BENNING
World Class Power Solutions

Excellent Technology, Efficiency and Quality



TEBECHOP SE

Rectifier systems and DC converters
with modular technology

- scalable, robust and cost-effective
- well-suited to deal with industrial requirements

TEBECHOP SE rectifiers and DC converters developed to cope with the highest demands



Fig. 1: TEBECHOP SE 1/5 19" Modules

Maximum availability for essential areas of application in industry

In areas of industry where it is crucial for the operating systems to perform with maximum availability in the interests of safety and profitability, no shutdown periods can be allowed, for example in the petrochemical industry, in the generation and distribution of energy and in highly automated applications, including traffic management. In such areas, the plant, the control systems and the monitoring technology must be fully protected against failure or faults in the electrical supply.

It's precisely here that battery-backed modular DC solutions operating in a parallel redundant mode have proven their worth. To such an extent that individual modules can even be swapped over without the need for interruption, quickly and straightforwardly. At the same time, these modular systems have proven their excellence in terms of the highest conceivable reliability, uncomplicated scalability, the maximum of flexibility, simple servicing and low operating costs.

With BENNING's TEBECHOP SE product line, it offers a new generation of highly affordable modular rectifiers which meet the challenges of sensitive, process-critical systems to an unrivalled extent: capable of operating in parallel with lead-acid or NiCd energy storage when it comes to battery-supported standby power solutions.

Main advantages

- **first-class design and high quality components created to operate in harsher industrial conditions**
- **n+1 (and/or n+r) redundancy**
- **the reliability that comes with hot-plug technology**
- **extensive range of alarm, status & monitoring functions, including Web-Interface via HTTP / HTTPS, SNMP, Modbus or Profibus, IEC 61850**
- **high MTBF, low MTTR**
- **sinusoidal mains current input / low input distortion**
- **low output ripple / excellent dynamic output characteristics**
- **cost-effectiveness and efficiency of operation even at partial-load**
- **high output density, consequently taking up less footprint wherever it's installed**
- **can be operated with or without a battery**
- **straightforward scalable system performance**

- **maximum availability**
- **maximum flexibility of application and investment**
- **minimum operating costs**

TEBECHOP SE industrial range ...
... reliable operation & maximum efficiency



Figure 2: 19“ rack insert with three convection-cooled TEBECHOP 3000 SE output modules, each with 1500 W output power.

Figure 3: DC power supply systems of 60 kW, based on 4 rectifier rack units, each with 5 output modules (max. 15000 W output power).

Rectifier systems
Individual, flexible, robust

Diverse range of options for meeting customer requirements with BENNING’s modular rectifier systems, thanks to the range of housings available.
There are wall-mounted or floor-standing enclosures, whilst smaller systems can use all-in-one cabinets which also accommodate the batteries. BENNING’s modular approach comprises a range of practical power supply and load distribution solutions for installation in the system cabinets.

When it comes to battery and load distribution, BENNING supplies a range of suitable system cabinets which will also house the modules of the MCU 3000 Monitoring and Control Unit 3000 (refer Figure 5).

Modular DC converters
can be easily combined

The 1/5, 19” wide DC converters are ideal for modular systems. Not only are they based on the same mechanical platform but also the front panel design provides for inter-compatibility. This means that combinations of these modules can be easily installed in shared system cabinets.

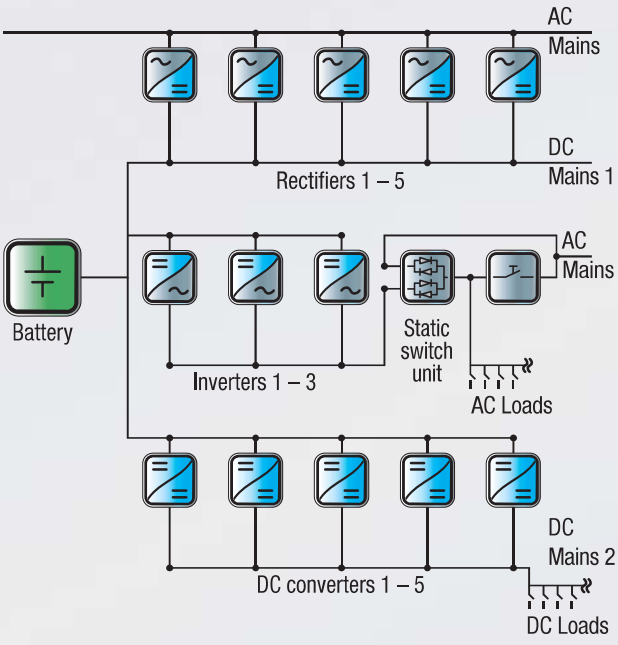
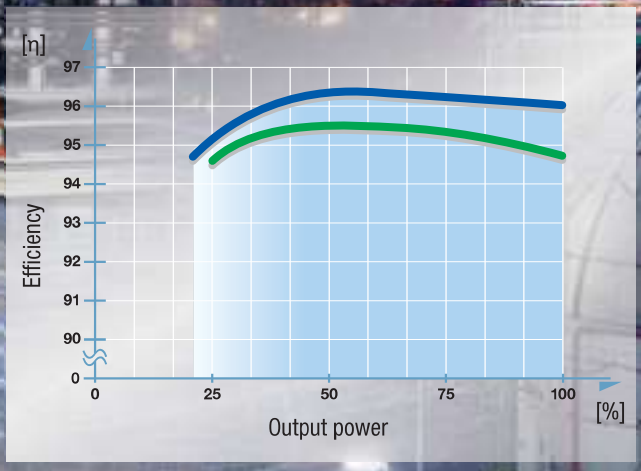


Figure 4: Block diagram illustrating the mode of operation of a modular-architecture power supply system with modular rectifiers, inverters and DC converters.





MCU 3000 (Figure 5)
On higher-output power systems, the MCU can be housed in the power supply system's cabinet door. This version comprises a 10" touch screen. The MCU is also available as a 19" rack insert (1U). The front of the controller module then features a 1.8" display, a USB 2.0 interface (to accommodate a WLAN stick, for example) and an ethernet port.

High efficiency, even at partial load (refer Figure 6)
TEBECHOP 3000 SE *TEBECHOP 13500 SE*
TEBECHOP SE series rectifiers offer very high levels of efficiency even within the load range of 25% to 90%. In systems with a high output, significant savings in electrical power can be achieved using this highly efficient range of rectifiers.

Ideally equipped for the challenges of today and the opportunities of tomorrow

Maximum availability and flexible power expansion (pay as you grow) on the basis of n + r redundancy
TEBECHOP SE rectifier systems combine straightforward, flexible power adjustment (scalability) with high availability and excellent energy efficiency.
The essential building blocks of these rectifier systems are power modules with reliable hot-plug technology which can be increased when power output requirements increases. Redundant systems (e.g. n + r redundancy) can be designed in order to achieve additional uptime availability.

Straightforward, safe operation combined with extensive reporting and monitoring functions
As an option, the MCU 3000 can be used for control and remote monitoring of the power supply systems (see Figure 5). Controls are logically tailored to the user's requirements, and offer clear, precise and comprehensive indication of all of the required readings and settings.
The MCU's advantages include an integrated web server and, in addition to remote maintenance which, for example, provided by BENNING's 360° service solution, enables the option of connecting up to various network topologies.

360° Proactive service

Low MTTR (Mean Times To Repair) and low maintenance and servicing costs
TEBECHOP SE rectifiers combine optimum reliability and shortest repair times in a system which meets the highest requirements for availability and quality in a reliable power supply system. Thanks to the "hot-swap" capability, each module can be easily replaced in less than 10 minutes. If replacement modules are available on site, the corresponding emergency intervention, or just routine servicing and repair tasks, can be readily carried out by the plant operator's trained staff. On this basis, repair times (MTTR) can be minimised simultaneously combined with maximised system uptime.

High output in the most restricted space
Thanks to the compact dimensions (3U) of TEBECHOP SE modules and the low power loss due to high efficiency, you can operate up to ten TEBECHOP 13500 SE plug-in rectifiers with 135 kW of output power or fifty TEBECHOP 3000 SE modules with 150 kW of output power in a single system cabinet measuring 2000 mm x 600 mm x 600 mm (H x W x D).



19" rack insert with TEBECHOP 3000 SE rectifier modules (refer Figure 7)
Each rectifier module supplies a maximum output power of 1800 W or 3000 W. In one 19" rectifier rack shelf, up to 5 power modules can be installed, to provide a power output range from 1800 W up to 15,000 W.

Technical data

Product type	E100-277G24	E100-277G48	E100-277G60	E100-277G108	E100-277G216
Input					
Voltage (AC or DC supply)	100 - 277 V -15 %, +10 %				
Frequency	16.7 - 60 Hz ± 10 % or DC				
Mains distortion THDi (100% load)	≤ 5 %				
Input power factor	≥ 0.97	≥ 0.99			
Rated current	9 A	14 A			
Network configurations	TN, TT, IT				
Output					
Voltage	24 V	48 V	60 V	108 V	216 V
Current (max. for 4 - 5 s)	75 A (97.5 A)	63 A (81.9 A)	50 A (65 A)	28 A (36.4 A)	14 A (18.2 A)
Power	1800 W	3000 W			
Adjustable voltage range	19 V – 33.6 V	36 V – 67.5 V	41 V – 86.4 V	88 V – 153.9 V	170 V – 297 V
Dynamic load regulation	± 5 % (transient time < 10 ms, load (90-10-90) %, di/dt < 200 A/ms)				
Charging characteristic	IPU / IU				
Hold up time	> 10 ms at rated power				
Ripple acc. EN 300132-2	< 20 mV			< 60 mV	
Psophometric noise	< 1 mV	< 2 mV		n. a.	
General data					
Module dimension (HxWxD)	133 x 85.6 x 300 mm / 5.24 x 3.37 x 11.8"				
Cooling	forced-air ventilated				
Operating temperature	-40 °C to 55 °C (reduction in power beyond this) max. 75 °C -40 °F to 131 °F (reduction in power beyond this) max. 165.2 °F				
Relative humidity	5 … 95 % (non-condensing)				
Storage temperature	-45 °C to 85 °C / -49 °F to 185 °F				
Installation height	2000 m (without reduction in power) max. 5000 m 6561 ft (without reduction in power) max. 16404 ft				
Weight	3.2 kg / 7.05 lbs				
Connection	hot swap modular				
Protection class	I				
Over voltage category	II				
Pollution degree	2				
Protection class	IP 20				
Parallel operation	up to 200 modules				
Efficiency	92 %	up to 96 %			
Acoustic noise	< 55 dB(A)				
MTBF (acc. SN 29500)	> 300 000 h			> 270 000 h	> 280 000 h
Standards					
Electrical Safety	EN 62368-1, UL 62368-1				
EMC	EN 61000-6-1 (immunity, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-3 (emmission, light industry) EN 61000-6-4 (emmission, industry)				
	ETSI EN 300386 (telecom) ETSI EN 300132-2 (telecom)			n.a.	

Specifications are subject to change without notice.



19" rack insert with convection-cooled TEBECHOP 3000 SE rectifier modules (refer Figure 8)
This convection-cooled rectifier series is specially designed for use in harsh ambient conditions (e.g. dust, acid, etc.). It is ideally suited for the severe conditions encountered in industrial applications, such as in the petrochemical industry, in power distribution and in traffic management applications.

Technical data

Product type	E230G24	E230G48	E230G60	E230G108	E230G216
Input					
Voltage (AC)	230 V ± 10 %				
Frequency	50 Hz ± 10 %				
Mains distortion THDi (100% load)	≤ 5 %				
Input power factor	≥ 0.97	≥ 0.99			
Rated current	4 A	7 A			
Network configurations	TN, TT, IT				
Output					
Voltage	24 V	48 V	60 V	108 V	216 V
Current (max. for 4 - 5 s)	42 A (97.5 A)	31 A (81.9 A)	25 A (65 A)	14 A (36.4 A)	7 A (18.2 A)
Power	1000 W	1500 W			
Adjustable voltage range	21.6 V – 31.2 V	43.2 V – 62.4 V	54 V – 76.8 V	97.2 V – 139 V	194.2 V – 278.4 V
Dynamic load regulation	± 5 % (transient time < 10 ms, load (90-10-90) %, di/dt < 200 A/ms)				
Charging characteristic	IPU / IU				
Hold up time	> 10 ms at rated power				
Ripple acc. EN 300132-2	< 20 mV			< 60 mV	
Psophometric noise	< 1 mV	< 2 mV		n. a.	
General data					
Module dimension (HxWxD)	88.7 x 142.8 x 300 mm / 3.5 x 5.6 x 11.8"				
Cooling	convection cooled				
Operating temperature	-40 °C to 35 °C (reduction in power beyond this) max. 45 °C -40 °F to 95 °F (reduction in power beyond this) max. 113 °F				
Relative humidity	5 … 95 % (non-condensing)				
Storage temperature	-45 °C to 85 °C / -49 °F to 185 °F				
Installation height	2000 m (without reduction in power) max. 5000 m 6561 ft (without reduction in power) max. 16404 ft				
Weight	3.1 kg / 6.83 lbs				
Connection	hot swap modular				
Protection class	I				
Over voltage category	II				
Pollution degree	2				
Protection class	IP 20				
Parallel operation	up to 200 modules				
Efficiency	92.5 %	up to 96 %			
Acoustic noise	< 55 dB(A)				
MTBF (acc. SN 29500)	> 300 000 h			> 290 000 h	> 280 000 h
Standards					
Electrical Safety	EN 62368-1				
EMC	EN 61000-6-1 (immunity, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-3 (emmission, light industry) EN 61000-6-4 (emmission, industry)				
	ETSI EN 300386 (telecom) ETSI EN 300132-2 (telecom)			n.a.	

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TEBECHOP 13500 SE (refer Figure 9)
The industrial TEBECHOP 13500 SE rectifier module is particularly suitable for the construction of power supply systems with power consumption requirements in excess of 50 kW. This 3U height, 19"rack module has a 3-phase mains connection, active power factor correction (0.99 input power factor) and constant a output power of 13,500 W.

Technical data

Product type	D400G48	D400G110	D400G220	D400G336
Input				
Voltage (AC)	400 V -15 %, +10 %			
Frequency	47 - 63 Hz			
Mains distortion THDi (100% load)	in accordance with EN / IEC 61000-3-12			
Input power factor	≥ 0.99			
Rated current	21 A			
Network configurations	TN, TT, IT			
Required mains fuse	40 A gL or 40 A MCB (B characteristic)			
Output				
Voltage	48 V	110 V	220 V	336 V
Current (max.)	250 A (300 A)	122 A (132 A)	61 A (66 A)	40 A (48 A)
Power	13500 W			
Adjustable voltage range	43.2 V - 57.6 V	97 V - 152 V	183 V - 270 V	280 V - 411 V
Dynamic load regulation	± 5 % (transient time < 50 ms, load (90-10-90) %, di/dt < 200 A/ms)			
Charging characteristic	IPU / IU			
Ripple	< 1 % SS			
General data				
Module dimension (HxWxD)	133 x 483 x 450 mm / 5.24 x 19 x 17.72"			
Cooling	forced-air ventilated			
Operating temperature	-33 °C to 55 °C (reduction in power beyond this) max. 75 °C -27.4 °F to 131 °F (reduction in power beyond this) max. 165.2 °F			
Relative humidity	5 … 95 % (non-condensing)			
Storage temperature	-45 °C to 85 °C / -49 °F to 185 °F			
Installation height	2000 m (without reduction in power) max. 5000 m 6561 ft (without reduction in power) max. 16404 ft			
Weight	25 kg / 55.12 lbs			
Connection	hot swap modular			
Protection class	I			
Over voltage category	II			
Pollution degree	2			
Protection class	IP 20			
Parallel operation	up to 200 modules			
Efficiency	up to 96 %			
Acoustic noise	< 55 dB(A)			
MTBF (MIL-HDBK-217-F)	> 120 000 h			
Standards				
Electrical Safety	EN 62368-1 UL 62368-1 CSA-C22.2	EN 62368-1	EN 62368-1	EN 62368-1 UL 62368-1 CSA-C22.2
EMC	EN 61000-6-2 (immunity, industry) EN 61000-6-4 (emmission, industry)			
		EN 61000-6-5 (immunity)		

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