



Internationale Hydraulik Akademie

Seminar programme 2017/2018

IHA

www.hydraulik-akademie.de

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Photos: HANSA-FLEX – J. Ahlers
YES – Jessica Großmann

FOREWORD



Dear Sir or Madam,

For more than nine years now, the Internationale Hydraulik Akademie in Dresden and Linz (A) has been deepening, widening and renewing people's knowledge in the field of fluid technology and hydraulic line equipment. Our innovative training concept and unique training stations enable continuous further development and support our new approaches to practice-based further training and education.

As a result, our current seminar programme again contains new and modified seminar types, which we have developed with the constantly changing requirements of the market in mind:

- Workshop and refresher for Authorised Persons / qualified experts qualified to conduct inspections of hydraulic line equipment in accordance with BetrSichV / AM-VO
- Pressure accumulators in hydraulic systems and associated obligations

The IHA offers several types of seminar that comply with the DGUV Rule 1, §4 "A company's duty to provide instruction" to enable you to meet the requirements for companies with regard to health and safety during the use of work equipment.

As technology continues to develop further at breakneck speed, so the demands made on hydraulic systems become more numerous almost daily. As machines are becoming increasingly complex, we must take steps to deepen our understanding of the subject matter and never stop learning. For this reason, the IHA has developed seminars and seminar modules for fluid technology and hydraulic line equipment and delivers them through professionals for professionals. In addition to covering basic topics, our programme of courses also contains material for advanced participants and professionals. This was one reason why we published the first part of the new series of seminar training booklets called "Valves in hydraulics":

- Pressure valves
- Directional control valves
- Flow control valves
- Check valves
- 2-way cartridge valves

The new series of booklets is intended mainly for professionals, hydraulics systems installers, maintenance engineers, servicing personnel, hydraulics engineers and hydraulic systems designers. The "Valves in hydraulics" topic is just the start. More information and extracts to read can be found at www.hydraulik-akademie.de.

In addition, the IHA offers manufacturer-independent and neutral services for investigating and analysing hydraulic components and systems. These services can be used to optimise products and processes and minimise fault rates, which reduces costs, prolongs operating times and increases efficiency in the long term.

With this brochure, we present an overview of our services and our new programme of seminars. We look forward to meeting you!

Ulrich Hielscher
Managing Partner



SERVICES OF THE IHA

TRAINING COURSES



Facilities include five training rooms, equipped with the most up-to-date presentation technology. Besides theoretical learning, we also provide practical instruction on 24 training benches, which have been developed especially for our courses. During the practical section, two participants work at each of the training benches to construct the hydraulic circuits they

have learned about in the theoretical content. The first practical exercises are simple but become increasingly difficult.

RESEARCH AND DEVELOPMENT SERVICES



■ UNIVERSAL TEST BENCH

The multipurpose test bench developed by the IHA can be used to investigate pumps in open or closed circuit or hydraulic components and control blocks in a manufacturer-neutral environment. The hydraulic subsystems and the latest measuring equipment are provided for these comprehensive tests.

A summary of the technical characteristics of the multipurpose test bench:

- Test bench with auxiliary control
- Max. driving power 160 kW
- Max. torque 900 Nm
- Max. speed 3200 rpm
- Highly-dynamic mobile measurement technology with calculation channels
- Volumetric flow sensors up to 1000 l/min

Manufacturers and operators of mobile and industrial hydraulic systems now have access to the following capabilities:

- Manufacturer-independent analysis of pumps, motors, valves and control blocks
- Fault analyses and loss investigation
- Results documentation
- Assistance in the development of prototypes
- Preliminary tests for developments
- Open to manufacturers, operators, scientists, consultants and experts
- Supportive consulting possible

FURTHER SERVICES FOR RESEARCH AND DEVELOPMENT



■ TEST BENCH FOR FIRE RESISTANCE INVESTIGATIONS

The suitability of hose lines and pipeline components that carry flammable materials must be demonstrated in a fire resistance investigation. This is required by classification societies for the shipbuilding and marine engineering industry as well as other institutions according to:

- DIN EN ISO 15540 Fire resistance of hose assemblies – Test methods
- ISO 19921 Fire resistance of metallic pipe components with resilient and elastomeric seals – Test methods
- VdS 2100-06, Guidelines Section 5.5 Pipe joints – Requirements and test methods – Flame test

Among other things, passing this test is an essential requirement to be able to certify components as “FLAME RESISTANT”. This test can also be used to test the flame resistance of components for other purposes.

The IHA is certified to perform these tests by DNV GL.



■ TEST BENCH FOR SALT SPRAY TEST

With the salt spray test, possible corrosion damage on metal components is detected very quickly. Normally, field tests lasting several years are required for this. Customers in almost all branches of industrial manufacturing are demanding successful corrosion testing. This is also true for the

automotive industry, the consumer goods industry and traditional machine building and plant construction, of which hydraulics is itself a part.

We test according to:

- ISO 9227 Corrosion tests in artificial atmospheres – Method for performing neutral salt spray tests
- DIN EN ISO 10289 Method for corrosion testing of metallic and other inorganic coatings on metallic base materials – Evaluation of specimens and results after a corrosion test

The test specimens are sprayed with a specified sodium chloride solution in the corrosion test chamber under specific temperature conditions. The chamber is opened at the intervals agreed in advance with the customer and the test specimen examined for corrosion damage.



CERTIFICATES OF THE IHA



DNV GL certificates for the performance of fire resistance tests.



■ CERTIFIED QUALITY

IHA has introduced a management system in accordance with ISO 9001. This certificate is valid for giving training and advice in all areas of hydraulic hose and fluid technology and testing, examination and analysis of hydraulic components and systems.



PRINCIPLES OF HYDRAULIC LINE EQUIPMENT

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

General requirements for hydraulic line equipment

Hose lines

- Selection, construction, cross section measurement
- Hose mechanics (bending behaviour, torsion, changes in length and diameter, external and internal, chemical and physical influences etc.)
- Marking requirements
- Storage and service period
- Installation in accordance with requirements of DIN 20066, DGUV Rule 113-015 (BGR 237)

Threaded technology

- Seal shapes on the sealing side
- Pipe connector shapes
- Cutting ring technology (functional principle, installation, user errors, further developments)

Pipelines

- Basic routing instructions taking into account thermal and installation stresses and decoupling of forces
- Various attachment methods and types



DURATION OF TRAINING

1 day (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 418 p.p. – incl. practical manual "Hydraulische Leitungstechnik" (832 pages)

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



INTRODUCTION TO HYDRAULIC COUPLINGS

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

- Applications
- Selection criteria for use of couplings
- Classification of couplings
- Standards for couplings
- The most common coupling types (plug-in, flat-face, screw and multicouplings)
- Design of various coupling types
- Forms of valves
- Seals and sealing systems, alternative sealing systems
- Definition of terms
- Typical causes of failure/user errors
- Assembly instructions
- Topic "Repair of couplings"
- Advantages / disadvantages of various coupling types
- Design of a coupling
- Correct storage of couplings

DURATION OF TRAINING

1 day (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 296 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

The seminar is also available in Linz, where it is based on the Austrian guidelines! The title of this seminar is: "Instruction in the technical knowledge for qualified experts in hydraulic line equipment in accordance with AM-VO 52 para 3"

AUTHORISED PERSON FOR HYDRAULIC LINE EQUIPMENT – INSTRUCTION IN THE TECHNICAL KNOWLEDGE IN ACC. WITH BetrSichV

Technical and safety-critical specifications governing line equipment in hydraulics – Seminar for future "Authorised Persons qualified to conduct inspections" in accordance with the Ordinance on Industrial Health & Safety. The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

Legal principles of safety of hydraulic line equipment

- Basic knowledge and meaning of the relevant regulations ArbSchG, BetrSichV, DIN EN ISO 4413 (formerly: DIN EN 982), DIN 20066, DGUV Information 209-070 (BGI 5100), DGUV Rule 113-015 (BGR 237), EU Machinery Directive 2006/42/EC
- Division of obligations (manufacturer, operator and hose line manufacturer)

Hydraulic hose technology

- Principles of selecting, dimensioning, assembling, and safe operation
- Influences of pressure, temperature, cross section and hydraulic fluid
- Types of crimping of hose lines and their differences
- Marking requirements
- Storage and service period including storage conditions in accordance with DIN 7716
- Basic conditions for installing line equipment
- Avoidance of user errors – installation in accordance with requirements
- Secondary protection requirements on failure of hydraulic hose lines

Pipe technology

- Threaded technology in connection with various seal types
- Pipework design and connection technology (cutting ring technology)
- Compensation for forces and movements in pipelines

Testing

- When is it necessary to replace hydraulic hose lines?
- Risk analyses, testing and inspection criteria / testing in accordance with TRBS 1201
- Inspection and replacement intervals in accordance with DGUV Rule 113-015 (BGR 237)
- Documentation (check list and inspection record) based on a practical example

After successful completion of the test, the participant can be named by his company as an "Authorised Person qualified to conduct inspections of hydraulic line equipment".

*** Note:** In this seminar, we not only deal with hydraulic hose lines in accordance with DGUV 113-015 (formerly BGR 237), but also line technology and the associated work equipment such as ball valves, couplings, screw fittings, pipes and other line technology components.

DURATION OF TRAINING

2 days* (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 767 p.p. – incl. practical manual "Hydraulische Leitungstechnik" (832 pages)

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

The seminar is also available in Linz, where it is based on the Austrian guidelines! The title of this seminar is: "Workshop and refresher for Authorised Persons qualified to conduct inspections of hydraulic line equipment in accordance with ASchG §3 para. 2"



WORKSHOP AND REFRESHER FOR AUTHORISED PERSONS QUALIFIED TO CONDUCT INSPECTIONS OF HYDRAULIC LINE EQUIPMENT IN ACCORDANCE WITH BetrSichV

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

Legal principles

- Basic knowledge and meaning of the relevant regulations ArbSchG, BetrSichV, DIN EN ISO 4413 (formerly: DIN EN 982), DIN 20066, DGUV Information 209-070 (BGI5100), DGUV Rule 113-015 (BGR237), EU Machinery Directive 2006/42/EC relating to the safety of hydraulic line equipment
- Division of obligations (manufacturer, operator and hose line manufacturer)
- Marking requirements
- Storage and service period including storage conditions in accordance with DIN 7716
- Avoidance of user errors – installation in accordance with requirements
- Secondary protection requirements relating to the hazards on failure of hydraulic hose lines

Testing

- When is it necessary to replace hydraulic hose lines?
- Risk analysis, testing and inspection criteria
- Required tests in accordance with TRBS 1201
- Inspection and replacement intervals in accordance with DGUV Rule 113-015 (BGR237)
- Regulation-compliant documentation (check list and inspection record) based on a practical example and discussion session
- Possibility of on-site advice

DURATION OF TRAINING

1 day

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 418 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



ENERGY EFFICIENT LAYOUT AND DESIGN OF HYDRAULIC PIPE AND HOSE LINES

CONTENTS

- Installation of hydraulic line components in accordance with requirements
 - How installation errors can effect elastomers and fluids
- V-T diagram – how the medium behaves at high temperatures
- What a high medium temperature means for the hydraulic components
- Example calculation
 - Physical principles for the calculation of losses
 - Necessary indices and their significance
- Cross sectional dimensioning of hose lines
 - Calculation of line diameters through practical user formulas
 - Determination of line diameters using nomograms
- Dimensioning of pipelines
 - Required wall thickness of pipelines after bending
 - Calculation in accordance with DIN EN 13480 – alternative procedure
- Effects of unroundness of bent pipelines
- Effect of forces with pipelines at temperature
- Pressure loss diagrams
 - What they tell us – how to interpret them correctly
 - Is the information provided by manufacturers and suppliers reliable?
- Pressure losses in hoses and pipelines
- Pressure losses at screw fittings
- Pressure losses at connection fittings
- User errors found in practice
- Calculations for a small hydraulic system (practical example)

DURATION OF TRAINING

1 day (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 418 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PRINCIPLES OF FLUID TECHNOLOGY, PART 1

The seminar provides the basic knowledge to ensure compliance with the law relating to working on hydraulic systems. It will also provide the knowledge of hydraulics necessary to allow safe working on hydraulic systems.

CONTENTS

Physical principles of hydraulics

- Fundamental laws and units (force, pressure, volumetric flow, velocity)
- Transmission of force and pressure, and its effect in practice
- Hydraulic energy / friction and pressure loss / temperature and cavitation

Pumps in hydraulics

- Pump types in hydraulics / Comparison of fixed and variable displacement pumps
- Design and function of gear pumps and motors with simple calculations
- Overview of the way other fixed displacement pumps work

Valves in hydraulics – Pressure valves

- Design/function of the most important pressure valves and their applications in practice

Valves in hydraulics – Directional control valves

- Design/function of poppet and directly controlled directional spool valves
- Interpreting the characteristic curves of CETOP directional control valves
- Vertical and horizontal CETOP valve chains

Valves in hydraulics – Flow control valves

- Physics of flow valves / Nozzles and baffles
- Design & mode of operation of throttle and throttle check valves
- Meter in and meter out control and their possibilities/limits of use
- Design and mode of operation of 2- and 3-way flow control valves

Valves in hydraulics – Check valves

- Design/function von check and load holding valves
- Important information on their use in practice
- Electrically actuated check valves
- Design, function, advantages and disadvantages of line break safety valves

Practical exercises on instruction stands to consolidate theory

DURATION OF TRAINING

5 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1421 p.p. (incl. companion manual, duration and price may vary according to location)

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PRINCIPLES OF FLUID TECHNOLOGY, PART 2

The seminar provides the basic knowledge to ensure compliance with the law relating to working on hydraulic systems. It will also provide the knowledge of hydraulics necessary to allow safe working on hydraulic systems.

CONTENTS

Review and supplementation of the most important principles

- Brief review of knowledge of important elements from Part 1
- Design and function of pilot-operated valves based on Part 1
- Introduction to load sensing technology

Circuit theory with practical exercises at the training stand

- Application of the theoretical knowledge gained in Part 1 in the form of independent preparation of hydraulic circuits and application at the training stand

The axial piston pump and its controls

- Open and closed circuit
- Design and mode of operation of axial piston pumps
- Design and mode of operation of pressure regulator of axial piston pumps
- Practical exercise: setting a pressure and flow rate regulator under various operating conditions on a realistic axial piston pump

Introduction to proportional hydraulics

- Comparison of black/white hydraulics and proportional hydraulics
- Important theoretical principles (specified values, ramps etc.)
- Design and function of proportional directional control valves
- Theoretical design of a proportional control and regulator
- Design and mode of operation of force and positionally controlled proportional valves
- Practical exercises at the instruction stands to consolidate theory

Accessories in hydraulics

- Design, function & energy efficiency. Use of pressure accumulators (incl. practical exercises)
- Design and mode of operation of heat exchangers, couplings, vibration dampers, hydraulic tanks etc.

A magnetic symbol chart is included in the seminar price

DURATION OF TRAINING

5 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1484 per person – duration and price may vary according to location

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



MOBILE HYDRAULICS I – INTRODUCTORY SEMINAR

This seminar provides basic knowledge of mobile hydraulics. Participants learn the difference between load-dependent and load-independent systems and are given important information about hydraulic drive and control concepts of mobile machines. After the seminar, participants know the particular requirements of mobile hydraulics and have the basic knowledge to attend the extension course “MOBILE HYDRAULICS II – LOAD-SENSING SYSTEMS IN MOBILE MACHINES”.

CONTENTS

- Introduction to mobile hydraulics
- Open and closed circuit
- Pumps and motors for mobile applications
 - Design and function of axial piston pumps
 - Function of important pump controllers
- Hydraulic pilot control in mobile machines
- Components of a mobile hydraulic circuit diagram
- Design and function of directional control valve blocks in hydraulics
- Hydrostatic steering systems and hydraulic brake systems
- Basic circuits for mobile hydraulics
 - Constant flow system
 - Constant pressure system
 - Throttle control
 - Load-sensing control (LS)
- Parallel circuits for different consumers
- Practical exercises, design of basic circuits, settings and measurements on the teaching stand with load unit

DURATION OF TRAINING

5 days

DATES

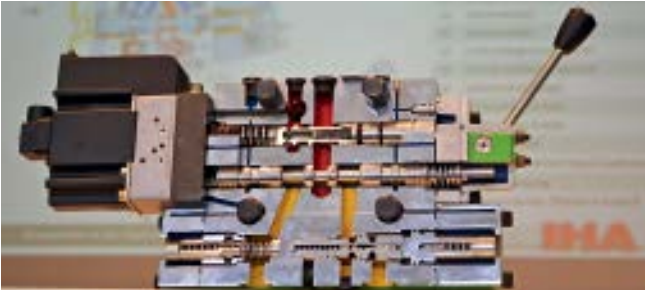
For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1564 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



MOBILE HYDRAULICS II – LOAD-SENSING SYSTEMS IN MOBILE MACHINES

CONTENTS

- Theoretical principles
- Practical application
- A closer look at various systems
 - Constant pump
 - Throttle control
 - Controlled constant pressure pump
 - LS pump
- Load sensing
 - Design and function / settings
 - Measurement of pressures and volumetric flows in the LS system
 - LS messages (variants, troubleshooting)
 - System behaviour in series operation
 - Parallel operation
 - Individual pressure compensators
 - Parallel operation with individual pressure compensators
 - System behaviour during undersaturation
 - Possible malfunctions
 - Primary pressure relief, secondary relief, LS pressure relief
 - Load holding and shock valves
 - Hydraulic pilot control and pilot oil supply
 - Electric control with joystick
- LS pump
 - Design and function / settings
 - Controls
- Negative control systems
- Practical exercises, settings and measurements on the teaching stand with load unit

DURATION OF TRAINING

5 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1564 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



MOBILE HYDRAULICS – CLOSED LOOP / HYDROSTATIC DRIVES

CONTENTS

- Theoretical principles
 - Hydrostatics / hydrodynamics / symbols
 - Difference and design of open and closed circuits
 - Principles of the design of a hydrostatic drive
 - Comparison of various manufacturers
- Practical application
- Pumps in closed circuit
 - Requirements / design and function
 - Control / controls
 - Technical data
- Motors in closed circuit
 - Types / design and function
 - Control
 - Technical data
- Design and function of additional components
 - Feed circuit / filtering / cooling
 - Overload protection
 - Requirements on the fluid
- Practical exercises, settings and measurements on the teaching stand
 - Installation / replacement of components
 - Commissioning / measuring the relevant data
 - Behaviour of individual pump controllers / high pressure relief setting
 - Towing
 - Motor adjustment
 - Temperature behaviour / cooling
- Simulation and measurement of driving scenarios on the test bench
- Practical fault analysis on real systems

DURATION OF TRAINING

3 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1469 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



TROUBLESHOOTING ON HYDRAULIC SYSTEMS

CONTENTS

- Construction and function of pressure gauges
- Construction and function of electronic measuring instruments
- Measurement chain
- Pressure sensors
 - Design and function / types
 - Technical data
 - Selection criteria
- Flow sensors
 - Types / functional principles
 - Alternative methods of flow measurement
- Working with an electronic data logger (for example a Hydrotechnik Multisystem 5060)
- Practical measurement of:
 - Pressure / pressure difference
 - Volumetric flow
 - Speed
 - Analogue signals
- Fault analysis of circuits by taking systematic measurements
 - Design of different hydraulic circuits
 - Preparation for measurements / setting the measuring device
 - Determining the measurement points / measuring
- Recording and storing measurement sequences
- Trigger
 - Function and use
 - Trigger types / selection criteria
- Graphical display and evaluation of measurement results
- Efficiency analysis and approaches to solution

DURATION OF TRAINING

4 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1421 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PRINCIPLES OF PROPORTIONAL HYDRAULICS

This seminar provides an introduction to proportional hydraulics. The participants receive information about the design and function of proportional valves and the interaction of proportional valves with control electronics. The very high practical component and extensive exercises on our instruction stands mean the participants gain important knowledge about the commissioning and operating behaviour of proportional valves and how to troubleshoot in a methodical manner.

CONTENTS

- Important physical principles
- Principles of proportional hydraulics – specified value, actual value, ramps, disturbances etc.
- Circuit symbols for proportional valves
- Proportional valves – design, types and function
- Proportional solenoids – design, types and function
- Design of a control/ regulation system with proportional valves
- Selecting proportional directional control valves using characteristic curves
- Practical exercises on training benches
- Fault analysis in proportional hydraulic systems
- Instructions for commissioning hydraulic systems with proportional technology (purity classes hydraulic oil, filter types, filling the system etc.)

DURATION OF TRAINING

3 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1174 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



DEVELOPMENT OF HYDRAULIC SYSTEMS AND CONTROLS

In this seminar, the participants learn about the systematic and step-by-step development of hydraulic units and small-scale hydraulic controls. The right procedure in the design and selection of hydraulic components and their interaction in the system are learned based on practical examples. This seminar also offers a good opportunity for the participants to raise and discuss any outstanding questions.

CONTENTS

- Basic circuits in hydraulics
- Theoretical design of hydraulic units
- Calculating and dimensioning all necessary components:
 - Driving motor
 - Hydraulic pump
 - Coupling and pump mounts
 - Tank and accessories
 - Valve technology
 - Cylinder
 - Hydraulic motor
 - Accumulators
 - Filter
 - Cooler
 - Lines
- Valve technology – Vertical and horizontal valve chains in accordance with CETOP standard
- Designing hydraulic systems following practical examples
- Practical exercises:
 - Designing and installing valve blocks in vertical and horizontal valve chains
 - Simulating hydraulic controls on the training bench

DURATION OF TRAINING

3 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1174 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PRINCIPLES OF FLUID TECHNOLOGY – PART 1

CONTENTS

- Physical principles of hydraulics
 - Fundamental physical laws and units of hydraulics (force, pressure, volume flow, velocity)
 - Transmission of force and pressure, and its effect in practice
 - Hydraulic energy / Friction and pressure loss
- Design and function of fixed displacement pumps in hydraulics
 - Pump types / Differences between fixed and variable displacement pumps
 - A closer look at some fixed displacement pumps
 - Design and function of gear pumps and motors with calculations
 - Design and mode of operation of Gerotor motors
- Pressure valves / Design and function of directly-controlled pressure valves
 - Applications of the various pressure valves in practice
 - Design and function of pressure switches
- Directional control valves
 - Design and function of directly controlled directional control valves
 - Working with characteristic curves of CETOP valves
 - Vertical and horizontal CETOP valve chains
 - Design and mode of operation of monobloc valves
- Flow control valves – design and function of various directly controlled flow control valves

COURSE DURATION

5 days (the schedule of the training may be changed for local requirements)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

1421 € p.P. (incl. training book, 322 sides the price may vary due to location)

REQUIREMENTS / TRAINERS

For current information, please visit www.hydraulik-akademie.de



HYDRAULIC OILS IN PRACTICE

This seminar deals with the topic of hydraulic oil as an engineering element. The participants are instructed in the correct way to handle the medium in order to recognise any possible downtimes at an early stage. Furthermore, users will find the knowledge they gain useful for recognising problems in the future and instigating improvements.

CONTENTS

- Hydraulic fluids (hydraulic oils) and what they are designed to do
- Types of hydraulic fluids according to DIN/ISO and their requirements
- Compatibility and miscibility of hydraulic oils
- Types of contamination and their effects
- Measures for prolonging the service life of hydraulic fluid
 - Fluid management – Monitoring oil condition
 - Difference between on-site trend analysis and a laboratory analysis
 - Practical procedure for taking a representative oil sample
- Testing for contamination using digital microscope and membrane
- Particle counter with determination of moisture content
- Densitometers and viscosimeters in practice
- What do the values mean in practice and what measures are necessary?
- Selection criteria for filters
- Partial flow filtration and oil care
- What is oil condition monitoring?
 - How condition monitoring can be implemented and the technology used in its operation
 - Examples of new servicing concepts using oil condition sensors
 - Advantages for the user from condition monitoring

DURATION OF TRAINING

2 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 556 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

HYDRAULICS MAINTENANCE FOR USERS: TIPS AND TRICKS FROM PRACTICE

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

Safe use of hydraulic hose lines: DGUV Rule 113-015 (BGR 237)

- A tool with operator responsibilities / Avoidance of user errors

Safety when servicing and repairing hydraulic systems

- Detecting hazards and problems
- Working safely on hydraulic systems

Water-free air supply to hydraulic systems

- Why is air supply drying done and what does it hope to achieve?
- What effects can no or incorrect air supply drying have?

When it jams – discussion of problems from the real world

- On-site measurements in cooperation with the laboratory
- Real case studies: Defining the scope of the investigation and problem solving
- Oil filtration versus oil change/ The concept of changing oils

Hydraulic oil as an engineering element

- Functions and requirements of hydraulic oils
- Standardised oil types and their typical application areas
- Mineral oils, bio-oils, flame resistant hydraulic fluids
- Miscibility and compatibility of hydraulic fluids
- Energy efficiency of hydraulic fluids

Hydraulic oil in operation

- Lubricant ageing / Changes in the base oil: oil oxidation, hydrolysis
- Breakdown and consumption of additives
- Causes and consequences of contamination
- Foaming, cavitation and the diesel effect
- Hydraulic oil as an information memory
- Wear metals as the key to wear and machine condition
- Contamination: A starting point for practical oil care
- Base oil condition and additive breakdown as the key to oil change decisions



DURATION OF TRAINING

2 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 735 p.p. – incl. practical manual "Hydraulic Line Equipment" (832 pages)

TRAINERS from the IHA and industry – H. Laas (GIEBEL FilTec), R. Krethe (OilDoc) and U. Gätgens (HANSA-FLEX)



SERVICING AND MAINTAINING HYDRAULIC SYSTEMS

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

- Dimensioning and routing of pipelines and hose lines
 - Dimensioning and technical instructions for selecting lines
 - Routing criteria / inspection criteria
- Maintenance and servicing of hydraulic systems – typical errors & their causes
- Mineral oils, synthetic oils or bio-based media – when are they used and what must be considered
- Measures for prolonging the service life of hydraulic fluid
- Filters in hydraulics
 - Determination of the purity class / selection criteria for the filters
- What is oil condition monitoring?
 - How condition monitoring can be implemented and the technology used in its operation
 - Examples of new servicing concepts using oil condition sensors
 - Advantages for the user from condition monitoring
- Practical section:
 - Pipe bending
 - Pipe preparation
 - Cutting ring assembly
- Safety during servicing of hydraulic systems and the requirements of DGUV 209-070 (BGI 5100)
- Failure analysis and understanding of hydraulic systems based on practical circuit diagrams
- Design, function and fields of use of pressure accumulators
 - Installation, removal & filling, including practical instruction
 - BetrSichV and the use of pressure accumulators



DURATION OF TRAINING

5 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1549 p.p. – incl. practical manual "Hydraulic Line Equipment" (832 pages)

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

SAFETY DURING HYDRAULICS MAINTENANCE: DGUV-INFORMATION 209-070 (BGI 5100)

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

- Company's duty to provide instruction
- Qualification of the maintenance person
- Working with hydraulic components
- Working safely on pressure accumulators
- Working with hydraulic fluids
- Working on pipelines
- Operation of hydraulic hose lines
 - Installation
 - Service life
 - Replacement
- Required tests
- Types of tests

DURATION OF TRAINING

1 day

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 418 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

RISK ASSESSMENT FOR HYDRAULIC POWER UNITS AND SYSTEMS

CONTENTS

- How to perform simple risk assessments using master copies based on EN 4413 Hydraulic fluid power
- General rules and safety requirements for hydraulic systems and their components
- CE principles
 - EU law and national implementation
 - Interface manufacturer/operator
- Risk assessment
 - System in accordance with EN ISO 12100
 - Fulfilling safety requirements (hydraulics, electrical, C standards)
 - Operating and installation instructions
 - Risk assessment of hose lines in accordance with DGUV Rule 113-015 (BGR 237)
- Machinery Dir./conformity assessment
 - Process for CE marking
 - Machines, incomplete machines
 - Safety requirements of the Machinery Directive
- CE organisation in the company
 - Efficient conformity assessment

DURATION OF TRAINING

1 day

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 418 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PRESSURE ACCUMULATORS IN HYDRAULIC SYSTEMS

The seminar will explain how pressure accumulators work, how to work with them, and the safety regulations associated with pressure accumulators in hydraulics. It will prepare the participant to become a qualified expert for hydro-pressure accumulators.

Participants receive a certificate in accordance with DIN EN ISO 4413 P.7.3.2.2. Clause c) certifying that they have been adequately instructed to perform servicing on pressure accumulators. The “Company’s duty to provide instruction” in accordance with DGUV Rule 1, § 4 is also fulfilled.

CONTENTS

- Fields of application and role of pressure accumulators
- Types, design and how to work with pressure accumulators
- Design of storage capacity and determination of dimensions
- Information about transport, storage and installation
- Safety devices of pressure accumulators
- Design and function of accumulator charging valves
- Information about testing intervals
- Important legal provisions
- Significance of BetrSichV in practice
- Practical section: Installation/removal of pressure accumulators
- Practical section: • Fill accumulator & practical exercises
- Final test of the learned specialist knowledge
- Award of certificate “adequately instructed person” in accordance with DIN EN ISO 4413 P.7.3.2.2

DURATION OF TRAINING

3 days (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 639 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PRINCIPLES OF SEALING EQUIPMENT

CONTENTS

Principles of sealing equipment for hydraulics

- Function and operational description of hydraulic seals
- Materials and their application descriptions

Special seal identification

- Function and operational description of hydraulic seals
- Materials and their application descriptions

DURATION OF TRAINING

1 day (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 296 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

ELECTROHYDRAULICS

CONTENTS

- Physical principles, laws and units of electrical engineering
- Working with a multimeter
- Design and construction of electrohydraulic circuits
- Introduction to graphical representation
- Function of electromechanical pressure switches and contactless switches
- Introduction to industrial wiring
- Fault location in electrohydraulic circuits on the training unit

DURATION OF TRAINING

5 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1280 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

SPECIALIST ELECTRICIAN TRAINING FOR DEFINED ACTIVITIES – PARTS 1 + 2

CONTENTS

- What defined activities can a specialist electrician carry out, and what not?
- The 5 safety rules
- Principles of electrical engineering
- Electrical circuits
- Protection classes, protection types
- Protection devices & protection equipment
- Selection of safety elements
- Reading and understanding circuit diagrams
- Exercises with the multimeter
- Preparing lines & cables professionally
- Producing power supply cables; use of 400 V three-phase current plugs
- Connecting motors in a professional manner
- Testing the rotary field of the motor
- Starting up a hydraulic unit
- Checking electrical operating materials

DURATION OF TRAINING

2 x 1 week, 80 hours total, oral and written test at the end of the seminar

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 1885 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

PERIODIC SPECIALIST ELECTRICIAN TRAINING FOR DEFINED ACTIVITIES IN ACCORDANCE WITH DGUV REGULATION 1

CONTENTS

- Safety at work in accordance with DGUV Regulation 1, DGUV Regulation 3, VDE 0105/100
- Duties and obligations of employees
- Duties and obligations of the electrician / electrician for defined activities/ person instructed in electrical engineering
- Current rules and regulations
- Effects of electrical current
- Personal protective equipment
- Working near electrically live systems
- Construction of low voltage systems and machines
- Selection and operation of systems and operating materials
- Ensuring the proper and safe condition of electrical equipment
- 5 safety rules of electrical engineering
- What to do in the event of an electrical accident
- First aid after electrical accidents

DURATION OF TRAINING

1 day

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 195 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



ADVANCED TRAINING QUALIFICATION AS “HYDRAULICS SPECIALIST” (HWK) – PART-TIME

Course participants are also able to book an additional week of advanced training after this course and obtain certification in “Specialist electrician training for defined activities” (see page 21). Further information available on request.

CONTENTS

- General introduction to hydraulics
- How a hydraulic system works
- Important physical principles
- Hydraulic cylinders and sealing technology
- Directional, flow control, pressure control, and check valves
- Dimensioning and routing of pipelines and hose lines
- Filtration technologies and oils
- Accessory elements in hydraulics
- Hydraulic pumps and hydraulic motors
- Adjustment and control devices for pumps and motors
- Electrohydraulics / control engineering
- Proportional hydraulics
- Design, function and calculation of pressure accumulators
- Safety provisions for pressure accumulators
- Overview of measurement equipment / Troubleshooting with measurement equipment
- Principles of mobile hydraulics
- Maintenance, operation and safety in hydraulic systems
- Designing circuit diagrams / Dimensioning of hydraulic systems
- Calculating with a hydraulic slide rule
- Practical exercises on instruction stands
- Testing before the Chamber of Commerce and Industry with certificate
- **Graduating as:** Advanced training qualification as a “Hydraulics Specialist” recognised by the Chamber of Crafts and Skilled Trades (HWK)

DURATION OF TRAINING

9 weeks (one week of instruction per month)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 6766 per person plus test administration fee

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

INTRODUCTORY SEMINAR ON METAL HOSES

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

Metal and PTFE hose lines

- Construction, dimensions, materials
- Which hose type for which medium
- Differentiating features
- Hose mechanics (bending behaviour, torsion, length and diameter changes)
- Distinction from compensators and elastomer hoses

Production method for hose lines

- Different production processes
- Variants in connection technology
- Temperature ranges

Prevention and installation guidelines

- Behaviour of the hose line upon twisting (torsion)
- Installing hose lines with consideration for installation guidelines
- Preventing damage by correct routing after consultation

DURATION OF TRAINING

1 day (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 296 per person – price may vary according to location.

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de

INTRODUCTION TO STAINLESS STEEL AND ELASTOMER COMPENSATORS

The course covers the safety requirements in connection with DGUV Rule 1, § 4, "A company's duty to provide instruction".

CONTENTS

- Principles of compensator equipment
- Purposes of elastomer and of stainless steel compensators
- Design of an elastomer compensator
- Design of a stainless steel compensator
- Principles of material technology
- Explanations of distinguishing features of various types
- Installation positions, guidelines, isometry
- Detailed application examples

DURATION OF TRAINING

2 days (also available as an in-house training course at the customer's site)

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 593 per person

REQUIREMENTS / TRAINERS

The latest information about this can be found at www.hydraulik-akademie.de



PNEUMATICS IN THEORY AND PRACTICE

CONTENTS

- Principles of pneumatics / Advantages and disadvantages of pneumatics
- Physical principles and associations
- Generating and treating compressed air
- Drive members
- Directional control, pressure, flow control and check valves / time delay valves
- Basic pneumatic circuits / Symbols according to DIN ISO 1219
- Notes for systematic troubleshooting
- Practical exercises on the test bench
- Use of pneumatic sensors
- Reading pneumatic circuits with a pathway-step diagram and GRAFCET

Participants learn about the design and use of pneumatic elements in order to understand basic controls.

DURATION OF TRAINING

3 days

DATES

For training schedule see last page or visit: www.hydraulik-akademie.de

SEMINAR PRICE

€ 626 per person

The latest information about this can be found at www.hydraulik-akademie.de

PROFILES OF THE IHA TRAINERS



ULRICH HIELSCHER

Managing Partner

Trainer Line Equipment, Hydraulic Oils

Trained as machine fitter, state certified mechanical technician specialising in production equipment, technical business economist, member of DIN standards committee NMST 2.8 – hydraulic hose lines and of specialist committee DGUV 113-015 (former BGR 237) of BG Chemie “Hydraulic hose lines – rules for safe operation”



FRANK WEIGEL

Authorised Signatory

Trainer Fluid Technology

Trained as fitter, qualification: general machinebuilding, Dipl.-Ing. (FH) in Machinebuilding



PETER POPPICK

Trainer Fluid Technology

Trained as electrical engineer, qualification: Electrical engineering, Dipl.-Ing. (FH) in electrical machinery and devices, trainer aptitude test



JÖRG BACKHAUS

Trainer Fluid Technology

Trained as aircraft mechanic and as communications engineer/telecommunications engineer, studies specialising in the technology of the metal processing industry, Dipl. Ing. (FH) for machine engineering



FRANK-PETER FRÜND

Trainer Fluid Technology, Pneumatics, Electrohydraulics

Trained as machine operator and fitter for heavy open-cast mining equipment, master technician for open-cast mining equipment, Dipl.-Ing. (FH) in open-cast mining technology



MARCO POHLMANN

**Trainer Line Equipment, Hydraulic Oils
Lubrication expert in acc. with CLS**

Trained as automotive mechanic with specialisation in vehicle repair and maintenance



ROBERT BECKER

**Test Engineer
Trainer Fluid Technology**

Dipl.-Ing. in Automotive Technology, Hydraulics Test Engineer in the fields of research and development



MATTHIAS MÜLLER

Trainer for Line Equipment

Trained as machine tool technician, specialising in pressing and forming technology, vocational diploma in technology, certified trainer (IHK)



DANIEL WERNER

Trainer Line Equipment/Pneumatics

Trained as industrial mechanic specialising in industrial engineering: state certified mechanical technician specialising in mechanical engineering, certified trainer (IHK)

GUEST TRAINERS

SEBASTIAN BODEN – Trainer for Electrical Engineering

ALEXANDER EILERT – Trainer for Elastomer Compensators

KLAUS SCHIEFERDECKER – Trainer for Sealing Equipment

WOLF-RÜDIGER SCHMIDT – Trainer Fluid Technology

REINHARD WIEGERS – Trainer for Metal Hoses

STEFAN WINKLER – Trainer for Safety in Hydraulics

INFORMATION AND BOOKING

CONSULTING

Our staff Ms. Alpermann, Ms. Domsch and Ms. Schubert will be glad to assist you with all of your questions about seminar contents, locations, dates and reservations.

We will also be glad to help you organise a series of seminar modules. The contents represent the major themes of the seminars. For more information about prerequisites, seminar objectives, the target group, contents and seminar modules, please visit our website: www.hydraulik-akademie.de

DATES AND PRICES

The seminar dates can be booked from October 2016.

The prices of the seminars are valid for the 2017/2018 seminar programme.

May be subject to change.

REGISTRATION

Internationale Hydraulik Akademie GmbH

Am Promigberg 26 | D-01108 Dresden

Tel. +49 351 658780-0 | Fax +49 351 658780-24

info@hydraulik-akademie.de

To register, please use the registration option on our website at:

<http://www.hydraulik-akademie.de/aktuelle-schulungen.html>

TRAVEL DIRECTIONS TO OUR SEMINAR LOCATIONS

You will find a link to a route planner beside the respective training location on our website:

<http://www.hydraulik-akademie.de/aktuelle-schulungen.html>

HOTELS AT THE SEMINAR LOCATIONS

We can recommend a number of hotels at the various locations, which you may wish to use while attending the seminar. Please visit our website for more information:

<http://www.hydraulik-akademie.de/hotelsuebernachtungen.html>

On the page for each respective hotel, you will find the special terms agreed with us under keyword "IHA".

CONTACT INFORMATION

Internationale Hydraulik Akademie GmbH

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Internet: www.hydraulik-akademie.de



SEMINAR DATES/LOCATIONS 2017/2018

Subject	Date	Town
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 11.01. - 12.01.17	11.01. - 12.01.17	Duisburg
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 08.02. - 09.02.17	08.02. - 09.02.17	Geisenfeld
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 14.03. - 15.03.17	14.03. - 15.03.17	Bremen
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 28.03. - 29.03.17	28.03. - 29.03.17	Dresden
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 17.05. - 18.05.17	17.05. - 18.05.17	Bielefeld
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 20.06. - 21.06.17	20.06. - 21.06.17	Saarlouis
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 24.10. - 25.10.17	24.10. - 25.10.17	Hamburg
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 28.11. - 29.11.17	28.11. - 29.11.17	Dresden
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 05.12. - 06.12.17	05.12. - 06.12.17	Weiterstadt
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 16.01. - 17.01.18	16.01. - 17.01.18	Duisburg
Authorised Person for hydr. line equipment...in acc. with BetrSichV 07.02. - 08.02.18	07.02. - 08.02.18	Bremen
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 06.03. - 07.03.18	06.03. - 07.03.18	Dresden
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 20.03. - 21.03.18	20.03. - 21.03.18	Bielefeld
Authorised Person for hydr. line equipment ... in acc. with BetrSichV 15.05. - 16.05.18	15.05. - 16.05.18	Geisenfeld
Pressure accumulators in hydraulic systems	03.04. - 05.04.17	Dresden
Pressure accumulators in hydraulic systems	04.09. - 06.09.17	Dresden
Pressure accumulators in hydraulic systems	04.04. - 06.04.18	Dresden
Pressure accumulators in hydraulic systems	18.06. - 20.06.18	Dresden
Specialist electrician training for defined activities part 1	29.05. - 02.06.17	Dresden
Specialist electrician training for defined activities part 1	04.09. - 08.09.17	Dresden
Specialist electrician training for defined activities part 1	25.06. - 29.06.18	Dresden
Specialist electrician training for defined activities part 2	30.01. - 03.02.17	Dresden
Specialist electrician training for defined activities part 2	25.09. - 29.09.17	Dresden
Specialist electrician training for defined activities part 2	22.01. - 26.01.18	Dresden
Electrohydraulics	29.05. - 02.06.17	Dresden
Electrohydraulics	04.09. - 08.09.17	Dresden
Electrohydraulics	25.06. - 29.06.18	Dresden
Energy-efficient design of hydr. pipe and hose lines	17.01.17	Duisburg
Energy-efficient design of hydr. pipe and hose lines	08.02.17	Dresden
Energy-efficient design of hydr. pipe and hose lines	04.04.17	Baunatal
Energy-efficient design of hydr. pipe and hose lines	18.10.17	Weiterstadt
Energy-efficient design of hydr. pipe and hose lines	13.03.18	Dresden
Troubleshooting on hydraulic systems	04.04. - 07.04.17	Dresden
Troubleshooting on hydraulic systems	17.10. - 20.10.17	Dresden
Troubleshooting on hydraulic systems	20.03. - 23.03.18	Dresden
Advanced training qualification as "Hydraulics Specialist" (HWK) 01/17	18.09.17 - 18.05.18*	Dresden
Principles of sealing equipment	27.04.17	Bielefeld
Principles of sealing equipment	23.10.17	Dresden
Principles of fluid technology part 1	09.01. - 13.01.17	Dresden
Principles of fluid technology part 1	30.01. - 02.02.17	Linz
Principles of fluid technology part 1	13.02. - 17.02.17	Dresden
Principles of fluid technology part 1	24.04. - 28.04.17	Dresden
Principles of fluid technology part 1	15.05. - 18.05.17	Linz
Principles of fluid technology part 1	29.05. - 02.06.17	Dresden
Principles of fluid technology part 1	12.06. - 16.06.17	Dresden
Principles of fluid technology part 1	28.08. - 01.09.17	Dresden
Principles of fluid technology part 1	09.10. - 13.10.17	Dresden
Principles of fluid technology part 1	13.11. - 16.11.17	Linz
Principles of fluid technology part 1	27.11. - 01.12.17	Dresden

* = each one week per month

The seminar dates indicated here can be booked from October 2016.

The prices are valid for the 2017/2018 seminar programme.

May be subject to change.

Subject	Date	Town
Principles of fluid technology part 1	08.01. - 12.01.18	Dresden
Principles of fluid technology part 1	19.02. - 23.02.18	Dresden
Principles of fluid technology part 1	23.04. - 27.04.18	Dresden
Principles of fluid technology part 1	04.06. - 08.06.18	Dresden
Principles of fluid technology part 2	16.01. - 20.01.17	Dresden
Principles of fluid technology part 2	06.03. - 10.03.17	Dresden
Principles of fluid technology part 2	27.03. - 30.03.17	Linz
Principles of fluid technology part 2	08.05. - 12.05.17	Dresden
Principles of fluid technology part 2	03.07. - 06.07.17	Linz
Principles of fluid technology part 2	03.07. - 07.07.17	Dresden
Principles of fluid technology part 2	04.09. - 07.09.17	Linz
Principles of fluid technology part 2	23.10. - 27.10.17	Dresden
Principles of fluid technology part 2	11.12. - 15.12.17	Dresden
Principles of fluid technology part 2	15.01. - 19.01.18	Dresden
Principles of fluid technology part 2	26.02. - 02.03.18	Dresden
Principles of fluid technology part 2	16.04. - 20.04.18	Dresden
Principles of fluid technology part 2	25.06. - 29.06.18	Dresden
Principles of hydraulic line equipment	17.01.17	Saarlouis
Principles of hydraulic line equipment	09.03.17	Nuremberg
Principles of hydraulic line equipment	07.11.17	Dresden
Principles of hydraulic line equipment	14.03.18	Bielefeld
Principles of proportional hydraulics	24.01. - 26.01.17	Dresden
Principles of proportional hydraulics	04.04. - 06.04.17	Linz
Principles of proportional hydraulics	20.06. - 22.06.17	Dresden
Principles of proportional hydraulics	07.11. - 09.11.17	Linz
Principles of proportional hydraulics	14.11. - 16.11.17	Dresden
Principles of proportional hydraulics	23.01. - 25.01.18	Dresden
Introduction to hydraulic couplings	14.02.17	Bielefeld
Introduction to hydraulic couplings	16.05.17	Dresden
Introduction to hydraulic couplings	29.06.17	Saarlouis
Introduction to hydraulic couplings	13.09.17	Dresden
Introduction to hydraulic couplings	26.10.17	Hamburg
Introduction to hydraulic couplings	28.11.17	Geisenfeld
Introduction to hydraulic couplings	16.01.18	Weiterstadt
Introduction to hydraulic couplings	10.04.18	Bielefeld
Introductory seminar on stainless steel & elastomeric compensators	02.03. - 03.03.17	Boffzen
Introductory seminar on stainless steel & elastomeric compensators	15.03. - 16.03.18	Boffzen
Hydraulics maintenance for users: Tips & tricks	23.03. - 24.03.17	Saarlouis
Hydraulics maintenance for users: Tips & tricks	21.11. - 22.11.17	Stuttgart
Hydraulics maintenance for users: Tips & tricks	20.02. - 21.02.18	Duisburg
Hydraulic oils in practice	15.03. - 16.03.17	Weiterstadt
Hydraulic oils in practice	10.05. - 11.05.17	Duisburg
Hydraulic oils in practice	05.09. - 06.09.17	Dresden
Hydraulic oils in practice	24.10. - 25.10.17	Bremen
Hydraulic oils in practice	09.01. - 10.01.18	Hamburg
Hydraulic oils in practice	12.06. - 13.06.18	Saarlouis
Introductory seminar on metal hoses	17.10.17	Boffzen
Introductory seminar on metal hoses	03.04.18	Boffzen
Mobile hydraulics I – Introductory seminar	09.01. - 13.01.17	Dresden

Subject	Date	Town
Mobile hydraulics I – Introductory seminar	13.02. - 16.02.17	Linz
Mobile hydraulics I – Introductory seminar	27.02. - 03.03.17	Dresden
Mobile hydraulics I – Introductory seminar	06.11. - 10.11.17	Dresden
Mobile hydraulics I – Introductory seminar	08.01. - 12.01.18	Dresden
Mobile hydraulics I – Introductory seminar	05.02. - 09.02.18	Dresden
Mobile hydraulics II – Load sensing syst. in mob. machines	06.02. - 10.02.17	Dresden
Mobile hydraulics II – Load sensing syst. in mob. machines	20.03. - 24.03.17	Dresden
Mobile hydraulics II – Load sensing syst. in mob. machines	04.12. - 08.12.17	Dresden
Mobile hydraulics II – Load sensing syst. in mob. machines	29.01. - 02.02.18	Dresden
Mobile hydraulics – Closed loop/hydrostatic drives	14.03. - 16.03.17	Dresden
Mobile hydraulics – Closed loop/hydrostatic drives	05.12. - 07.12.17	Dresden
Mobile hydraulics – Closed loop/hydrostatic drives	13.03. - 15.03.18	Dresden
Pneumatics in theory and practice	09.01. - 11.01.17	Dresden
Pneumatics in theory and practice	03.04. - 05.04.17	Dresden
Pneumatics in theory and practice	11.09. - 13.09.17	Dresden
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