Reference Story

CLEAN POWER FOR SECOND LARGEST PORT IN WORLD

Movable shore power supply system with Vacon AC drives at Shanghai Port

Clean AC power is essential for the reliable and efficient operation of electrical equipment. The Port of Shanghai, the second largest port in the world, uses a movable 2000 kVA shore power supply system with Vacon AC drives to supply electricity from the national grid to the ships in dock. This miniature electricity substation is green not only in colour but also in terms of the benefits it brings: low exhaust emissions, costs and noise.

Large ships have a vast range of electrical equipment and high requirements for the quality of the power supply, so the capacity and quality of the power supply are issues that need to be considered carefully.

As a rule, ships in port generate the electricity they need with their own generators using diesel fuel, and this creates exhaust emissions and noise. In most ports, ships have to use expensive high-octane fuel so as to reduce exhaust emissions.

So far a few ports in the world have adopted a shore power supply system for docked ships, meaning that ships are supplied with low-emission, noise-free electricity from the national grid through a shore power box and a link cable.

An important import and export base for goods in China, the Port of Shanghai uses a 2000 kVA shore power supply system with Vacon AC drives, capable of converting the 10 kV shore power into 440 V/60 Hz or 380 V/50 Hz high-quality clean power for the ships in the port. This solution is not only good for the environment but also gives other benefits such as a low level of noise, low power consumption and vibration, high efficiency, accuracy and stability of the power supply, and has a long life.

Satisfying various application requirements

At present, an average of nearly 170 large ships as well as numerous small ships dock in Shanghai port every day. The grid standards used on ships coming from all over the world differ from each other. Many ocean-going vessels have a 440 V/60 Hz 3-phase, 3-wire system, while a 380 V/50 Hz 3-phase, 4-wire system is used in China. Since the wrong power supply can damage marine equipment, the shore power supply system is used to convert shore power to ship power, and to provide power for ships using various grid standards.

Reliable products and outstanding control

A key component in the design of the 2000 kVA shore power supply system at the Port of Shanghai was the Vacon NXP AC drive, featuring coated PCBs, a compact structure and high control performance. In addition, it conforms to ABS and DNV standards.

After the Vacon NXP output is filtered by a sinusoidal filter, a pure, smooth alternating current is supplied to the ship through a special flexible cable reel. To prevent the impact of inductive loads and startup currents, the voltage converter monitors variations in the voltage in real time, and the PID controller compensates for any voltage drop within milliseconds. In addition, the powerful software programming tool Vacon NC61131 also plays an important role in providing outstanding process control.

Extraordinary industrial performance

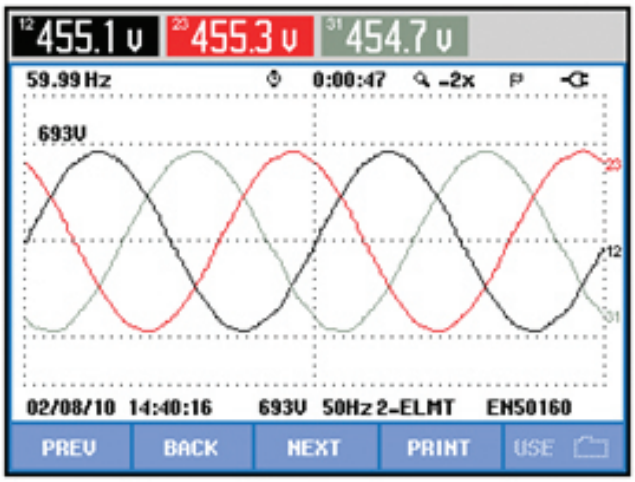
During the design phase of the 2000 kVA shore power project for the Port of Shanghai, comprehensive evaluations and strict reviews were carried out for every participating brand. Vacon won the customer's trust with its high performance products, excellent industrial experience, and enthusiastic and professional service attitude. During the project design process, the engineers of Vacon provided specific technical data and onsite instructions for installation and commissioning.

Reduced carbon emissions in future

Ships need to burn a large amount of heavy oil or diesel to maintain normal operation while in dock. Data shows that port cities produce 25 % more exhaust emissions than other cities because ships run their generators while in port. For instance, 93.3 tons of harmful substance, such as lead, and 31,000 tons of CO_2 are emitted by the large ships in Shanghai port every day.

The 2000 kVA shore power supply system developed jointly by Shanghai port and its partner Wuhan Guide has shown unprecedented technical benefits. Implementing this technology for all the large ships in the ports of the Shanghai Port International Group (SIPG) will eliminate the emissions of at least 33,800 tons of harmful substances and 11,3150 thousand tons of CO_2 annually and save 366,000 tons of standard coal. SIPG has filled a gap in the international shipping industry, and in future this technology can be expected to become an international standard.

In the future, moreover, the converter power application derived from the shore power voltage technology will have a more extensive application area, such as the power supply for medium-frequency heating furnaces with 400 Hz medium-frequency AC current, and for temperature rise testing of motors and generators using adjustable frequency and voltage. Compared to conventional devices, it has significant advantages such as a small volume and low noise and costs.



Voltage waveform under load.

Excellent technical indexes
The stabilization accuracy of the output frequency is approximately 0.02 % (under 100 % load)
The stabilization accuracy of the output voltage is approximately 2.5 % (under 100 % load)
Voltage waveform distortion THDu: < 3 %
Power factor: > 97 %
Overall efficiency: > 90 %
Output crest factor: 1.4

Movable shore power supply system at Shanghai Port. Shore power supply systems can cut costs considerably. Based on an oil barrel cost of USD 80, the annual savings for a cruise liner can be up to EUR 400,000. If one port includes a shore supply system, the annual savings for a container ship can be up to EUR 150,000, and if 15 % of ports include shore supply system, the annual savings for a container ship can rise to EUR 500,000. In Europe, the ports in Kemi and Oulu in Finland, Gothenburg in Sweden, and Lübeck in Germany have a shore supply system.

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