SecoGear™
17.5kV Metal Clad Switchgear

SecoVac™
3.3kV - 17.5kV
Embedded Pole Vacuum
Circuit Breaker
More than 80 Years of Interrupter Experience

GE pioneered experimental vacuum interrupters in the 1920's, refined it and introduced the world's first 15kV vacuum circuit breaker in the 1960's.

To date, this interrupter design has been the world leader in vacuum technology and has accumulated over 45 years of reliable field service.

World Class Quality

SecoGear/SecoVac is manufactured, assembled and tested in the same facility assured by ISO 9001:2000 and ISO 14001 certification.

Precision tooled parts, computer aided design and advanced production techniques, as well as the protection of the “E Coat” (cathodic electrocoating) paint process has resulted in a standard of excellence.

Universal Applications

SecoVac is designed, assembled and tested to meet or exceed applicable IEC, GB and DL standards. It is suitable for applications in all major industries including Transmission and Distribution (T&D), Oil & Gas, Automotive, Processing plants, Iron and Steel mills, Mining, Commercial buildings, etc.

It provides protection for all types of applications: cable, overhead lines, motors, capacitors, transformers, busbar sections, etc.

Environment

Selecting low environmental impact technologies has become increasingly important to engineers tasked with choosing equipment for an application.

With commitment to environment protection, the solid insulation of epoxy resin is used for SecoVac series MV embedded pole vacuum circuit breakers instead of SF6 gas.
SecoGear™

17.5kV Metal Clad Switchgear

- SecoGear is an air insulated switchgear with compact design
- SecoGear is safe and reliable for universal indoor applications
- Designed with full segregation of its breaker compartment and equipped with embedded pole SecoVac Plus vacuum circuit breaker
- Cable compartments with ample space for ease of power cable connection
- Guaranteed arc-proof unit
- Tested in accordance with the international standards
- Front panel features easy operation and low maintenance
- SecoGear has a reliable interlocking system to prevent miss operation and to improve safety

General

SecoGear metal clad switchgear is designed and manufactured with advanced technology and has been comprehensively and successfully type tested by KEMA. SecoGear switchgear is typically used in power plants, substations and suitable to provide control and protection for transformers, capacitors and motors.

The rated voltage of SecoGear is 12kV - 17.5kV and rated current ranges from 630A to 4000A (4000A has force cooling). All SecoGear with switching device are equipped with SecoVac vacuum circuit breaker with corresponding specifications.

SecoGear switchgear is designed for indoor applications, and is particularly suitable for applications in industry, mining, oil and gas and infrastructure. SecoGear is designed, assembled and tested to meet or exceed applicable IEC 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 or racked-out from the connect position
- A circuit breaker being closed to 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 the circuit breaker is at the connect position

Automatic Shutter System

SecoGear metal clad switchgear is equipped with an automatic grounded metal shutter 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 close and lock to provide the designed IP protection and prevents the operator from opening the shutters by mistake, which may cause personnel injury during maintenance.
SecoGear™

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 if an internal arc-fault occurs in a compartment. The pressure relief flaps protect 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.

Arc-Proof Tested

The metal clad design, sturdy door hinges and lock system, enables SecoGear to successfully pass 40kA/1s internal arcing test in accordance with IEC 62271-200 in all its three primary compartments. SecoGear metal clad switchgear is designed to meet protection degree of IP40X as per IEC 60529. The grounded metal enclosure protects operators from live and moving parts inside the switchgear. The enclosure is sealed to eliminate penetration of external objects, which may cause short-circuit of the system.

Highly 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 qualified during a 40 year lifetime accelerated thermal durability test.

Robust Drawout Mechanism

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

SecoGear offers space heaters in 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 through a humidistat or thermostat after the switchgear is in normal operation.

Environmental Conditions

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

- Epoxy resin embedded pole vacuum circuit breaker
- Corrugated design of insulators and bushings
- Totally enclosed under all operation conditions
- Grade II pollution test
- Condensation test and salt spray test

SecoGear has successfully passed the seismic testing to UBC Zone 4 and GB Intensity 9.

Remote Control Solution

Remote control from a central control room should be indented under:

- Motorized drawout mechanism for remote connect and test position
- Remote opening and closing the switchgear device
- Motorised earthing switch

The functions of SecoGear can be provided as optional.
Performance Features

Reliability

The three primary compartments and one 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 bushings to prevent travel of arcing to the entire main busbar lineup.

SecoGear is equipped with a highly reliable SecoVac vacuum circuit breaker with excellent electrical and mechanical performance. The circuit breaker has three positions: connect, test and disconnect.

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 circuit 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.

Safety

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

- The circuit breaker can only be moved from test to connect position and vice versa when the circuit breaker is opened.
- The earthing switch can’t 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 only be opened 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 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 pressure relief flaps located on the topside of the switchgear.
- Any overpressure inside the compartment by internal arcing will be released through the pressure relief flaps.
Technical Data

Electrical Data

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<th>Description</th>
<th>Unit</th>
<th>Data</th>
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<tr>
<td></td>
<td></td>
<td>17.5</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage (1 min)</td>
<td>kV</td>
<td>28</td>
</tr>
<tr>
<td>Phase to phase and to earth</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Between isolating distance</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>kV</td>
<td>75</td>
</tr>
<tr>
<td>Phase to phase and to earth</td>
<td></td>
<td>95</td>
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<tr>
<td>Between isolating distance</td>
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<td>95</td>
</tr>
<tr>
<td>Rated short time withstand current</td>
<td>kA</td>
<td>31.5 - 40</td>
</tr>
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<td>Rated peak value withstand current</td>
<td>kA p</td>
<td>82 - 104</td>
</tr>
<tr>
<td>Rated duration time for short-circuit</td>
<td>s</td>
<td>3</td>
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<tr>
<td>Internal arc degree</td>
<td></td>
<td>Class A FLR for 40 kA, 3s for all HV compartment</td>
</tr>
</tbody>
</table>

Normal Service Conditions

| Operating temperature | -15°C to + 40°C |
| Storage temperature   | -30°C           |
| Relative humidity     | ≤ 95%           |
| Altitude              | Up to 1000m above sea level max |

Dimensions & Weights

<table>
<thead>
<tr>
<th>Description</th>
<th>630A / 1250A</th>
<th>1600A / 2000A / 2500A / 3150A / 4000A</th>
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<tr>
<td>Height mm (h)</td>
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<td>Width mm (w)</td>
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<td>1000</td>
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<td>Depth mm (d)</td>
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<tr>
<td>Weight (kg)</td>
<td>900-950</td>
<td>1300</td>
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</table>

SecoGear front and cross section view

A = Busbar compartment
B = Circuit Breaker compartment
C = Cable compartment
D = Low Voltage compartment
SecoVac™

Embedded Pole Vacuum Circuit Breaker
3.3kV - 17.5kV, up to 4000A and 40kA

Front Panel
This front panel fits into a collar-frame in the equipment when the breaker is in the CONNECT position. It provides a metal barrier between the breaker compartment and the secondary device compartment. Well-marked and easy-to-read operating controls and indicators include TRIP button, CLOSE button, OPEN/CLOSE indicator, CHARGE/ DISCHARGE indicator, OPERATIONS counter and provision for manual charging the breaker.

Primary Disconnect
The primary disconnect finger set is rugged and easy to inspect. Designed for optimum contact, built of silver-plated copper and tested for continuous and short time current. Cycloid design is more convenient to connect and expand wider contact area than flat design. These disconnects provide proper contact integrity throughout the life of the gear for the critical primary disconnect function.

Breaker Mechanism
All the mechanical parts of the mechanism are integrated into opening and closing modules individually. The closing and opening modules are universal to the entire SecoVac embedded pole vacuum circuit breaker in spite of the ratings. Such design assures no mechanical readjustment after the replacement, thereby not only shortens lead-time but also reduces operation and maintenance cost.

Interlock System
For personnel safety, SecoVac is designed with a number of mechanical and electrical interlocks. For example, breaker contacts must be open before the breaker can be moved to or from the CONNECT position. A positive mechanical stop is provided when the breaker reaches the CONNECT or TEST/ DISCONNECT positions. Mechanical interference interlocks are provided to permit only the insertion of properly rated breakers into any specific compartment. These and other necessary interlocks provide a comprehensive protection system. Furthermore, springs automatically discharge when the breaker is withdrawn from the CONNECT position and breakers cannot be inserted in the closed position.
General

SecoVac series circuit breaker designed by GE Energy is a three-phase AC indoor breaker with 3.3kV - 17.5kV rated voltage and can be applied in controlling and protecting electrical equipment in industry mining, power plants and substations, especially suitable for conditions which require frequent operation. The product conforms to IEC 62271 standard. The breaker can be installed in both fixed and withdrawable type switchgear and is the premium choice for the control and protection of MV power distribution systems.

Predominant Vacuum Technology

Vacuum interrupting technology is the dominant switching principle in medium voltage. Innovative developments are leading to fundamental advantages such as reliability, availability, compactness and environmental responsibility using vacuum technology as a switching medium.

Vacuum interrupter

1923 Sorensen & Mendenhall commence first research into Vacuum interruption; commercialization not possible due to lack of supporting technologies.

GE’s milestone in Vacuum technology

1950 General Electric commence programme for Vacuum interrupter development. Spiral petal arc control contact developed by General Electric. Copper-Bismuth contact material developed by General Electric.

1962 General Electric announces first development power interrupter rated at 15.5kV, 12.5kA; 650A, CuBi material, spiral petal contacts. Dr. Thomas H. Lee was named Vacuum circuit breaker father.

1965 Announcement of the first commercially available Power Vacuum Interrupter by GE.

1966 GE decides to apply Vacuum interrupter technology to high voltage applications.

1969 GE licenses Vacuum interrupter technology to Meidensha (Japan).

Arc quenching

During the galvanic separation of the contacts, the current to break produces a metal-vapour arc discharge. The current flows through this metal-vapour plasma until the next current zero. Near the current zero, the arc extinguishes. The metal vapour loses its conductivity after a few microseconds – the insulating capability of the contact gap recovers quickly. To maintain the metal vapour arc discharge, a specific minimum current is required. If this minimum current is not reached, it will chop before the natural current zero.

To prevent unpermissible switching overvoltage while switching inductive circuits, the chopping current must be limited to the lowest possible values. Using a special contact material, the chopping current in vacuum circuit breakers is just 2 to 3A. Due to the fast recovery of the contact gap, the arc is safely quenched even if the contacts separate right before a current zero. Therefore, the arcing time in the last-pole-to-clear are 15ms as a maximum. Depending on the breaking current and the interrupter dimensions, different contact geometries are used.
**Axial magnetic-field application in SecoVac Series breaker**

The arc remains diffused even with high currents due to the axial magnetic field. The disc-type contact surfaces are uniformly stressed, and local melting is avoided.

This results in a very small arc voltage ranging between 20 and 200V. For this reason, and due to the short arcing times, the energy converted in the contact gap is very low. Because of this relatively low stress, the quenching system is maintenance-free. In the stationary condition, the pressures in the interrupter are very low (less than 10^-9 bar), so that contact distances of just 6 to 20 mm are required to reach a very high dielectric strength. Apart from circuit breakers, the vacuum interrupter technology can also be used in contactors and switches. Today, more than 70% of all circuit breakers installed in medium voltage systems are based on vacuum interrupter technology.

**Unique and Proven Embedded Pole Technology**

SecoVac Series MV embedded pole vacuum circuit breaker uses the latest technology of Automatic Pressure Gelatin (APG) to embed the vacuum interrupter and connection terminals within epoxy resin. The vacuum interrupter is cast in the epoxy resin, without screw fixation which can cause the concentrated harsh electrical field and result in decrease of the electrical insulation strength of the pole. Thanks to the embedded pole technology, the assembly of the pole is simplified, and the assembly accuracy as well as quality of the embedded pole is easily controlled by the state of the art production process. The embedded pole technology will also improve the environmental resistant capability of the breaker, as the primary circuit of the breaker is completely embedded inside the epoxy resin, the risk of insulation fault caused by adverse operating environment such as dust, humidity, vermin, polluted ambient and high altitude operating site are eliminated.

The key know-how of the embedded pole technology is the buffering layer between epoxy resin and ceramic housing of the vacuum interrupter, where the material and processing of the buffering layer is essential to ensure the integrity of epoxy resin of the embedded pole providing adequate adhesion between each other in any circumstance.

Our patented LSR (Liquid Silicon Rubber) buffering layer and double APG (Auto Pressure Gelatin) Process adopted in the producing of the embedded pole thoroughly eliminate the cracking of the epoxy resin caused by the large difference of the thermal expansion coefficient between epoxy resin and ceramic in case of rapid changing of the ambient temperature. APG process for LSR buffering layer ensures that there will not be any air gap or bubble between the buffering layer and ceramic housing, hence, the high electrical insulation strength of the embedded pole of SecoVac Series MV embedded pole vacuum circuit breaker is guaranteed.

The partial discharge value of embedded pole manufactured by our patented LSR (Liquid Silicon Rubber) buffering layer and double APG (Auto Pressure Gelatin) process is below 5 pC (Maximum Permissible Partial Discharge) with an applied testing voltage of 1.2Um.
Vacuum Circuit Breaker

Before delivery, the following tests and inspections will be done for SecoVac embedded pole vacuum circuit breaker in the factory by means of advanced testing equipment:

- Dynamic characteristics measurement
- Power frequency withstand voltage testing
- Inspection of interlocking system between breaker and withdrawable unit
- Secondary wiring inspection
- Circuit resistance measurement

Modular Operation Mechanism

SecoVac is equipped with modular operation mechanism, which is standard and easy for maintenance. The principal axis is driven by cam of mechanism directly which reduces more processes and saves energy. The mechanism incorporates a changing lever thus no need to order it separately. Another feature of the operating mechanism of SecoVac embedded pole vacuum circuit breaker is that the total number of parts of the mechanism is reduced compared with the traditionally designed mechanism, so that the reliability of the mechanism is enhanced significantly. The opening damper of the mechanism plays a very important role to ensure reliable performance and high mechanical endurance of SecoVac embedded pole vacuum circuit breaker. By adoption of the opening damper, the over travel and re-bounce of moving contacts of vacuum interrupters during the opening of this VCB is reduced to a minimum. The lower over travel of the moving contacts means lower mechanical stress to the bellow of the vacuum interrupter, so the designed mechanical endurance of the vacuum interrupter is guaranteed. The lower re-bounce of the contact ensures low arc re-striking probability during the breaking of capacitive current, so the occurrence rate of operating overvoltage is reduced. By the contribution of the opening damper, SecoVac has successfully passed type tested as Class C2 breaker in accordance with IEC standards.

The State of the Art Process and Advanced Quality Control

The high quality of the embedded pole is achieved by using the latest APG (Auto Pressure Gelatin) technology and advanced vacuum mixing and degassing technology that are carried out by the equipment. The Vogel clamping machine is an essential piece of equipment to ensure the mechanical and insulating strength of the embedded pole of SecoVac Series MV embedded pole vacuum circuit breaker.

As well as the processing facilities, the testing facilities are also very important to the quality control of the breaker. In the manufacturing process of SecoVac, from incoming material quality control to the final inspection and testing, every step is strictly calibrated and tested by means of testing facilities.

For every embedded pole, before it goes into the breaker assembly line, it shall go through the following inspections and testing carried out in the factory:

- X-ray inspection
- Power frequency withstand voltage test
- Partial discharge measurement
- Extremely high and low temperature impulse test
SecoVac™

Overall Dimensions

SecoVac 630-4000A (Phase to phase distance: 150mm)

| [mm] | 630A / 1250A | 1600A / 2000A / 2500A / 3150A / 4000A /
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>[mm]</td>
<td>31.5kA (650mm)</td>
<td>40kA (1000mm)</td>
</tr>
<tr>
<td>a</td>
<td>488</td>
<td>838</td>
</tr>
<tr>
<td>b</td>
<td>201.5</td>
<td>376.5</td>
</tr>
<tr>
<td>c</td>
<td>503</td>
<td>853</td>
</tr>
<tr>
<td>d</td>
<td>516</td>
<td>864</td>
</tr>
<tr>
<td>e</td>
<td>531</td>
<td>881</td>
</tr>
<tr>
<td>f</td>
<td>498</td>
<td>836</td>
</tr>
<tr>
<td>g</td>
<td>(456)</td>
<td>(794)</td>
</tr>
<tr>
<td>h</td>
<td>150</td>
<td>275</td>
</tr>
<tr>
<td>i</td>
<td>Ø 35/49(1)</td>
<td>Ø 109</td>
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</table>

SecoVac L-frame

| [mm] | 630A / 1250A | 1600A / 2000A / 2500A / 3150A / 4000A /
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>[mm]</td>
<td>31.5kA (650mm)</td>
<td>40kA (1000mm)</td>
</tr>
<tr>
<td>j</td>
<td>275</td>
<td>310</td>
</tr>
<tr>
<td>k</td>
<td>280</td>
<td>295</td>
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<tr>
<td>l</td>
<td>78</td>
<td>86</td>
</tr>
<tr>
<td>m</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>n</td>
<td>95.5</td>
<td>95.5</td>
</tr>
<tr>
<td>o</td>
<td>637</td>
<td>375</td>
</tr>
<tr>
<td>p</td>
<td>436</td>
<td>361</td>
</tr>
<tr>
<td>q</td>
<td>599</td>
<td>586</td>
</tr>
<tr>
<td>r</td>
<td>200</td>
<td>200</td>
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</table>

(1) Rating: 630A - 35mm, 1250A - 49mm

SecoVac L-frame

| [mm] | 630A / 1250A | 1600A / 2000A / 2500A / 3150A / 4000A /
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>[mm]</td>
<td>31.5kA (650mm)</td>
<td>40kA (1000mm)</td>
</tr>
</tbody>
</table>

Width (w) 632 - 641 (very end) 982 - 991 (very end)
Height (h) 931 1039
Depth (d) 934 969

Warning!

High voltage dangerous! Always observe the instruction manual and follow the rules.
Internal Wiring Diagram

Withdrawable

S1~S3: Energy storing travel switch
BC: Electromagnet for locking (optional)
TC: Opening coil
S4: Electromagnet for locking auxiliary switch
CC: Closing coil
V1~V4: Rectifier
S5: Auxiliary switch
KO: Anti-pumping relay (optional)
ZC: Electromagnet for locking truck (optional)
S8: Limit switch (testing position)
M: Energy storing motor
S9: Limit switch (working position)

Notes
1. This wiring diagram describes that a breaker is uncharged and is in an opening state, and the handcart is in the testing position.
2. The polarity in dashed frame should be consistent when the operation voltage is direct current.

Technical Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Data</th>
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<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
<td>3.3kV</td>
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<tr>
<td>Rated current</td>
<td>A</td>
<td>630/1250/1600/2000/2500/3150/4000 (1)</td>
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<tr>
<td>Rated power frequency withstand voltage (1min)</td>
<td>kV</td>
<td>28</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (peak values)</td>
<td>kV</td>
<td>75</td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>kA</td>
<td>25/31 5/40</td>
</tr>
<tr>
<td>Rated short time withstand current (3s)</td>
<td>kA</td>
<td>25/31 5/40</td>
</tr>
<tr>
<td>Rated peak withstand current</td>
<td>kA</td>
<td>65/82/104</td>
</tr>
<tr>
<td>Rated peak making current</td>
<td>kA</td>
<td>65/82/104</td>
</tr>
<tr>
<td>Capacitor bank switching current</td>
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<td>Electrical endurance</td>
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<td>274(E2)</td>
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<tr>
<td>Mechanical endurance</td>
<td>No. of times</td>
<td>10,000 (M2)</td>
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<tr>
<td>Operating cycle</td>
<td>No. of times</td>
<td>O-0.36-CO-15s-CO</td>
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<tr>
<td>Rated auxiliary control voltage</td>
<td>V</td>
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</tr>
<tr>
<td>Opening time</td>
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<tr>
<td>Breaking time</td>
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<td>25–35</td>
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<tr>
<td>Closing time</td>
<td>ms</td>
<td>30–70</td>
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(1) 4000A is 3150A VCB with force cooling
### Ordering Information

#### Coding System of Vacuum Circuit Breaker

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meanings</th>
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<tbody>
<tr>
<td>SEP</td>
<td>SEP SecoVac VB2 Plus</td>
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<table>
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</table>

#### Meanings of Code

- **SEP**: SEP SecoVac VB2 Plus
- **06**: Rated voltage: 12kV
- **12**: Rated voltage: 17.5kV
- **12**: Rated current: 630A
- **16**: Rated current: 1250A
- **20**: Rated current: 1600A
- **25**: Rated current: 2000A
- **31**: Rated current: 2500A
- **40**: Rated current: 3150A
- **40**: Rated current: 4000A
- **25**: Rated short-time withstand current: 25kA
- **31**: Rated short-time withstand current: 31.5kA
- **40**: Rated short-time withstand current: 40kA
- **1**: Motor voltage: AC110
- **2**: Motor voltage AC125
- **3**: Motor voltage: AC220
- **4**: Motor voltage: DC110
- **5**: Motor voltage: DC125
- **6**: Motor voltage: DC220
- **1**: Operation voltage: DC24
- **2**: Operation voltage: DC30
- **3**: Operation voltage: DC36
- **4**: Operation voltage: DC48
- **5**: Operation voltage: DC60
- **6**: Operation voltage: DC110
- **7**: Operation voltage: DC125
- **8**: Operation voltage: DC220
- **9**: Operation voltage: AC110
- **A**: Operation voltage AC125
- **B**: Operation voltage AC12C
- **C**: Operation voltage AC220
- **1**: Fixed
- **2**: With anti creep
- **3**: With anti creep
- **4**: With anti creep
- **1**: With open-cut and cart blocked
- **2**: With open-cut blocked, without cart blocked
- **3**: Without open-cut blocked, with cart blocked
- **4**: Without open-cut blocked, without cart blocked
- **0**: Without 2nd tripping coil
- **1**: With 2nd tripping coil
Certificates

**TIC 2025-11**
TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a metal-enclosed Switchgear unit

**TIC 2026-11**
TYPE TEST CERTIFICATE OF SWITCHING PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a metal-enclosed Switchgear unit

**TIC 2028-11**
TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE
A metal-enclosed Switchgear unit, incorporating a three-phase moulded-case withdrawable vacuum circuit-breaker

**TIC 2029-11**
TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE
A metal-enclosed Switchgear unit, containing a three-phase moulded-case withdrawable vacuum circuit-breaker and a three-phase earthing switch

**TIC 2031-11**
TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE
A three-phase air-insulated earthing switch in a metal-enclosed Switchgear unit

**TIC 2032-11**
TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a metal-enclosed Switchgear unit

**TIC 2033-11**
TYPE TEST CERTIFICATE OF SWITCHING PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a test rig

**TIC 2030-11**
TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a metal-enclosed Switchgear unit

**TIC 2442-11**
REPORT OF PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a metal-enclosed Switchgear unit

**TIC 2443-11**
REPORT OF PERFORMANCE
A three-phase moulded-case withdrawable vacuum circuit-breaker in a test rig
Protection and control

F650 – Feeder Protection and Bay Controller System

Monitoring and Metering
- Fault locator, record of last 10 faults - metering, current, voltage, power, energy, frequency and harmonics
- Breaker operation and trip failure
- Total breaker arcing current
- Event recorder - 479 events
- High resolution oscillography and data logger, with programmable sampling rate
- Metering: V - I - Hz - W - VA - PF
- Demand: Ia - Ib - Ic - Ig - Isg - I^2 - MW - MVA
- Configurable graphical HMI interface
- Alarm panel

Protection and Control
- Time, instantaneous & directional phase, neutral, ground and sensitive ground overcurrent
- Manual close with cold load pick-up control via PLC, forward power and directional power units
- Load encroachment supervision
- Wattmetric ground fault detection
- Positive and negative sequence based over/undervoltage elements
- Four-shot auto-recloser with synchronism check
- Breaker control and breaker failure
- Abnormal frequency protection (rate of change, under- and overfrequency)
- Broken conductor and locked rotor
- Synchrocheck - V and Hz
- Up to 64 programmable digital inputs and up to 16 digital outputs
- Trip circuit supervision

EnerVista™ Software
- Sophisticated software for configuration and commissioning
- Document and software archiving
- EnerVista™ integrator providing easy integration of data in the F650 into new or existing monitoring and control systems

Find out more on
http://www.gedigitalenergy.com/multilin/catalog/F650.htm
http://www.gedigitalenergy.com/multilin/catalog/3Series.htm

SR3 MV Protection System

SR350
Feeder Protection
Features:
- 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

SR345
Transformer Protection
Features:
- Dual slope, dual breakpoint characteristic restrained differential
- Second harmonic inrush and fifth harmonic over-excitation inhibits
- Instantaneous differential
- Restricted ground fault
- Thermal model
- Neutral timed and instantaneous overcurrent
- Phase and ground timed and instantaneous overcurrent
- Negative sequence timed overcurrent
- Breaker failure
- Logic elements

SR339
Motor Protection
Features:
- Thermal model biased with RTD and negative sequence current feedback
- Phase and ground TOC and IOC
- Start supervision and inhibit
- Mechanical jam
- Current unbalance
- Undervoltage / Overvoltage
- Underfrequency / Overfrequency
- Voltage phase reversal
- Acceleration time
- Undercurrent / Underpower
- Starts per hour

User Interface
- 4 line display for easy viewing of key data
- 10 LED indicators for quick diagnostics
- Front USB and rear RS485 serial communications
- Multiple communication protocols: IEC 61850 IEC 61850 GOOSE, MODBUS TCP/IP, MODBUS RTU, DNP 3.0, IEC 60870-5-104, IEC 60870-5-103

Find out more on
http://www.gedigitalenergy.com/multilin/catalog/SR345.htm
Value added services
Make your life easier

From presale to operation of your plant

- Customized panel solution for substation protection and control applications
- Automation projects. Real-time protection and control monitoring
- On-site field services. Testing and consulting
- IEC 61850 Process Bus projects
- Relay performance studies, selectivity studies and settings calculation
- System integrity protection schemes (SIPS), also called Power System Protection (PSP) or Wide Area Protection schemes
- Special real-time tests for all protection applications in an electrical network
- Advanced training services. Standard or customized trainings at customer premises or in our training facilities located all over the world.
- CT and VT calculation
- Troubleshooting on power systems
- Overall project management.
- Plug & Play complete solution cubicle, relays, control, system, integration to/from other systems (DCS or NCC).
Industrial Solutions (formerly Power Protection) a division of GE Energy, is a first class global supplier of low and medium voltage products including wiring devices, residential and industrial electrical distribution components, automation products, enclosures and switchboards. Demand for the company’s products comes from wholesalers, installers, panelboard builders, contractors, OEMs and utilities worldwide.

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