



PUMPING TECHNOLOGY TRAINING COURSES GUIDE



Pumping Fundamentals | Pump Selection | Pump Testing | Pump Systems | Pump Hydraulics

PUMPING TECHNOLOGY

TRAINING COURSES INFORMATION

INTRODUCTION

WITH AN EXPANDING GLOBAL ECONOMY AND THE HIGH NUMBER OF YOUNG PEOPLE BEING DRAWN TO MEDIA-BASED INDUSTRIES, IT IS CRITICAL THAT UK COMPANIES DEVELOP THEIR EMPLOYEES' SKILLS IN ORDER TO MAINTAIN A STRONG MANUFACTURING BASE.

With limited availability of skilled staff, employers need to understand the value of developing the knowledge of their workforce.

BPMA Pumping Fundamentals Courses are aimed at all sectors purchasing and operating pumps including engineering, contractors, end users, procurement, service and maintenance personnel.

We offer a selection of traditional lecturer based courses starting from basic pumping fundamentals to the more advanced courses dealing with pump hydraulics and pump systems.

Our courses can be delivered at our purpose built conference centre or "in-house" if you have more than eight delegates.



WITH HIGHLY EXPERIENCED LECTURERS OUR COURSES PROVIDE:

- Full one-day modules
- Regular course dates*
- Convenient UK venue (only 2 minutes from J1 of the M5)
- First-class training facilities with catering
- Full support and training guidance
- Transparent pricing and special booking rates
- Cost effective in-house training delivery**

- Comprehensive course manual
- BPMA Certificate (subject to course assessment).***

*Pumping Fundamentals Module 001 Parts 1 and 2 are held at our purpose built conference centre approximately every three months with Modules 007, 008 & 009 annually.

**We can provide any module on an "in-house" basis for eight or more delegates.

***Assessments graded on a Pass, Credit or Distinction basis.



WWW.BPMA.ORG.UK

For booking information contact:
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MODULE 001 PART 1 PUMPING FUNDAMENTALS

COURSE OUTLINE

DIVIDED INTO TWO SESSIONS, THE FIRST SESSION COVERS PUMP PERFORMANCE, CONSTRUCTION AND SELECTION WHILST THE SECOND SESSION COVERS PUMPING SYSTEMS AND PUMP OPERATION.

AIMS

The initial part of the course is aimed at establishing an understanding of the fundamentals of pumps; how they work, their performance characteristics and the influence of key design parameters and liquid properties on pump behavior.

The second part of the course is intended to build upon the basic fundamentals of pumps and pump performance and establish an understanding of pump operating conditions.

OBJECTIVES

At the end of the course delegates should be able to:

- Contribute to the pump selection process through improved knowledge of the hydraulic performance and behaviour of pumps and their operating limitations
- Recognise the reasons for the selection of pump types
- Understand pumping system characteristics and the interaction of pumps and systems for single and multiple pump installations
- Recognise operating conditions which cause pump and system operating problems
- Contribute to good practice in the specification, selection, and operation of pumps.

KEY CONTENTS

Course Outline

Aims and Objectives

Pumps As Machines

- General
- Rotodynamic pumps
- Positive displacement pumps.

Liquid Properties and Definitions

Pumping Terminology - Definitions

Fluid Flow - Basic Concepts

- Flow continuity energy equation
- Pressure losses in pipes

- The flow regime - laminar and turbulent flow.

Cavitation

Net Positive Suction Head

The System Performance

- The hydraulic gradient
- The system curve.

Pump Performance Curves

- Rotodynamic pumps
- Positive displacement pumps.

Matching The Pump And The System

- Pump systems

- Pump selection considerations
- Multiple pump systems.

Pump Flow Control

- Typical approaches to pump flow control
- Energy efficiency.

Course Recap

MODULE 001 PART 2

PUMP SELECTION

COURSE OUTLINE

COVERS THE BASIC PRINCIPLES OF SELECTING THE BEST PUMP TO SUIT A GIVEN DUTY.

The course is designed to enhance the skills and knowledge of:

- Individuals whose role includes the planning and specification of pumping operations
- Anyone who has a need to be conversant with the principles of pump selection.

Provides a foundation of understanding the issues that need to be considered when selecting a pump and follows on from Part 1 of the Module, which deals with pumping fundamentals.

A series of presentations and exercises will be used to illustrate the principles underlying the process in the most practical way possible.

AIMS

Designed to enable individuals with general engineering or commercial background to gain an understanding of the principles associated with the selection of pumping equipment.

OBJECTIVES

At the end of the course delegates should be able to:

- Classify and summarise different types and classes of pumping equipment
- Ensure an efficient exchange of information between purchaser and vendor
- Consider the selection of auxiliary pump equipment
- Undertake selection procedures based on hydraulic and other parameters
- State the purposes of a quotation and a contract.

KEY CONTENTS

Recap Of Some Key Pumping Fundamentals

Pumps As Part Of The Machine Or Set

Pump Families

General Approach To Selecting A Pump

- The selection process.

Defining The Need

- Collecting information from customer
- Standard data sheets customer data sheet
- Maker's data sheet.

Grouping The Desired Features

Eliminating Unsuitable Pump Types

Selecting The Pump To Meet The Hydraulic Requirements

- Selecting a rotodynamic pump
- Selecting a positive displacement pump.

Checking The Installation Requirements

Checking The Compatibility Requirements

Reviewing The Selection

Specifications For Other Equipment

- Driver
- Turbine drives

- Electric motors and hydrostatic drives

- Connectors
- Function of a connector
- Transmission
- Couplings and alignment
- Baseplate
- Seals
- Ancillary items.

Contractual Issues

- The role of a quotation
- Preparing a quotation
- Data sheet
- Commercial liability
- bid evaluation.

MODULE 007

PUMP TESTING

COURSE OUTLINE

THE COURSE EXAMINES A RANGE OF METHODS ASSOCIATED WITH THE TESTING OF VARIOUS PUMP PERFORMANCE INDICATORS.

Using presentations and exercises the course takes a practical approach to what is a complex subject.

Delegates will have the opportunity to complete a straightforward assessment dealing with the principles covered during the day.

AIMS

Designed to enable individuals to enhance their knowledge and skills in the practice of pump testing.

OBJECTIVES

At the end of the course delegates should be able to:

- State the range of pump performance indicators likely to be tested
- Describe the range of common test methods used for each performance criteria
- Describe the standard procedures accepted for testing pump performance
- Describe the critical factors of NPSH required testing
- Understand how pump efficiency can be derived from the temperature difference measure across a pump
- State the standards applicable to verification of the Guarantee.

KEY CONTENTS

Test Methods

- Flow
- Head
- Rotational speed
- Absorbed mechanical power
- Absorbed electrical power
- Noise
- Vibration
- Minimum/Maximum flow
- Zero flow tests
- Priming tests
- Pump temperatures.

NPSH Required Testing

- Method Of NPSHR testing
- Variables to be measured during NPSHR testing

- Calculation of NPSH During Testing
- Particular Problems With NPSHR testing
- Interpretation of NPSHR test results
- Sump pumps.

Pump Efficiency - The Thermodynamic Method

Measurement Inaccuracy

- Instrument errors
- Calibration errors
- Human errors
- Arithmetic errors
- Unsteady readings (oscillations).

Instrument Accuracy

- Calculation of instrument accuracy
- Error analysis - some warnings.

Some Very Practical (But Often Ignored) Points

Verification Of The Guarantee And Reporting

- Verification of the guarantee
- Reporting
- Worked example of a typical centrifugal pump test.

MODULE 008 PUMP SYSTEMS

COURSE OUTLINE

WELCOME TO THIS ONE DAY COURSE DEALING WITH THE SUBJECT OF PUMP SYSTEMS. THE COURSE EXAMINES THE FACTORS THAT HAVE TO BE CONSIDERED IN THE DESIGN OF PUMP SYSTEMS. USING PRESENTATIONS AND EXERCISES THE COURSE TAKES A PRACTICAL APPROACH TO WHAT IS A COMPLEX SUBJECT.

AIMS

Designed to enable individuals to enhance their knowledge and understanding of the factors that have to be considered in the design of pump systems.

OBJECTIVES

At the end of the course, members should be able to:

- Understand the meaning of the terms and the difference between “system head”, “static head”, “velocity head” and “friction head”
- Understand the special considerations of unsteady flow conditions relating to positive displacement pumps.
- Be able to describe a “system curve” and understand how it is derived
- Understand how to determine performance in multiple pump operations
- Know the differences and relationship between NPSH, (NPSH)_R and (NPSH)_A
- Understand the main requirements of pump system design and the problems associated with poor design

KEY CONTENTS

Common Types Of Pump System

Fluid Flow Fundamentals

- The energy equation
- Continuity
- Flow regimes
- Origins of pressure losses
- Turbulence
- Pressure losses.

Determination Of System Head

- Friction head in fittings
- An example of the use of loss co-efficients
- Special considerations for positive displacement Pumps
- Acceleration head.

Interaction Of Pump and Systems

- System curves
- Allowing for system head estimation errors
- Pump performance curves
- Centrifugal pump performance characteristics
- Pump performance with variable speed.

Pump Operating Limitations

- Partial flow operation of rotodynamic pumps
- Pump and system component inlet conditions
- Cavitation
- Net positive suction head.

System Design

- The management of flow system design
- Pipe work and fittings system design review
- Sump design.

System Operation

- Key operating considerations
- Pump flow control
- Systems using pump discharge valve control
- Systems with pumps in parallel and inlet sump level control
- Systems with discharge pipe siphons
- Pump starting and stopping.

Whole Life Costing

MODULE 009 - HYDRAULIC DESIGN OF CENTRIFUGAL PUMPS

COURSE OUTLINE

WELCOME TO THIS ONE DAY COURSE DEALING WITH THE SUBJECT OF HYDRAULIC DESIGN AND PERFORMANCE OF CENTRIFUGAL PUMPS. THE COURSE EXAMINES THE FACTORS THAT HAVE TO BE CONSIDERED IN PUMP HYDRAULIC DESIGN. USING PRESENTATIONS AND EXERCISES THE COURSE TAKES A PRACTICAL APPROACH TO WHAT IS A COMPLEX SUBJECT.

AIMS

This course is designed to introduce the subject of centrifugal pump hydraulic design to individuals who have a general technical background in pump engineering and for whom increased knowledge of the basis of pump hydraulic design and performance achievement would improve their contribution

to pump engineering. Trainee hydraulic design engineers may also benefit.

OBJECTIVES

At the end of the course delegates should:

- Have gained an appreciation of the basic principles of centrifugal pump hydraulic design.
- Understand pump performance characteristics and the influence of key design parameters.
- Be able to evaluate the hydraulic aspects of a centrifugal pump design.
- Be able to contribute to pump range planning and development.

KEY CONTENTS

Introduction

- Units
- Symbols used.

Basic Principles of Centrifugal Pump Hydraulic Design

- Centrifugal pumps - principles of operation
- Hydraulic design practice
- Euler equation for pump head
- Impeller velocity triangles
- Forced vortex & free vortex velocity distributions.

Key Hydraulic Design Parameters

- Choosing the pump design duty
- Pump Specific Speed (Ns) & Suction Specific Speed (Nss)
- Pump design duty and Specific Speed

- Pump Specific Speed experience
- Impeller inlet design and NPSH required
- Using head and flow coefficients and Area Ratio
- Throat area
- Flow in a volute throat.

Pump Efficiency And Performance Losses

- Pump efficiency and hydraulic losses
- Leakage loss and volumetric efficiency
- Impeller disc friction loss and mechanical efficiency.

Performance Characteristics

- Estimated performance characteristics

- The shape of pump performance characteristics
- Pump performance and recirculation at off-design flows.

Hydraulic Thrust Loading In Volute Pumps

- Axial thrust
- Estimating axial thrust load
- Radial thrust
- Estimating radial thrust load.

An Introduction To Hydraulic Design Procedures

- Impeller Blade Design
- Volute Casing Design.

Pump Hydraulic Design Audit Check Lists

Recap Of The Pump Hydraulic Design Process

- A pump design example using area ratio.

BRITISH PUMP MANUFACTURERS' ASSOCIATION LTD



The British Pump Manufacturers' Association Ltd (BPMA) is a trade association representing the interests of UK suppliers of liquid pumps and pumping equipment. BPMA's prime mission is to influence the business environment in the interests of the competitiveness and profitability of the UK Pump Industry through a range of services including commercial, marketing, technical, environmental, educational and energy together with regular meetings of members.

Membership of the BPMA provides a wide and growing range of services some of which are free and discounted. Membership is open to manufacturers, distributors, importers, contractors and repairers of industrial pumps as well as being available to suppliers to pump companies such as manufacturers of bearings, seals, couplings, motors, components, software (pump specific) etc.

Benefits include:

- Free project tender service
- Free business support helpline
- Technical helpline
- Free publications
- Member visits
- Discounted insurance
- Representation
- Promotion
- Regular meetings
- Weekly newslink bulletin
- Discounted training
- Seminars and conferences
- Exhibitions
- Energy auditing
- Social media
- EU Directives Updates
- Pump Standards Updates.



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