Мультимедийный обучающий модуль

МОМ «СУДОВОЕ ГИДРАВЛИЧЕСКОЕ ОБОРУДОВАНИЕ»

(Версия 1.0)

Назначение:

Мультимедийный обучающий модуль предназначен для использования при теоретической подготовке специалистов машинного отделения по судовому гидравлическому оборудованию.

Что такое мультимедийный обучающий модуль?

МОМ представлен в виде электронного учебника. Размещенный в нем теоретический материал сопровождается рисунками, схемами и анимационными роликами. Для проверки полученных знаний включен раздел тестирования.

Содержание:

- Введение
- Графические обозначения
- Компоненты гидравлических систем
- Гидравлические контуры
- Управлению скоростью гидропривода
- Примеры гидравлического оборудования
- Гидравлическое масло

Целевая аудитория

Машинная команда – Управления

Машинная команда – Эксплуатация

Машинная команда – Вспомогательный

Тип судна

Все типы

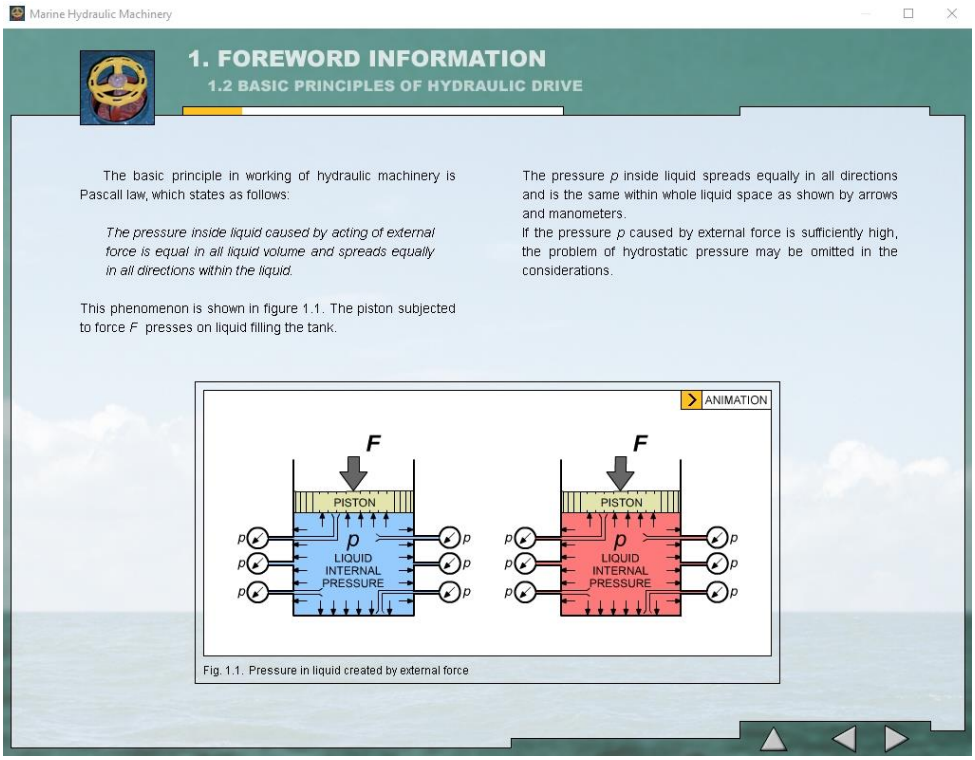
Нормативная база

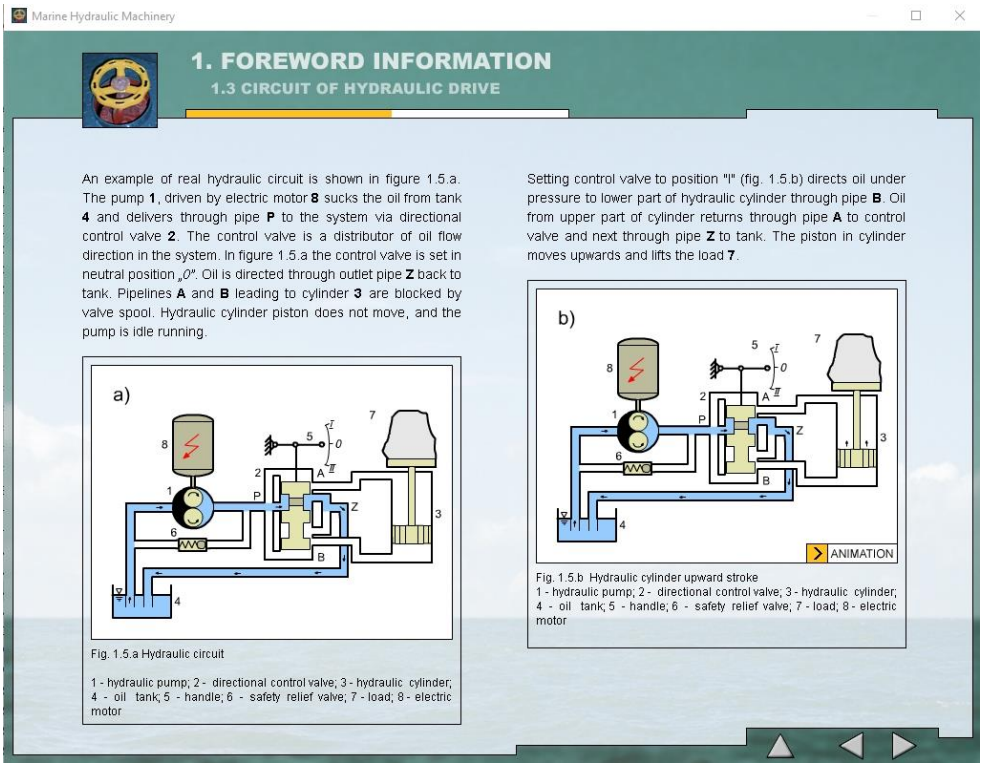
Конвенция ПДНВ:

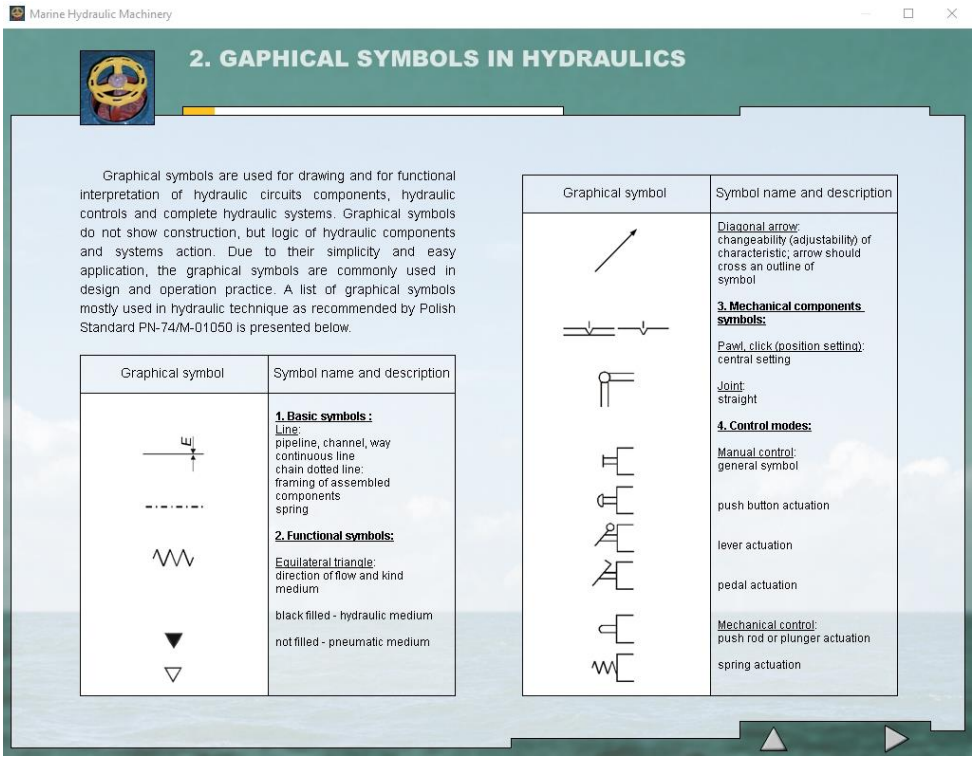
- Правила III/1, III/2, III/3, III/4, III/5.

Кодекс ПДНВ:

- Раздел A-III/1, Таблица A-III/1 «Спецификация минимального стандарта компетентности для вахтенных механиков судов с обслуживаемым или периодически необслуживаемым машинным отделением», сфера компетентности «Эксплуатация главных установок и вспомогательных механизмов и связанных с ними систем управления».
- Раздел A-III/2, Таблица A-III/2 «Спецификация минимального стандарта компетентности для старших механиков и вторых механиков с главной двигательной установкой мощностью 3 000 кВт или более», сфера компетентности «Эксплуатация, наблюдение, оценка работы и поддержание безопасности двигательной установки и вспомогательных механизмов».
- Раздел A-III/4, Таблица A-III/4 «Спецификация минимального стандарта компетентности для лиц рядового состава машинной вахты», сфера компетентности «Выполнение обычных обязанностей по вахте в машинном отделении, которые поручаются лицам рядового состава».
- Раздел A-III/5, Таблица A-III/5 «Спецификация минимального стандарта компетентности для лиц рядового состава в качестве квалифицированного моториста на судах с обслуживаемым или периодически необслуживаемым машинным отделением», сфера компетентности «Содействие наблюдению и управлению несением машинной вахты».


Marine Hydraulic Machinery
1. FOREWORD INFORMATION
1.2 BASIC PRINCIPLES OF HYDRAULIC DRIVE
The basic principle in working of hydraulic machinery is Pascall law, which states as follows:
The pressure inside liquid caused by acting of external force is equal in all liquid volume and spreads equally in all directions within the liquid.
This phenomenon is shown in figure 1.1. The piston subjected to force F presses on liquid filling the tank.
The pressure p inside liquid spreads equally in all directions and is the same within whole liquid space as shown by arrows and manometers.
If the pressure p caused by external force is sufficiently high, the problem of hydrostatic pressure may be omitted in the considerations.
ANIMATION
F
PISTON
p
LIQUID INTERNAL PRESSURE
Fig. 1.1. Pressure in liquid created by external force


Marine Hydraulic Machinery
1. FOREWORD INFORMATION
1.3 CIRCUIT OF HYDRAULIC DRIVE
An example of real hydraulic circuit is shown in figure 1.5.a. The pump 1, driven by electric motor 8 sucks the oil from tank 4 and delivers through pipe P to the system via directional control valve 2. The control valve is a distributor of oil flow direction in the system. In figure 1.5.a the control valve is set in neutral position „0". Oil is directed through outlet pipe Z back to tank. Pipelines A and B leading to cylinder 3 are blocked by valve spool. Hydraulic cylinder piston does not move, and the pump is idle running.
Setting control valve to position "I" (fig. 1.5.b) directs oil under pressure to lower part of hydraulic cylinder through pipe B. Oil from upper part of cylinder returns through pipe A to control valve and next through pipe Z to tank. The piston in cylinder moves upwards and lifts the load 7.
a)
b)
ANIMATION
Fig. 1.5.a Hydraulic circuit
1 - hydraulic pump; 2 - directional control valve; 3 - hydraulic cylinder; 4 - oil tank; 5 - handle; 6 - safety relief valve; 7 - load; 8 - electric motor
Fig. 1.5.b Hydraulic cylinder upward stroke
1 - hydraulic pump; 2 - directional control valve; 3 - hydraulic cylinder; 4 - oil tank; 5 - handle; 6 - safety relief valve; 7 - load; 8 - electric motor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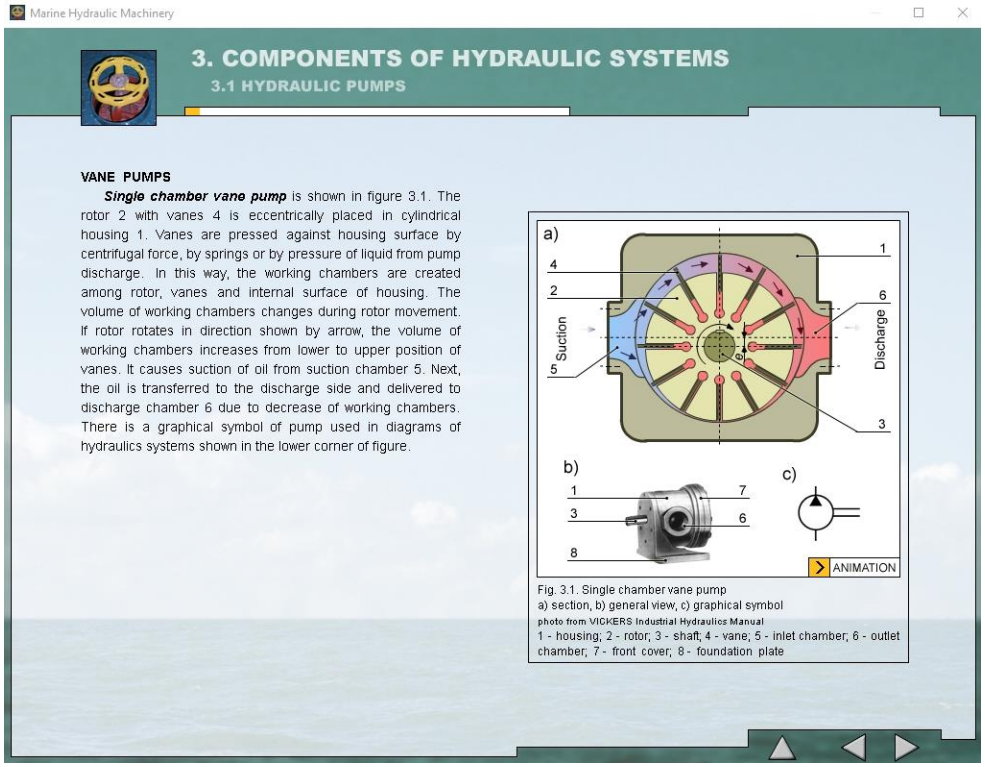
2. GAPHICAL SYMBOLS IN HYDRAULICS
Graphical symbols are used for drawing and for functional interpretation of hydraulic circuits components, hydraulic controls and complete hydraulic systems. Graphical symbols do not show construction, but logic of hydraulic components and systems action. Due to their simplicity and easy application, the graphical symbols are commonly used in design and operation practice. A list of graphical symbols mostly used in hydraulic technique as recommended by Polish Standard PN-74/M-01050 is presented below.
Graphical symbol
Symbol name and description
1. Basic symbols :
Line:
pipeline, channel, way
continuous line
chain dotted line:
framing of assembled components
spring
2. Functional symbols:
Equilateral triangle:
direction of flow and kind medium
black filled - hydraulic medium
not filled - pneumatic medium
Graphical symbol
Symbol name and description
Diagonal arrow:
changeability (adjustability) of characteristic; arrow should cross an outline of symbol
3. Mechanical components symbols:
Pawl, click (position setting):
central setting
Joint:
straight
4. Control modes:
Manual control:
general symbol
push button actuation
lever actuation
pedal actuation
Mechanical control:
push rod or plunger actuation
spring actuation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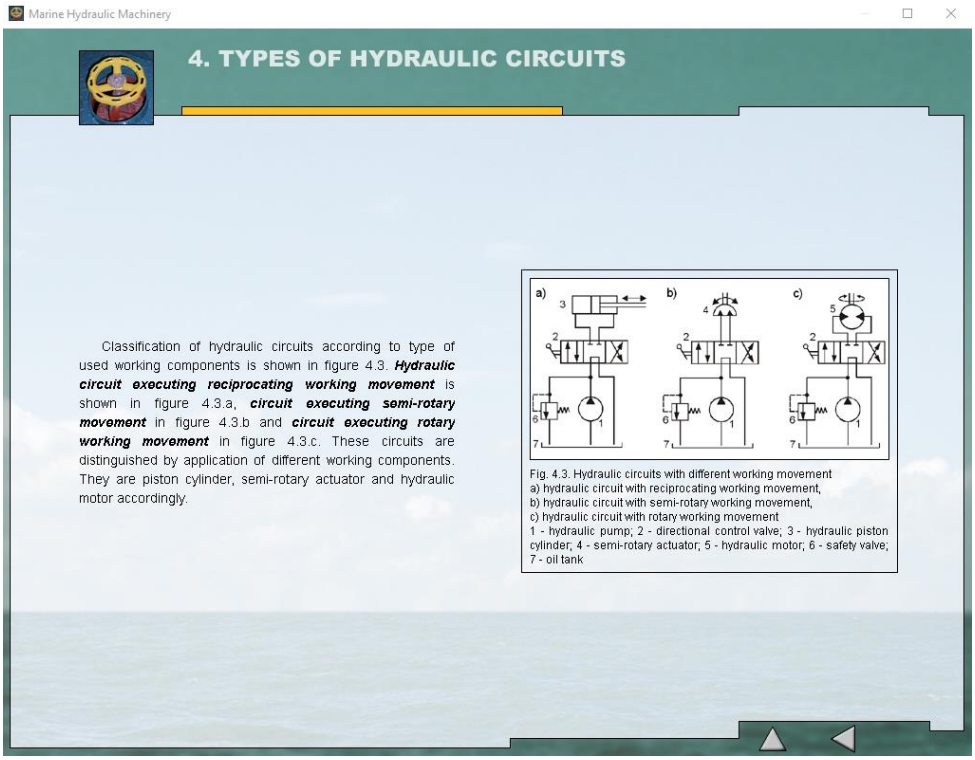
3. COMPONENTS OF HYDRAULIC SYSTEMS
3.1 HYDRAULIC PUMPS
VANE PUMPS
Single chamber vane pump is shown in figure 3.1. The rotor 2 with vanes 4 is eccentrically placed in cylindrical housing 1. Vanes are pressed against housing surface by centrifugal force, by springs or by pressure of liquid from pump discharge. In this way, the working chambers are created among rotor, vanes and internal surface of housing. The volume of working chambers changes during rotor movement. If rotor rotates in direction shown by arrow, the volume of working chambers increases from lower to upper position of vanes. It causes suction of oil from suction chamber 5. Next, the oil is transferred to the discharge side and delivered to discharge chamber 6 due to decrease of working chambers. There is a graphical symbol of pump used in diagrams of hydraulics systems shown in the lower corner of figure.
a)
b)
c)
Suction
Discharge
ANIMATION
Fig. 3.1. Single chamber vane pump
a) section, b) general view, c) graphical symbol
photo from VICKERS Industrial Hydraulics Manual
1 - housing; 2 - rotor; 3 - shaft; 4 - vane; 5 - inlet chamber; 6 - outlet chamber; 7 - front cover; 8 - foundation plate


Marine Hydraulic Machinery
4. TYPES OF HYDRAULIC CIRCUITS
Classification of hydraulic circuits according to type of used working components is shown in figure 4.3. Hydraulic circuit executing reciprocating working movement is shown in figure 4.3.a, circuit executing semi-rotary movement in figure 4.3.b and circuit executing rotary working movement in figure 4.3.c. These circuits are distinguished by application of different working components. They are piston cylinder, semi-rotary actuator and hydraulic motor accordingly.
a)
b)
c)
Fig. 4.3. Hydraulic circuits with different working movement
a) hydraulic circuit with reciprocating working movement,
b) hydraulic circuit with semi-rotary working movement,
c) hydraulic circuit with rotary working movement
1 - hydraulic pump; 2 - directional control valve; 3 - hydraulic piston cylinder; 4 - semi-rotary actuator; 5 - hydraulic motor; 6 - safety valve; 7 - oil tank


Marine Hydraulic Machinery
7. HYDRAULIC OILS
Hydraulic oil is to be periodically subjected to analysis to obtain information of its service ability. Usually the analysis is free of charge in oil producer laboratory.
Replacement of oil in the system is to be executed according to machinery producer recommendations and according to analysis results. Tables of oils properties and substitutes are included in operation manuals.
In case of emergency other oils available on board can be used. Such a substitute oil can be used conditionally and replaced by right oil as soon as possible. Before the proper oil is poured, the system is to be rinsed according to procedure recommended by machinery producer. It is not recommended to mix different grades of hydraulic oils due to possibility of conflict between additives and loss of operational properties of oil.
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