PLUTON TURN ON THE FUTURE

METAL-CLAD RECTIFIER SEMICONDUCTOR SUBSTATIONS KVPP

INDUSTRY

METAL-CLAD RECTIFIER SEMICONDUCTOR SUBSTATIONS KVPP

Metal-Clad Rectifier Semiconductor Substations KVPP is meant for power supply of 230 V DC consumers, DC power supply of industrial plants workshops networks, including electric drive.

Substation includes:

- rectifier unit:
  - rectifier;
  - transformer;
- cabinets with automatic equipment;
- busbar bridges.

▲Rectifier and Cabinet with automatic equipment

TECHNICAL PARAMETERS OF KVPP

Name of parameter	Value
Number of units	One-unit, two-units, three-units
Unit rated current, A	1000, 1250, 2000, 4000
Units design	right, left
Remote control of HV circuit breaker and outgoing feeder circuit-breaker	through interface RS485, with dry contacts
Parameters transfer to the upper level through interface RS- 485	I, U, P, insulation monitoring
Interference immunity	satisfies all requirements of standards
Generator voltage frequency permissible variation for a long time	+2/-3

RECTIFIER UNIT

Rectifiers are manufactured with application of modern technologies and achievements. It refers to cabinet design, rectifier power part, electrical assembly, circuit and process solutions of rectifier protection, diagnosis and control system, maintenance and repair technology.

We supply rectifier with Resibloc® windings dry transformer.

We produce zero circuit rectifiers with smoothing reactor and three phase bridge circuit rectifiers:

Current	Rectification circuit
1000 A, 1250 A, 2000 A, 4000 A	three-phase bridge circuit for current
1000 A, 2000 A, 4000 A	three-phase zero circuit with smoothing reactor

▲Rectifier

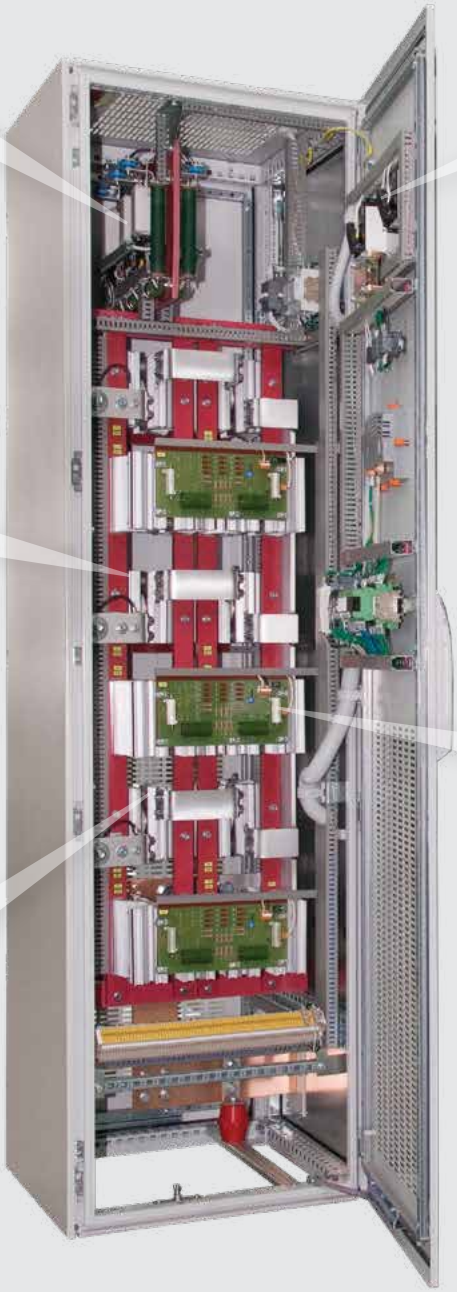
RECTIFIER CONFIGURATION AND MAIN FEATURES

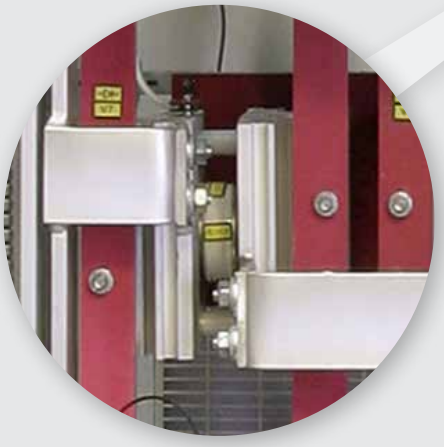
Switching surge protection

Power semiconductor devices are protected against internal and external switching surges. Diodes are protected against internal switching surges with RC-circuits and against external switching surges combined with RC- circuits and varistors.

Power Diodes

Pill power diodes manufactured by VISHAY (formerly International Rectifier) are applied.



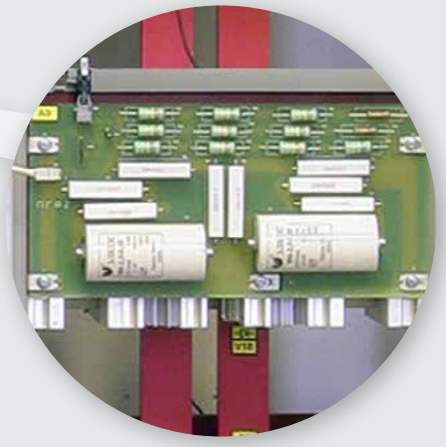


Contact Connections Stabilizing

Power part of rectifier is manufactured applying maintenance-free contact connections.

Diagnostics and Control System

The system is based on **industrial controller PP70** (with colored HMI panel) providing each diode parameters monitoring in dynamic mode during operation of the rectifier. It also provides events logging, visualization of temperature distribution, voltage and other diode parameters, protection against rectifier and transformer overheating, protection against diodes breakdown, communication with SCADA system etc.



Galvanic isolation boards provide protection against overvoltage with RC-circuits, supply information for diagnostics system controller analysis.

TRANSFORMER

KVPP includes the following transformer:

- RESIBLOC (250, 400, 630, 1000, 1600, 2500) kVA – for bridge rectification circuit and for zero rectification circuit with smoothing reactor.
- TSZPU-(1000, 2000) /10 GT N3 – for zero rectification circuit with smoothing reactor.

Transformer with RESIBLOC® windings provides compliance with the following requirements:

- fire safety;
- environmental compatibility;
- “cold” start with maximum load;
- high resistance to dynamic loads under overloads and short circuits;
- overvoltage resistibility;
- minimum maintenance;
- reliable operation under conditions of high
- pollution, high humidity, low temperatures.

Transformers have original design of HV and LV winding made of wire and foil. Windings are shrouded with epoxy-impregnated fiberglass string.

High content of fiberglass (approximately 80 %) and combination of lateral and longitudinal reinforcement makes winding with a very high lateral and longitudinal strength. Transformer windings mechanical strength is 650-750 N/mm^2.

Transformers operate under condition of 100 % humidity, water vapor condensation, and chemical pollution.
Transformers can be equipped with low noise radial fans. Forced cooling system allows to increase transformers rated capacity up to 40 %.

DIAGNOSTICS AND CONTROL SYSTEM

Rectifiers are equipped with microprocessor control and diagnostics system. This system issues the following criteria information about state of each diode on visualization panel: “normal operation”, “parameters derating”, “breakdown”, as well as diodes temperature.
Monitoring of each diode parameters is made dynamically, during rectifier operation.

Diagnosis of the mentioned criteria can significantly increase the period of rectifier trouble-free operation.

In case of diode parameters changing to critical for this circuit level, the power diode can be replaced without its breakdown. In case of one diode breakdown, the rectifier continues operation.

Visualization power panel is a modular type industrial controller PP70 with color LCD screen produced by Bernecker & Rainer (Austria).

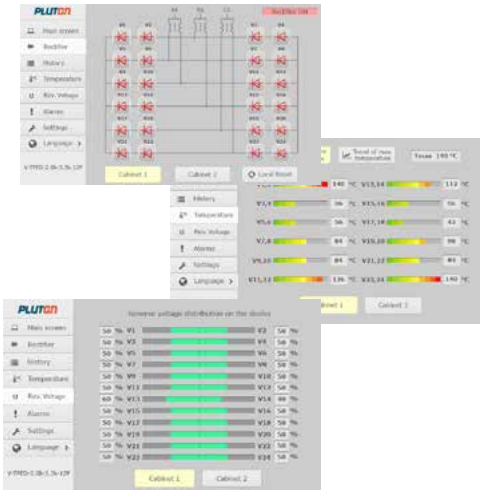
Information about state of the rectifier and its elements can be observed on visualization panel or computer monitor using special program.

Mnemonic symbols of rectifier diodes, graphs of reverse voltage distribution between diodes and arms temperature is displayed.

The rectifier is connected with medium voltage switchgear protection devices and SCADA system.

The following data is displayed on visualization panel:

- rectifier single-line diagram;
- events log;
- diodes temperature;
- diodes temperature diagram;
- voltage distribution between two diodes in series;
- signals:
  - transformer overheating;
  - doors condition;
  - rectifier overheating;
  - diode parameters derating.



CABINETS WITH AUTOMATIC EQUIPMENT

▲ Linear units cabinet

Cabinets with automatic equipment are meant for power supply and protection of 230 V DC circuits of iron and steel works crane substations.

TTypes of cabinets:
SHLA – linear units cabinet;
SHVA – incoming units cabinet;
SHSA – section units cabinet.

Cabinets with automatic equipment include automatic circuit-breakers of the leading European manufacturers (ABB, Schneider Electric) having the following advantages:

- withdrawable design;
- high switching capacity, up to 65 kA;
- electronic tripping device;
- two power supply channels;
- capacitor bank for tripping device power supply support up to 5 s.

TECHNICAL PARAMETERS

MAIN PARAMETERS OF RECTIFIERS

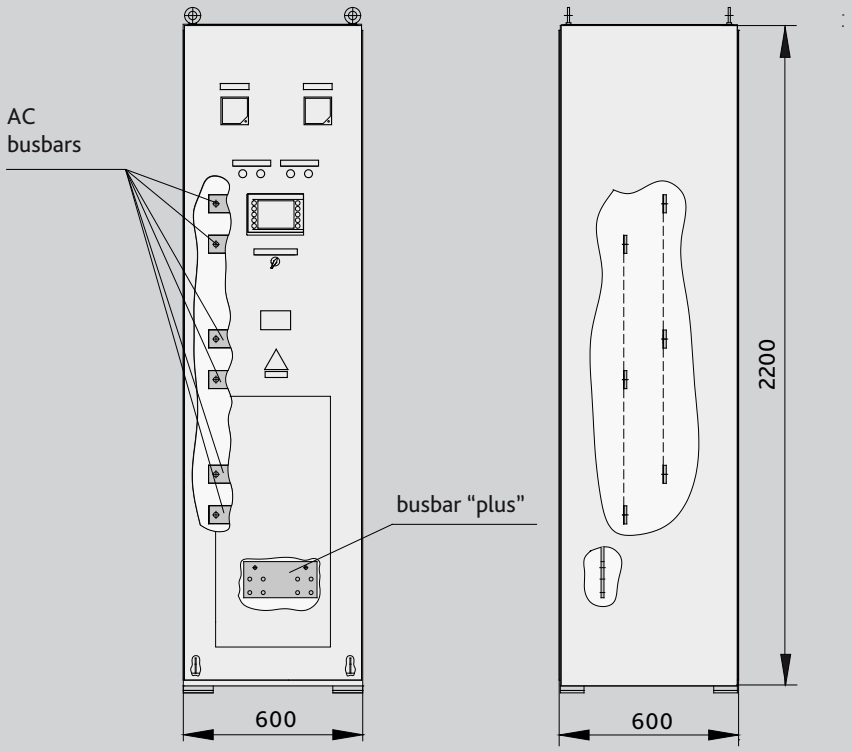
Name of parameter	Unit	V-TPED-2.0k-230N	V-TPED-4.0k-230N	V-TPED-2.0k-230M	V-TPED-4.0k-230M
Rated output active power	kW	460	920	460	920
Rated output voltage	V	230			
Rated output current	A	2000	4000	2000	4000
Rated input voltage	kV	6; 6.3; 10; 10.5			
Rated input frequency	Hz	50 (60)			
Number of rectifier input voltage phases	-	3			
Number of phase connections of converter section	-	6		3	
Type of converter section cooling	-	Air, natural			
Voltage of auxiliary circuit	V	~220			
Capacity coefficient (design), no less than	r.u.	0.95			
Efficiency coefficient (design), no less	%	98			
Standard power of converting transformer	kVA	1000	2000	1000	2000
Rated power of converting transformer	kVA	700	1365	700	1365
Type of converter transformer	-	RESIBLOC® 800	RESIBLOC® 1600	RESIBLOC® 630	RESIBLOC® 1250
		TSZPU-1000/10	TSZPU-2000/10	TSZP-1000/10	TSZP-1600/10
Ratio of current overload tolerance, once and during permissible overloads		1,25 - 7200 s, twice in 24 hours* 1,5 - 300 s, 1 time per 30 minutes.** 2,0 - 60 s,1 time per 30 minutes.**			
Converter section overall dimensions, no more than length depth height	mm	 600 600 2200	 1000 600 2200		
Weight of converter section, no more than	kg	200	400		

* RMS current value per any 8 hours during the day should not exceed rated current.
** RMS current value per any 30 minutes should not exceed rated current, and if during these 30 minutes 100 % overload takes place, the averaging time should be 5 minutes.

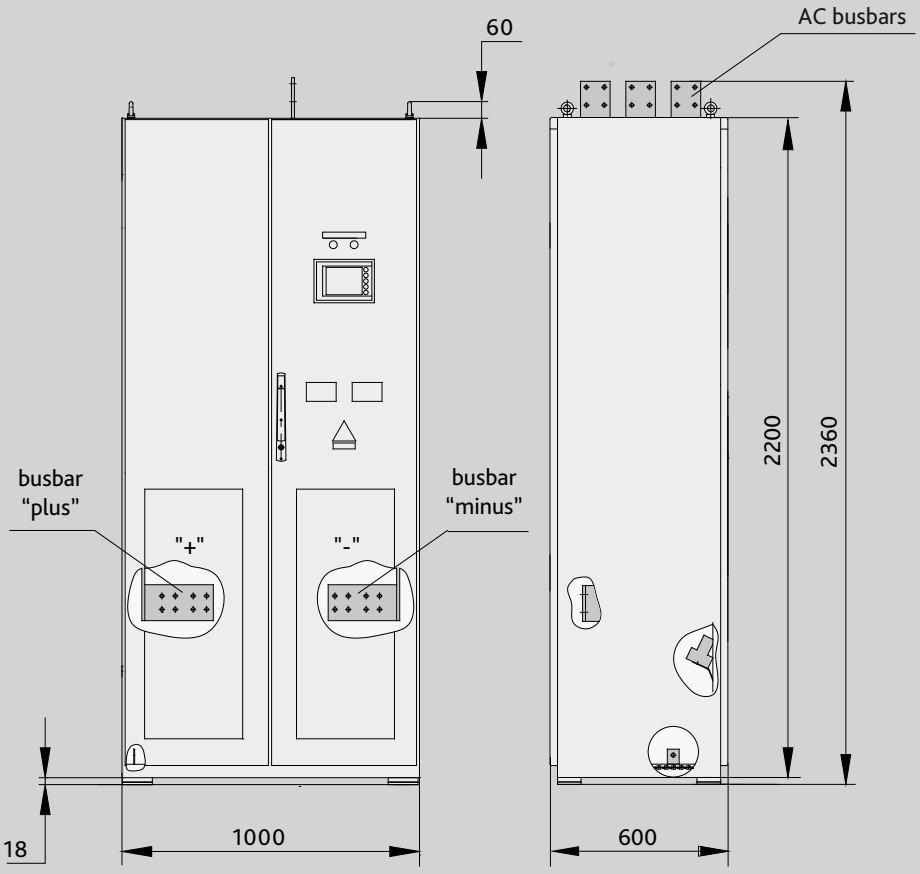
MAIN PARAMETERS OF CABINETS WITH AUTOMATIC EQUIPMENT

Name of parameter	Unit	Value
Cabinet designation	-	L-linear, S-section, V-incoming
Rated current of circuit-breaker, In	A	800, 1000, 1250, 1600, 2000, 2500, 3200, 4000
Rated current of tripping device	A	(0.6…1.0)*In
Max. tripping device setting current	A	(1,5; 2,5; 4; 8)*In
Design	-	left, right
Outgoing line connection	-	busbar, cable
Maintenance	-	single-sided, double-sided

OUTLINE DRAWING OF RECTIFIER

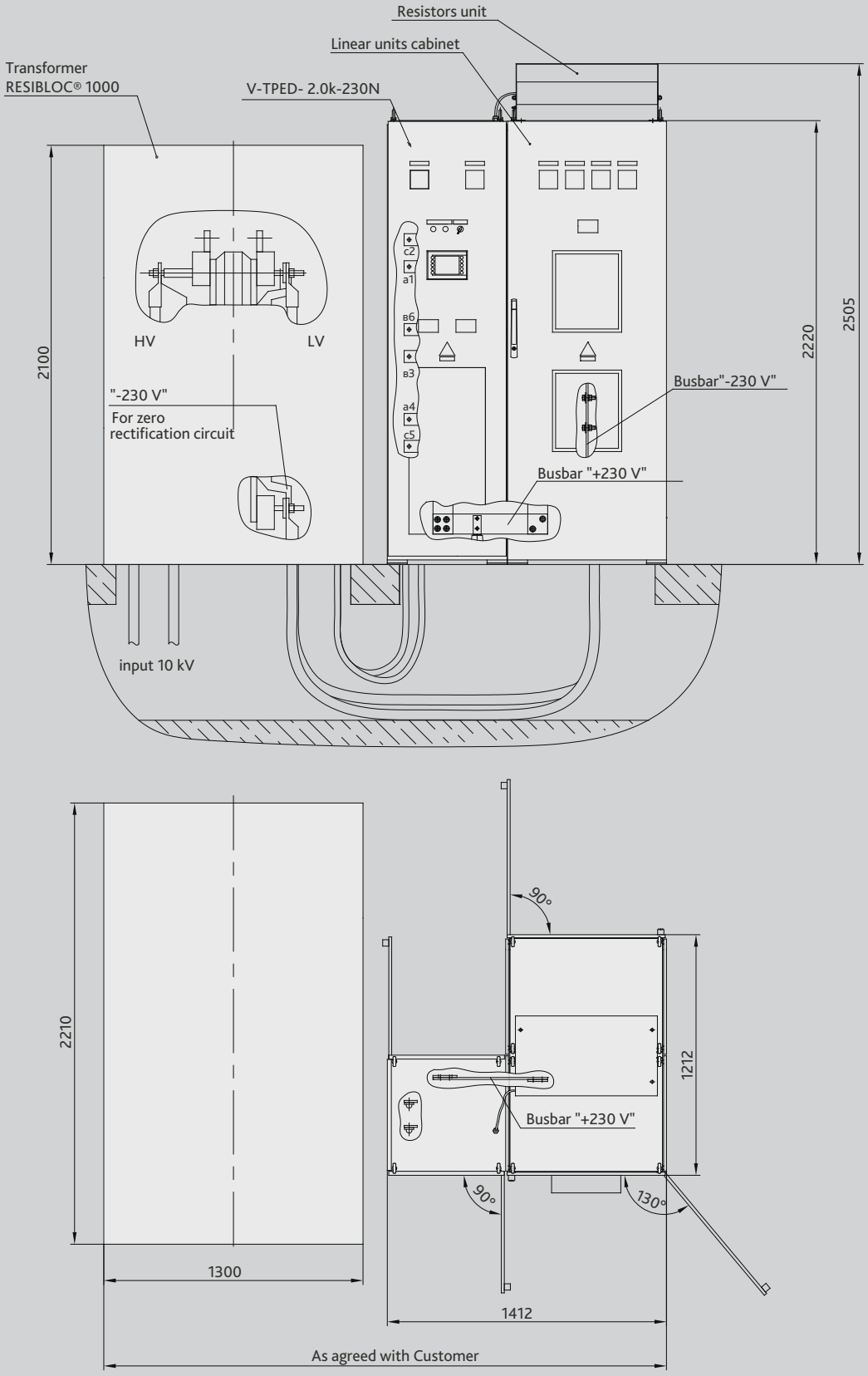


V-TPED-2.0k-230N
zero rectification circuit



V-TPED-2.0k-230N
bridge rectification circuit

EXAMPLE OF DESIGN ARRANGEMENT KVPP



Example of design arrangement of a single-unit substation KVPP-2,0k-230 with RESIBLOC 1000 transformer, rectifier V-TPED-2.0k-230N, with one linear units cabinet. Cable connection. Linear units cabinet with double-sided maintenance.

TYPE DESIGNATION

V-TPED - XXX - 230X

V	rectifier;
T	feeding line current type: three-phase;
P	output current type: constant;
E	cooling: air natural;
D	type of applied main semiconductor units of power circuit: diodes;
XXX	value of rated output current: 2.0 kA; 4.0 kA;
230	value of rated output voltage in volts;
X	rectification circuit: N- zero; M - bridge.

KVPP - XXXX - 230

K	metal-clad;
V	rectifier;
P	semiconductor;
P	substation;
XXXX	rated output current: 1000, 1250, 2000, 4000 A;
230	rated output voltage, V.

IMPLEMENTED PROJECTS

Alchevsk Iron and Steel Works
(Alchevsk, Ukraine)
2006
Supply of 2 package Metal-Clad Rectifier Semiconductor Substations KVPP-4.0k-230:

- Rectifier V-TPED - 4 units;
- Linear units cabinet - 8 units.

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