

# Operation on battery packs of damaged installations on a tugboat

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**Abstract.** The supply of own services of direct current is made from at least two sources of DC power, the independent and capable sources of ensuring, each of them, the entire consumption. As a normal power source, are used AC/DC rectifiers and DC/DC converters, as the case. The provision of safety power supplies its able to take over, for a limited time, normalized, the whole consumption in the DC of this objective, is mandatory for all objectives. As a safe power supply are used battery packs. Each battery pack supplies a single network; it is not supplied from the same battery, two or more distribution networks, with different nominal voltages through intermediate sockets. For voltage supply, in case of dismissal of the basic source, they can be used as local sources, which provide electricity directly, the battery, built to ensure the required voltage and capacity in battery packs. The ships present the damaged installation which can operate supplied by battery packs. Electrical control circuits, signalization circuits, protection circuits and automation circuits are supplied with DC voltage. In this article we will calculate the battery capacity of a ship.

## 1 Overview

Safety in the power supply depends on the reliability of the electricity production, transport and distribution installations.

As the electricity obtained from the alternators cannot be stored, it means that when the voltage disappears to the consumer it can only be supplied from another local source which implies the existence of a generator, an automatic starter installation, etc.

This solution is used to ensure the supply of vital and relatively high power consumers, but which do not have a widespread.

Known, however, that the continuous electricity can be "accumulated", it is practiced the solution of continuous voltage supply of the importing consumers, but with powers not too great, having the advantage that, for supply, in case of dismissal of the basic source, they can be used as local sources, which provides electricity directly, battery, built to ensure the voltage and capacity required in battery packs. [1]

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Usually, electrical control circuits, signalization, protection and automation are supplied with DC voltage.

The battery packs ensure the direct current supply of the electric receivers the supply of which must be ensured during the disappearance of the voltage of its own AC services.

For those electrical receivers whose power must not be interrupted at any time and high-power electrical receivers and short-lived, which does not support the voltage variations that occur if their supply is made exclusively by rectifiers or converters.

Usually, each battery pack supplies a single network, with a single nominal voltage and they cannot be powered from the same battery two or more distribution networks with different nominal voltages, through intermediate sockets.

Networks with different voltages are powered by different batteries. The networks with different nominal voltages will be galvanic separated.

For electrical stations with voltage  $\geq 110$  V with large number of cells ( $\geq 5$ ) in the case of a single working battery, this system can be divided into two sections.

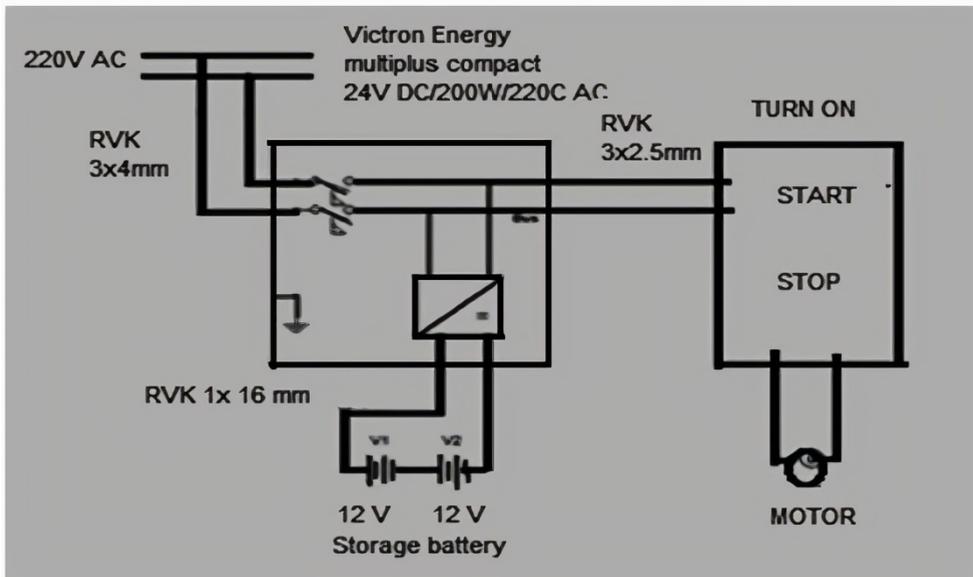
The battery is connected to both bar sections and the charging sources are either basic or backup, each one is connected to one of the sections (Fig. 1.).

Usually in the case of a single working battery, the two sections are permanently connected. The connection between the sections can be opened during operation for short periods of time for the galvanic separation of the receivers, for earthquake detection, or during the revision work maintenance or repair at one of the bar sections.

For each working battery there is a simple system of main collector bars divided into two or three sections by one or two longitudinal couplings.

In the case of a single working battery, the principle of bar connection of the power supplies is applied. [2]

## 2 Fire extinguishing system in the machine compartment with battery packs



**Fig. 1.** Fire installation for extinguishing the fire in the machine compartment with battery packs

The power supply is 220V AC and the two batteries are charged by a Victron energy multiplier compact 24 V DC / 2200 W / 220 V.

The batteries are sized 12 V every 180 Ah.

The conversion from 24 V to 220 V AC is performed.

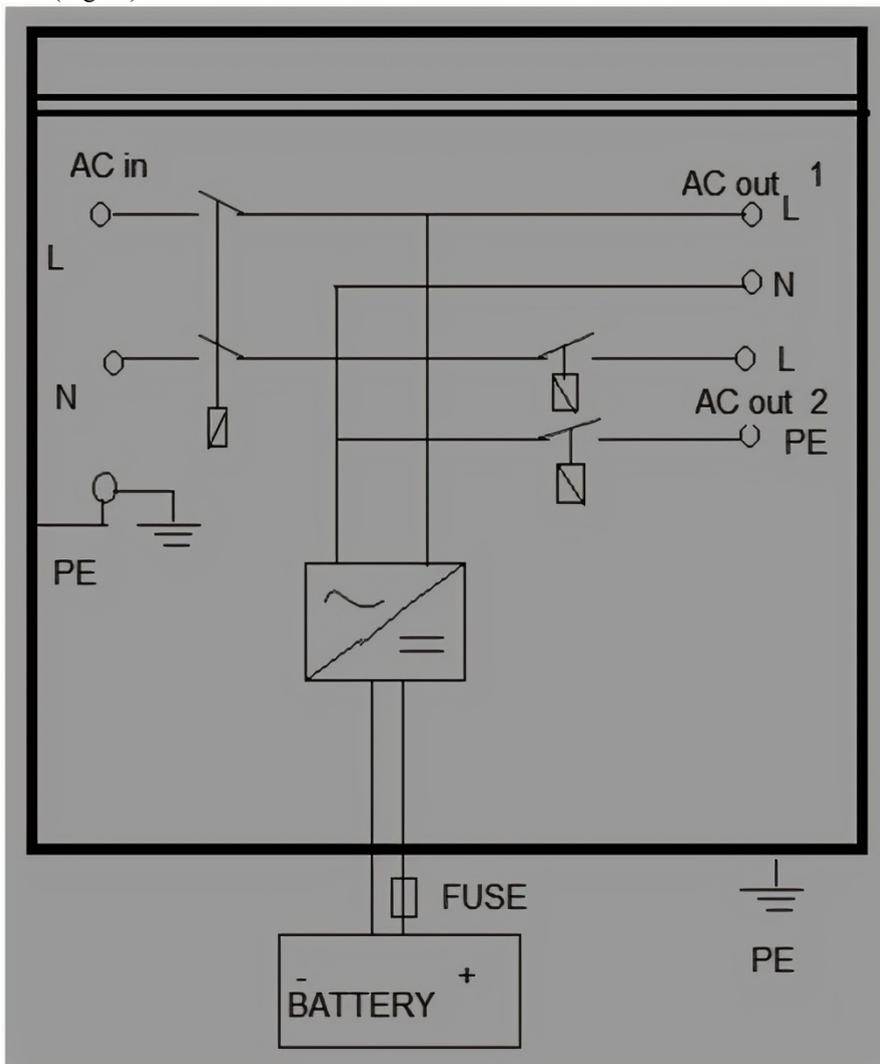
In this way the operation of the pump motor in case of failure is ensured.

The pump motor is 1.1 kW, 2800 rpm operating at a voltage of 220 V.

The driven pump draws water from a freshwater tank supplied from the dock and pushing it on the system with sprinklers, with a pressure of 6 bars.

The sprinkler system consists of a manually operated sprinkler head which starts only when the system start button is pressed. They are located above the main engines and the DG of damage.

The inverter regulates the AC output frequency for the systems with coupled photovoltaic inverters (Fig. 2.)



**Fig. 2.** Inverter block diagram

MultiInverter can be used in the solar converter connected to the network that is, a photovoltaic inverter, to make an island system. [4]

Thus the charge will flow to the battery.

This can cause the batteries to charge.

To prevent this, the solar converter must be powered or stop when the battery voltage becomes too much.

Most brands and types of PV inverters can be power limited by adjusting the output frequency of the MultiInverter, that is, by changing the frequency, the loading process can be adjusted.

The transfer switch can affect the frequency range.

When the system is in inverter mode the output power of the inverter connecting to the electrical network is controlled by changing the frequency of alternating current output of the system. A mechanism commonly referred to as "frequency change".

The conditions that must be met to change the frequency:

1. The battery voltage decreases below the recharged voltage threshold: the voltage that causes the system to restart the charging cycle.

For lithium batteries, this threshold is defined as the floating voltage - 0.8V.

When configured at 54.8 V or more, then the battery voltage should fall below 54V.

For lead batteries, the recharged voltage is defined as 5.2V below the configured floating voltage.

Unless it is set to 56.8 V or greater: then the battery voltage must decrease below 51.6 V.

2. The system is connected to the mains supply or to the generator

As soon as you apply a voltage to the AC input, it will synchronize the AC frequency to 50Hz and then connect.

List of probably consumers:

- general alarm
- navigation lights
- fog signaling facility
- CO<sub>2</sub> launch signaling facility
- navigation equipment
- interphone
- lighting damaged
- various signals

The *alarm bell installation* is used to set the alarm on board the ship or to transmit different signals on the ship.

The alarm is transmitted from the wheelhouse.

The installation of the alarm bells is supplied at 24V DC from the battery charger.

The alarm goes off on the ship by actuating the switch in the navigation desk where in parallel with the alarm switch the lamp is connected which signals the functioning of the bells.

At least every 10 days but every time before the ship at sea the proper functioning of the alarm bell system must be checked.

The *super typhoon siren installation* is used for signaling provided for by the "London 1974 Convention for the Protection of Human Life at Sea" under low visibility conditions, the ship being equipped with super typhoon siren installation.

The super typhoon siren installation is composed of:

- air siren
- automatic control block
- fog lamp
- button

The system is powered at 220 V, 50 Hz.

*Radio goniometer installation OG 132* is used to determine the position of the ship based on the bearings, the ship being equipped with a goniometer radio installation.

The installation consists of:

- receiver
- radiometer
- connection box
- food block
- frame antenna

The radio goniometer installation is powered at 220 V, 50 Hz and 24 V.

To ensure the proper functioning of the installation, before leaving for the drive it is done position determinations at 1-2 radios, determining the correct functioning of the device and maintaining the viability of the broadcasting curve.

Periodically, the status of the frame antenna, the compensation antenna, the receiver and their connections is examined.

*Radiotelephony installation UUSR 6401*

To ensure the short distance connection between ships at sea in the case of convoy navigation in port with tugboats and piles, in the wheel and in the port basin with the port dispatcher, the ship is equipped with a UUS radio station.

Radiotelephony facility in UUS for ships type R6401 t is supplied at 220 V, 50 Hz.

The connection to the ship's on-board network is made through the power cord of the transmission-reception unit.

*Radiotelephone RR3906 – 2*

To ensure radio links on the ship, a RR3906 - 2. is installed. The installation consists of:

- radio phone UI
- power supply and charging batteries
- battery batteries
- antenna stick

The system is supplied at 220 V, 50 Hz.

### 3 Calculations to determine the battery capacity of radio batteries

- VHF / DSC radiotelephone cl. A - emission  
- reception

$$3\text{h} \times 5.5 \text{ A} = 16.5 \text{ Ah} \quad (3.1.)$$

$$3\text{h} \times 1.0 \text{ A} = 3.0 \text{ Ah} \quad (3.2.)$$

- VHF / DSC radiotelephone cl. D - emission  
- reception

$$1 \text{ h} \times 5.5 \text{ A} = 5.5 \text{ Ah} \quad (3.3.)$$

$$1\text{h} \times 1.0 \text{ A} = 1.0 \text{ Ah} \quad (3.4.)$$

- MF / HF radio handset - broadcast  
- reception

$$3\text{h} \times 8.0 \text{ A} = 24.0 \text{ Ah} \quad (3.5.)$$

$$3\text{h} \times 1.2 \text{ A} = 3.6 \text{ Ah} \quad (3.6.)$$

- NAVTEXT

$$6 \text{ h} \times 0.1 \text{ A} = 0.6 \text{ Ah} \quad (3.7.)$$

- GPS

$$6 \text{ h} \times 0.1 \text{ A} = 0.6 \text{ Ah} \quad (3.8.)$$

$$\text{Total: } 54.8 \times 1.5 = 82.2 \text{ Ah} \quad (3.9.)$$

Battery 2x12 V Capacity 90 Ah

The battery forming charge must ensure the nominal capacity of the battery. Charging is also done at a lower current than the maximum charging current, but in this case the charging time is extended proportionally. It does not charge at a load current of less than 40% of the maximum load current. Generally for battery formation, a step-by-step charge is used. The load current is a current of 7 [A] for each element. The total current flowed from the load source is obtained by multiplying by 7 the number of elements placed in parallel to the load. If the battery is discharged with a high current, the discharge will stop when the voltage reaches 1.8 [V] per element. If the unloading is done in one hour, the voltage on the element should not fall below 1.75 [V]. After the battery is discharged, the battery is charged. Charging starts after at least 20 minutes and at most two hours when the download is stopped. It is most favorable charge is the one with constant current value and equal to 1/3 of the maximum load current.

## 4 Conclusions

On board ships, the electricity sources are represented by the electric generators. These are either DC or AC. They are driven by diesel engines or turbines, as well as battery packs. If the ship runs out of power it switches automatically/manually on battery packs.[3] They provide the minimum electricity for moving the ship.

## References

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