

# rexroth

## A Bosch Company



**Hydraulic Training Schedule  
March - December 2026**

VENUE	COURSE TITLE	2026
ST NEOTS	BASIC HYDRAULICS 3 days	March 3-5
ST NEOTS	PROPORTIONAL HYDRAULICS* 3 days	March 3-5
ST NEOTS	FAULT FINDING* <b>NEW</b> 2 days	March 3-4
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 5
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 6
WAKEFIELD	BASIC HYDRAULICS 3 days	March 3-5
WAKEFIELD	PROPORTIONAL HYDRAULICS* 3 days	March 3-5
WAKEFIELD	FAULT FINDING* <b>NEW</b> 2 days	March 3-4
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 5
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 6
ST NEOTS	BASIC HYDRAULICS 3 days	March 17-19
ST NEOTS	PROPORTIONAL HYDRAULICS* 3 days	March 17-19
ST NEOTS	FAULT FINDING* <b>NEW</b> 2 days	March 17-18
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 19
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 20
WAKEFIELD	BASIC HYDRAULICS 3 days	March 17-19
WAKEFIELD	PROPORTIONAL HYDRAULICS* 3 days	March 17-19
WAKEFIELD	FAULT FINDING* <b>NEW</b> 2 days	March 17-18
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 19
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	March 20
CORK	BASIC HYDRAULICS 3 days	<b>APRIL</b> 14-16
ST NEOTS	BASIC HYDRAULICS 3 days	April 14-16
ST NEOTS	PROPORTIONAL HYDRAULICS* 3 days	April 14-16
ST NEOTS	FAULT FINDING* <b>NEW</b> 2 days	April 14-15
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	April 16
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b> 1 day	April 17
WAKEFIELD	BASIC HYDRAULICS 3 days	April 14-16
WAKEFIELD	PROPORTIONAL HYDRAULICS* 3 days	April 14-16

WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	April 14-15
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	April 16
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	April 17
ST NEOTS	BASIC HYDRAULICS	3 days	April 28-30
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	April 28-30
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	April 28-29
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	April 30
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	May 1
WAKEFIELD	BASIC HYDRAULICS	3 days	April 28-30
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	April 28-30
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	April 28-29
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	April 30
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	May 1
ST NEOTS	BASIC HYDRAULICS	3 days	<b>MAY</b> 12-14
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	May 12-14
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	May 12-13
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	May 14
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	May 15
WAKEFIELD	BASIC HYDRAULICS	3 days	May 12-14
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	May 12-14
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	May 12-13
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	May 14
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	May 15
ST NEOTS	BASIC HYDRAULICS	3 days	<b>JUNE</b> 2-4
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	June 2-4
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	June 2-3
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 4
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 5

WAKEFIELD	BASIC HYDRAULICS	3 days	June 2-4
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	June 2-4
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	June 2-3
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 4
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 5
CORK	BASIC HYDRAULICS	3 days	June 16-18
ST NEOTS	BASIC HYDRAULICS	3 days	June 16-18
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	June 16-18
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	June 16-17
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 18
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 19
WAKEFIELD	BASIC HYDRAULICS	3 days	June 16-18
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	June 16-18
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	June 16-17
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 18
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	June 19
ST NEOTS	BASIC HYDRAULICS	3 days	June 30 - 2 July
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	June 30 - 2 July
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	June 30 - 1 July
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	<b>JULY 2</b>
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 3
WAKEFIELD	BASIC HYDRAULICS	3 days	June 30 - 2 July
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	June 30 - 2 July
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	June 30 - 1 July
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 2
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 3
ST NEOTS	BASIC HYDRAULICS	3 days	July 14-16
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	July 14-16

ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	July 14-15
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 16
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 17
WAKEFIELD	BASIC HYDRAULICS	3 days	July 14-16
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	July 14-16
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	July 14-15
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 16
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 17
ST NEOTS	BASIC HYDRAULICS	3 days	July 28-30
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	July 28-30
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	July 28-29
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 29
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 30
WAKEFIELD	BASIC HYDRAULICS	3 days	July 28-30
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	July 28-30
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	July 28-29
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 29
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	July 30
ST NEOTS	BASIC HYDRAULICS	3 days	<b>AUGUST</b> 11-13
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	August 11-13
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	August 11-12
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 13
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 14
WAKEFIELD	BASIC HYDRAULICS	3 days	August 11-13
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	August 11-13
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	August 11-12
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 13
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 14

ST NEOTS	BASIC HYDRAULICS	3 days	August 25-27
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	August 25-27
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	August 25-26
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 27
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 28
WAKEFIELD	BASIC HYDRAULICS	3 days	August 25-27
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	August 25-27
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	August 25-26
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 27
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	August 28
ST NEOTS	BASIC HYDRAULICS	3 days	<b>September 8-10</b>
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	September 8-10
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	September 8-9
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	September 10
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	September 11
WAKEFIELD	BASIC HYDRAULICS	3 days	September 8-10
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	September 8-10
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	September 8-9
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	September 10
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	September 11
CORK	BASIC HYDRAULICS	1 day	<b>October 20-22</b>
ST NEOTS	BASIC HYDRAULICS	3 days	October 20-22
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	October 20-22
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	October 20-21
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	October 22
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	October 23
WAKEFIELD	BASIC HYDRAULICS	3 days	October 20-22
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	October 20-22

WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	October 20-21
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	October 22
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	October 23
ST NEOTS	BASIC HYDRAULICS	3 days	<b>November 3-5</b>
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	November 3-5
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	November 3-4
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 5
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 6
WAKEFIELD	BASIC HYDRAULICS	3 days	November 3-5
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	November 3-5
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	November 3-4
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 5
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 6
ST NEOTS	BASIC HYDRAULICS	3 days	November 17-19
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	November 17-19
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	November 17-18
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 19
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 20
WAKEFIELD	BASIC HYDRAULICS	3 days	November 17-19
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	November 17-19
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	November 17-18
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 19
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	November 20
ST NEOTS	BASIC HYDRAULICS	3 days	<b>December 1-3</b>
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	December 1-3
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	December 1-2
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 3
WAKEFIELD	BASIC HYDRAULICS	3 days	December 1-3

WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	December 1-3
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	December 1-2
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 3
CORK	BASIC HYDRAULICS	3 days	December 8-10
ST NEOTS	BASIC HYDRAULICS	3 days	December 8-10
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	December 8-10
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	December 8-9
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 10
WAKEFIELD	BASIC HYDRAULICS	3 days	December 8-10
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	December 8-10
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	December 8-9
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 10
ST NEOTS	BASIC HYDRAULICS	3 days	December 15-17
ST NEOTS	PROPORTIONAL HYDRAULICS*	3 days	December 15-17
ST NEOTS	FAULT FINDING* <b>NEW</b>	2 days	December 15-16
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 17
ST NEOTS	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 18
WAKEFIELD	BASIC HYDRAULICS	3 days	December 15-17
WAKEFIELD	PROPORTIONAL HYDRAULICS*	3 days	December 15-17
WAKEFIELD	FAULT FINDING* <b>NEW</b>	2 days	December 15-16
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 17
WAKEFIELD	ACCUMULATOR COMPETENCE* <b>NEW</b>	1 day	December 18

\* **Level 2 training course, please refer to entry requirements.**

## **Booking/Pricing**

All bookings subject to receipt of completed booking form (please contact us), and official order number. Quoted price per attendee, per course, excluding VAT. Course materials and light buffet lunch included. All visa, travel, hotel and subsistence responsibility of attendee.

**Quoted prices refer to standard courses. Bespoke Training packages are also available, delivered at Bosch Rexroth St Neots or Wakefield, or customer site, duration to suit, prices on request. Please contact us for further details.**

## **UK Venues**

Bosch Rexroth, St Neots, Cambridgeshire. PE19 2ES  
Bosch Rexroth, Normanton, Wakefield. WF6 1GX

## **Pricing 2026**

3-day course	£1165.00
2-day course	£780.00
1-day course	£570.00

## **Cork**

All courses Price on request

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## **For course bookings, please contact:**

**St Neots / Wakefield**  
**M Morris**

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**Email: [sales@boschrexroth.co.uk](mailto:sales@boschrexroth.co.uk)**

**Cork**  
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Certified by the British Fluid Power Association



Level 1 Training:

**BASIC HYDRAULICS TRAINING COURSE (3 days): Typical Content**

1. **Self-Assessment Questionnaire**
  - used to support the introduction to hydraulics and identify levels of previous knowledge and understanding
2. **Introduction to the basic principles of Fluid Power Systems**
  - what is a hydraulic system?
  - important characteristics of hydraulic systems
  - where do we use hydraulics?
  - 7 basic principles that underpin hydraulic systems
  - Pascal's Law, Force Transmission, Pressure Transmission
3. **Introduction to Circuit Symbols (to current ISO standards)**
  - hydraulic symbols, shape and recognition
  - how to read hydraulic circuit diagrams
  - open and closed loop circuits
4. **Pumps**
  - different pump types and basic principal of operation (gear, vane, piston)
  - shaft input power and hydraulic output power
  - suction performance, cavitation, aeration, causes of failure
  - installation and commissioning
5. **Pressure Control Devices – function, operation and circuit application**
  - pressure relief valves – direct and pilot operated (including unloading)
  - pressure reducing valves
  - sequence valves
6. **Directional Control Valves – function, operation and circuit application**
  - direct operated and pilot operated
  - valve sizes and nominal flow rates
  - poppet valves
7. **Load Holding and Motion Control – function, operation and circuit application**
  - standard check valves
  - pilot operated check valves
  - counter balance valves
8. **Flow Control Valves – function, operation and circuit application**
  - simple throttle valves
  - viscosity compensated valves
  - pressure compensated valves
  - meter in / meter out flow control
9. **Pipes, Hoses and Fittings**
  - compression joints - establishing the perfect connection
  - knowing the parts and application
  - hose construction and selection
  - hose failures and correct installation
  - safety
10. **Motors**
  - different motor types and basic principal of operation (axial piston, radial piston, fixed and variable displacement)
  - shaft speed, displacement, input flow-rate, torque.

11. **Cylinders**
  - different types, basic construction / operation
  - force, effective area, flow rate and velocity
  - intensification
  - regeneration
12. **Accumulators**
  - different types (piston, diaphragm, bladder)
  - Basic principal of operation
  - applications
  - safety and legislation
13. **Hydraulic Oil**
  - important characteristics and different types
  - additives
  - viscosity
  - management control
14. **Contamination Control**
  - origin and nature of contaminants
  - particle sizes and typical component clearances
  - establishing target cleanliness levels
  - monitoring and maintaining cleanliness standards (measurement)
  - sampling methods
15. **Fault Finding**
  - fault diagnosis, start point and procedures to follow
  - health and safety and establishing safe working practices
  - planning and preparation
  - application of 'fault-cause-remedy' techniques
16. **Practical Exercises (in-house training rigs)**
  - performance testing a pump
  - comparing the performance of a simple throttle valve to a pressure compensated flow control valve
  - to observe and understand pressure intensification
  - to prepare a set up procedure for three different pressure control valves with different settings
  - to build and understand a simple accumulator circuit
17. **Hydraulic Safety**
  - general safety, personal hygiene and handling of oils



Level 2 training - please refer to entry requirements.

### **FAULT FINDING TRAINING COURSE (2 Days): Typical Content**

1. **Review of the basic principles of Fluid Power**
  - fundamental principles that underpin hydraulic systems
  - Pascal's Law, transmission of force, power
  - formulae used to calculate flow, pressure, power, torque and force
2. **Maintenance and Fault Finding**
  - maintenance strategies
  - planning and fault finding techniques
  - system monitoring
  - fluid condition
  - tools and measuring equipment
  - use of technical reference information
3. **Circuits and Symbols**
  - review of circuit symbols and circuit diagrams
  - examples of different circuit diagrams
  - circuit errors
  - 'truth tables' / 'solenoid charts'
4. **Accumulators**
  - basic principal of operation
  - back up bottles
  - safety and legislation
5. **Logic Elements**
  - basic function
  - different types (direction and pressure)
  - applications
6. **Proportional Valves**
  - basic function
  - command and feedback signals
  - diagnostic equipment
7. **Faults and Failures**
  - installation problems
  - cavitation and aeration
  - effects of temperature
  - causes of failures
8. **Hydraulic Oil**
  - contamination control
  - condition monitoring
  - sampling methods
9. **Practical Exercises (in-house training rigs)**
  - practical exercises to identify and rectify faults
  - practise fault finding techniques
  - use of measuring equipment
10. **Safety**
  - general safety, personal hygiene and handling of oils
  - risk assessments
  - safe systems of work

Level 2 training - please refer to entry requirements.

### **ACCUMULATOR COMPETENCE TRAINING COURSE (1 DAY): Typical Content**

1. **Introduction - Review of the basic principles of Fluid Power Systems**
  - important characteristics of hydraulic systems
  - basic principles that underpin hydraulic systems
  - the importance of fluid cleanliness
  - Pascal's Law, useful formulas
  
2. **Introduction to accumulators**
  - history and developments
  - basic operating principles
  
3. **Gas charged accumulators**
  - gas laws and operating principles
  - nitrogen
  - compressibility
  - gas cylinder - supply options
  - safe working with Nitrogen
  
4. **Gas charged accumulator types**
  - understanding common terms
  - details of operation of - Diaphragm, Bladder and Piston accumulators
  - back-up gas bottles
  - safety equipment associated with accumulator systems
  - charging kit
  - the gas charging process
  - sources of information
  
5. **The Pressure System Safety Regulations**
  - the responsibility of users and owners of systems
  - the written scheme of examination
  - drawing up a written scheme of examination
  
6. **Application examples**
  - various examples
  
7. **Practical exercises**
  - practical exercises to support the topics
  - practice gas charging
  - build accumulator circuits

\*Level 2 training - please refer to entry requirements.

## **SERVO & PROPORTIONAL HYDRAULICS TRAINING COURSE (3 Day)**

### **TYPICAL CONTENT**

- 1. Proportional hydraulics – an introduction**
  - overview of 'on-off' control and its limitations
  - introduction to a proportional alternative
- 2. How proportional directional valves control flow**
  - the proportional directional valve spool
  - differences between proportional and servo valves & the history of their development
  - symbol recognition
  - application examples
- 3. Proportional directional control valves**
  - the proportional solenoid
  - amplifier control
  - understanding new terms (I min, I max, gain, ramp)
  - integrated electronics
  - force control and position control solenoids
  - proportional valve spool types and spool ratings
  - Proportional valve performance terminology
  - pilot operated proportional directional valves
- 4. Other proportional valves**
  - proportional pressure relief and pressure reducing valves
  - proportional flow control valves
  - proportional pump controls
- 5. Servo valves**
  - overview of high response proportional valves and servo valves
  - servo valve history and developments (jet pipe, flapper & nozzle)
  - servo valve performance
- 6. Electronics**
  - cables and connectors for proportional valves
  - digital and analogue amplifier cards
  - PID, pulse width modulation and dither
- 7. Practical work**
  - setting up an analogue amplifier card
  - using a proportional directional valve with integrated electronics
  - adding pressure compensation to a proportional directional valve
  - using call-up command values and ramp times
  - using a proportional pressure relief valve and proximity sensor
  - setting up and using a pressure switch to control a proportional directional valve
  - observing the effects of ramp time and velocity inputs on stopping distance

\*Level 2 training - please refer to entry requirements.

**BASIC HYDRAULIC DESIGN TRAINING COURSE (3 Day) [Dates on Request](#)**

**TYPICAL CONTENT**

- 1. Determining the Load**
  - size, volume, density, and mass
  - calculating force and acceleration
  - effects of gravity
  - effects of static and sliding friction
  - calculating torque
  - calculating rotational speed
  
- 2. Sizing the Actuator**
  - cylinder sizing
  - rod buckling load calculation
  - motor sizing
  - use of step-up and step-down gearboxes
  
- 3. Planning and Duty Cycle**
  - flow-time graphical representation
  - pressure-time graphical representation
  
- 4. Control Valve Selection**
  - directional valve selection from graphical characteristic curves
  - open-centre and closed centre 'mobile' multi-function valves
  - PO Check valve pilot pressure calculation
  - counterbalance and overcentre valve selection and pilot pressure calculation
  - logic valve sizing (including area ratios) and pilot pressure calculations
  
- 5. Sizing the Power-Pack (Pump, Prime Mover and Reservoir)**
  - pump sizing and selection
  - prime mover selection (electric motors & diesel engines)
  - reservoir sizing
  - reservoir layout and internal construction
  
- 6. Throttling**
  - orifice calculation
  - calculating intensification for meter-out throttling applications
  - proportioning/mobile valve spool selection from graphical performance curves
  
- 7. Heating and Cooling**
  - Fluid selection (choosing viscosity grade for ambient temperature)
  - Cooling calculations (including ambient radiation from reservoirs)
  - Heating calculations
  
- 8. Sizing Pipework and Hoses**
  - Calculating pipe & hose internal diameter
  - Calculating change of pressure drop due to changes in flowrate

**9. Turbulent Flow Flushing**

- calculating turbulent flowrate for flushing

**10. Tips and Tricks to Improve Machine Performance**

- accumulator sizing calculations
- use of 2-stage relief valve for unloading and multiple pressure selection
- use of externally piloted 'unloader' valve for Hi-Lo pump systems and accumulator charging applications
- calculating cylinder regenerative ('regen') extension flow/speed

**11. Filter Placement**

- use of BFPA 'P5' process to determine filter placement

**12. Case Study**

- attendees will carry out a case study to design a typical hydraulic system incorporating the above topics

## **Level 2 Training**

- Fault Finding
- Accumulator Competence
- Proportional Hydraulics
- Basic Hydraulic Design

## **Entry Requirements**

Completion of the Basic Hydraulics course is strongly recommended prior to attending a Level 2 course. Alternatively, attendees must have sound knowledge/experience of:

- the basic principles that underpin all hydraulic systems (relationship between, pressure, flow, force, torque, speed, power);
- reading and interpreting circuit diagrams using current symbols;
- the function and operation of relief, sequence and pressure reducing valves;
- the principle of pressure compensation relating to flow control; operation of spool valves; gear, vane and piston pumps;
- characteristics of oils and contamination control;
- accumulators and their use, safety and legislation.

**rexroth**

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