COURSE OVERVIEW ME0080
Hydraulic System Operation, Maintenance & Troubleshooting

Course Title
Hydraulic System Operation, Maintenance & Troubleshooting

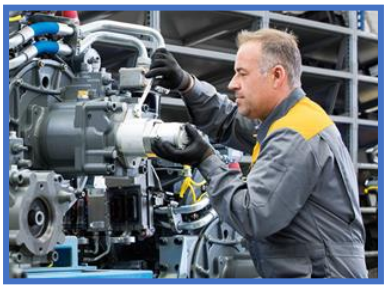
Course Reference
ME0080

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	January 28-February 01, 2024	The Mouna Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE
2	February 18-22, 2024	Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar
3	March 03-07, 2024	Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey

Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

Whatever your hydraulic applications, you can increase your knowledge of the fundamentals, improve your maintenance programs and become an excellent troubleshooter of problems in this area by attending this information packed course. Cutaways of all major components are brought to the sessions to visually demonstrate the components' construction and operation. Developing an understanding of "How" it works leads to an understanding of how and why it fails. Multimedia views of the equipment are given to give you as realistic a view of hydraulic systems as possible.

The Hydraulics course is a comprehensive, highly practical and interactive five-day course. You will have an opportunity to discuss Hydraulic Systems construction, design-applications, operations, maintenance and management issues and be provided with the most up-to-date information and Best Practice in dealing with the subject. Towards the end of the course, you will have developed the skills and ability to recognise and solve hydraulic problems in a structured and confident manner.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Operate, maintain and troubleshoot hydraulic panel units in a professional manner
- Work with hydraulic components and identify how hydraulic components function in a hydraulic circuit
- Discuss pressure and flow and define the limits of pressure measurement
- Determine hydraulic fluids, hydraulic pipe and hoses, hydraulic cylinders, hydraulic accessories, hydraulic pumps and hydraulic motors
- Read hydraulic schematics and work safely with hydraulic components and systems
- Troubleshoot hydraulics problems and apply a simple preventative maintenance program to lengthen hydraulic components life
- Make simple repairs to hydraulic systems and identify hydraulic systems components
- Develop an understanding of the essential hydraulic terms and their key applications and recognise the impact hydraulic fluids have on components
- Discuss the correct operation, control sequences and procedures for the safe operation of various simple hydraulic system
- Identify the control valves, direction control valves, pressure control valves and flow control valves
- Recognize electro-hydraulic systems and hydrostatic transmission
- Initiate an effective inspection and maintenance program and minimise forced outages
- Prevent serious damage to hydraulic equipment and outline the latest technologies available for electro-hydraulic systems
- Employ proper application of hydraulic circuits and troubleshooting of hydraulic systems

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course covers systematic techniques in the operation, maintenance and troubleshooting of hydraulic system for operation, maintenance, inspection & repair managers, supervisors & engineers, plant engineers, plant operations and maintenance personnel, mechanical engineers, design engineers, consulting engineers and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations:

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Andrew Ladwig is a **Senior Process & Mechanical Engineer** with over **25 years** of extensive experience within the **Oil & Gas**, **Refinery**, **Petrochemical & Power** industries. His expertise widely covers in the areas of **Ammonia Manufacturing & Process Troubleshooting**, **Distillation Towers**, **Crude Oil Distillation**, **Fundamentals of Distillation** for Engineers, **Distillation** Operation and Troubleshooting, **Advanced Distillation** Troubleshooting, **Distillation** Technology, Vacuum **Distillation**, **Ammonia Storage & Loading** Systems, **Ammonia Plant** Operation, Troubleshooting & Optimization, **Ammonia Recovery**, **Ammonia Plant Safety**, Hazard of **Ammonia Handling**, Storage & Shipping, **Operational Excellence** in **Ammonia Plants**, **Fertilizer Storage** Management (Ammonia & Urea), **Fertilizer Manufacturing** Process Technology, **Sulphur Recovery**, Phenol Recovery & Extraction, **Wax Sweating & Blending**, **Petrochemical & Fertilizer** Plants, **Nitrogen Fertilizer** Production, **Petroleum Industry Process** Engineering, **Refining Process & Petroleum Products**, **Refinery Planning & Economics**, Safe **Refinery Operations**, **Hydrotreating & Hydro-processing**, **Separators** in **Oil & Gas** Industry, **Gas Testing & Energy** Isolations, Gas Liquor Separation, **Industrial Liquid Mixing**, **Wax Bleachers**, **Extractors**, **Fractionation**, Operation & Control of **Distillation**, Process of **Crude ATM & Vacuum Distillation** Unit, **Water Purification**, **Water Transport** & Distribution, **Steam & Electricity**, **Flame Arrestors**, **Coal Processing**, **Environmental Emission Control**, R&D of **Wax Blending**, **Wax** Molding/Slabbing, **Industrial Drying**, Principles, Selection & Design, Certified **Process Plant** Operations, Control & Troubleshooting, **Operator** Responsibilities, **Storage Tanks Operations** & Measurements, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant Performance**, Efficiency & Optimization, Continuous Improvement & Benchmarking, **Process Troubleshooting** Techniques, Oil & Gas Operation/Introduction to **Surface Facilities**, **Pressure Vessel** Operation, **Process Equipment** Performance & Troubleshooting, **Plant Startup & Shutdown**, **Startup & Shutdown** the Plant While Handling Abnormal Conditions, **Flare & Relief** System, **Process Gas Plant** Start-up, Commissioning & Problem Solving, **Process Liquid** and **Process Handling & Measuring** Equipment. Further, he is also well-versed in **Compressors & Turbines** Operation, Maintenance & Troubleshooting, **Heat Exchanger** Overhaul & Testing Techniques, Balancing of **Rotating Machinery** (**BRM**), **Pipe Stress** Analysis, **Valves & Actuators** Technology, Inspect & Maintain **Safeguarding Vent & Relief System**, Certified Inspectors for **Vehicle & Equipment**, Optimizing **Equipment Maintenance** & Replacement Decisions, Certified Maintenance Planner (**CMP**), Certified Planning and Scheduling Professional (**AACE-PSP**), **Tank Design**, Construction, Inspection & Maintenance, **Material Cataloguing**, Specifications, Handling & Storage, **Steam Trap** Design, Operation, Maintenance & Troubleshooting, **Steam Trapping & Control**, **Column**, **Pump & Exchangers**, Troubleshooting & Design, **Rotating Equipment** Operation & Troubleshooting, **Control & ESD** System, **Detailed Engineering Drawings**, Codes & Standards, **Budget** Preparation, Allocation & Cost Control, Root Cause Analysis (**RCA**), **Production Optimization**, Permit to Work (**PTW**), Project Engineering, **Data** Analysis, **Process Hazard** Analysis (**PHA**), **HAZOP** Study, Sampling & Analysis, **Training** Analysis, **Job Analysis** Techniques, Storage & Handling of **Toxic Chemicals & Hazardous Materials**, **Hazardous Material** Classification & Storage/Disposal, **Dangerous Goods**, **Risk** Monitoring Authorized Gas Tester (**AGT**), Confined Space Entry (**CSE**), Personal Protective Equipment (**PPE**), Fire & Gas, First Aid and Occupational Health & Safety.

During his career life, Mr. Ladwig has gained his practical experience through his various significant positions and dedication as the **Mechanical Engineer**, **Project Engineer**, **Reliability & Maintenance Engineer**, **Maintenance Support Engineer**, **Process Engineer**, **HSE Supervisor**, **Warehouse Manager**, **Quality Manager**, **Business Analyst**, **Senior Process Controller**, **Process Controller**, **Safety Officer**, **Mechanical Technician**, **Senior Lecturer** and **Senior Consultant/Trainer** for various companies such as the Sasol Ltd., Sasol Wax, Sasol Synfuels, just to name a few.

Mr. Ladwig has a **Bachelor's** degree in **Chemical Engineering** and a **Diploma** in **Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and has delivered various trainings, workshops, seminars, courses and conferences internationally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons

Course Fee

Dubai	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Hydraulics*** *Origin of Hydraulics & Classification ● Force ● Work ● Power ● Energy ● Mass ● Weight ● Torque ● Density ● Specific Gravity ● Specific Weight*
0930 – 0945	*Break*
0945 – 1100	***Pressure & Flow*** *Definition & Units of Pressure Measurement ● Pascal's Law & Applications ● Pressure-Force Relationship ● Fluid flow/ Discharge ● Steady & Unsteady Flows ● Bernoulli's Principle ● Laminar & Turbulent Flows ● Pressure- Flow Relationship*
1100 – 1215	***Hydraulic Fluids*** *Cavitation ● Aeration ● Locations of Filters & Strainers ● Filter Terminology ● Measurement of Contamination Levels*

1215 – 1230	*Break*
1230 – 1330	***Hydraulic Pipes & Hoses*** *Major Components of Hydraulic Lines ● Hydraulic Hoses ● Metal Tubes & Pipes ● Designing Hydraulic Lines ● Hose Routing & Installations*
1330 – 1420	***Hydraulic Cylinders*** *Classification (Single & Double Acting) ● Construction of Cylinders ● Cylinder Mounting ● Seals ● Cylinder Design Checklist ● Common Cylinder problems*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Hydraulic Accessories*** *Reservoirs (Pressure & Non Pressure Types) ● Accumulators ● Heat Exchangers ● Hydraulic Actuators*
0930 – 0945	*Break*
0945 – 1100	***Hydraulic Pumps*** *Principle of Pump Operation ● Classification (Positive & Non-Positive Displacement) ● Gear Pump ● Vane Pump (Variable Volume & Pressure Compensated Variable Volume Pumps)*
1100 – 1215	***Hydraulic Pumps (cont'd)*** *Piston Pump (Axial/Inline, Bent Axis, Radial, Variable Volume, Pressure Compensated & Over Center Axial Pumps) ● Gerotor Pump ● Rating of Pumps ● Pressure, Flow & Efficiencies of Pumps*
1215 – 1230	*Break*
1230 – 1420	***Hydraulic Motors*** *Principle of Motor Operation ● Classification (Rotating & Piston Type) ● Gear Motors ● Vane Motors ● Piston Motors ● Difference Between Hydraulic Motors & Hydraulic Pumps ● Specification of Hydraulic Motors ● Efficiency of Hydraulic Motors ● Motor Slippage*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Control Valves*** *Purpose ● Classification (Direction, Pressure & Flow control valves) ● Valve Symbols*
0930 – 0945	*Break*
0945 – 1100	***Direction Control Valves*** *Poppet Valve ● Check Valve ● Spool Valve (Rotary & Sliding Valves) ● Direct & Indirect Operated Valves ● Valve Actuation Methods (Manual, Electrical, Pilot, Pneumatic, Electro-Hydraulic & Electro- Pneumatic)*
1100 – 1215	***Direction Control Valves (cont'd)*** *2,3 & 4 Way Direction Control Valves ● Positive & Negative Overlapping ● Center Conditions (Open Center, Closed Center, Tandem Center & Float Center Valves)*
1215 – 1230	*Break*
1230 – 1420	***Pressure Control Valves*** *Relief Valves (Pressure Regulating & Emergency Relief) ● Meaning of Surge Pressure ● Sequence Valves ● Counterbalance Valves ● Pressure Reducing Valves ● Unloading Valves*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

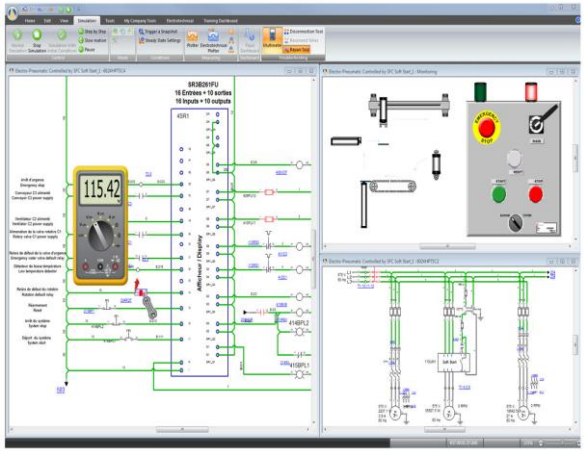
0730 – 0930	***Flow Control Valves*** *Classification (Non-Pressure Compensated & Pressure Compensated) ● Location of Flow Control Valve (Meter-in, Meter-out & Bleed-off Circuits)*
0930 – 0945	*Break*
0945 – 1100	***Electro-Hydraulic Systems*** *Proportional Solenoid ● Proportional Valves (Direction Control, Flow Control & Pressure Control Valves)*
1100 – 1215	***Electro-Hydraulic Systems (cont'd)*** *Servo Valves (Direction & Pressure Servo Valves, Single Stage & Multi Stage Servo Valves) ● Use of Transducers in Hydraulic Systems*
1215 – 1230	*Break*
1230 – 1420	***Hydrostatic Transmission*** *Overview of Hydrostatic Transmission ● Configurations of Hydrostatic Transmission ● Control of Hydrostatic Transmission ● Applications of Hydrostatic Transmission*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

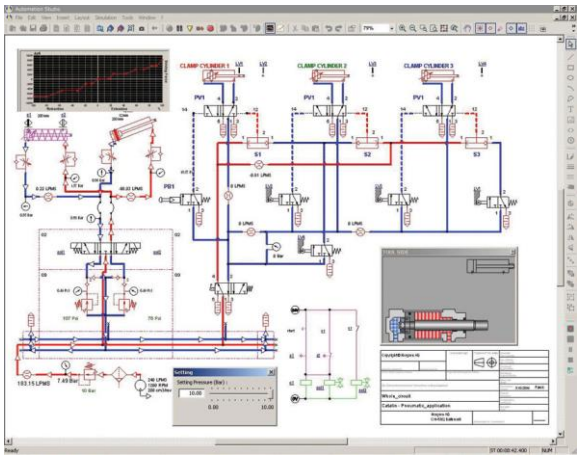
Day 5

0730 – 0930	***Application of Hydraulic Circuits*** *Symbols of Hydraulic Components ● Need for Check Valve in Hydraulic Circuits ● Regenerative Circuit*
0930 – 0945	*Break*
0945 – 1100	***Application of Hydraulic Circuits (cont'd)*** *Flow Equalizer ● Counterbalance Circuit ● Pre Fill & Compression Relief Circuit*
1100 – 1215	***Application of Hydraulic Circuits (cont'd)*** *Decompression Circuit ● Circuits of Open Center, Closed Center, Tandem Center & Indirect Control ● Hydraulic Circuits of Various Machines*
1215 – 1230	*Break*
1230 – 1345	***Troubleshooting Hydraulic Systems*** *Flow Chart Analysis of Hydraulic Circuits ● Maintenance*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

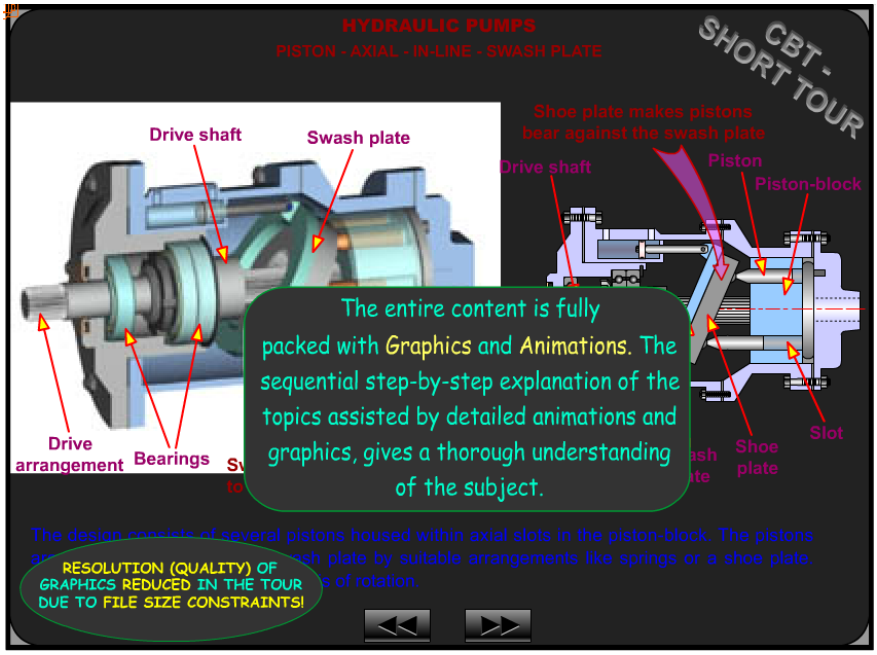
Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "Automation Studio (Hydraulic & Pneumatic Software)" and "Industrial Hydraulic Software".





"Automation Studio (Hydraulic & Pneumatic Software)"



Industrial Hydraulics Software

Course Coordinator

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