K-Sim® Engine
High Voltage Training System

Kongsberg Maritime's K-Sim Engine models with high-voltage (HV) functionality comply fully with the training requirements of the STCW Code 2010. Integrated with a real HV circuit breaker, K-Sim Engine provides a safe, realistic, and efficient training environment for electrical engineer students and shipboard crew, ensuring full alignment with STCW standards.

Training - operational level:
- Functional, operational and safety requirements for marine HV system
- Basic arrangement of HV systems and their protective devices
- Immediate actions to be taken under fault conditions
- Hazards associated with HV systems, incl. safety procedures related to disconnection, isolation and removal of a real circuit breaker
- Practical procedures and maintenance
- Use of trapped key system in high voltage systems

Training - Management level:
- Assignment of qualified personnel for HV maintenance and repair
- Taking remedial action necessary during faults in a HV system
- Producing a switching strategy for isolating components of a HV system
- Selecting suitable apparatus and carry our procedures for isolation and testing of HV equipment, complete with safety documentation

Meeting High Voltage Training standards

The International Maritime Organisation (IMO) has mandated High Voltage Breaker training to improve safety in shipping, meaning that engineers and maritime officers must complete STCW based courses to retain their Certificate of Competence.

Kongsberg Maritime's world leading K-Sim Engine simulators are the perfect choice to meet the new training requirements in section A-III/1, A-III/2, A-III/6 and B-III/2 in the STCW Code 2010.

High Voltage Training Solution

Several of our K-Sim Engine simulator models are available with a simulated high-voltage (HV) switchboard and an interface to a real HV circuit breaker. These models comply with the latest STCW requirements for practical HV training, enabling electrical engineers to gain a thorough understanding of HV systems while practicing and developing safe operational procedures in a controlled training environment. A typical high-voltage training configuration consists of one student station and one instructor station, both running a K-Sim Engine model with HV functionality, integrated with a real HV circuit breaker.

K-Sim Engine models can be seamlessly connected to physical breakers, allowing trainees to perform operations identical to those carried out on board. While the real circuit breaker enables physical actions such as isolation and earthing of equipment, the simulator provides system-level process understanding. Because the circuit breaker is fully integrated, any operation performed on the physical device is immediately reflected in the simulated electrical power plant, and vice versa. The instructor can introduce faults and assess trainee performance during and after each exercise.

High Voltage mimics

A mimic diagram provides a graphical representation of the HV plant, supporting both operational and safety procedure training related to isolation and earthing of equipment. The synchronizing panel and all circuit breakers are accessible via pop-up panels. Trainees must follow correct operational procedures on the equipment to safely carry out maintenance or service tasks.

Trapped Key System

Trapped key interlocks are widely used in real high-voltage (HV) systems to ensure safe access to equipment that may otherwise be live. The fundamental principle is that any switchgear capable of energizing areas requiring access must be fully isolated, earthed, and mechanically locked, preventing any possibility of re-energization while those areas remain accessible for maintenance. A typical training scenario involves accessing a transformer or converter following a malfunction. In such cases, the trapped key interlock system compels the user to correctly isolate and earth the equipment before access is permitted, thereby reinforcing safe operational procedures.

Integrated Automation System

All K-Sim Engine models features an Integrated Automation System (IAS) covering the user interface for important remote control and monitoring functions:

- Power Management
- Auxiliary machinery control
- Ballast/bunker monitoring and control
- Cargo monitoring and control
- Alarm handling
- Trend systems

Operations on the real HV breaker, will reflect status and alarms in the IAS as on board an actual ship.

Photo below: Screen dump of the mimic diagram presenting the high voltage switchboard

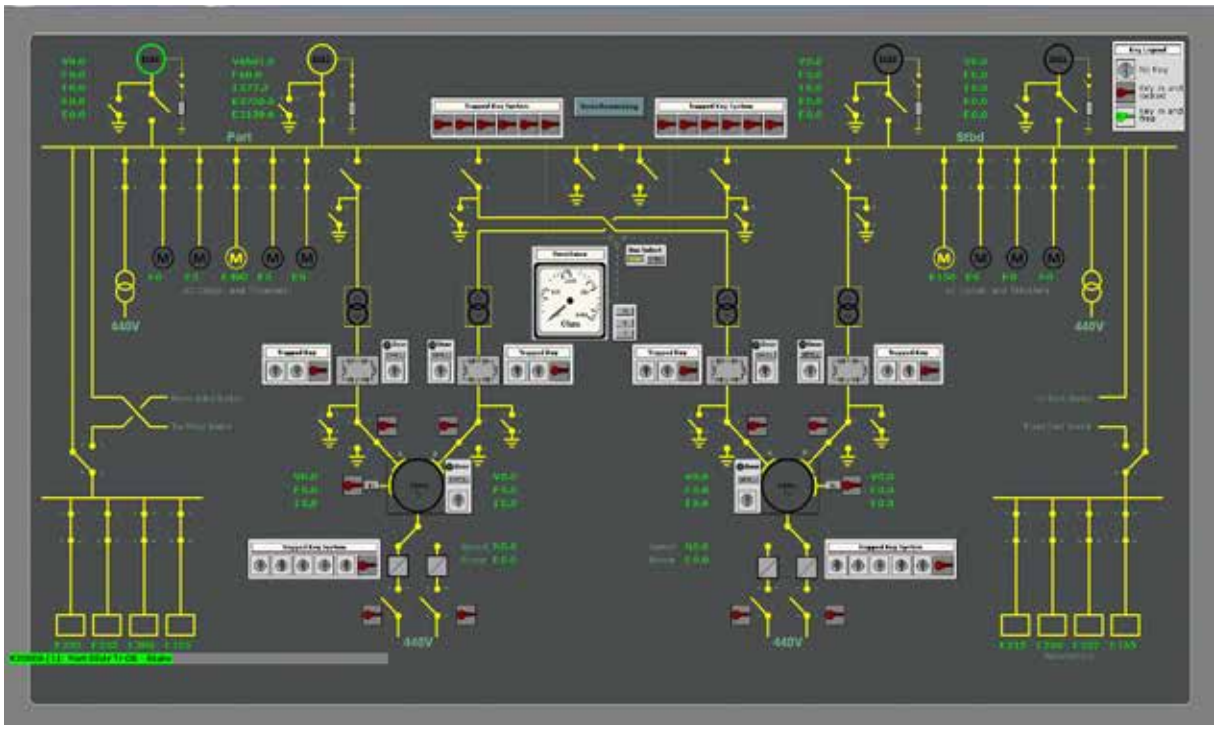

ABB High Voltage circuit breaker

Maritime training centres providing high voltage training courses by using real high voltage switchboards and distribution systems are limited to perform hands on hardware operation based on well prepared scenarios. When using simulators during the high voltage courses in combination with a real hardware circuit breaker, more realistic operational scenarios can be performed.

Real switchboard equipment such as a high voltage circuit breaker from ABB, can be integrated with a K-Sim Engine model to perform training scenarios identical to onboard operations. By using a simulator the operation will have an impact on the entire ship since the entire process onboard is affected.

Circuit breaker type vacuum:

Rated Voltage:	12 kV
Rated Frequency:	60 Hz
Rated Busbar Current:	630 A
Rated Short Circuit Current:	16 kA
Peak Current:	40 kA
Local Control Voltage:	24 VDC
Weight:	630 kg

A service trolley is included with the delivery.

K-Sim Engine simulator models for High Voltage training

Kongsberg Maritime has an extensive and expanding library of K-Sim Engine simulator models with various high voltage system configurations. All our models with high voltage systems can be connected to a real high voltage circuit breaker.

Available K-Sim Engine models for HV training:
Diesel Electric engine models:

- ERS DE-DF LNG carrier
- ERS DE22-III cruise ship
- ERS DE32 landing helicopter dock
- ERS DE66 drill ship
- ERS DE88 semi-submersible drilling rig
- ERS DE-DF LNG cruise ferry
- ERS DE42 landing ship dock

Power management models:

- PMT DE66 drill ship
- PMT DE88 semi-submersible drilling rig

"We are extremely pleased with the HV solution delivered by Kongsberg Maritime. The system enables us to offer courses for engineers who need to upgrade their certificates according to the new STCW 2010 requirements.

The course we provide is customised and comprises 50 hours of theory and practice at our school, in addition to 20 hours of self-study on electricity safety prior to this. The courses have become very popular and we are running HV courses every other week now"

- Lars Hellevik, Instructor at Bergen Maritime Vocational School, Norway

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