

NFPA
Education and
Technology
Foundation

Donor Impact Report August 2014



Our Mission

The NFPA Education and Technology Foundation is committed to meeting the workforce development needs of the U.S. fluid power industry. Through the generous support of our donors, we support programs that:

- Engage students at middle and high school grade levels in learning about fluid power.
- Encourage the development of new fluid power laboratories and other teaching resources at 2-year colleges and 4-year universities.
- Support pre-competitive fluid power research initiatives that build academic infrastructure and connect talented graduate students to our industry.
- Foster ongoing forums between educators and industry so that productive partnerships can develop based on mutual interests and priorities.

As a result of these programs, the talent pool available to our industry is changing. More students are aware of our industry. More 2-year college and 4-year university graduates have specific training in fluid power. More universities have research facilities and programs focused on fluid power. More partnerships between industry and academia are increasing our access to highly talented candidates.

This is truly *our* mission—yours and ours—and it *is* working. Thank you for your critical participation and support.

Best regards,

A handwritten signature in white ink that reads "Eric Lanke". The signature is fluid and cursive.

Eric Lanke

CEO, NFPA Education and Technology Foundation

Your Gifts at Work

Your gifts to the NFPA Education and Technology Foundation are helping to engage students at middle and high school grade levels in learning about fluid power.

FLUID POWER CHALLENGE

The NFPA Fluid Power Challenge is a competition that challenges middle school students to solve an engineering problem using fluid power. The students work in teams to design and build a fluid power mechanism, and then compete against other teams in a timed competition.

The Fluid Power Challenge has many benefits:

- Actively engages students in learning about fluid power
- Gives support and resources to teachers for science and technology curriculum
- Creates a learning environment where math and science are fun
- Encourages students to acquire a diversity of teamwork, engineering and problem-solving skills
- Introduces students to careers in the fluid power industry

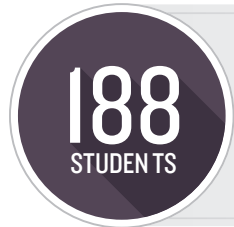


“I feel more confident, because even though my team didn’t win, we solved more problems than I ever thought we would.”

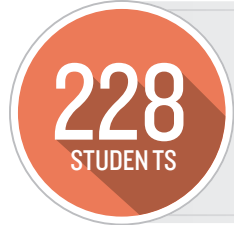


FLUID POWER CHALLENGE

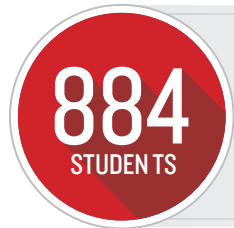
Over 200 individuals in NFPA member companies have been involved in mentorship, classroom activities, and events related to the Fluid Power Challenge. To date, NFPA member companies have hosted a total of 26 Fluid Power Challenge events, reaching more than 2,500 students. These “Fluid Power Challenge Champions” include:



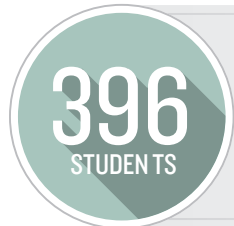
**Center for Compact and Efficient Fluid Power
(at the University of Minnesota) has held 3 events
benefitting 188 students.**



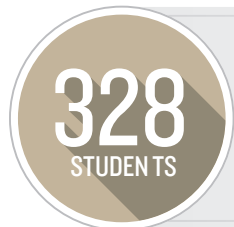
**Daman Products Company, Inc. has held 4 events
benefitting 228 students.**



**Deltrol Fluid Products has held 5 events
benefitting 884 students.**




**Milwaukee School of Engineering has held 6 events
benefitting 396 students.**





**Wojanis Supply Company, Inc. has held 4 events
benefitting 328 students.**

FLUID POWER CHALLENGE GRANTS PROGRAM

The Foundation awards grants to middle and high schools to facilitate the teaching of hydraulics and pneumatics. Grant awards defray the costs related to the educational aspects of the Fluid Power Challenge program—either for fluid power kits for use in the classroom or those associated with participating in the Fluid Power Challenge event. Highlights of this program include:

 Felicia Roher, a teacher at a private school in Oregon City, OR, organized a Fluid Power Challenge with her class of sophomore and junior high school students.

 Canon-McMillan School district in Canonsburg, PA purchased classroom kits and used them as a hands-on learning activity for middle school students. The teacher is hoping to encourage more students to get involved with fluid power and would like to grow this into a school-wide program.

 Wauwatosa School District in Wisconsin has developed a curriculum which includes the fluid power classroom kits and the Fluid Power Challenge. This curriculum has been distributed to 50 middle and high school teachers in the Wisconsin area, five teachers in New Mexico and one teacher in India.



“We learned to overcome difficulties and work together, and it was a lot of fun!”

Your Gifts at Work

Your gifts to the NFPA Education and Technology Foundation are helping to encourage the development of new fluid power laboratories and other teaching resources at 2-year colleges and 4-year universities.

FLUID POWER LABORATORY GRANTS

Through our Fluid Power Laboratory Grant Program, we are helping to establish fluid power labs and trainers that will be used by hundreds of budding engineers.



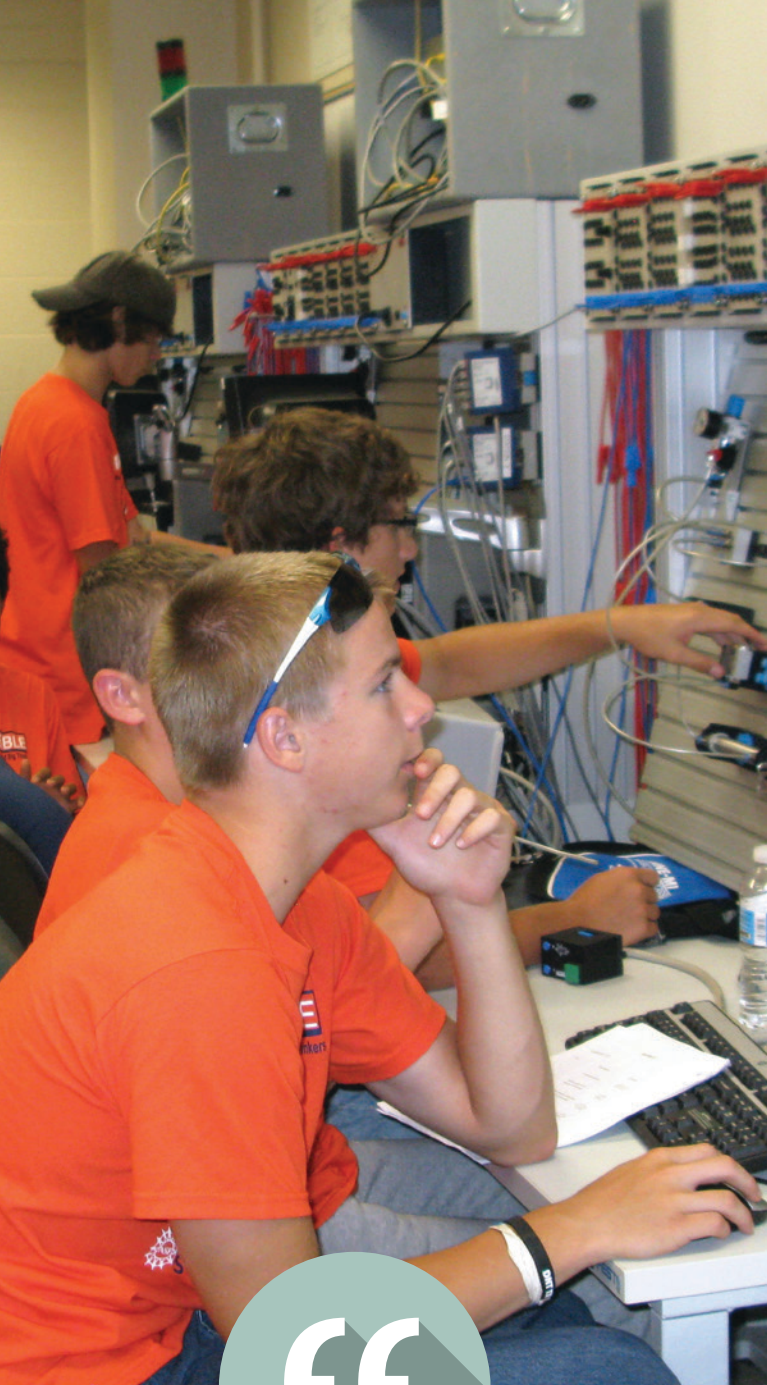
A grant was awarded to Western Michigan University. Each year, 130 students will use the hands-on training lab in five different undergraduate and graduate level fluid power courses.



Another grant was awarded to the Milwaukee School of Engineering (MSOE) for a new mechatronics/fluid power laboratory. It is anticipated that 250 mechanical engineering students will use the equipment each year when the project is completed in August 2015.



Grant awards were given to four community colleges—Angelina College, Central Community College, Hennepin Technical College and Macomb Community College—to help them buy hydraulic and pneumatic trainers for their fluid power departments.



“For my senior project, my team and I designed and built a fluid powered gantry crane. The project has given me a desire to further my education in the mechanical engineering field.”

FLUID POWER TEACHING GRANTS

The Foundation funds a number of other educational activities through its Teaching Grant Program. With this support, hundreds of students and instructors in 2-year colleges and 4-year universities across the country are engaging in countless ways:

- Holding hands-on student competitions
- Developing fluid power courses and software
- Building fluid power systems and demonstrators
- Designing student capstone projects

TO DATE, 33 TEACHING GRANTS HAVE BEEN GIVEN TO 20 DIFFERENT SCHOOLS:

Central Community College

SHINE in Fluid Power

Cleveland Community College

Fluid Power in Automation

Fluid Power and Cloud System Interface

Fluid Power Institute

Georgia Institute of Technology

Integrating Pneumatics Into Introductory Mechanical Design

Use of Pneumatic Systems in Introductory Mechanical Design Projects

Hennepin Technical College

Hydrostatic Service Truck

Illinois Institute of Technology

Multiple Configuration Hybrid Hydraulic Transmission Demonstrator

Iowa State University

Distributed Sensing and Control of Hydraulic Circuits

Lawrence Technological University

Senior Capstone Project: A Gantry Crane Utilizing Fluid Power

Marquette University

Fluid Power Workshop for Teachers

Teaching Fluid Dynamics Utilizing Fluid Power Applications: A Workshop for Secondary Science Teachers

Fluid Power System and Control Module Development

Massachusetts Institute of Technology (MIT)

Introduction of Pneumatics into 2.007—Design and Manufacturing

Milwaukee School of Engineering

Compact Variable Displacement Motor for Human Powered Vehicles

TRAXX, an Electro-Hydraulic Remote Controlled Robot

Raiders 1/4 Scale Tractor Pull

Montana State University

Automation Lab

Fluid Power System Efficiency Student Laboratory

Hydraulic Pump Efficiency Student Research Project

Purdue University

Test Bench for Energy Efficient Active Oscillation Damping on Mobile Hydraulic Machines

Portable Pneumatic Trainer for Hands-On Demonstrations

Water Hydraulic Test Rig for “Fluid Power in Fluid Mechanics”

Continuously Variable Hydraulic Transmission for a Small Wind Power Drive Simulator

Fluid Power Mechatronics Demonstrator for Education and Outreach

Rochester Institute of Technology

Fluid Powered Prototype “Green” Vehicles

Texas State Technical College at Waco

Get Technical

University of Illinois at Chicago

Instruction Test Bench for Energy Efficient Electrohydraulic Systems with Independent Metering Valves

University of Illinois at Urbana-Champaign

Study of Influences of Control Methods on E/H System Responses and Performances

University of Minnesota

Hydrostatic Wind Turbine

Vernon College

Introduction to Fluid Power

Western Michigan University

Performance Analysis of Hydraulic System Components for Fluid Power Curriculum and Capstone Design Project

Worcester Polytechnic Institute

Hydraulic Dynamometer

Your Gifts at Work

Your gifts to the NFPA Education and Technology Foundation are helping to support pre-competitive fluid power research initiatives that build academic infrastructure and connect talented graduate students to our industry.



“Once I worked on the hydrostatic wind turbine project, I was really interested in the fluid power system that was being used as an alternate energy source and I wanted to do more research into improving the system on the turbine, to improve its efficiencies of generating electricity.”

FLUID POWER RESEARCH GRANTS

Our Fluid Power Research Grants are given to conduct pre-competitive research projects that connect graduate students to the study of fluid power and expand the capabilities of their host institutions to research and teach fluid power.



In 2009, the NFPA Foundation funded a two-year research project at Purdue University, *Design, Simulation and Control of Hydraulic Topographies with Integrated Energy Recovery*. The goal of this project was to research and provide new system topologies using high speed switching valves that will increase system efficiency, lower system cost, incorporate energy recovery, and provide reliable power transmission.

Two graduate students earned advanced degrees from the project and sought careers in fluid power. Undergraduate and K-12 students were also involved as research assistants and through tours of the laboratory.



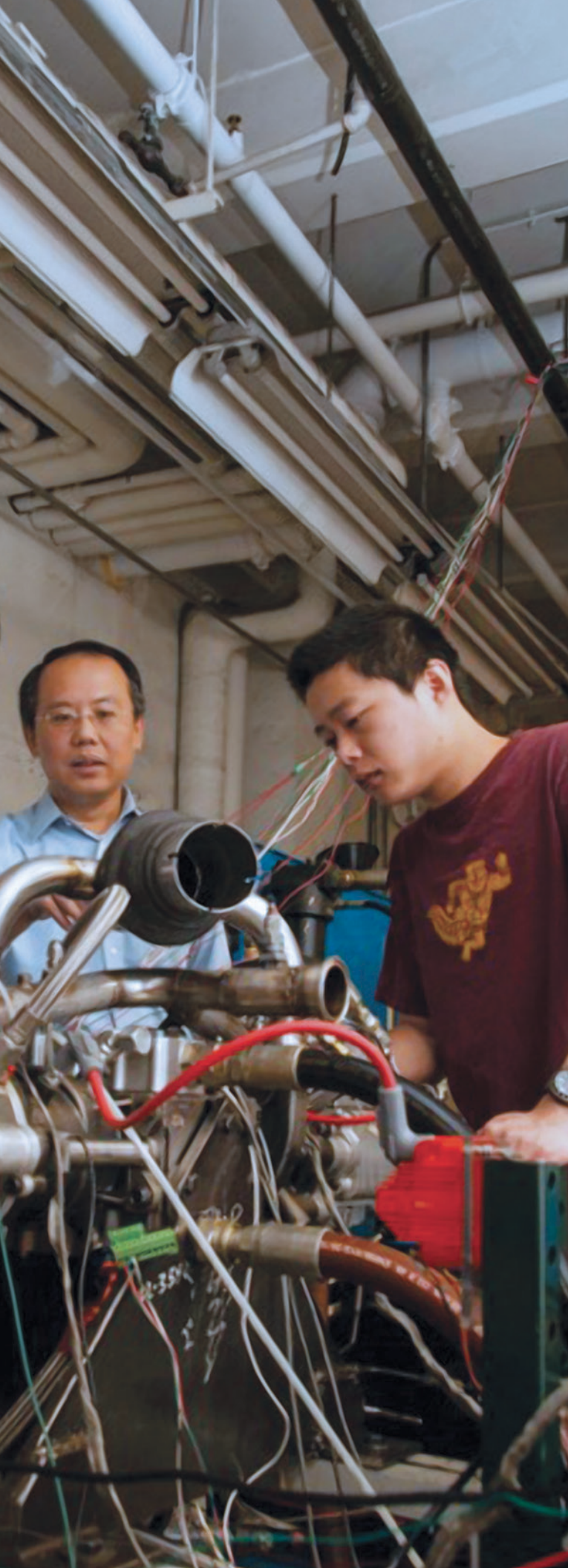
In 2012, the NFPA Foundation funded a two-year research project at Iowa State University, *Dielectric Spectroscopic Sensor Development for Hydraulic Fluid Contaminant Detection*. The goal of this project was to develop a practical low-cost contaminant sensor for hydraulic fluids based on the results of a previously funded project by NFPA, *Dielectric Spectroscopy of Hydraulic Fluid for Contamination Detection*.

The project engaged one graduate student as a research assistant, who was responsible for sensor design, experimental design, and documentation of research results. In addition, several senior capstone projects were associated with this project, in which undergraduate students solved design problems.



In 2014, the NFPA Foundation provided a supplementary grant to Iowa State University for a one-year extension in support of continued sensor research for pneumatics, *An Investigation of Dielectric Spectroscopic Contamination Sensing in a Compressed Air Stream*. The goal of this project is to determine the signal-to-noise levels and performance of dielectric spectroscopic measurements in estimating the level of typical contaminants and lubricating oil in pneumatic systems.

The Ph.D. graduate research assistant that supported the hydraulic project is continuing to work on the pneumatic research.



CENTER FOR COMPACT AND EFFICIENT FLUID POWER (CCEFP)

The CCEFP is a network of fluid power research laboratories, academic faculty, graduate and undergraduate students at seven universities:

- Georgia Institute of Technology
- Milwaukee School of Engineering
- North Carolina A&T University
- Purdue University
- University of Illinois at Urbana-Champaign
- University of Minnesota
- Vanderbilt University

Starting in 2014, the NFPA Foundation will support and help expand the pre-competitive fluid power research activities of the CCEFP, dramatically increasing the number of institutions and students impacted by our research program.

Since its inception in 2007, the CCEFP has engaged more than 6,000 university students in a variety of workforce development programs, including:

- **Pre-competitive Fluid Power Research Projects**—directed by industry to the topics most needed, these projects help build fluid power infrastructure at CCEFP schools and engage promising students in the study of fluid power. Forty-five percent of these students go on to work in the fluid power industry.
- **Fluid Power Scholars Program**—an internship program where industry-selected candidates receive fluid power “boot camp” training before working at the company location for the summer.
- **Fluid Power Courses**—fluid power lab exercises, textbook chapters and online training developed by CCEFP professors and offered across the nationwide network of undergraduate mechanical engineering programs

For more information on the CCEFP, please visit www.ccefp.org

Your Gifts at Work

Your gifts to the NFPA Education and Technology Foundation are helping to foster ongoing forums between educators and industry so that productive partnerships can develop based on mutual interests and priorities.



FLUID POWER INNOVATION AND RESEARCH CONFERENCE (FPIRC)

Hosted by the Center for Compact and Efficient Fluid Power (CCEFP), this annual conference features collaborative technical breakout sessions, networking opportunities, tours of local research laboratories, and panel discussions on the technologies and workforce skills transforming the fluid power industry.

Participants include industry practitioners and leaders, government representatives and academic fluid power researchers and students from around the world. The next FPIRC will be held October 13-16, 2014 at Vanderbilt University in Nashville, TN.

For more information visit: <http://www.ccefp.org/get-involved/fpirc-2014>

The Pascal Society

The NFPA Education and Technology Foundation extends our gratitude to the many generous donors who share our mission of meeting the workforce development needs of the U.S. fluid power industry.

Named after Blaise Pascal, the French mathematician, physicist and inventor whose famous law describes the fundamental principle that gives fluid power its force multiplier effect, the Pascal Society is the annual giving society of the



NFPA Education and Technology Foundation for those seeking to create a similar effect for our industry.

By combining their financial and volunteer contributions into one concerted effort, these organizations are making indispensable contributions towards developing the resources, tools and people needed to meet the technology and workforce needs of the U.S. fluid power industry.

GOLD MEMBERS

- Bimba Manufacturing
- Caterpillar
- Daman Products Company
- Danfoss Power Solutions
- Eaton Corporation
- Enfield Technologies
- Hydra-Power Solutions
- Pall Corporation
- Parker Hannifin Corporation

SILVER MEMBERS

- Afton Chemical
- CNH
- Deltrol Fluid Products
- Donaldson Company
- Fluid Power World Magazine
- Evonik Oil Additives
- G.W. Lisk Company
- Gates Corporation
- Linde Hydraulics
- MICO
- Moog
- Netshape Technologies
- Quality Control Corporation
- Simerics
- Woodward HRT

BRONZE MEMBERS

- Bosch Rexroth Corporation
- Delta Computer Systems
- Festo Corporation
- FORCE America / Valve Division
- HECO Gear
- Hitachi
- Hoowaki
- HUSCO International
- Main Manufacturing Products
- Master Pneumatic
- National Tube Supply
- Nexen
- ROSS Controls
- Sun Hydraulics
- Walvoil Fluid Power

Pascal Society members as of July 29, 2014

For information on how to join The Pascal Society, contact Eric Lanke at (414) 778-3351 or elanke@nfpa.com

To make a donation, visit: <https://secured.nfpa.com/donation/foundationdonation.aspx>



Eric Bretey
Danfoss
Power Solutions

PASCAL SOCIETY GOLD MEMBER PROFILE

What do you do for Danfoss?

I am the manager for the Advanced Systems Engineering Team at Danfoss Power Solutions.

How crucial is fluid power to Danfoss?

Fluid power is our business and livelihood, so it's not just crucial, it's central to what we do.

What challenges are you facing?

We face the same challenges our customers in the mobile off-road agriculture and construction market face. Those challenges are improved energy efficiency, increased machine productivity, and precise machine control. We constantly work to improve our product and system software technologies to address those challenges. To create better solutions, we need bright energetic people in our organization. Finding those people is a challenge, too.

Why do you support the NFPA Foundation through the Pascal Society?

The NFPA Foundation does a good job of supporting programs that keep the fluid power industry in the United States vibrant and relevant. It does so by educating young potential future fluid power engineers on the applications and benefits of fluid power. The Pascal Society is an extension of that, focused on supporting coordinated university and industry research, especially through the Center for Compact and Efficient Fluid Power (CCEFP). It helps to drive innovative research projects at the university level that eventually become new advances in fluid power technology. These can be applied in pneumatic and hydraulic systems that positively impact our lives every day.

What impact is the NFPA Foundation having on the challenges you face?

The CCEFP provides a forum for sharing ideas and advancing the state of the art in fluid power in the U.S. The discussions I have with my colleagues from other companies and the member universities help to shape the research that is advancing the state of the art in fluid power. The whole industry benefits from that.

Another nice benefit is that the university students working on these research projects are also gaining valuable experience that carries over into their professional careers. The exposure and training they receive makes them great fluid power engineers. One of the students we hired in December 2013, Zhekang Du, worked on the CCEFP's hydraulic hybrid passenger car test bed vehicle at the University of Minnesota. That experience in modeling complicated hydraulic systems was directly transferrable to Danfoss' product development needs.



Zhekang Du

Legacy Builders

The NFPA Education and Technology Foundation extends our gratitude to the many generous donors who share our mission of meeting the workforce development needs of the U.S. fluid power industry.

The following organizations have achieved Legacy Builder status—cumulative giving of \$25,000 or more—as of the end of our last recognition year, April 30, 2014.

Class of 2009-10

Sun Hydraulics Corporation

Class of 2011-12

Enfield Technologies

Class of 2012-13

Bimba Manufacturing
Bosch Rexroth Corporation
Caterpillar
Deltrol Fluid Products
Parker Hannifin Corporation

Class of 2013-14

Danfoss Power Solutions
Eaton Corporation
Gates Corporation
ROSS Controls





The NFPA Education and Technology Foundation extends our gratitude to the many generous donors who share our mission of meeting the workforce development needs of the U.S. fluid power industry.

The following individuals and organizations made a donation in our last recognition year—between May 1, 2013 and April 30, 2014.

- | | | |
|--|---|---------------------------------|
| AAA Products International | Gulf Controls Company, LLC | Parker Hannifin Corp. |
| Ace Controls, Inc. | Hanna Cylinders, LLC | PARTsolutions |
| Aggressive Hydraulics | HAWE Hydraulik GmbH & Co KG | Peninsular Cylinder Company |
| Air Logic | HECO Gear, Inc. | Penton Media, Inc. |
| Airline Hydraulics | Hercules Sealing Products | Plymouth Tube Co. |
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| Alro Steel Corporation | Hunger Hydraulics, C.C. Ltd. | Price Engineering |
| AMETEK | HUSCO International, Inc. | Prince Industries, Inc. |
| Anfield Industries, Inc. | HYDAC TECHNOLOGY CORPORATION | PTI Technologies, Inc. |
| Applied Industrial Technologies, Inc. | Hydraforce, Inc. | QCC - Quality Control Corp |
| ARGO-HYTOS Inc. | Hydra-Power Systems, Inc. | R & J Cylinder & Machine, Inc. |
| ASCO Numatics | Hydraquip Distribution, Inc. | R.M. Wright Company |
| Avanti Engineering, Inc. | Hydraulic Management Group, LLC | R.T. Dygert |
| B-D Cylinder | Hydrotech, Inc. | RHM Fluid Power, Inc. |
| Biederman, Fred | IC-Fluid Power, Inc. | ROSS Controls |
| Bimba Manufacturing Company | Industrial Hard Chrome, Ltd. | RYCO Hydraulics, Inc. |
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| Brand Hydraulics | Iowa Fluid Power | Sapa Extrusions |
| Camozzi Pneumatics, Inc. | J.H. Bennett & Company, Inc. | Schmalz Inc. |
| Caterpillar Inc. | Jacobi, Justin | Schroeder Industries LLC |
| Certified Power Inc. | JARP Industries, Inc. | Service Center Metals |
| Comer Industries Inc. | John Henry Foster Co.
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| Custom Fluid Power | Karlsson Spools AB | Starcyl Cylinders Inc. |
| Daman Products Company | KTI Hydraulics | Stucchi S.p.A. |
| Danfoss | KYB Americas Corporation | Sun Hydraulics Corp. |
| Delta Computer Systems, Inc. | Lanke, Eric & Linda | SunSource |
| Delta Power Company | Lexair, Inc. | Swiss Automation Inc. |
| Deltrol Fluid Products | Main Manufacturing | Thermal Transfer Products |
| Dura-Bar | Marmon/Keystone Corp. | Thomas Magnete USA, LLC |
| Earle M. Jorgensen Co. | Master Pneumatic-Detroit, Inc. | Tobul Accumulator Incorporated |
| Eaton Corporation -
Hydraulics Operations | McCluskey, Philip | Twin Disc, Inc. |
| Enfield Technologies | MICO, Incorporated | Vallourec USA |
| Evonik Oil Additives USA, Inc. | Milwaukee Cylinder | Wandfluh of America, Inc. |
| Fairfield Manufacturing
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| Festo Corporation | Motion Industries, Inc. | Wojanis Supply Co., Inc. |
| Firestone Industrial Products Co. | MP Filtri USA Inc. | Womack Machine Supply Co. |
| Fluidyne Fluid Power Corporation | Muncie Power Products | World Wide Fittings Corporation |
| FORCE America Inc. | National Filters, Inc. | World Wide Metric Inc. |
| Fordsell Machine Products
Company, Inc. | National Fluid Power Association | Yates Industries, Inc. |
| G.W. Lisk Co., Inc. | National Tube Supply Company | Zinga Industries, Inc. |
| Galland Henning Nopak, Inc. | NORGREN | |
| Gates Corporation | OEM Controls, Inc. | |
| | Pall Corp. | |



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NFPA EDUCATION AND TECHNOLOGY FOUNDATION

6737 West Washington Street, Suite 2350

Milwaukee, WI 53214

(414) 778-3344

www.nfpafoundation.org