



# **cetop**

*The Voice of the European  
Fluid Power Industry*

## ***EDUCATION RECOMMENDATIONS***

**COMPLEMENT TO THE SERIES  
OF COMPETENCE-BASED QUALIFICATIONS  
DESIGNED AROUND  
CETOP OCCUPATIONAL LEVELS 1, 2, AND 3  
IN HYDRAULICS AND PNEUMATICS**

★ **FLUID POWER  
ELECTRONICS PROGRAMME  
RE 2020/03.01 – FPE1**

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**RE 2025/01.01 - FPE1**

## INTRODUCTION

This Applied Electrical/Electronic Programme is a single, stand-alone guidance document which aims to compliment the series of competence-based qualifications designed around CETOP occupational levels.

For the purposes of these recommendations the term **Integrated System** is used and this can represent either a combination of hydraulics and applied electronics or pneumatics and applied electronics.

It complements the necessary knowledge and competence based skills for those people taking part in all three levels of qualifications involving the maintenance and management of Integrated Fluid Power Systems (Hydraulics, Pneumatics and Applied Electrical/Electronics). It is the responsibility of the educator to apply the contents of this document into their programmes according to the level of awareness for electronics demonstrated by their candidates.

**Note: In all cases, if the programme represents a “stand-alone” qualification the student must have a basic understanding of either hydraulics or pneumatics before taking this programme.**

## CETOP OCCUPATIONAL LEVEL

This document introduces Electrical and Electronics used in the Fluid Power Industry and may be complimentary to all CETOP levels 1, 2 and 3 in hydraulics and pneumatics.

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

Throughout the programme, emphasis is placed upon the development of knowledge relating to “FUNCTION”, “OPERATION”.

The knowledge-based section will support the development and effective application of practical skills necessary to carry out, in a safe and effective manner:

- PERFORMANCE TESTING
- PROACTIVE MAINTENANCE AND MACHINE MANAGEMENT
- SERVICING

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 emphasised throughout all aspects of this programme.

## METHODOLOGY AND ASSESSMENT

The programme will 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.

Assessment will consist of:

- A written examination with a pass mark of 60%.

Expected completion time can be agreed by the Approved Centre and candidates will require a high level of personal commitment to study and research the subject areas.

- Practical task competence based unit assessment will be carried out where possible on a “one to one” basis, candidate to tutor, or in small groups on a pass/fail basis, against agreed evidence of performance.

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## **PRACTICAL TASK ASSESSMENT (FPE)**

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 confirm the, “type of evidence” to be obtained, this can range from:

- Direct Observation
  - Verbal Questioning/Candidate Commentary
  - Written Report
- And may include all of these types

## **ASSESSMENT REQUIREMENTS**

**In the context of Integrated Fluid Power Systems students must achieve the following:**

### **Assessed Ability**

FPE1.1.0 Interpret relevant circuit diagrams and identify components and their function

### **Evidence Required**

FPE1.1.1 Components and their function correctly identified

FPE1.1.2 Correct System Start-Up procedure followed

FPE1.1.3 System operates according to requirements

FPE1.1.4 Safe working practice followed at all times

### **Assessed Ability**

FPE1.2.0 Identify and utilise correct test equipment on Integrated Fluid Power Systems to establish the normal operational requirements.

### **Evidence Required**

FPE1.2.1 Test equipment correctly selected for application

FPE1.2.2 Test equipment correctly adjusted to suit testing requirements

FPE1.2.3 Safe operation of test equipment when carrying out system checks

FPE1.2.4 Written report by the student completed covering all findings

### **Assessed Ability**

FPE1.3.0 Use basic fault-finding techniques on a system relating to an integrated fluid power system.

### **Evidence Required**

FPE1.3.1 Identify System sequence requirements correctly

FPE1.3.2 Correct test equipment utilised

FPE1.3.3 Fault-finding procedures correctly specified and followed

FPE1.3.4 Fault identified and written report by the student completed

FPE1.3.5 Safe working practice followed at all times

### **Assessed Ability**

FPE1.4.0 Carry out relevant maintenance on system components and select suitable components for replacement

### **Evidence Required**

FPE1.4.1 Identify from given information the maintenance requirements

FPE1.4.2 Select correct replacement component from technical specification

FPE1.4.3 Correct tools and test equipment used.

FPE1.4.4 Faulty component replaced, adjusted or repaired in line with planned procedures

FPE1.4.5 System tested after maintenance to ensure efficient working

FPE1.4.6 Safe working practice and relevant statutory regulations followed at all times

FPE1.4.7 Written report by the student covering actions taken

## **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 duration to suit
- 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.

### **KNOWLEDGE BASED UNIT (FPE) Contents**

FPE1.5.0 Fundamental Electrical/Electronic Principles and their application

FPE1.6.0 Application of Fundamental Principles

FPE1.7.0 Describe a basic Integrated System

FPE1.8.0 Identify Integrated System Control methods

FPE1.9.0 Awareness of current Safety requirements of an Integrated System

FPE1.10.0 Circuit and Control Features (Recognition and use of component symbols)

FPE1.11.0 Basic Maintenance Procedures

### **FPE1.5.0 Electrical/Electronic Principles and their application in the control of integrated fluid power systems - (Knowledge Based Unit)**

- state and use the relationship between voltage, current, resistance and power
- state the relationship between movement,
- magnetism and current
- meaning of the term inductance and its effect upon DC circuits
- meaning of the term capacitance and its effect upon DC circuits

#### **FPE1.5.1 Conductors, Insulators and semi-conductors**

- State the difference between conductors, Insulators and semi-conductors
- State the applications of Conductors, Insulators and Semi-conductors
- State that a magnetic field exists around the wire when a current flows (Electro- magnetism)
- Uses of Electro-magnetism and Permanent magnets

#### **FPE1.6.0 Application of Fundamental Principles**

- Relationship between current flow, voltage drop, temperature and length of conductors
- The significance of series and parallel resistance

#### **FPE1.6.1 Control of Pressure, Flow and Direction**

Describe how voltage and current can be used to control:

- Pressure
- Flow
- Direction within a Fluid Power System

#### **FPE1.7.0 Describe a basic Integrated System**

Identify the components used in a basic Integrated Fluid Power System

#### **PE1.7.1 Identify the basic components in an integrated system**

Power supplies, Control system, Sensors and Actuators

### **FPE1.7.2 Electrical Components**

Describe the function, operation and application of electrical components used in integrated systems:

- Switches/Contacts: Normally Open (NO), Normally Closed (NC), Change Over (CO)
- Protective devices
- Lighting
- Relays
- Solenoids
- Limit switches
- Distance sensors
- Photo-electric sensors
- AC and DC Motors
- Electric Motor control technology

### **FPE1.7.3 Electronic Sensors for Control and Condition Monitoring in integrated Fluid Power Systems**

Identify sensors used in integrated Fluid Power Systems

- Pressure
- Flow
- Temperature
- Level
- Particle
- Humidity
- Viscosity
- Conductivity
- Noise
- Vibration

### **FPE1.7.4 Electrical/Electronic sensor signals in integrated Fluid Power Systems**

Describe the function, operation and application of electrical communication signals used in integrated systems:

- Digital (switching)
- Analog
- Bus
- Bi-directional communication
- Wire-less

### **FPE1.8.0 Recognize and understand the application of integrated system control methods used in integrated fluid power systems.**

- Relay control
- Power Amplifier control
- Analog and digital
- Open loop control
- Closed loop control
- Computer control

### **FPE1.9.0 Awareness of current Safety requirements of an integrated system**

- Overview of relevant regulations

#### **FPE1.9.1 Safe working practices for an integrated system**

- Utilize the safe working practices and procedures to be used when working on integrated systems
- Risk Assessments for the system and your work place
- Utilize the safe working practices and procedures to be used when working on integrated systems
- Risk Assessments for the system and your work place
- Comply with all Health and Safety requirements for the machine and your work place
- Use the correct Personal Protection Equipment (PPE)

#### **FPE1.9.2 Safety related components**

Describe the basic function and application of safety equipment and components used in integrated fluid power systems

- Personal safety
- Machine safety

### **FPE1.10.0 Circuit and Control Features (Recognition and use of component symbols)**

Identify symbols and describe common drawing practices in integrated fluid power systems

### **FPE1.11.0 Basic Maintenance Procedures**

Outline maintenance, monitoring and fault-finding procedures used in relevant integrated fluid power systems

### **FPE1.11.1 Health and Safety- CORE ELEMENT**

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

### **FPE1.11.2 Literacy and Numeracy -CORE ELEMENT**

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