DVCAS-38
38 kV UL Listed Arc-resistant Switchgear for Wind Turbines

Make the most of your energy™
A comprehensive offer
The DVCAS range is part of a comprehensive offer of products that are perfectly coordinated to meet medium-voltage electrical distribution requirements.

All of these products have been designed to work together: electrical, mechanical, and communication compatibility. The electrical installation is thus both optimized and has improved performance:

- better service continuity
- increased personnel and equipment safety
- guaranteed upgradeability
- efficient monitoring and control

Tools for facilitating the design and installation
With Schneider Electric you have a complete range of tools to help you get to know and install the products while complying with current standards and working practices. These tools, technical sheets and guides, design software, training courses, etc., are regularly updated.

Schneider Electric is partnering with its customers to produce optimized, protection-focused, upgradeable, and compliant installations.

For a real partnership with you
A universal solution doesn't exist — each electrical installation is specific. The variety of combinations from our offer allows you to truly customize the technical solutions for your installation. You are able to express your creativity and personalize when designing, manufacturing, and exploiting an electrical installation.
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**Field of application**

**Wind farms**
DVCAS switchgear functional groups have been designed as compact units, and built as the union of modular switchgear. Each functional unit contains all the necessary equipment for the protection and connection of the transformer of each wind generator to the MV network of the wind farm.

**DVCAS**
DVCAS switchgear has been specifically designed to meet all the needs of networks up to 38 kV, inside wind farms. The DVCAS switchgear can be installed in wind farms up to 6,561 ft./2,000 m above sea level.

**CBGS-0**
38 kV CBGS-0 switchgear is the perfect complement for DVCAS, in the MV/HV collecting substations of wind farms.

**New wind farms 38 kV x Multi MW**
The continuous technological development in wind farms leads to new challenges, for which DVCAS is the best solution.
- Rated power of wind generators: constant growth
- Medium-voltage networks: 38 kV is the dominant trend
- Installation inside the towers: size restrictions

Wind farms present special erecting conditions, and a critical aspect in their design is the size of the doors which give access to wind generators.

Medium-voltage switchgear is usually installed inside the wind generators, so their design must allow enough access through the door in case replacement is needed.

DVCAS switchgear can go through doors that are a minimum of 23.6 in./600 mm wide.
DVCAS
General overview

Wind farms

| Wind farms | DVCAS switchgear benefits from the accumulated experience gathered by Schneider Electric for more than 65 years in the design and manufacturing of MV and HV equipment. Schneider Electric has supplied MV switchgear for more than 550 wind farms all over the world. Gamesa™, Vestas™, Suzlon™, Nordex™, Siemens™, Alstom™, and Acciona are some of the main manufacturers of wind generators who already equip their wind turbines with switchgear made by Schneider Electric. Such references place Schneider Electric as the world leader in wind power applications for MV switchgear. Experience in wind farms

- More than 15,000 wind turbines
- More than 550 collecting substations
- More than 27,500 MW

Advantages of the DVCAS range

- Maximum availability: service continuity
- Can fit through narrow (600 mm) doorway
- Maximum safety conditions for staff personnel
- Designed from the ground up for wind turbine applications
- Certificates: IEC®, ANSI/IEEE®, and UL® Listed
- Environmentally friendly: ISO 14001:2004
- Simple installation
- Superior engineering
- No exposed connections
- Full mechanical interlocks ensure proper switching of circuits
- Easily take transformer/turbine out of service without taking down other units
- Arc-resistant for added safety
- Schneider Electric services

Choosing DVCAS switchgear ensures the experience of a world leader in the field of wind power.

World-wide leadership ... and still growing

Countries

<table>
<thead>
<tr>
<th>Countries</th>
<th>Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
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<td>United States</td>
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<tr>
<td>Greece</td>
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</tr>
</tbody>
</table>
**Environment**

A strict policy of materials management throughout the whole manufacturing process allows the traceability of the product, ensuring that no pollutants are released into the environment.

**No emissions**

Schneider Electric is highly committed to the protection of the environment. As a part of this commitment, DVCAS switchgear has been designed to be environmentally friendly.

Due to the level of tightness of the cubicles, DVCAS switchgear may be classified as "sealed pressure systems" according to the definition established in the standards. At the materials used — the conductors as well as the insulators — can be clearly identified and are easy to separate.

At the end of its life, DVCAS switchgear can be processed and recycled. Their components can be recovered by following the directions given by the European legislation regarding end-of-life of electrical and electronic products.

The environmental management system followed by Schneider Electric is certified according to the established requirements of the ISO 14001:2004 standard.

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**International standards**

**Design: certified as per IEC and ANSI standards**

DVCAS switchgear has been designed and certified according to the following standards.

- Common specifications for switchgear IEC 62271-1
- Arc-resistant switchgear complies with IEC Internal Arc 62271-200
- Circuit breakers IEC 62271-100
- Disconnectors and grounding switches IEC 62271-102
- Switch-disconnectors IEC 62271-103

DVCAS-38 switchgear from Schneider Electric is designed, manufactured, and tested in accordance with the following ANSI standards:

- C37.04
- C37.06
- C37.09
- C37.20.2
- C37.20.3
- C37.20.4
- C37.57
- C37.58

**Manufacturing: accurate and systematic control**

The quality system followed for the design and manufacturing of DVCAS switchgear has been certified in accordance with the requirements of the ISO 9001:2000 quality standard.

For quality control purposes, each DVCAS switchgear undergoes systematic routine tests during its manufacturing process.

The results of all these controls are recorded and are a part of the test certificate which each switchgear has available.
DVCAS
General overview

Compact and modular
For its standard wind power application, DVCAS switchgear can be composed of up to four interconnected modular functional units, thus forming the most commonly used wind power functional group.
Each of the modular function is composed of:
• Metal base frame
• Operating mechanism and relay compartment
• MV cable compartment
• Stainless steel, gas-tight cubicle which uses SF6 gas as insulating medium and houses the busbar system and the circuit breaking devices
One of the advantages of the DVCAS switchgear design is the low pressure of SF6 gas inside the cubicle.
The busbar system is interconnected between functions by means of single-phase coupling bushings made of screened elastomeric insulation.
DVCAS switchgear is supplied as a complete functional group; the different functional units are assembled at the factory.
Such configuration provides the user with the advantages of a compact architecture and modularity at the same time.

<table>
<thead>
<tr>
<th>General electrical/Constructive data</th>
<th>Hz</th>
<th>60</th>
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<tbody>
<tr>
<td>Frequency</td>
<td></td>
<td>38</td>
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<tr>
<td>Rated voltage</td>
<td>kV</td>
<td>38</td>
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<tr>
<td>Insulation level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power frequency withstand voltage</td>
<td>kV</td>
<td>60</td>
</tr>
<tr>
<td>Lightning impulse withstand voltage</td>
<td>kV peak</td>
<td>150</td>
</tr>
<tr>
<td>Rated current of the main busbar</td>
<td>A</td>
<td>600</td>
</tr>
<tr>
<td>Short time withstand current</td>
<td>kA/s</td>
<td>20/2</td>
</tr>
<tr>
<td>Short circuit breaking current capacity</td>
<td>kA</td>
<td>20</td>
</tr>
<tr>
<td>Short circuit making capacity</td>
<td>kA peak</td>
<td>50</td>
</tr>
<tr>
<td>Internal arc withstand IAC AFL</td>
<td>kA/1s</td>
<td>20</td>
</tr>
<tr>
<td>Degree of protection</td>
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<td></td>
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<tr>
<td>HV compartment</td>
<td>NEMA®/NEMA TYPE/IP</td>
<td>6/67</td>
</tr>
<tr>
<td>LV and operating mechanism compartment</td>
<td>NEMA TYPE/IP</td>
<td>6P/3X</td>
</tr>
<tr>
<td>SF6 gas pressure at 20 °C</td>
<td>PSI/bar</td>
<td>4.35/0.3</td>
</tr>
</tbody>
</table>

For other values, please consult Schneider Electric.
Definition depending on the type of switchgear:
D Circuit breaker
I Three-position switch-disconnector
T Riser with grounding switch
0 Rigid riser to busbar system

Definition depending on the coupling possibilities:
NE Non-extendable
LE Extendable on the left
RE Extendable on the right
DE Extendable on both sides

Modular functions
Considering the special characteristics of the MV collecting networks most commonly used in wind farms, the units that are going to be installed must provide the following functions:

- Outgoing line to the following wind generator (*)
- Incoming line from the preceding wind generator (**)
- Transformer protection

The union of the different functional units creates a series of standard configurations. Such configurations represent the whole range of specific solutions for wind farms' usual needs.

(*) The following wind generator is the nearest to the substation.
(**) The preceding wind generator is the farthest from the substation.

Range of DVCAS Modules
The combination of functional units and coupling possibilities form the particular range of functional units, with different versions depending on their performance.

Standard configurations

Special configurations

Combination of cubicles
Combination of functions
Depending on the number of entrances or exits in each wind turbine, it may be necessary to utilize different functional groups similar to those shown below.

Recommended functional groups

DVCAS-38 kV NE (D + 0)
Transformer protection + Outgoing line

DVCAS-38 kV NE (I + D + 0)
Incoming line + Transformer protection + Outgoing line

DVCAS-38 kV NE (I + I + D + 0)
2 x Incoming line + Transformer protection + Outgoing line

A rigid riser of cables is recommended for the outgoing line to the following wind generator (0). To better provide for maintenance and commissioning of the wind farm, it is recommended that a three-position switch-disconnector (I) be utilized.
DVCAS Functional groups

Each modular switchgear with protection function D is composed of:
- Metal base frame
- Operating mechanism and relay compartment
  - disconnector operating mechanism
  - operating mechanism of the circuit breaker
  - protection relay VIP
  - zero sequence current transformer CSH 30
  - motor for the operating mechanism of the circuit breaker (optional)
- MV cable compartment
  - bushings for cable connection
  - three CRc current sensors per phase
- Stainless steel, gas-tight tank
  - busbar system
  - three-position disconnector
  - circuit breaker

There are two options, depending on the number of riser-to-busbar-through-bushing combinations.

Any connection of functional units, type I or T, is always performed on the left.

In case of no connection on the left of function D, the inner cones will be provided with insulating caps.

DVCAS switchgear is supplied with a vacuum circuit breaker which complies with the requirements of IEEE C37.54 standard.

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**Electrical data of circuit breakers**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Hz</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>kV</td>
</tr>
<tr>
<td>Insulation level</td>
<td></td>
</tr>
<tr>
<td>Power frequency withstand voltage (50 – 60 Hz/1 min.)</td>
<td>kV</td>
</tr>
<tr>
<td>Lightning impulse withstand voltage (1.2/50 μs)</td>
<td>kV peak</td>
</tr>
<tr>
<td>Rated current</td>
<td>A</td>
</tr>
<tr>
<td>Short time withstand current</td>
<td>kA/s</td>
</tr>
<tr>
<td>Short circuit breaking current capacity</td>
<td>kA</td>
</tr>
<tr>
<td>Short circuit making capacity</td>
<td>kA peak</td>
</tr>
<tr>
<td>Operation sequence</td>
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</tr>
<tr>
<td>Electrical endurance</td>
<td>Class</td>
</tr>
<tr>
<td>Mechanical endurance</td>
<td></td>
</tr>
<tr>
<td>Class operations</td>
<td></td>
</tr>
</tbody>
</table>

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**Protection chain**

**Protection systems characteristics**

For its usual wind power application, DVCAS switchgear is provided with a protection system which allows operation without the need of auxiliary power supply.

The system comprises:
- Three CRc current sensors per phase, which are toroidal type.
- Homopolar current sensor CSH 30, which is toroidal-shaped and is mounted on the rear of the VIP relay.
- Electronic relay VIP
  - It is fitted on the front operating mechanism panel and is protected by a transparent cover, which gives the unit a degree of protection IEC IP54/NEMA Type 12.
  - Main electrical characteristics:
    - protection against phase-to-phase faults
    - protection against ground faults
    - no need for auxiliary power supply
- Tripping coils
  - DVCAS switchgear with circuit breaker is standard equipped with two tripping coils:
    - Mitop coil: self-powered through relay
    - YO1 coil for external tripping

**Indications: reliability**

A viewing window is located on the top of the enclosure to allow verification of the disconnector position as required by IEEE C37.57.
Protection function D

Interlocks
In the design of both the circuit breaker and the disconnector, all possible operating conditions have been taken into account to provide maximum protection for operating personnel. Functional interlocking is provided to prevent possible inappropriate operation of the switchgear.

Combination of circuit breaker and disconnector
Whenever the selector of the disconnector is not in neutral position, any mechanical or electrical operations on the circuit breaker are not possible.
Also, when the disconnector is grounded, no electrical operations on the circuit breaker can be performed. Additionally, any operation on the three-position disconnector is not possible whenever the circuit breaker is closed.

Access to MV cables and transformer compartment
Protection function has, as an option, a key that is free when this function is grounded. Moreover, access to MV compartment is not allowed while protection function is not circuit breaker or on the grounding switch. The interlocks also work when the MV cable panel is removed.

Three-position disconnector
DVCAS switchgear is provided with a three-position disconnector, which meets the requirements of IEEE C37.32 and IEEE C37.38 standards for disconnectors and grounding switches.

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>kV</th>
<th>38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power frequency withstand voltage (50 Hz/1 min.)</td>
<td>kV</td>
<td>60</td>
</tr>
<tr>
<td>Lightning impulse withstand voltage (1.2/50 μs)</td>
<td>kV peak</td>
<td>150</td>
</tr>
<tr>
<td>Rated current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short time withstand current</td>
<td>kA/s</td>
<td>20/2</td>
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<tr>
<td>Disconnecter</td>
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<td></td>
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<tr>
<td>Electrical endurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical endurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-load Making</td>
<td></td>
<td></td>
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<tr>
<td>Grounding switch (through circuit breaker)</td>
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<td></td>
</tr>
<tr>
<td>Short circuit making capacity</td>
<td>kA peak</td>
<td>50</td>
</tr>
<tr>
<td>Mechanical endurance</td>
<td></td>
<td></td>
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<tr>
<td>Operations</td>
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<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td>1,000</td>
</tr>
</tbody>
</table>

The speed of all opening and closing operations depends on the operator’s performance. The short circuit making capacity is performed by means of the circuit breaker on both extreme positions of the disconnector, that is, busbar and ground.

Operation
The three-position disconnector is always manually operated by means of a handle. The function (admissible operation on the disconnector) is selected by means of a flag-type selector.
Outgoing line function 0

**Rising function: 0**

For safe access to MV cables in the 0 function, the grounding switch of the following wind generator must be previously grounded.

The modular switchgear DE-0 can also be used as an outgoing line allowing two MV cables per phase.

**Every modular switchgear with outgoing line function 0 consists of:**
- Metal base frame
- Voltage presence indicator
- MV cable compartment
  - bushings for cable connection
  - clamps for MV cable fastening

**Rising function with grounding switch 000T (0T + 0T + 0T)**

In some cases, a grounding switch is required for the incoming-outgoing lines of the wind generator. A functional module DVCAS RE-0T can be used. This module permits the connection of up to three cables per phase for incoming and outgoing lines.

Adequate interlocks must be used in order to avoid any unintentional grounding of the whole MV circuit under voltage.

The components of this module are the same as those of the incoming line function I, except for the associated elements to the switch function, which are not included in this unit.
Incoming line function I

Switch-disconnector function I

A modular DVCAS switchgear with a three-position switch-disconnector is recommended for the incoming line function from the preceding wind generator in MV networks of wind farms I, because it:

- reduces breakdown time caused by faults
- helps fault detection
- reduces interruptions due to maintenance work
- improves energization works

Each modular switchgear with line function I consists of:

- metal base frame
- operating mechanism compartment
  - operating mechanism of the switch-disconnector
  - motor for the operating mechanism (optional)
- MV cable compartment
  - bushings for cable connection
- stainless steel, gas-tight tank
  - busbar system
  - three-position switch-disconnector

There are two options, depending on their interconnection possibilities: RE-I, and DE-I. Function I is always connected to protection function D on the right by means of single-phase coupling bushings made of elastomeric screened insulation.

Characteristics

DVCAS switchgear is provided with a three-position switch-disconnector, which meets the requirements of IEEE C37.32 standard for switches and IEEE C37.38 standard for disconnectors and grounding switches.

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>Hz</th>
<th>kV</th>
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<tr>
<td>Frequency</td>
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<td>Insulation level</td>
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</tr>
<tr>
<td>Power freq. with voltage (50 Hz/1 min.)</td>
<td>kV</td>
<td>60</td>
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<tr>
<td>Lightning imp. with voltage (1.2/50 μs)</td>
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<td>Switch-disconnector</td>
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<tr>
<td>Grounding switch</td>
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<tr>
<td>Short time withstand current</td>
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<td>20/2</td>
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<td>Short circuit making capacity</td>
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<tr>
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<td>5</td>
</tr>
<tr>
<td>Mechanical endurance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Flair fault detectors are fitted on the incoming line, providing an advanced management of the MV network in wind power plants.

Maximum efficiency is achieved when MV switch-disconnectors incoming lines are motor operated.

In this way, faults can be detected and service immediately restored in the unaffected part of the network.
DVCAS
Functional groups

Incoming line function I

Switch-disconnector
The breaking system uses the autopneumatic “puffer” technique of SF₆ gas onto the contacts separation area.

Operation
The speed of all opening and closing operations is independent of the operator’s action (except for the grounding switch opening).
The three-position switch-disconnector is always manually operated by means of a handle.
Optionally, the operating mechanism of the switch function can be motorized and the handle can be anti-reflex type.
The optional motorization kit can also include a battery charger-rectifier in order to allow switch-disconnector operation even in case of loss of auxiliary voltage.
This function, combined with the fault detector’s Flair and the protections in the collecting substation, permits remote fault isolation and gradual service restoration.

Indication: reliability
The indication system for the switch-disconnector position is highly reliable as it complies with the specifications of IEEE C37.38.

Interlockings
In the design of the switch-disconnector, all possible operating conditions have been taken into account to ensure maximum protection for the operators and the installation.
The architecture of the switch-disconnectors used in DVCAS switchgear is of the three-position type (closed/opened/grounded), which, by design, avoids the possibility of inappropriate operation.

Access to MV cable compartment
It is always interlocked with the switch-disconnector in the grounded position. So the cover of this compartment can only be opened in this position.
An interlock by key lock can be supplied optionally, where the key is released with the grounding switch in closed position.

1 Fixed contact “switch in closed position”
2 Mobile contact fingers
3 Switch chamber
4 Fixed contact “grounding switch in closed position”
5 Handle
6 Flexible connection
General description
VIP 35 relays have the optimum design for transformer protection in transformer substations of wind farms. They are provided with phase functions (50-51) and ground functions (50N). They are self-powered relays (no external auxiliary voltage is required), which are fed by toroidal current sensors, CRc type, fitted on the bushings for MV outgoing cables to the transformer. The VIP 35 relay operates on the circuit breaker by means of a tripping (coil), Mitop type. The relay is usually placed on the operating mechanism front panel of the DVCAS switchgear, protected by a transparent cover which can be lead-sealed to prevent unauthorized access. The whole assembly has a degree of protection IP54/NEMA 12.

Phase protection Is (50-51)
Phase protection is provided by a time-dependent curve which operates at 1.2 times the operating current (Is).
Phase current is measured by means of three CRc toroidal sensors which are usually fitted on the bushings for MV cable connection.
Phase operating current is adjusted on the front, using rotary switches.
Settings are made according to the transformer rating and the operating voltage.
Operating threshold can be adjusted from 8 A to 80 A or from 20 A to 200 A.

\[ I_s (A) \geq \frac{\text{Transformer rating (kW)}}{\sqrt{V_{\text{op}}}} \]

I_s regulation

### S1-S2 (200/1)

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>Rated Service</th>
<th>1500</th>
<th>1750</th>
<th>2000</th>
<th>2250</th>
<th>2500</th>
<th>2750</th>
<th>3000</th>
<th>3250</th>
<th>3500</th>
<th>3750</th>
<th>4000</th>
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</tbody>
</table>

(*) Transformer power only.

### S1-S3 (500/1)

<table>
<thead>
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<th>Voltage (kV)</th>
<th>Rated Service</th>
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<th>2000</th>
<th>2250</th>
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<th>3500</th>
<th>3750</th>
<th>4000</th>
<th>4250</th>
<th>4500</th>
<th>4750</th>
<th>5000</th>
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<td>79</td>
<td>83</td>
<td>88</td>
</tr>
</tbody>
</table>

(*) Transformer power only.
Ground protection
Protection relay VIP 35

\( I_0 \) (50N)
Ground protection works by means of a curve at independent time. Measurement is carried out by a CSH 30 core balance CT, mounted on the back of the VIP 35. This toroidal measures the residual current based on the sum of the sensor secondary currents.

Time delay \( t_0 \) can be set in a range between 0.1 s and 1 s.

Phase current \( I_0 \) and time delay settings are done on the front of the relay, with the corresponding rotary switches.

The VIP 35 relay is supplied with a selector switch (ON-1s) which starts up the inrush current delay. This time delay prevents tripping from the ground protection when the transformer is energized if \( I_0 \) and \( t_0 \) settings are low.

When this selector switch is in “ON” position and 1 s after the transformer has been energized, ground protection is time delayed as per the selected setting \( t_0 \).

Although VIP 35 relays can perform an adequate protection function in wind farms, a DVCAS switchgear can be optionally supplied with other relays, like the VIP 300 or any of the models of the Sepam™ relay range.

VAP 6
Relay tester
VIP relays have a test plug for VAP 6 unit connection. This testing unit allows:

- Injecting an electrical signal, two pushbuttons are used to check that the short circuit and zero sequence fault current protection devices are operating.
- An extra pushbutton may be supplied to inhibit tripping of the circuit breaker.

\( I_s \) regulation

- **Recto (S1 – S2 wiring)**
- **Verso (S1 – S3 wiring)**
Advanced management of wind farms

The Schneider Electric Easergy™ fault detection system can provide advanced management of the wind farm distribution system.

The Easergy fault indicators assist to find the fault quickly to help restore the system to normal operation with minimum downtime.

DVCAS is the only switchgear for wind turbines to offer this as a factory option.

Easergy fault indication system

Easergy fault sensors and indicators are integrated into the DVCAS switchgear at the factory, saving time and money on installation of a fault indicator system at the wind farm.

Easergy is also available as a separate stand-alone fault indicating system for which includes sensors to overhead and underground fault locating, directional fault sensing, communications, and remote monitoring software.

Remote communications and control

Communications to a remote monitoring or SCADA system can be provided using Modbus or DNP 3.0.

When an incoming line apart from the Flair indicator has the optional battery charge rectifier and motor operator, the switch-disconnector will be able to isolate a fault remotely.

By the time the fault is isolated, the affected wind farm line will be ready for reconnection to the grid.
The MV cable compartment contains the following elements:
- panel for access to the compartment
- warning signal for electrical hazard
- voltage presence indicators
- three C type bushings (600 A/25 kA/screwed M16)
- fastening system (clamps) for MV cables
- ground busbar

Apart from the visual safety elements (voltage indicators and electrical hazard signal), the access panel of the MV cable compartment is provided with the necessary interlockings to promote proper operation.

For all functions (D + I + T), the panel can only be removed when the corresponding grounding switch is in closed position.

Because there is no grounding switch with the O function, tools are required to remove the MV cable compartment panel. Optional key interlocking to coordinate with other grounding switches can be provided.

**Bushings**

Particularly, the bushing used in all the functions of DVCAS switchgear is type C with an M16 thread, in compliance with the EN 50181 standard. Values are 600 A rated current and 20 kA short circuit current.

All the bushings made of epoxy resin undergo routine dielectric tests at power frequency as well as partial discharge tests.

**Connectors**

DVCAS switchgear is designed with bushings that can only be connected by “T” type screwed connectors of the range 38 kV/600 A/20 kA.

Although in its most common application in wind farms, DVCAS switchgear is supplied with only one MV cable per phase, they can allow connection for up to two cables per phase.

**Selection chart of connectors**

<table>
<thead>
<tr>
<th>General characteristics</th>
<th>Range</th>
<th>Section (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geometry</strong></td>
<td>“T” shaped</td>
<td></td>
</tr>
<tr>
<td><strong>Screened</strong></td>
<td>Grounded</td>
<td></td>
</tr>
<tr>
<td><strong>Inner profile</strong></td>
<td>C type</td>
<td></td>
</tr>
<tr>
<td><strong>Screwed connection</strong></td>
<td>M16</td>
<td></td>
</tr>
<tr>
<td><strong>Rated and testing voltage</strong></td>
<td>38/70/170 kV</td>
<td></td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td>600 A</td>
<td></td>
</tr>
<tr>
<td><strong>Short time withstand current</strong></td>
<td>20 kA/3 s</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manufacturer (examples)</th>
<th>Range</th>
<th>Section (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prysmian</td>
<td>PMA-5/400/38 AC</td>
<td>240 mm²</td>
</tr>
<tr>
<td>Tyco</td>
<td>RSTI-88</td>
<td>300 m²</td>
</tr>
</tbody>
</table>