

# **BFPA LEVEL 1 HYDRAULICS (HQ1)**

## **COMPETENCE BASED QUALIFICATION**



**BRITISH FLUID POWER ASSOCIATION**

VERSION 3 - FEBRUARY 2024

# Introduction - BFPA Learning and Development Programme

This is the entry level to the BFPA Learning and Development Programme of a three-tier competence-based qualification in the maintenance and management of hydraulic systems.

It combines the necessary knowledge and skills base to ensure competency may be assessed successfully when working with hydraulic equipment and systems.

On successful achievement of this level, a candidate may wish to attain a higher level complementary qualification inline with their personal career goals.

## Level 1: First Line (Advanced Apprentice/Technician)

This person will:

- perform activities, following an established procedure.
- Use suitable test equipment to ensure safe isolation of systems when performing specific tasks.
- Carry out activities which will be of short duration and which reoccur frequently.
- Identify problems which will be reported and rectified through predefined actions.

## Level 2: Second Line (Technician)

This person will:

- perform a variety of activities needing some understanding of the technical factors involved.
- carry out activities which may require the interpretation and application of varied and non-routine specifications.
- carry out activities which will involve the use of simple diagnostic checks and ability to make a positive response to deviations.
- Work in co-operation with others in teams or work groups as may be required.

## Level 3: Third Line (Senior Technician/Engineer)

This person will:

- be involved in a broad and often complex range of activities, often requiring independent decisions to be made on technical matters concerning specifications, resources or processes.
- be responsible for planning of work will be a responsibility, as well as the finding and rectification of faults.
- be responsible for the quality of work undertaken and for ensuring the correct required outcomes are achieved.

Emphasis upon health and safety and developing safe working practices are 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 will be placed upon the development of knowledge relating to:

Function, operation and application

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

- Performance testing
- Planned predictive maintenance
- Supervised machine/system management

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

## Pre-requisite

BFPA Level 1 Hydraulics Vocational Course (HV1).

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# Methodology and Assessment

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Approved training providers may deliver the knowledge-based content either remotely (online) or face-to-face. The practical skills-based section must be delivered face-to-face.

Both knowledge based and skills based sections must be successfully completed within three months of each other, to gain the qualification.

Final assessment for the knowledge-based units will be via a written examination of a minimum of 2 hours duration. The pass mark for the written examination will be 60%.

Practical task preparation and competence-based unit assessment will be carried out by arrangement with the Approved Centre. Final assessment will be carried out on a “one to one” basis, candidate to tutor, and the outcome will be pass or fail.

Successful completion of both the knowledge-based and skills-based units will result in the award of the BFPA Level 1 Hydraulics Competence Based Qualification (HQ1)).

When assessing competence, the following processes must be adhered to:

Relating to the occupational level, a series of performance criteria are identified. These represent the “doing part” of a person’s job and requires a combination of both practical skills and applied knowledge.

In all cases candidates must meet the requirements of each performance criteria.

# Practical Assessments

Assessed by observation of performance, direct questioning, and written evidence as required.

Centres performing the practical assessments must assess the completion of assignments 1, 2 & 3. In addition the Centre must offer either 4a or 4b as the final assignment.

## H1.1 Performance Criteria - Task 1

**Candidates must recognise the component parts of a selected machine and their functionality, linked to the system and circuit diagram. Candidates must also check operating pressures at strategic points and record findings.**

**Level 1 vocational course subject reference:**

■ 5/6/7/8/10/11/24/25/26

**Evidence indicators against a constructed circuit and diagram provided.**

- H1.1.1 Obtain the associated risk assessment and establish safe working procedures for the task
- H1.1.2 Explain the functionality of the reservoir and associated parts
- H1.1.3 Identify pump type and connections
- H1.1.4 Identify method used for controlling pressure and flow
- H1.1.5 Identify actuator type
- H1.1.6 Identify filter location and performance indicator
- H1.1.7 Assess the working environment before commencing pressure checks, reviewing safety protocols
- H1.1.8 Identify test points on a circuit diagram and the machine system
- H1.1.9 Establish a check list for checking test points and select correct range of pressure gauges
- H1.1.10 Demonstrate measuring and recording pressure readings safely
- H1.1.11 Produce a comprehensive report of all findings

## H1.2 Performance Criteria - Task 2

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

**Level 1 vocational course subject reference:**

■ 22/24/25/29

**Evidence indicators against a constructed circuit and diagram provided.**

- H1.2.1 Obtain the associated risk assessment and establish safe working procedures for the task
- H1.2.2 Follow established procedures for checking and charging an accumulator
- H1.2.3 Follow recommended safe working procedures and ensure all safety documentation is complete
- H1.2.4 Identify the correct pre-charge from the appropriate schematic diagram
- H1.2.5 Inspect the charging equipment, ensuring it is fit for purpose and the oxygen free nitrogen supply is adequate and correct
- H1.2.6 Perform the pre-charge procedures, topping up to meet the required specification
- H1.2.7 Complete all necessary documentation noting any issues and advising resolutions

### H1.3 Performance Criteria - Task 3

Carry out hose inspection on a hydraulic circuit and record the findings and actions to be taken.

Level 1 vocational course subject reference:

- 16 - 20/22/24/27 – 34

Hydraulic Hose Inspections.

Evidence indicators against a constructed circuit and diagram provided.

- H1.3.1 Obtain the associated risk assessment and establish safe working procedures for the task
- H1.3.2 Recognise the common faults found in hose assemblies
- H1.3.3 Describe the importance of using isolation procedures such as Lock Out Tag Out (LOTO) or other appropriate safe isolation procedures and ensure the system is de-energised fully, prior to commencing maintenance
- H1.3.4 Identify if hose(s) are installed to the relevant current international standards and manufacturers' recommendations
- H1.3.5 Record all maintenance carried out and ensure the hose register is updated accordingly

### H1.4a Performance Criteria - Task 4a

Follow established procedures for replacing a filter element and associated seal kit.

Level 1 vocational course subject reference:

- 11/27 – 34

Evidence indicators against a constructed circuit and diagram provided.

- H1.4a.1 Obtain the associated risk assessment and establish safe working procedures for the task
- H1.4a.2 Identify the specification of the new element against machine specification, including part number, type and size
- H1.4a.3 Describe the importance of using isolation procedures such as Lock Out Tag Out (LOTO) or other appropriate safe isolation procedures and ensure the system is de-energised fully, prior to commencing maintenance
- H1.4a.4 Demonstrate the correct use of tools for the task
- H1.4a.5 Demonstrate cleanliness control procedures and prevention of oil spillage at all times
- H1.4a.6 Explain the correct filter disposal procedure
- H1.4a.7 Demonstrate operational checks after installation (to ensure system is "fit for purpose")

### H1.4b Performance Criteria - Task 4b

Follow established procedures for replacing a hydraulic valve seal kit.

ISO 3 Directional Control Valve Maintenance.

Level 1 vocational course subject reference:

- 9/27 – 34

Evidence indicators against a constructed circuit and diagram provided.

- H1.4b.1 Obtain the associated risk assessment and establish safe working procedures for the task
- H1.4b.2 Identify the correct replacement seal specification including size and material
- H1.4b.3 Describe the importance of using isolation procedures such as Lock Out Tag Out (LOTO) or other appropriate safe isolation procedures and ensure the system is de-energised fully, prior to commencing maintenance
- H1.4b.4 Demonstrate the correct use of tools for the task, including identifying the correct torque settings as per manufacturer's recommendations
- H1.4b.5 Demonstrate removing the valve from the mounting/subplate and replacing seals
- H1.4b.6 Describe the importance of a clean work area and the requirement to minimise oil spillage
- H1.4b.7 Demonstrate the correct disposal procedures for old components
- H1.4b.8 Explain operational checks after installation (to ensure system is "fit for purpose")

# Knowledge Based Units - Written Examination Specification

The examination paper will contain questions from all sections of this programme with core elements being integrated, as necessary.

- Examination will have a minimum duration of two consecutive hours
- Pass mark will be 60%
- Question style may be single subject or multiple subjects, and maybe short answer, or multiple choice

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

## H1.5.0 Basic Principles

- H1.5.1 The basic layout of a typical hydraulic circuit
- H1.5.2 The function and operation of the parts that are used to construct a typical circuit
- H1.5.3 The fundamental principles that underpin the operation of all hydraulic systems in relationship to:

- Pressure and force
- Flow, displacement and speed
- Pressure, displacement and torque
- Power in, with reference to the prime mover
- Power out, with reference to actuator operations
- Pressure drops, power losses and heat generation

This section should involve simple calculations, associated units, and terminology.

## H1.6.0 Hydraulic Symbols

**Candidates should be able to recognise the hydraulic symbols in current use relating to ISO-1219-012 and be able to apply these to the various component parts within a hydraulic circuit with reference to a typical:**

- Open circuit
- Closed circuit

## H1.7.0 Hydraulic Pumps

**Candidates should know the types of pump in common use (gear, vane and piston) with reference to:**

- Construction and principle of operation
- Fixed and variable displacement
- Methods used to control displacement (pressure compensation)
- Relationship between flow and pressure (pump performance)

## H1.8.0 Hydraulic Fluid Oil Reservoirs

**Candidates should know the basic layout and function of a typical hydraulic fluid oil reservoir – features and characteristics.**

## H1.9.0 Pressure Control

**Candidates should know the devices used to control and limit pressure within a working circuit with reference to:**

- Relief valves, pressure reducing valves and sequence valves
- Following safe setting up procedures
- Effects upon performance if adjustments are made

## H1.10.0 Flow Control

**Candidates should know the difference in construction between a simple throttle valve and a pressure compensated flow control valve with reference to:**

- Performance and energy losses
- Pressure intensification when using flow control valves

## H1.11.0 Direction Control

**Candidates should know the construction, function and principle of operation of:**

- Simple check valves
- Pilot operated check valves
- Spool-type direction control valves (including a brief overview of options and control methods)

### H1.12.0 Hydraulic Actuators

Candidates should know the construction and operation of the types of actuators in common use:

- Single-rod double-acting hydraulic cylinders
- Hydraulic motors

### H1.13.0 Contamination Control

Candidates should know the importance of cleanliness management associated with hydraulic system performance with reference to:

- Locations where contamination can enter a system and recommended preventative measures/procedures that must be followed
- Effects upon performance due to ingress of contamination
- Filter performance and location
- Regular monitoring of systems to ensure required cleanliness levels are maintained

### H1.14.0 Hydraulic Fluid

Candidates should know:

- The function of the hydraulic fluid within a system
- The meaning of the term viscosity and how it affects overall performance
- The factors that affect the life of the hydraulic fluid in service
- The importance of good fluid storage and transfer processes

### H1.15.0 Hydraulic Hose Technology

Candidates should know:

- The general construction of hydraulic hose assemblies and the concept of 'fit for purpose'  
The meaning of the acronym- 'STAMPED' (Size, Temperature, Application, Medium, Pressure, End-couplings & Delivery)
- The points to inspect prior to installing a hose
- The recommended procedures to follow to correctly install a hose
- The causes of reduced hose life and hose failure
- The procedures to follow when safely carrying out hose inspection and the signs of deterioration and subsequent actions to be taken
- The differences between flexible hydraulic hoses and rigid tube assemblies

### H1.16.0 Maintenance Procedures

Candidates should know:

- The main causes of failure in hydraulic systems
- The importance of being able to identify normal key system performance indicators
- The symptoms associated with a change in performance
- The importance of a pro-active maintenance scheme and associated record keeping
- The importance of following safe working procedures at all times including when carrying out such activities as: installation, commissioning, servicing/testing, inspecting, checking performance, and any other activities that fall within a job role specification

### H1.17.0 Test and Measurement in Hydraulic Systems

Candidates should have an overview of the test and measurement equipment in common use.

# Health and Safety

Due to the nature of a working hydraulic system and the utilisation of oil under pressure to transmit power, together with that of moving parts, it is important to follow safe working practices at all times.

These recommendations will improve a candidate's knowledge and skills and will lead to a greater overall understanding of the power transmission process and the components involved, as well as improve their ability to identify dangers, assess the associated risk and to put in place the necessary control measures that will become part of their daily work.

## Candidates must know:

- The importance of personal protection associated with the working environment
- The importance of following safe isolation procedures
- The dangers of trapped pressure and stored energy such as within accumulators and how to deal with it
- The dangers associated with hydraulic oil leakage and how to deal with it
- The effects of oil injection injuries and the immediate actions to be taken
- The procedures to follow before starting work on any hydraulic system
- The importance of training and working within their trained capability
- The importance of following all safe working procedures and rules laid down by their employer

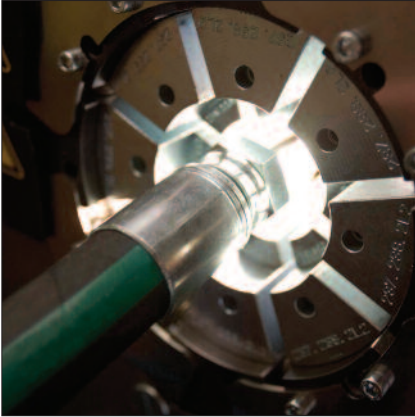
## Hydraulic Accumulators

### Candidates should know:

- The common procedures for accumulator inspection and maintenance
- How to check the nitrogen pre-charge pressure of an accumulator against the system specifications
- How to follow recognised procedures to charge an accumulator to the system specifications, using the correct tools
- Safe working practices when working with accumulators including the dangers associated with compressed gas







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