BFPA FOUNDATION LEVEL - PNEUMATICS

BFPA
LEARNING & DEVELOPMENT PROGRAMME

BRITISH FLUID POWER ASSOCIATION

Q20 - Version 2

Foreword

This document and its contents were developed by the British Fluid Power Association using the expertise and resources of the BFPA Education and Training Committee. It presents the consolidated view of leading representatives and specialists in the Fluid Power Industry. It is the product of a dedicated initiative managed by a specially convened BFPA E&T Task-force. The BFPA and members of the task-force wish to acknowledge the valuable contributions made by other industry stakeholders including academia, representatives from other BFPA member organisations, OEM's and the wider UK engineering industry. This document is one of three publications covering, Hydraulics, Pneumatics and Electronic Control of Fluid Power Systems respectively. In today's world of fluid power motion and control very rarely are pneumatics applied as a single technology. They now encompass electrical/electronic control and therefore these recommendations should consider those, be it at an introductory level.

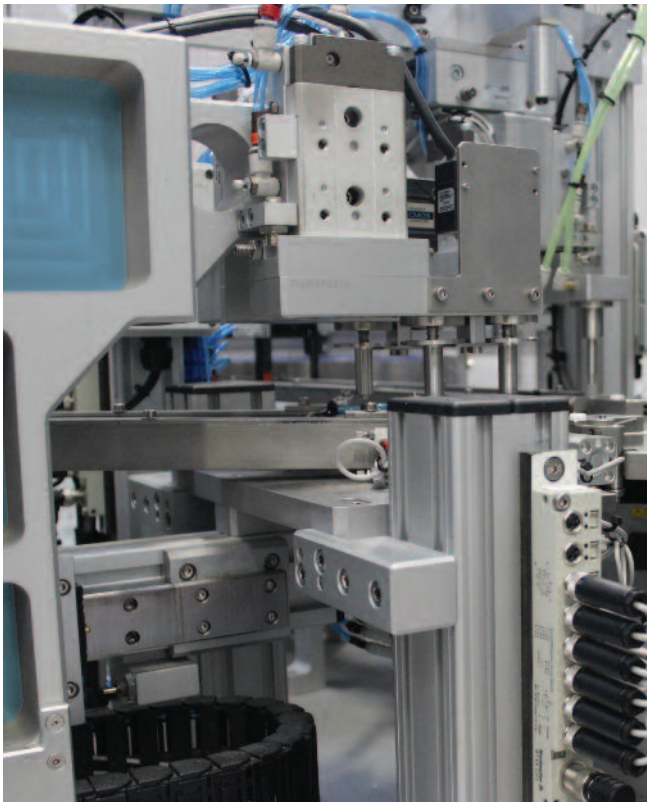
The BFPA has always taken the lead within the UK as regards the provision of educational recommendations for those involved in the maintenance and management of Fluid Power Systems and their associated control. Many of its recommendations now form the basis for competence-based qualifications which have been widely adopted by CETOP* in Europe.

The health and safety of all personnel maintaining and managing Fluid Power Systems remains the primary driver underpinning the work of the BFPA. To this extent, following a one-year investigative programme with key stakeholders, these recommendations are applicable to everyone in every sector where Fluid Power is employed.

They should be regarded as an Industry standard, forming the foundation level of knowledge and understanding necessary for practical operatives, whilst ensuring that safe working practices are followed at all times.

This guideline is formulated as a series of outcome-related statements. It is not intended to be a training course, however from these recommendations, approved education and training establishments will be able to formulate effective training programmes and modules to meet this foundation level of understanding.

Wherever possible the learning process should be supported by the development of key practical skills thus hands-on training in a practical context is also recommended.



For whom are these recommendations intended?

These recommendations are primarily intended for those involved in the maintenance and management of Fluid Power Systems but many other key professions would benefit across a range of levels from Apprentices to Service Engineers, Technical Representatives and Project Engineers. These Recommendations establish a foundation to build upon as individuals develop their Engineering careers and become more involved with Integrated Systems Engineering.

Everyone can learn by following these recommendations and improve their Health and Safety knowledge making them more aware of the potential dangers and how to manage them.

* European Trade Federation for national fluid power associations

BFPA Foundation Level - Pneumatics

Introduction to the application of Fluid Power

Candidates should:

Know where Fluid Power (pneumatics/electro-pneumatics) is used in today's modern society and the realisation of its importance in the provision of power and motion control.

A range of examples should be introduced at this stage clearly showing the extent to which this technology is applied.

Technical Recommendations

On completion of any programme of study involving these recommendations candidates should know:

Basic Principles

1. The basic layout of a typical pneumatic installation from compressor to air application.
2. The functionality of the components that are used to construct a typical system.
3. The fundamental principles that underpin the operation of all pneumatic based systems in relationship to:
   a) Pressure, flow, size and force relating to cylinder performance
   b) Pressure, flow, displacement and torque relating to air motor and rotary actuator performance
   c) Flow rate, pressure drop, pipe size and length
   d) Fundamental principles of power transmission using air
   e) Power pressure losses and the effects of leakage
   f) Gauge pressure, absolute pressure and vacuum
   g) Pressure boosting
   h) Noise control

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

Pneumatic Symbols

Candidates should:

4. Recognise the Pneumatic Symbols in current use relating to ISO1219-1:2012 (Fluid Power Systems and Components-Graphical Symbols and Circuit Diagrams Part 1) and apply these to the various component parts within a pneumatic system. *(Ideally this section should be incorporated throughout as the function and operation of component parts are identified and the compressed air circuit is progressively developed).*

Compressors

Candidates should:

5. Know the types of compressors in common use with reference to construction, principles of operation and the importance of correct siting and installation.

Airline Components

Candidates should:

6. Know the function, operation and associated control features of:
   a) a typical service/maintenance (FRL) unit.
   b) isolation valves
   c) soft start and dump valves

Pressure Control

Candidates should:

7. Know the various types of pressure control valves in common use together with the range of different control methods and mounting arrangements and identify their performance when applied to a working circuit.

Flow Control

Candidates should:

8. Know the types of components in common use to control flow, their control features and identify their effects on performance when applied to a working circuit including cushioning devices.

Direction Control

Candidates should:

9. Know the various types of direction control valves in common use together with the range of different control methods and mounting arrangements and identify their functionality when applied to a working circuit.

Pneumatic Actuators

Candidates should:

10. Know the construction and operation of the types of actuators in common use.

Tube and Pipe Work

Candidates should:

11. Know the general construction of the various systems in common use for transmitting air under pressure, associated sealing and connecting methods.

Electrical Principles and Techniques (equate to fluid power analogies where possible)

Candidates should:

12. Know the relationship between voltage, current and resistance (Ohm's Law) (use simple electrical circuits and calculations to support the knowledge development at this stage).
13. Know the principle of operation and performance of typical solenoids and their interface with pneumatic valves.
14. Recognise the types of relays including their typical construction, the types in use and their functionality.
15. Know the functional operation of input and output devices (analogue and digital).
16. Know the difference between open loop and closed loop control systems (overview).

Electrical Symbols in common use

17. Identification of common symbols in a typical electro-pneumatic circuit.

Vacuum (overview)

Candidates should:

18. Know the types of vacuum systems commonly used.

Maintenance Procedures

Candidates should:

19. Know the main causes of failure in pneumatic systems.
20. Know the importance of establishing data relating to the correct system performance to enable changes to be identified.
21. Know the symptoms associated with a change in performance.
22. Know the importance of a pro-active maintenance scheme and associated record keeping.
23. Know the importance of following safe working procedures at all times when carrying out such activities as: installation, commissioning, servicing/testing, inspections, checking performance, and any other activities that fall within your job role specification.

Test and measurement in pneumatic systems

24. Overview of test and management equipment in common use.

Health and Safety

Due to the nature of a working pneumatic system and the utilisation of air 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 with a greater overall understanding of the power transmission process and the components involved, their ability to identify dangers, assess the risk and to put in place the necessary control measures that will become part of their daily work.

CANDIDATES MUST:

25. Know the importance of personal protection associated with the working environment.
26. Know the importance of following safe isolation procedures.
27. Know the dangers of trapped and stored energy and how to deal with it.
28. Know the dangers associated with air leakage and how to deal with it.
29. Know the effects of air injection injuries and the immediate actions to be taken.
30. Know the dangers associated in working with compressed air systems and associated controls.
31. Know the importance of maintaining accurate records.
32. Know the importance of training and working within their trained capability.
33. Know the importance of following all safe working procedures and rules laid down by their Employer.

Practical Recommendations

To support the implementation and effectiveness of these Recommendations, Candidates must be given the opportunity to install and commission small working systems, whilst interpreting circuit diagrams, follow safe working practices and setting up procedures.

Contributing Organisations

A C Hydraulics
Aventics
Bachy Soletanche
Bosch Rexroth
British Fluid Power Association
Eaton
Fluid Power Design Solutions
FPI North West
Hercules Hydraulics
Hydrasun
Mechatronics International Limited
National Fluid Power Centre
Parker Hannifin
Pirtek UK
Systems Services
SMC

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