GE
Industrial Solutions

WORLDWIDE PARTNER

SecoCube

Gas Insulated Medium Voltage Switchgear

Leading the future of electrification

GE imagination at work

GE

GE is a diversified organization covering a myriad of market segments, including infrastructure, finance and media. From energy, water, transportation and health to access to money and information, GE serves customers in more than 100 countries and employs more than 300,000 people worldwide.

The company traces its beginnings from Thomas A. Edison, who established the Edison Electric Light Company in 1878. In 1892, a merger of Edison General Electric Company and Thomson-Houston Electric Company created the General Electric Company. GE is the only company listed in the Dow Jones Industrial Index today that was also included in the original index in 1896.

Industrial Solutions

GE Industrial Solutions, a division of GE Energy Management, is a global leading provider in power distribution, offering a wide range of services and products which include medium and low voltage power distribution equipment and components, motor & control systems and service products that are safe, reliable and offer high performance.

Honour

FORTUNE WORLD'S MOST ADMIRED COMPANIES 2011
Industry Champion – Ranked #1
2011 World's Most Admired Companies

Interbrand Creating and managing brand value™
2011 Best Global Brand

FINANCIAL TIMES
2008 World's Most Respected Companies

BusinessWeek
2010 World's Most Innovative Companies

BARRON'S
《BARRON'S》
2009 World's Most Respected Companies

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2007 World's Best R&D Companies

Gas Insulated Medium Voltage Switchgear

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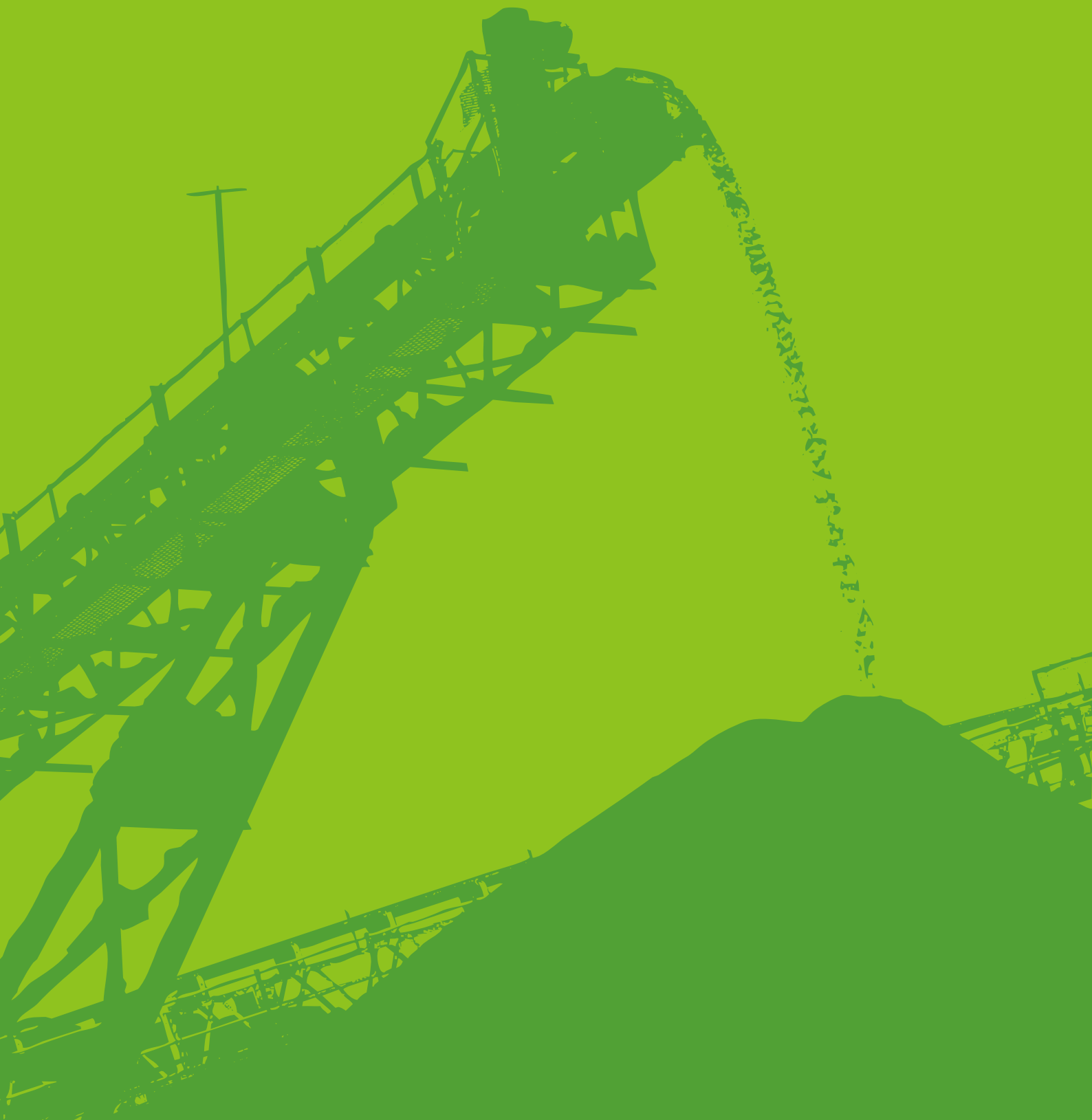

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SecoCube

Gas Insulated Medium Voltage Switchgear

SecoCube is an indoor, factory-assembled, metal-enclosed, cubicle type gas-insulated switchgear for single busbar applications, including "Green Type" and "Standard Type". The "Green SecoCube" incorporates the advanced technologies of mixed gas-insulated (SF_6 + N_2) and vacuum breakers, allowing the equipment to operate in a more reliable and environmentally friendly manner. The "Standard SecoCube" is of 100% SF6 insulated, high performance and easy use.

With modern digital manufacturing and automatic testing coupled with sensor, monitor and protection technology, SecoCube is ideal fit for power distribution demands. SecoCube is particularly suited to industries with high reliability requirements such as Power Networks, Mining, Rail Transportation, Petrochemical Plants, Wind Farms and Metropolitan Rail Systems.

Environment and Energy Efficiency

Reduce Greenhouse Gas Emissions

SecoCube incorporates the advanced technologies of mixed gas-insulated (SF_6 + N_2) and vacuum breakers, a fundamental choice made by GE to assist in reducing the greenhouse effect. SF_6 (sulphur-hexafluoride) is on the list of greenhouse gasses in the Kyoto Protocol, with a Global Warming Potential (GWP) of 23,000. Many other medium voltage switchgear systems use SF_6 gas as the only insulating medium. Leakage of SF_6 gas from switchgear contributes to the threat of the greenhouse effect and associated climate change.

With our commitment to protection of the environment, SecoCube helps reduce greenhouse gas emissions by utilising mixed gas-insulated technology together with vacuum switching technology.

A 50% reduction in SF_6 is achieved by using Nitrogen (N_2) in the SecoCube mixed gas-insulated breakers. Nitrogen is the largest component of air and its arc decomposition product is non-toxic.

Joined together by plug-in connectors and the modular nature of the panels ensures ease of installation and extension without the need for extra gas handling activities on-site.

Low Energy Consumption

Heat loss (I^2R) is mainly caused by circuit resistance, however the main circuit resistance of the SecoCube is only one-third to one-half of equivalent air-insulated switchgear. This results in SecoCube exhibiting lower heat losses.

With an optimized structural design for heat transfer along with surface treatments, SecoCube achieves reliable heat dissipation by natural cooling. Fan-forced ventilation is not required for SecoCube at any ratings, including the 2500A switchgear. Energy is saved during switchgear operation whilst operating reliability is enhanced.

Environmental, Health And Safety Of Materials

GE has strict processes to ensure regulations for the environment, health and safety of materials used during product design and manufacturing are observed. Only re-usable and/or recyclable materials are used in producing SecoCube switchgear. It reflects GE's commitment to environmental challenges while delivering valuable products and services to the customer.

Operating Conditions

Normal operating conditions

The switchgear is fundamentally designed for the normal service conditions for indoor switchgear to GB 3906. The following limit values, among others, apply:

- Ambient temperature
  - Maximum +40℃
  - Minimum -25℃
  - Daily average maximum temperature +35℃
- The maximum site altitude is 1000 m above sea level
- Humidity
  - Daily average relative humidity ≤ 95%
  - Monthly average relative humidity ≤ 90%
  - Daily average vapor pressure ≤ 2.2×10^{-3}MPa
  - Monthly average vapor pressure ≤ 1.8×10^{-3}MPa
- The surrounding environment shall not suffer obvious pollution caused by corrosive, flammable or explosive gas
- Electromagnetic interference in the secondary system shall be less than 1.6kV
- Pollution level is not more than class II identified by GB/T 5582

Special Operating Conditions

High altitude (>1000m a.s.l.) SecoCube is available. Special operating conditions apply, please contact GE in advance.

The manufacturer and end-user must agree about special operating conditions which deviate from operation under normal conditions. The manufacturer/ supplier must be consulted in advance if especially severe operating conditions are involved.

SecoCube is designed for use in the following applications:

- Mining
- Oil &Gas
- Power system
- Transportation
- Chemical industry
- Cement industry
- Steel Industry
- Textile, pager and food industry
- Pipeline system
- Commercial buildings

Applications

SecoCube Advantage

70% Reduction In Switchroom Size

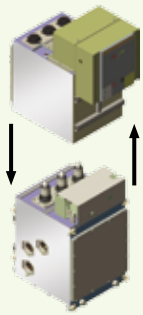
- An optimized electric field design combined with excellent insulating performance, results in a compact switchgear product that operates safely and reliably.
- Save 70% space compared with air-insulated switchgear
- Retrofitting into existing switchroom is easy
- Reduce cost of substation land

Maximum Safety For Operator And Equipment

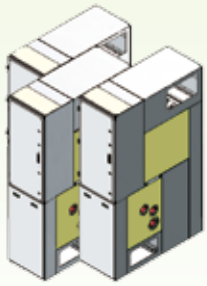
- The min. functional pressure of SecoCube is 0.00MPa (20˚C, rel.). That means, even under such severe conditions, SecoCube still maintains the rated insulation level and keeps all its rated functionality. Switching off the power supply is not a desirable situation. However, SecoCube can continue to be energised even if gas is escaping from the switchgear. This would allow a shutdown to be scheduled at a convenient time, possibly avoiding economic or social loss
- Both the gas tank and cable compartment are internal arc classified (25kA/1s), to ensure maximum personal safety. The arc duct design achieves high operational safety. When an internal arc fault occurs, the pressure relief device will open, allowing the pressurized gas to flow via the arc duct away from the operator
- Reliable electrical and mechanical interlocks are designed between the circuit breaker and three-position switch, to prevent misoperation
- Error-proof earthing is achieved by three-position switch and circuit breaker, to ensure operator safety

Easy Installation/Low Operation And Maintenance Cost

- Green type SecoCube has unique separable gas tanks design. Busbar gas tank and breaker gas tank are independent. Replacement of the circuit breaker is possible without interrupting busbar operation



- Panels in the middle can easily be removed for maintenance without moving neighbouring panels, increasing availability



- All the high voltage live parts are fully sealed in the gas tank and free from environmental impacts, such as dust, condensation, small animals etc. Therefore, SecoCube is suitable for use under severe operating conditions with the primary live parts remaining maintenance free

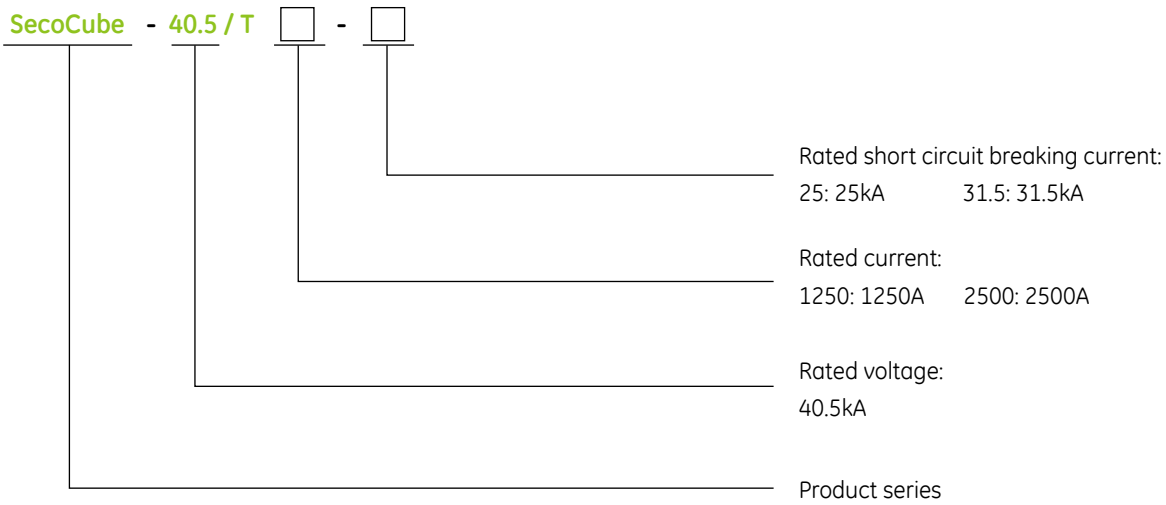
Standards

SecoCube complies with the standards and specifications for factory assembled metal enclosed switchgear and has been type tested in accordance with the GB standards as given below.

GB/T 11022 (IEC 62271-1)	Common specifications for high-voltage switchgear and controlgear standards
GB 3906 (IEC 62271-200)	A.C. metal-enclosed switchgear for rated voltages of 3.6~40.5kV
GB 1985 (IEC 62271-102)	Alternating current high-voltage disconnectors and earthing switches
GB 1984 (IEC 62271-100)	Alternating current high-voltage circuit breakers
GB 8905 (IEC 60480)	The guide for processing and measuring SF_6 gas in power apparatus
GB 28537 (IEC 62271-303)	Test guide of SF_6 gas tightness for high-voltage switchgear
GB 12022 (IEC 376, 376A, 376B)	Sulphur hexafluoride for industrial use
DL/T 593	Common specifications for high-voltage switchgear and controlgear
DL/T 404	Indoor AC High Voltage Switchboard Ordering requirement

All other corresponding IEC publications, national or local safety regulations must be followed during the installation and operation of the switchgear. In addition, any project specific advice from GE must be considered.

Product Type



Switchgear Technical Specifications

General				
			Standard Type	Green Type
Rated voltage		kV	40.5	40.5
Rated power frequency withstand voltage (1min)*	To earth/phase to phase	kV	95	95
	Across isolating distance	kV	118	118
Rated lightning impulse withstand voltage*	To earth/phase to phase	kV	185	185
	Across isolating distance	kV	215	215
Rated frequency		Hz	50	50
Rated current		A	1250	1250, 2500
Single capacitor bank breaking capacity		A	-	400
Rated cable charging breaking current		A	50	50
Rated shortcircuit breaking current		kA	25	31.5
Rated short circuit making current(peak)		kA	63	80
Rated short time withstand current and endurance time		kA/s	25/4s	31.5/3s
Rated peak withstand current		kA	63	80
Operating Sequence			O-0.3s-CO-180s-CO	O-0.3s-CO-180s-CO
Gas System				
Insulated gas			100%SF_6	50%SF_6+50%N_2
Annual leakage rate		%/Y	≤ 0.1	≤ 0.1
Rated gas pressure (abs, 20˚C)		MPa	0.12	0.12
Alarm pressure (abs, 20˚C)		MPa	0.11	0.11
Minimum operating pressure (abs, 20˚C)		MPa	0.10	0.10
Degree Of Protection				
Gas tank			IP65	IP65
Enclosure			IP4X	IP4X
Motor And Trip Coil				
Circuit breaker charging motor		W	90	90
Rated power of closing coil		W	220	220
Rated power of opening coil		W	220	220
Rated voltage of auxiliary circuit		V	DC 24, 48, 110, 220; AC220	DC24, 48, 110, 220 AC220
1 min power frequency withstand voltage of auxiliary circuit		kV	2	2
Dimensions And Weight				
Dimensions(W × D × H)	1250A	mm	600 × 1600 × 2400	600 × 1500 × 2400
Dimensions(W × D × H)	2500A	mm	-	800 × 1500 × 2400
Weight	1250A	kg	800 ~ 1000	800 ~ 1000
Weight	2500A	kg	-	1100 ~ 1400

* On request

Internal Arc Classification A FLR 31.5kA/0.5s

Type of accessibility A Switchgear in closed electrical service location, access "for authorized personnel only" according to IEC 62271-200

F Access from the front

L Access from the lateral

R Access from the rear

Loss Of Service Continuity Category (LSC) According To IEC 62271-200

Cable compartments LSC2B

Gas tanks Not applicable

LSC category defines the possibility to keep other compartments and/or functional units energized when opening a main circuit compartment.

Gas tank is fully sealed for its service life and cannot be opened under service conditions, otherwise, it will lose its functionality. Therefore, there is no criterion for LSC category of inaccessible compartments. The LSC category is not applicable for gas tanks.

Cable compartment of SecoCube is LSC2B because it may remain energized when other accessible compartment of the panel is open.

Switchgear Partition Class Acc. To IEC 62271-200 PM

Partition class in IEC 62271-200 defines whether metallic or non-metallic materials for separation to live parts is used. SecoCube provides continuous metallic partitions, intended to be earthed, between opened accessible compartments and live parts of the main circuit.

Advanced Manufacturing and Testing Process

CNC Laser Cuttong/Punching Center

The laser beam cutting precision of TEUMPF CNC laser cutting/punching center is ±0.05mm, while the targeting precision of this machine is 0.02mm, ensuring the splicing clearance of the gas tank 0.1mm.

Three-Dimensional Five-Axis CNC Laser Welding System With Automatic Helium Protection

With high accuracy and energy concentrating features, the laser welding process can weld the stainless steel in a split second without using any solder. Older welding techniques can result in missing welds, incomplete welds and foreign materials caught in the welding joint, often resulting in weld deformation. The laser welding process significantly improves weld quality, ensuring the reliability and quality identity of the gas tank. Annual leakage rate of the gas tank is less than 0.1% per year.

Night Train Flexible Manufacturing System

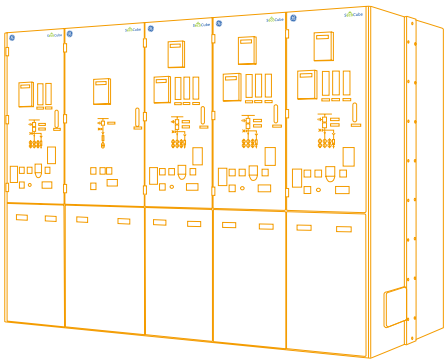
Night train flexible manufacturing system is a global leading solution for sheet metal manufacturing. It puts automatic loading and unloading, shearing, punching and bending together, while the automated systems for sorting and stacking is also integrated. As a combination of work stage management and automated material management, night train FMS not only ensures the sheet metal manufacturing precision, but also enhances the material utilization and production efficiency.

Partial Discharge Testing Laboratory

GE has a top-class fully shielded partial discharge testing laboratory, to perform comprehensive and strict partial discharge testing on switchgears and its main components, ensuring high insulating performance during their service life.

Automatic HELIUM Leak Detection Equipment

The gas tanks are tested for leaks using Helium gas. This leak testing process is more sensitive and accurate than older methods because Helium has a small molecule size. The leak test is performed using an automated system; simultaneously evacuating and filling the tanks, avoiding gas tank deformation, whilst sensing and detecting gas leaks. This automated leak testing process takes only 15 minutes, being highly efficient and suited to our busy production schedules.



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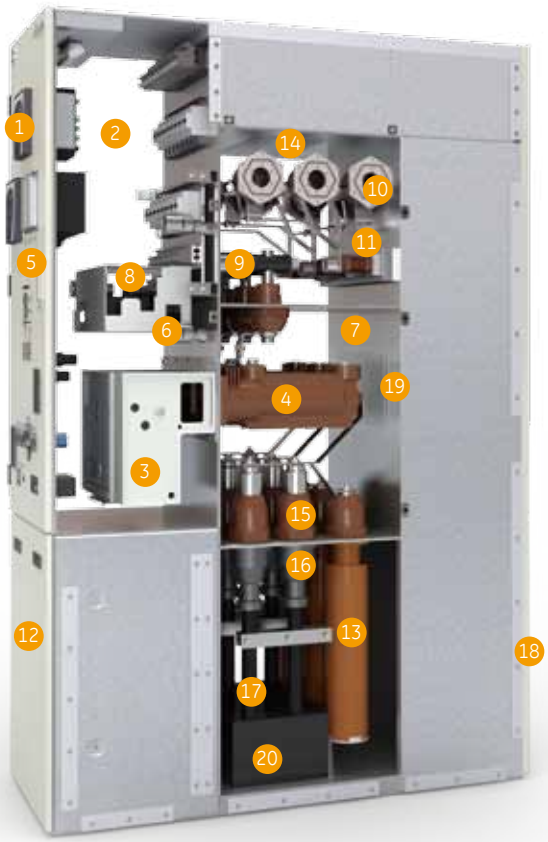
Modular Design

Each panel consists of several functional compartments: low voltage compartment, cable compartment, vacuum circuit breaker compartment, main busbar compartment, arc duct for the circuit breaker compartment, arc duct for the main busbar compartment and cable compartment etc. Each functional compartment is separated from other compartments by metallic partitions and many combinations are available without impacting the gas system.

Benefits of the modular design include easy assembly and replacement combined with limited disruption in the event of a fault.

Standard SecoCube



Green SecoCube

1. Protection and control unit
2. LV compartment
3. VCB mechanism
4. SecoVac-G Embedded pole vacuum circuit breaker
5. LV compartment door
6. Gas density indicator
7. VCB gas tank
8. 3-position switch mechanism
9. 3-position switch
10. Main busbar
11. Main busbar gas tank
12. Front cover
13. Surge arrester
14. Pressure relief device of main busbar gas tank
15. Inner-cone cable bushing
16. Cable terminal
17. Cables
18. Rear cover
19. Pressure relief device of VCB gas tank
20. CT

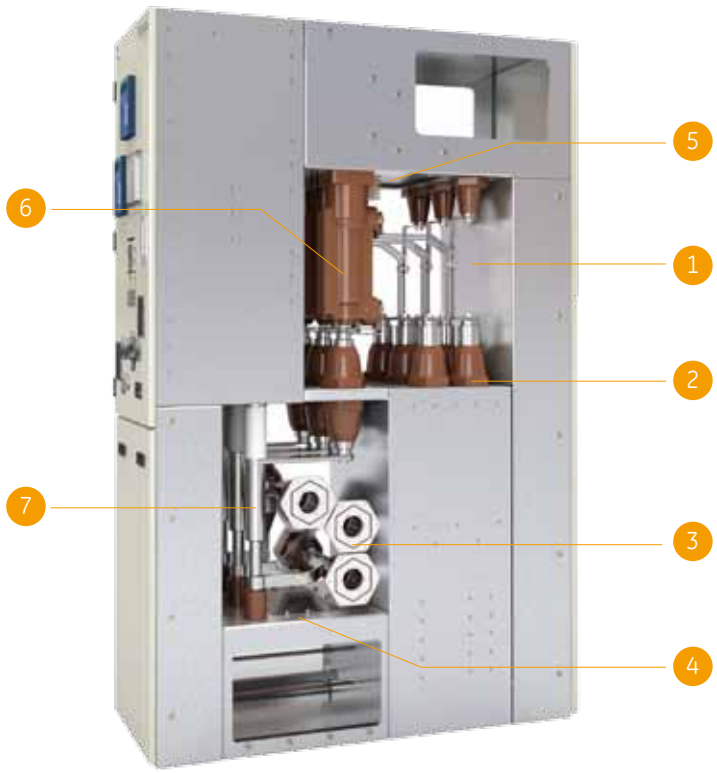
Structure

Low Voltage Control & Protection Compartment

The compartment is isolated using earthed metal partitions. It provides ample space for the control and protection devices and also contains a secondary control circuit.
External secondary cables are bottom entry through the base plate of the low voltage compartment. A fully isolated metal wire channel is mounted at the top of each switchgear panel. This connects together to form a continuous secondary wiring channel that runs along the entire length of the switchgear.
To avoid condensation in environments with high humidity, a heater is mounted in the low voltage compartment.

Cable Compartment

The compartment consists of cable terminals, high voltage cables, earthing bar, cable clamps. It is available for mounting Ring CT and surge arrester. Up to three cables per phase are available as well as test plugs.
If an arc fault occurs in the cable compartment or main busbar compartment, the pressure relief device will open to vent the gas through the arc duct at the bottom of the panel.



1. VCB compartment
2. Cable bushing
3. Main busbar
4. Pressure relief device
5. Pressure relief device
6. Embedded VCB
7. Three position switch

Busbar Compartment

The main busbar and three-position switch are completely enclosed in a separate earthed metal compartment which vents into the arc duct. The busbars are type tested for ratings up to 2500A and are fully insulated along their entire length. The busbar compartment and the breaker compartment are independent. Each compartment has a pressure relief valve and pressure relief passage to allow venting of the pressurised gas created by an internal arc.

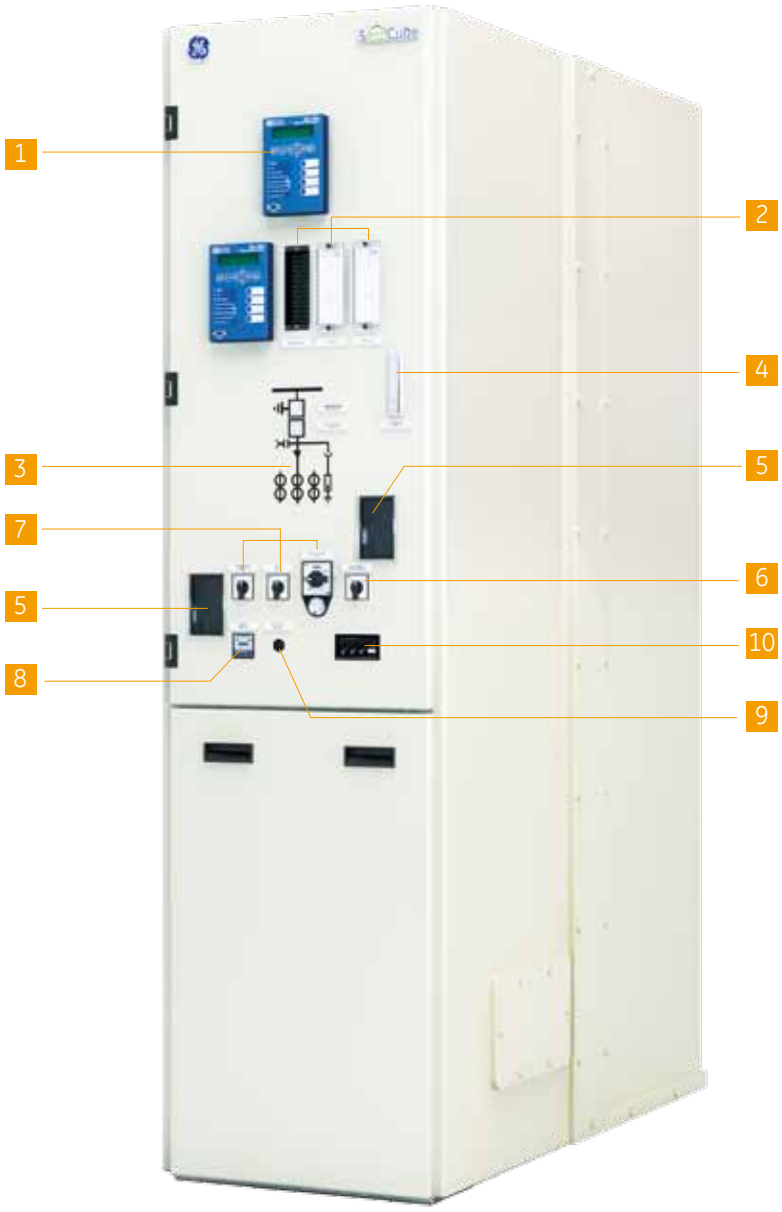
Vacuum Circuit Breaker Compartment

The VCB compartment is fully isolated by earthed metal partitions, and has a separate pressure relief channel opening into the arc duct. The compartment provides all the safety interlocking mechanisms required for safe and reliable operation of the vacuum circuit breaker.

The circuit breaker and the main busbar are in two separate gas tanks. The two gas systems are separate from each other. It is possible to maintain operation of the busbar in the event of a fault in the circuit breaker compartment.

The gas tank is made up of 3mm high quality stainless sheet and is manufactured by advanced laser cutting and a laser welding process. A gas leakage test is performed using highly accurate leak detection equipment, where the annual leakage rate is determined to be less than 0.1%. The expected service life of the gas tank is more than 30 years.

Switchgear Front Panel



1 Control And Protection Relay

GE has a range of Multilin relay options that can be fitted as standard. Customer specified protection relays can be fitted in the factory upon request.

2 Test Block (Optional)

Test blocks can be installed as required. Test blocks allow rapid system testing, enabling the safe isolation of protection relays and subsequent verification of system performance.

3 Single Line Diagram

Highly visible representative diagram showing the main configuration of the switchgear.

Indicators show the status of the three-position switch and circuit breaker. The breaker position indicator shows the breaker in the connected/service or disconnected/test position. The position indicator of the three-position switch shows the switch in the open, closed or earthed position.

Screen painting process makes the single line diagram extremely durable.

4 Mechanical Lock

Access to the low voltage compartment door is controlled by a keyed lock. The lower cover of the front panel is accessible only when the upper cover is open. When the low voltage compartment door is closed, the switchgear can only be modified using motorised operation.

5 Viewing windows

The viewing windows allow viewing of the pressure indicator on the gas tank.

6 Local-Remote Selector Switch

Operator can choose to operate the circuit breaker and the three-position disconnector locally or remotely via local-remote selector switch. Various control means can be used such as protection relays, switches, PLCs.

7 Disconnector Switch/ Earth Switch/ Circuit Breaker Switch

For motorized operation.

8 Heat Monitor

When the ambient humidity reaches ≥ 60%RH ±5%, the heater switches on to control the humidity and temperature inside the switchgear.

9 Trip Circuit Healthy

The device is to show the VCB is tripped by fault.

10 Voltage Presence Indicating System

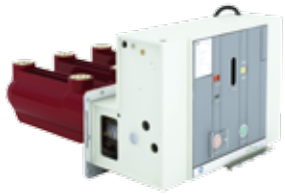
The capacitive high voltage indicator works in conjunction with the integrated sensor to detect the live condition of the feeder and the busbar. It also verifies the safe isolation from the supply.

The capacitive high voltage indicator with interlock function can lock the switchgear to prevent any dangerous operation or access when the equipment is live.

Test sockets are available on the front panel for phase checking.

Embedded SecoVac-G Vacuum Circuit Breaker

SecoVac-G vacuum circuit breaker is fixed mounted, while its three-phase embedded poles are arranged vertically into the circuit breaker gas tank.
Due to the vacuum switching technology, an arc is limited in the vacuum interrupter, reducing the exhaust volume of insulation gas. Vacuum switching is of high performance in frequent short-circuit and numerous on-load switching applications.



Standard Type: VCB horizontal arranged

Green Type: VCB vertical arranged

Circuit Breaker Specification

General				
			Standard Type	Green Type
Rated voltage		kV	40.5	40.5
Rated insulation level*	Rated power frequency withstand voltage (1min)	kV	95	95
	Rated lightning impulse withstand voltage	kV	185	185
Rated frequency		Hz	50	50
Rated current		A	1250	1250, 2500
Single capacitor bank breaking capacity		A	-	400
Rated cable charging breaking current		A	50	50
Rated shortcircuit breaking current		kA	25	31.5
Rated short circuit making current(peak)		kA	63	80
Rated short time withstand current and endurance time		kA/s	25/4s	31.5/3s
Rated peak withstand current		kA	63	80
Electrical endurance			E2	E2
Operating Sequence			O-0.3s-CO-180s-CO	O-0.3s-CO-180s-CO

* Can maintain the rated insulation level at 0.00 MPa (rel.) SF_6 pressure.

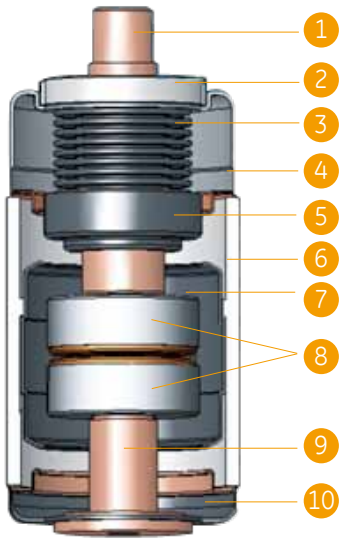
Main Circuit Resistance of SecoVac-G

Item	Unit	Value	
Rated Current	A	1250A	2500A
Resistance	Ω	≤ 45	≤ 25

Vacuum Interrupter

The vacuum interrupter of the VCB is of an optimized design, the ceramic insulator is compact with high insulation level and a high current breaking capability. The contacts are made of Copper-Chromium, with excellent abrasion resistance, long electrical endurance, and high short circuit breaking capacity.
The embedded poles are assembled on the flange plate of the frame. The vacuum interrupter and terminals are fixed inside the embedded pole by APG epoxy molding process.

The arc inside the vacuum interrupter is extinguished using the axial magnetic field (AMF) principle. The vacuum interrupter has a high degree of vacuum and low contact resistance. When the VCB breaks a fault current (or a normal load current) a vapour arc arises between the moving and fixed contacts. An axial magnetic field between the open contacts makes the arc move across the contact surface, with a lower arc voltage. The arc is extinguished at the next natural zero of the alternating current, while the ion, electron and metal vapour polymerize together to re-establish the insulating capability between the contacts. The result is the current flow is securely interrupted.



1. Moving contact rod
2. Guide glove
3. Metal bellow
4. Stainless steel cover
5. Shield
6. Ceramic insulator
7. HV Shield
8. Contacts
9. Fixed contact rod
10. stainless steel cover

Circuit Breaker Front Panel

Manual operation buttons allow full operation of the vacuum circuit breaker from the front panel of the circuit breaker mechanism.
A padlock device on the circuit breaker front panel prevents accidental opening.

1. Close button
2. Open button
3. Counter
4. VCB indicator
5. Manual charging
6. Charging status indicator
7. Circuit breaker nameplate

Embedded SecoVac-G Vacuum Circuit Breaker

Circuit Breaker Operating Mechanism

The vacuum circuit breaker is equipped by a modularized spring-charging mechanism, which can be operated manually or electrically. Thanks to the optimized design, fewer components are used and high reliability is realized.

The VCB enclosure also serves as the frame for the operating mechanism. The enclosure is divided into five sections by four pre-assembled plates of the opening and closing modules. The transmission, charging, tripping, closing and damping device are mounted inside. Opening and closing the circuit breaker is realized by controlling the main shaft.

The embedded poles and operating mechanism are assembled as a whole installation module, which simplify the transmission device and optimize the mechanical characteristics. Such design reduces the energy consumption and improves the mechanical reliability.

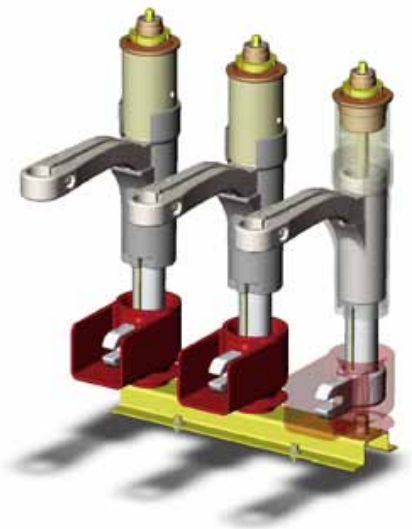
The mechanical endurance reaches 10000 operations.

1 Motor
2 Transmission gear
3 Transmission chain
4 Charging module
5 Micro switch S1
6 Closing trip coil Y3
7 Closing lever
8 Closing latching electromagnet Y1
9 Auxiliary contacts S3
10 VCB indicator
11 Charging indicator
12 Control wiring board
13 Counter
14 Opening trip coil
15 Opening lever

Mechanical Characteristic

		Standard Type	Green Type
Rated voltage	kV	40.5	40.5
Closing time (Rated operating voltage)	ms	50 ~ 80	50 ~ 80
Opening time (Rated operating voltage)	ms	25 ~ 40	25 ~ 40
Mechanical endurance	times	10000 (Class M2)	10000 (Class M2)
Rated voltage of auxiliary circuit	V	DC24, 48, 110, 220 AC220	DC24, 48, 110, 220 AC220
Opening speed	m/s	1.4 ~1.9	1.4 ~1.9
Closing speed	m/s	0.6 ~1.3	0.6 ~1.3
Clearance between open contacts	mm	19 ± 1.0	19 ± 1.0
Bouncing time during closing	ms	⩽ 3	⩽ 3
Asynchronous time during closing	ms	⩽ 2	⩽ 2
Asynchronous time during opening	ms	⩽ 2	⩽ 2

IST Three-position Switch



Connect to the main busbar (Closed)

Disconnect from the main busbar (Open)

Connect to the earthing contacts (Earthed)

- The three position disconnector and earthing switch is of rod type, and vertically equipped in the busbar compartment.The moving contact assembly with 3 stable positions (closed, open and earthed), makes natural interlocking
- The driving mechanism of 3-position disconnector is installed in the low voltage compartment outside the gas tank, which can be operated electrically and manually. Position indicator is front viewable on the driving mechanism
- The earthing contact can be removed as per customer requirement

IST Three-position Switch

Three-position Switch Specification

General				
			Standard Type	Green Type
Rated voltage		kV	40.5	40.5
Rated power frequency withstand voltage (1min)	To earth/phase to phase	kV	95	95
	Across isolating distance	kV	118	118
Rated lightning impulse withstand voltage	To earth/phase to phase	kV	185	185
	Across isolating distance	kV	215	215
Rated frequency		Hz	50	50
Rated current		A	1250	1250, 2500
Rated short time withstand current and endurance time		kA/s	25/4s	31.5/3s
Rated peak withstand current		kA	63	80
Rated voltage of auxiliary circuit		V	DC24, 48, 110, 220 AC220	DC24, 48, 110, 220 AC220
Motor power		W	180	180
Opening/closing time of the disconnector		s	⩽ 10	⩽ 10
Opening/closing time of the earthing switch		s	⩽ 10	⩽ 10
Mechanical endurance		times	2000	2000
Rated manual operating torque		Nm	<20	<20

Interlock Between Circuit Breaker And Three-position Switch

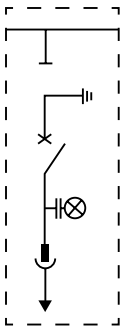
The mechanical interlock is provided to make it impossible to operate the three-position switch when the circuit breaker is in the open position.
It is also impossible to operate the circuit breaker, if the three-position switch is not positioned to either of the earthed/open/closed positions.

Earthing Function Achieved by Circuit Breaker And Three-position Switch

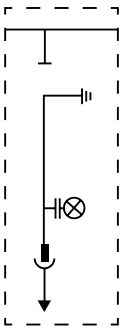
The earthing function is realized by cooperation of the three-position switch and the VCB. The vacuum circuit breaker has a superior fault making capability than the earthing switch.

Eathing of the cable circuit

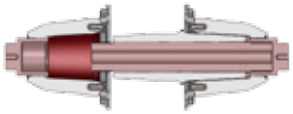
a) Earth the 3-position disconnector



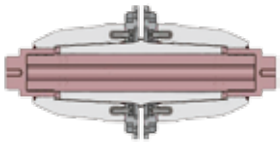
b) Close the circuit breaker



Busbar System



Busbar connection, plug in at one end



Busbar connection between panels

1. Insulating part of busbar connector
2. Semi-conductive part of busbar connector
3. Earthing spring
4. Busbar conductor bolts

SecoCube panels are connected by plug-in busbar connectors, requiring no gas work on site. The silicone-rubber busbar connectors are standardized according to EN50181. The busbar connector differs with current ratings. Its application should be based on specific requirements of the project. End plugs are provided for fitting on the side panels to permit future extension.

The busbar conductor bolts are axially movable from the silicone busbar connector. The silicone insulating part isolates the high voltage potential part from the earthed potential part. The black semi-conductive section protects the silicone insulating surface from possible damage by the earthing spring.

High conductivity flat copper bars are utilized in the main busbar compartment;
Combined with optimized electrical field, the bars achieve high current performance and high heat dissipation.
The busbar are rated at 1250A and 2500A.

Inner-cone Cable Connection System

Circuit breaker compartment with inner-cone bushing

- Inner cone cable bushings on the gas tanks facilitate the connection with high voltage cables, plug-in VT, surge arrester and testing adaptor. When not in use, each bushing is to be covered by an end plug or during delivery, by a white protection cover
- Inner-cone cable terminal and cable bushing comply to EN 50181 standard in size 2 and 3
- Cables can be either bottom entry or top entry. 2 or 3 cables per phase are available

Plug size	Cable cross section (mm^2)	Max. number of parallel cables
2	35-240	3 sets
3	50-630	3 sets

Surge Arrester

The surge arrester is used to protect electrical equipment against transient operating or lightning over-voltage. It is connected between primary conductor and ground for protecting protective load from damage effect.

- Plug- in type, metal enclosed, easy for maintenance and replacement
- The enclosure is reliably earthed and safe for touching
- Can be equipped with discharge counter and online current leakage detector

Voltage Transformer

- Plug-in type voltage transformers are mounted outside the gas tank. All its high voltage parts are sealed in a solid insulation medium. The enclosure is reliably earthed
- Integrated internal HV fuse for panel protection is available
- Easy access and installation/replacement due to the structure of the VT panel
- Voltage transformer can be mounted on feeder side (busbar side on request) or a separate VT panel
- When a VT sensor is required, please contact GE in advance

Rated Vltage (kV)	Accuracy Class	Rated Output (VA)	Max. Output (VA)	Insulation level (kV)
$\frac{35}{\sqrt{3}} / \frac{0.1}{\sqrt{3}} / \frac{0.1}{3}$	0.2 /3P	30 / 100	400	40.5 / 95/ 200
	0.5 /3P	90 / 100	400	
$\frac{35}{\sqrt{3}} / \frac{0.1}{\sqrt{3}} / \frac{0.1}{\sqrt{3}} / \frac{0.1}{3}$	0.2 / 0.5 / 3P	20 / 25 / 100	250 / 150	

Voltage transformers

Current Transformer

Conventional Inductive CT

- The current transformers, ring-core type, are mounted outside the gas tank, eliminating exposure to dielectric stress
- Cast in resin and totally enclosed, provides superior protection against pollutants and moisture
- It can be equipped with one or more independent magnetic cores with equal or different characteristics for measuring, metering and protection purposes
- Depending on the primary current, up to 5 cores can be accommodated in a single current transformer
- Can be installed on feeder side or busbar side

Block-type CT

The block type CT is used in the bus coupler panel or cable riser/disconnect riser panel for rated current up to 2500A. It is located in the gas tank and therefore independent of any outside influence. The secondary circuit terminal board is easily accessible from the outside.

Current Sensor

Current sensors, based on the use of the Rogowski coil, mounted outside the gas tank, can be requested as an option. Please contact GE in advance.

Earth Fault Sensing CT

The split type zero-sequence CT is mounted on the feeder side for measuring phase currents and detecting the earth fault current. All the power cables in a panel are routed through the CT. Zero-sequence CT is usually installed in the cable trench below the switchgear.

Gas System

The gas tank of the SecoCube product contains Nitrogen and SF_6 mixed gas. The gas is non-toxic, non-combustible, and chemically inactive. Compared with pure SF_6 insulated systems, N_2 and SF_6 mixed gas retains high dielectric strength, and reduces the greenhouse gas content.

The making and breaking of the arc is achieved by the vacuum circuit breaker, whilst the N2 - SF6 mixed gas provides insulation.
Under normal operating conditions and being free from decomposition, aging and contamination, the gas is maintenance free throughout it's service life
The use of busbar connectors allows panel installation to be performed without impacting the gas system. Eliminating the need to work with the gas on site.
During an internal arc fault most of the insulating gas decomposes under the high temperatures. The gas will recompose and recover, post-arc, at lower temperatures whilst the remainder will be absorbed by the desiccant in the tanks.

Each gas tank is equipped with either a temperature compensated gas pressure gauge, density indicator or a density monitor to monitor the insulated gas pressure.

Temperature Compensated Pressure Gauge

A temperature compensated pressure gauge (standard) is fitted and indicates the inner pressure of the gas tank.
A simple visual check of the red/green indicator shows if ready for service.

Gas Density Monitor (Optional)

The gas density monitor is used to monitor the gas pressure remotely. In the event of a pressure decrease within the gas tank, the set point alarm pressure, protection and control unit will give an alarm signal and/or trip the circuit breaker.

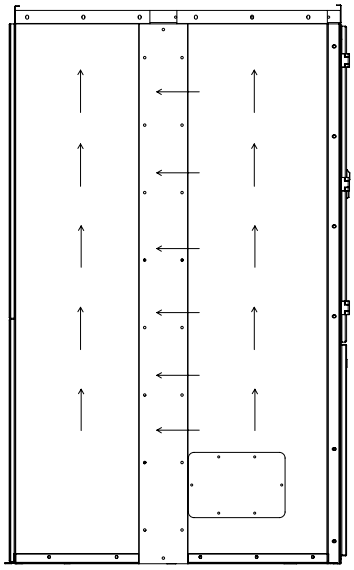
Gas Density Indicator (Optional)

A gas density indicator allows the operator to monitor the gas pressure both locally and remotely. In the event of a pressure decrease within the gas tank, the set point alarm pressure, protection and control unit will give an alarm signal and/or trip the circuit breaker.

Pressure Relief System

Arc Relief Device

Each gas tank of SecoCube is equipped with a pressure relief device. If an internal arc fault occurs, and the actual pressure exceeds its designed relief pressure, the pressure relief device will open, allowing the pressurized gas flow through to the pressure relief passage to release the pressure. Thus ensuring the safety of the equipment and personnel.



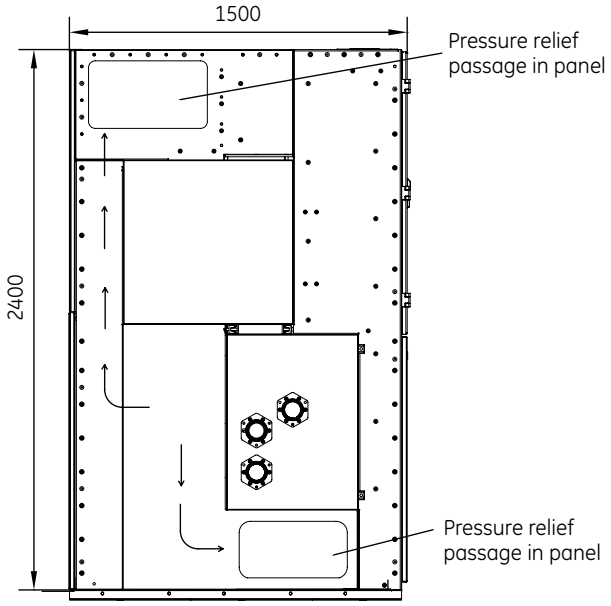
Discharge Pressure Via Arc Duct

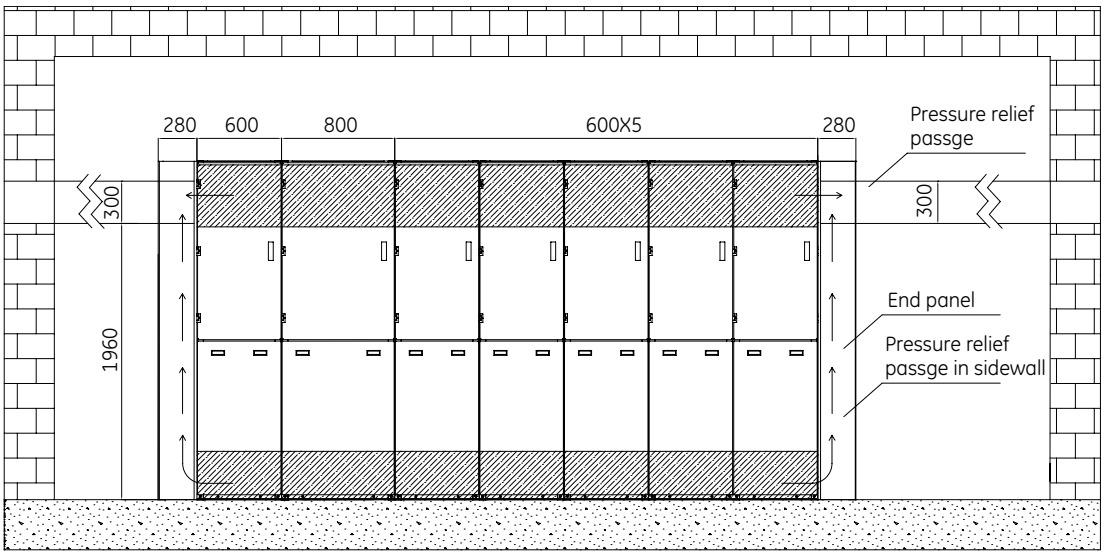
Arc duct is a perfect solution for in limited spaces, such as E-houses and Mining operations, avoiding the release of hot particles and gases into the switchroom, ensuring personnel safety.

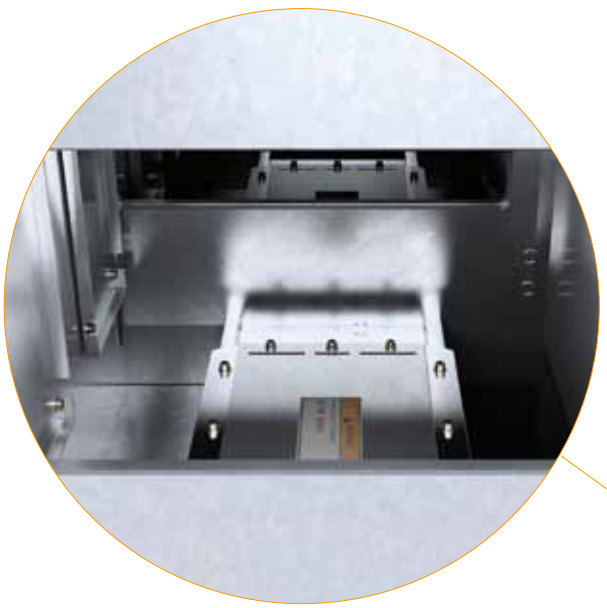
An internal arc fault, vented into the room, can cause personal injury and significant economic loss due to damage of the equipment and interruption of the power supply.

In the unlikely event of an internal arc fault, the pressure relief device on the gas tank will open, allowing the release via the customized arc duct in the top, bottom and side walls of the panels before finally venting outside the switchroom.

The panel is designed to sustain the internal arc fault in the main busbar compartment, breaker compartment and cable compartment independently.




280
600
800
600X5
280
Pressure relief passge
300
300
1960
End panel
Pressure relief passge in sidewall



Measurement, Protection and Control

For more information visit our website: http://www.gedigitalenergy.com/multilin/catalog/3Series.htm

Multilin 3 Series

Intuitive industrial and utility protective relay systems for feeders, motors and transformers

Key benefits

- Easy-to-use and cost effective protection and control for feeders, motors and transformers
- Effortless draw-out construction eliminates requirements for test switches and reduces downtime
- Environmental monitoring system to alarm on destructive operating conditions to enable preventative maintenance
- Easy-to-use interface and set up in one simple step
- Accelerated Life Cycle Tested to ensure reliability of relay operation under abnormal conditions
- Advanced power system diagnostics to increase reliability through fault and disturbance recording capabilities
- Arc Flash mitigation via zone intertripping, flex curves and multiple setting groups
- Application flexibility with the use of programmable logic elements
- Large backlit display with 40 characters for easy viewing of relay information and settings
- Flexible communications with multiple ports & protocols to allow seamless integration into new and existing infrastructure
- Easy access to information via multiple communication network options including USB, Serial, Fiber & Copper Ethernet
- Reduced wiring with support for remote I/O
- Reduced setup and configuration time with the Simplified Motor Setup screen
- Powerful Security Audit Trail tool to increase security and minimize system risks by tracking setting changes

Applications

- Advanced protection, monitoring & control relays for feeders (Multilin 350), motors (Multilin 339) and transformers (Multilin 345)
- Industrial feeders with enhanced breaker monitoring and diagnostics
- Distribution utility downstream breaker protection
- Medium voltage utility feeders with advanced control features including, cold load pickup, auto reclose and multiple setting groups

Features

Protection & control

(for Multilin 350 Feeder Protection System)

- Phase, neutral and ground TOC and IOC
- Undervoltage, overvoltage, frequency
- Neutral/ground directional
- Negative sequence overcurrent
- ANSI, IAC, IEC, flex curves
- Cable Thermal Model protection
- Breaker failure
- Cold load pick-up
- Four-shot auto reclose
- 8 digital inputs, 7 contact outputs
- Two setting groups

Metering & monitoring

- Event Recorder: 256 events with 1ms time stamping
- Oscillography with 32 samples per cycle and digital states
- IRIG-B clock synchronization
- Relay & Asset Health Diagnostics
- Security audit trail

User interface and programming

- 4x20 character LCD display
- Control panel with 12 LED indicators
- Front USB and rear serial, Ethernet and Fiber ports
- Multiple protocols - IEC 61850 & 61850 GOOSE, ModBus ™ RTU, ModBus ™ TCP/IP, DNP 3.0, IEC 60870-5-104, IEC 60870-5-103

EnerVista ™ software

- An industry-leading suite of software tools that simplifies every aspect of working with Multilin devices
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date

Overview

The Multilin 3 Series of protection relays are highly functional, economical protection relays for feeders, motors and transformers. By providing an economical system for protection, control, monitoring and metering, and with both local and remote user interfaces in one assembly, the Multilin 3 Series relays effectively eliminate the need for expensive discrete components.

The Multilin 3 Series provides detailed diagnostic information allowing users to troubleshoot and minimize downtime. Detailed diagnostics are provided via the 256 1ms time stamped event recorder and the 192 cycle Oscillography report sampled at 32 samples per cycle.

The robust Multilin 3 Series streamlines user work flow processes and simplifies engineering tasks such as configuration, wiring, testing, commissioning, and maintenance. This cost-effective relay also offers enhanced features such as diagnostics, preventative maintenance, device health reports and advanced security features.

Easy-to-use

Drawout construction

The Multilin 3 Series offers a complete drawout feature, eliminating the need for rewiring after testing has been concluded. The withdrawable feature also eradicates the need to disconnect communication cables, e.g. fiber, copper, RJ45, etc and helps retain the communication status even after a relay has been withdrawn from its case.

Advanced communications

Easy integration into new or existing infrastructure

With several Ethernet and serial port options and a variety of communication protocols, the Multilin 3 Series provides advanced and flexible communication selections, enabling seamless integration into new or existing applications.

The Multilin 3 Series supports various industry standard protocols such as, IEC 61850 & IEC 61850 GOOSE, Modbus RTU, Modbus TCP/IP, DNP3.0, IEC 60870-5-104 and IEC 60870-5-103.

Enhanced diagnostics

Preventative maintenance

The Multilin 3 Series allows users to track relay exposure to extreme environmental conditions by monitoring and alarming at high temperatures. This data allows users to proactively schedule regular maintenance work and upgrading activities.

All relays utilize EnerVista™ setup software for communication, monitoring and metering. Actual values, setpoints, status, trending and waveform capture information can all be viewed via the software and can be used for troubleshooting.

EnerVista™ Launchpad

EnerVista ™ Launchpad is a complete set of powerful device setup and configuration tools that is included in the SR relays at no extra charge.

- Set up the Multilin 3 Series Relays - and any other Multilin device - in minutes. Retrieve and view oscillography and event data at the click of a button
- Build an instant archive on any of the latest Multilin manuals, service advisories, application notes, specifications or firmware for your SR Relay
- Automatic document and software version updates via the internet and detailed e-mail notification of new releases

Security

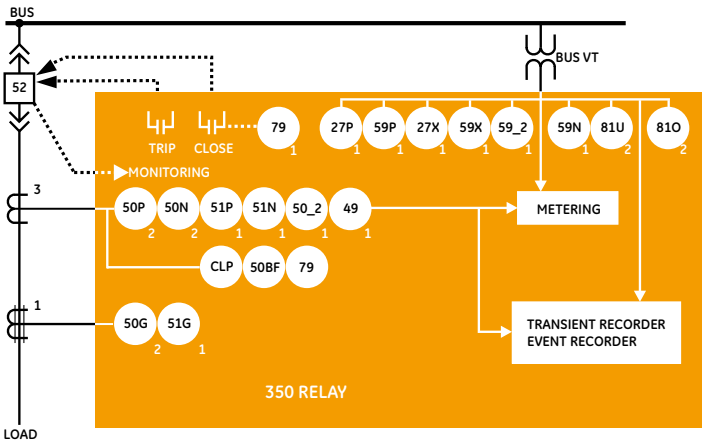
Security audit trail

The Multilin 3 Series monitors security and reliability of asset protection. The Multilin 3 Series protection devices offer complete traceability of any relay setting and command changes, allowing the user to quickly identify changes made to the relay.

User Interface

- SETPOINT GROUP 1, 2:
  These indicators are continuously on if the corresponding group provides settings for protection elements.
  TRIP:
  The indicator turns on when the relay detects a trip condition.
  Operates the trip relay to open the breaker.
  ALARM:
  While the relay detects an alarm condition, the indicator flashes.
  PICKUP:
  Indicator lights steady when any protection feature pickup threshold exceeded.
- DISPLAY:
  4 line text for easy viewing of key data.
- LEDs:
  10 LED indicators for quick diagnostics.
- KEYPAD:
  Ten button keypad for access to device interrogation and change of settings.
- FRONT PORT:
  An electrically isolated front USB communication port.

Protection Features



ANSI Device Numbers & Functions

Device Number	Function
27P	Phase Undervoltage
27X	Auxiliary Undervoltage
49	Thermal Model
50P	Phase Instantaneous Overcurrent
50N	Neutral Instantaneous Overcurrent
50G	Ground/Sensitive Ground Instantaneous Overcurrent
50BF	Breaker Failure
50_2	Negative Sequence Overcurrent
51P	Phase Timed Overcurrent
51G	Ground Timed Overcurrent
51N	Neutral Timed Overcurrent
59P	Phase Overvoltage
59X	Auxiliary Overvoltage
59N	Neutral Overvoltage
59_2	Negative Sequence Overvoltage
67G	Ground Directional Overcurrent
67N	Neutral Directional Overcurrent
79	Autoreclose
81U	Underfrequency
81O	Overfrequency
CLP	Cold Load Pickup

Latched Lockout available as a standard feature

Measurement, Protection and Control

For more information visit our website: http://www.gedigitalenergy.com/multilin/catalog/F650.htm

Multilin 650 Family

Advanced protection, control and monitoring system

Key benefits

- Unique built-in control features - Comprehensive protection plus programmable logic
- Flexible and cost effective control for complex systems - Use IEC compatible programmable logic to customize the functionality of your protection & control system to address unique, site specific applications
- Human machine interface (HMI) - Standard backlit LCD display with 4 x 20, optional 16 x 40 (240 x 128 pixels) graphical LCD, programmable buttons and directional keys for selecting setting menus and submenus
- Minimize replacement time - Modular with card draw-out construction
- Reduce troubleshooting time and maintenance costs - IRIG-B time synchronization, event reports, waveform capture, data logger
- Cost Effective Access information - Via multiple protocols, through standard RS232 & RS485 Ethernet Ports
- Optimal integration flexibility via open standard protocols - Modbus RTU, DNP 3.0 Level 2, IEC 60870-5-104, IEC 61850, IEC 870-5-103
- Minimize communication down time - Reliable redundant Ethernet Communication ports with 10/100BaseTX, 100BaseFX with ST connectors and optional double 100BaseFX, with ST connectors
- Complete asset monitoring - Full metering including demand & energy
- Follow technology evolution - Flash memory for product field upgrade

Applications

- F650: Management and primary protection of distribution feeders and bus couplers
- F650: Backup protection of busses, transformers and power lines
- G650: Packaged generator mains failure detection
- G650: Distributed generation management device
- G650: Reliable Distributed Generation interconnection protection system
- W650: Wind turbine protection, control and monitoring
- W650: Distributed generation grid interconnection device

Features

Protection and control

- Up to 32 Programmable digital inputs
- Up to 16 digital outputs
- Trip Circuit Supervision
- Redundant power supply option
- Configurable PLC logic according to IEC 61131-3
- Fully configurable graphic display HMI interface
- Alarms panel

Monitoring and metering

- Energy metering
- Demand metering
- Trip circuit monitoring
- Oscillography
- Data logger
- Sequence of event
- Self diagnostic

User interface

- Large graphic (16 x 40) or regular (4 x 20) character display
- Easy-to-use control via Shuttle key
- Front USB port or standard RS232
- Rear wire 10/100BaseTX Ethernet for LAN connection
- Rear wire CAN bus port (OPEN CAN protocol - W650)
- Optional fibre optic 100BaseFX Ethernet, single or redundant
- Optional rear RS485 port
- 1 ready LED and 15 programmable LED indicators
- EnerVista™ Integrator providing easy integration of data in the 650 relay into new or existing monitoring and control systems

Overview

The Multilin 650 family has been designed as a comprehensive protection, control, metering and monitoring package. The microprocessor based architecture is a complete solution for different applications that complies with the most relevant international standards.

All the elements required for each application have been integrated into a single package for a cost-effective, reliable and simple utilization. The low number of components, thanks to the use of state-of-the-art but mature technology, deliver a very high reliability.

Hardware inputs and outputs have been designed in a modular way that allow easy migration from simple to more complex applications.

The control functions include a full-scheme virtual PLC with an optional graphical display. The combination of both elements provide total control for a bay. This means real-time monitoring of breakers and selector switches, open and close commands supervised by the programmable interlockings and metering screens.

The metering capability allows 0.5% accuracy for current and 1% from 10V to 208V for voltage in metering range.

Monitoring functions include a 479 event recorder, and a programmable oscillography recorder.

The Multilin 650’s communications capability and option make the product very unique. These units include a maximum of three independent communication ports: COM1, COM2 and COM3, with many physical choices through the use of two removable plug-and-play boards.

The brain of the Multilin 650 units includes a powerful built-in virtual PLC. This PLC can be programmed according to the IEC 61131-3 language by functional block diagrams.

650 units come with 8 to 32 digital inputs and with 8 to 16 outputs depending on options. All digital inputs may be filtered with a separate debounce time to tailor customer requirements.

Metering

The Multilin 650 provides the following metering values.

- Current: Ia, Ib, Ic, In, Ig, Isg
- Phase-to-phase and phase-to-ground voltage values for bus and line: Van, Vbn, Vcn, Vab, Vbc, Vca, Vx
- Active power (per phase and total) : Wa, Wb, Wc, W
- Reactive power (per phase and total) : VARa, VARb, VARc, VAR
- Power factor (per phase and total)
- Frequency
- These signals are available for local display and accessible remotely using communications

Recording functions

The recording functions within the Multilin 650 include:

- Event recorder capable of storing 479 time-tagged events (1 true millisecond accurate tagging)
- Up to 20 separate oscillography records can be stored in memory. The capacity of each record will depend on the type of oscillo selected (1 Mbyte/Max. No. Osc)

These records are stored in non volatile memory. Therefore, there is no need for internal battery monitoring or maintenance.

Trip circuit monitoring

Multilin 650 units offer as an option two complete supervision circuits for breaker trip and closing coils and circuits. These supervision inputs monitor both the battery voltage level and the continuity of the trip and/or closing circuits, applying current through those circuits and checking that it flows properly. In order to apply this feature it is necessary to choose I/O board 1 option 2.

Communications

Multilin 650 units incorporate up to three ports that operate independently. Redundant ports are available for high reliability applications:

Available protocols for rear port 1 and 2 are ModBus RTU, IEC 103 and serial DNP 3.0.

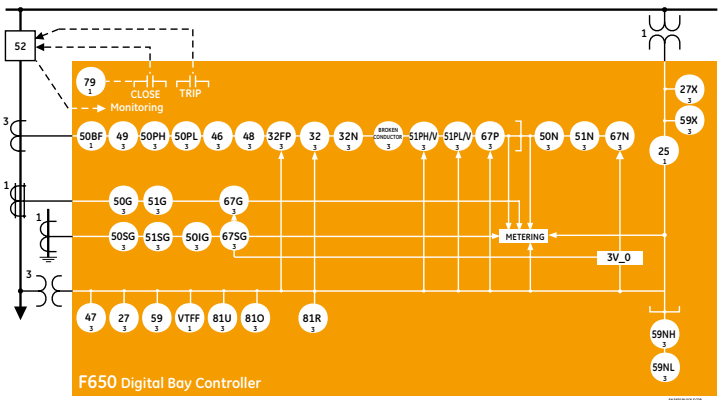
The third port is located in a removable communications card. This plug-and-play card can be easily changed in the future as new standards arrive to the market, thus providing a migration path to the customer.

The protocol available for the third port is DNP 3.0 over TCP/IP, UDP/IP, ModBus TCP/IP and IEC 60870-5-104.

User Interface

- Graphic 16 x 40 or text 4 x 20 LCD display
- Fluorescent backlight to improve visibility
- Multicolor programmable LEDs with label panel
- Local/Remote/Off pushbutton with LEDs
- Key control for easy navigation
- Ergonomic programmable keys
- Electrically isolated front USB communication port

Functional Block Diagram



ANSI Device Numbers & Functions

Device Number	Function
25	Synchrocheck
27/27X	Bus/Line Undervoltage
32	Sensitive Directional Power
32FP	Forward Power
32N	Wattmetric zero-sequence directional
46	Negative Sequence Time Overcurrent
47	Negative Sequence Voltage
48	Blocked Rotor
49	Thermal Image - overload protection
50 BF	Breaker Failure
50PH/PL	Phase Instantaneous Overcurrent (High/Low)
50N	Neutral Instantaneous Overcurrent
50G	Ground Instantaneous Overcurrent
50SG	Sensitive Ground Instantaneous Overcurrent
50IG	Isolated Ground Instantaneous Overcurrent
51N	Neutral Time Overcurrent
51G	Ground Time Overcurrent
51SG	Sensitive Ground Time Overcurrent
51PH/V	Voltage Restraint Phase Time Overcurrent
51PL/V	
59/59X	Bus/Line Overvoltage
59NH/NL	Neutral Overvoltage - High/Low
67P	Phase Directional Overcurrent
67N	Neutral Directional Overcurrent
67G	Ground Directional Overcurrent
67SG	Sensitive Ground Directional Overcurrent
79	Autorecloser
81 U/O	Under/Over Frequency Broken Conductor Detection
N/A	Load Encroachment
81R	Frequency Rate of Change
VTFF	VT Fuse Failure Detection

EnerVista

Device setup & document management toolset

The EnerVista™ launchpad software is a powerful toolset used for the complete support and management of Multilin products. Support application including product software, manuals, and setting files management is used to ensure your important files are kept up-to-date and easily accessible. Site Management will allow you to properly maintain your asset and devices by providing real-time diagnostic data and reports.

Logic, IEC 61850 system configuration and Real-Time monitoring

Viewpoint Engineer is the most advanced tool for protection & control engineers and commissioning staff available. Use the full-featured Graphical Logic Designer to build and annotate complex Flexlogic ™ and then observe it in real-time with the Graphical Logic Monitor. Use the System Designer option to design and annotate IEC61850 communication schemes, including ICD file import and SCD file export for non-GE IEDs.

Security auditing, device and asset health reporting and fault data retrieval

Viewpoint Maintenance provides security auditing, device and asset health reporting as well as easily accessible fault data. With a comprehensive security audit report, changes to the device settings, including the MAC address, are recorded enabling compliance with NERC / Critical Infrastructure Protection Standards. Device and Asset status reports detail current and historical health for both the intelligent protection device and the asset being protected.

Easy-to-Use monitoring and data recording

Viewpoint Monitoring provides simplified visualization of real-time data from all GE Multilin using ready-made Plug-and-Play screens. Built-in data logger, alarm annunciator and time synchronization round out this HMI package. Third-party devices can be incorporated using either generic Modbus RTU or Modbus TCP/IP or IEC61850 and optional OPC/DDE server connectivity can link to existing facility DCS or SCADA systems.

OPC connectivity to automation and historian applications

Seamless integration of GE Multilin and generic Modbus devices into existing DCS, SCADA systems and other data consumer applications (data historians, data visualization tools) using standard open OPC/DDE connectivity.

Accessories

VCB manual charging handle

Inner-cone cable terminal

Capacitive high voltage indicator

Busbar connector

End plugs (Size 2 and size 3)

Testing Tools

Cable terminal installation tool

Panel installation/extension tool

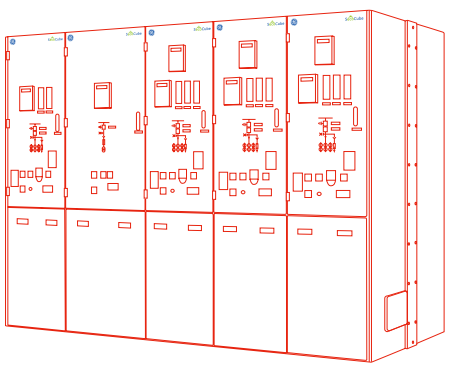
High voltage test tool: voltage adaptor

Operating handle for three-position switch

VT fuse replacement tool

Phase comparator

Circuit resistance test tool:
Current adapter



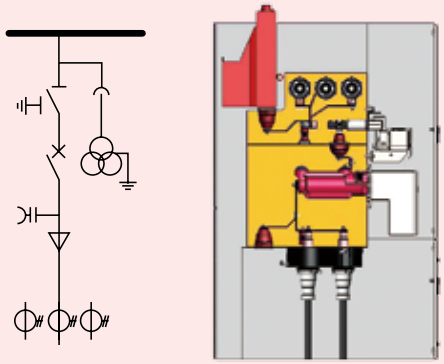
Typical solution

Standard SecoCube Typical Panels 40
Green SecoCube Typical Panels 41
Typical Schemes 43

Standard SecoCube Typical Panels

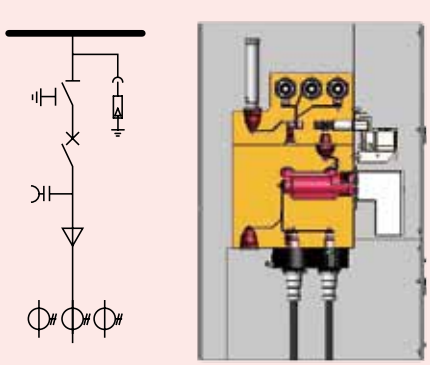
Incoming/outgoing Feeder Panel + Busbar PT

Cable terminal under the protection of CT (Optional),
Separated cable testing socket (Optional)



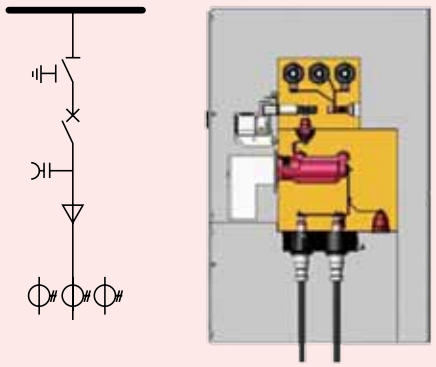
Incoming/outgoing Feeder Panel + Busbar Surge Arrester

Cable terminal under the protection of CT (Optional),
Separated cable testing socket (Optional)



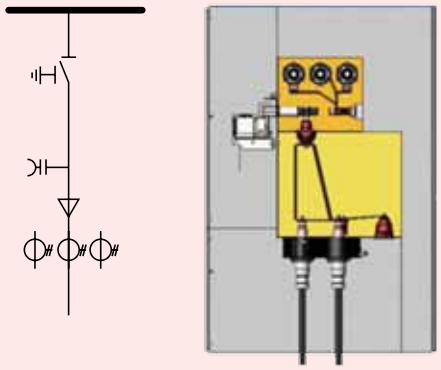
Incoming/outgoing Feeder Panel

Cable terminal under the protection of CT (Optional),
Separated cable testing socket (Optional)

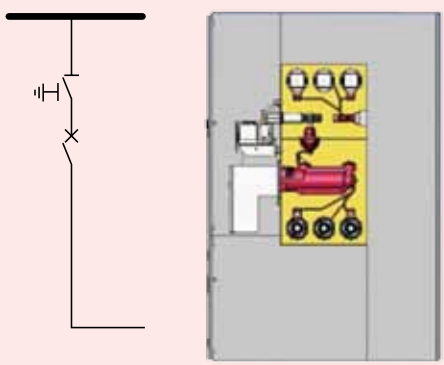


Disconnect Riser Panel

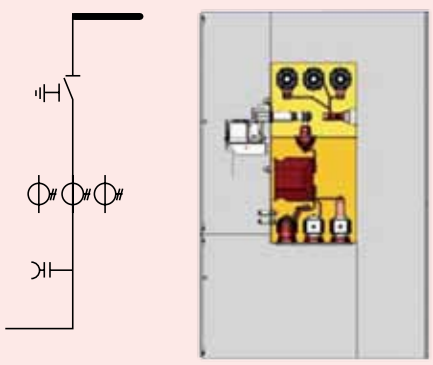
Cable terminal under the protection of CT (Optional),
Separated cable testing socket (Optional)



Bus Sectionalizer Panel



Bus Coupler Panel

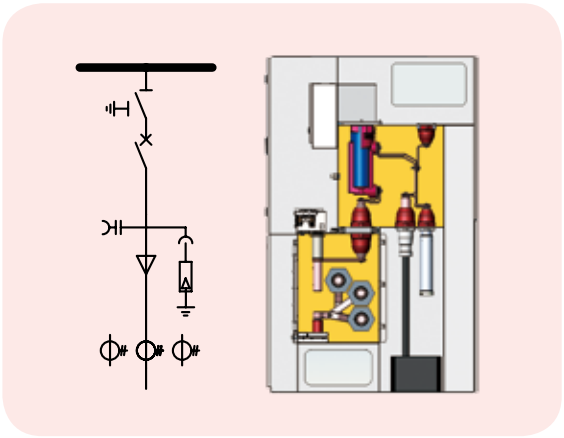


*Top entry schemes, please contact GE for further information.

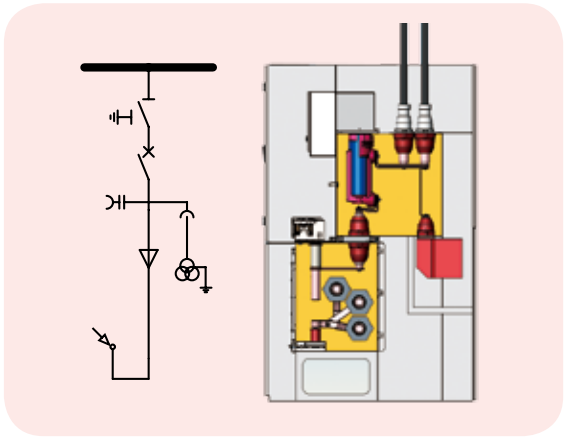
Green SecoCube Typical Panels

Incoming/outgoing Feeder Panel

Cable bottom entry

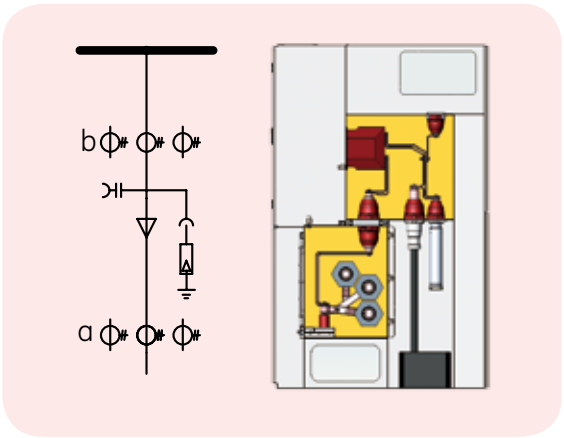


Cable Top Entry

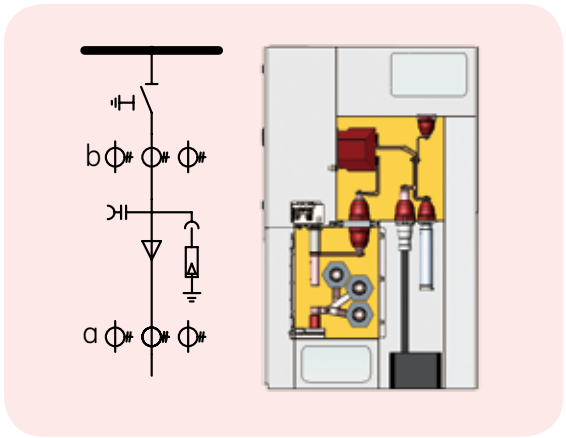


Riser Panel

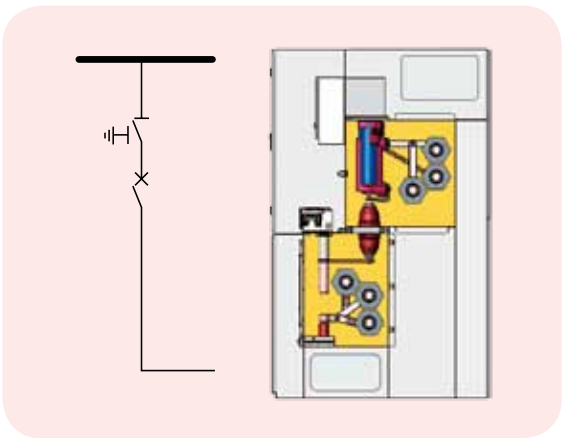
Cable Riser Panel



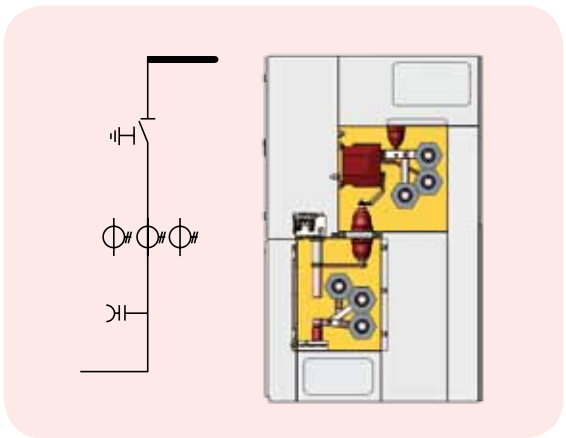
Disconnect Riser Panel



Bus Sectionalizer Panel

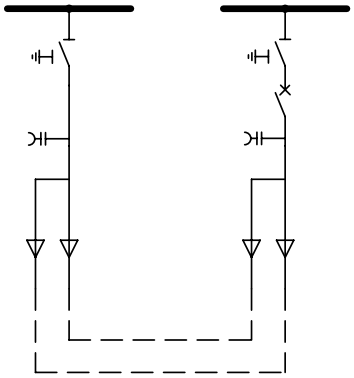


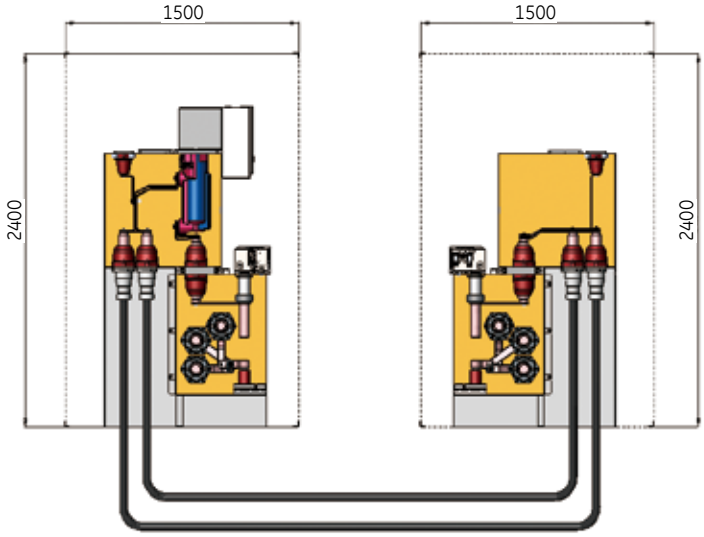
Bus Coupler Panel



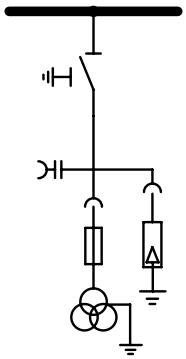
Green SecoCube Typical Panels

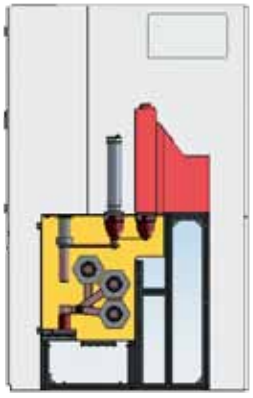
Sectionalizer using cable to connect two system blocks



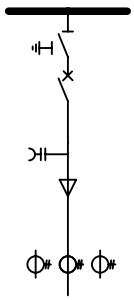
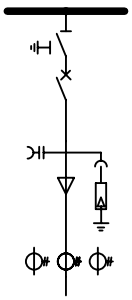
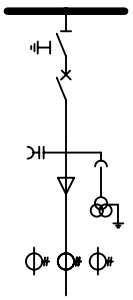
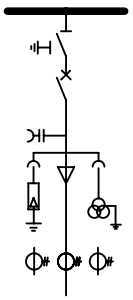


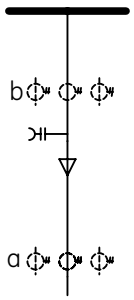
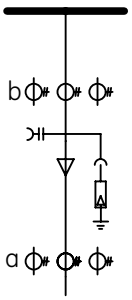
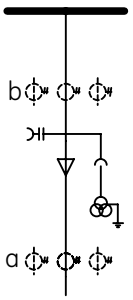
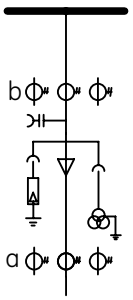
VT Panel



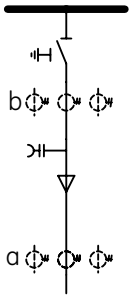
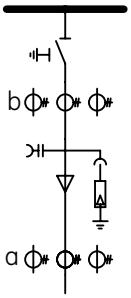
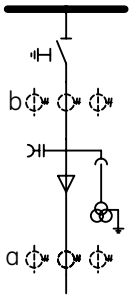
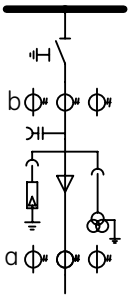


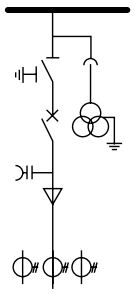
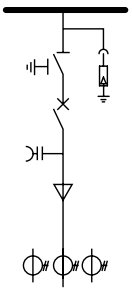
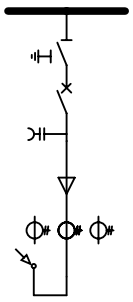
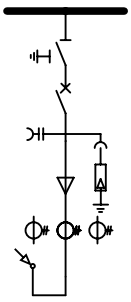
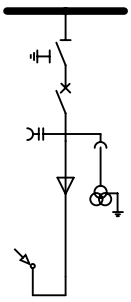
Typical Schemes

Scheme Number			01	02	03	04
Function			Feeder	Feeder	Feeder	Feeder
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker		1	1	1	1
	3-position switch		1	1	1	1
	CT	Ring core type	3	3	3	3
		Block type	-	-	-	-
	VT		-	-	3	3
	Potential indicator		1	1	1	1
	Surge arrester		-	3	-	3
	Cable terminal		1 set	1 set	1 set	1 set
			Bottom entry	Bottom entry	Bottom entry	Bottom entry
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

Scheme Number			05	06	07	08
Function			Cable Riser	Cable Riser	Cable Riser	Cable Riser
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker		-	-	-	-
	3-position switch		-	-	-	-
	CT	Ring core type ("a")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
		Block type ("b")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
	VT		-	-	3	3
	Potential indicator		1	1	1	1
	Surge arrester		-	3	-	3
	Cable terminal		1 set	1 set	1 set	1 set
			Bottom entry	Bottom entry	Bottom entry	Bottom entry
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

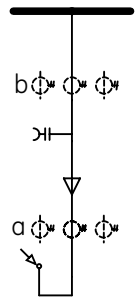
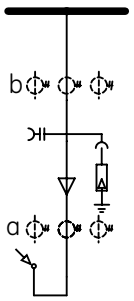
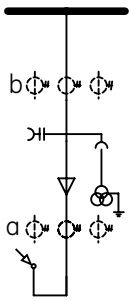
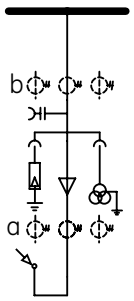
Typical Schemes

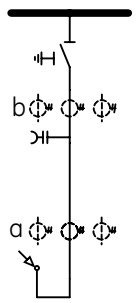
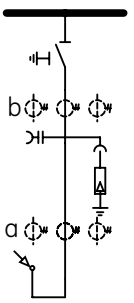
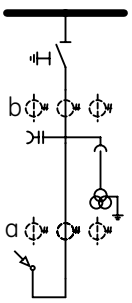
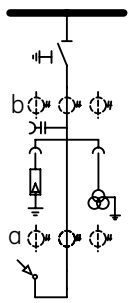
Scheme Number			09	10	11	12
Function			Disconnect Riser	Disconnect Riser	Disconnect Riser	Disconnect Riser
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker		-	-	-	-
	3-position switch		1	-	1	1
	CT	Ring core type ("a")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
		Block type ("b")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
	VT		-	-	3	3
	Potential indicator		1	1	1	1
	Surge arrester			3	-	3
	Cable terminal		1 set	1 set	1 set	1 set
			Bottom entry	Bottom entry	Bottom entry	Bottom entry
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

Scheme Number			13*	14*	15	16	17
Function			Feeder	Feeder	Feeder	Feeder	Feeder
Single Line Diagram							
Configuration	SecoVac-G Circuit breaker		1	1	1	1	1
	3-position switch		1	1	1	1	1
	CT	Ring core type	3	3	3	3	3
		Block type	-	-	-	-	-
	VT		3	-	-	-	3
	Potential indicator		1	1	1	1	1
	Surge arrester		-	3		3	-
	Cable terminal				1 set	1 set	1 set
					Top entry	Top entry	Top entry
Rated current			1250A	1250A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm	600mm	600mm/800mm	600mm/800mm	800mm/800mm

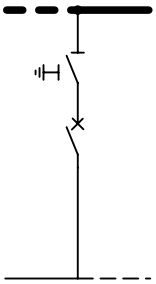
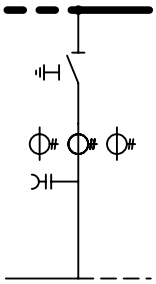
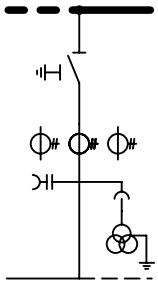
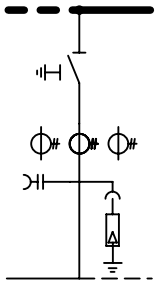
*: Only available for standard type.

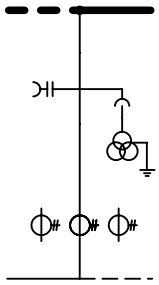
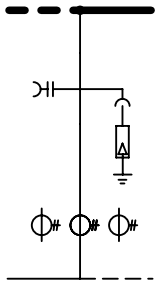
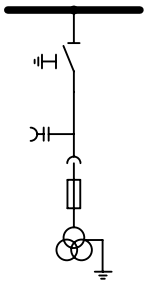
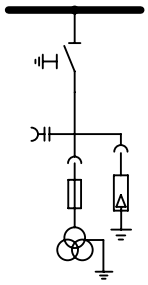
Typical solution

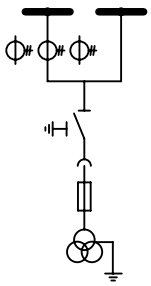
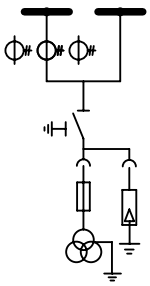
Scheme Number			18	19	20	21
Function			Cable Riser	Cable Riser	Cable Riser	Cable Riser
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker		-	-	-	-
	3-position switch		-	-	-	-
	CT	Ring core type ("a")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
		Block type ("b")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
	VT		-	-	3	3
	Potential indicator		1	1	1	1
	Surge arrester			3	-	3
	Cable terminal		1 set	1 set	1 set	1 set
			Top entry	Top entry	Top entry	Top entry
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

Scheme Number			22	23	24	25
Function			Disconnect Riser	Disconnect Riser	Disconnect Riser	Disconnect Riser
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker		-	-	-	-
	3-position switch		1	1	1	1
	CT	Ring core type ("a")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
		Block type ("b")	3 (Optional)	3 (Optional)	3 (Optional)	3 (Optional)
	VT		-	-	3	3
	Potential indicator		1	1	1	1
	Surge arrester			3	-	3
	Cable terminal		1 set	1 set	1 set	1 set
			Top entry	Top entry	Top entry	Top entry
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

Typical Schemes

Scheme Number			26	27	28	29
Function			Bus Sectionalizer	Bus Coupler	Bus Coupler	Bus Coupler
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker		1			
	3-position switch		1	1	1	1
	CT	Ring core type				
		Block type		3	3	3
	VT				3	
	Potential indicator			1	1	1
	Surge arrester					3
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

Scheme Number			30	31	32	33
Function			Bus Coupler Riser	Bus Coupler Riser	VT Panel	VT Panel
Single Line Diagram						
Configuration	SecoVac-G Circuit breaker					
	3-position switch				1	1
	CT	Ring core type				
		Block type	3	3		
	VT		3		3	3
	Fuse				3	3
	Potential indicator		1	1	1	1
	Surge arrester			3		3
Rated current			1250A/2500A	1250A/2500A	1250A/2500A	1250A/2500A
Panel width			600mm/800mm	600mm/800mm	800mm/800mm	800mm/800mm

Scheme Number			34	35
Function			Metering	Metering
Single Line Diagram				
Configuration	SecoVac-G Circuit breaker			
	3-position switch		1	1
	CT	Ring core type		
		Block type	3	3
	VT		3	3
	Fuse		3	3
	Potential indicator			1
	Surge arrester			3
Rated current			1250A/2500A	1250A/2500A
Panel width			800mm/800mm	800mm/800mm

* Customized panel versions, please contact GE.

SecoCube Dimensions

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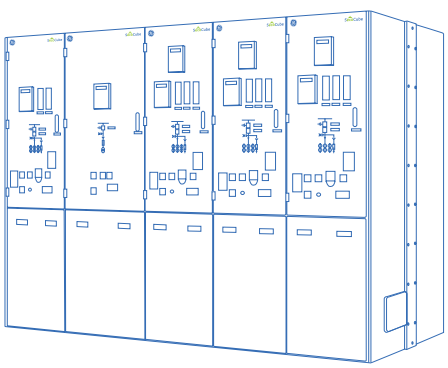
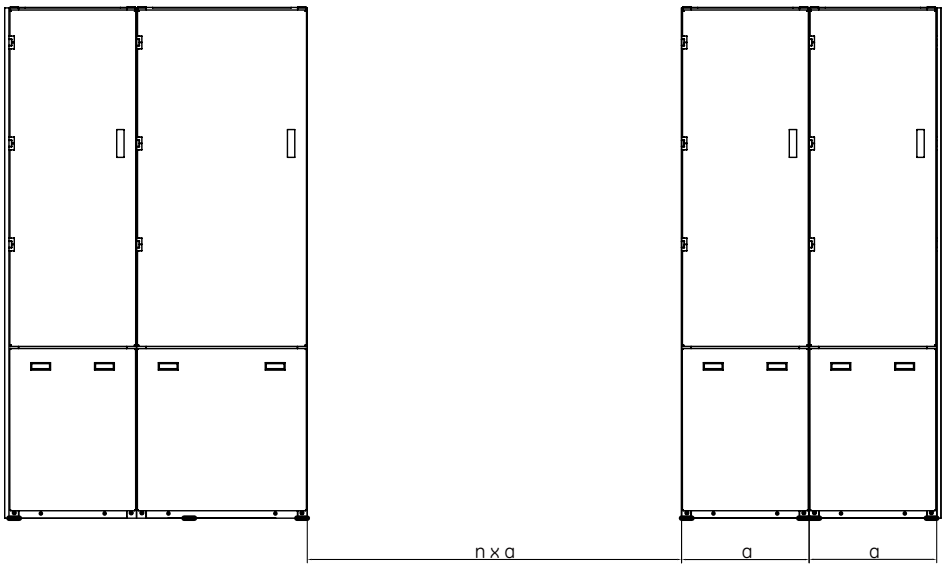
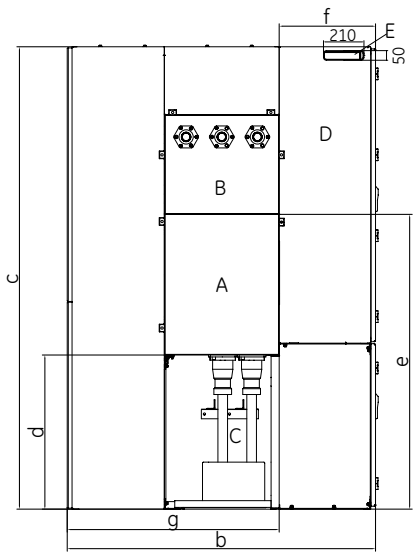
SecoCube Control Circuit Schematic Drawing.....51
SecoCube Installation Foundation.....53
SecoCube Shipping Data 59



SecoCube Dimensions





A. Circuit breaker gas tank

B. Main busbar gas tank

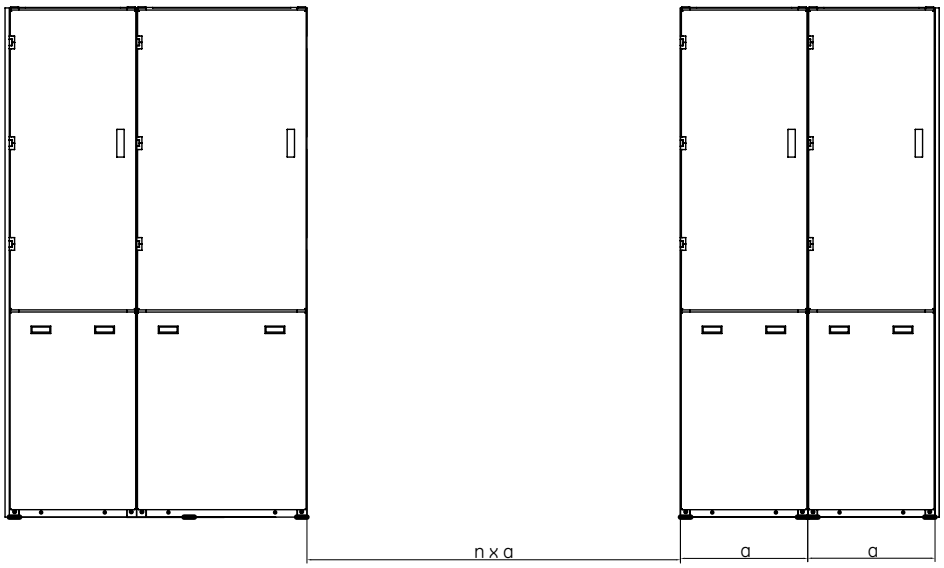
C. Cable compartment

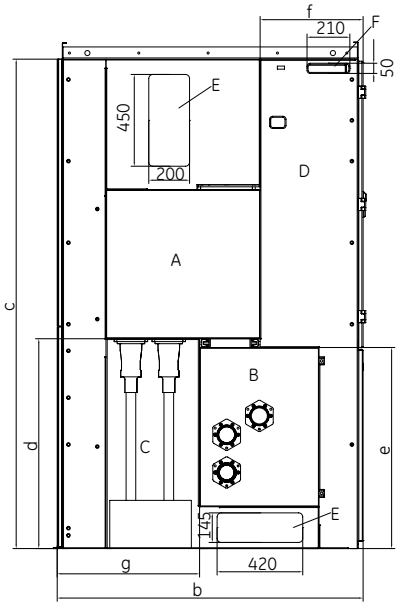
D. LV compartment

E. Control bus duct

SecoCube	Rated current	a(mm)	b(mm)	c(mm)	d(mm)	e(mm)	f(mm)	g(mm)
	1250A	600	1600	2400	800	1550	500	1100

SecoCube Dimensions





A. Circuit breaker gas tank

B. Main busbar gas tank

C. Cable compartment

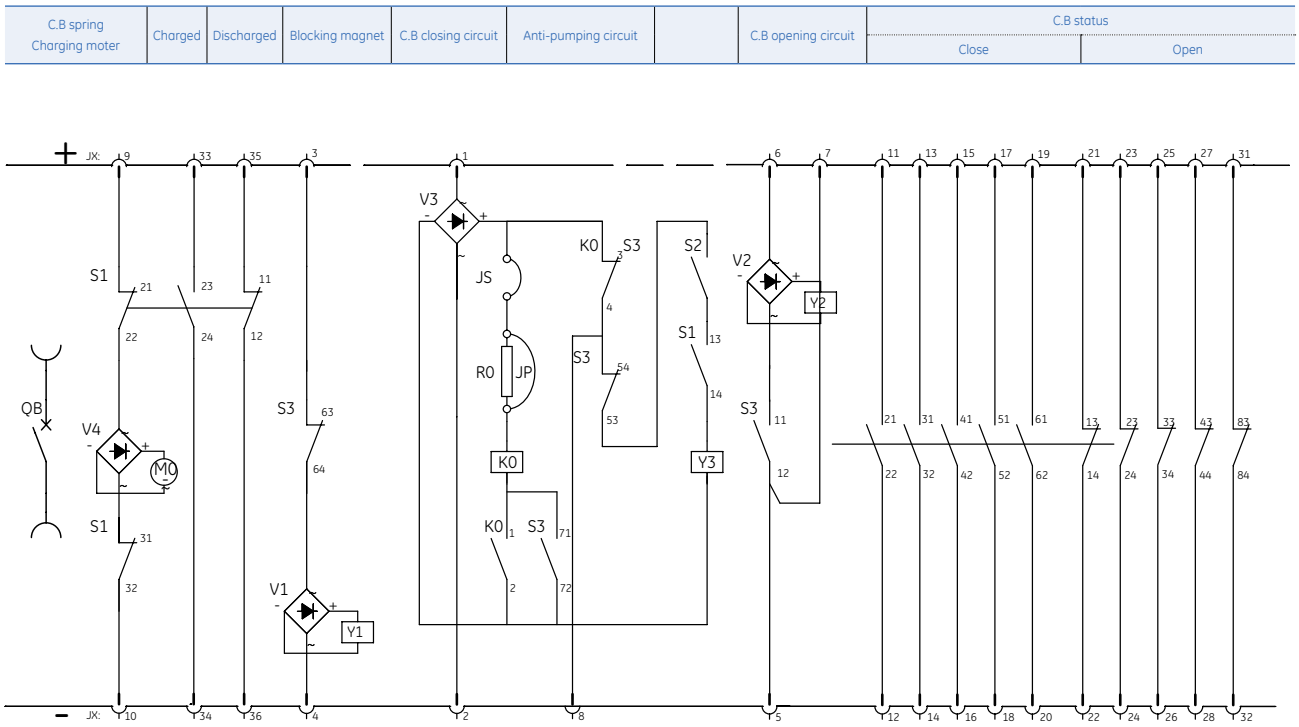
D. LV compartment

E. Control bus duct

	Rated current	a(mm)	b(mm)	c(mm)	d(mm)	e(mm)	f(mm)	g(mm)
SecoCube	1250A	600	1500	2400	1030	990	505	700
	2500A	800	1500	2400	1030	990	505	700

SecoCube Control Circuit Schematic Drawing

SecoVac-G Vacuum Circuit Breaker Control Circuit



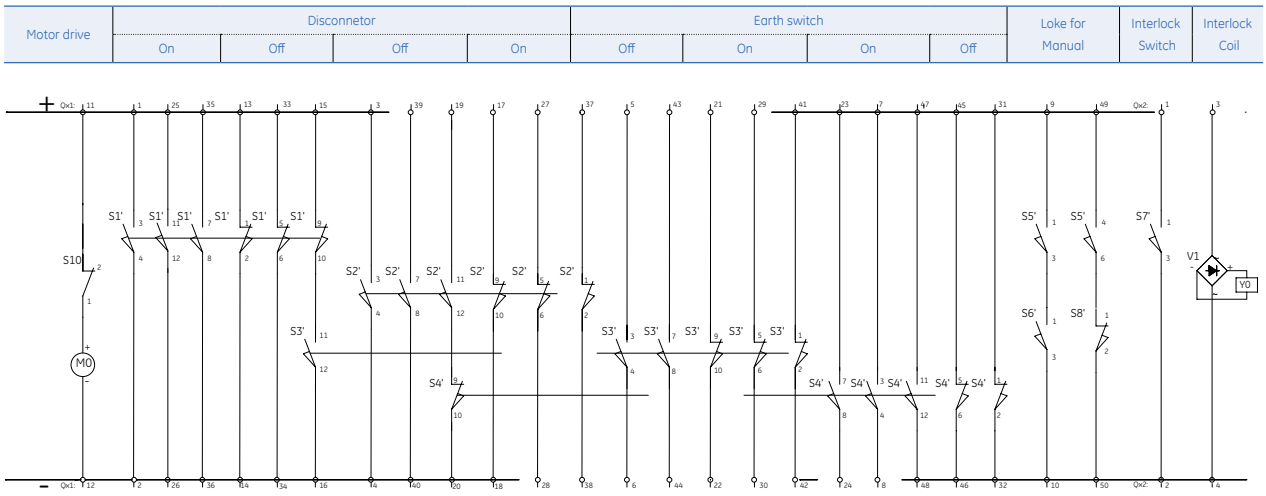
Remark:

This diagram shows the vacuum circuit breaker open, VCB spring discharged, all coils de-energized.

Symbol	Description	Symbol	Description
Y1	Closing block magnet	S1	Mechanism auxiliary switch
Y2	First opening release	S2	Aux. Switch on block magnet
Y3	Closing release	S3	C.B. Auxiliary switch
M0	Spring charging motor	Jp	R0 entry connecting line
K0	Anti-pumping relay	Js	K0 release connecting line
R0	Resistance		
V0~v4	Rectifier		

SecoCube Control Circuit Schematic Drawing

IST 3-position Switch Control Circuit



Illustraion diagram for travel switch

S1' Closing travel switch
S2' Opening travel switch
S3' Es-open travel switch
S4' Earthing travel switch
S5' Travel switch for blocking motor During manual operation

S6' Travel switch for closing and blocking of circuit breaker
S8' Protection travel switch for 3-position switch
S10' Travel switch for blocking motor During manual operation

Closing Position | Openning Position | Earthing Position

The travel switch is activated
The travel switch is released

Note:

These contacts will be reserved for three-position disconnector control dircuit.

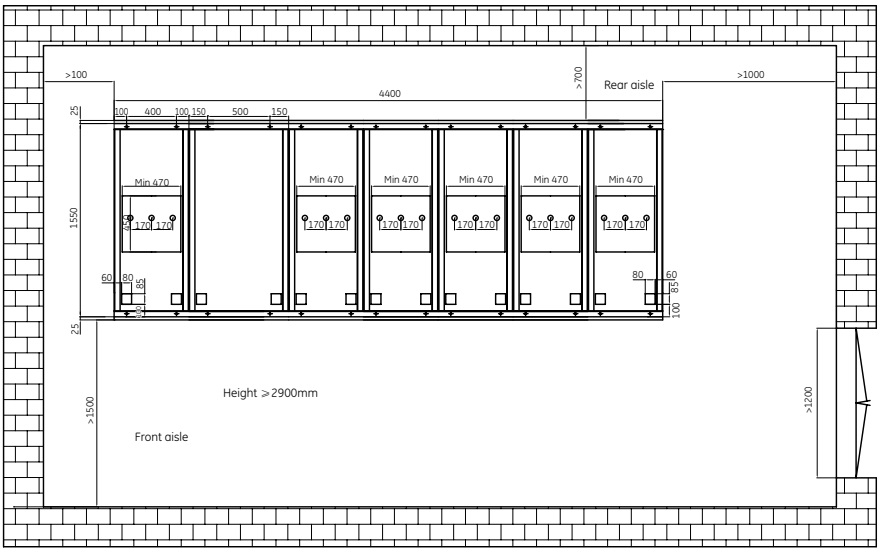
Qx1: 15-16,17-18,19-20,21-22,27-28,29-30,49-50

Symbol	Description	Symbol	Description
Qx1	Terminal block	S1',s2',s3',s4'	Micro switch
Qx2	Terminal block (Optional)	S5',s6'	Micro switch
Y0	Interlock coil (Optional)	S7'	Micro switch
V1	Rectifier (Optional)	S8'	Micro switch
M	Motor	S10'	Micro switch

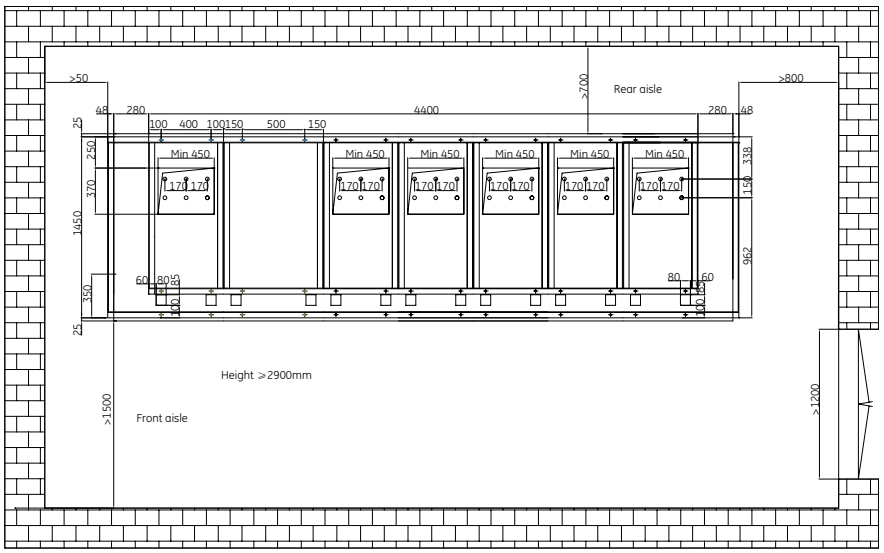
SecoCube Installation Foundation

SecoCube Layout Drawing

Standard SecoCube Layout Drawing



Green SecoCube Layout Drawing, with arc duct



Switchgear installation: Free-standing arrangement (IAC FLR)

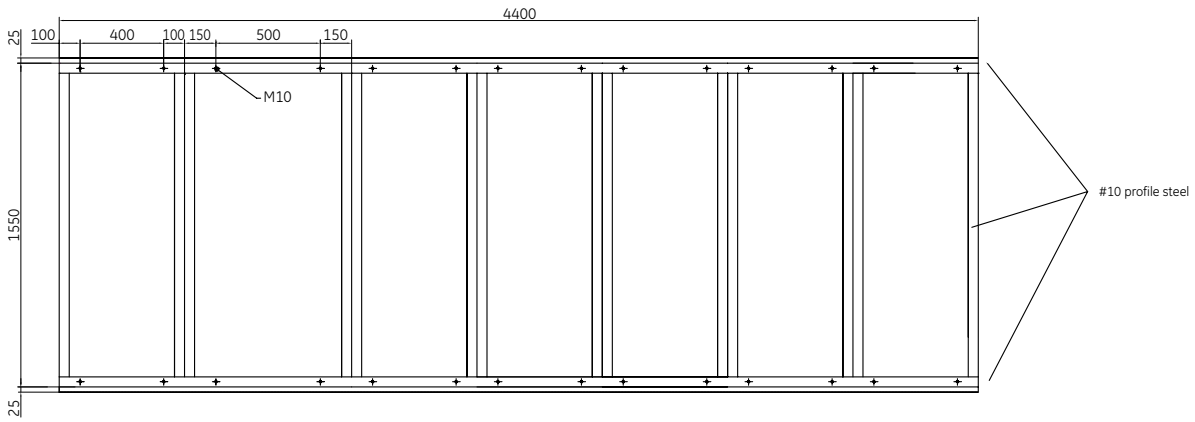
Room Dimensions

Rated current	A	1250A	2500A
Panel width	mm	600	800
Room height (min.)	mm	3200	3200
Min. back to wall distance	mm	700	700
Min. front to wall distance	mm	1500	1500
Panel weight	kg	850 ~1000	1300 ~1400
Min. load-breaking of the floor	Kg/m^2	1300	1600

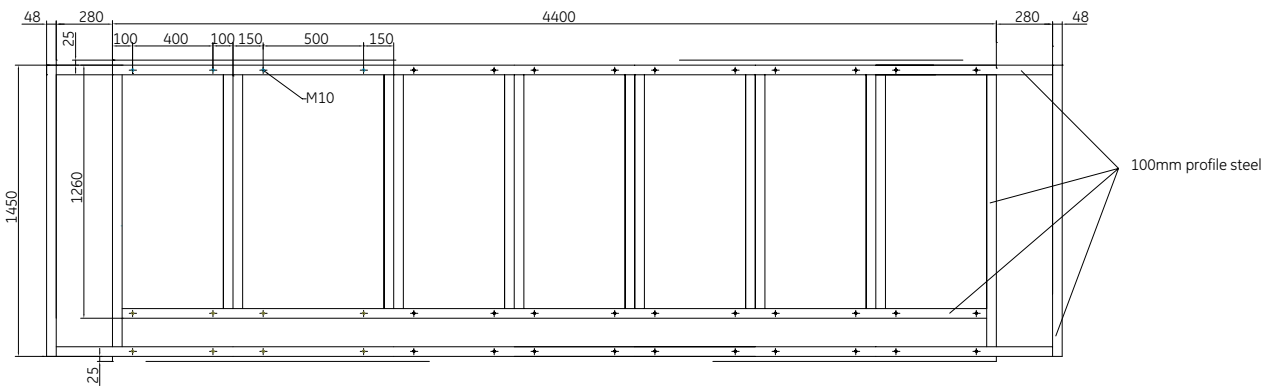
SecoCube Installation Foundation

SecoCube Foundation Framework

Standard SecoCube Foundation Framework



Green SecoCube Foundation Framework

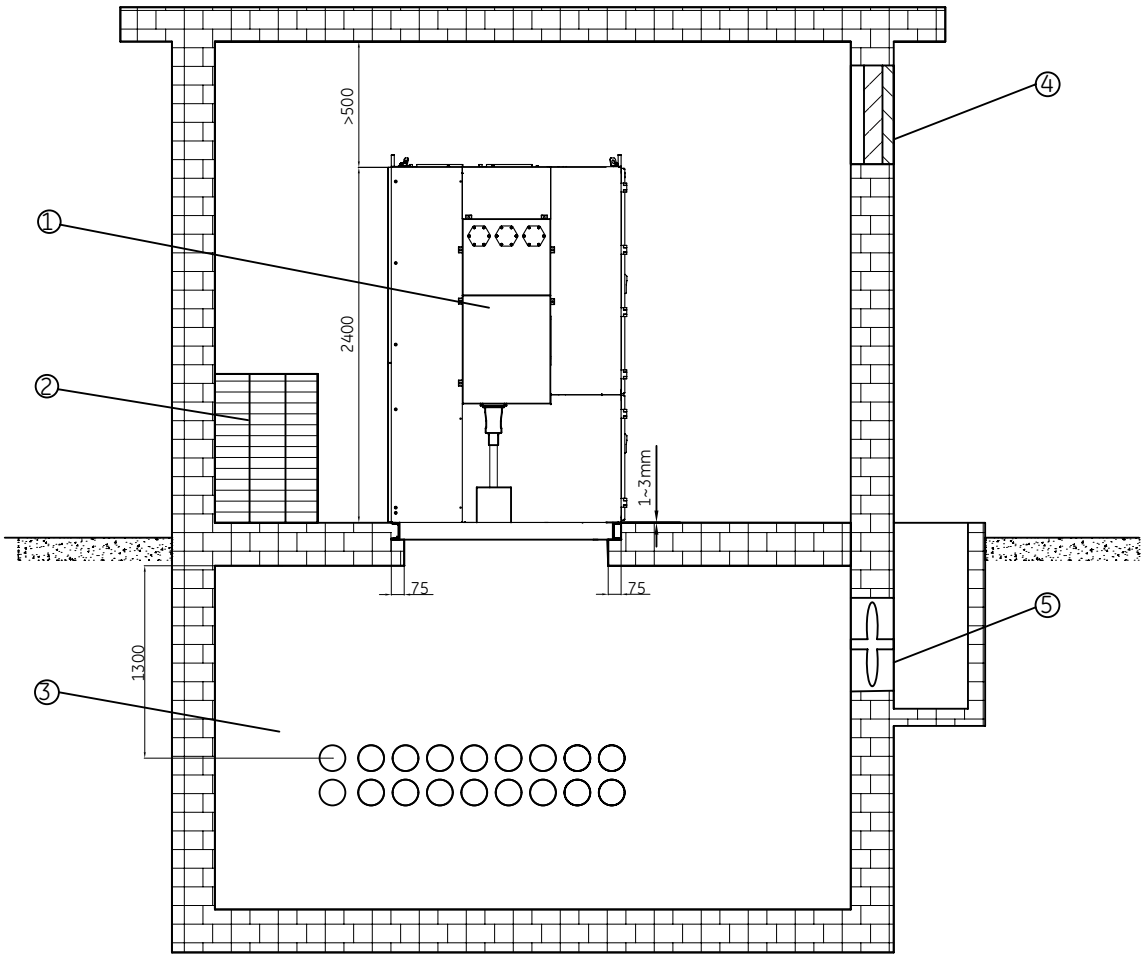


It is recommended that laying the installation foundation should comply with local standard.

Tolerances for laying the floor frame are:

- Evenness tolerance: ± 1mm/m^2
- Straightness tolerance: Max. 1 mm/m, but max. 2 mm for the entire length of the frame

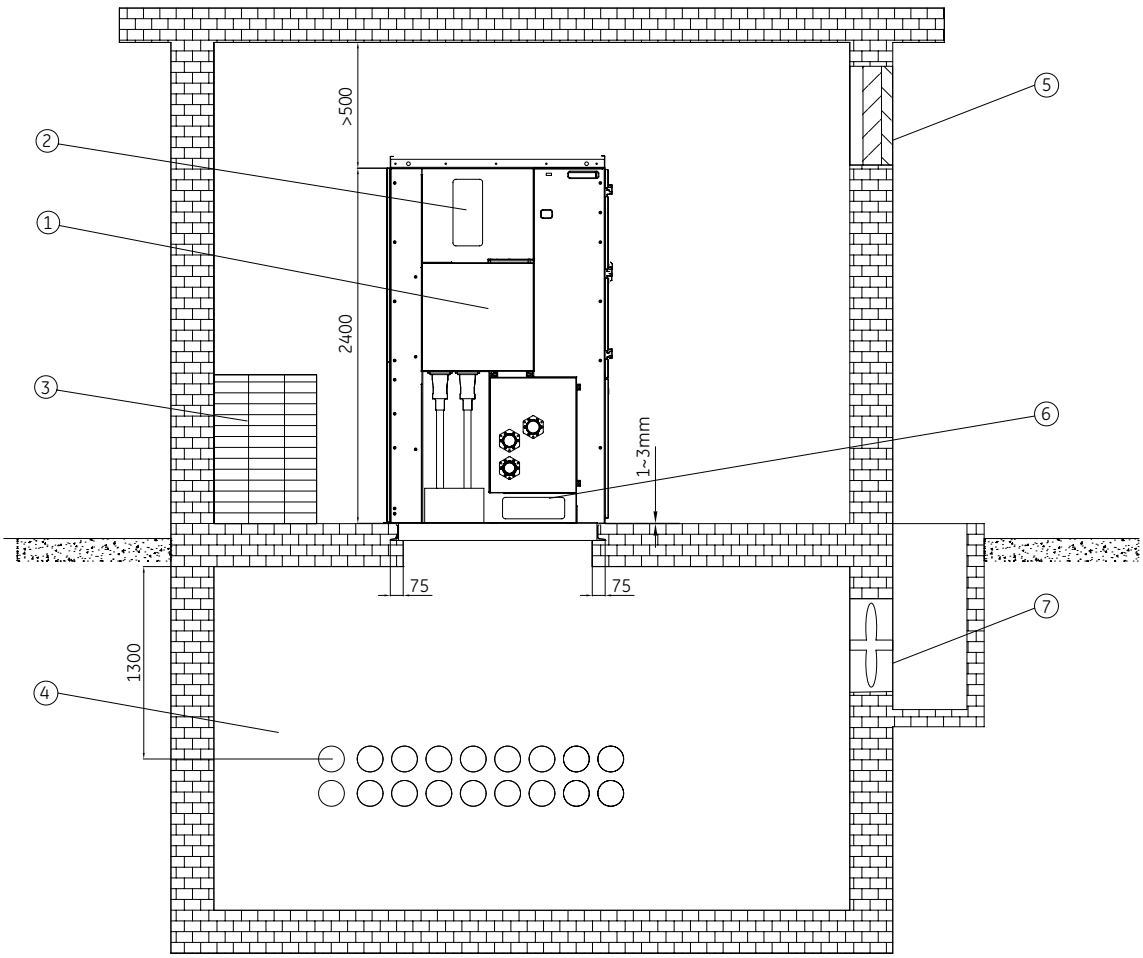
Standard SecoCube Cable Interlayer Installation



1. SecoCube switchgear
2. Lower ventilation device
3. Cable interlayer
4. Upper ventilation device
5. Cable interlayer ventilation device

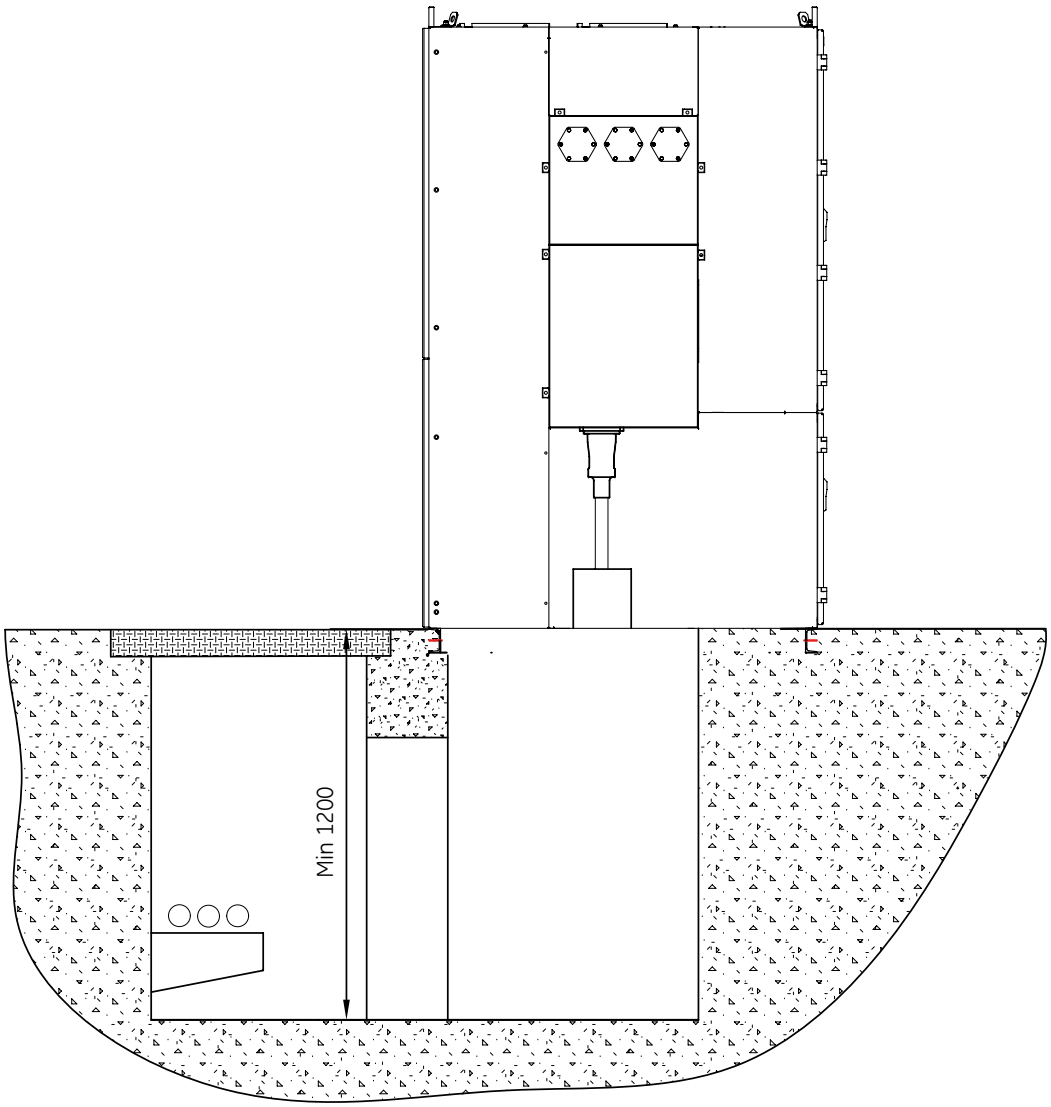
SecoCube Installation Foundation

Green SecoCube Cable Interlayer Installation



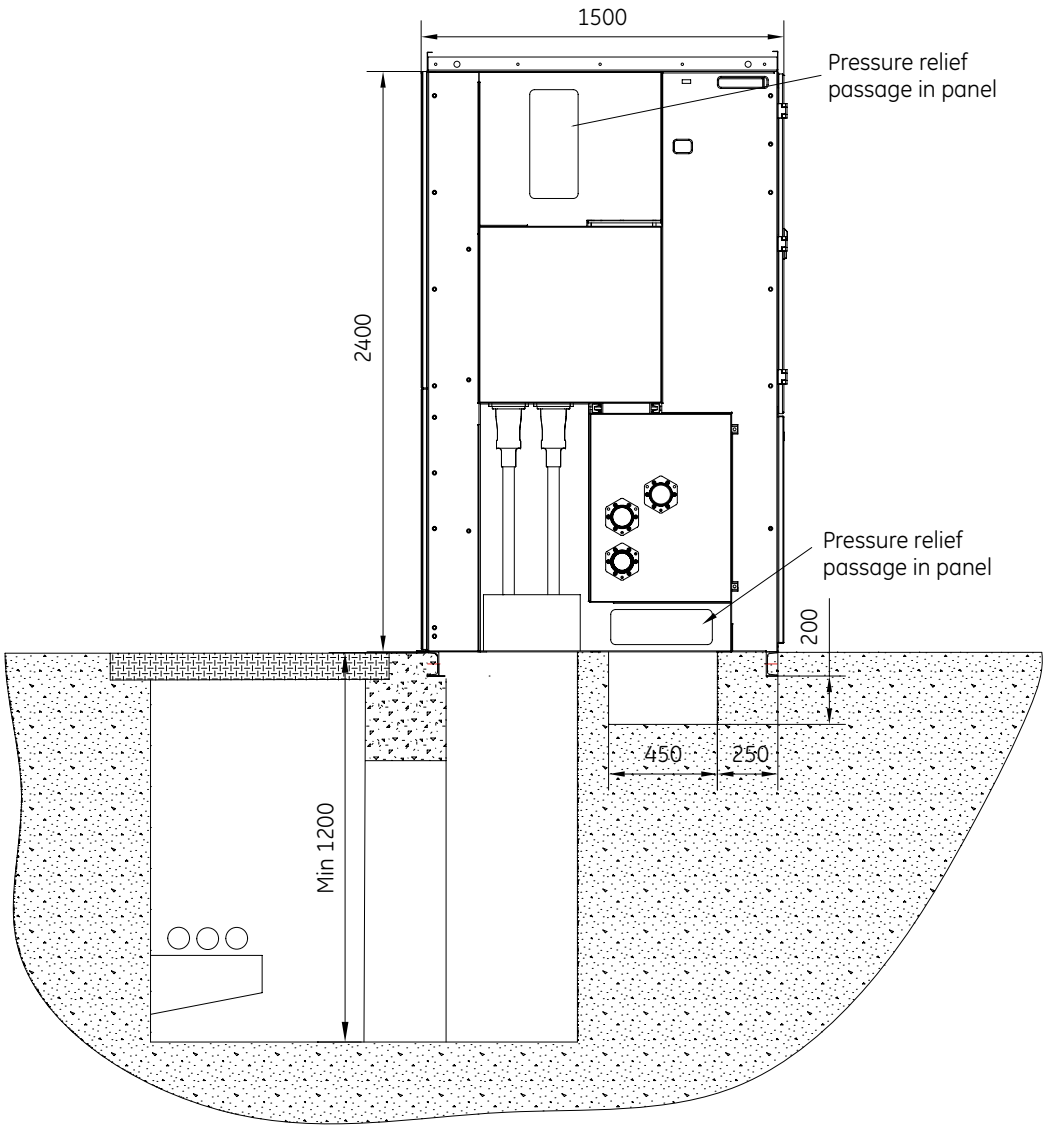
1. Arc duct of VCB gas tank
2. SecoCube switchgear
3. Lower ventilation
4. Cable layer
5. Upper ventilation
6. Arc duct of main busbar gas tank
7. Cable layer ventilation

Standard SecoCube Cable Trench Installation



SecoCube Installation Foundation

Green SecoCube Cable Trench Installation



SecoCube Shipping Data

Each SecoCube panel is delivered in a transport unit, with the dimensions and weight as per table below.

Transport dimensions, transport weights

Panel widths (mm)	Transport dimensions Width*Height*Depth (mm x mm x mm)	Transport weight with packing Approx. (kg)	Transport weight without packing Approx. (kg)
1 x 600	850 x 2540 x 1700	900	780
1 x 800	1050 x 2540 x 1700	1500	1380

Packing

Packing for rail or truck transportation

- Panels on pallets
- Packed in sealed aluminium film with desiccant
- Open packing with PE protective foil

Seaworthy packing

- Panels on pallets
- Packed in sealed aluminium film with desiccant
- Enclosed in a wooden box
- Max. storage time: 6 months

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