



### Назначение:

Мультимедийный обучающий модуль предназначен для теоретической подготовки пилотов ТНПА, осуществляющего эксплуатацию и техническое обслуживание силовых систем с напряжением свыше 1000 вольт.

### Что такое мультимедийный обучающий модуль?

Мультимедийный обучающий модуль (МОМ) представлен в виде электронного учебника. Размещенные в нем теоретический материал сопровождается рисунками и схемами. Для самостоятельной проверки знаний в МОМ включены разделы тестирования. МОМ может быть установлен на одном компьютере или по сетевой лицензии на всех компьютерах, объединенных одной локальной сетью.

### Содержание:

#### High Voltage Electricity

- Introduction to HV systems
- Safety
- Certification
- Description of system components
- Repair/maintenance
- References

#### Electricity in Hazardous Areas

- Introduction
- Safety
- Certification/Labelling
- Environment
- Description of Components
- Repair/maintenance
- References

### Нормативная база:

- IMCA C005 "Guidance on Competence Assurance and Assessment".

### Целевая аудитория

Операторы ТНПА



**TRAINING IN HIGH VOLTAGE ELECTRICITY**  
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Section 1: Introduction to HV systems

**Reasons for use of HV system.**


As the demand for electrical power increases on vessels, especially on large offshore construction vessels with diesel electric propulsion installations, the supply current becomes too high for efficient and practical use of the usual shipboard 3 phase voltage supply of 440 Volts (V) AC.

To reduce the level of running currents and fault current levels it is necessary to specify a higher system voltage for the higher power rated equipment.

By generating electrical power at 440V from 3 x 1 megawatt, 0.8 power factor diesel generator sets, each generator main cable and circuit breaker has to handle a full load current of:

$$\text{Power}(W) = \sqrt{3} \times \text{Voltage}(V) \times \text{Current}(I) \times \text{Power factor}(\cos\theta)$$
$$W = \sqrt{3} \times V \times I \times \cos\theta$$

Which returns a current of:



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Section 2: Safety


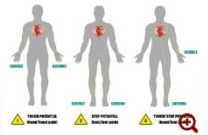
**Safety.**

**Electrical hazards to the human body.**

When electrical systems break down what are the primary hazards and what are the consequences to personnel?

- Electric shock;
- Exposure to Arc-Flash;
- Exposure to Arc-Blast;
- Exposure to excessive light and sound energies.

Secondary hazards may include burns, the release of toxic gases, molten metal, airborne debris and shrapnel. Unexpected events can cause startled workers to lose their balance and fall from ladders or jerk their muscles possibly causing whiplash or other injuries.



IMCASP022 Electrical Hazards

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Section 2: Safety

**Arc-Flash and Arc Blasts.**

An Arc-Flash is an unexpected sudden release of heat and light energy produced by electricity traveling through air, usually caused by accidental contact between live conductors.

Temperatures at the arc terminals can reach or exceed 35,000 degrees Fahrenheit (F), or four times the temperature of the sun's surface. The air and gases surrounding the arc are instantly heated and the conductors are vaporized causing a pressure wave called an Arc Blast.

Personnel directly exposed to an Arc-Flash and Arc-Blast events are subject to third degree burns, possible blindness, shock, blast effects and hearing loss. Even relatively small arcs can cause severe injury. The secondary effect of arcs includes toxic gases, airborne debris, and potential damage to electrical equipment, enclosures and raceways. The high temperatures of the arc and the molten and vaporized metals quickly ignite any flammable



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Section 2: Safety

**Procedures to minimize risk while working on HV systems.**

Factors likely to increase the risk of receiving an electric shock include the following:

- HV work onboard may be carried out in close proximity to a person(s) not familiar with HV hazards;
- Therefore the area must be properly cordoned off from the surrounding work that may be going on and danger notices well posted.
- There will be large areas of earthed metal that can be easily touched, increasing the possibility of electric shock from an HV conductor;
- High voltage insulation testing (flash testing) can be particularly hazardous when several parts of the equipment are energized for a period of time;



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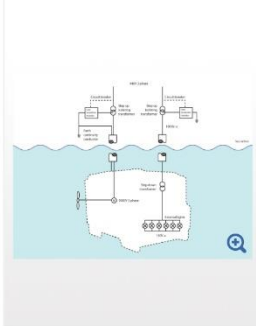
Section 5: Description of system components

**Description of system components.**

Primary power is derived from the vessel's 440v 3 phase system stepped up to 1100V through an isolating transformer to provide 1000V via the umbilical to the hydraulic pump motor mounted on the vehicle.

This supply is monitored by an Line insulation monitor (LIM), connected to an alarm.

Lights and controls are also fed in a similar manner and monitored by a second LIM.



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Section 5: Description of system components



**Fuses.**

A fuse is an intentional weak link in a circuit. It is a thermally responsive device designed to provide overcurrent protection. The main function of a fuse is to protect conductors and equipment from damaging overcurrents and quickly deenergize faulted circuits minimizing hazards to personnel.

A fuse is designed to safely open the circuit only once. Therefore, it must be carefully selected to keep the equipment operating unless there is danger of severe overheating or if a short circuit or arcing fault occurs. Selecting the right fuse for the application is critical to overall safety and reliability. At the same time, fuses are fail-safe. Unlike mechanical devices, nothing can happen to a fuse that will prevent it from opening or increase its opening time.

Fuses are used in the following ROV systems:

- Propulsion;



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