cetop

The Voice of the European Fluid Power Industry

EDUCATION RECOMMENDATIONS

★ ***HYDRAULICS PROGRAMME H1 CETOP***
Passport Occupational Level 1

RE 2025/01.01-H1

HYDRAULICS & ASSOCIATED CONTROL PROGRAMME (H1): RE 2025/01.01 - H1

CETOP (Passport) Occupational Level 1

INTRODUCTION

This is the LEVEL 1 Hydraulics Programme, forming the start of a series of competence- based qualifications designed around CETOP occupational levels.

It combines the necessary knowledge and competence based skills for those people on route to a higher level qualification at levels 2 and 3, involving the maintenance and management of both Industrial and Mobile hydraulic systems.

Note: In all cases, each programme represents a "stand-alone" qualification but can also be a progressive route to a higher level.

CETOP OCCUPATIONAL LEVEL 1

LEVEL (1) This person will perform activities that follow an established procedure. Activities will be recurring and of a short-term nature. The reaction to most problems will be to summon help or follow a predefined set of actions.

This level 1 programme provides an excellent introduction to power hydraulics and places great emphasis on the understanding of fundamental principles, component functionality and principles of operation.

Emphasis upon health and safety and that of developing safe working practices is applied throughout, as a CORE ELEMENT within the scheme. CORE ELEMENTS are not necessarily taught as specific subject areas but integrated within the scheme.

Throughout the programme, emphasis is placed upon the development of knowledge relating to "FUNCTION", "OPERATION" and "APPLICATION".

- The knowledge based section will support the development and effective application of practical skills necessary to carry out in a safe and effective manner:
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- INSTALLATION
- COMMISSIONING
- PERFORMANCE TESTING
- PROACTIVE MAINTENANCE AND MACHINE MANAGEMENT
- SERVICING
- COMPONENT REMOVAL AND REPLACEMENT

The development of planning and preparatory skills, the use of technical information and specifications and the formulation and implementation of safe working procedures will be emphasized throughout all aspects of this programme.

METHODOLOGY AND ASSESSMENT

The programme can be offered via a range of learning modes devised by the Approved Centres ranging from that of short courses to distance learning and centre based modules. The time scale can also be flexibly managed by the Approved Centres.

Candidates will be expected to complete a series of written assignments throughout the programme of study to reinforce the learning process. These can be supportive to the final marks for the knowledgebased section.

Assessment will consist of:

- A written examination of 2 hours minimum duration with a pass mark of 60%.
- Practical task competence based unit assessment will be carried out on a "one to one" basis, candidate to tutor, on a pass/fail basis, against agreed evidence of performance.

PRACTICAL TASK ASSESSMENT (H1)

When assessing competence, the following processes must be followed:

- Relating to the occupational level, a series of Assessed Abilities are identified. These represent the ”DOING PART” of a person’s job and requires a combination of both practical skills and applied knowledge.
- For each Assessed Ability, evidence of performance is then established and shown as EVIDENCE REQUIRED (sometimes termed performance criteria).

In all cases candidates must meet the requirements of each Assessed Ability.

During practical task assessment, the ASSESSOR will agree the ”type of evidence” to be obtained and this can range from:

- Direct Observation
- Verbal Questioning/Candidate Commentary
- Written Report

and may include all types.

ASSESSMENT REQUIREMENTS

Assessed Ability

H 1.1 Recognize the component parts of a selected machine and their functionality, linked to system and circuit diagram.

Evidence Required

H 1.1.1 Reservoir and associated parts identified including functionality.

H 1.1.2 Pump type identified and associated connections.

H 1.1.3 Method used for controlling pressure identified.

H 1.1.4 Method used for controlling flow identified.

H 1.1.5 Actuator type identified.

H 1.1.6 Filter location identified and associated filter performance indicator.

Assessed Ability

H 1.2 From circuit diagram provided and associated system, check operating pressures at strategic points and record.

Evidence Required

H 1.2.1 Safety checks carried out before pressure checks commence and working environment assessed.

H 1.2.2 Test points identified on circuit diagram and machine system, check list established.

H 1.2.3 Correct range of pressure gauges and connections used at all times.

H1.2.4 Pressure readings taken and recorded.

H 1.2.5 Safe working practices followed at all times.

H 1.2.6 Written report completed covering all findings.

Assessed Ability

H1.3 Change filter element on a system.

Evidence Required

H 1.3.1 Risk assessment check carried out and working procedures established.

H 1.3.2 Specification of new element (element checked against machine specification part number type and size).

H 1.3.3 Correct isolation procedures followed before dismantling process commenced.

H 1.3.4 Correct tools used at all times.

H 1.3.5 Cleanliness control procedures followed and spillage of oil prevented at all times.

H 1.3.6 Filter disposal procedures established.

H 1.3.7 Operational checks carried out after installation (system ”fit for purpose”).

Assessed Ability

H 1.4 Check accumulator pre-charge pressure and establish level against specification.

Evidence Required

H 1.4.1 Established procedures followed at all times.

H 1.4.2 Safe working practices followed at all times.

H 1.4.3 Correct tools and test equipment used.

H 1.4.4 Written report completed covering all actions taken.

KNOWLEDGE BASED UNIT (H1)

H1.5 *Contents*

H 1.5.1 Fundamental Principles.

H 1.5.2 Hydraulic System Construction (BASIC BUILDING BLOCKS).

H1.5.3 Components – Function and Operation.

H1.5.4 Hydraulic Fluids.

H1.5.5 Cleanliness Control.

H1.5.6 First Line Management.

H1.5.7 Maintenance Procedures.

Health and Safety CORE ELEMENT

- Do's and Don'ts
- Good/Safe Working Practices/Risk Assessments

Literacy and Numeracy CORE ELEMENT

- Use of Basic Formula
- Application of Simple Calculations and Associated Units
- Terminology

KNOWLEDGE BASED UNIT – WRITTEN EXAMINATION SPECIFICATION

The examination paper will contain questions from the 7 sections of this programme and core elements will be integrated as necessary.

- Examination minimum duration 2 consecutive hours
- Pass mark 60%
- Question style may be single subject, multiple subject, short answer and multiple choice

Where calculations and formulae are involved, all progressive stages of the calculation together with their corresponding units must be shown.

HYDRAULICS - (Knowledge Based Unit)

H1.5.1 Fundamental Hydraulic Principles

a) Know the fundamental principles that underpin the operation of all hydraulic systems and how they affect performance:

- flow makes it go
- pressure provides the pushing force
- oil in a system always takes the path of least resistance
- pressure is a measure of the resistance to flow
- for oil to flow in any system, there has to be a pressure difference
- the greater the pressure drop the greater the flow potential
- when fluid flows from a high pressure level to a lower pressure level and no work is carried out, then heat is generated

b) State and use the relationship between:

- pressure, area and the force transmitted by a cylinder
- flow rate, cylinder dimensions and piston velocity
- pressure, displacement and hydraulic motor torque flow rate, displacement and motor speed
- pump displacement, shaft speed and flow rate
- pump flow rate, operating pressure and hydraulic power
- volumetric efficiency, mechanical efficiency and overall efficiency of pumps and motors
- pipe diameters, flow rates, fluid viscosity and pressure losses

c) Know the units and terminology relating to:

- flow rate
- speed
- pressure
- temperature
- power
- torque
- motor and pump sizes

H1.5.2 Hydraulic System Construction and Symbolic Representation

a) Know the component parts used to construct a hydraulic system and the basic layout (basic building blocks).

b) Outline the function of the component parts used to design a hydraulic system relating to:

- prime mover
- coupling and bell housing
- pumps
- reservoir
- filters
- pipes – rigid and flexible
- relief valves
- pressure reducing valves
- direction control valves
- flow control valves
- hydraulic motors
- hydraulic cylinders
- pressure gauges
- flow meter
- check valves- inline and pilot operated
- bladder accumulator

c) Recognize and use current graphical hydraulic symbols to represent the component parts of a hydraulic system. (ISO standards).

H1.5.3 Operation of the Major Components used to design a Hydraulic System

Describe the operating principles of the following components:

- gear pump (external)
- vane pump (cartridge type)
- piston pump (swash plate – pressure compen- sated)
- relief valve (direct and pilot operated)
- pressure reducing valve
- direction control valves (lever operated and solenoid operated)

- pilot operated check valve
- throttle valve (with and without free flow check valve)
- pressure compensated flow control valve
- filter with bypass and differential indicator
- hydraulic motor (piston and orbit)
- cylinders (tie rod and screwed body types)
- cylinder cushioning
- accumulator and safety block

H1.5.4 Hydraulic Fluids and their Characteristics

a) Know the meaning of the following terms:
- viscosity
- ISO viscosity grade
- viscosity index

b) Know the function of the hydraulic fluid:
- power transmission
- lubrication
- cooling
- carrying contaminants to the nearest filter

c) Outline the effect of system temperature on:
- oil viscosity and system performance

d) Know the factors that affect the life of the hydraulic fluid and their effect upon system performance:
- contamination
- heat
- moisture

H1.5.5 Contamination Control

a) Know the origin of contamination and ways in which it enters a system.

b) Outline procedures to follow to reduce contamination ingression.

c) Know the effects of contaminants on the life and performance of component parts.

d) Know the locations of filters within a system.

e) Outline the performance of a filter, including by-pass and indicator.

f) Know the importance of regular fluid contami- nation analysis and the correct interpretation of the results.

H1.5.6 First Line Management of Hydraulic Systems

a) Know the points of inspection and the observations to be made:
- Power unit and prime mover:
  - Stop – Start – Isolation
  - general external cleanliness
  - position and security of all guards
  - relevance of all notices – risk assessment
  - noise level and general temperature
  - hydraulic oil level and color at sight glass
  - suction hose connections and hose conditions
  - pressure gauge readings
  - signs of leakage
  - security of fittings – pipes and hoses
  - filter indicator status
  - reservoir access points and sealing arrangements
  - accumulator inspection and associated safety block (pre-charge pressure checks)
  - general structure of power unit (steel work)
- Hydraulic System:
  - operation of services (feedback from operator)
  - leakage (cylinders, motors, hoses,sub-plates and stacks) view topping up record
  - pressure readings inline with operating specification
  - noise and vibration
  - system filter and indicator status

b) Know how to effectively complete a written report covering:
- non compliances
- actions taken
- request for further investigation

H1.5.7 Maintenance Procedures

a) Know the requirements of a pro-active maintenance programme with reference to health and performance monitoring and relating to:
- pump performance testing (QP)
- periodically taking pressure readings under varying operational conditions
- taking regular oil samples to enable cleanliness level to be assessed
- taking regular oil samples to determine oil life expectancy
- checking systems temperatures
- checking working performance (time based operations)

b) Know how to effectively complete a written report covering:
- non compliances
- results identified
- actions taken
- request for further investigation