ENGINEERING



Course Catalog 2024

Learning and Training Solutions for Hydraulics Education



Danfoss Power Solutions Hydraulics Education Training Program

Welcome to the Hydraulics Education Training Program by Danfoss. The Learning and Training Solutions team is here to help you and/or your employees acquire an in-depth understanding of hydraulics technology. Having evolved from the industry leading Vickers training center, our training program has transformed over the years to meet the needs of hydraulic technicians worldwide. We are the first choice of many customers for their fluid power training needs.

We offer courses and training materials designed to help you reach your educational goals. Each class is constructed to broaden understanding and deepen your confidence in hydraulic applications. To accomplish this, our courses are facilitated by certified and accredited instructors with years of industry field experience.

This catalog contains a variety of training solutions to support individual and group learning, as well as materials to support those who are designing their own customized training programs. From newcomers to application specialists, our technology courses cover an array of fluid power topics designed to fit the needs of anyone interested in learning more about the field of hydraulics. Course offerings include both virtual and in-person instructor-led classes, where the students work with hydraulic components, machines and circuits. In both the virtual and in-person classes, the student experience is enhanced by limiting class size and utilizing hydraulic simulators, cutaways and take-a-parts. Students are also provided with supporting course presentations and materials.

We have laid out the learning paths to help you build your knowledge base easier and faster. Save time and effort! Start at the level that best matches your competency and work your way up to your educational goals! Browse through our training offerings and start learning today!

We invite you to contact Danfoss' Learning and Training Solutions team for a virtual or in-person tour of our training facilities. There's nothing like seeing what you're getting. We look forward to helping you further your learning path!

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Virtual and On-Site Classroom Training

Virtual and On-Site Classroom Training

Virtual Classroom - Instructor-Led Courses (VILT)

Virtual instructor-led (VILT) courses are delivered electronically (live) each day. The typical daily session is four-hours in length (unless otherwise specified) with breaks in between topics. Each session incorporates live demonstrations of product materials and instructor interaction via the internet, allowing for an up-close and personal learning experience that is second to none. Participants will interact with instructors and other attendees while engaging in classroom activities and group discussions in real time, creating a personalized learning environment, much like you would experience if you were physically in the classroom. Academic testing is accomplished via the internet, utilizing secure professional web-based software. Once linked to the internet, and using nothing more than your computer, web-camera and microphone, you can join our virtual classroom from the convenience of your computer regardless of location.

Requirements to attend the virtual classroom include: valid email address, personal computer, access to the internet, web camera and phone line or headset to be used with a computer. Course materials will be shipped prior to start of class. Students will be required to attend and participate in all sessions, demonstrate proficiency in the course topics, and successfully complete an online exam with a score of 70% or higher in order to receive a certificate of completion. Students who do not take the exam, or who score lower than a 70%, will receive a certificate of attendance.

On-Site Classroom - Instructor-Led Courses (ILT)

Our on-site instructor-led (ILT) courses range anywhere from 3 days to 2 weeks, depending on the class format. Participants will have hands-on exercises with products, simulators and equipment. Our state-of-the-art training facility is headquartered in Maumee, OH (Toledo area) and can accommodate all training offerings. Students will be required to attend and participate in all sessions, demonstrate proficiency in the course topics, and successfully complete a written exam with a score of 70% or higher in order to receive a certificate of completion. Students who do not take the exam, or who score lower than a 70%, will receive a certificate of attendance.

Please contact hydraulicstraining@danfoss.com for the most up-to-date schedules. Class schedules are subject to change.

Industrial Hydraulics Learning Path

Recommended Course Path for Industry Certifications

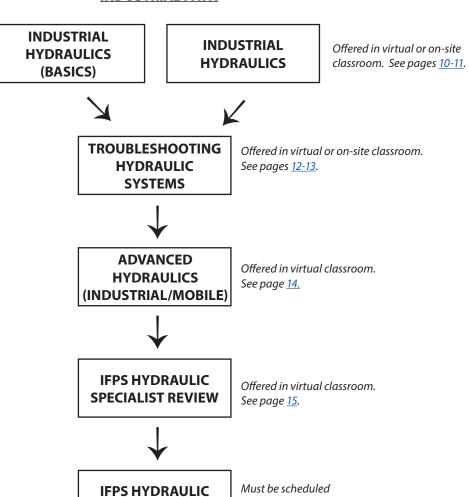
Learning Paths:

Listed below is our recommended course progression following the Industrial Hydraulics Learning Path, prior to taking the IFPS Hydraulic Specialist exam.

INDUSTRIAL PATH

SPECIALIST EXAM

Offered in virtual classroom. See page <u>8</u>.



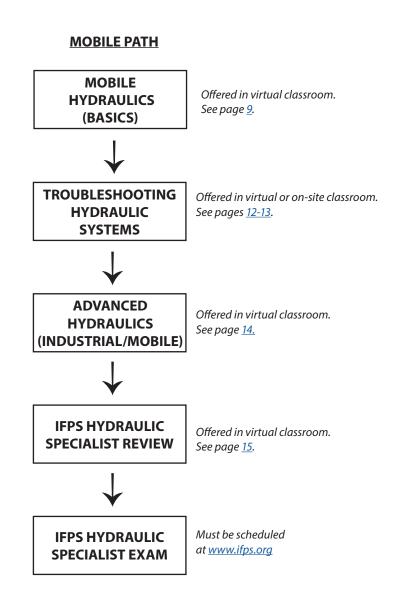
at www.ifps.org

Mobile Hydraulics Learning Path

Recommended Course Path for Industry Certifications

Learning Paths:

Listed below is our recommended course progression following the Mobile Hydraulics Learning Path, prior to taking the IFPS Hydraulic Specialist exam.



Virtual Classroom

Industrial Hydraulics (Basics)

Learning Goals:

The Industrial Hydraulics (Basics) course covers the fundamentals and principles of industrial hydraulics. The construction, operation and uses of individual hydraulic components are a major focus of this program. Basic hydraulic formulas, class exercises, and system labs are used in combination to enhance understanding.



- Introduction to hydraulics
- Graphic symbols
- Principles and symbols
- Fluids
- Reservoirs
- Pumps
- Fluid conductors
- Directional control valves
- Pressure controls
- Flow controls
- Contamination control

Class Offerings:

January 8-12, 2024		
July 8-12, 2024	11:00 AM - 3:00 PM (EDT)	<u>To register</u>
September 9-13, 2024		

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for operations, sales, design, maintenance and repair personnel who work with industrial machinery.



Pre-requisites

None



Location

Virtual classroom



Duration

5 days, 4 nours daily



Tuition \$1,415

Virtual Classroom

Mobile Hydraulics (Basics)

Learning Goals:

The Mobile Hydraulics (Basics) course covers the fundamentals and principles of mobile hydraulics. The construction, operation and uses of individual hydraulic components are a major focus of this program. Basic hydraulic formulas, class exercises, and system labs will be used for enhancing understanding.

Topics Covered:

- Introduction to mobile and basic hydraulic principles
- Graphic symbols
- Linear actuators (cylinders)
- Rotary actuators (motors)
- Directional control valves
- Hydraulic steering
- Pressure and flow controls
- Pumps
- · Hydrostatic transmissions
- Fluid conductors
- Fluids
- Fluid conditioning

Class Offerings:

January 22-26, 2024		
May 6-10, 2024	11:00 AM - 3:00 PM (EDT)	<u>To register</u>
October 14-18, 2024		

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for operations, sales, design, maintenance and repair personnel who work with industrial machinery.

Pre-requisites
None

LocationVirtual classroom

Duration
5 days, 4 hours daily

Tuition \$1,415

On-Site Classroom

Industrial Hydraulics

Learning Goals:

The (on-site) classroom Industrial Hydraulics course covers all the material in the Industrial Hydraulics (Basics) course including fundamentals and principles of industrial hydraulics. This course continues building on that knowledge with explorations of more complicated components, exercises and circuit constructions. Additional exercises, system labs and presentations are used to enhance understanding.



- Introduction to hydraulics
- Principles and symbols
- Fluids
- Reservoirs
- Pumps
- Fluid conductors
- Directional control valves
- Pressure controls

- Flow controls
- Contamination control
- Actuators
- Cartridge valves
- Proportional valves
- Servo valves
- Accessories
- Industrial hydraulic circuits

Class Offerings:

April 8-19, 2024	8:00 AM - 4:00 PM (EDT)	To register
Sept. 23 - Oct 4, 2024		

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for operations, sales, design, maintenance and repair personnel who work with industrial machinery.



Pre-requisites



Location



Duration 10 days, 8 hours daily



Tuition

Virtual Classroom

Industrial Hydraulics

Learning Goals:

The (virtual classroom) Industrial Hydraulics class covers all of the material from the Industrial Hydraulics (Basics) course, including fundamentals and principles of industrial hydraulics. This course builds on that foundation with explorations of more complicated components, exercises and circuit constructions. Additional exercises, system labs and presentations are used to enhance understanding.

Topics Covered:

- Introduction to hydraulics
- Principles and symbols
- Fluids
- Reservoirs
- Pumps
- Fluid conductors
- Directional control valves
- Pressure controls

- Flow controls
- Contamination control
- Actuators
- Cartridge valves
- Proportional valves
- Servo valves
- Accessories
- Industrial hydraulic circuits

Class Offerings:

May 13-24, 2024	11:00 AM - 3:00 PM (EDT)	To register
August 12-23, 2024		<u>To register</u>

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for operations, sales, design, maintenance and repair personnel who work with industrial machinery.





Duration10 days, 4 hours daily

Tuition \$2,000

On-Site Classroom

Troubleshooting Hydraulic Systems

Learning Goals:

The (on-site classroom) Troubleshooting Hydraulic Systems course is designed for those individuals involved with the preventative or corrective repair of hydraulic systems in either the industrial or mobile environment. Key focus areas include exercising troubleshooting processes, symptom identification and fault isolation. Basic hydraulic formulas, class exercises and system labs will be used for enhancing understanding.

Topics Covered:

- Hydraulic fundamentals (brief review)
- Graphic symbology (brief review)
- Component functions and failures
 - Pressure controls
 - Flow controls
 - Pumps
 - Actuators
- Diagnostic instruments
- Systemic troubleshooting procedures
- Circuit and control analysis

Class Offerings:

October 28 - November 1, 2024	8:00 AM - 4:00 PM (EDT)	To register
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^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for maintenance, repair, sales and system design personnel who work with hydraulic equipment or machinery.



On-site classroom

Duration
5 days, 8 hours daily



Troubleshooting Hydraulic Systems

Learning Goals:

The (virtual classroom) Troubleshooting Hydraulic Systems course is designed for those individuals involved with the preventative or corrective repair of hydraulic systems in either the industrial or mobile environment. Key focus areas include exercising troubleshooting processes, symptom identification and fault isolation. Basic hydraulic formulas, class exercises and system labs will be used for enhancing understanding.

Topics Covered:

- Hydraulic fundamentals (brief review)
- Graphic symbology (brief review)
- Component functions and failures
 - Pressure controls
 - Flow controls
 - Pumps
 - Actuators
- Diagnostic instruments
- Systemic troubleshooting procedures
- Circuit and control analysis

Class Offerings:

February 5-9, 2024		
July 15-19, 2024	11:00 AM - 3:00 PM (EDT)	<u>To register</u>
November 18-22, 2024		

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for maintenance, repair, sales and system design personnel who work with hydraulic equipment or machinery.





Duration 5 days, 4 hours daily



Virtual Classroom

Advanced Hydraulics (Industrial/Mobile)

Learning Goals:

The Advanced Hydraulics (Industrial/Mobile) course is designed for individuals interested in learning about industrial component selection and sizing. This course will examine the options and trade-offs to consider when making these selections.

Topics Covered:

- Pump selection and sizing
- Relief valve and pressure control options
- Direct acting and pilot operated directional controls
- Flow control options and selections
- Cylinder specifications and selections
- Motors and controls selection
- Cartridge valve options

Class Offerings:

February 19-23, 2024		
July 29 - August 2, 2024	11:00 AM - 3:00 PM (EDT)	<u>To register</u>
December 9-13, 2024		

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants
Open to Danfoss distributors,
Danfoss employees and external
customers. This course is
appropriate for operations, sales,
design, maintenance and repair
personnel who work with
industrial machinery.









International Fluid Power Society (IFPS) Hydraulic Specialist Review

Learning Goals:

The Hydraulic Specialist Review course is appropriate for individuals who have been trained and work in the field of fluid power; who desire to enhance their understanding of fluid power principles, and test taking skills prior to testing for certification as an International Fluid Power Society (IFPS) Hydraulic Specialist. The instructors for this course are IFPS certified and accredited.

Topics Covered:

- Hydraulic symbols
- Circuit diagrams, size components, recognizing functions
- System parameters
- Force, distance, work, torque, speed, velocity and power
- Load calculations
- Motor characteristics
- Hydraulic pump and motor applications
- Valve sizing for hydraulic circuits
- Electrohydraulics: prop valves and amplifier cards
- Accumulators, intensifiers and boosters
- Heat exchangers and fluid conductors
- Filtration fluids and lubricants
- Troubleshooting

Recommended Learning Path:

- Industrial/Mobile Hydraulics (Basics), Industrial Hydraulics
- Troubleshooting Hydraulic Systems
- Advanced Hydraulics (Industrial/Mobile)

Class Offerings:

June 24-28, 2024	11:00 AM - 3:00 PM (EDT)	To register
December 16-20, 2024		<u>To register</u>

^{*}Must be logged in to your <u>Danfoss Learning</u> account to register



Participants Participants

Open to Danfoss distributors, Danfoss employees and external customers. This course is appropriate for operations, sales, design, maintenance, repair and service personnel who work with industrial machinery. Electronics knowledge is not a requirement.

Pre-requisites

TVOLIC



Virtual classroom



Duration

5 days, 4 hours daily



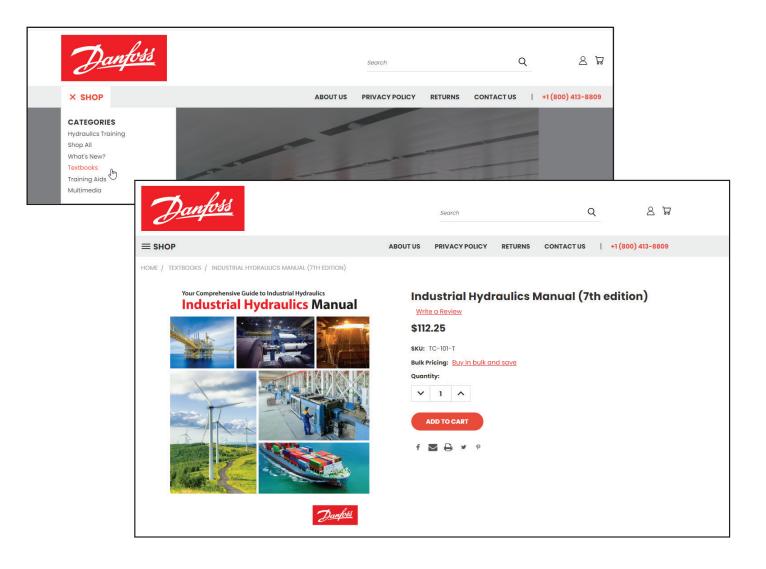
Tuition \$1,010

Completion Requirements:

Students will be required to attend and participate in all training sessions. If student wishes to take the IFPS exam after attending the review session, they will need to contact IFPS to schedule (www.ifps.org).



Orders for textbooks and supporting educational materials can be placed at https://www.hydraulicsliteraturestore.com.



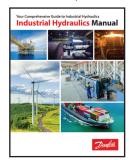


Training Item

Description

Industrial Hydraulics Manual (7th edition) Item # TC-101-T

ISBN: 979-8-218-15800-2, Published 2023



The **NEW** Industrial Hydraulics Manual is now available and is a color-illustrated, 600+ page, hard-bound textbook.

This book covers everything you need to know about hydraulics and electrohydraulics, including the principles of basic hydraulics, basic electricity and electronics, amplifiers, cartridge valves and circuits. A systems chapter focuses on the operation of industrial hydraulic circuits and injection molding systems.

Included in the appendices are commonly used formulae, conversion charts, tables that can be used as on-the-job reference materials, and much more. Additionally, we have included metric values throughout the textbook.

Industrial Hydraulics Manual Answer Key Item # TC-101-A



This book contains the answers to all of the questions shown in the 7th edition of the Industrial Hydraulics Manual. It was written as a training aid for instructors who are currently using our textbook.

Industrial Hydraulics Manual Graphics Flash Drive

Item #TC-101-FD



The graphics flash drive consists of almost 600 images from the Industrial Hydraulics Manual. These PowerPoint slides are in order and broken down in the same way as the Industrial Hydraulics Manual. It is the perfect companion for anyone who wishes to teach from the best textbook in the fluid power training industry.

Bird Bones and Sludge Manual (1st edition) Item # TC-104-01-E ISBN: 0-9634162-4-3, Published 1996



You'd be surprised what you'll find in a hydraulic system. Bird bones, feathers, sandwiches and shop rags are just a few of the items routinely found. In fact, just about anything that's used on a typical shop floor can end up in a hydraulics system as contamination. Bird Bones and Sludge is a book published by Hydraulics Training Services that provides a comprehensive reference on contamination control of hydraulic systems. Written for individuals with a basic knowledge of hydraulics, the book's purpose is to help people find ways to identify and eliminate particles as small as a few microns in order to prolong hydraulic machine and component life.

Training Item

Description

Mobile Hydraulics Manual (3rd edition) Item # TC-102-T ISBN: 979-8-218-15801-9, Published 2023

The **NEW** Mobile Hydraulics Manual is now available and is a color-illustrated, 500+ page, hard-bound textbook.

Vaur Comprehense Guide to Mobile Hydraulics

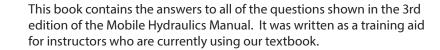
Mobile Hydraulics Manual

The Comprehense Guide to Mobile Hydraulics

The Comprehense Guide to Mobile Hydraul

This edition has improved graphics and end of chapter test questions. Every major aspect of mobile hydraulics theory and application is covered, including basic hydraulic theory, basic electrical theory, hydrostatic transmissions, and fixed and variable displacement pumps. If you work on mobile applications or are teaching a fluid power course with mobile concepts, this manual is the perfect companion to support your professional development and curriculum. The end of each chapter contains review questions to test comprehension of the material as you progress.

Mobile Hydraulics Manual Answer Key Item # TC-102-A





Mobile Hydraulics Manual Graphics Flash Drive

Item #TC-102-FD



The graphics flash drive consists of over 600 images from the Mobile Hydraulics Manual. These PowerPoint slides are in order and broken down in the same way as the Mobile Hydraulics Manual. It is the perfect companion for anyone who wishes to teach from the best textbook in the fluid power training industry.

Lightning Reference Manual Item # LRH-8



The Fluid Power Designer's Standard Engineering Data handbook is, quite simply, the best fluid power engineering reference book in existence. Included are full conversion tables, formulas and shortcut component size tables, as well as current graphic symbology for several different applications. It covers standards and practices, fluid power data, fluids, actuators, conductors, valves, connectors, seals, etc. If you are in the fluid power industry, you should have this manual...no excuses!

Training Item

Description

Elementary Hydraulics – Student Guide Item # TC-105-S Published 2023



In a continued response to the industry's need of a first step in the learning path, we have revised and expanded upon our previously offered "Introduction to Hydraulics Technology" workbook. The new guide is now titled "Elementary Hydraulics."

The Student Guide has all of the content of the now obsolete "Introduction to Hydraulics Technology" workbook, as well as two new chapters: Cartridge Valves and Hydrostatic Steering.

As before, the Student Guide workbook introduces students to the language of hydraulics - basic principles of force, pressure and area, as well as component names and purposes, common circuits, and their basic symbols.

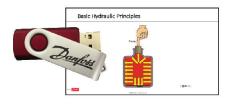
Elementary Hydraulics – Instructor Guide Item # TC-105-I Published 2023



In addition to including everything from the Student Guide, the Instructor Guide workbook also offers chapter specific questions and answers for validation of student comprehension. Also included is an appendix offering standard imperial and metric formulas for instructor reference.

Elementary Hydraulics – Graphics Flash Drive

Item #TC-105-FD



The graphics flash drive contains all of the workbook figures and images from the Elementary Hydraulics Instructor/Student Guides in PowerPoint® ready format for faster development of instructional materials.

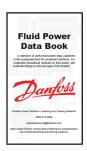
Hydraulic Formulas Reference Card Item # HF-101



Pocket-size reference card, 2-sided, which contains many of the formulas used in hydraulic calculations.

Training Item	Description
Potentiometer Adjustment Tool Item # TA-102	An insulated screwdriver which can be used to make adjustments to amplifier cards, etc. Also referred to as a "tweaker."

Fluid Power Data Book Item # FPDB-101



A 64-page desk drawer size booklet with fluid power, mechanical, and electrical control design data and tables.

Pump Failure Analysis brochure Item # PFA-101

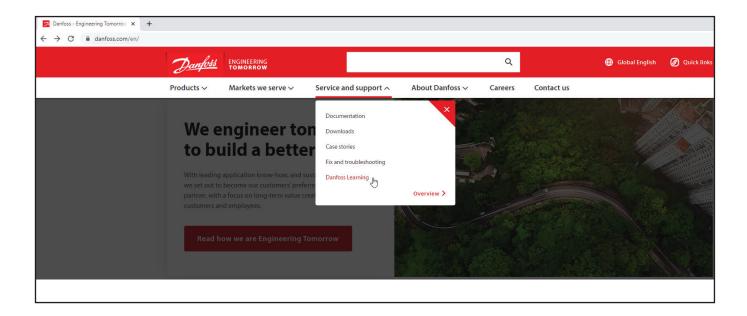


A 26-page color brochure with images depicting various types of pump failures. This brochure will also teach learners how to recognize the causes of pump failures, how to troubleshoot failures, and also includes a list of suggested repairs.

How to enter **Danfoss Learning** from the **Danfoss Website**

(Users without my.Danfoss.com)

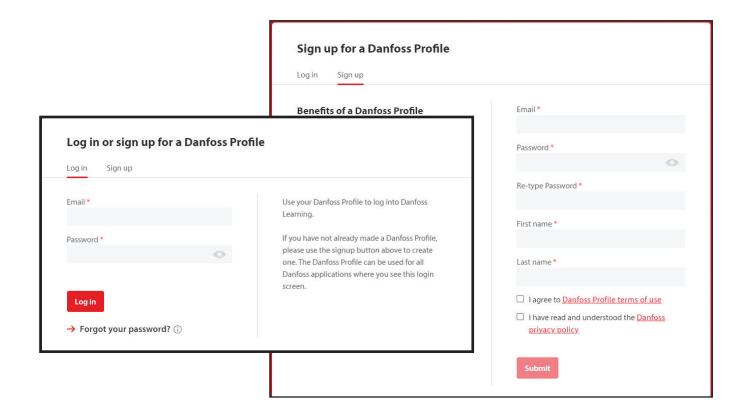
- 1. Navigate your browser to <u>Danfoss.com</u>.
- 2. Click on "Danfoss Learning" under the "Service and Support" menu.



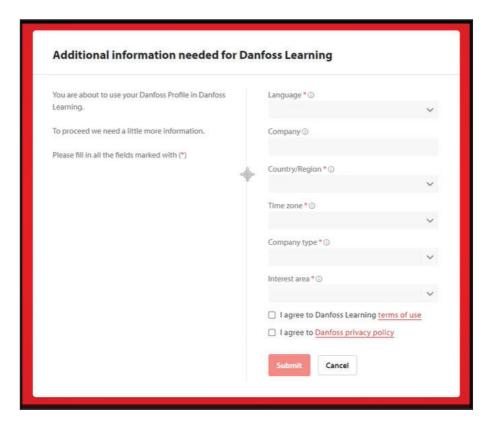
3. Click the link for "Danfoss Learning Login".



4. Either log in or sign up for a Danfoss Learning profile.



5. You will receive a verification email and also be prompted to specify your interests so that relevant learning content can be linked to your profile.



Terms and Conditions

Scope

Our Hydraulics Education training sessions are open to Danfoss Power Solutions Sales and Service Partners, and OEM personnel, as well as the general public.

Enrollment

A Danfoss Learning profile is required for enrollment. Enrollment must be completed through the training platform in "Danfoss Learning" for individual learners. Should it prove necessary to change your enrollment, we will do what we can to offer an alternative option. We recommend that you sign up early to secure a seat in the training class you would like to attend; latest enrollment date is three (3) weeks prior to the start of class

Confirmation

Once you have registered for a class in Danfoss Learning, you will receive a notification that acknowledges your entry. Approximately two (2) weeks prior to the training, you will receive an email that confirms, accepts (or declines) your enrollment, and provides you with all the information you need to attend the class.

Cancellation

We reserve the right to change the venue and/or the date, and to fully cancel a training at short notice (in case of instructor's illness). We will cancel two (2) weeks prior if enrollment falls under the six (6) person minimum class level. In case of cancellations, we will offer you alternative options. In such cases, we will immediately inform those who signed up. Participants who signed up for training sessions that were cancelled cannot make any further claims.

Right of withdrawal

If you should suddenly become unable to attend the training you signed up for, you can pass your seat to a substitute at no further expense. If you are forced to withdraw and cannot find a substitute, please notify us in writing at least two (2) weeks before the class at the latest. If you notify us two (2) weeks before and return the materials, you can withdraw free of charge. If you do not return the materials or you do not show up, you will be charged the entire training price. The process and timing for charging cancellation fees may vary based on payment method.

Completion requirements

Students will be required to attend and participate in all training sessions. Successful completion of courses will require passing an academic exam with a minimum score of 70% in order to receive a certificate of course completion. If an individual does not pass the written test on the first attempt; the attendee will be placed in remediation status and offered one re-test at no additional expense.

Training price

Unless otherwise specified, pricing covers training, training materials and catering (if applicable) during the class hours. ("Free of charge" training provides the same at no charge to the customer.) Invoices will be issued after the training, if applicable to payment method. Hotel accommodations and meals outside of training hours are not included in the training price.

Data protection

As a participant, you accept and agree that Danfoss Power Solutions GmbH & Co. OHG will store and process personal data that are related to your participation in our training sessions.

Liability

We accept no liability other than for damage caused by our employees, either intentionally or negligently. Otherwise we disclaim all liabilities.

Copyright

The reproduction of training material for unauthorized purposes, creation, forwarding, reusing or communicating its contents to third parties, and creation of derivative works are forbidden.

Certificate

After you have successfully completed a training, and pass the assessment, you will receive a certificate (if applicable).

Training duration

The duration of each class varies and appears in the description of the selected training course in the Danfoss Learning training platform.

Safety

As a participant, you are obliged to observe our safety and accident prevention regulations. For our product, system and service training sessions, safety shoes and safety glasses are required.

Room reservation

It is the student's responsibility to arrange hotel accommodations and transportation, but we can provide a list of recommended hotels.

Transportation

Danfoss Power Solutions does not offer any kind of transportation.

Disclaimer

We reserve the right to substitute instructors, and change the contents, procedures and location of a training course, provided that such changes do not impair the intended outcome of the training.