

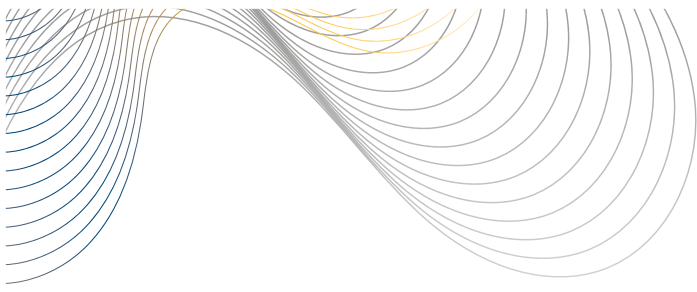


TRUST. WELL EARNED.

Switchgear Products

At the forefront of
switchgear design





TRUST. WELL EARNED.

Switchgear Products

Providing global switchgear solutions

BRUSH Switchgear (the trading name of Hawker Siddeley Switchgear) is a leading manufacturer of highly reliable medium voltage indoor and outdoor AC and DC switchgear.

BRUSH Switchgear provides cutting-edge solutions and excellent customer service across a range of market sectors worldwide.

With over 130 years' expertise, BRUSH Switchgear has a reputation for innovation, first class product performance and delivering high service standards to our customers in the major utilities, industrial, transport and infrastructure sectors across the world.

Our award winning magnetic actuator technology and electromagnetic spring innovations are widely acclaimed developments which provide BRUSH with a leading edge in circuit breaker technology.

Our state-of-the art manufacturing facility, highly skilled workforce and innovative Switchgear Technology Centre, all located on one site in South Wales, are the foundations upon which our success is based as we continue to drive innovation and growth in the future.





TRUST. WELL EARNED.

Switchgear Products

BRUSH Switchgear offer AC and DC switchgear solutions to electrical distribution utilities and public and private sector end user organisations operating in a variety of market sectors.

At the heart of all of our products is our award winning magnetic actuator.

A technology that ensures reliability and long life with minimal requirement for maintenance.

AC Switchgear
Indoor

AC Switchgear
Outdoor

DC Switchgear



ECLIPSE

QUANTUM

BSR

SWR12



HORIZON

HORIZON COMPACT

GVR RECLOSER



LIGHTNING

SAFEB**OND**



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AC Switchgear - Indoor

BRUSH offer a complete range of AC Switchgear Indoor solutions for use throughout the distribution network for both primary and secondary applications.

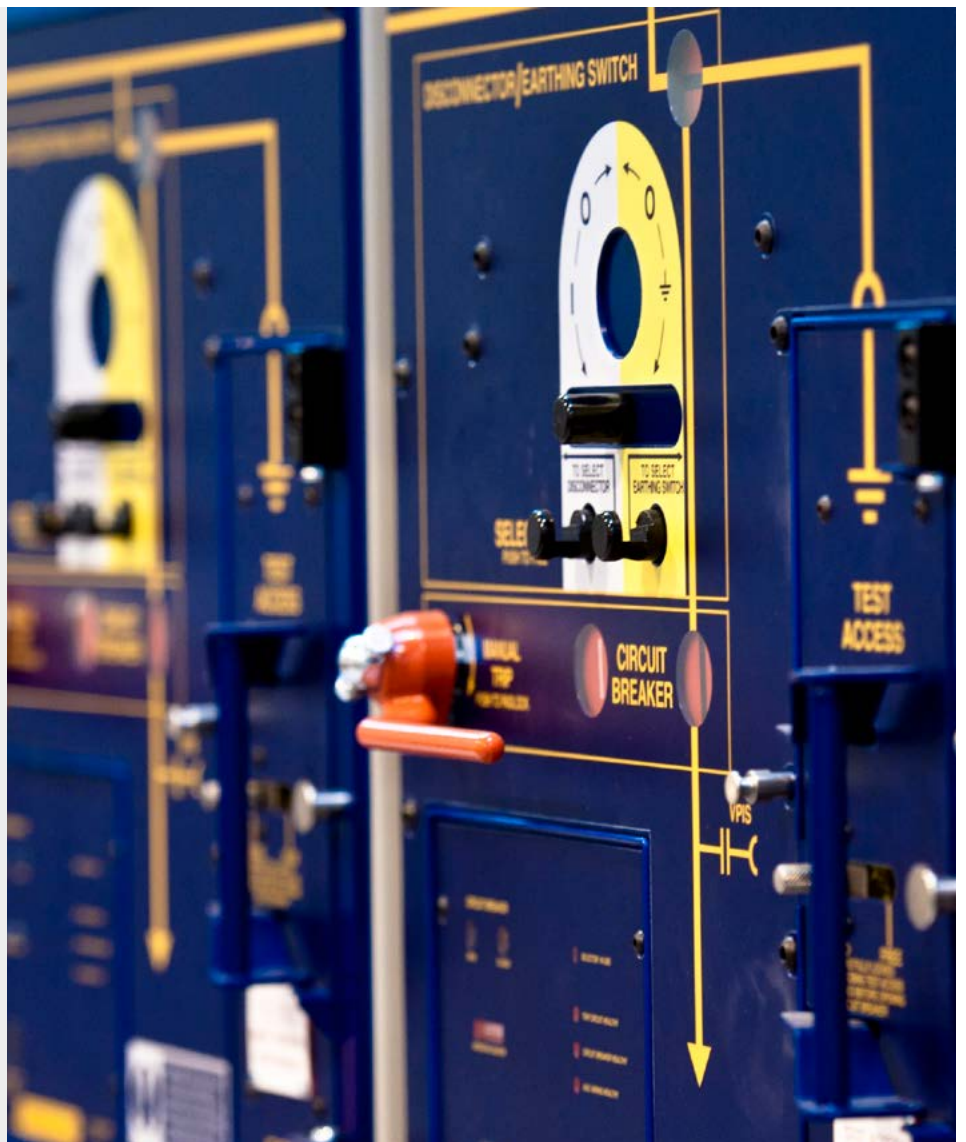
The product range comprises fixed pattern, air insulated metal clad panels with vacuum circuit breaker technology and a range of OEM designed retrofit products, enabling the removal of oil and SF₆ circuit breakers from our legacy products. The current voltage range is 3.3-15kV with standards meeting IEC and ANSI requirements.

ECLIPSE

QUANTUM

BSR

SWR12





ECLIPSE 12kV Fixed Pattern Indoor Metalclad Vacuum Switchgear

The Eclipse is designed to provide a lifetime of unrivalled service, bringing together one of the most advanced operating mechanisms available on the market today, the award-winning magnetic actuator technology.

Key Features

- Superior technology with minimal maintenance
- The fixed pattern design has the simplicity of air insulation and, with the low parts count (the total parts count has been reduced by a factor of x20 and the number of moving parts by a factor of x50), is more compact (500mm wide) than equivalent rated GIS equipment
- The Eclipse boasts of superior operator safety with a fully interlocked disconnect selector mechanism, animated front panel mimic and a front access cable test facility, eliminating the need for any intrusive access to high-voltage compartments
- The Eclipse is certified to IEC62271 and available as a pre-engineered solution in ratings up to 25kA, 2000A. Alternatively, it can be fully engineered to meet exact customers needs
- Environmentally friendly vacuum interrupters
- Internal arc containment
- Voltage Presence Indication System (VPIS) is fitted as standard to all panels (circuit)
- Award-winning magnetic actuator technology powered from substation battery via contactors
- Trip circuit supervision, self diagnostics & position indication contacts included as standard
- Customer's choice of protection

Ratings

Rated Normal Current
630/1250/2000A

Rated Voltage
12 kV

Rated Frequency
50 Hz

Rated BIL
75/95 kV pk

Rated Power Frequency Withstand
28/38 kV 1min

Rated Short-Time Withstand Current
20/25 kArms 3secs

Rated Peak Making Current
50/62.5 kA

Internal Arc Compliance
25 kA 1sec

Rated Short Circuit Breaking Current
20/25kA

Degree of Protection
IP4X

Single Capacitor Bank Breaking Current
400/1250A

Circuit Breaker Classification
E2, S2, C2

Auxiliary Operating Supply
125/110/48/30 V dc

Busbars Normal Current
1250, 2000A

Typical Weight
500 - 650kg

Ambient Air Temperature
-5 °C to +40 °C

Relative Humidity
<95%

Altitude
<1000m

Mechanical Endurance
M2, 10,000 operations





QUANTUM

12kV Fixed Pattern Indoor Metalclad Vacuum Switchgear

Quantum expands the BRUSH Switchgear portfolio of medium-voltage indoor switchgear with its deserved reputation for great reliability and low maintenance.

Maintaining all of the benefits of our award-winning magnetic actuator technology, Quantum delivers a technology refresh whilst retaining the simplicity of air insulation and vacuum technology in a fixed-pattern design and offers further space saving benefits with its integrated busbar CT design and top-mounted busbar earthing facility.

Fully certified to IEC 62271, Quantum is currently available with ratings up to 2000A, 25kA.

Key Features

- Compact design offering reduced footprint
- Reliable technology with minimal maintenance requirements
- IAC (AF and AFL) internal arc protection with rear venting
- Superior operating safety with fully interlocked front-access cable-test facility
- New design of integrated CT busbar bushing
- New design of top-mounted busbar earthing switch facility*
- Wide range of top and bottom entry cable connection options including separable 'C'-type connectors
- VPIS as standard on all circuits (mounted on fascia panel)
- Expandable LV top box for more complex solutions
- Resilient on-board electronics control module providing trip circuit supervision and self-diagnostics as standard

* Coming soon

Ratings

Rated Normal Current

Up to 2000A

Rated Voltage

12 kV

Rated Frequency

50 Hz

Rated BIL

75/95 kV pk

Rated Power Frequency Withstand

28/38 kV 1min

Rated Short-Time Withstand Current

25kA rms 3 secs

Rated Peak Making Current

62.5 kA

Internal Arc Compliance

25 kA 1sec

Rated Short Circuit Breaking Current

25kA

Degree of Protection

IP4X

Single Capacitor Bank Breaking Current

400A

Circuit Breaker Classification

E_2, S_2, C_2

Auxiliary Operating Supply

110 V dc

Busbars Normal Current

Up to 2000A

Typical Weight

500 - 700kg

Ambient Air Temperature

-5 °C to +40 °C

Relative Humidity

<95%

Altitude

<1000m

Mechanical Endurance

M2, 10,000 operations



BSR – The Retrofit Solution

The BSR is an OEM designed retrofit circuit breaker for both the BRUSH Switchgear VSI range of Oil Circuit Breakers and the VMV vacuum Circuit Breaker, to IEC 62271-100.

BRUSH Switchgear is proud of its heritage in the VSI, VTD & VMV range of switchgear, which continue to work at the highest standards today.

Technological advances have allowed us to improve further and offer our customers a circuit breaker that boasts the award-winning magnetic actuator technology with vacuum interrupters.

The BSR circuit breaker offers a new lease of life for existing switchgear with this effective retrofit solution.

The BSR is designed for 10,000 operations and a life expectancy of 30 years. It is designed for retrofitting into existing switchboards without the need for panel modification.

Key Benefits to Retrofit

- Superior, proven technology with minimal maintenance
- No civil works required and existing HV cabling remains undisturbed
- Improvement of Health & Safety by removal of oil
- Considerable life extension of the existing switchgear
- Lower owner costs through virtually no maintenance requirements and increased switchboard life expectancy
- Uses existing design of primary and automatic secondary contacts
- Improved panel interlocking to latest ENA requirements
- In addition to the retrofit of the circuit breaker BRUSH Switchgear can offer a more complete system solution to enhance the control and automation of the distribution network



Ratings

| | | |
|--|--|--------------------|
| Rated Voltage | kV | 12 |
| Normal Rated Currents | A 800,1600 | 630, 1250, 2000 |
| Lightning Impulse Withstand Voltage | kVP | 75/95 |
| Short Duration Power Frequency Withstand Voltage | kV | 28 |
| Rated Frequency | Hz | 50 |
| Rated Short-Time Withstand Current | kA(s) | 25 for 3 seconds |
| Rated Peak Withstand Current | kA Peak | 62.5 |
| Making Current (peak) | kA | 62.5 |
| Symmetrical Breaking Current | kA | 25 |
| Rated Auxiliary Voltages | V dc | 30, 48/50, 110/125 |
| Minimum opening time/closing time | ms | 33ms/76ms |
| Normal Operations | | 10,000 |
| Weight | Kg | 211 |
| Rated Operating Sequence | O-0.3s-CO-15s-Co | |
| Operating Mechanism Type | Dependent power closing (Magnetic actuator); Stored energy opening (Springs charged during closing stroke) | |



SWR12 – The Retrofit Solution

The SWR12 is an OEM designed retrofit circuit breaker for both the South Wales Switchgear C & D range Oil Circuit Breaker and the HG12 Gas Circuit Breaker, to IEC 62271 Series of Standards

BRUSH Switchgear is proud of its heritage in the C and D range of switchgear, which have provided continuously reliable service.

Technological advances have allowed us to improve further and offer our customers a circuit breaker that boasts the award-winning magnetic actuator technology along with removing the need for SF₆ gas.

The SWR12 circuit breaker, offers a new lease of life for existing switchgear, with this effective retrofit solution.

Employing award-winning magnetic actuator technology with vacuum interrupters, the SWR12 is designed for 10,000 operations and a life expectancy of 30 years. It is designed for retrofitting into existing switchboards without the need for panel modification.

Key Benefits to Retrofit

- Superior, proven technology with minimal maintenance
- No civil works required and existing HV cabling remains undisturbed
- Improvement of Health & Safety by removal of Oil or SF₆ gas
- Considerable life extension of the existing switchgear
- Lower owner costs through virtually no maintenance requirements and increased switchboard life expectancy
- Uses existing design of primary and automatic secondary contacts
- Improved panel interlocking to latest ENA requirements
- In addition to the retrofit of the circuit breaker, BRUSH Switchgear can offer a more complete system solution to enhance the control and automation of the distribution network

Standard Ratings

| | | |
|--|--|--------------------|
| Rated Voltage | kV | 12 |
| Normal Rated Currents | A | 400/630, 800, 1250 |
| Lightning Impulse Withstand Voltage | kVp | 75 |
| Short Duration Power Frequency Withstand Voltage | kV | 28 |
| Rated Frequency | Hz | 50 |
| Rated Short-Time Withstand Current | kA(s) | 25 for 3 seconds |
| Rated Peak Withstand Current | kA Peak | 62.5 |
| Making Current (peak) | kA | 62.5 |
| Symmetrical Breaking Current | kA | 25 |
| Rated Auxiliary Voltages | V dc | 30, 48/50, 110/125 |
| Minimum opening time/closing time | ms | 33ms/76ms |
| Normal Operations | | 10,000 |
| Weight | Kg | 211 |
| Rated Operating Sequence | O-0.3s-CO-15s-Co | |
| Operating Mechanism Type | Dependent power closing (Magnetic actuator); Stored energy opening (Springs, charging for closing) | |



TRUST. WELL EARNED.

AC Switchgear - Outdoor

The BRUSH AC Switchgear outdoor range comprises the Horizon product range to meet the need for outdoor, ground-mounted circuit breakers, and our well established GVR product range, where highly-reliable Reclosers and Sectionalisers are required. These products are available in a voltage range of 15kV - 38kV with standards meeting the IEC and ANSI requirements.

HORIZON

HORIZON COMPACT

GVR RECLOSER





HORIZON 38kV Outdoor Circuit Breaker

The Horizon fills the market need for outdoor, ground-mounted circuit breakers and features the award-winning magnetic actuator technology.

Designed for a 38kV application, the Horizon can be used with other products from BRUSH Switchgear to provide cost-effective and compact substations or breathe new life into existing substations by replacing old and obsolete equipment.

Key Features

- Superior, proven technology with minimal maintenance
- Vacuum interruption in an SF₆ filled, controlled environment
- Dead tank construction suitable for live or dead tank applications
- Internal arc containment
- Generous accommodation for current transformers
- The lightweight aluminium tank makes the Horizon easier to transport and install
- The silicone rubber bushings are resistant to damage from vandalism or mishandling and have an extended creepage of 1550mm
- Cubicle with space for ancillary equipment and option for integrated control and protection relay
- Optional Adjustable Legs version

Ratings

- Maximum System Voltage
38kV
- Continuous Current
1250/2000A
- Interrupting Current
25/31.5kA
- Rated Operating Sequence
O - 0.3sec - CO - 15sec - CO
- Impulse Voltage Withstand
170kV at atmosphere pressure 0.0 bar (g)
200kV at 0.3 bar (g)
- Power Frequency Withstand Dry
1min 80kV
- Power Frequency Withstand Wet
10secs 80kV
- Control Voltage
110/125 V dc (48 & 220 Optional)
- Rated Frequency
50/60Hz
- Rated 3 sec Short-Time Current
25/31.5kA
- Rated Peak Making Current
65/82kA
- Ambient Air Temperature
-50 – +50 °C
- Weight
800kg

Standards

- ANSI C37.06
- ANSI C37.09
- IEC 62271 Series of Standards
- ENA Notice of Conformity No.1034

Patents

- GB2289374 B
- EP 0 909 453 B1





HORIZON COMPACT

15/27kV Outdoor Circuit Breaker

A substation frame, stand or pole-mounted vacuum circuit breaker with SF₆ insulation in a self-contained package, the Horizon Compact expands our Horizon family of products.

Featuring the most advanced operating mechanism available on the market today – the award-winning magnetic actuator technology, the Horizon Compact offers unrivalled reliability, protection and environmental endurance for outdoor circuit breakers.

Designed for a 15kV or 27kV application, the Horizon Compact can be used with other products from BRUSH Switchgear to provide cost-effective and compact substations or breathe new life into existing substations by replacing old and obsolete equipment.

Key Features

- Superior, proven technology with minimal maintenance
- Uses a magnetic actuator driven vacuum circuit breaker without the need for electronic control
- EPDM Bushings
- Corrosion resistant, light weight Aluminium tank and cover
- Dead tank construction suitable for live or dead tank applications
- Internal arc certified
- Cubicle with space for ancillary equipment and option for integrated control and customer specified protection relay
- Substation frame, stand or pole-mounted, the Horizon Compact can be integrated into the most advanced distribution schemes or operate as a stand alone breaker
- Variety of mounting options provide compact solution where space is at premium

Ratings

| | | | |
|---------------------------|-----|------------|------------|
| Maximum System Voltage | kV | 15.5 | 27 |
| Continuous Current | A | 1250 | 1250 |
| Interrupting Current | kA | 25 | 25 |
| Impulse Voltage Withstand | kV | 110 | 125 |
| Ambient Air Temperature | °C | -50 to +50 | -50 to +50 |
| Maximum Weight | lbs | 650 | 650 |

Standards

- ANSI C37.06
- ANSI C37.09



GVR RECLOSER Pole Mounting & Substation Applications

BRUSH Switchgear's world renowned GVR Recloser was the first in a range of equipment utilising one of the most advanced operating mechanisms available on the market, featuring the award-winning magnetic actuator technology.

The GVR provides 'intelligent control' and protection on power distribution networks, whilst offering a lifetime of trouble-free service.

The GVR automatic recloser is now available as a tank only option for those customers who wish to connect their own protection and control cubicles.

Alternatively, customers looking for a ground-mounted solution can select our epoxy separable bushings for cable connected networks.

Key Features

- Superior, proven technology with minimal maintenance
- BRUSH Switchgear's, single coil magnetic actuator mechanism allows the GVR to operate independently of the MV supply
- Environmentally friendly vacuum interruption produces no by-products

- The lightweight corrosion resistant aluminium tank makes the GVR easier to transport and install
- The EPDM bushings are tested for tracking and erosion to IEC 61109 and are resistant to damage from vandalism or mishandling
- Endurance tested to 10,000 operations
- Pole mounted or substation mounted, the GVR can be integrated into the most advanced distribution automation schemes, or can operate as a stand-alone recloser
- By using the advanced control and protection functions of the Beckwith M-7679, the GVR can also be used in applications where reclosers have not traditionally been used such as closed rings and underfrequency load shedding schemes
- The 3-in-1 Recloser – the GVR can be configured to function as a Switch, Sectionaliser or Recloser by using one of the specially pre-engineered protection and control cubicles

Ratings

| | | GVR 15 | GVR 27 | GVR 38 |
|--|------------------|----------------------|----------|-------------------------------|
| Maximum System Voltage | kVrms | 15.5 | 27 | 38 |
| Continuous Current | A | 630 | 630 | 630 |
| Interrupting Current | kA | 12.5/16 | 12.5 | 10 |
| Impulse Voltage Withstand | kV peak | 110 | 125/150 | 150 (internal) 170 (external) |
| Power Frequency Withstand Dry | kVrms for 60secs | 50 | 60 | 70 |
| Power Frequency Withstand Wet | kVrms for 60secs | 50 | 50 | 60 |
| Rated Gas Pressure for above | Atmospheric | Atmospheric/0.3 bar* | | 0.3 bar (gauge) |
| Number of Operations with no Maintenance | | 10,000 | 10,000 | 10,000 |
| Weight | kg | 145 | 145/155* | 155 |

* Ratings for 150kV impulse version



TRUST. WELL EARNED.

DC Switchgear

BRUSH offer a range of DC Switchgear solutions for the global traction market.

As a result of the high performance and resilience of BRUSH Switchgear's DC circuit breaker technology, the company has deservedly earned a reputation as one of the world's leading suppliers of technology into the rail and mass transit systems of major companies throughout North America, the United Kingdom, the Middle East and Asia.

LIGHTNING

SAFEBOND





LIGHTNING Incorporating the NDC Circuit Breaker

The BRUSH Switchgear Lightning product, incorporating the high-speed NDC Circuit Breaker, utilises award winning magnetic actuator technology and provides an innovative DC switchgear solution for a variety of markets and demanding applications.

Combining innovation with 50 years of DC circuit breaker design and manufacturing experience, the Lightning offers optimal safety, reliability and high speed performance – the ideal solution to your DC requirements.

Key Features

- Simple, reliable mechanism with no mechanical latch
- Ergonomic, intuitive truck isolation and interlocking
- Enhanced electrical and mechanical endurance
- Patented Arc transfer coil
- Fully bi-directional current interruption
- Hard wearing main contact material (silver tungsten carbide) ensuring long life
- Integrated operation with a wide range of protection relay options
- Superior proven technology with minimal maintenance
- A long service life designed to exceed 30 years
- Superior compact design concept and operating mechanisms
- High speed operation, direct overload and electrical tripping

Ratings

| Rated Voltage | V dc | 900 | 1800 |
|------------------------------------|--------|---------------------|---------------------|
| Rated Service Current | A | 4000/6000/8000 | 4000/6000 |
| Nominal Voltage | V dc | 750 | 1500 |
| Power-Frequency Withstand Level | kV | 9 | 9 |
| Rated Short-Time Withstand Current | kAp/kA | 100/71 250ms | 100/71 250ms |
| Rated Track Time-Constant | ms | 100 | 63 |
| Rated Short-Circuit Current | kAp/kA | 180/125 | 142/100 |
| Bi-directional Critical Current ** | A | 25 | 25 |
| Mechanical Endurance | | 50,000 operations | 50,000 operations |
| Breaking Characteristic | | High Speed | High Speed |
| Insulation Category | | OV4 | OV4 |
| Rated Impulse Withstand kVp | | 20 | 20 |
| Auxiliary Operating Supply | V dc | 48 / 50 / 110 / 125 | 48 / 50 / 110 / 125 |

** As defined in BS EN50123-1: 2003, the critical current quoted is the current with the longest arcing time.
At 900V/25A the arcing time is approximately 330ms



SAFE BOND Integrated Track Feeder and Negative Shorting Panel

The BRUSH Switchgear SafeBond integrates the feeder circuit breaker function and the remote bonding function into one standard Lightning panel footprint, a big advantage in floor space saving, civil engineering, cabling and operational consistency and safety.

The SafeBond incorporates the NDC high speed, unidirectional circuit breaker, featuring the award-winning magnetic actuator, to carry out the making and breaking of all load and fault currents, whilst an "off-load" motorised two position disconnecter selects the circuit.

With the disconnecter in the positive position and the NDC CB closed, the positive busbar is connected to the track feeder cable thereby functioning as a standard feeder circuit breaker.

With the disconnecter in the negative position and the NDC CB closed the track feeder cable is bonded to the negative busbar, thereby functioning as a negative bonding device.

All operations are fully electrically interlocked and the control system can be operated remotely via SCADA or locally via the local control panel.

BRUSH Switchgear believe this product will contribute to improving safety and reducing lead times for track maintenance periods (possessions).

As with all BRUSH Switchgear products the SafeBond is designed, manufactured and assembled to the highest standard of quality, fulfilling the customers' requirements and leading the market in innovative technology.



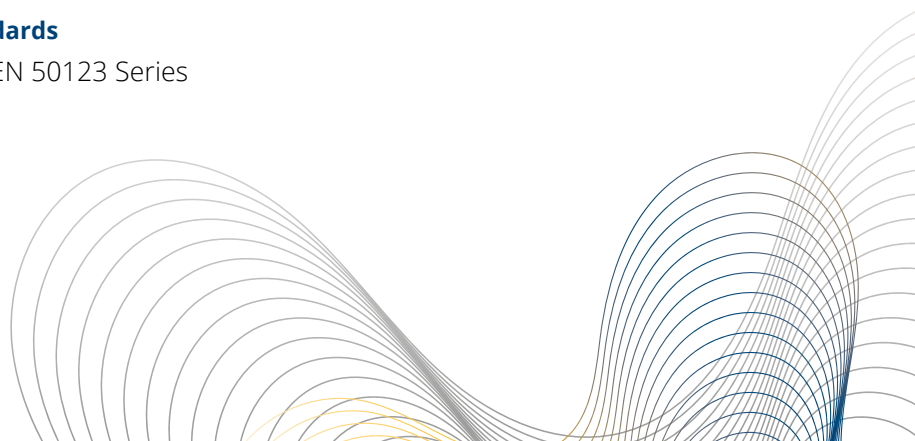
Key Features

- Same footprint as standard Lightning panel – 450mm x 1526mm
- Feeder circuit breaker and bonding functions integral to one panel
- Fully rated, type tested and proven NDC circuit breaker does the making and breaking
- Proven 'off-load' 2 position disconnecter selects the circuit
- Disconnecter in positive position – Feeder circuit breaker function
- Disconnecter in negative position – negative bonding function
- Electrical control/interlocking schemes to suit customer requirements
- SCADA Remote control of complete unit as standard
- No additional civil engineering/cabling costs
- No additional outdoor housing costs



Standards

- BSEN 50123 Series





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