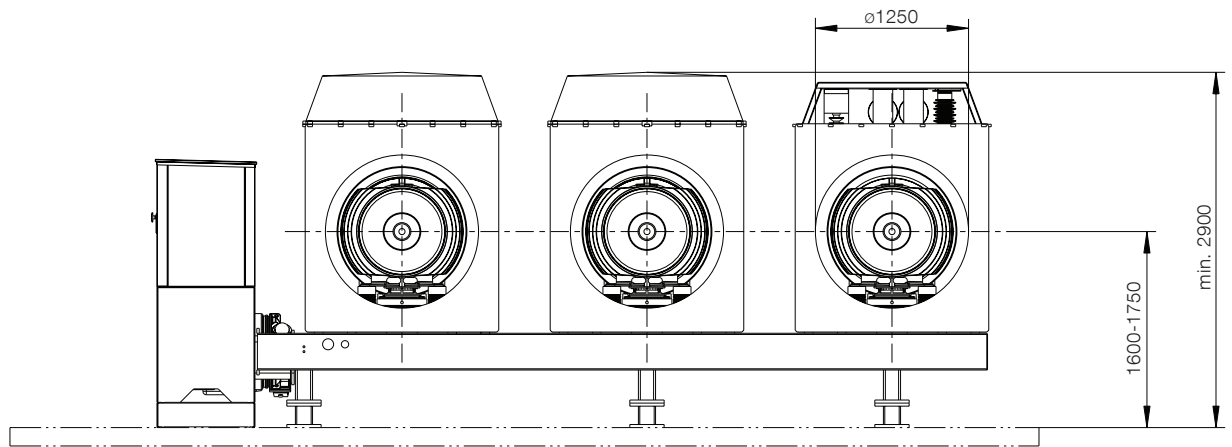
Current transformers
- 7

Voltage transformers
- 8

Surge arrester



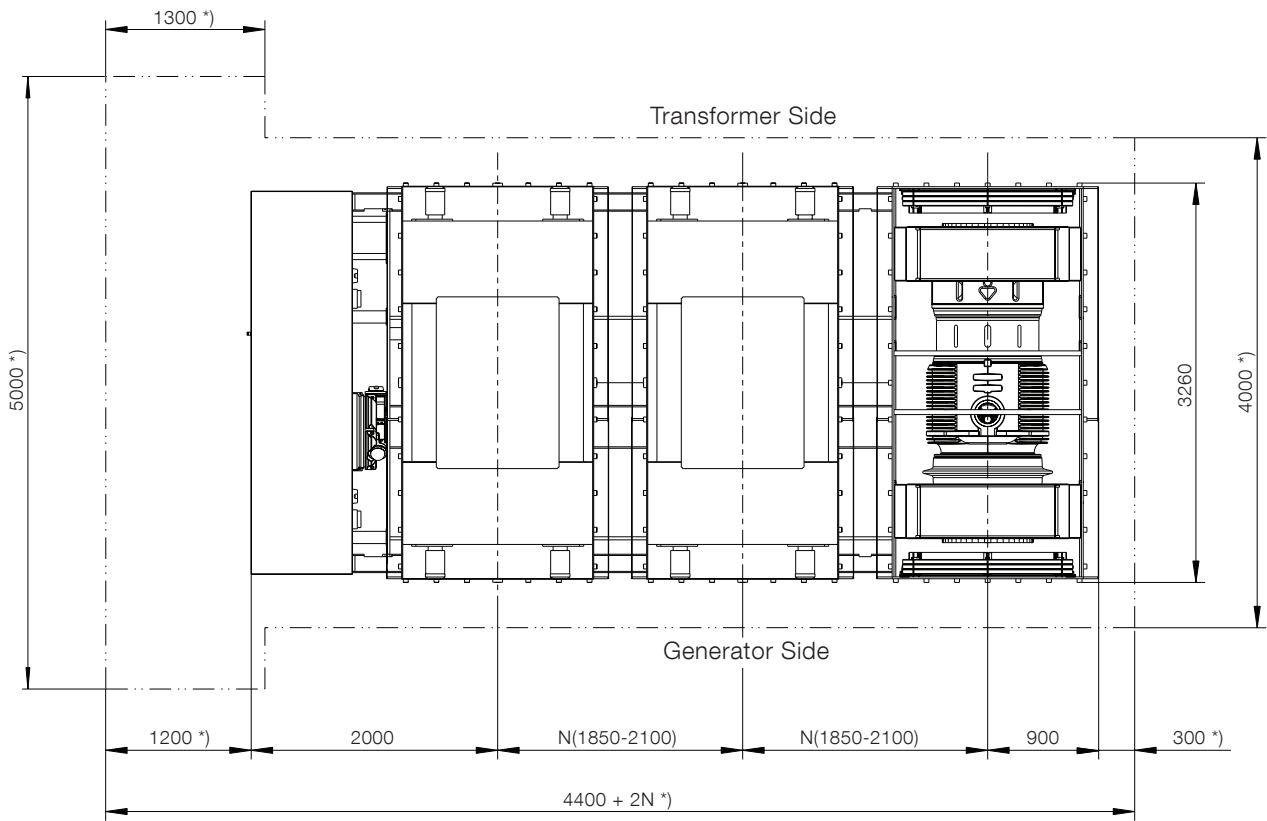
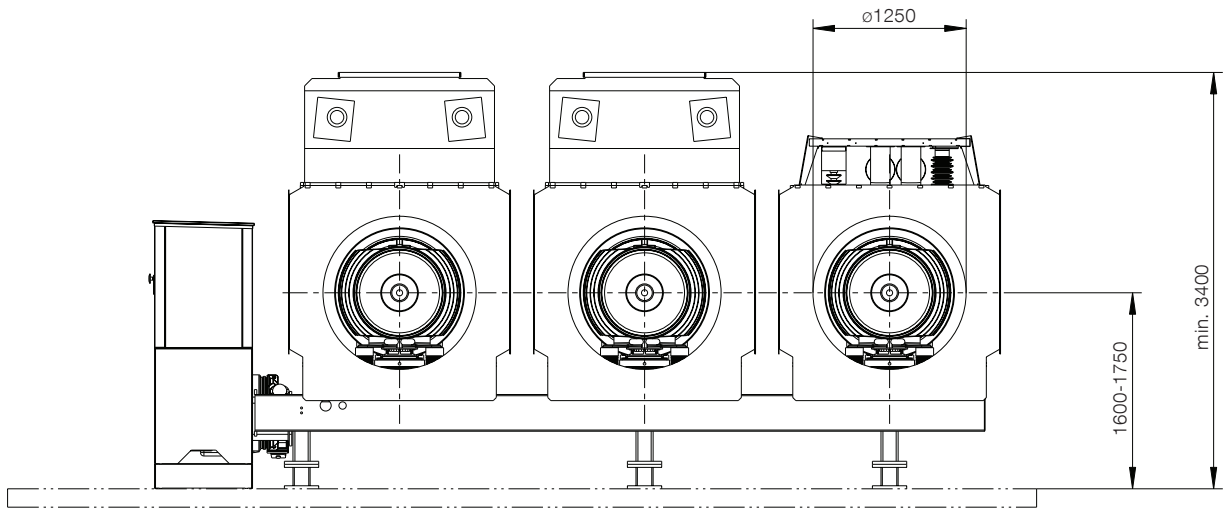
Dimension Drawing HEC 7



N = Phase distance

*) min. space required for erection and maintenance

Dimension Drawing
HEC 8



N = Phase distance

(*) min. space required for erection and maintenance

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
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Product Brochure

Generator Circuit-Breaker Systems HEC 7/8

Technical Data

Generator circuit-breaker system type		HEC 7A/8A	HEC 7B/8B	HEC 7C/8C
---------------------------------------	--	-----------	-----------	-----------

General				
Rated maximum voltage	kV	30	27.5	25.2
Rated frequency	Hz	50/60	50/60	50/60
Rated continuous current 50 Hz	HEC 7 naturally cooled	A rms	up to 25000	up to 25000
	HEC 8 naturally cooled (enhanced convection)	A rms	up to 28000	up to 28000
Rated continuous current 60 Hz	HEC 7 naturally cooled	A rms	up to 22000	up to 22000
	HEC 8 naturally cooled (enhanced convection)	A rms	up to 26500	up to 26500

Rated insulation level				
Rated power frequency withstand voltage				
to earth and across circuit-breaker/switch contacts	kV rms	80	80	80
across isolating distance of disconnecter	kV rms	88	88	88
Rated lightning impulse withstand voltage				
to earth and across circuit-breaker/switch contacts	kV peak	150	150	150
across isolating distance of disconnecter	kV peak	165	165	165

Circuit-breaker				
Rated peak withstand current	kA peak	466	521	575
Rated short-time withstand current	kA, 3s	170	190	210
Rated short-circuit making current	kA peak	466	521	575
Rated short-circuit breaking current	kA rms	170	190	210
Rated operating sequence			CO - 30min - CO	
Opening time	ms	33 ± 3	33 ± 3	33 ± 3
Rated interrupting time	ms	58	58	58
Mechanical endurance life	CO	10000	10000	10000

Disconnecter				
Rated peak withstand current	kA peak	466	521	575
Rated short-time withstand current	kA, 3s	170	190	210
Operating time	s	2	2	2

Earthing Switch				
Rated peak withstand current	kA peak	466	521	575
Rated short-time withstand current	kA, 1s	170	190	210
Operating time	s	2	2	2

The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

Equipment Options

- 1

Generator circuit-breaker
- 2

Line disconnect switch
- 3

Earthing switch
- 4

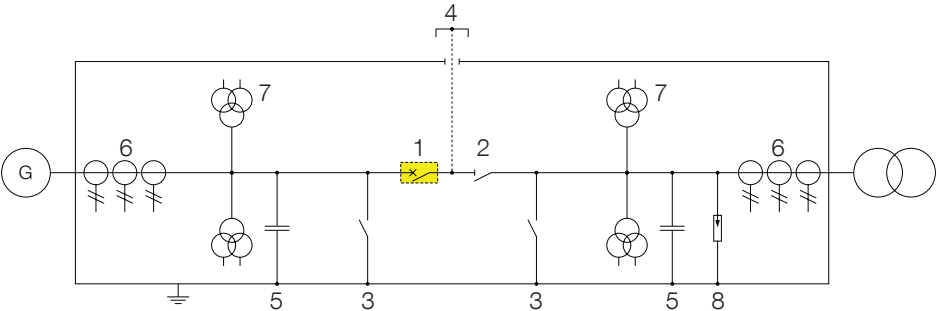
Manual short-circuiting connection
(by removal of cover)
- 5

Surge capacitor
- 6

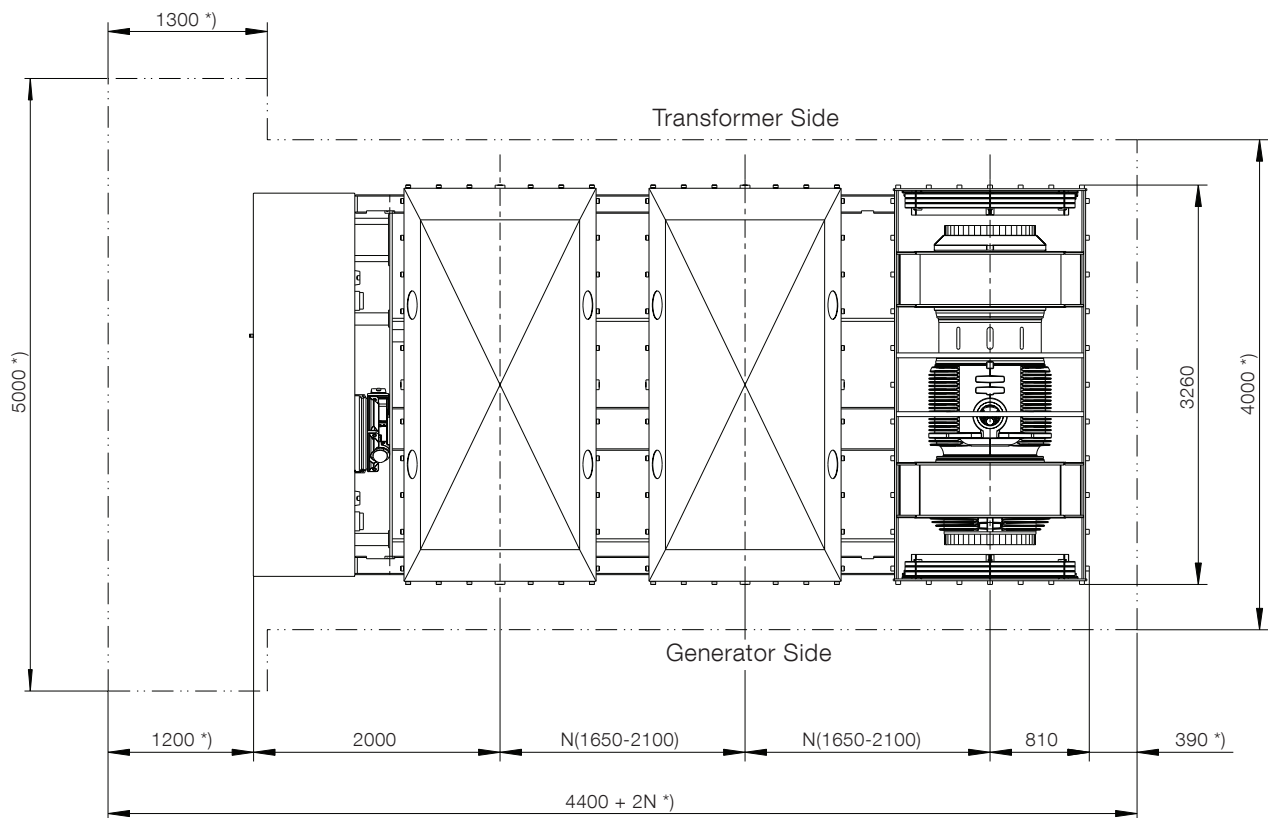
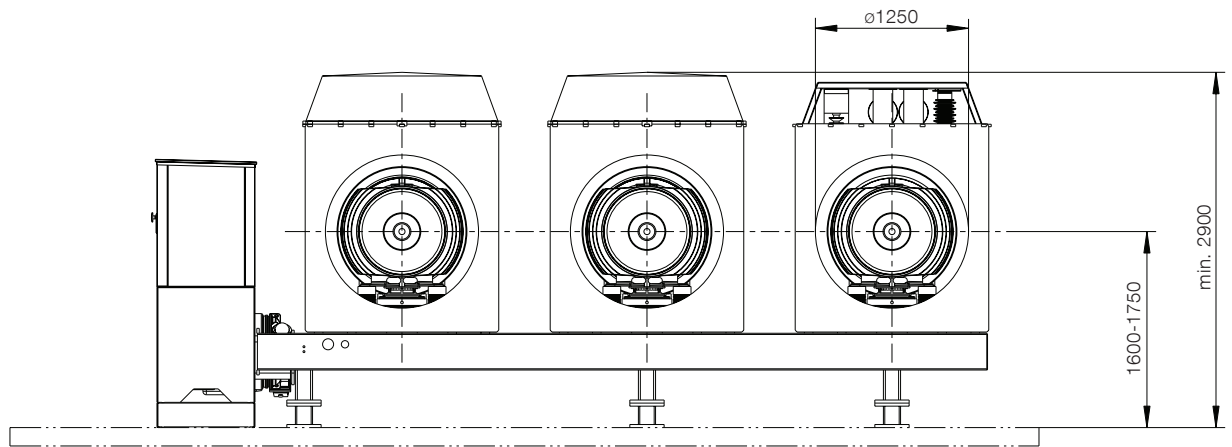
Current transformers
- 7

Voltage transformers
- 8

Surge arrester



Dimension Drawing HEC 7

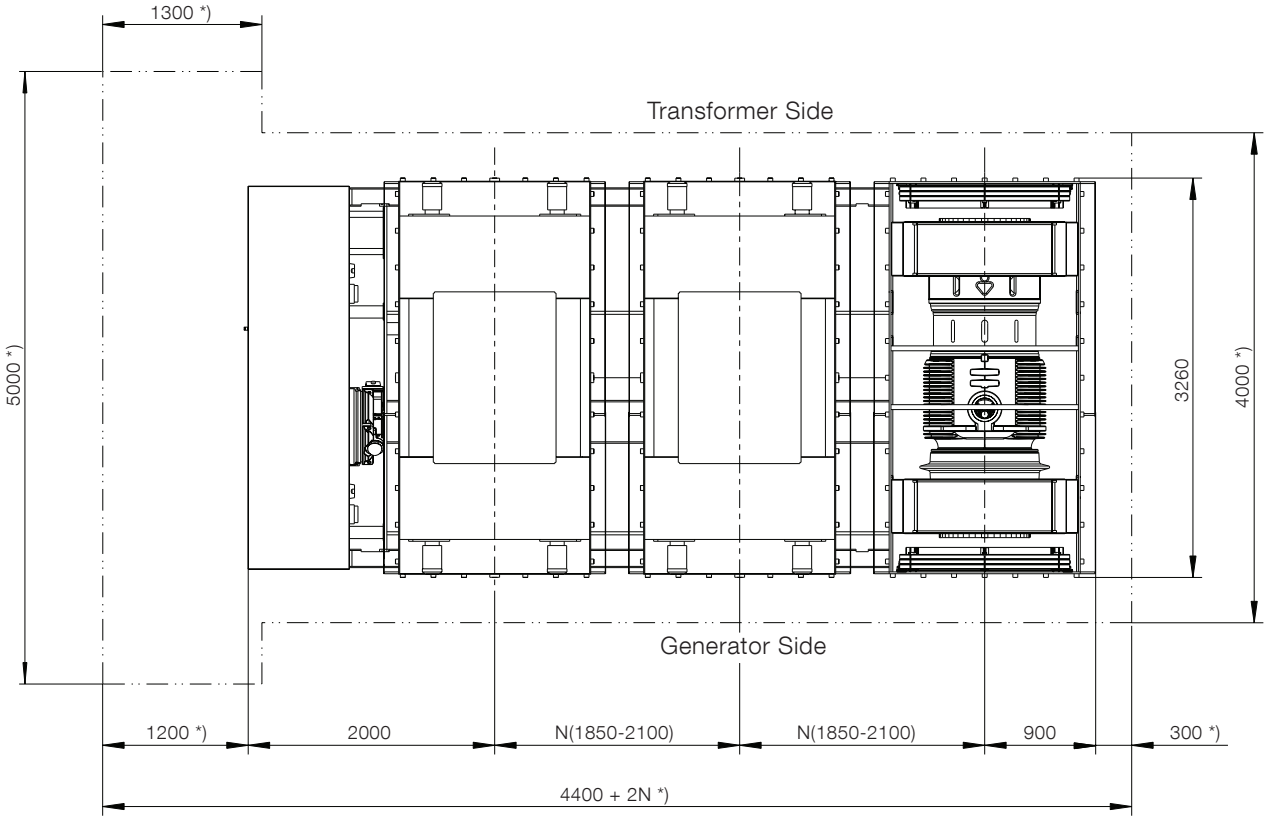
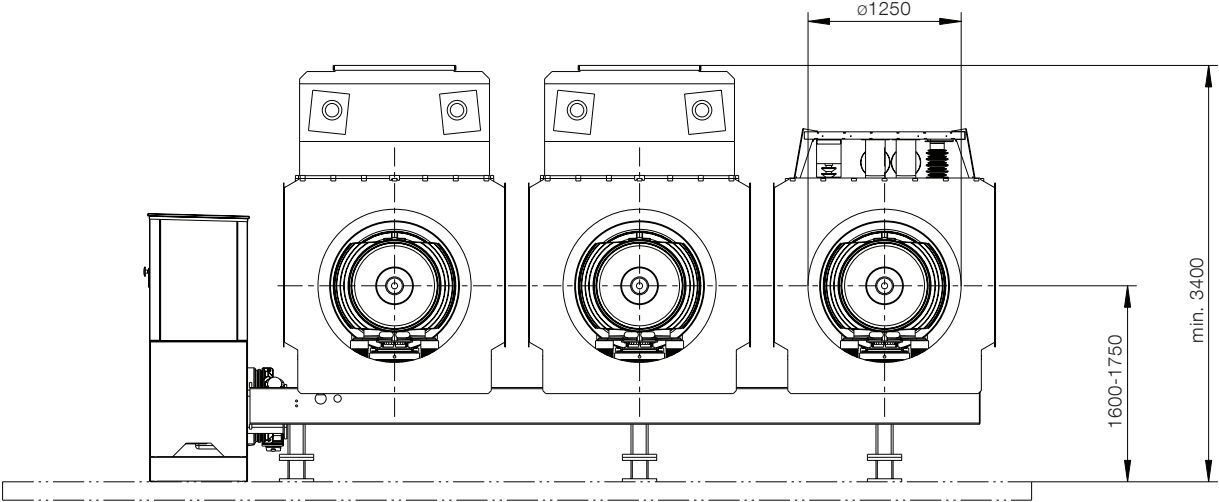


N = Phase distance

*) min. space required for erection and maintenance

Dimension Drawing

HEC 8



N = Phase distance
^{*)} min. space required for erection and maintenance

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
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Product Brochure

Generator Circuit-Breaker Systems HEC 9

Technical Data

Generator circuit-breaker system type

HEC 9-250

HEC 9-300

General			
Rated maximum voltage	kV	31.5	31.5
Rated frequency	Hz	50/60	50/60
Rated continuous current 50 Hz *) (HEC 9-L) naturally cooled	A rms	up to 28500	up to 28500
	(HEC 9-XL) naturally cooled (enhanced convection)	A rms	up to 33500
Rated continuous current 60 Hz *) (HEC 9-L) naturally cooled	A rms	up to 26500	up to 26500
	(HEC 9-XL) naturally cooled (enhanced convection)	A rms	up to 32500
*) with IPB longitudinal forced air cooling	A rms	up to 57000	up to 57000

Rated insulation level

Rated power frequency withstand voltage			
to earth and across circuit-breaker/switch contacts	kV rms	80	80
across isolating distance of disconnector	kV rms	90	90
Rated lightning impulse withstand voltage			
to earth and across circuit-breaker/switch contacts	kV peak	150	150
across isolating distance of disconnector	kV peak	165	165

Circuit-breaker

Rated peak withstand current	kA peak	685	822
Rated short-time withstand current	kA, 3s	250	
Rated short-time withstand current	kA, 2.5s		300
Rated short-circuit making current	kA peak	685	822
Rated short-circuit breaking current	kA rms	250	300
Rated operating sequence		CO - 30min - CO	
Opening time	ms	26 ± 2	26 ± 2
Rated interrupting time	ms	50	50
Mechanical endurance life	CO	5000	5000

Disconnecter

Rated peak withstand current	kA peak	685	822
Rated short-time withstand current	kA, 3s	250	
Rated short-time withstand current	kA, 2.5s		300
Operating time	s	2	2

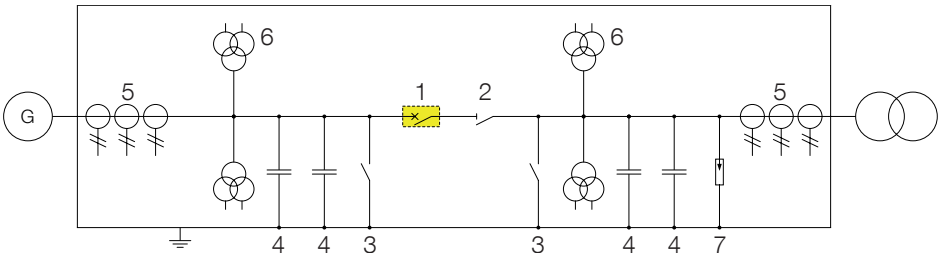
Earthing Switch

Rated peak withstand current	kA peak	685	822
Rated short-time withstand current	kA, 1s	250	300
Operating time	s	2	2

The above data are not limiting values. Additional data on request. We reserve the right to alter data and technical details without notice.

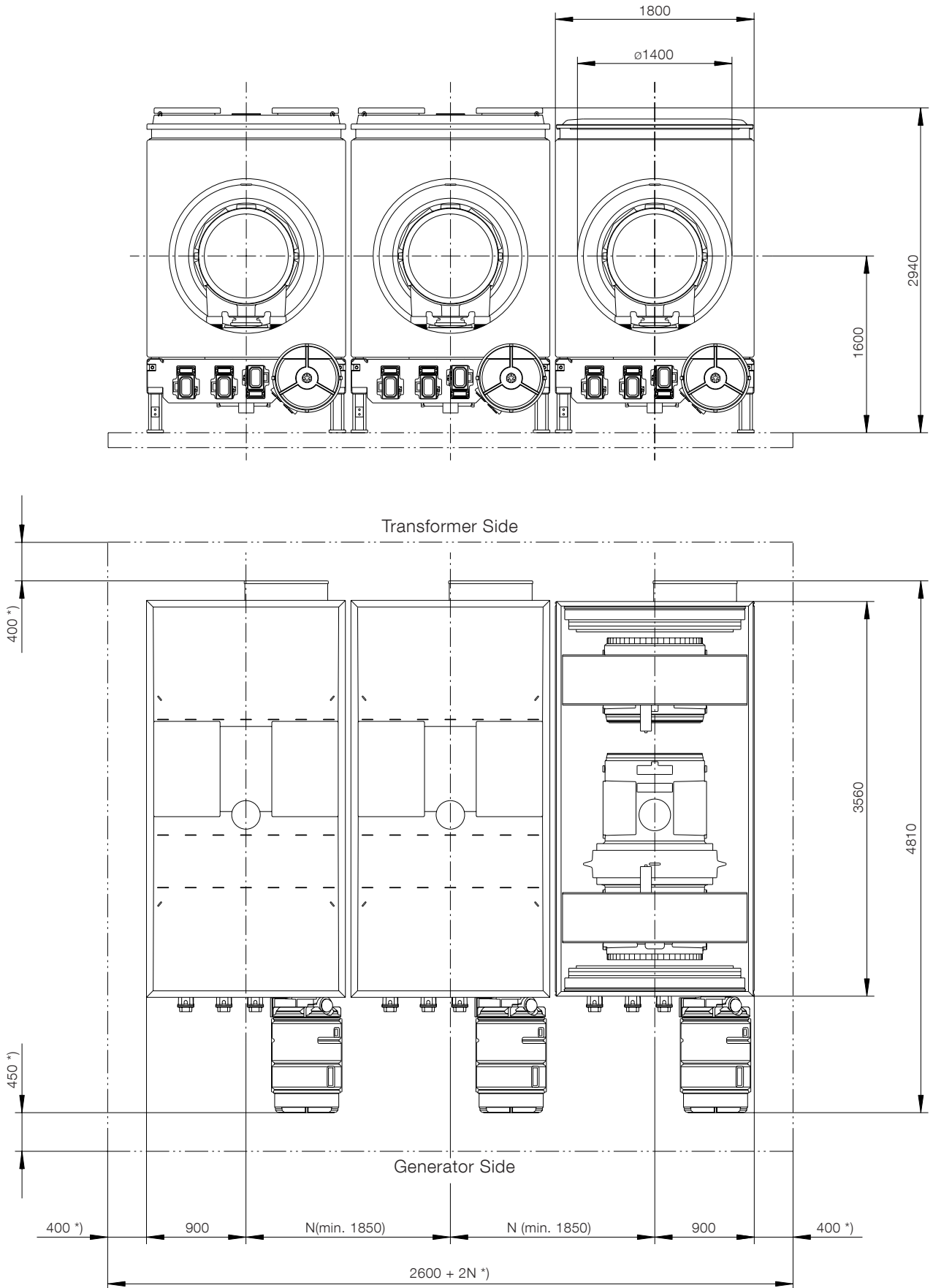
Equipment Options

- 1 Generator circuit-breaker
- 2 Line disconnect switch
- 3 Earthing switch
- 4 Surge capacitor
- 5 Surge capacitor
- 6 Current transformers
- 7 Voltage transformers



Dimension Drawing

HEC 9



N = Phase distance

*) min. space required for erection and maintenance

Contact us

ABB Switzerland Ltd
High Voltage Products
Brown Boveri Strasse 5
CH-8050 Zurich / Switzerland
Phone: +41 58 588 34 24
Email: sales.gcb@ch.abb.com
www.abb.com/gcb

Note

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