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Applications

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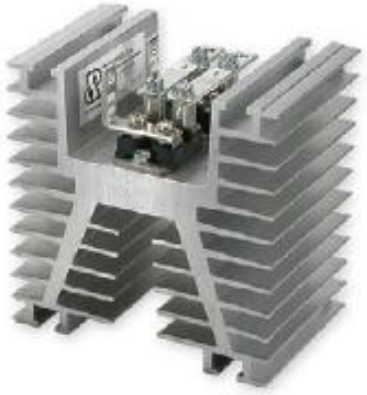
Power semiconductor units PSU

Power semiconductor units are assemblies of semiconductor devices and heatsinks in various electrical connections which are supplemented by accessories like ventilators, control units, overvoltage and commutating protections, temperature sensors, insulators, fuses, air tunnels etc. Since the assemblies use potential-free power modules, it is possible to attach the heatsink without any additional insulation.



Features:

- Electric strength (outlets / heatsink) 2.5 kV for PSU with power modules
- Electric strength (heatsink / mounting clamp) up to 7 kV, according to mounting clamp
- Air heatsinks (natural or forced cooling), liquid heatsinks or heat pipes
  Long durability of used component parts

Most frequent PSU types:

Type	Voltage		Output current		Main dimensions	Weight
	V_{RMS}	V_d	I_{dN}	I_{dF}		
	[V]	[V]	[A]	[A]	[mm]	[kg]
Connection B2U						
PSU T50 B2U 380/340 12/20	380	340	12	20	106 x 65 x 27	0,23
PSU Y80 B2U 380/340 40/80	380	340	40	80	120 x 120 x 80	1,05
PSU Q180 B2U 380/342 83/203	380	342	83	203	220 x 125 x 190	4,50
PSU Y120 B2U 380/340 60/120	380	340	60	120	120 x 120 x 120	1,35
Connection B6U						
PSU Y160 B6U 380/510 60/120	380	510	60	120	120 x 120 x 160	2,05
PSU Q180 B6U 380/510 100/270	380	510	100	270	220 x 125 x 190	5,02
PSU Q360 B6U 310/415 219/450	310	415	219	450	400 x 135 x 175	8,00
Connection W1C						
PSU L65 W1C 280/280 90/– C	280	280	90	-	100 x 65 x 150	1,39
PSU Q120 W1C 550/550 110/190 FC	550	550	110	190	125 x 160 x 185	1,72
Connection W3C						
PSU Q180 W3C 380/380 59/168 FT	380	380	59	168	125 x 220 x 185	5,62

The marking key is on page 11

Other PSU types:

In order to obtain information about other PSU types, please, contact our commercial department

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Custom-design PSU

PSU power semiconductor units are assemblies consisted of power semiconductor devices and heatsinks in various electrical wirings designed and constructed according to the requirements of customers.

Features:

- Wide range of power parameters
- Possibility of the use of all power semiconductor devices
- Air or liquid cooling
- Adaptation to the construction requirements of customers
- Long durability of used component parts

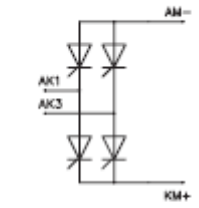
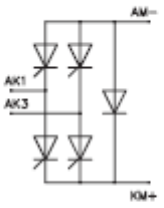
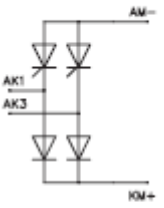
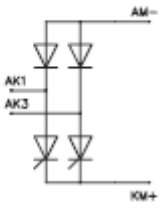
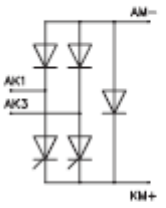
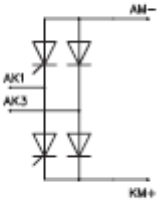
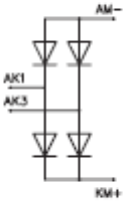
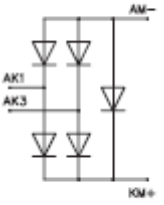
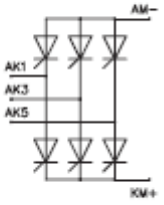
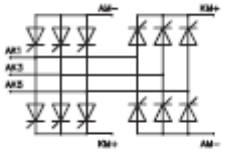
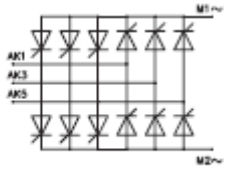
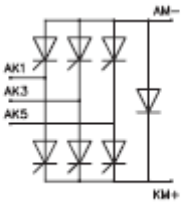
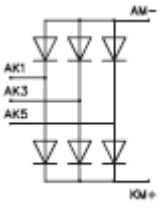
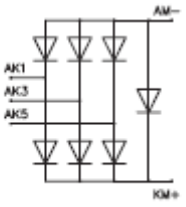
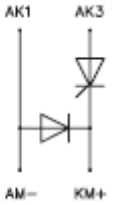
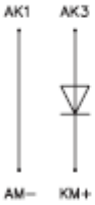
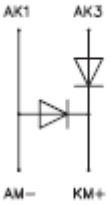
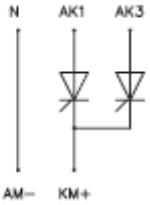
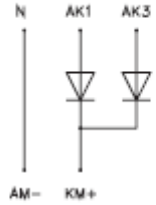
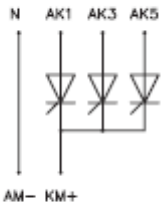
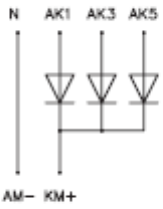
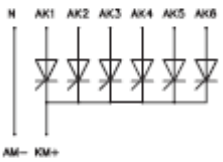
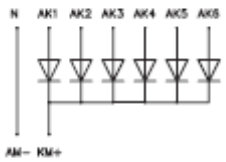
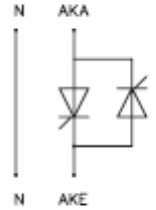
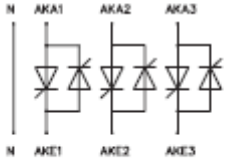
Necessary parameters for design:

- Sort of connection
- Input voltage
- Output current
- Character of the load
- Cooling system
- Description of operational environment (temperature, dust nuisance etc.)
- Protection method
- Construction requirements
- Special requirements (weight, dimensions, increased insulation, thermal protection etc.)

Example of custom-design PSU

product marking	PSU K2 B6U 380/510 -/1500 T
connection	3-phase B6U diode bridge
input voltage	380 V AC
output voltage	510 V DC
output current	1500 A (3000 A po dobu max. 2 min)
range of operating frequencies	50 ÷ 400 Hz
Insulating voltage of live parts contra supporting framework	5000 V
cooling	forced liquid
quantity of coolant	4l/min per heatsink
temperature of coolant	0°C ÷ 30°C
sort of coolant	cooling water
dimensions (h x d x w)	200 x 100 x 200 mm
weight	approx 17 kg
mounting position	any position, the assembly is attached behind the supporting plate with two M10 bolts

PSU wirings

B2C 	B2CF 	B2HA 	B2HK 	B2HKF 
B2HZ 	B2U 	B2UF 	B6C 	(B6C)2 
(B6C)2L 	B6CF 	B6U 	B6UF 	E1CK 
E1CKF 	E1UK 	E1UKF 	M2CK 	M2UK 
M3CK 	M3UK 	M6CK 	M6UK 	W1C 
W3C 				

GU 3391 control unit for tyristors

GU3391 unit is designed for exciting of a couple of antiparallel-connected thyristors. It can be used in systems of regulation of one or three phase load. The unit is operated by input controlling voltage. Each of thyristors is controlled independently.

Features::

- Designed for controlling of thyristors or thyristor modules
- Thyristor switching by sequence of gate current pulses
- Max. gate current up to 1,5 A
- Galvanic separation input/output
- Galvanic separation of power supply
- Possibility of attaching to the DIN panel

Parameters:

power supply	20 ÷ 80 V DC
controlling signal ON	15 ÷ 40 V (5 ÷ 15 V option) / 5 ÷ 12 mA
controlling signal OFF	< 4 V / < 1 mA
output pulses	1,5 A / 0,5 V; 1,7 kHz
electric strenght input – output	5 kV
operating temperature	-25 ÷ 60 °C
dimensions w × h × d	22 × 110 × 120 mm
weight	0,18 kg
cover protection degree	IP20

GU 4000 control unit for tyristors

GU 4000 unit is designed for control of a couple of antiparallel-connected thyristors. It can be also used for easy construction of solid state relays. Controlling can be done by AC or DC voltage. GU 4000 unit can be also used for phase controlling of power. The moment of thyristor switching on is regulated by voltage or current DC signal. The unit can be easily controlled by the elements attached to the front side under a transparent cover where LED signal diodes are placed. Unit GU 4000 is applicable in one or three phase line for resistance or inductive load as well.

Features:

- Designed for controlling of thyristors or thyristor modules
- Designed for voltage of 230 or 400 V AC/50Hz
- Zero voltage switching
- Switching in a required phase angle
- Voltage or current phase load control
- Starting by wide range of DC and AC signal
- Galvanic separation of inputs and outputs
- Possibility of attaching to the DIN panel
- Visual signaling of control unit state

Parameters:

types	GU 4000, GU 4000 – 400
power supply	230 V AC / 50 Hz, 25 mA (GU 4000) 400 V AC / 50 Hz, 25 mA (GU 4000 – 400)
starting signal	3 ÷ 60 V DC 5 ÷ 45 V AC / 50 Hz
voltage phase control	0 ÷ 10 V DC (0 V ~ 180°, 10 V ~ 0°)
current phase control	4 ÷ 20 mA DC (≤ 4 mA ~ 180°, 20 mA ~ 0°)
output phases	1,5 A, 22 µs, 3,7 kHz
electric strenght input – output	5 kV
operating temperature	-25 ÷ 60 °C
dimensions w × h × d	45 × 110 × 120 mm
weight	0,38 kg
cover protection degree	IP20

Power semiconductor converters

Power semiconductor converters include power semiconductor devices, heatsinks and control units. Basic type families can be modified according to the specific customer requirements. GTO or IGCT thyristors are applied as active controlled devices. Efficient cooling of semiconductor devices is provided on the basis of heat pipes with forced air cooling. Robust however relatively lightweight converters design allows very easy maintainability which - in connection with excellent quality of power semiconductor devices - provides guarantee of their long life and high operating reliability.

Typical fields of the applications:

- Phase-controlled voltage converters
- Electronic switches
- Traction pulse power converters for DC motors
- Power inverter for asynchronous motor

References:

Traction converter of the PSC 6060 and PSC 6070 series create an essential part of electrical equipment for trolleybuses 14Tr, 15Tr, 17Tr, 21Tr and 22Tr manufactured by ŠKODA company With using of GTO or IGCT converters have also recently modernized some older types of trolleybuses. Application of the new converters enables energy recuperation to the supply network and helped to simplify the maintenance of vehicles. It also contributed to higher operating reliability of vehicles and better travel comfort of passengers.

Traction converter for class 560 electric unit

Class 560 ČSD electrical units have not gone through any complex serial modernization since about three decades of operation. The first complex modernization of one unit was done in 1993 – 1994 after a number of partial technical adaptations due to the operational requirements. In 2002 the Czech Railways (ČD) advertised new competitive examinations for modernization of other units.
The decision was to modernize completely the traction drive including all the auxiliary electric drives and the control system. Traction drive modernization included renovation of high voltage circuits, main transformer and traction motors. Furthermore there was a need of substituting the existing traction converter, which was already showing high fault rate and its dynamic and power parameters did not meet the current requirements any more. Another important condition of this modernization was to have the possibility of running a modernized and non-modernized motor carriage in the same train and at the same time.
Traction converter reaches the required power level of 465 kW, has better running and braking parameters than was required and works with high power efficiency and electric power factor approaching the value of 1. The converter also enables recuperation of electric energy back to the power supply system or to the self-consumption mains at braking. One motor carriage of the electric unit is filled with 2 boxes. Each box contains a compatible rectifier and a chopper, which feeds 2 DC traction motors. The chopper is formed by 2 shifted converters. This connection guarantees a low current ripple of motors. Most modern power semiconductor devices – IGCT thyristors – are used in all converters. They facilitate high overload capacity and high working frequency at the same time. Thyristor control is done by means of optical cables. Optical cable control is resistant to interfering pulses and separates galvanicaly the control part from the power part at the same time. All power devices in the converters are cooled by air-cooled heat pipes.

Features of the converter:

- Use of most modern IGCT power devices
- High overload capacity
- Very lonw interference regarding railway regulations
- High power factor value
- Possible recuperation of electric energy
- Low output current ripple
- Electrodynamic brake independent on line voltage

Parameters of the converter:

supply voltage	2x465 V	
output voltage	730 V	
output current	630 A continously	
	700 A for 1 hour	
	1200 A/ for 1 minute	
power	420 kW continously	
	465 kW for 1 hour	
operating frequency of the converter	600 Hz	
power factor value:	> 0,98 for power range	P > 0,5 Pjm
	> 0,95 for power range	0,33 Pjm < P ≤ 0,5 Pjm
	> 0,90 for power range	0,17 Pjm < P ≤ 0,33 Pjm
forced cooling	4000 m^3/hod.	
insulation strength	5000 V/1 min.	
dimensions (w x d x h)	1015 x 930 x 1250 mm	
weight	460 kg	

Draw-out rectifier for metro traction substations

Traction substations, which feed the oldest part of the line C of the Prague metro, are equipped with rectifiers from 70s, when the metro was opened. Regarding the moral and technical obsolescence the decision was made to substitute these rectifiers by new ones. Demanding requirements were put on modernization, they result from specific working conditions of rectifiers.

The assembly converts 3-phase AC voltage to DC voltage for feeding traction drives of metro units. The working regime requires the possibility of short-time overload. The designed rectifier is able to endure up to 3 times higher overload during 1 minute. The rectifier is equipped with specially designed power diodes. These diodes can endure high overload, which enables us to miss out fuses for single devices. Protection is then ensured by a fast switch. Regarding the requirement of natural cooling and high powers, heat pipe coolers were used for cooling of power devices. The inner setting of the rectifier was divided into 3 thermally independent sections in order to achieve better cooling. The outer dimensions of the box were designed so that it would be possible to place the new rectifier into the former spaces. The sophisticated design has enabled us to reduce the weight considerably, which makes manipulation easier.

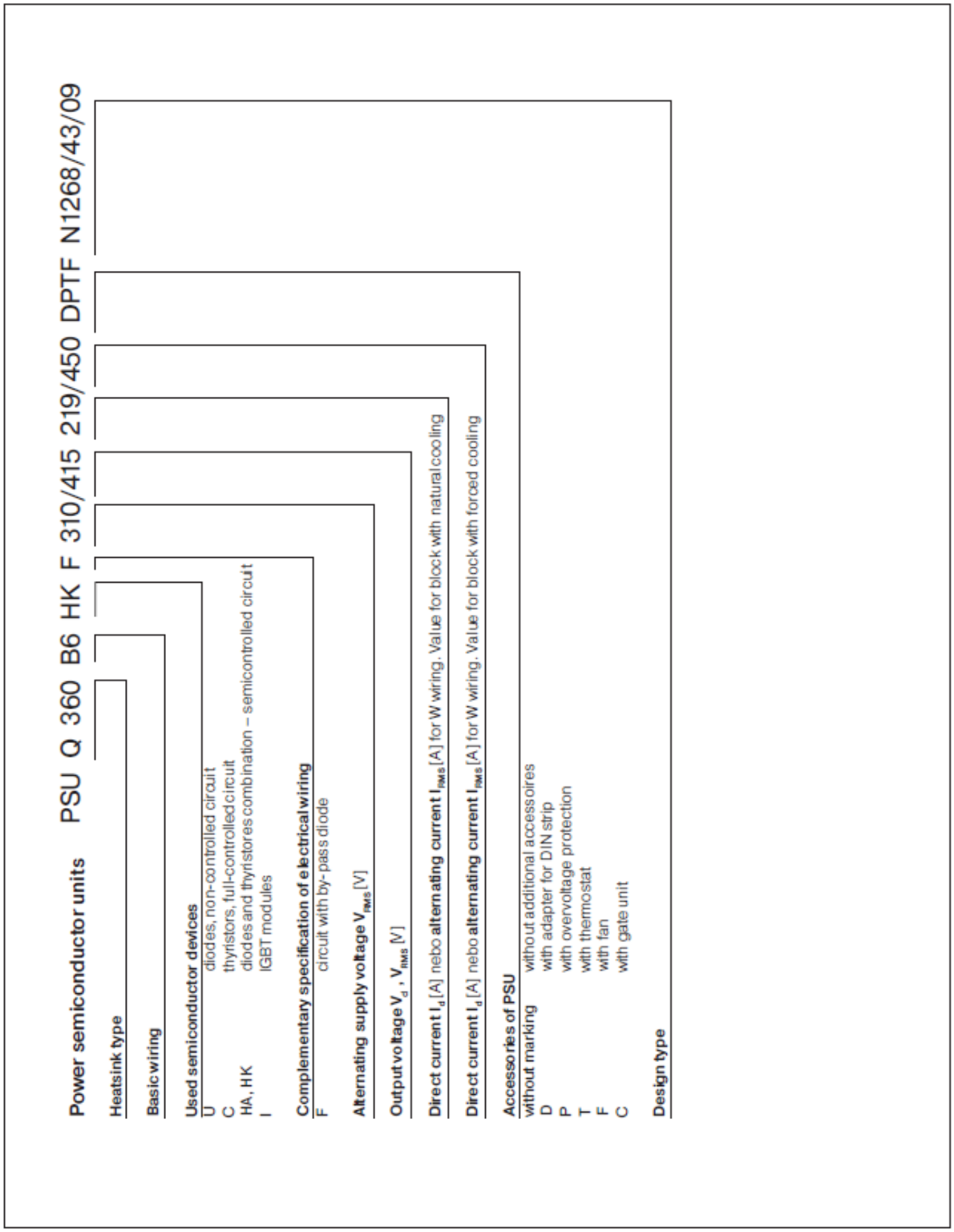
Features of the rectifier:

- Use of most modern power diodes
- High overload capacity
- Natural cooling
- Low weight

Parameters of the rectifier:

connection	3-phase diode bridge with 2 parallel-connected diodes
traffic class	VI
input voltage	660 V AC/50Hz
output voltage	884 V DC
maximum peak voltage	2000 V
output current	Id = 3000 A continuously Id = 4500 A for 2 hours Id = 9000 A for 1 minute

Marking keys



Symbols

I_d	average output current of converter
I_{RMS}	RMS current value
V_d	average output voltage of converter
V_{RMS}	RMS voltage value

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