Secure Power for Oil & Gas, Petrochemical & Chemical Plants
Power protection systems for oil & gas, petrochemical and chemical production and processing

Power supply reliability is crucial for safe and efficient operation in the oil & gas industry as well as in petrochemical and chemical plants. System outages due to power failures or even minor disturbances in the power supply can interrupt the process chain with serious environmental and financial consequences and may jeopardize the safety of human lives. Industrial-grade power protection solutions like UPS systems, inverters and DC systems with stand-by lead acid or nickel cadmium batteries provide emergency back-up power for mission-critical applications.

For more than seven decades BENNING has designed, manufactured, tested, installed and serviced AC and DC emergency power solutions that ensure the stable and safe operation of all types of critical loads in the oil & gas, petrochemical, chemical, energy and utility industries.

Today BENNING is a leading global supplier of customized high quality backup power systems with field proven reliability. BENNING’s headquarter is located in Bocholt/Germany with manufacturing plants in Germany, Ireland and Romania. All manufacturing facilities are certified in accordance with ISO 9001 and ISO 14001.

Wholly owned Benning subsidiaries in 25 countries and a network of agents across Europe, the Americas and Asia have experienced teams to provide a global reach with local solutions.

Working with many of the world’s biggest engineering contractors BENNING provides dedicated management teams for every project through all phases from the first design to final installation. This includes specification review, project management, detailed documentation and engineering calculations.

Most of the power protection projects for the Oil & Gas industry are designed to customer specifications and require unique engineering or design work and significant customization activities. BENNING's organization has considerable experience in handling this kind of ETO (Engineer-To-Order) project.

Many of BENNING’s subsidiaries have their own local assembly and test facilities and are able to assemble customized power solutions and to arrange customer defined system testing.

At the customers request, tests may be witnessed by 3rd party agencies or certification bodies e.g. DNV, ABS or TÜV. In many cases customers visit our subsidiaries to witness the tests themselves (FAT, Factory Acceptance Test).

High efficiency modular power solutions (SMPS technology)

Over 30 years ago BENNING started producing SMPS (Switch mode power supplies) for telecom and medical applications. These AC and DC power modules with SMPS technology are 4 to 5 times lower in weight and volume and up to 20 % higher in efficiency when compared to traditional solutions and are now available for industrial applications.

SMPS technology with its modular architecture allows the flexible design of redundant power system configurations with easy and rapid replacement and scalability. N+x redundancy ensures a high level of availability with less initial investment. All SMPS modules are hot plug-able and can be replaced at any time whilst the load continues to be supplied with secure power.

Today BENNING offers a wide range of modular industrial-grade UPS, inverter, rectifier and DC-DC systems with SMPS technology.

ENERTRONIC modular SE with 20 kVA power modules. Output power 80 kVA (n+1)
BENNING’s strategy is to develop relationships based on a long-term commitment policy that provides efficient service and optimum benefit to its customers.

BENNING’s industrial power solutions for applications in the oil & gas and petrochemical industries include:

- **UPS systems**
  - ENERTRONIC: 1-phase, AC output 10 kVA – 120 kVA
  - ENERTRONIC modular SE: 3-phase, AC output 20 – 500 kVA

- **Industrial inverters**
  - INVERTRONIC: 1-phase, AC output 10 kVA – 120 kVA
  - INVERTRONIC modular: 3-phase, AC output 15 – 180 kVA

- **Industrial DC systems**
  - THYROTRONIC: DC output: 24 V, 20 A – 1200 A
  - THYROTRONIC modular: 48 V/60 V, 10 A – 1200 A
  - THYROTRONIC modular: 110 V/220 V, 5 A – 1200 A

- **Modular power systems**
  - TEBECHOP: inverters, rectifiers, DC-DC converter

- **SMPS technology**

BENNING’s power solutions, renowned for their reliability, are designed to meet the strict requirements for installations in:

- **Refineries**
- **Pipeline control centers**
- **Chemical and petrochemical plants**
- **Gas processing and booster stations**
- **FLNG (Floating Liquefied Natural Gas)**
- **FPSO (Floating Production Storage and Offloading)**
- **Emergency lighting**
- **Fire and gas detection systems**
- **Instrumentation and process control**
- **Telecommunications**
- **Radio and paging communication**
- **HV and MV switchgear tripping**
- **Navigational aids**
- **Gas turbine control**
- **Lube-oil pump supply**
- **Data processing**
- **Signaling**
BENNING has considerable experience ranging from complete power systems design and installation to scheduled check-up and preventive maintenance programs.

The service center and training headquarters are located in Bocholt/Germany.

A global network of BENNING subsidiaries and several partners provide installation, commissioning, operation and maintenance services worldwide.

Global service organization

BENNING has developed a comprehensive range of training courses specially aimed at technicians and engineers who work on industrial emergency power systems and battery installations.

Training courses

BENNING can provide critical spares or replacement parts at very short notice, delivered to any destination in the world.

Operation and maintenance services can include remote monitoring, preventive maintenance, corrective maintenance, battery management, replacement, refurbishment and in-house repairs.

24/7 service hot-line and rapid response maintenance contracts are available.

Spare part management

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24/7 service hot-line and rapid response maintenance contracts are available.
ENERTRONIC I Industrial UPS Systems

Key Features:

- Single or three phase output
- True on-line double conversion UPS (VFI SS 111)
- High efficiency even under partial load conditions
- Inverter with IGBT technology
- AC input power factor typ. 0.99
- Parallel configuration with up to 8 UPS
- Excellent dynamic and overload behaviour
- Monitored, redundant, speed controlled fans

The MMI (Man-machine interface) enables simple operation and monitoring of the ENERTRONIC I UPS System.

Status and configuration data on the ENERTRONIC I UPS system is available through a 4-line 80 character liquid crystal display mounted on the front panel. Push buttons provide intuitive navigation of the user menu to allow the system status to be viewed or parameters to be changed.

13 LEDs are provided to indicate the most important operation and fault signals.

Measurements

**Rectifier:**
- Input voltage (phase to phase and phase to neutral)
- Input current per phase
- Frequency

**Inverter:**
- Output voltage (phase to phase and phase to neutral for three phase output systems)
- Output current (per phase)
- Real power
- Frequency

**Battery:**
- Voltage
- Charge/discharge current (remaining back up time, remaining capacity)

**Bypass:**
- Input voltage (phase to phase and phase to neutral for three phase systems)
- Input current (per phase)
- Frequency

An event recorder stores each occurring event (push button operation, switching event and error) with a date and time stamp. Up to 1200 entries can be stored. The following information is indicated via 6 volt free change over contacts:

- Mains operation (mains OK)
- Battery operation
- Bypass operation
- Manual bypass activated
- Low battery voltage
- Common alarm

**ENERTRONIC I Interior view**

**MMI (Man-machine interface)**

**Measurements**

**ENERTRONIC I 1-phase**

| UPS nominal output power (cos. φ = 0.8 ind.) [VA] | 10 20 30 40 50 60 80 100 120 -- |

**ENERTRONIC I 3-phase**

| UPS nominal output power (cos. φ = 0.8 ind.) [VA] | 10 20 30 40 50 60 80 100 120 160 200 |

**ENERTRONIC I 3-1 and 3-3**

| Input | Max. input current with high rate charging [A] | 16 35 50 65 80 96 112 155 186 248 310 |

**Transformer**

- Autotransformer (Isolation transformer option)
- Input power factor ≥ 0.99 cos. φ
- Nominal input voltage [V] 3/N 400 V ± 15 % (others on request)
- Nominal input frequency [Hz] 50 Hz ± 5 %
- Mains distortion at 100 % load [%] ≤ 5
- Current ripple < 5 A / 100 Ah

**Output**

- Output voltage 1-phase [V] 230 V ± 1 %
- Output voltage 3-phase [V] 400 V ± 1 %
- Overload: 1 ph %
- Crest factor ≥ 3
- Frequency [Hz] 50 or 60 Hz ± 3 %

**Intermediate DC circuit**

- Voltage [V] 110/125/220 (400 V on request)
- Max. charging current [A] 6 13 20 27 34 55 69 83 110 135

**General data**

- Over-all efficiency (AC to AC) without battery charging [%] typ. 90
- Heat dissipation at 100 % load [kW] 1.4 2.2 3.2 4.2 5.2 6.3 8.4 10.4 12.6 16 19
- Ambient temperature [°C] -5 to 40
## Key Features:

- High efficiency even under partial load conditions (IGBT technology)
- Parallel configuration with up to 8 Inverters
- Excellent dynamic and overload behaviour
- Monitored, redundant, speed controlled fans
- Built-in static-switch and manual bypass

### MMI (Man-machine interface)

Status and configuration data for the INVERTRONIC inverter system is available through a 4-line 80 character liquid crystal display mounted on the front panel. Push buttons allow intuitive navigation of the user menu to allow the system status to be viewed or parameters to be changed. 13 LEDs are provided to indicate the most important operation and fault signals.

### Measurements

**Inverter:**
- Input voltage
- Input current
- Output voltage
- Real power
- Output current per phase

**Bypass:**
- Input voltage
- Input current per phase

A recorder stores each occurring event (push button operation, switching event and error) with a date and time stamp. Up to 1200 entries can be stored.

### Single Phase Inverter

<table>
<thead>
<tr>
<th>UPS nominal output power (cos. φ = 0.8 ind.) [kVA]</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage [V]</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input voltage range (%)</td>
<td>-15 to +20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitted DC ripple (%)</td>
<td>&lt; 5 rms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC current feedback on DC input (%)</td>
<td>&lt; 5 rms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch on current &lt; I-Nom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input current at cos. φ = 0.8 and nominal input voltage [A]</td>
<td>40</td>
<td>80</td>
<td>118</td>
<td>156</td>
<td>196</td>
<td>233</td>
<td>307</td>
<td>383</td>
<td>460</td>
</tr>
<tr>
<td>DC power at battery operation [kW]</td>
<td>8.8</td>
<td>17.6</td>
<td>26</td>
<td>34.4</td>
<td>43</td>
<td>51.1</td>
<td>67.4</td>
<td>84.2</td>
<td>101</td>
</tr>
<tr>
<td>Efficiency at nominal load (%)</td>
<td>91</td>
<td>91</td>
<td>92</td>
<td>93</td>
<td>94</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

### Three Phase Inverter

<table>
<thead>
<tr>
<th>UPS nominal output power (cos. φ = 0.8 ind.) [kVA]</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage [V]</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input voltage range (%)</td>
<td>-15 to +20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitted DC ripple (%)</td>
<td>&lt; 5 rms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC current feedback on DC input (%)</td>
<td>&lt; 5 rms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch on current &lt; I-Nom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input current at cos. φ = 0.8 and nominal input voltage [A]</td>
<td>8.7</td>
<td>17.4</td>
<td>26.5</td>
<td>33.9</td>
<td>42.5</td>
<td>51.1</td>
<td>67.4</td>
<td>84.2</td>
<td>101</td>
</tr>
<tr>
<td>DC power at battery operation [kW]</td>
<td>9</td>
<td>17.2</td>
<td>28.8</td>
<td>35</td>
<td>42.3</td>
<td>57.8</td>
<td>72.2</td>
<td>86.7</td>
<td>115</td>
</tr>
<tr>
<td>Efficiency at nominal load (%)</td>
<td>92</td>
<td>92</td>
<td>94</td>
<td>94</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

### Inverter output

<table>
<thead>
<tr>
<th>Output voltage [V]</th>
<th>400/230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment range of output voltage [%]</td>
<td>± 5</td>
</tr>
<tr>
<td>Nominal output current per phase [A]</td>
<td>14.4</td>
</tr>
</tbody>
</table>

### MMI (Man-machine interface)

Status and configuration data for the INVERTRONIC inverter system is available through a 4-line 80 character liquid crystal display mounted on the front panel. Push buttons allow intuitive navigation of the user menu to allow the system status to be viewed or parameters to be changed. 13 LEDs are provided to indicate the most important operation and fault signals.

### Inverter:
- Input voltage
- Output frequency
- Input current
- Apparent power
- Output voltage
- Real power
- Output current per phase

### Bypass:
- Input voltage
- Input frequency
- Input current per phase

A recorder stores each occurring event (push button operation, switching event and error) with a date and time stamp. Up to 1200 entries can be stored.
THYROTRONIC
Industrial Rectifier Systems

Key Features:
- 6-pulse microprocessor controlled thyristor technology with isolation transformer (Option: 12-pulse version)
- Advanced digital monitoring and signalling
- Comprehensive monitoring functions with internal event log to save up to 200 log files
- Industrial design with high MTBF and low MTTR
- Standard or customer configurations

MMI (Man-machine interface)
The MMI (Man-machine interface) mounted on the front door of the THYROTRONIC features 13 LEDs to indicate system operational status and alarms. The integrated LCD shows measurements in plain text and the built-in key-pad allows the user to set operational parameters and to get access to the event and alarm log.

MMI (Man-machine interface)
ENERTRONIC modular SE
3-Phase Modular UPS Systems

Key Features:
- Scaleable UPS systems with hot-plug power modules
- N+1 redundancy ensures maximum availability
- Advanced UPS design with IGBT and MOSFET semiconductors and DSP processors
- UPS classification VFI-SS-111 in accordance with EN/IEC 62040-3
- High efficiency, even with partial load, reduces energy losses
- Sinewave input current (powerfactor 0.99)
- Input current with low harmonic distortion (THDi < 5 %)
- Short MTTR (Mean Time To Repair)
- Replacement of modules without load interruption
- Online diagnostics and monitoring

Systems with 20 kVA modules

Systems with 40 kVA modules

Display der ENERTRONIC modular SE

Combination cabinets with built-in batteries

Cabinet dimensions: 1800 X 600 x 800 mm (Height x width x depth)

<table>
<thead>
<tr>
<th>Output power (kVA)</th>
<th>UPS systems</th>
<th>20 kVA modules</th>
<th>40 kVA modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 kVA</td>
<td>Modules</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>40 kVA</td>
<td>Battery time at max. output power [min]</td>
<td>32</td>
<td>13</td>
</tr>
</tbody>
</table>

System cabinets

<table>
<thead>
<tr>
<th>Modules</th>
<th>20 kVA</th>
<th>40 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of modules</td>
<td>1-5</td>
<td>1-6</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>190</td>
<td>210</td>
</tr>
</tbody>
</table>

*Weight without modules

ENERTRONIC modular SE

<table>
<thead>
<tr>
<th>Power (cos ϕ = 1.0)</th>
<th>Module power</th>
<th>Footprint UPS Cabinet (W x D)</th>
<th>Power per m²</th>
<th>Maximum number of modules per system</th>
<th>Operating temperature range</th>
<th>Relative humidity</th>
<th>Noise level</th>
<th>Protection</th>
<th>Installation height</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 kW</td>
<td>20 kW</td>
<td>600 x 800 mm</td>
<td>Up to 250 kW/m²</td>
<td>25</td>
<td>0 … 40 °C (above this there is a power reduction)</td>
<td>5 … 95 % (non-condensing)</td>
<td>Typically &lt; 65 dBA</td>
<td>IP20 (others on request)</td>
<td>1000 m (without power reduction)</td>
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<tr>
<td>40 kW</td>
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<td>Up to 415 kW/m²</td>
<td>25</td>
<td></td>
<td></td>
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Input

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Frequency</th>
<th>Total distortion THDi (100 % load)</th>
<th>Input power factor</th>
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<tr>
<td>3 / N 400 V ± 15 %</td>
<td>50 Hz ± 5 % / 60 Hz ± 5 %</td>
<td>≤ 3 %</td>
<td>≥ 0.99</td>
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Output (Inverter operation)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Voltage tolerance (static)</th>
<th>Frequency tolerance</th>
<th>Total distortion THDU</th>
<th>Efficiency</th>
<th>Overload operation, inverter</th>
<th>Overload operation, bypass</th>
<th>Short circuit response, inverter</th>
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<tr>
<td>380 V / 400 V / 415 V</td>
<td>± 1 %</td>
<td>± 0.1 %</td>
<td>≤ 1 %</td>
<td>99 % (SE Mode, 96 % (double inverter operation))</td>
<td>150 % for 60 s, 125 % for 10 min, 110 % for 30 min</td>
<td>1000 % for 100 ms, 110 % for 1 min, 125 % continuous</td>
<td>&gt; 200 % for 1 s</td>
<td>&gt; 1000 % for 100 ms</td>
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Battery

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<tr>
<th>Nominal voltage</th>
<th>Battery technologies</th>
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<tr>
<td>480 - 576 V (240 - 288 Pb cells)</td>
<td>Lead, nickel cadmium, lithium ion (optional)</td>
</tr>
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Block diagram

ENERTRONIC modular SE with built-in batteries, Output power 20 kW (n-1)

ENERTRONIC modular SE 3-Phase Modular UPS System

Key Features:

- Scaleable UPS systems with hot-plug power modules
- N+1 redundancy ensures maximum availability
- Advanced UPS design with IGBT and MOSFET semiconductors and DSP processors
- UPS classification VFI-SS-111 in accordance with EN/IEC 62040-3
- High efficiency, even with partial load, reduces energy losses
- Sinewave input current (powerfactor 0.99)
- Input current with low harmonic distortion (THDi < 5 %)
- Short MTTR (Mean Time To Repair)
- Replacement of modules without load interruption
- Online diagnostics and monitoring

ENERTRONIC modular SE

3-Phase Modular UPS Systems

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Systems with 20 kVA modules

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Display der ENERTRONIC modular SE

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ENERTRONIC modular SE

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Output (Inverter operation)

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</thead>
<tbody>
<tr>
<td>380 V / 400 V / 415 V</td>
<td>± 1 %</td>
<td>± 0.1 %</td>
<td>≤ 1 %</td>
<td>99 % (SE Mode, 96 % (double inverter operation))</td>
<td>150 % for 60 s, 125 % for 10 min, 110 % for 30 min</td>
<td>1000 % for 100 ms, 110 % for 1 min, 125 % continuous</td>
<td>&gt; 200 % for 1 s</td>
<td>&gt; 1000 % for 100 ms</td>
</tr>
</tbody>
</table>

Battery

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>Battery technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>480 - 576 V (240 - 288 Pb cells)</td>
<td>Lead, nickel cadmium, lithium ion (optional)</td>
</tr>
</tbody>
</table>

Block diagram

ENERTRONIC modular SE with built-in batteries, Output power 20 kW (n-1)
The convection cooled TEBECHOP 4000 rectifier offers reduced operating costs due to its very low heat dissipation enabled by its high efficiency (even under partial load conditions).

Scalability of the output power as well as redundant system configurations (such as n+1 redundancy) are possible.
TEBECHOP 3000 I
Rectifier and DC-DC Converter Modules

Key Features:
- Modular rectifiers, DC/DC converters and inverters can be combined in a system
- Redundant, scaleable, hot-plug technology
- Excellent overall efficiency and low volume and weight
- Replacement of modules without any load break
- Remote and local control and monitoring with MCU 2500

### DC/DC converter plug-in unit with 5 TEBECHOP 3000 I
Output voltage 24 V, output current 250 A

### Rectifier plug-in unit with 4 TEBECHOP 3000 I and MCU 2500
Output voltage 110/220 V, output current 80 A

<table>
<thead>
<tr>
<th>Number of rectifiers per 19&quot; rack</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage [V]</td>
<td>1 x 85 – 264*</td>
<td>1 x 85 – 264*</td>
<td>3 x 360 – 460 = N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input current [A]</td>
<td>15</td>
<td>30</td>
<td>45</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>Frequency [Hz]</td>
<td>47 – 63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power factor</td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output current at: - 24 V</td>
<td>70/70</td>
<td>140/140</td>
<td>210/210</td>
<td>280/280</td>
<td>350/350</td>
</tr>
<tr>
<td>- 48 V</td>
<td>50/60</td>
<td>100/120</td>
<td>150/180</td>
<td>200/240</td>
<td>250/300</td>
</tr>
<tr>
<td>- 60 V</td>
<td>40/48</td>
<td>90/96</td>
<td>120/144</td>
<td>160/192</td>
<td>200/240</td>
</tr>
<tr>
<td>- 110 V</td>
<td>20/24</td>
<td>40/48</td>
<td>60/72</td>
<td>80/96</td>
<td>100/120</td>
</tr>
<tr>
<td>- 220 V</td>
<td>10/12</td>
<td>20/24</td>
<td>30/36</td>
<td>40/48</td>
<td>50/60</td>
</tr>
</tbody>
</table>

### Additional data for rectifiers and DC/DC converters

- Output voltage stability: static
  - ± 1 (typically ± 0.5 %)
  - ± 4 (load ≥ 10 % – 90 % – 10 %)

- Efficiency [%]
  - 85 – 93

- Radio Frequency interference
  - Class B to EN 55022

- Ingress Protection
  - IP 20

- Ambient temperature [°C]
  - -5 to +40

### Additional data for rectifiers and DC/DC converters

- Power derating at 110 V input

### Inverter plug-in unit with 3 INVERTRONIC compact, static and manual bypass

### Additional data for inverters and DC/DC converters

#### Output power [W]
- 3000 6000 9000 12000 15000

#### Number of DC/DC converters per 19" rack
- 1 2 3 4 5

#### DC-Input 110 V/220 V

#### Inverter input
- Input voltage 110/220
- Input voltage range [%] -15 to +20
- Permitted DC ripple Voltage [%] < 5 %
- Input current at 110 V DC [A] 12 24 36 48 60
- Input current at 220 V DC [A] 6 12 18 24 30

#### Inverter output
- Output voltage [V] 220/230/240 1-ph., N, PE (selectable)
- Voltage tolerance: static [%] ± 1
- Dynamic [%] ≤ 10 at 100 % load step
- Regulation time [ms] ≤ 25
- Output current at 230 V AC [A] 6.5 13.0 19.5 26.0 32.5
- Motorload [%] 100 (be aware of starting current)
- Overload behaviour [%] 2.0 x I-nom for 4 sec., 1.2 x I-nom for 60 sec., then switch off
- Short-circuit current [A] 2.1 x I-nom for 4 sec.
- Output frequency [Hz] 50 (60) ± 0.1 % oscillator or mains synchronised
- Synchronisation range [Hz] 50 (60) ± 5 % (selectable)
- Wave form
  - Sineoidal
- Distortion factor [%] ≤ 2 with linear load, ≤ 5 with non linear load according to EN 50591-1-1
- Efficiency [%] ≥ 91.5

### Static bypass
- Rated output power [kVA] 23 (at 230 V AC)