Switchgear Type 8BT1, up to 24 kV, Air-Insulated

Medium-Voltage Switchgear

Catalog HA 26.31 · 2006
Switchgear Type 8BT1, up to 24 kV, Air-Insulated

Contents

Application

Benefits, typical uses

Benefits (see also page 10 for details)

- Saves lives
- Peace of mind
- Increases productivity
- Saves money

Switchgear type 8BT1 is a factory-assembled, type-tested switchgear for indoor installation according to IEC 62271-200 and VDE 0671-200.

8BT1 panel
Maximum ratings 24 kV / 25 kA / 2000 A

Typical uses
The 8BT1 switchgear can be used in transformer and switching substations, e.g.:

Application: Power supply system
- Power supply companies

Application: Industry
- Chemical industry
- Petroleum industry
- Pipeline installations
- Electrochemical plants
- Petrochemical plants
- Diesel power plants
- Emergency power supply installations
- Lignite open-cast mines
- Traction power supplies
Switchgear Type 8BT1, up to 24 kV, Air-Insulated

**Typical uses**

*Public power supply system*

*BBT1 switchgear*
# Technical Data

## Switchgear Type 8BT1, up to 24 kV, Air-Insulated

### Electrical data (maximum values) of 8BT1

<table>
<thead>
<tr>
<th>Switchgear 7.2 kV</th>
<th>Rated voltage</th>
<th>7.2 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>50 Hz</td>
<td></td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>20 kV</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>60 kV</td>
<td></td>
</tr>
<tr>
<td>Rated short-time withstand current, 3 s</td>
<td>25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current at 50 Hz</td>
<td>63 kA</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current at 50/60 Hz</td>
<td>63 kA</td>
<td></td>
</tr>
<tr>
<td>Rated normal current of busbar</td>
<td>2000 A</td>
<td></td>
</tr>
<tr>
<td>Rated normal current of feeders</td>
<td>2000 A</td>
<td></td>
</tr>
<tr>
<td>– with circuit-breaker</td>
<td>630 A</td>
<td></td>
</tr>
<tr>
<td>– with switch-disconnector</td>
<td>400 A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switchgear 12 kV</th>
<th>Rated voltage</th>
<th>12 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>50 Hz</td>
<td></td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>28 kV</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>75 kV</td>
<td></td>
</tr>
<tr>
<td>Rated short-time withstand current, 3 s</td>
<td>25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current at 50 Hz</td>
<td>63 kA</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current at 50/60 Hz</td>
<td>63 kA</td>
<td></td>
</tr>
<tr>
<td>Rated normal current of busbar</td>
<td>2000 A</td>
<td></td>
</tr>
<tr>
<td>Rated normal current of feeders</td>
<td>2000 A</td>
<td></td>
</tr>
<tr>
<td>– with circuit-breaker</td>
<td>630 A</td>
<td></td>
</tr>
<tr>
<td>– with switch-disconnector</td>
<td>400 A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switchgear 24 kV</th>
<th>Rated voltage</th>
<th>24 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>50 Hz</td>
<td></td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>50 kV</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>125 kV</td>
<td></td>
</tr>
<tr>
<td>Rated short-time withstand current, 3 s</td>
<td>25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current at 50 Hz</td>
<td>63 kA</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current at 50/60 Hz</td>
<td>63 kA</td>
<td></td>
</tr>
<tr>
<td>Rated normal current of busbar</td>
<td>2000 A</td>
<td></td>
</tr>
<tr>
<td>Rated normal current of feeders</td>
<td>2000 A</td>
<td></td>
</tr>
<tr>
<td>– with circuit-breaker</td>
<td>630 A</td>
<td></td>
</tr>
<tr>
<td>– with switch-disconnector with fuses</td>
<td>400 A</td>
<td></td>
</tr>
</tbody>
</table>

1) Depending on the rated current of the HV HRC fuses installed.
Classification of the 8BT1 switchgear acc. to IEC 62 271-200

<table>
<thead>
<tr>
<th>Internal arc classification</th>
<th>IAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td></td>
</tr>
<tr>
<td>– Front</td>
<td>Type A</td>
</tr>
<tr>
<td>– Rear</td>
<td>Type A</td>
</tr>
<tr>
<td>– Lateral</td>
<td>Type A</td>
</tr>
<tr>
<td>Test current</td>
<td>kA 25</td>
</tr>
<tr>
<td>Test duration</td>
<td>s 0.1/1.0</td>
</tr>
</tbody>
</table>

Dimensions

All panel types

<table>
<thead>
<tr>
<th>Width B</th>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2/12 kV</td>
<td>For max. 1250 A vacuum circuit-breaker</td>
</tr>
<tr>
<td></td>
<td>For 2000 A vacuum circuit-breaker</td>
</tr>
<tr>
<td></td>
<td>For switch-disconnector</td>
</tr>
<tr>
<td>Height H1</td>
<td>With standard low-voltage compartment</td>
</tr>
<tr>
<td></td>
<td>H2 With duct 3)</td>
</tr>
<tr>
<td>Depth T1</td>
<td>Without low-voltage compartment</td>
</tr>
<tr>
<td></td>
<td>T2 With low-voltage compartment</td>
</tr>
</tbody>
</table>

24 kV

<table>
<thead>
<tr>
<th>Width B</th>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>For max. 1250 A vacuum circuit-breaker</td>
<td>800</td>
</tr>
<tr>
<td>For 2000 A vacuum circuit-breaker</td>
<td>1000</td>
</tr>
<tr>
<td>For switch-disconnector</td>
<td>800</td>
</tr>
<tr>
<td>Height H1</td>
<td>With standard low-voltage compartment</td>
</tr>
<tr>
<td></td>
<td>H2 With duct 3)</td>
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<tr>
<td>Depth T1</td>
<td>Without low-voltage compartment</td>
</tr>
<tr>
<td></td>
<td>T2 With low-voltage compartment</td>
</tr>
</tbody>
</table>

Room planning (room height ≥ 2800 mm, ≥ 2400 mm 2)

Single-row arrangement (plan view)

For dimensions B (width) and T (depth) refer to the table on this page

1) For panel replacement:
   Control aisle ≥ 1600 mm
2) Lead-off duct required
3) For an arc fault duration of 1 s
Switchgear Type 8BT1, up to 24 kV, Air-Insulated

Product Range

Panels

Circuit-breaker panel

Disconnecting panel

Switch-disconnector panel

Components

- Current transformer
- Voltage transformer without primary fuses
- Capacitive voltage detection system
- Make-proof earthing switch
- Cable sealing ends 1)
- HV HRC fuse
- SION vacuum circuit-breaker
- Disconnector
- Switch-disconnector

1) The details refer to conventional single-core sealing ends and are reduced by 1 cable when using surge arresters.
Switchgear Type 8BT1, up to 24 kV, Air-Insulated

Product Range

Panels

Bus sectionalizer I

Bus sectionalizer II

Metering panel

Busbar connection panel

Components

Current transformer

Voltage transformer without primary fuses

Capacitive voltage detection system

Voltage transformer with primary fuses

Make-proof earthing switch

SION vacuum circuit-breaker

Cable sealing ends \(^1\) max. 4 x 500 mm\(^2\) per phase

1) The details refer to conventional single-core sealing ends and are reduced by 1 cable when using surge arresters.
Panel design

Legend for panel design:
1. Door of low-voltage compartment
2. Opening for locking or unlocking the low-voltage compartment door
3. Option: Capacitive voltage detection system for feeder and busbar
4. High-voltage door of switching-device compartment
5. Inspection window for checking the disconnected/service position of the switching-device truck
6. Opening for locking or unlocking the high-voltage door
7. Actuating opening for the busbar earthing switch
8. Actuating opening for mechanical charging of circuit-breaker closing spring
9. Openings for manual operation (ON/OFF) of the circuit-breaker
10. Inspection window for checking the CLOSED/OPEN indication of the circuit-breaker, the "spring charged" indication and operating cycle counter
11. Knob for opening the door
12. Actuating opening for moving the switching-device truck
13. Actuating opening for the earthing switch
14. Busbars
15. Make-proof busbar earthing switch
16. Bushings
17. Busbar voltage transformer
18. Current transformer
19. Voltage transformer
20. Make-proof earthing switch
21. Cable sealing ends
22. Pressure relief
23. Low-voltage plug connector
24. Switching-device truck
25. Switch-disconnector
26. HV HRC fuse
27. Integrated partition
28. Operating mechanism for switch-disconnector
29. Operating mechanism for earthing switch
30. Actuating opening for the switch-disconnector
31. Inspection window for checking the switch-disconnector position, the earthing switch position and the "fuse tripped" indication

A Combined switching-device compartment
B Busbar compartment
D Switching-device truck
E Low-voltage compartment/low-voltage niche
Compartments, interlocks, operation

Combined switching-device/connection compartment
- All switching operations with high-voltage door closed
- Pressure relief upwards
- Doors, front frames and end walls are powder-coated with epoxy resin. Rear wall and ceiling components are made of galvanized sheet metal
- Partition class: Metallic, earthed shutters and partitions ensure partition class PM for circuit-breaker panel
- High-voltage door pressure-resistant in the event of internal arcs in the panel
- Metallic ducts on the side for laying control cables
- Interlocking between high-voltage door and circuit-breaker truck ensures interlock-based access
- Switching-device compartment to accommodate components for implementing various panel versions with
  - Vacuum circuit-breaker
  - Disconnecting truck
  - Metering truck
- Suitable for connection of
  - Single-core cables
  - Three-core cables
- Earthing busbar
- Connection from front interlock-based
- Option: Pressure-resistant floor cover
- Use of block-type current transformers
- Interlocked high-voltage door with connection from front provides interlock-based access

Components at the panel connection (option)
- Single-core XLPE cables, up to max. 4 x 500 mm² per phase
- Three-core XLPE cables, up to max. 2 x 300 mm² per phase
- Coupling electrode for capacitive voltage detection system
- Voltage transformers
  - Cast-resin insulated
  - Max. 3 x 1-pole
  - Fixed-mounted, without primary fuses
- Make-proof earthing switches
  - With manual operating mechanism
  - In addition to standard interlocking of earthing switch/circuit-breaker truck, optionally lockable or with electromagnetic interlock
- Surge arresters
  - Surge arresters for protecting the switchgear against external overvoltages

Busbar compartment
- Pressure relief upwards
- Busbar transverse partition between panels
- Busbars made of flat copper, bolted from panel to panel
  - For rated normal currents up to 2000 A
- Bolted front covers provide tool-based access
- Option: Coupling electrode for capacitive voltage detection system
- Options: Possibility of installing the following components
  - Voltage transformers
  - Busbar earthing switch

Interlocks
- Interlocking conditions are satisfied according to IEC 62 271-200 / VDE 0671-200
- Earthing switch can only be operated with circuit-breaker truck in disconnected position
- Circuit-breaker truck can only be moved with circuit-breaker "OPEN" and earthing switch "OPEN"
- Circuit-breaker can only be operated in interlocked disconnected or service position
- Mechanical coding on the circuit-breaker truck prevents insertion of similar circuit-breaker trucks for lower rated normal currents into panels with higher rated normal currents
- Circuit-breaker truck can only be moved from disconnected to service position with door closed
- The high-voltage door can only be opened when the circuit-breaker truck is in disconnected position
- Option: Electromagnetic interlocks

Low-voltage compartment
- Accommodates equipment for protection, control, measuring and metering
- Separated from the high-voltage part of the panel, safe-to-touch
- Low-voltage compartment can be removed, bus wires and control cables are plugged in
- Option: Test sockets for capacitive voltage detection system

Low-voltage cables
- Control cables of the panel are flexible and have metallic covers
- Connection between switching-device truck and panel wiring to low-voltage compartment via 64-pole coded plug connectors
- Bus wires pluggable from panel to panel

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### Benefits and features

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
</table>
| **Saves lives**           | • All switching operations including emergency manual operations with high-voltage door closed  
• Interlocking between high-voltage door and switching devices  
• Rack-in, rack-out operations of the circuit-breaker truck with high-voltage door closed  
• Metallic, earthed shutters and partitions, partition class: PM for circuit-breaker panels  
• Internal arc classification up to 25 kA, 1 s, according to IEC 62 271-200, Annex A  
• Use of vacuum circuit-breakers                                                                                                                                                                      |
| **Peace of mind**         | • Factory-assembled, type-tested switchgear according to IEC 62 271-200  
• Type testing of the circuit-breaker and make-proof earthing switch inside the panel  
• Use of standard, worldwide available components  
• Use of maintenance-free vacuum circuit-breakers  
• Quality management according to DIN EN ISO 9001  
• Design based on global best practice sharing and experience, compact design with high flexibility                                                                                                                                                        |
| **Increases productivity** | • Use of metallic, earthed shutters and partitions ensures highest loss of service continuity category of the switchgear (LSC2A according to IEC 62 271-200) during maintenance  
• Use of maintenance-free vacuum circuit-breakers  
• Cable testing without isolating the busbar                                                                                                                                                           |
| **Saves money**           | • Use of maintenance-free vacuum circuit-breakers  
• Compact design requires minimum space                                                                                                                                                                 |
Standards, specifications, guidelines

Standards

The switchgear complies with the relevant standards and specifications applicable at the time of type tests.

In accordance with the harmonization agreement reached by the countries of the European Community, their national specifications conform to the IEC standard.

Overview of standards (May 2006)

<table>
<thead>
<tr>
<th>Switchgear</th>
<th>IEC standard</th>
<th>VDE standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>8BT1</td>
<td>IEC 60 694</td>
<td>VDE 0670-1000</td>
<td>EN 60 694</td>
</tr>
<tr>
<td></td>
<td>IEC 62 271-200</td>
<td>VDE 0671-200</td>
<td>EN 62 271-200</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Devices</th>
<th>IEC standard</th>
<th>VDE standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit-breaker</td>
<td>IEC 62 271-100</td>
<td>VDE 0671-100</td>
<td>EN 62 271-100</td>
</tr>
<tr>
<td>Disconnectors and earth switches</td>
<td>IEC 62 271-102</td>
<td>VDE 0671-102</td>
<td>EN 62 271-102</td>
</tr>
<tr>
<td>Switch disconnectors</td>
<td>IEC 60 265-1</td>
<td>VDE 0670-201</td>
<td>EN 60 265-1</td>
</tr>
<tr>
<td>Switch disconnectors/fuse combinations</td>
<td>IEC 62 271-105</td>
<td>VDE 0671-105</td>
<td>EN 62 271-105</td>
</tr>
<tr>
<td>HV HRC fuses</td>
<td>IEC 60 282</td>
<td>VDE 0670-4</td>
<td>EN 60 282</td>
</tr>
<tr>
<td>Voltage detection systems</td>
<td>IEC 61 243-5</td>
<td>VDE 0682-415</td>
<td>EN 61 243-5</td>
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</table>

<table>
<thead>
<tr>
<th>Degree of protection</th>
<th>IEC standard</th>
<th>VDE standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>IEC 60 529</td>
<td>VDE 0470-1</td>
<td>EN 60 529</td>
</tr>
<tr>
<td>Insulation</td>
<td>IEC 60 071</td>
<td>VDE 0111</td>
<td>EN 60 071</td>
</tr>
<tr>
<td>Transformers</td>
<td>IEC 60 044-1</td>
<td>VDE 0414-1</td>
<td>EN 60 044-1</td>
</tr>
<tr>
<td>Voltage transformers</td>
<td>IEC 60 044-2</td>
<td>VDE 0414-2</td>
<td>EN 60 044-2</td>
</tr>
<tr>
<td>Installation</td>
<td>IEC 61 906-1</td>
<td>VDE 0101</td>
<td>–</td>
</tr>
</tbody>
</table>

Type of service location

The switchgear can be used for indoor installation in accordance with IEC 61 936 (Power installations exceeding 1 kV AC) and VDE 0101

- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools.
- Inside lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering. Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.

Table – Insulating capacity

<table>
<thead>
<tr>
<th>Rated voltage (rms value) kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration power-frequency withstand voltage (rms value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Across isolating distances kV</td>
<td>23</td>
<td>32</td>
<td>39</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>– Between phases and to earth kV</td>
<td>20</td>
<td>28</td>
<td>35</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (peak value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Across isolating distances kV</td>
<td>70</td>
<td>85</td>
<td>105</td>
<td>110</td>
<td>145</td>
</tr>
<tr>
<td>– Between phases and to earth kV</td>
<td>60</td>
<td>75</td>
<td>95</td>
<td>95</td>
<td>125</td>
</tr>
</tbody>
</table>

Altitude correction factor Kₐ

For site altitudes above 1000 m, the altitude correction factor Kₐ is recommended, depending on the actual site altitude above sea level.

Insulating capacity

- The insulating capacity is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 60 694/ VDE 0670-1000 (see table “Insulating capacity”).
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11 g/m³ humidity in accordance with IEC 60 071 and VDE 0111).
- The insulating capacity decreases with increasing altitude. For site altitudes above 1000 m (above sea level) the standards do not provide any guidelines for the insulation rating. Instead, special regulations apply to these altitudes.
- Site altitude
  - As the altitude increases, the insulating capacity of insulation in air decreases due to the decreasing air density. This reduction is permitted up to a site altitude of 1000 m according to IEC and VDE.
  - For site altitudes above 1000 m a higher insulation level must be selected. It results from the multiplication of the rated insulation level for 0 to 1000 m with the altitude correction factor Kₐ.

Example:

3000 m site altitude above sea level, 17.5 kV switchgear rated voltage 95 kV rated lightning impulse withstand voltage

Rated lightning impulse withstand voltage to be selected 95 kV · 1.28 = 122 kV

Result: According to the above table, a switchgear for a rated voltage of 24 kV with a rated lightning impulse withstand voltage of 125 kV is to be selected.
Standards, specifications, guidelines

Terms
“Make-proof earthing switches” are earthing switches with short-circuit making capacity according to
- IEC 62 271-102 and
- VDE 0671-102/
- EN 62 271-102

Internal arc classification
- Safety of operating personnel ensured by tests to verify internal arc classification.
- Internal arc tests in accordance with IEC 62 271-200/VDE 0671-200, Annex A.
- The switchgear complies with criteria 1 to 5 specified in the mentioned standards for the basic version up to 25 kA.
- Definitions of the criteria:
  - Acceptance criterion 1
    Covers and doors remain closed. Limited deformations are accepted.
  - Acceptance criterion 2
    No fragmentation of the enclosures. No projection of small parts above 60 g weight.
  - Acceptance criterion 3
    No holes in the accessible sides up to a height of 2 m.
  - Acceptance criterion 4
    Indicators do not ignite due to the effect of hot gases.
  - Acceptance criterion 5
    The enclosure remains connected to its earthing parts.

Current-carrying capacity
- According to IEC 60 694/VDE 0670-1000 and
- IEC 62 271-200/VDE 0671-200 current-carrying capacities refer to the following ambient temperatures:
  - Maximum of
    24-hour mean + 35 °C
    Maximum + 40 °C
- The current-carrying capacity of the panels and busbars depends on the ambient temperature outside the enclosure.
- To attain the maximum rated normal currents, the panels are provided with natural or forced ventilation.

Climate and ambient conditions
The switchgear may be used, subject to possible additional measures, under the following ambient conditions and climate classes:
- Ambient conditions
  - Natural foreign materials
  - Chemically active pollutants
  - Small animals
- Climate classes
  - 3K3
  - 3K5
The climate classes are classified according to IEC 60 721-3-3.

Protection against solid foreign bodies, electric shock and ingress of water
8BT1 switchgear fulfills acc. to the standards
- IEC 62 271-200/VDE 0671-200
- IEC 60 529/VDE 0470-1
the following degrees of protection:
- Enclosure: IP 3XD
  IP 4X (option)
- Compartments: IP 2X
Siemens AG
Power Transmission and Distribution
Medium Voltage Division
Postfach 32 40
91050 Erlangen
Germany
www.siemens.com/medium-voltage-switchgear

If not stated otherwise on the individual pages of this catalog, we reserve the right to include modifications, especially regarding the stated values, dimensions and weights.

Drawings are not binding.

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If not stated otherwise, all dimensions in this catalog are given in mm.

The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases.
The required features should therefore be specified in each individual case at the time of closing the contract.

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If you have any questions about Power Transmission and Distribution, our Customer Support Center is available around the clock

Tel.: +49 180 / 524 70 00
Fax: +49 180 / 524 24 71
(Subject to charges, e.g.: 12 ct/min.)

E-Mail: support.energy@siemens.com
www.siemens.com/energy-support