BENNING

World Class Power Solutions

Excellent Technology, Efficiency and Quality

Industrial

- Modular DC Power Systems
- TEBECHOP 3000 HDI and 13500 SE

Modular DC Power Systems
High Availability and Efficiency

Modular DC Power Systems for Industrial Application

For several years BENNING has been supplying high quantities of modular DC power Systems for business critical infrastructure within the telecommunication and information industry. These modular DC power systems are often equipped with battery back-up to protect communication systems against mains disturbances or mains power failure.
The modular system design with parallel operating hot-plug DC power modules (plug and play) provides high availability, can be upgraded and is easy to install and to maintain.

BENNING has now developed a special range of industrial modular DC power systems to meet the specifications required in the industrial sectors, such as the petrochemical industry, the power distribution and power generation industry and the automation control industry.
These systems are available for DC output voltages 24 V, 48 V, 60 V, 110 V, 220 V and 336 V.
The IU output characteristic of the DC modules (fig. 1) allows operation with or without batteries.

Fig. 2: 19" modular rectifier shelf with 4 modules TEBECHOP 3000 HDI and remote monitoring unit MCU 2500 output voltage 110 V, output current 80 A

Fig. 3: 19" modular rectifier shelf with 5 modules TEBECHOP 3000 HDI output voltage 110 V, output current 100 A

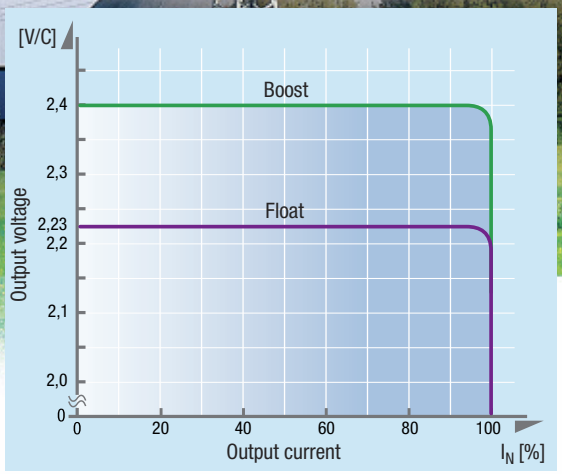


Fig. 1: IU-characteristic, DIN 41773 for lead acid batteries

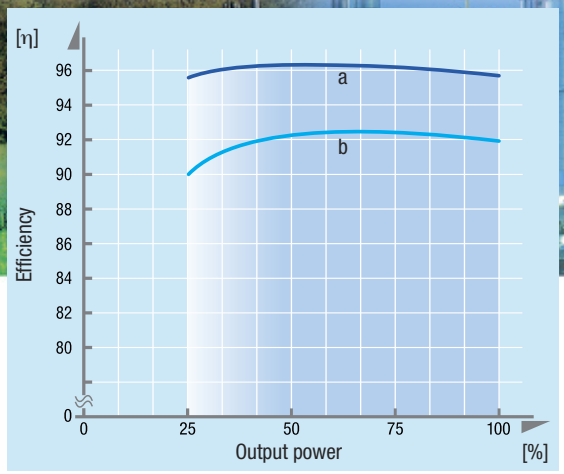


Fig. 4: Efficiency versus output power a) TEBECHOP 13500 SE, b) TEBECHOP 3000 HDI

Modular DC systems offer flexible power scalability, high availability and excellent efficiency

Parallel operating DC power modules integrated into 19" rectifier shelfs are the base of these systems.
The DC power modules are hot pluggable and allow easy output power scaling as well as n+1 redundancy.

Thanks to the compact and space saving design, only 3 Us are needed for the integration of the 19" rectifier shelves into system cabinets.

Fig. 4 shows the high efficiency level of the DC power modules with more than 90 % efficiency between 30 % and 100 % of the rated load, which contributes to lower energy costs during operation.

19" rectifier shelf with TEBECHOP 3000 HDI power modules

Fig. 2 shows one 19" rectifier shelf with built-in power modules TEBECHOP 3000 HDI. Each module is designed to supply max. 3000 W output power.

The 19" rectifier shelf can support from 1 up to 4 or 5 power modules and covers the output power range from 3000 W up to 15000 W.

If only 4 power modules are integrated. one slot of the shelf can be used for the monitoring and control unit MCU 2500 (fig. 2)

The MCU 2500 can also be integrated into the DC system cabinet, if the 19" rectifier shelf will be equipped with 5 power modules.

19” Rectifier Modules

Compact, Variable, Energy Saving

19” rectifier version TEBECHOP 13500 SE (fig. 5)

The TEBECHOP 13500 SE has a three phase rectifier design but in contrast to the TEBECHOP 3000 HDI, it consists of only one power module which can be built into a 19” rectifier shelf. The industrial version of the TEBECHOP 13500 SE is available with DC voltages 48 V, 110 V, 220 V and 336 V.

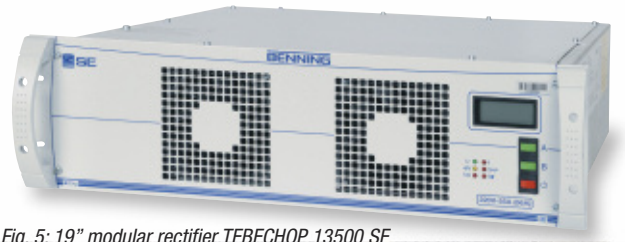


Fig. 5: 19” modular rectifier TEBECHOP 13500 SE output voltage 220 V, output current 55 A

The TEBECHOP 13500 SE is a very powerfull rectifier which can supply 110 A at 110 V and 55 A at 220 V DC.
It is the perfect choice for high power DC systems up to 13500 W.

System redundancy (n+1) can be realized by adding one additional rectifier.

Fig. 6: Modular rectifier system with 4 modules TEBECHOP 13500 SE, output voltage 220 V, output current 220 A

Advantages of the Industrial Modular DC Power Systems

- **High power density with low volume and weight**
- **Unity power factor (0,99 at nominal load)**
- **DC modules with real hot-plug design**
- **High efficiency 90 % between 30 % and 100 % load**
- **DC output with excellent dynamic behaviour and low ripple**
- **Wide input voltage range**
- **Temperature compensated battery charging**
- **MCU 2500 for local and remote system status and alarm monitoring**
- **Remote monitoring with modem, HTML or SNMP adapter**

TEBECHOP 3000 HDI and 13500 SE, High Power Density, Low Operating Losses

Fig. 7: 19" modular rectifier shelf with 4 modules TEBECHOP 3000 HDI and remote monitoring unit MCU 2500 output voltage 110 V, output current 80 A

Fig. 8: 19" rectifier TEBECHOP 13500 SE output voltage 220 V, output current 55 A

Remote Monitoring Unit MCU 2500

Broad Monitoring Capability

Remote monitoring and control unit MCU 2500

The microprocessor controlled MCU 2500 is designed for local and remote monitoring and control of modular DC power systems.

The MCU 2500 allows local monitoring via pushbuttons and LCD-display. PC-connection is possible using the built-in RS-232 interface. Remote monitoring can be done with modem, Ethernet, web or SNMP.

The MCU 2500 design is extremely flexible and provides extended functionality and an increased number of measuring points to meet different customer specifications.

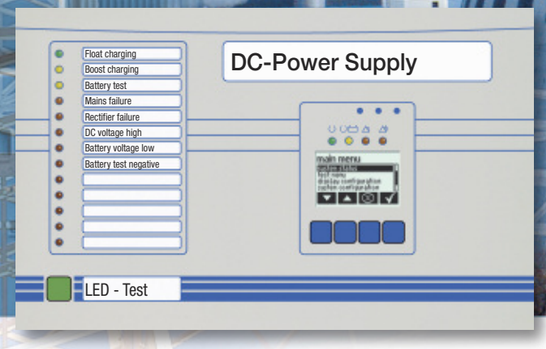


Fig. 9: Monitoring and control unit

Fig. 10: Monitoring concept of the MCU 2500

RS232 Serial communication (UPS protocol)

TCP-IP Protocol, complete data set is transferred

Graphical user interface for all Windows Oss

Web-Browser: system values and configuration

Modular DC Power Systems
A Flexible Range of Customised Solutions

Two MCU 2500 versions are available:

1. 19” Modul, height 3U, width 1/5 19”
   This version can be integrated into the TEBECHOP 3000 HDI rectifier shelves.

2. Cabinet version
   The cabinet version consists of a base unit, measurement cards, digital and analog relay cards and front panel.
   These components can be mounted into DC system cabinets.

Modular DC Systems

BENNING’s DC system cabinet range is very flexible and allows us to meet different customer specifications.
Besides wall and floor cabinets, cabinets for the integration of batteries are available.
BENNING also offers some new AC and DC distribution solutions, which makes it easier to adapt the distribution design to various customer requirements.

Examples of modular DC-power systems:

Fig. 11: output voltage 24 V, output current 210 A

Fig. 12: output voltage 220 V, output current 100 A

Fig. 13: same as Fig. 12, but with open frontdoor

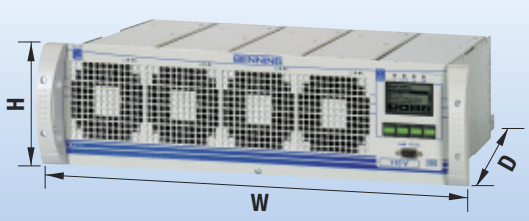
Specifications
of Rectifier Modules

Output power	[W]	3000 HDI	6000 I	9000 I	12000 I	15000 I	13500 SE
Number of modules		**1**	**2**	**3**	**4**	**5**	**1**
Input voltage	[V]	1 x 85–264*1	1 x 85 – 264*1 or 3 x 360 – 460 + N				340 – 440
Input current (at 1 x 230 V)	[A]	15	30	45	60	75	21*2
Frequency	[Hz]	47 – 63					
Power factor	[A]	0,99					> 0,99
Output current at							
24 V	[A]	70	140	210	280	350	–
48 V	[A]	50	100	150	200	250	250
60 V	[A]	40	80	120	160	200	–
110 V	[A]	20	40	60	80	100	110
220 V	[A]	10	20	30	40	50	55
336 V	[A]	–	–	–	–	–	40
Characteristic		IU					
Output voltage							
Boost	[V/C]	2,4 V/Cell					
Float	[V/C]	2,23 V/Cell					
Output voltage stability							
Static	[%]	± 1 (typical ± 0,5 %)					
Dynamic	[%]	± 5 (load Δ 10 % - 90 % - 10 %)					
Response time	[ms]	< 2 (load Δ 10 % - 90 % - 10 %)					
Efficiency*3	[%]	92					≤ 97
Ripple	[%]	< 1					
Radio interference		EN 61000-6-2 / EN 61000-6-4					
Protection class		1, VDE 0804 and IEC 60950					
Protection		IP 20					
Ambient temperature	[°C]	-33 to +75					
Operating altitude	[m]	up to 2000 above sea level					
Moisture class		F DIN 40040					
Cooling		forced ventilation					
Voltage/Current measurement		LCD-display on the frontpanel*4					
Frontpanel indications (LED)							
Mains		–					yellow
DC overvoltage		–					red
Normal operation		green					green
Fault		red					red
Fuse alarm		–					red
Potential free common alarm		existing					only with MCU
Dimensions 19" module							
Height (front panel)	[mm]	132,5 (HU)					
Width (front panel)	[mm]	482,6 (19")					
Depth	[mm]	400					450
Weight	[kg]	14	17	20	23	26	25

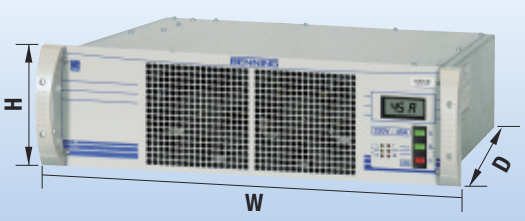
1) Power decreasing at 205 V input voltage
2) at 400 V
3) Efficiency at 24 V approx. 1 % lower
4) only with MCU 2500

Specifications are subject to change without notice.

Dimensions



TEBECHOP 3000 HDI



TEBECHOP 13500 SE

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