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SecoGear

24kV Metal-clad Switchgear

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FINANCIAL TIMES

2006 World's Most Respected Companies (#1)
Financial Times (1998, 1999, 2000, 2001, 2002, 2003, 2004,2006)

Forbes

2006-Named a member of the Dow Jones Sustainability Index
Forbes Magazine (2006)

2007 Global Most Admired Companies (#1)
Fortune Magazine (2005, 2006, 2007)

BUSSINESSWeekly

4th Most Valuable Brand Worldwide
Business Weekly (2006)

BUSSINESSWeekly

Most Valuable Brand Equity
Business Weekly (2007)

SecoGear

24kV Metal-clad Switchgear

- SecoGear is an air insulated switchgear with a compact design
- SecoGear is a safe and reliable switchgear for universal indoor applications
- SecoGear is designed with full segregation of its breaker compartment and equipped with embedded pole SecoVac vacuum circuit breaker
- SecoGear has cable compartments with ample space for ease of power cable connection
- SecoGear has perfect interlocking system to prevent misoperation and to improve safety
- SecoGear front panel features easy operation and low maintenance

General

SecoGear metal-clad switchgear is designed and manufactured with advance technology and has been comprehensively and successfully type-tested.

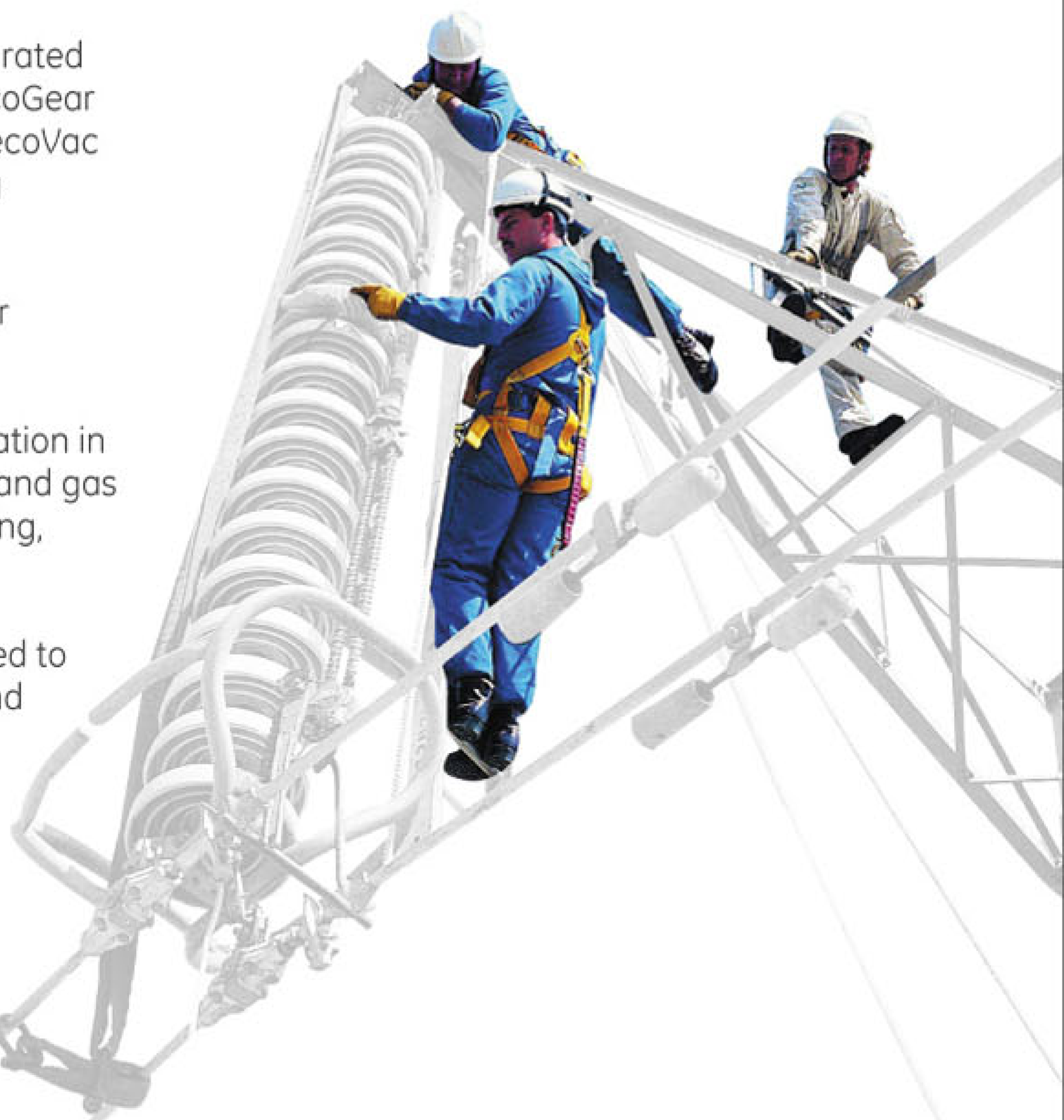
SecoGear switchgear is typically used in power plant, substation of public utilities and suitable to provide control and protection for transformers, capacitors and motors.

The rated voltage of SecoGear is 24kV and rated current ranges from 630A to 2500A. All SecoGear with switching device are equipped with SecoVac vacuum circuit breaker with corresponding specifications.

SecoGear switchgear is designed for indoor applications.

SecoGear is particularly suitable for application in industrial i.e. iron and steel mill, mining, oil and gas and infrastructure projects i.e. hi-rise building, airport, water treatment, etc.

SecoGear is designed, assembled and tested to meet or exceed applicable IEC, DIN VDE, and GB/DL standards.



Comprehensive and Reliable Interlocking System

For personnel safety, SecoGear is designed with a number of comprehensive mechanical interlocks. The mechanical interlocks are designed to prevent:

- A closed circuit breaker being racked-in to or racked-out from the connect position
- A circuit breaker are being closed on other than connect and test position
- A circuit breaker being racked-in to the connect position if the secondary socket has not been plugged/connected
- Rack-in of the circuit breaker into the connect position or rack-out from connect position if the door of circuit breaker compartment is opened
- Closing of earthing switch when circuit breaker is locked in the connect position
- Opening of cable compartment door when earthing switch is in the open position
- Disconnecting the secondary socket when circuit breaker at the connect position

Automatic Shutter System

SecoGear metal-clad switchgear is equipped with an automatic grounded metal shutter each for bus and line/load in front of its primary disconnect bushing. When the breaker is in the test or disconnect position, the shutter will automatically closed and locked to provide the designed IP protection and preventing operator from mistake-opening the shutters which may cause personnel injury during maintenance.

Safety - Pressure Relief Design

All three primary compartments of SecoGear are provided with pressure relief flaps, which will automatically open and guide the pressurized gas to the rear side direction if an internal arc-fault occurs in an affected compartment.

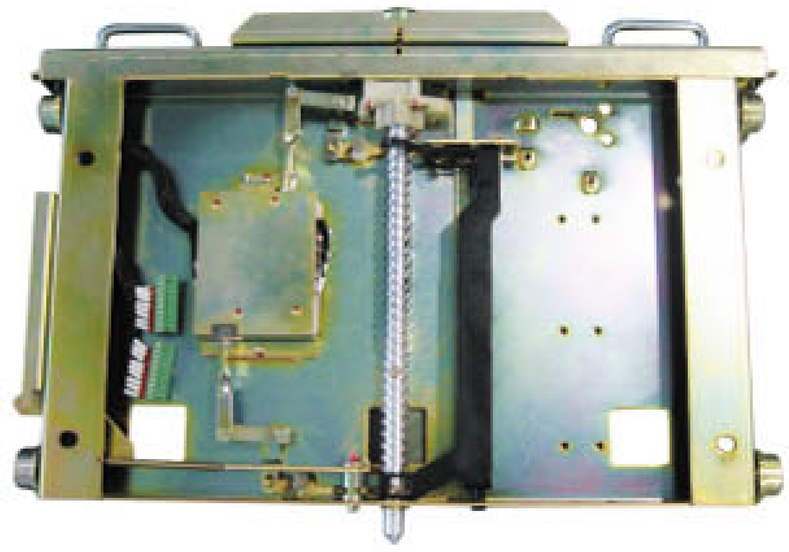
The pressure relief protects damage to switchgear components and the risk of injury to personnel, which may endanger an operator or extend the arc-fault effect to the entire switchgear lineup:

Arc-proof Tested

SecoGear enclosure is designed to meet protection degree of IP4X as per IEC 60529.The grounded metal enclosure protects operators from live parts and moving parts inside the switchgear. The enclosure is sealed to eliminate penetration of external objects, which may cause short circuit of the system. The metal-clad design, sturdy door hinges and lock system, enabled SecoGear to successfully passed internal arcing test in accordance to IEC 62271-200 in all its three primary compartments.

High Reliable Components

SecoGear reliability is based on the usage of proven components. All components including the advanced SecoVac embedded pole vacuum circuit breaker, insulating materials, disconnect bushings, inter-unit bushing and instrument transformers have been strictly selected and have been qualified for 40 years lifetime thru accelerated thermal aging tests.

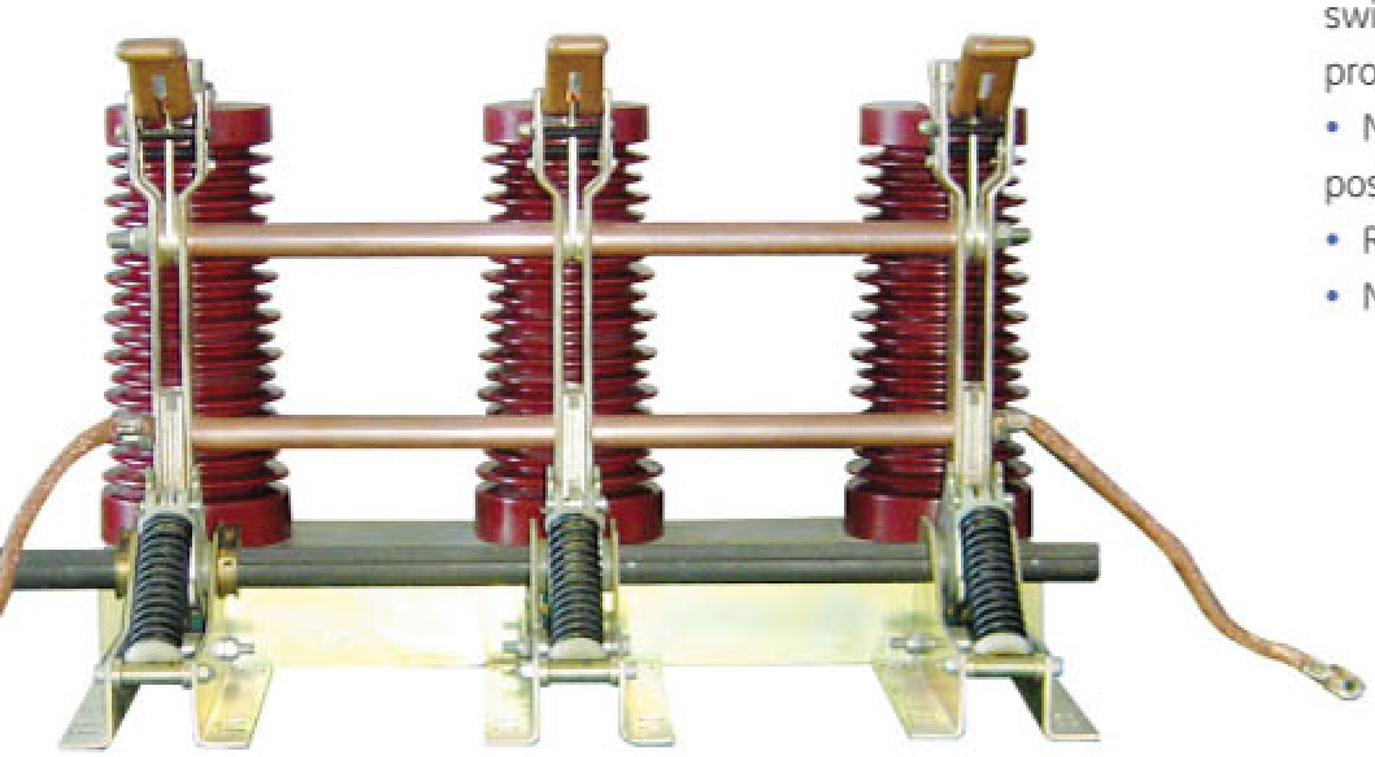


Robust Drawout Mechanism

SecoGear drawout mechanism is designed to avoid misalignment during racking, therefore overheating of the primary disconnect is prevented. All drawout mechanism is bolted to the enclosure frame with a double bended support

Space Heaters

SecoGear offers space heaters at the cable compartment as a standard feature to avoid condensation inside the switchgear due to high humidity. Space heaters should be permanently energized during installation and commissioning period and can be controlled thru humidistat or thermostat after switchgear is in normal operation.



Environmental Conditions

SecoGear is equipped with the following components which guarantee successful operations under adverse climatic and environment:

- Epoxy resin embedded pole vacuum circuit breaker
- Corrugated design of insulators and bushings
- Totally enclosed under all operation conditions

SecoGear had successfully passed the high altitude application tests up to 2000m above sea level, grade II pollution test, condensation test and salt spray test.

Remote Control Solution

- Only for special order
- For remote control from a central control room for intelligent switchgear systems, the following functions of SecoGear are provided:
- Motorized drawout mechanism for remote connect and test position
- Remote opening and closing the switchgear device
- Motorized earthing switch

Performance Features

Reliability

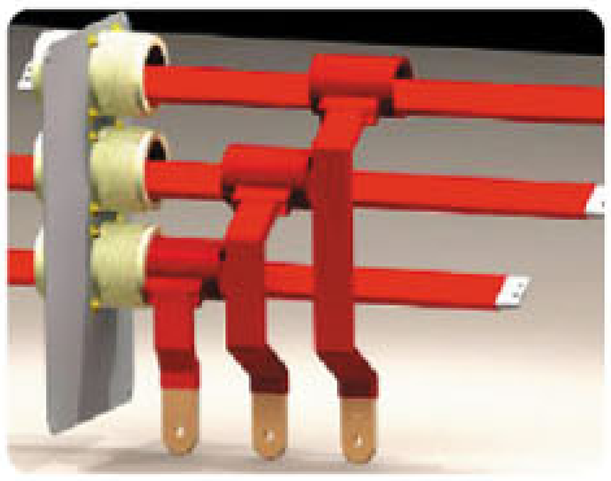
• The 3 primary compartments and 1 secondary compartment are completely self contained and segregated from each other which limits the influence between compartments and prevents spreading of an arc-fault between compartments.

• SecoGear is equipped with a Quick-action earthing switch type JN(ESW) with short circuit making capability.

• A heat-shrinkable material with high dielectric and strength properties insulates the busbar. The main busbar is provided with inter-unit bushing to prevent travel of arcing to the entire main busbar of the lineup.

• SecoGear is equipped with a highly reliable SecoVac vacuum circuit breaker with excellent electrical and mechanical performance.

• Circuit breaker in the SecoGear switchgear has three positions: connect, test and disconnect positions



Safety

SecoGear is designed with a number of interlocking systems to prevent maloperation:

• The circuit breaker can only be moved from test to connect position and vice versa when circuit breaker is opened.

• The earthing switch cannot be closed when the circuit breaker is in the connect position and in the traveling position between test and connect.

• The cable compartment door can be opened only when the earthing switch is closed and at the same time the earthing switch can be opened only when the cable compartment door is closed.

• The secondary plug can only be inserted or removed only when the circuit breaker is in the test position.

• The circuit breaker can only be closed when the circuit breaker is precisely in the definite test or connect position.

• When the circuit breaker is removed from connect position, the metal shutters will close automatically.

• The switchgear is internally arc-proof.

• All high primary compartments are provided with a pressure relief flaps located on the topside of the switchgear.

• Any overpressure inside the compartment by an internal arcing will be released thru the pressure relief flaps.

Adaptability

- SecoGear cable compartment provides ample space for easy power cable connection
- Standard current transformers, zero sequence current transformer, voltage transformers, surge arresters, protection relays and other instruments can be easily installed into the switchgear.
- SecoVac vacuum breakers with the same rating are interchangeable without any adjustment.
- CNC punching and bending machines ensure high quality and consistent dimensions and weight of the cubicle.

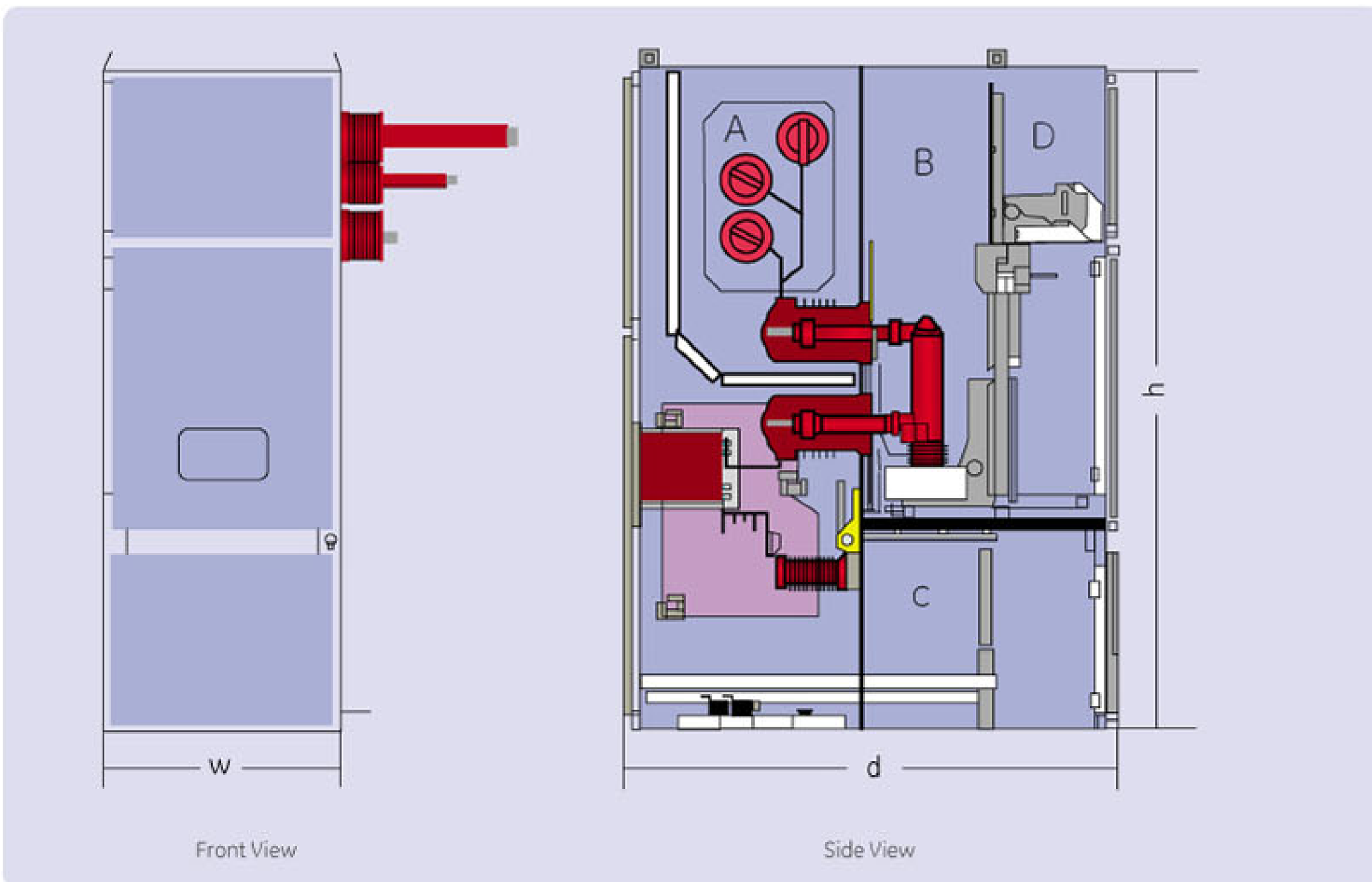
Technical Data of SecoGear Switchgear

Description		Unit	Data
Rated Voltage		kV	24
Rated Frequency		Hz	50/60
Rated Insulation Voltage	Rated Power Frequency Withstand Voltage/1 minute	kV	65
	Lightning Impulse Withstand Voltage (peak value)	kV	125
Rated Current of Busbar		A	630/1250/1600/2000/2500
Rated Current of T-off Busbar		A	630/1250/1600/2000/2500
Rated Short Time Withstand Current(3s)		kA	20/25/31.5
Resistance of Main Circuit		μΩ	≤150+CT*(630A) ≤100+CT*(1250A) ≤70+CT*(2000A) ≤50+CT*(2500A)
Ingress Protection			Panel IP4X,Compartment IP2X
Rated Peak Withstand Current(Peak Value)		kA	50/63/80

*CT: Direct current resistance of current transformer

Dimensions and Weight of SecoGear Switchgear

Height (h)		mm	2250
Width (w)	T-off busbar rated current ≤ 1250A Short time withstand current ≤ 25kA	mm	800 or 1000 (Choice of better optional)
	1250A < T-off busbar rated current ≤ 2500A 25kA < Short time withstand current ≤ 31.5kA	mm	1000
Depth (d)		mm	1680
Mass		kg	800-1200



SecoGear front and cross section view

A. Busbar Compartment

B. Circuit Breaker Compartment

C. Cable Compartment

D. Low Voltage Compartment

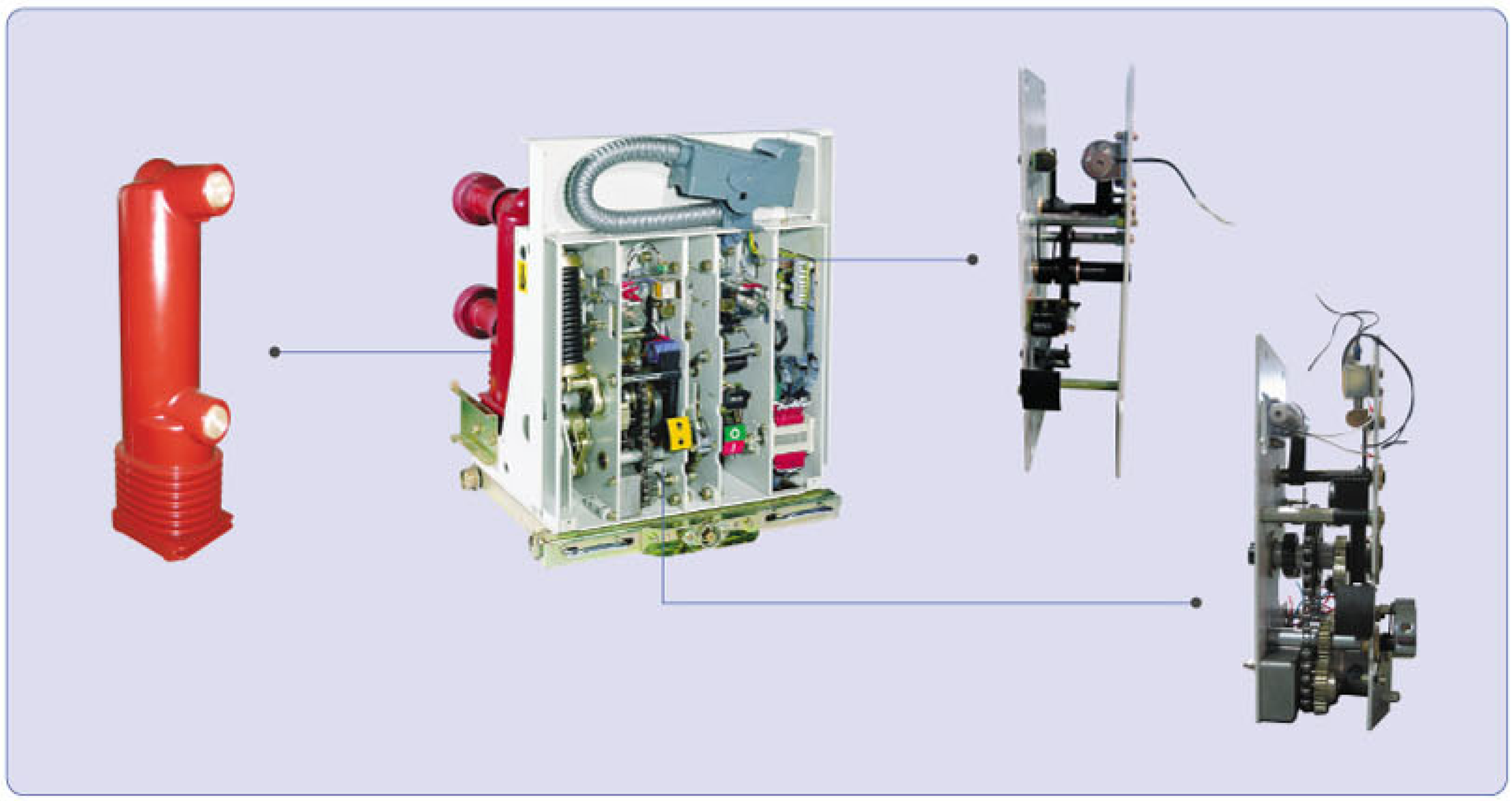
SecoVac

Medium voltage embedded pole vacuum circuit breaker 24kV, ...2500A, ...31.5kA

- SecoVac satisfies diverse application requirements; its simple but reliable operating mechanism is a key factor to make switchgear compact.
- SecoVac is manufactured using specially customized materials and specialized techniques. The process ensures quality and reliability of product. It is suitable for application in different operating conditions.
- The modularized operating mechanism design of SecoVac allows for standardized mass production, shorter lead-time, and a fast module replacement to minimize downtime.
- SecoVac fully complies with IEC, DIN VDE and GB/DL standards.

Description	Unit	Data
Rated voltage	KV	24
Rated frequency	Hz	50/60
Rated power frequency withstand voltage(1 minute)	KV	65
Rated impulse withstand voltage (peak value)	KV	125
Rated current	A	630/1250/1600/2000/2500
Rated short circuit breaking current	KA	20/25/31.5
Rated short time withstand current (3 seconds)	KA	20/25/31.5

Rated peak value withstand current	KA	50/63/80	
Rated short circuit making current (peak value)	KA	50/63/80	
Electrical endurance	No. of times	274(E2)	IEC62271-100: 2006
Rated short circuit breaking times	No. of times	50	
Rated operating sequence		with ARC	O-0.3s-CO-180s-CO
		without ARC	O-180s-CO-180s-CO
Rated auxiliary control voltage	V	AC110/220; DC110/220	
Closing time	ms	≤60	
Opening time	ms	≤45	
Breaking time	ms	≤60	
Average closing speed	m/s	0.5~1.1	
Average opening speed	m/s	1.1~1.7	
Asynchronous time	ms	≤2	
Bouncing time	ms	≤2	
Resistance of main circuit	μΩ	≤80(630A) ≤45(1250A) ≤35(1600~2000A) ≤35(2500A)	
Distance between poles	mm	210/275	
Mechanical endurance	No. of times cycles	20000(M2)	



VT Module

There are 2 types of VT modules available on our SecoGear:

- Withdrawable VT Module with primary fuses for Line Voltage sensing at the cable compartment of Breaker panel
- Withdrawable VT Module with primary fuses for Bus Voltage sensing at Metering Panel

A special fixed type VT module without primary fuses for Bus Voltage sensing (mounted on the top of Breaker panel) is available. This option is intended to eliminate number of vertical sections for dedicated metering panel.

Number of the Voltage Transformer on the VT module can be 2 or 3 VT depending on the application and requirement.

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The withdrawable VT module allows replacement of the fuses with the switchgear in service. Truck racking-out with the door closed operates closure of an automatic shutter between the live parts of the switch-gear and the VT metering panel compartment.

Surge arresters on a Drawnout VT module and Blown Fuse indicator switch are as an option.

Instrument Transformer

Current Transformer

The current transformer and voltage transformer are cast-resin type instrument transformers for measuring devices and protection devices of indoor application at the frequency of 50 or 60 Hz..

The instrument transformers are molded in high quality epoxy resin to have a good performance at high polluted and humid area. The instrument transformer is designed to suite installation in tropical environment and it doesn't need special maintenance.

The instrument transformers can be mounted at any position. The lightweight and small dimensions are the main features of its design.

The current transformer secondary terminals are located in recesses either in one or both sides of the transformer base, therefore giving two connection possibilities for installation flexibility.

A ring type CT is also available for ground protection devices.

Voltage Transformer

The voltage transformers can be one or two poles type, with performances and accuracy classes suited to the functional requirements of the connected devices.

When they are installed on a withdrawable truck they are fitted with primary fuses.

The current and voltage transformers are designed to meet or exceed requirement of IEC60044-1 and IEC60044-2 standards respectively.

Primary scheme of SecoGear

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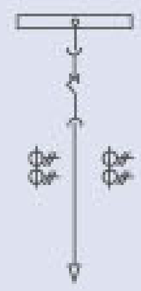
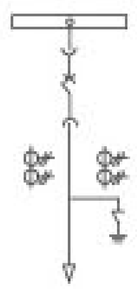
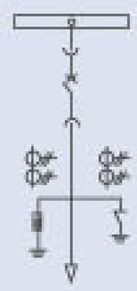
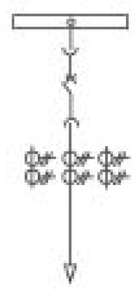
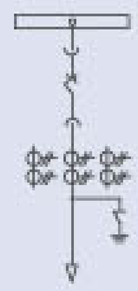
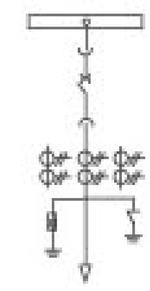
Primary Schemes							
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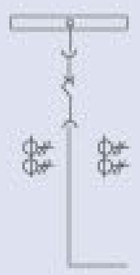
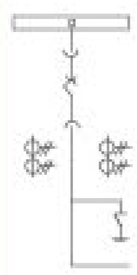
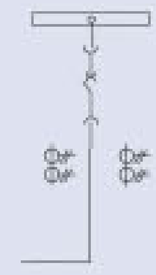
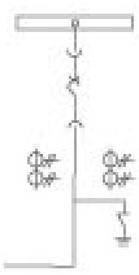
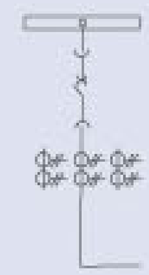
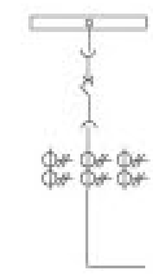
Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1	1	1	1	1
	Current Transformer	2	2	2	3	3	3
	Voltage Transformer						
	High Voltage Fuse						
	Earthing Switch		1	1		1	1
	Arrester			1			1
Application		I.F	I.F	I.F	I.F	I.F	I.F

Scheme No		7	8	9	10	11	12
Primary Schemes							
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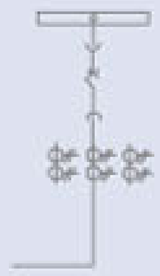
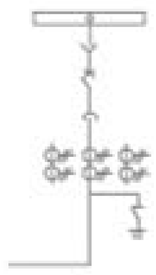
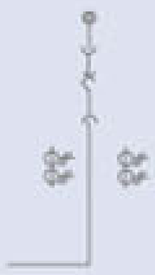
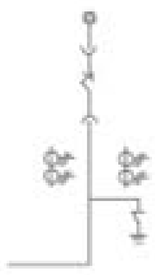
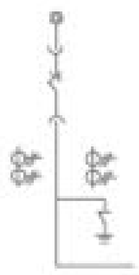
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1	1	1	1	1
	Current Transformer	2	2	2	2	3	3
	Voltage Transformer						
	High Voltage Fuse						
	Earthing Switch		1		1		
	Arrester						
Application		B	B	B	B	B	B

Scheme No		13	14	15	16	17	18
Primary Schemes							
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Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1	1	1	1	1
	Current Transformer	3	3	2	2	2	2
	Voltage Transformer						
	High Voltage Fuse						
	Earthing Switch		1		1		1
	Arrester						
Application		B	B	B	B	B	B

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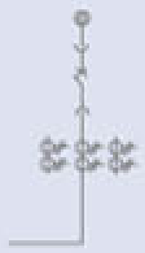
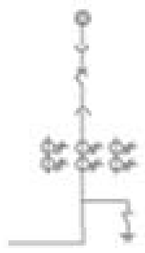
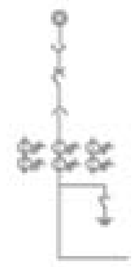
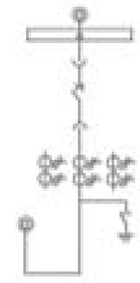
Primary Schemes							
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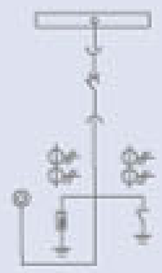
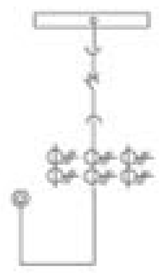
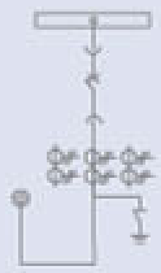
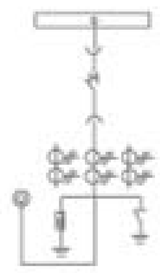
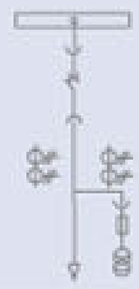
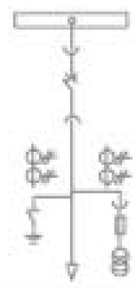
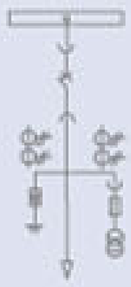
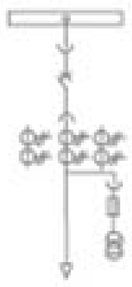
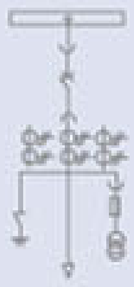
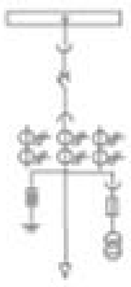
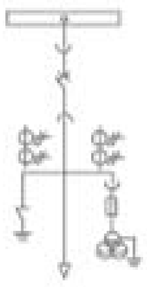
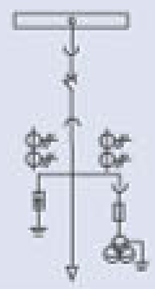
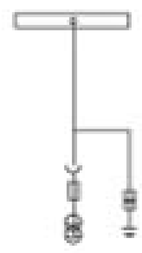
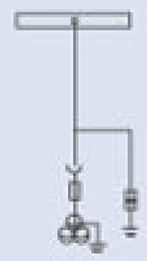
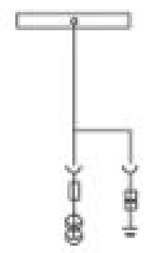
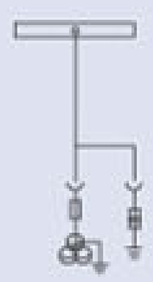
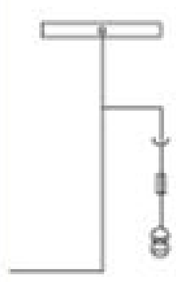
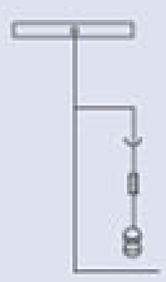
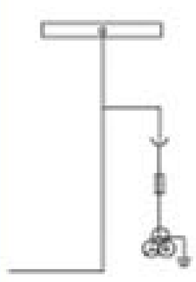
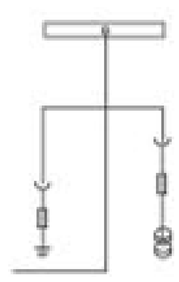
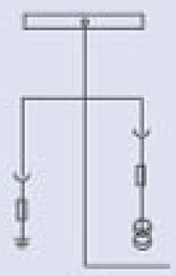
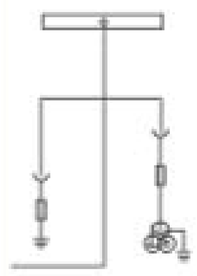
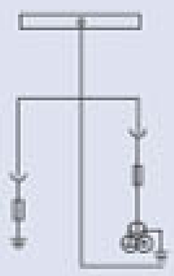
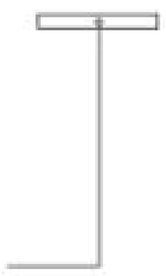
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1	1	1	1	1
	Current Transformer	3	3	3	3	2	2
	Voltage Transformer						
	High Voltage Fuse						
	Earthing Switch		1		1		1
	Arrester						
Application		B	B	B	B	I.F	I.F

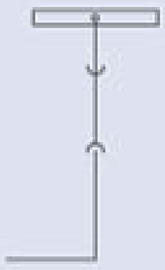
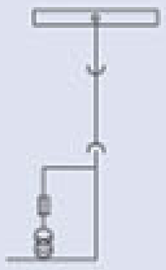
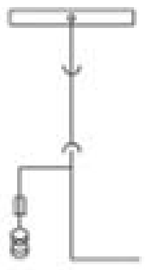
Scheme No		25	26	27	28	29	30
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1	1	1	1	1
	Current Transformer	2	3	3	3	2	2
	Voltage Transformer					2	2
	High Voltage Fuse					3	3
	Earthing Switch	1		1	1		1
	Arrester	3			3		
Application		I.F	I.F	I.F	I.F	I+P	I+P

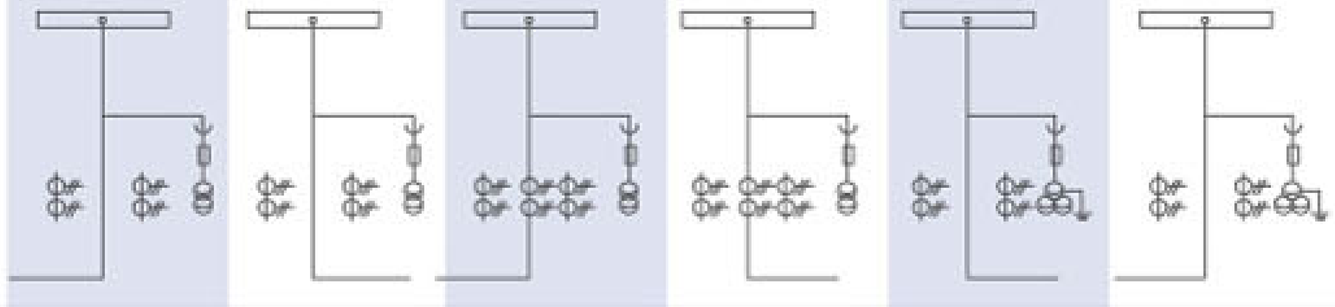
Scheme No		31	32	33	34	35	36
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1	1	1	1	1
	Current Transformer	2	3	3	3	2	2
	Voltage Transformer	2	2	2	2	3	3
	High Voltage Fuse	3	3	3	3	3	3
	Earthing Switch			1			1
	Arrester	3			3		
Application		I+P	I+P	I+P	I+P	I+P	I+P

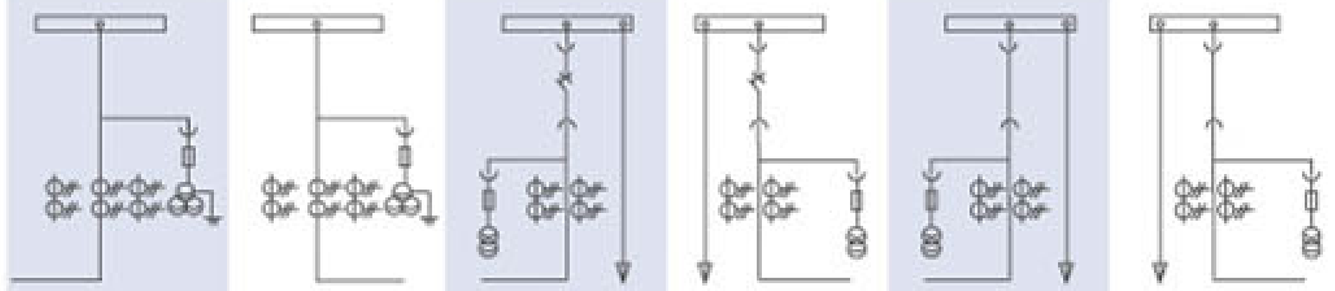
Scheme No		37	38	39	40	41	42
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker	1					
	Current Transformer	2					
	Voltage Transformer	3	2	3	2	3	2
	High Voltage Fuse	3	3	3	3	3	3
	Earthing Switch						
	Arrester	3			3	3	3
Application		I+P	P	P	P+Arrester	P+Arrester	P+Arrester

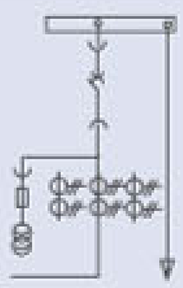
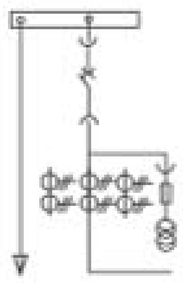
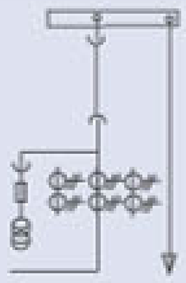
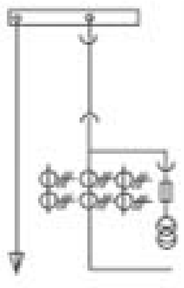
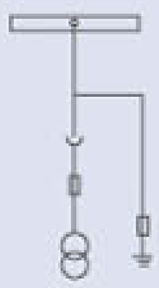
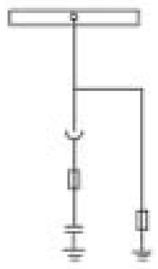
Scheme No		43	44	45	46	47	48
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker						
	Current Transformer						
	Voltage Transformer	3	2	2	3	3	2
	High Voltage Fuse	3	3	3	3	3	3
	Earthing Switch						
	Arrester	3					3
Application		P+Arrester	P+R	P+R	P+R	P+R	R+P+Arrester

Scheme No		49	50	51	52	53	54
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker						
	Current Transformer						
	Voltage Transformer	2	3	3			
	High Voltage Fuse	3	3	3			
	Earthing Switch						
	Arrester	3	3	3			
Application		R+P+Arrester	R+P+Arrester	R+P+Arrester	R	R	D

Scheme No		55	56	57	58	59	60
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker						
	Current Transformer						
	Voltage Transformer			2	2		
	High Voltage Fuse			3	3		
	Earthing Switch						1
	Arrester						
Application		D+B	D+B	D+B+P	D+B+P	Outgoing Phase Changing	Outgoing Phase Changing

Scheme No		61	62	63	64	65	66
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker						
	Current Transformer	2	2	3	3	2	2
	Voltage Transformer	2	2	2	2	3	3
	High Voltage Fuse	3	3	3	3	3	3
	Earthing Switch						
	Arrester						
Application		M	M	M	M	M	M

Scheme No		67	68	69	70	71	72
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker			1	1		
	Current Transformer	3	3	2	2	2	2
	Voltage Transformer	3	3	2	2	2	2
	High Voltage Fuse	3	3	3	3	3	3
	Earthing Switch						
	Arrester						
Application		M	M	I+M	I+M	I+M	I+M

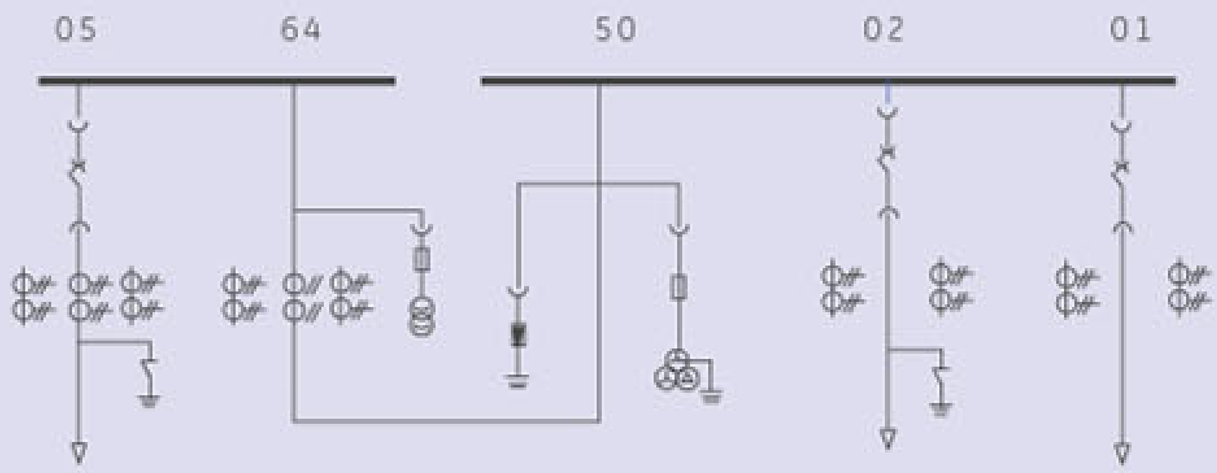
Scheme No		73	74	75	76	77	78
Primary Schemes							
Dimension of Cubicle (WXDXH)		800（1000）×1680×2250					
Rated Current(A)		630～2500	630～2500	630～2500	630～2500	630～2500	630～2500
Main Apparatus	SecoVac Vacuum Circuit Breaker	1	1				
	Current Transformer	3	3	3	3		Capacitor×3
	Voltage Transformer	2	2	2	2	Transformer×1	
	High Voltage Fuse	3	3	3	3	3	3
	Earthing Switch						
	Arrester					3	3
Application		I+M	I+M	I+M	I+M	T	Compensation

Meaning of code name in primary schemes

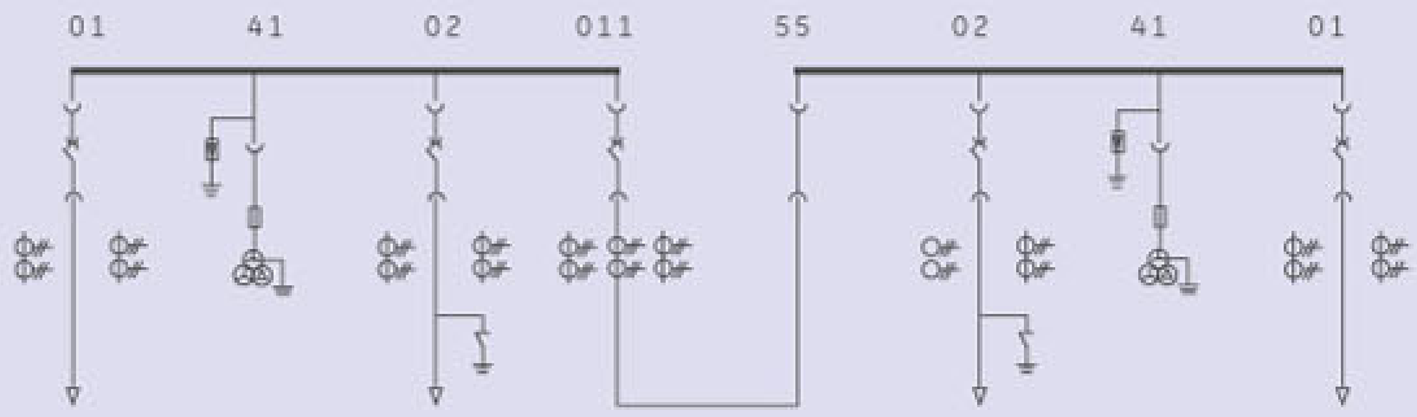
I- Incoming F-Outgoing D-Disconnecting B-Coupling

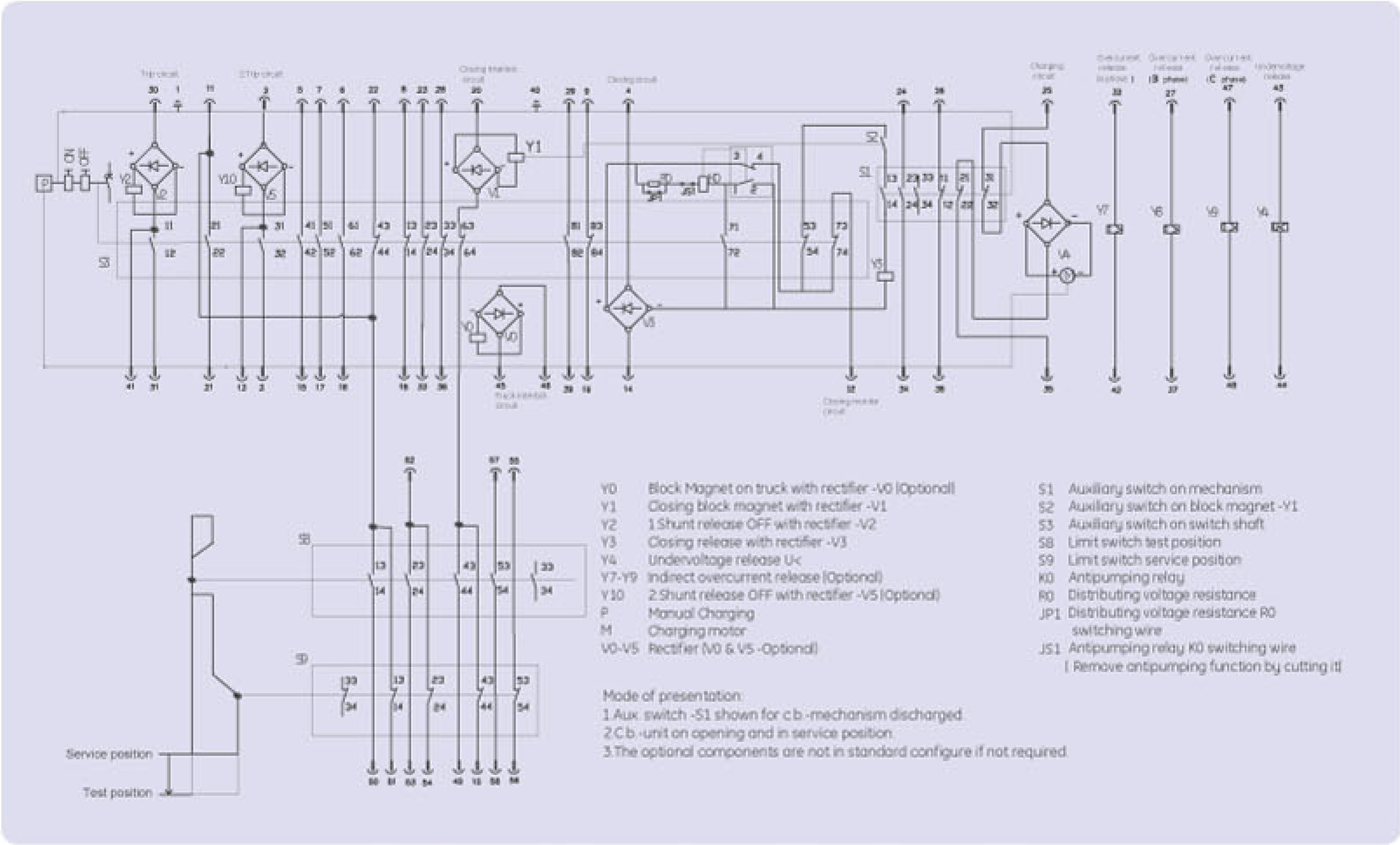
R-Busbar Rising M-Metering P-PT T-CPT

Examples of the Scheme Application (1)

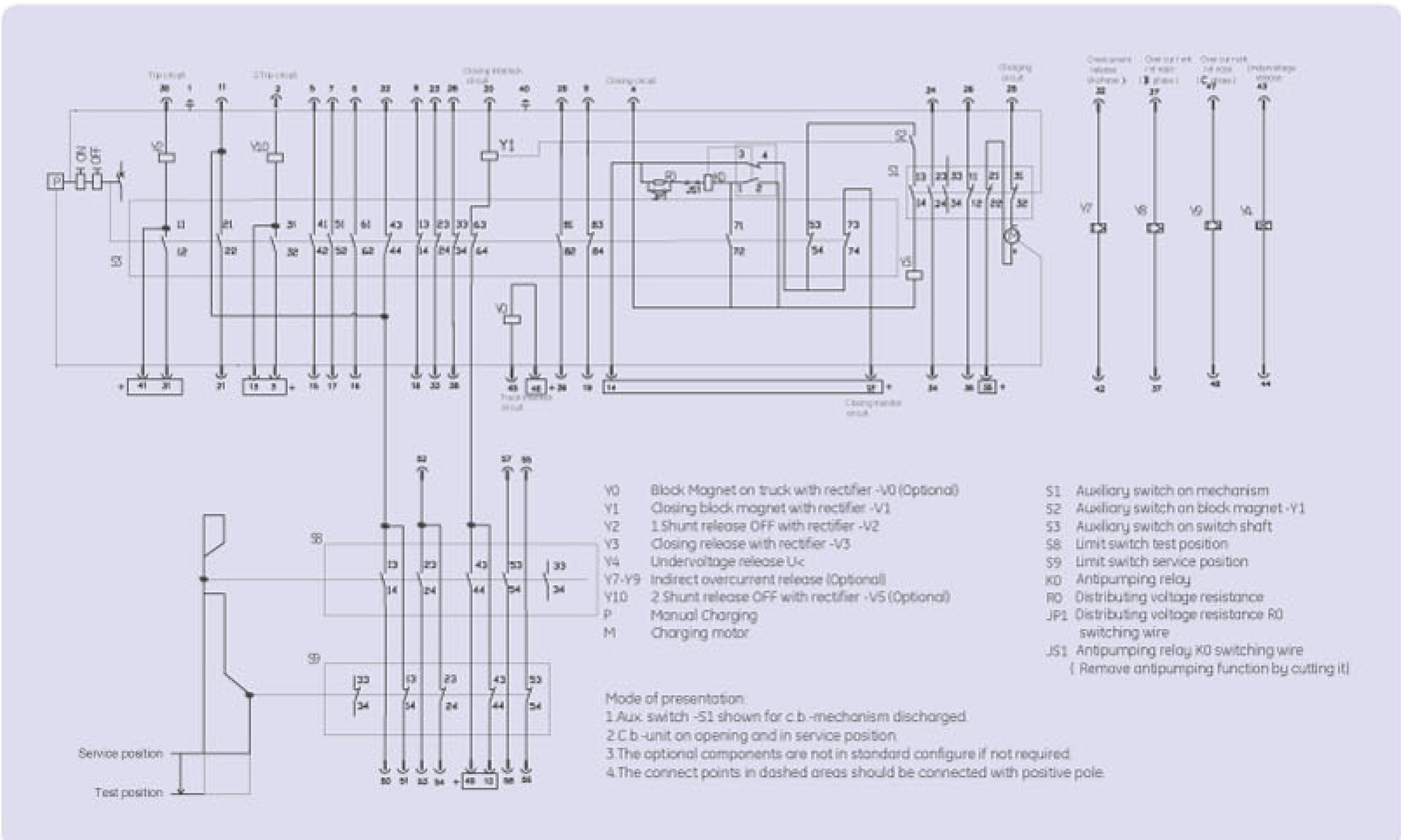


Examples of theScheme Application (2)

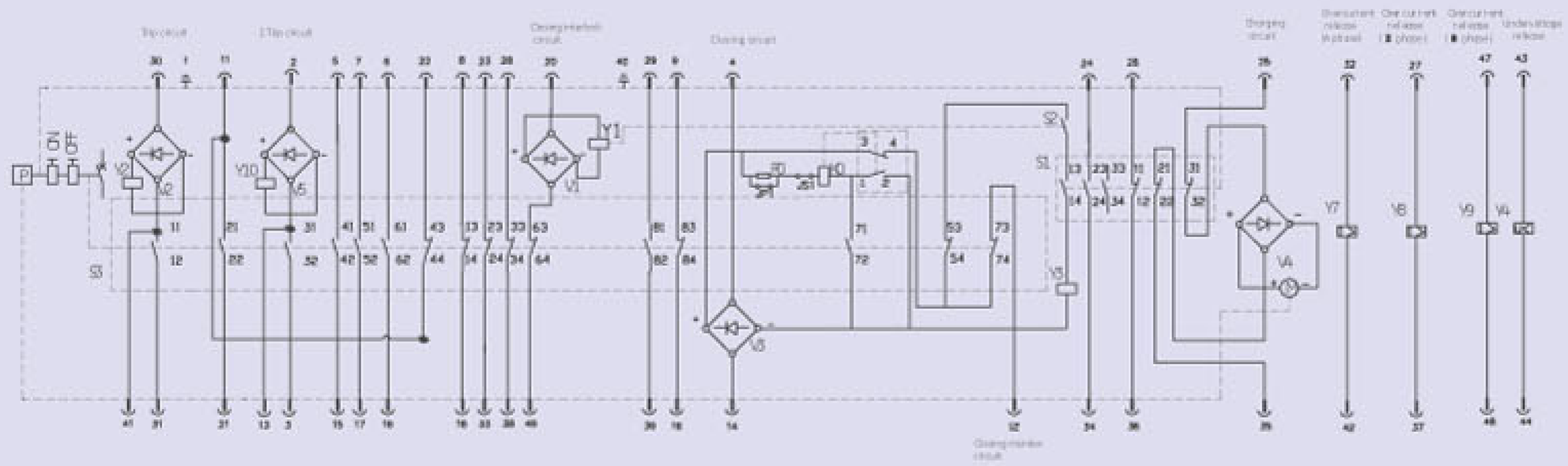




Wiring diagrams for SecoVac C.B. on withdrawable part (A.C.)



Wiring diagrams for SecoVac C.B. on withdrawable part (D.C.)

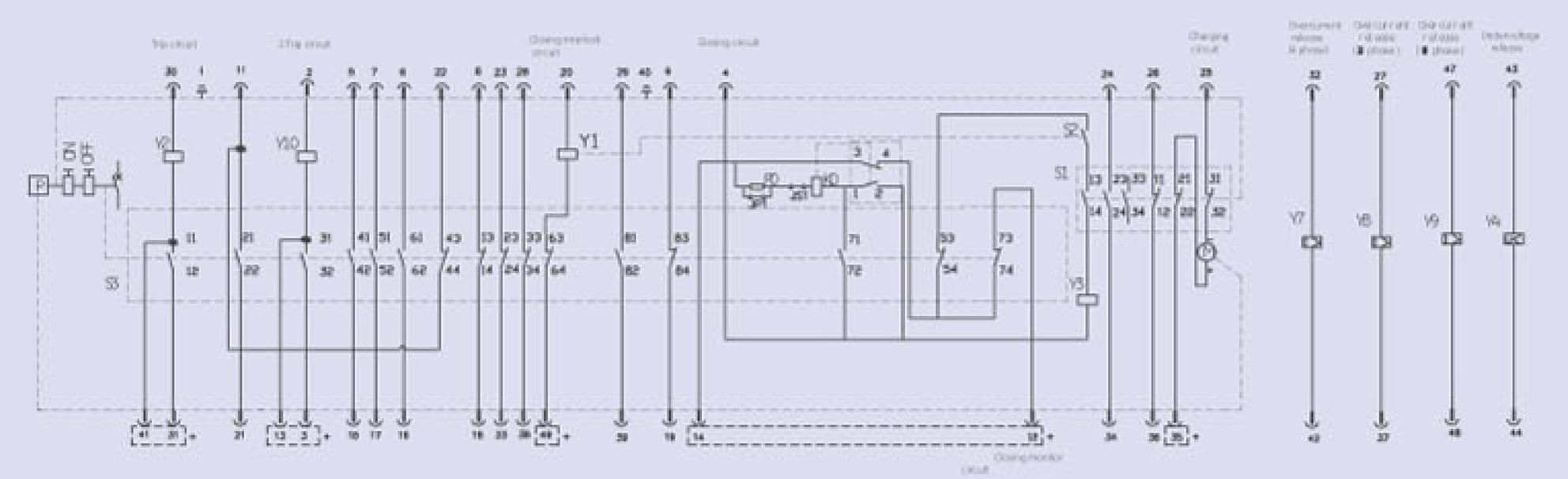


Mode of presentation:
1.Aux. switch -S1 shown for c.b.-mechanism discharged.
2.C.b.-unit on opening.
3.The optional components are not in standard configure if not required.
4.Auxiliary switch S2 should be connected when block magnet Y1 not in c.b. unit.

Y1	Closing block magnet with rectifier -V1(Optional)
Y2	1.Shunt release OFF with rectifier -V2
Y3	Closing release with rectifier -V3
Y4	Undervoltage release U<
Y7-Y9	Indirect overcurrent release (Optional)
Y10	2.Shunt release OFF with rectifier -V5 (Optional)
P	Manual Charging
M	Charging motor
V1-V5	Rectifier (V1 & V5 -Optional)

S1	Auxiliary switch on mechanism
S2	Auxiliary switch on block magnet -Y1
S3	Auxiliary switch on switch shaft
K0	Antipumping relay
R0	Distributing voltage resistance
JP1	Distributing voltage resistance R0 switching wire
JS1	Antipumping relay K0 switching wire (Remove antipumping function by cutting it)

Wiring diagrams for SecoVac C.B. on fixed part (A.C.)



Mode of presentation:
1.Aux. switch -S1 shown for c.b.-mechanism discharged.
2.C.b.-unit on opening.
3.The optional components are not in standard configure if not required.
4.Auxiliary switch S2 should be connected when block magnet Y1 not in

The connect points in dashed areas should be connected with positive pole.

Y1	Closing block magnet with rectifier -V1 (Optional)
Y2	1.Shunt release OFF with rectifier -V2
Y3	Closing release with rectifier -V3
Y4	Undervoltage release U<
Y7-Y9	Indirect overcurrent release (Optional)
Y10	2.Shunt release OFF with rectifier -V5 (Optional)
P	Manual Charging
M	Charging motor
V1-V5	Rectifier (V1 & V5 -Optional)

S1	Auxiliary switch on mechanism
S2	Auxiliary switch on block magnet -Y1
S3	Auxiliary switch on switch shaft
K0	Antipumping relay
R0	Distributing voltage resistance
JP1	Distributing voltage resistance R0 switching wire
JS1	Antipumping relay K0 switching wire (Remove antipumping function by cutting it)

Wiring diagrams for SecoVac C.B. on fixed part (D.C.)

Installation of switchgear

In order to obtain an optimum installation sequence and ensure high quality standards, site installation of the switchgear should only be carried out by specially trained, or at least by personnel supervised and monitored by responsible persons.

On commencement of installation on site, the switch-room must be fundamentally finished, provided with lighting and the electricity supply, lockable, dry and with facilities for ventilation. It is also required that the basic frame and indoor ground of switch should be checked and accepted before the construction. It must be ensured that the ceiling height is sufficient for the opening travel of the pressure relief plates.

Tolerances for laying the floor frame are: Evenness tolerance: ± 1 mm within a measuring length of 1 m. Straightness tolerance: 1 mm per 1 m, but not more than 3 mm over entire length of frame.

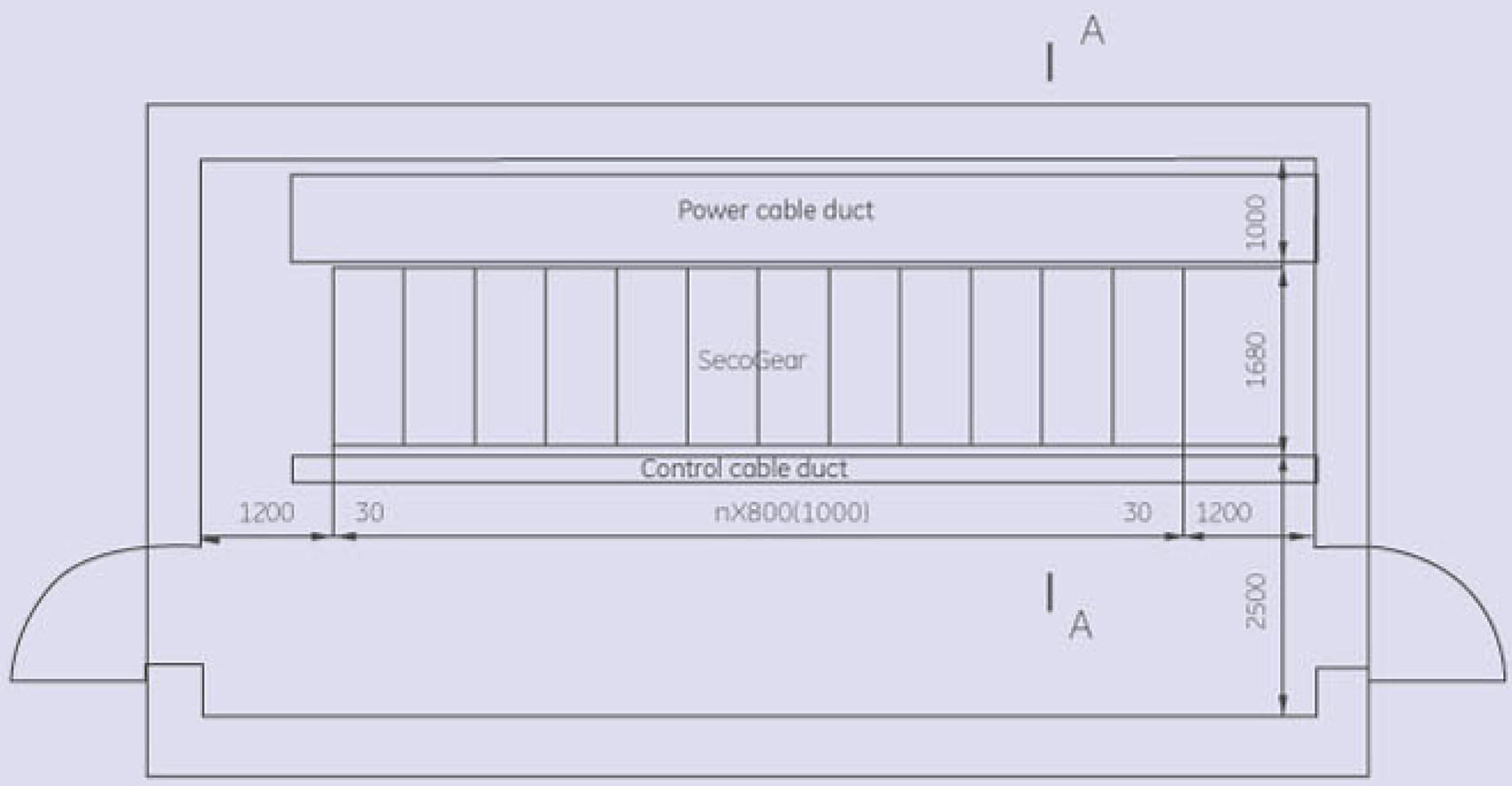


Figure1: plane layout for switchgear arrangement

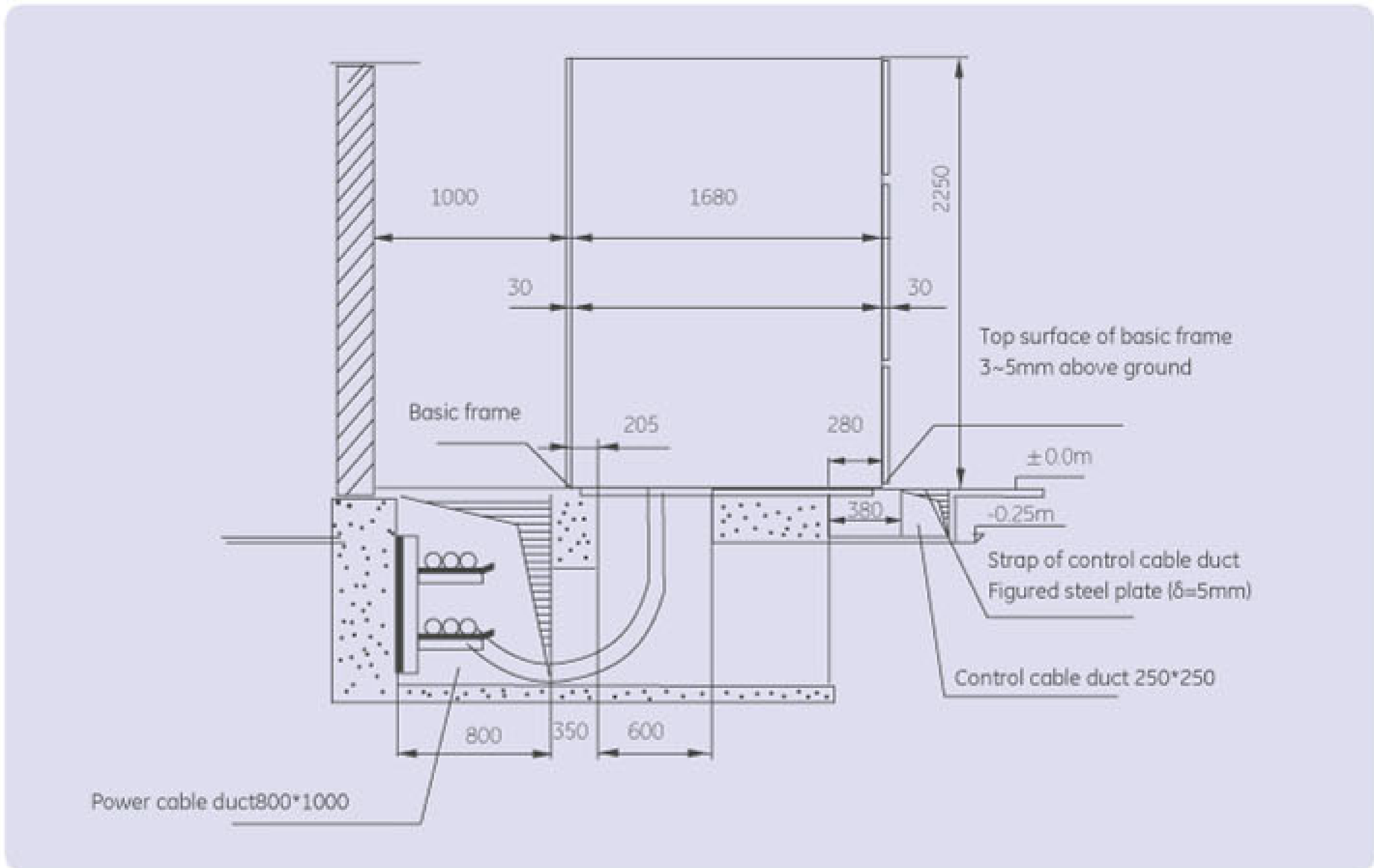


Figure2: plane layout for switchgear arrangement (section A-A)

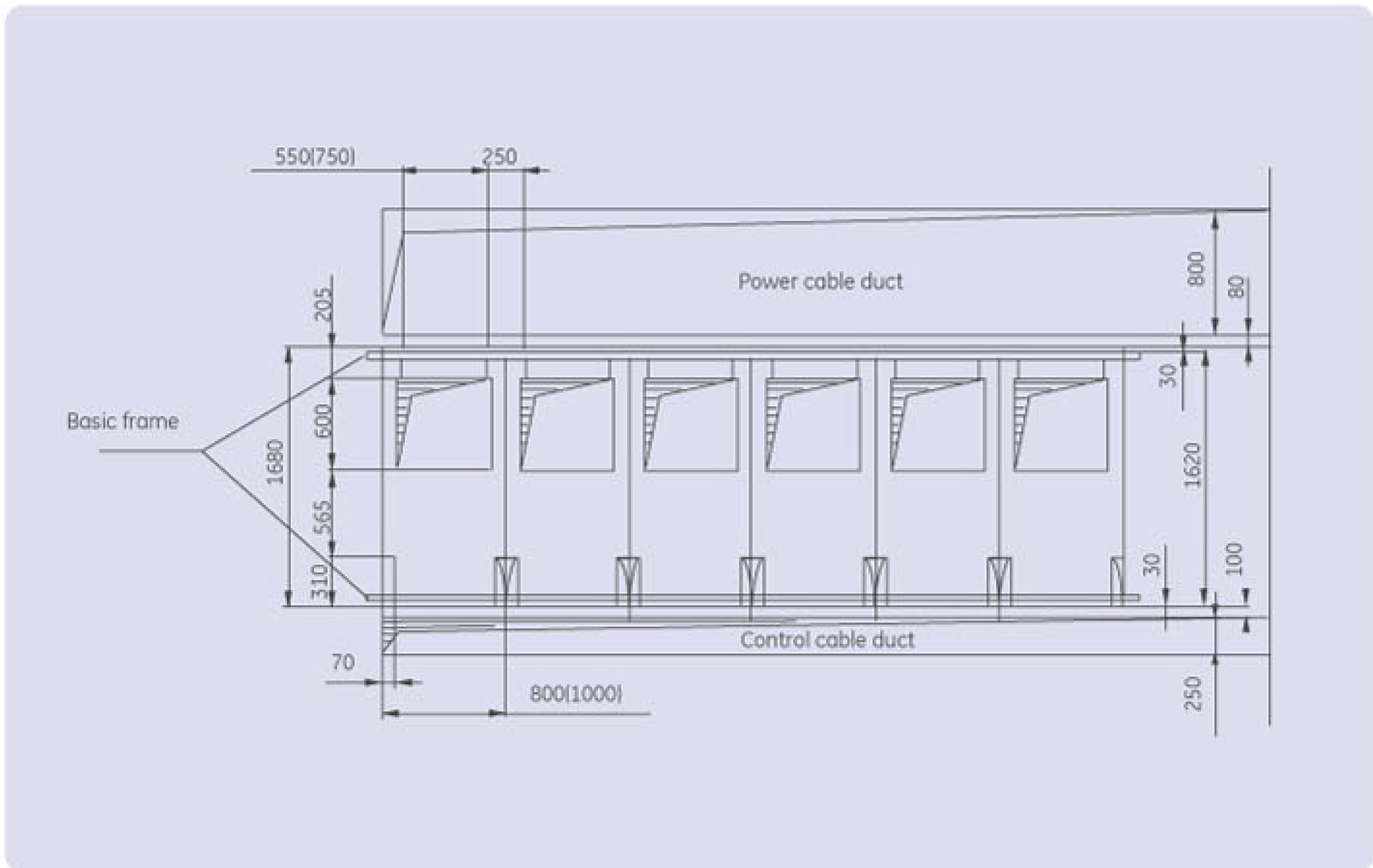


Figure3: Switch-room cable duct arrangement

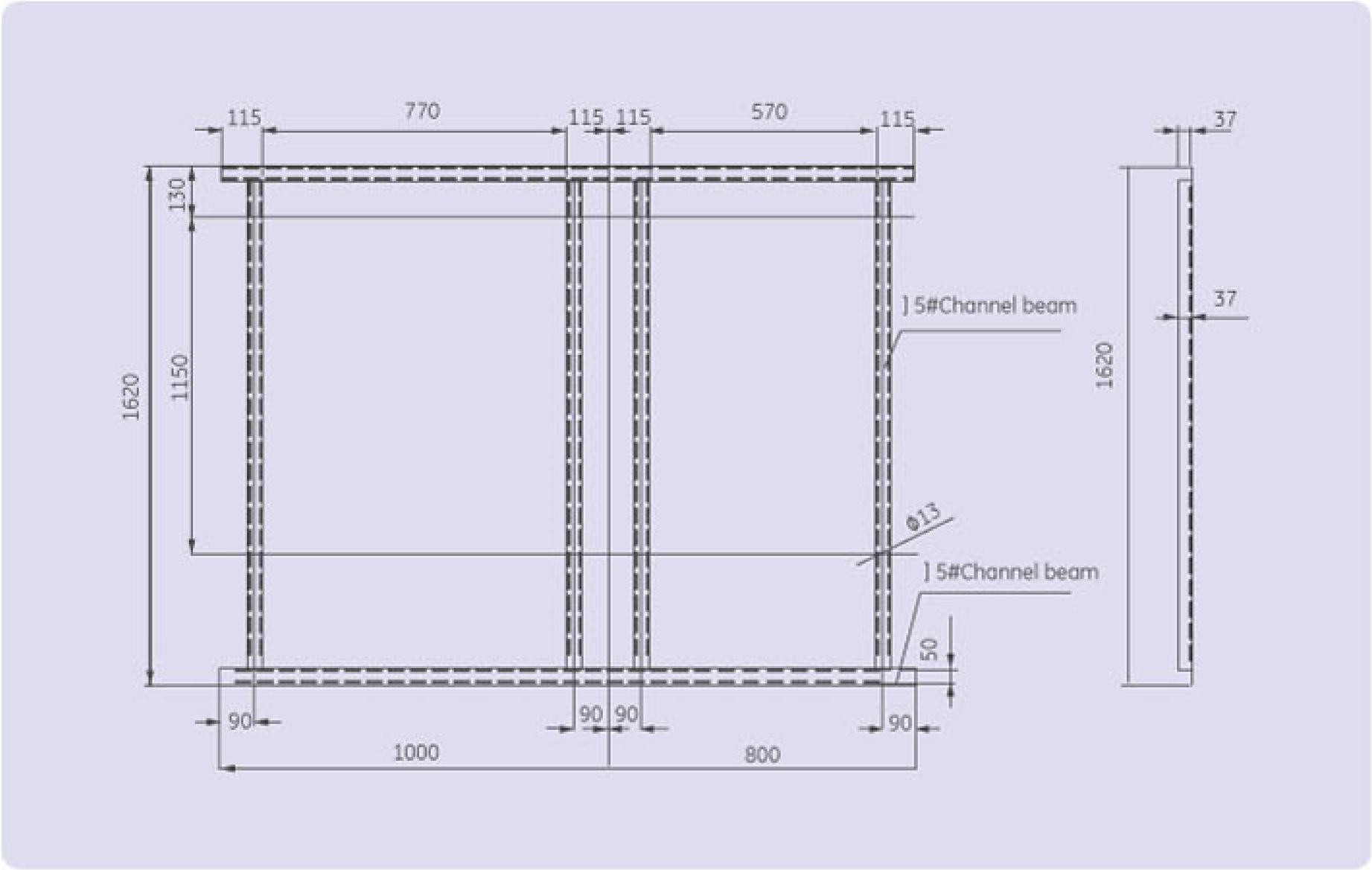


Figure4: Typical basic frame foundation (for 1000mm/800mm width dimension model)

GE SecoGear is designed for power protection applications in all major industries, including Power Generation, T&D, Oil&Gas, Automotives, Processing Plants, and Commercial Buildings