

Hands-On Hydraulics & Pneumatics

Action Challenge Introduces Students to Fluid Power Industry

Matthew Jaster, Senior Editor

It begins with a box of parts.

Middle school students (working in teams of four) receive a basic tool kit and are tasked with building a prototype machine using fluid power to move and rotate objects from one area to another. This might take place on steps or on a platform, according to Lynn Beyer, director of workforce development programs at the National Fluid Power Association (NFPA).

“The setup and the challenge scenario change for every new event. The most important aspect of the competition is that the students learn a little and have some fun in the process,” she said.

There are many different Science, Technology, Engineering and Math (STEM) educational programs and competitions available to students today, but few focus specifically on fluid power.

“With the NFPA Fluid Power Action Challenge, students learn about problem-solving, teamwork and perseverance,” Beyer said. “And our members get an opportunity to promote this industry to potentially the next generation of fluid power engineers.”

All Things Fluid Power

Fluid power is a term that describes both hydraulic and pneumatic technologies. Both technologies use a fluid (liquid or gas) to transmit power from one location to another. With hydraulics, the fluid is a liquid (usually oil), whereas pneumatics uses a gas (usually compressed air). Both are forms of power transmission. They are just slightly different than the gears, chains, belts and other mechanical drives typically found in the pages of *Power Transmission Engineering*.

The NFPA website states that although they’re viewed as competing technologies, no single method of power transmission (mechanical, electrical or fluid power) is the best choice for all applications. In fact, most applications are served by a combination of technologies.

There are, however, many advantages to fluid power systems. For starters, they can transmit equivalent power within a smaller space than mechanical or electric drives. They also offer speed, force, torque and control of direction using simple valves. Fluid power systems often do not require electrical power, which eliminates the risk of electrical shock, fire, or explosions.

And most importantly, for the context of this particular article, fluid power devices make a great educational tool for budding engineers and manufacturers. The idea for the

Fluid Power Action Challenge was a calling card of sorts for associations, manufacturing partners and educational institutions to spread the word on fluid power technology.

The contest was originally created by the Canadian Fluid Power Association to develop fluid power theories in the classroom and provide students with hands-on kits to build simple fluid power devices for an engineering competition.

“Steve Rogers, Mechanical Kits Ltd., came up with the kits in order to introduce students to these concepts. Today, Rogers continues to change the kit design for each new fluid power competition,” Beyer added.

In 2008, the NFPA, headquartered in Milwaukee, Wisconsin, began introducing challenges here in the United States (14 events in Wisconsin). Last year, more than 3,623 students were introduced to fluid power according to Arlen Garcia, workforce manager at NFPA.



Milwaukee School of Engineering hosts an NFPA Fluid Power Action Challenge.

“We’re continually promoting these events and trying to spread the word on the fluid power industry,” Beyer said. “At the same time, it’s important to get our own members involved. We’re extremely excited about the growth potential.”

The NFPA launched a new website for the Fluid Power Challenge in June 2016. On the website, users can learn about the three different challenges based on different age groups: The Fluid Power Action Challenge, Fluid Power Robotics Challenge and the Fluid Power Vehicle Challenge. While this article will focus on the Action Challenge, here’s a quick breakdown of the two other programs currently offered:



Students in Macomb County, Michigan participate in the NFPA Fluid Power Action Challenge in 2016.

The Robotics Challenge is a scholarship program new this year. The NFPA will be offering one merit-based scholarship (\$10,000 per year for four years) to high school seniors who have participated in a 2017 *FIRST* Robotics Competition Team (www.firstinspires.org).

The NFPA Fluid Power Vehicle Challenge is a new program based on an initiative pioneered by the Parker Hannifin Corporation. This STEM competition challenges college engineering students to redesign a traditional bicycle using hydraulics as the mode of power transmission.

The Action Challenge

The NFPA Fluid Power Action Challenge is a competition that challenges middle school students to solve an engineering problem by assembling a fluid power machine. Students work in teams to design and build the machine and then compete with other teams in a timed competition. The competition is broken up into two days: A Workshop Day and a Challenge Day.

Workshop Day

“On the first day, students watch a video to learn about the basics of fluid power,” Beyer said. “They also get the chance to learn the cool things they can do with a career in fluid power.”

Next, students put together very basic fluid power kits. “They learn how water can move through the parts they are building and start working on machines that rotate and even lift objects,” she added. “This is where we first introduce practical fluid power methods and applications.”

The Workshop Day wraps up by giving the students the Action Challenge. This is the engineering problem they must solve by developing a plan and building a prototype machine that will compete against other teams. The students have four to six weeks to prepare for the competition.

Challenge Day

On Challenge Day, the teams come back together for the official competition. They utilize the same tools and an

identical kit of supplies to recreate their unique machines. Working as a team, the students build the device in an allotted timeframe. Teams are judged on their portfolio, design, teamwork and total machine points.

As the teams work, the judges observe and interview students, asking questions about their designs and how they work together as a team. When the time limit is reached, the teams put their machines to the test and the judges score how well the machines perform the designated task.

Master Pneumatic — Year Three

The scenario went something like this: Your team of highly trained experts in the field of material handling has been commissioned to design a controlled pneumatic or hydraulic device that will safely move containers of “highly toxic materials” between storage areas.

Teams are instructed to build a device that picks up the containers and deposits said containers to a designated area. All movements of the device must be controlled using fluid power. Teams will transport as many containers as possible between the two areas in a two-minute time frame.

Thus began Master Pneumatic’s third venture into the NFPA Fluid Power Action Challenge. The company recently hosted 108 sixth-grade students at Macomb Community College, located in Warren, Michigan, for the Workshop Day portion of the event. Since this competition is geared more towards seventh- and eighth-graders, the rules were bent ever so slightly to accommodate the sixth-grade students.

“We’re always impressed with the students that participate in these events. It’s worth all the energy, time and effort when a team of students put together their machine and that light bulb comes on. This is what makes it so rewarding,” said Cathy Meyer, engineering assistant and customer service at Master Pneumatic.

The key to running a successful Fluid Power Action Challenge is get as many people involved as possible, Meyer added. “Our president was excited about the opportunity to go out into the community and talk about fluid power. It starts at the top. You also need great sponsors and great volunteers, people that are committed to helping these kids learn.”

Even some of Master Pneumatic’s local competition turns up each year to volunteer their time. “They’re always asking how they can help and if they can come back the following year and participate in the next event,” Meyer said. “It’s fulfilling to see such a positive response throughout the community.”

Meyer received positive feedback from both teachers and students once they wrapped the first day of the event

in January. “These kids are learning skills that involve math, science, engineering, manufacturing, problem-solving, etc. during the competition. They’re putting together a nice knowledge base that will help them no matter what career they choose down the road,” she added.

Now that the Workshop Day is over, the students will return to Macomb Community College on March 28 for Challenge Day. The teams will have two hours to construct their robotic devices. Just two hours to prove they can move the most containers from Point A to Point B. “The Challenge Day gives us a real sense of how far they’ve come,” Meyer said. “It’s a lot of fun to see the progress these students make and what they take away from the competition.”

How to Get Involved

These educational programs would not be possible without the volunteers and the assistance of NFPA member companies. Beyer believes that the more involved the fluid power community gets, the better the industry is served long-term.

In order to run a successful challenge, three key roles must be filled by participating organizations (coordinator, facilitator and judge). The coordinator handles all the organizational details and logistics of the event, the facilitator runs the Workshop and Challenge Days and the judge (4-6 judges for every 20 teams of competing students) must work in the industry and must be knowledgeable about fluid power. The head judge will calculate totals and assign other judges to specific tasks.

“We welcome volunteers and encourage organizations to team up with local school districts and present these



Parker Hannifin hosts an Action Challenge event and is also involved in the NFPA Fluid Power Vehicle Challenge.

various programs to students,” Beyer said. “As industry and government come together to help solve the skilled labor shortage, these competitions continue to be a great resource to attract kids to manufacturing and engineering positions.”

Companies and institutions involved in the Fluid Power Action Challenge in 2017 include Force America, Daman Products, Parker Hannifin, Master Pneumatic, Caterpillar, Price Engineering, Wojanis, Jarp, Deltrol Fluid Products, Milwaukee School of Engineering, Cleveland Community College, Purdue University and more.

Beyer said that participating companies can host a private action challenge or a public challenge that includes additional schools and organizations.

So what’s the best way to get involved? Simply contact Beyer at the NFPA. “We have detailed instructions on the website and I can certainly help anyone get started,” she said.

By creating a variety of fluid power programs, Beyer hopes that many of the young students that get involved in the Action Challenge stick with STEM activities.

“We hope that the middle school kids go on to participate in the robotics challenge in high school and then the vehicle challenge in college,” she said. “This is a great opportunity to keep students engaged in fluid power throughout the course of their education.” **PTE**

For more information:

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Master Pneumatic hosts the Action Challenge each year hoping to spread the word on fluid power and get the community more involved in STEM activities.

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