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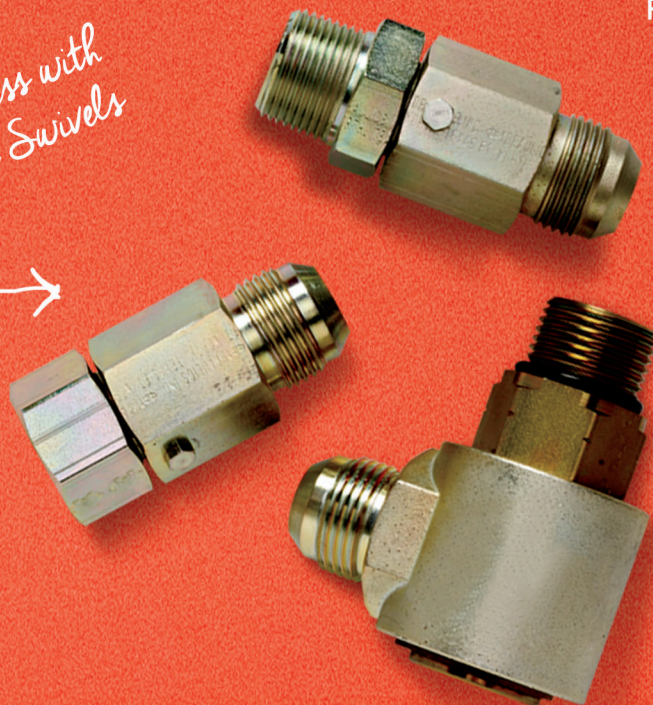
Hydraulics innovations in concrete pump trucks

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FluidLines



Mary C. Gannon • Editor

Making headway with hands-on experiences

I've always maintained that the four-year college degree — while useful in teaching young people to be adults — can be a waste. As a journalist, I learned most of what I needed to know in two courses and several internships. That's why I'm a big proponent of hands-on training — be it co-op programs, internships, or apprenticeships.

Over the last few months, I've had opportunities to chat with people that are pushing the envelope when it comes to giving young people better exposure to real-life applications and hands-on experience in their future careers.

A few years ago, Festo Didactic brought its apprenticeship model to the U.S. Thomas Lichtenberger, CEO, said it graduated its second class of students from its Mason, Ohio program, where students worked at Festo and other local manufacturers while attending school to earn an Associate's degree in mechatronics. The organization has also recently worked with The Space Coast Consortium Apprenticeship Program. Finally, Festo Didactic has provided its Cyber-Physical Lab to Owensboro Community and Technical College, to give students a real-world glimpse into advanced manufacturing and Industry 4.0 careers.

The good news continues with the NFPA adding its second Fast Track/FAMTEN Hub school at Triton College in Illinois. This workforce development pathway partners local technical colleges with industry partners and high school teachers to create awareness and interest in fluid power and train students along a path that leads to careers in fluid power at NFPA member companies.

And, along these same notes, I've had ample opportunity to explore the Parker Hannifin Motion Control Laboratory for Fluid Power Systems at Cleveland State University with Bogdan Kozul, assistant professor in the Department of Mechanical Engineering. Kozul designed and custom-built the trainers and workstations with Parker's help to give students hands-on skills. I was also delighted to learn that a new acquaintance has been selected as the automation/fluid power advisory partner for the Mechanical Engineering Technology Program at Chattanooga State Community College. Here, Southern Fluid Power will supply automation/fluid power trainers equipped with the latest technologies including Industry 4.0 capabilities. Curriculum will be focused on Parker-brand trainers and textbooks.

Finally, I've also had a chance to speak with several women in fluid power about their thoughts on the industry. Key to these discussions has been how getting younger people involved in fluid power is essential to the industry's growth. And all these women echoed my sentiments — it's those hands-on experiences early in school and in their careers that help students fall in love with engineering, technology and hopefully, fluid power.

This is all amazing news and I'm excited to see the changes these new developments bring to the industry and to future fluid power engineers. Bring on 2020!

Mary C. Gannon

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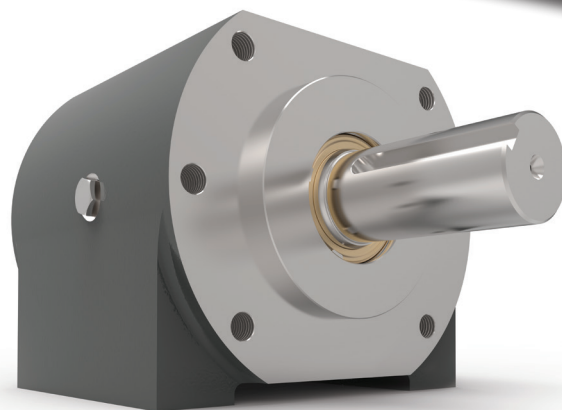
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From the Field



Know what's in your customer's head

At this year's FPDA/ISD Joint Industry Summit, Joe Ellers spoke on what customers really care about, and he challenged attendees to try and get inside their clients' heads. Ellers explained that one of his favorite things is to go out and make customer calls with salespeople.

"I get to get out and actually talk to some real customers. And then I get to hear what the customers are really saying, not necessarily what the salespeople tell me they're saying. I get to hear it from them," he said.

Ellers said that before they arrive at an appointment, he likes to ask the salesperson a series of questions, such as:

- Exactly what do these people do?
- Who are their customers?
- Who are their competitors?
- What's their fiscal year?
- What's their planning cycle?
- What are two or three things they're actually trying to accomplish this year?
- What are their corporate goals?

Ellers explained that the vast majority of salespeople don't know the answers and generally give him a puzzled look. His point is that most people don't wake up every day hoping someone comes to sell them something. But they do wake up with a list of problems, a list of goals, a list of key metrics that they're held accountable for — and that they're focused on. By digging down and finding out those types of things, a sale becomes easier, because the goal is problem solving. What's more, the customer is generally thrilled to discuss their problems and answer the types of initial questions he lists.

In general, Ellers said that many companies have similar goals, including:

- Reduce the price of components they're buying
- Enter new markets
- Acquire new customers in existing markets
- Add features or reduce costs on the products they make
- Increase sales to existing customers
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- Reduce disposal costs

If you can appeal to these sorts of things, a company will be more likely to purchase from you. But the best way to figure out which of these things are most important? You have to start off by asking the question. 

Paul J. Heney

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Look for changes at IFPE 2020

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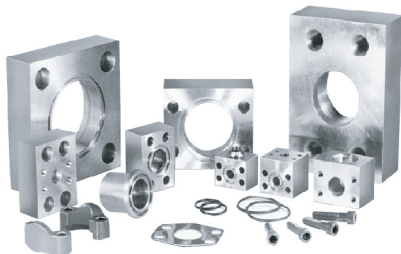


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Recession? What recession?

Many economists say U.S. industry is headed into a recession. GDP growth is going negative, November's ISM Manufacturing Index registered further contraction, and NFPA's monthly statistics report continued decline in both fluid power shipments and orders.

Flying in the face of all the gloom, demand for fluid power specialists is still robust. Just about everyone who wants a job has one. And more importantly, someone who wants a better job, whether for more-challenging responsibilities, career advancement or simply more money, has a decent shot at getting one.

"The job market is still strong," said Eric Bergsman, a certified personnel consultant at Marvel Consultants in Cleveland. "My board is filled with openings for bona fide qualified people." Available positions run the gamut from generalists with limited experience to niche technical experts, from product and application engineers to sales and marketing executives.

And counter to conventional wisdom that holds for older workers, too. "I always get a chuckle out of people who are told to say they have no more than 10 or 15 years of experience, but it's obvious once you look at their resume that they've been around a

lot longer," he said. "Particularly when it comes to fluid power and related industries, the talent pool is shrinking. I give NFPA and IFPS credit for trying to make our industry attractive to younger people. But it's hard to find young, energetic people who are willing to work in fluid power right now."

As a result, companies are more receptive to seasoned veterans. "Most clients feel if the person still has the desire, still has the juice and still wants to make an impact, they'll get serious consideration. Compared to 10 years ago, there's a newer perspective on that," he said.

Do opportunities vary for men and women? "Absolutely not!" emphasized Bergsman. "I have not run into any difference and, in fact, a lot of these companies would welcome female talent because the industry is so predominantly old boy. They would absolutely embrace the diversity, and there is no salary disparity, none."

Candidates, to some degree, have leverage right now, so businesses must actively compete for coveted workers or risk falling behind their peers, he continued. "I've seen employers with a lobby that looks like the set of *I Love Lucy* and they're not about to change." But most companies are concerned that they project a positive image and attract quality people by offering appropriate compensation and opportunities for advancement. And especially for younger workers, the stereotypical work-life balance — whether it's extra vacation, flex time, or paternal leave. Firms need to react quickly, too. "This market is among the fastest moving that I've seen." If a potential employer sees value in a candidate, don't hesitate. Make them an offer or risk losing out and waiting another three to six months, he said.

Any advice for those looking, beyond updating resumes and social media? "Network with everyone, because your next lead could come from church, neighbors or friends. And don't discount online job boards. I tell job seekers to do a little reflection and think about companies where you'd like to work, why, and how you could make a positive impact for them," he said. "Compile a list, then approach someone like me or find out who's the likely hiring manager. Don't just send your resume to HR where it falls into the abyss. Contact that person and have a little elevator pitch ready. If you call 100 companies you may get 10 or 15 responses. All you need is one." 





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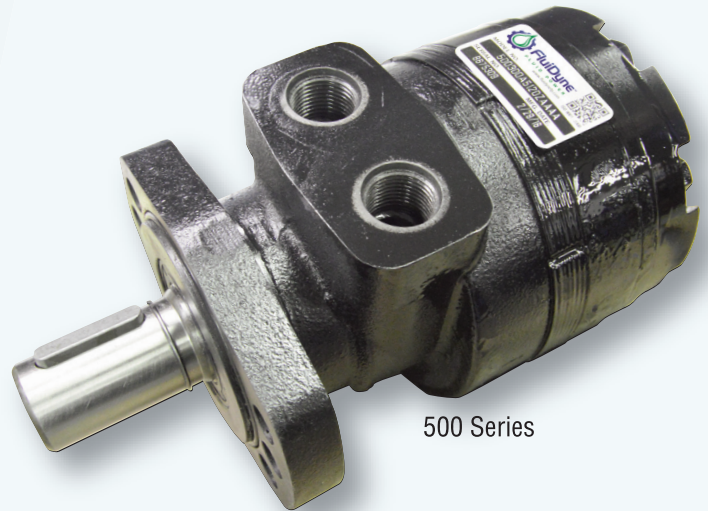
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MSOE hosts 11th Annual **Fluid Power Action Challenge**

On November 11, Milwaukee School of Engineering (MSOE) hosted 26 student teams from Milwaukee-area schools to compete in their 11th annual NFPA Fluid Power Action Challenge. Wheatland Center School (WCS) won the Overall Champion Award at the event.

Students had five weeks after workshop day to work on their prototypes and create their portfolio before returning to MSOE to compete on challenge day. Each team was judged based on safety, teamwork, portfolio, interview questions, and the functionality of their machine on the challenge board.

This was the third year that WCS had competed, and it had three teams in this year's competition. In an article released by West of the I, student Mason *Biehn* said, "It was easier this year because I knew what to expect, but it was still challenging to build an efficient machine to accomplish the task."

Another student, Jani Beck, said, "The constraints and project management were the toughest parts of this project. Once we had a plan for our prototype, it was much easier to get everyone involved and ready for challenge day. I would definitely recommend this project to others."

Kandi Horton, WCS teacher, said, "It was an incredible experience. Wheatland students have progressively improved their performance in this challenge. It is a high pressure, timed situation with a small margin for error, and they came through in a big way. I am always amazed at the commitment students give during the process and how they push through failure to achieve success."

Judges, volunteers, and sponsors of the event included MSOE, Bosch Rexroth, CEJN Industrial Group, FORCE America, GS Global Resources, HUSCO International, JM Grimstad, Poclain Hydraulics, and Precision Plus. 

NFPA | nfpa.com



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NFPA Annual Conference slated for Feb 11-13 in Miami

Registration is still open for the National Fluid Power Association's 2020 Annual Conference, slated for February 11-13 at the Mandarin Oriental in Miami.

This year's conference features an expanded general session for more diverse topics and solid takeaways:

- Fred Harburg of the Kellogg School of Management will use his expertise in executive coaching and growth guidance to help attendees identify ways to maximize their executive resilience.
- Dan Bagley of B&B Management Labs will provide insights into current and future technology trends, such as artificial intelligence and cobots, and the impact on manufacturing and workforce.
- Don Rheem of E3 Solutions will bring attendees up to speed on the neuroscience behind high-performance cultures and how to build a productive culture on this basis.
- Geopolitical strategist Peter Zeihan will go in depth into the current state of global geopolitics, specifically as it relates to trade wars, and how it all affects business.



Because of the diversity of NFPA's members and their reasons for attending the conference, the speakers appeal across the fluid power supply chain and deliver a broad spectrum of insights.

Other conference highlights include golf and off-site tours. 

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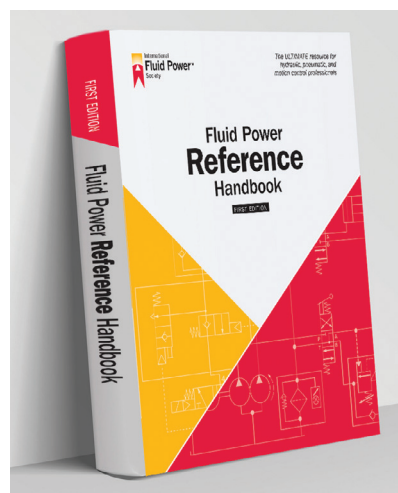
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IFPS releases new **Fluid Power Reference Handbook**



The IFPS, the only organization to provide comprehensive technical certifications for professionals in the fluid power and motion control industry, recently published a new *Fluid Power Reference Handbook*. This handbook contains both U.S. customary and metric units, full-color graphics, charts, drawings and symbology that comply with ISO, ANSI and SAE standards.

“Unlike any other reference book, this reference handbook broadly covers both industrial and mobile applications of fluid power within hydraulics and pneumatics systems,” said Donna Pollander ACA, IFPS Executive Director. “The

color-coded table of contents and index match 17 color-coded sections, making information easy to find. It is truly the ultimate, must-have resource for any fluid power professional.”

The soft-cover book is 380 pages. Topics cover safety, symbology, fluid power data, fluids, fluid conditioning, connectors and conductors, reservoirs, compressors, prime movers, valves, cylinders, motors, semi-rotary actuators, vacuum, accumulators, control theory, troubleshooting algorithms, pumps, and a glossary of terms.

Pre-Order by visiting www.ifps.org; estimated shipping is January 2020. 

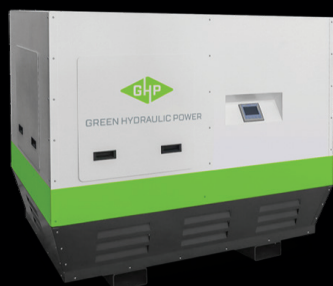
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When demand is sizeable, hydraulic systems suppliers will often manufacture customer-specific tank systems with filters, valves and sensors built-in. Now ARGO-HYTOS GmbH, headquartered in Kraichtal, Germany, has developed the Hybrid Integrated Tank (HIT) that offers similar benefits for short production runs. The hybrid tank combines two manufacturing technologies, rotational molding and injection molding, and

integrates all required tank functions into a complete module that is cost-effective even in small quantities.

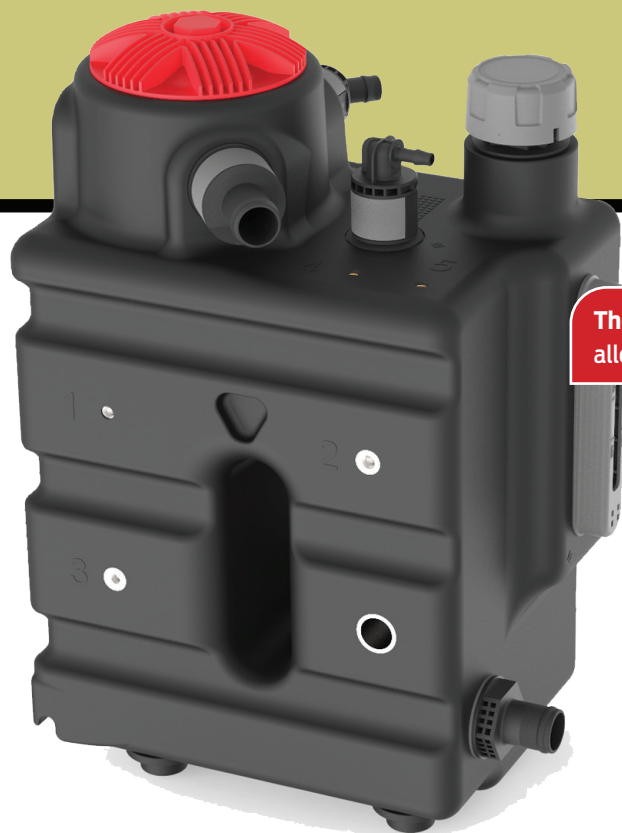
Tank basics

According to Thomas Weiser, Head of Global R&D Filter & Systems, Fluid Management at ARGO-HYTOS, hydraulic tanks for mobile machinery are primarily made of welded steel or aluminum; or rotational- or blow-molded plastic. In addition, ARGO-HYTOS offers two interesting alternatives: plastic injection-molding and hybrid construction.

With injection-molded products, tank halves are welded together abrasion-free to form one tank volume. Advantages include lighter weight than metal options and high resistance to mechanical and thermal stresses. The corrosion-resistant materials minimize contamination in the tank and

render reworking and cleaning processes prior to installation unnecessary.

Engineers systematically implement customer-specified functions during development. And the tank's shape, as well as accessibility for maintenance and service, can be adapted to fit complex installation spaces. It results in highly integrated tank modules that exactly meet application demands. The tank systems are leak-tested and delivered ready-to-install, therefore reducing assembly times. In addition, the company's Quick-Connect-System allows for fast, correct and safe hose mounting without tools. It features low mounting forces and fault detection through a safety clip. The clip engages only when the connector is completely pushed onto the port. Otherwise, the clip protrudes visibly and can be detected by touch.



The HIT takes advantage of the Quick-Connect-System that allows for fast, correct and safe hose mounting without tools.

Hybrid Integrated Tank

The Hybrid Integrated Tank was developed to provide the same advantages of injection-molded tank systems for machines that see lower production volumes. Manufacturing the HIT involves welding injection-molded connection parts to a rotational-molded tank. For example, the welded ports of the Quick-Connect-System facilitate simple and safe hose assembly. Likewise, mating the upper part of the filter housing to the tank reduces the number of components as the filter head, usually made of cast aluminum, is no longer needed. And with the housing now part of the tank, there are no sealing points and therefore no risk of leakage. Flexibility of the process ensures that even subsequent modifications, such as installing additional connections, are easily made.

Tank geometry can be adapted as required to meet OEM preferences thanks to customized rotational-mold tooling. Likewise, many application-specific provisions can be addressed, such as the type of hydraulic and electrical connections, tank mounting attachments, internal flow controls and filter-connection dimensions. A common-part strategy takes advantage of an existing family of modular components such as filter covers and Quick Connect fittings and, thus, does not result in any tooling costs to the customer. This guarantees that the design economically meets users' needs while reducing the complexity for in-house material planning and production, said Weiser.

Advanced functions

The basic functions of any hydraulic tank are to store and supply fluid. The HIT does much more. For example, contamination control can be enhanced with one or more return, return-suction, suction and filling filters. Large flow cross-sections for suction and return ports ensure a compact installation height. Filter elements are available with copy-protection to avoid counterfeits and knock-offs. That ensures proper filtration performance and can safeguard the OEM's spare parts

business. Copy protection involves soft sealing of a lip seal against an oval-shape face.

In addition to oil cleanliness, good air-separation capabilities are essential. Especially in applications with high circulation rates – meaning short dwell times of the oil in the tank – various measures can improve separation efficiency. Inlets and outlets can be arranged and aligned such that there is no direct fluid exchange. Special-shape extrusions can also be added to influence flow and significantly increase the coalescence of air bubbles. A larger buoyancy force to surface area ratio speeds up air separation.

Due to the variable working volume, breathers are needed for ventilating hydraulic tanks. Different sizes and designs are available for the HIT. Breathers with integrated pre-load valves can be used, depending on requirements and specifications. The temporary excess pressure in the tank improves suction performance in certain operating conditions. Simulation tools are used in the early development stages for dimensioning of pre-loaded tanks, especially plastic ones.

Finally, common auxiliary functions are easily integrated into the HIT system. Oil level indicators, sight glasses, oil drain plugs and valves, protective filling screens, as well as cable brackets, can be included as needed to address an application.

Technical features

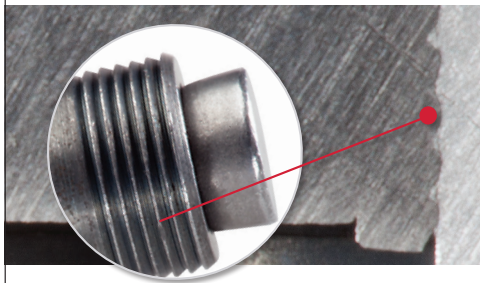
The rotational-molded HIT wall is made from oil-resistant polyamide (PA 6). Compared with the widely used rotational-molding material cross-linked polyethylene (XPE), parts made from PA 6 are recommended for the use in hydraulic fluids with temperatures up to 100°C, and with temporary excursions permissible to 120°C. The unit is also suitable for environmentally friendly hydraulic fluids such as HEES and HETG.

Fusibility of the material lets injection-molded parts be readily welded to the tank. Laser-welding, similar to infrared welding, is an abrasion-free joining process that does not generate dirt or debris. The flexibility of the laser-welding system permits various welding geometries on one tank, without needing to change tools or fixtures.

Effective sealing between filter cover or breather and the rotational-molded tank is possible due to a high-quality surface with minimal deformation. Slow and uniform cooling of the molded parts, as well as the use of cooling fixtures, reduces part deformation. Subsequent conditioning reduces internal stress and increases elongation properties. Once solidified, the PA 6 virtually mirrors the mold surface, and thus meets requirements for roughness and contact area for sealing with standard seals, such as O-rings.

The modular filtration system encompasses various elements in different lengths that can handle flow rates from 150 to 350 lpm. In addition to commonly used grades of fineness – 10 µm(c) and 16 µm(c) – special configurations are possible.

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DESIGN NOTES

At the recent ICUEE Show in Louisville, Ky., ARGO-HYTOS exhibited a HIT equipped with three sensors integrated into the tank to demonstrate data collection from the hydraulic fluid for oil condition monitoring. For display purposes, LEDs visualized data flow from the tank to a controller.



Hydraulics 4.0

The available scope of the HIT system makes it possible to quickly design customized tank systems to suit a large variety of applications, and help address the growing need for tanks that must fit ever-tighter and more-complex installation spaces.

Another industry trend is the move toward detailed monitoring of oil conditions. Sensor technology connecting the digital and real worlds is one of the most important elements of Industry 4.0. But incorporating sensor technology into hydraulic tanks has lagged behind that of other fluid power components.

In the past, only the pressure upstream of the filter and the temperature of the oil were typically measured. In order to meet future requirements, the HIT makes it possible to integrate or adapt a moisture sensor Lubcos H2O+; a wear sensor OPCom FerroS (ferromagnetic particles in the oil); and a continuous level and temperature sensor, which reads the oil volume even in tanks with complex geometries. All three sensors are proven ARGO-HYTOS products.

With the integration, ARGO-HYTOS meets customers' desire for a product which enables condition monitoring or predictive maintenance. The capabilities are built-in, with no need for a subsequent, usually complex assembly of external sensors.

Networking of sensor data is not just about forwarding data to higher-level systems, said company officials, but also about the clever interaction of several sensors. The focus is on merging data from different sensors to increase detection performance and to better classify data. Thanks to the use of three sensors in the tank that monitor diverse characteristics such as temperature, wear and water content, users can holistically track and evaluate the overall oil condition. By linking the individual sensor data, operational safety and reliability will be increased and errors detected at an early stage. 

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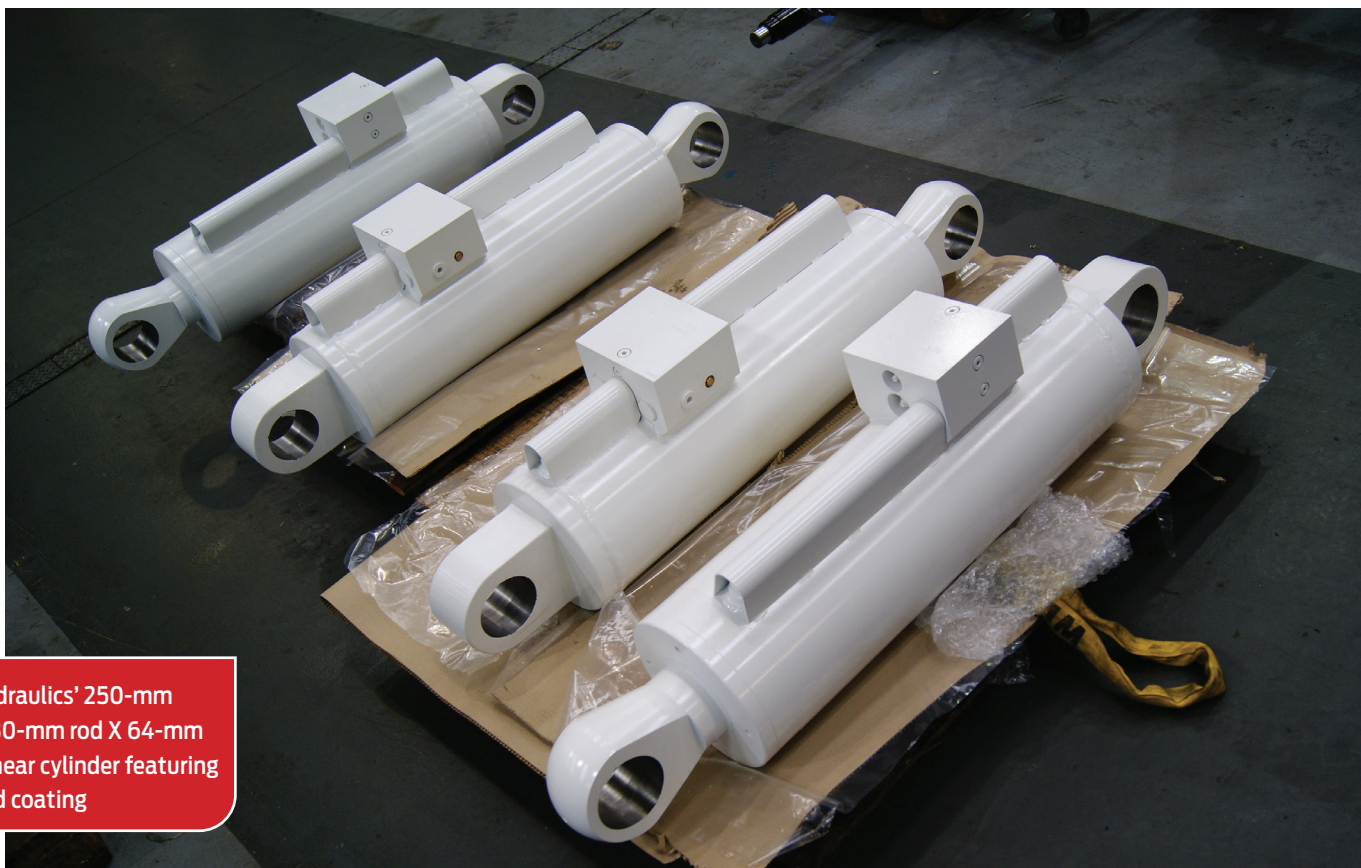
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Apex Hydraulics' 250-mm bore X 130-mm rod X 64-mm stroke shear cylinder featuring Corex rod coating

Supreme rod coating aids mining machine development

Apex Hydraulics has a long history of producing custom built and highly specialized hydraulic cylinders for mining applications. When the company was formed in 1985, the main source of work was from mining. Now, most work comes from oil, renewable energies and factories. However, due to the decades of experience, mining companies worldwide still approach Apex Hydraulics for commissions for mining applications.

A Russian company, focused on developing highly bespoke mining machinery for coal and pot ash mines, required highly robust hydraulic cylinders to be placed inside the state-of-the-art machines. They were producing a run of three different machines, with each machine weighing up to 300 tons. Each machine required several different types of hydraulic cylinders to be manufactured.

These specialist machines were prototypes, to be tested and then sent underground for mining companies to trial, with the intention of securing sales once the machines had proved their worth. Because of this the client required the absolute best of everything, with no potential for the machine to fail or breakdown. They chose Apex, with their long history of specialist mining hydraulics, along with their innovative engineering reputation, to design and manufacture the hydraulic cylinders.

Apex Hydraulics suggested their own supreme rod coating, Corex, developed specifically for hydraulic rods that are to be used within harsh environments, subject to excessive heat, pressure and contamination. With twice the bond strength of Hard Chrome Plating at over 10,000 psi and a hardness of up to 1400 HV, Corex has exceptional resistance to the impact that it may be subject to in a mining environment from chips of rock and coal. The porosity (that can allow corrosion within the rod) is at less than 1%, as opposed to Hard Chrome plating's 5%. These features give Corex an excellent resistance to the pitting and cracking that can allow contaminants to enter the hydraulic cylinder and will make the rod prone to rust and degrading.

Corex is more expensive than standard chrome plating. For example, a recent rod

was priced at £16,000 as opposed to the HCP version at £11,000. However, in the event of machine breakdown, stripping down the entire machine and replacing the part would cost several thousand pounds, as well as another £11,000 for a replacement standard cylinder rod. Considering that in other mining applications, Corex has been seen to extend cylinder life by over 700%, the savings over the lifetime of the machine could be upwards of £80,000; not to mention the savings in terms of downtime and the priceless benefit of the reputation of the company.

In addition, the process of applying a Corex coating is more environmentally friendly than the application of Hard Chrome Plating. Combined with the reduced number of rod changes over the lifetime of a machine, this makes Corex by far the most sustainable option.

The client has been so impressed with the Corex coated hydraulic cylinder rods that they continue to request new products. All cylinders go out displaying the Union Jack, Apex logo and the Corex logo, so the client can sell the product on its provenance. The branding represents a blending of the decades of experience Apex have with mining engineering, and the cutting-edge technology, pushing forward to always develop the newest and the best.

Corex is an ideal choice for mining applications as well as many other types of industries where longevity is vital, particularly under extreme working conditions. 

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The bag gripper from Piab takes sacks off the roller belt. The width of the gripper was customized according to the roll spacing.

Bag grippers help keep roads ice-free

At the company Sapho GmbH,

a company of the Bilgram Chemie Group, the old bag gripper no longer provided the necessary performance. The regions of southern Germany, Austria, and parts of France are supplied by Sapho with de-icing salt from its up to 50,000 tons of salt warehouse, which is partly filled from May to October from mines in the region.

When visiting another company, they noticed a better gripping solution. Of particular interest was that no one had to

monitor it directly — freeing employees for other tasks. To be well prepared for the upcoming winter season, they decided to invest in a new gripper.

“The impetus was that we wanted to get more power out of the machine and wanted to pack the pallets cleaner and more dimensionally stable. With the combination of robots and grippers from Piab, we are quick at the time when it counts,” said Uwe Grundstein, Technical Director at Sapho.

Piab’s hybrid bag grippers are designed precisely for payloads of up to 50 kg. Accordingly, they are constructed for the handling of 10, 25, and 50 kg of salt bags from Sapho.

The hybrid gripper is attached to a robotic arm that removes the sacks and bags from a roller belt on which they are placed after filling. It grabs the sacks from above, drives the forks on both sides between the rollers of the belt, and thus picks up the bag on the underside. As a result, the bag lies on the massive gripper fingers during movement. For the hybrid bag gripper to fit precisely to the existing system and in particular to the roller belt used by Sapho, the fork spacing was adapted to the spacing of the rollers.

“In this way, we could deploy a standard product and adapt it to customer needs with just a few changes,” said Roland

Singer, Team Leader Vacuum Automation & Robotic Gripping Division at Piab.

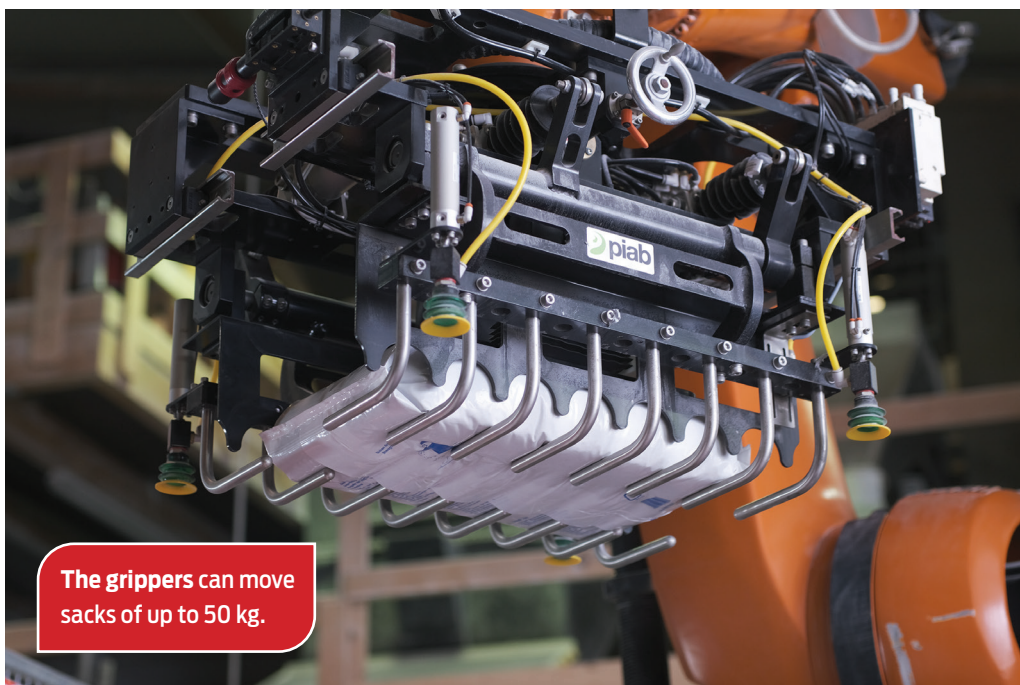
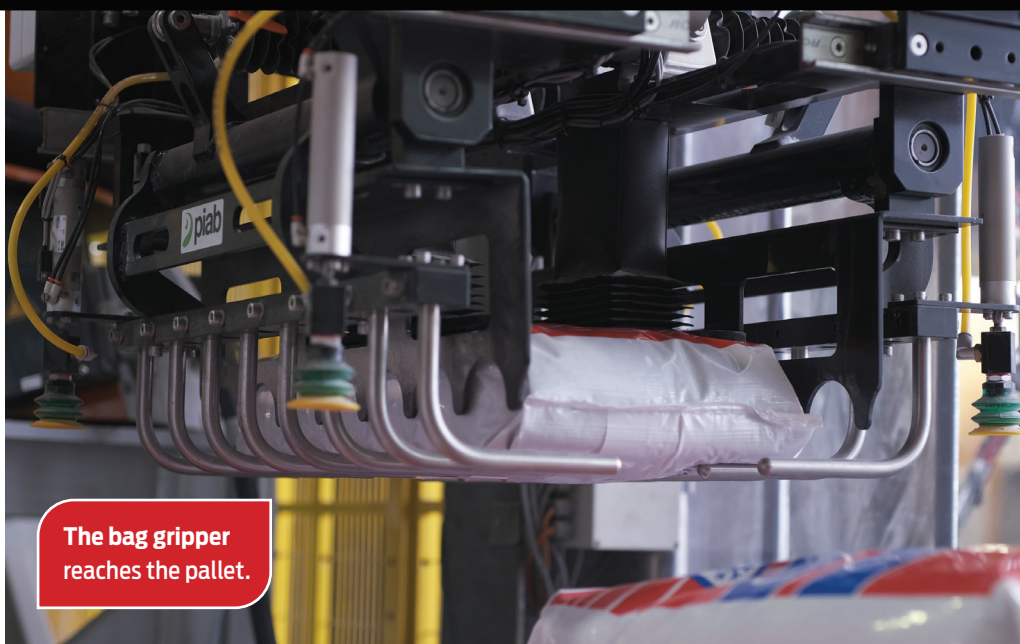
When laying down the bags, the gripper fingers open first and then the integrated cover plates. As a result, the bags are kept in shape during drop-down and stacked firmly and dimensionally stable on the pallets.

Grundstein explained, “From our loose salt warehouse where we store a literal mountain of salt, we automatically fill big bags, PE sacks, bags, and buckets at more than ten machines. This setup equals more than 800 to 1,000 pallets a day. Particularly, the palletizing of the bags had to run with much higher cycle times than before to increase productivity. With the new hybrid bag gripper and a minor process optimization, we can now palletize nine bags per minute compared to six bags with the old system. This corresponds to up to 16 pallets more per day and thus more than half a truckload. In addition, the process now runs smoothly and without damaging the bag.”

“Our employees are relieved further, too. Thanks to the automatic intermediate layer handling integrated into the gripper, palletizing of the 10-kg sacks eliminates the need to stoop and manually place a cardboard liner on each pallet. This protects the back and has the advantage for us that the employee can devote himself to other tasks. It also eliminates the need to interfere with the automated process,” added Manuel Bender, Deputy Head of Filling Solids.

“We used the summer break to retrofit the plant so that it is now ready for winter business. The installation was simple and smooth — basically like plug and play,” said Grundstein.

The bag gripper range is suitable for palletizing plastic, fabric, or paper bags containing grains, chemicals, dog food, minerals, and many other products. In addition to the adjustable hybrid bag grippers, static bag grippers are also available. Both types are designed for payloads of 25 and 50 kg. They eliminate the need for custom tools and can usually be set up in under five minutes. They are made of safe, solid stainless-steel gripper fingers. The cover plates are used for precise and tight placement of the bags on the pallet. Both gripper types can be optionally equipped with suction cups for placing intermediate layers or pallet hooks. 

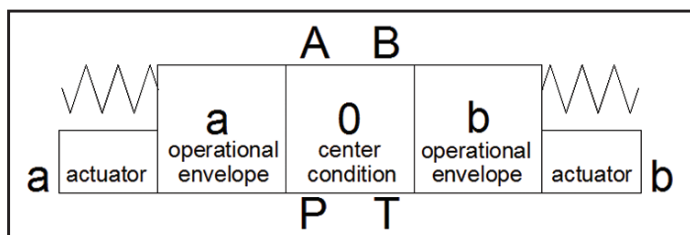




Hydraulic Symbolology 201: industrial directional valves

This article is the third in my series on hydraulic symbolology, this time going beyond the basics to discuss symbols in higher detail. If you haven't read Hydraulic Symbolology 101 and Hydraulic Symbolology 102, please find them at fluidpowerworld.com and read them first to gain the basics required for this article. If your basics are sound, however, carry on learning the intricacies of industrial directional valve symbolology.

I'm separating the lessons on directional valves between industrial, mobile and cartridge valve technologies. Each uses symbolology differently because their valves are manufactured and applied individually based on the needs of their industries. Through-center valves are not used with industrial applications, and 3-way valves are only common with cartridge valves, for example. This article covers the basics of industrial valve symbols, while Hydraulic Symbolology 202 will cover the compound symbols used with industrial stack valves.

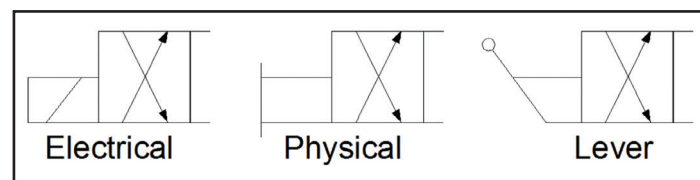


The above symbol shows the typical 3-position directional valve with the internal lineation removed. Each of the square boxes depicts one of the three functional envelopes of which the valve is capable. The center condition is referenced as *position 0* because it's the natural valve state prior to any actuation. The center condition is important to consider because the type of pump needed is dictated by center flow conditions. If the valve allows flow in neutral, a fixed displacement pump is ideal, while a center condition blocking incoming flow requires a pressure compensated, variable displacement pump.

The remaining two squares depict the operational envelopes of the second and third valve positions, which are the functions of the valve. Envelopes are referenced with *a* or *b* to define the envelope pertaining to the given actuation method. The reference can be located on either side of the valve symbol, and is generally

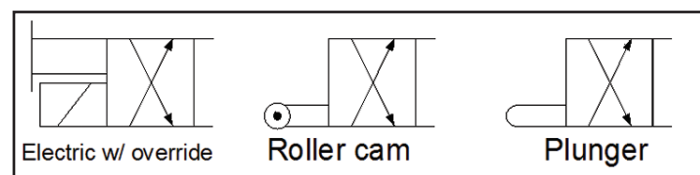
manufacturer specific, so ensure you use their documentation when interpreting symbols. What matters is that the *a* *actuator* operates the *a* *envelope*, for example.

The valve ports are listed both above and below the center condition envelope. This not only provides clarity on the port locations, but also defines the at-rest position of the valve. For example, a valve may not have a neutral center condition, but could be at rest in the *a* or *b* envelopes, such as with a 2-position valve. Regardless, I've only ever seen the display order of A B on top with P T underneath.

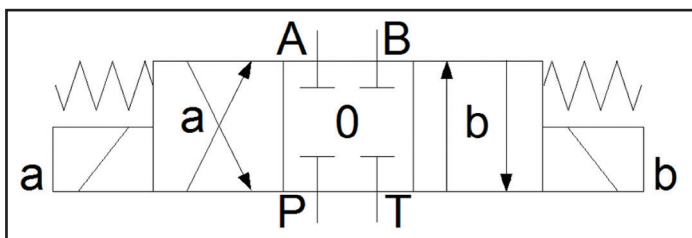


The actuators, in function, are the electric or mechanical devices that shift the valve out of neutral to any of the operational envelopes. There are myriad actuators, although with electronic technology advancing so quickly, the forms of mechanical actuation are becoming rarer. Electric solenoid operation is by far the most common for industrial valves, and is depicted by the same basic actuator rectangle with a diagonal line. Although a line leaning to the left is meant to represent the coil *pulling* on the plunger, the right-leaning line showing a coil *pushing* on the plunger is more common, regardless of axial direction.

The blunted actuator representing a physical actuation is the most generic representation of manual operation. This symbol can technically represent any form of physical actuation but is non-descriptive. It's preferred to reserve this for only the manual override of a valve, and is often used in conjunction with the solenoid operator (see below). For the strictly manually operation, the lever actuator makes sense, and can be seen in forms varying from the one above.

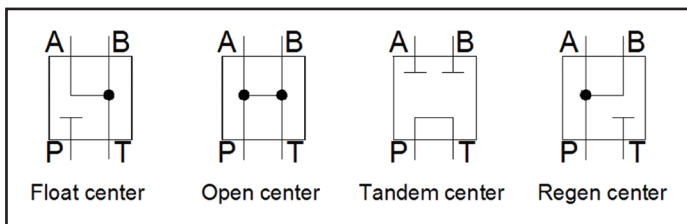


It was previously common to do factory automation by way of directional control valves, but the practice is less common in the current electronic age. However, you may still come across roller cam or plunger valves. The roller cam is ideal for actuating a valve as a device moves perpendicular to the cam, pushing it down and switching the valve. You can imagine this valve creating a functional series, as the extension of one hydraulic cylinder at the end of stroke can actuate the next function. The same can be said of the plunger valve, which is similar to the cam function but meant to accept only axial force against the plunger.



Above is the same valve as previously shown, but with the internal lineation replaced. This is a complete hydraulic symbol showing a closed-center, 4-way, 3-position, spring-centred solenoid valve. In the at-rest position, all ports are blocked and the only flow that occurs is the result of leakage. The pump will be variable displacement or with some sort of automatic unloading function. Flow to and from the actuator will be blocked, but because of the leakage I mentioned, you wouldn't use this for load holding. Firing the *a* coil would provide flow paths from P to B and A to T, while firing of the *b* coil would allow flow from P to A and B to T.

Other common center conditions for valves are shown below. The *float center* spool is used in circuits where both work ports are required to be open to tank while in the neutral position. It is used in conjunction with load holding or motion control valves, which themselves necessitate draining of their spring chambers, a function that wouldn't occur with a closed center. These spools are also called *motor spool* because they allow fluid to pass through the center of the valve from one port of the motor to the other. This operation allows a motor to spin down naturally under its own energy, rather than an abrupt stop as would occur with a closed center. The float center spool has its P-port blocked, so pressure compensated pumps are needed.



The *open center* valve provides the same benefits as the float spool, but can be used with fixed displacement pumps. The pump flow is naturally unloaded to tank, and the spool also provides a drainage flow path for any accessory valves attached to the A and B work ports. The *tandem center* valve is also used for fixed flow systems where fluid is unloaded to tank in neutral and work port flow is blocked. This spool is common on gear pump

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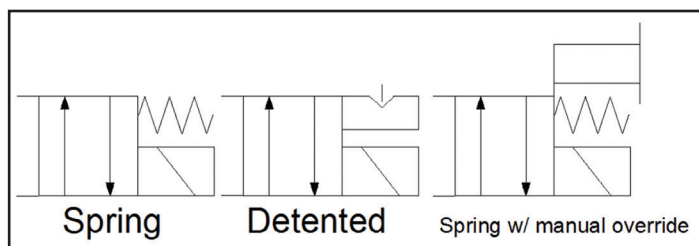
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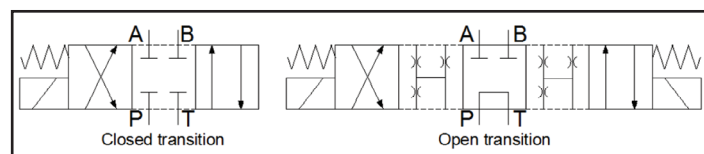
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systems operating cylinders with no work-holding requirement. Less common but worth mention is the *regen center* valve, which opens pump flow to both work ports simultaneously. This counterintuitive function allows a differential cylinder to extend with twice the speed at half the force, and can be controlled electronically or hydraulically to provide full or part-time regeneration. There are dozens of other center conditions for spool valves, but these five make up 90% of what you'll come across.



There are auxiliary functions to every directional control valve, and these add utility to the valve. The *spring* is used to center a 3-position valve, or to offset a 2-position valve. When no power is applied to a coil, the spring force is sufficient to center the valve to its at-rest position. Some occasions require that a valve is left in

an actuated state without any physical or electrical motivation to maintain position. A *detent* mechanism can be added to either side of a valve to create maintained flow such as is required for some motor or clamping functions. The *manual override* can be added to nearly any directional valve symbol, but when real estate is limited, this function is typically added above the others, as shown. The method of physical override is not spelled out, and could occur through knobs, handles or even hidden buttons.



If you look at the above symbols, you'll notice something odd if you're not deeply familiar with symbology. How is it possible to have three distinct positions with a single coil? For that matter, how is it possible to have five distinct positions in *any* valve. The symbols here depict spool transitions. The *closed transition* example is actually a 4/2 single solenoid valve, but if you look closely you can see a dashed lined in the center envelope.

The dashed line in directional valve symbology illustrates the transition of a valve; it's the functional action of the valve as the spool moves from being solid against the valve body, to partially open and finally fully open. What happens in between has consequences on system performance. The closed transition shows us this valve has no metering as it switches from P to B and A to T and then to P to A and B to T. Flow simply stops abruptly, and then restarts in the opposite direction.

In the open transition example, the valve spool has a metering effect at all ports before finally providing the directional function as listed above. Starting in neutral with P to T flow while the work ports are blocked, if we switch to the left side envelope, A, B and P are metered into the center while the tank line bleeds directly to reservoir. As the spool shifts fully, P flows to B while A drains to T. This spool shifts smoothly, but because fluid has a temporary path to tank during transition, you must be careful to use load holding, if required, since the downstream actuator can drop its load for a fraction of a second.

Next time, I'll discuss the methods of building pilot operated and stackable valves. Pilot operated valves are required for system flows above 30-40 gpm, and these valves can be illustrated two ways. Modular stack valves are a method of creating complete circuits using CETOP ISO valves, but their symbology is different from normally drawn circuits. 

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Novel circuit boosts machine efficiency

European researchers recently wrapped up the three-year Forwarder2020 project, which aimed to develop a next-generation forwarder that's more efficient, productive and environmentally sustainable than anything currently in use. Engineers are now reporting preliminary findings from lab tests and field trials, with encouraging results.

Forwarders are articulated vehicles that carry felled timbers from the woods to a roadside landing for subsequent loading onto log trucks. Among the objectives of the project: reduce ground pressure under the wheels to avoid deep ruts, improve fuel economy, offer higher travel speeds and reduce wood-extraction costs.

To address these requirements the project team designed several new technology "modules" that included the hydraulics, transmission and suspension. They were integrated into prototypes using an HSM 208 F from Hohenloher Spezial-Maschinenbau, Neu-Kupfer, Germany, as the base platform. Tests at several forest sites across Europe produced some notable insights.

Working drive efficiency. One key feature of the Forwarder2020 prototype is a hybrid hydraulic system for energy recuperation and regeneration in the machine's Palfinger Epsilon S11F crane. The crane is made up of a pillar, main arm (inner boom) and articulating arm (outer boom), as well as related cylinders and grapple.

The circuit includes a hydraulic transformer, consisting of two fixed-displacement hydraulic motors whose shaft ends are mechanically connected via a coupling. The transformer is important

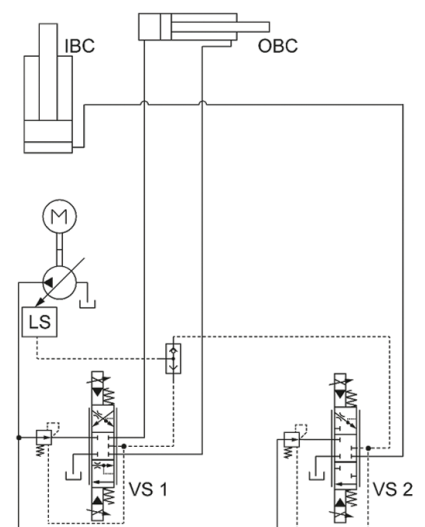
because there are frequent situations where the main arm and articulating arm act simultaneously, offering the potential to transfer energy between the two and make the motion significantly more efficient.

Within this system, as shown in the accompanying diagrams, the hydraulic transformer HT1 connects the inner boom cylinder (IBC) with the outer boom cylinder (OBC), said researcher Chris Geiger of the Karlsruhe Institute of Technology (KIT). And actuating valve section VS1 creates hydraulic parallel movement that permits quasi-horizontal extend or retract movement of the grapple. For example, during extension movements, the power of the lowered IBC transfers via HT1 to the OBC, resulting in retraction in the latter with minimal additional flow from the main pump.

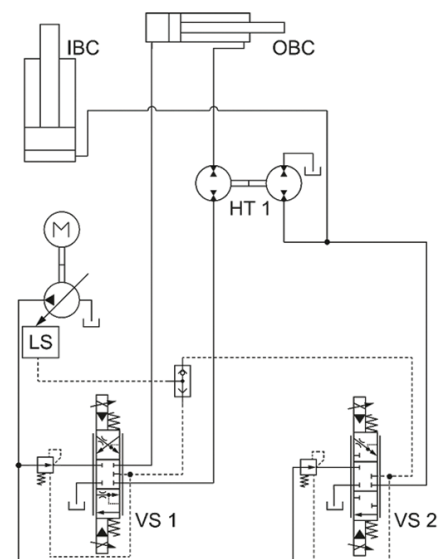
Tests conducted on the new design against a reference cycle showed an average energy consumption of 76 Wh per cycle for the HT system compared to a comparable conventional system with 90.3 Wh. On average, it achieved an energy savings of 15.8%. There was also a slight reduction of cycle time over a complete loading cycle, to 18.9 sec from about 20 sec, resulting in at least constant productivity with the new hydraulic system, said Geiger.

Drive-train efficiency. The prototype used a hydrostatic-mechanical power-split transmission from Dana Rexroth that reportedly combines the best properties of a mechanical transmission with those of a hydrostatic travel drive, and is technologically advanced in that it provides an infinitely variable speed output. The unit reportedly is far more efficient than the industry norm.

Technicians tested the power-split transmission under reproducible conditions on



Conventional crane circuit



Crane hydraulic-transformer system



Field tests conducted on wetlands showed the triple bogie and larger track reduced rutting.

📺 | Michael Starke, Bern University of Applied Sciences

a roller test bench at KIT. They compared the prototype with the new drive train against an in-market machine with similar specifications but with a hydrostatic drive train. For example, simulating driving on a forest road at 10 km/h showed the drive-train efficiency could be increased by up to 75% compared to a conventional hydrostatic drive, said Geiger.

Triple bogie. The builders of the HSM machine developed a rear triple-bogie axle that increases the surface under the bogie tracks and reduces ground pressure. This is an innovation permitting environmentally friendly timber harvesting on wetlands, according to HSM CEO Felix zu Hohenlohe.

Field tests conducted on forest wetlands in Saxony showed the triple bogie's advantages for reducing rutting. Compared to the standard design (860-mm wide tracks) the Bigfoot concept (tracks 1,340-mm wide) and the triple bogie (wheelbase 3,100 mm versus 1,500 mm standard) give a footprint under the load that is more than three times as large (322%), said zu Hohenlohe. And that confirms data that show rut depth and cumulative damage were significantly lower, compared with standard vehicles.

"The triple bogie with the extra wide tracks needs softer ground to really show the advantage of the big footprints. We have done tests in Banchory, Scotland and Puna, Lithuania. Here, on very soft ground, the results were very positive for the local specialists, but could not be quantified, simply because no other system was available that could extract the timber on this ground," said zu Hohenlohe. 📺

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School of hard knocks

A technical high school had to replace its 12-year-old lubricated screw air compressor after 100,000 hours of operation. The unit had simply worn out after many hours of operation.

The school maintenance staff was unaware that some screw compressors, if installed with very little storage, will run unloaded continuously, consuming significant power but producing no air. This 15-hp unit ran constantly for more than 10 years, never shutting off except briefly for maintenance intervals.

The school only operates its shops for six hours per day, five days per week over 10 months of the year. This calculates out to only about 1,200 hours per year. However, the actual annual operation of this unit was more than 8,000 per year. The compressor was loaded about 2% of the time and consumed 5 kW when unloaded, so the wasted energy calculated to a cost of roughly \$4,000 every year. Through the life of the compressor, about \$48,000 worth of energy was wasted. The maintenance supervisor was surprised and said he had learned something he did not know — this proved to be a very expensive lesson.

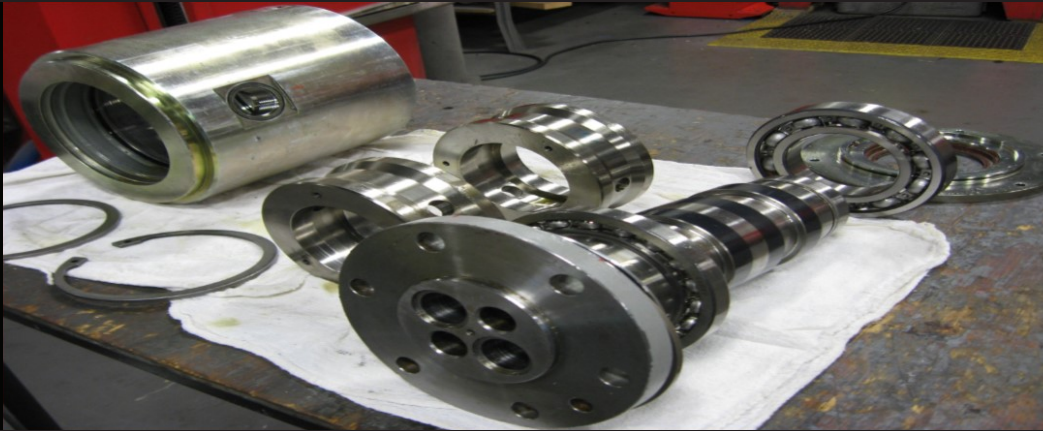
A better choice would have been a compressor that was rated for start/stop operation or VSD control that would consume no unloaded power. A similar sized compressor running for 1,200 hours (with the unit being shut down at night) would consume about \$100 worth of electricity per year in the expected 24 annual hours of loaded run time. And this solution is exactly what the school has done now. They have learned their lesson well. 



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- THE SLEEVES ARE "BORE GAGED" TO CHECK FOR ROUNDNESS OR WEAR SPOTS. THE FIT BETWEEN THE SHAFT "OD" AND THE SLEEVE "ID" IS CRITICAL. IF THE SLEEVES ARE BAD WE MAKE NEW ONES.
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STAYING PROTECTED WITH PNEUMATIC SAFETY VALVES



Pneumatic safety valves, including bleed-and-block designs and 3/2 valves, are essential in manufacturing.

Josh Cosford • Contributing Editor

Pneumatic systems are known for their ability to rapidly employ compressed gas to achieve work, and in fact, it's this element that makes pneumatics the top choice for high-speed actuation of machinery. The pneumatic press, for example, is capable of rapid movement with relatively high force, suitable for stamping, forming or punching through any material up to and including steel.

With such a capacity to make plastic, aluminum or even steel yield to fluid power authority, you can imagine how human flesh would afford little safeguard against accidental interaction with pneumatic actuators. A punch press would care as much if your hand was in its way as much as it would a hunk of plasticine.

Safety is a top priority to any machine builder, especially where the potential for human interaction with such a machine is common. A punch press, for example, requires the loading and unloading of parts. If that process is manual rather than automated, it provides the opportunity for the machine operator to place their hands in the path of danger. There are codes and standards too lengthy to discuss here, but if a machine moves too quickly and across enough of a gap, provisions for safe machine operation must be put into place.

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Figure 1. The DM2 series valve from Ross Controls is a 3-way, 2-position normally closed valve that blocks primary inlet pressure from reaching downstream, while ensuring that downstream pressure is vented to atmosphere.

A safe machine is one that prevents the possibility of harm should the operator — or their body parts — enter a dangerous location, such as space in a press between the tooling and the workpiece. It's common practice to use a light curtain fixed between the operator and work area, which when its beam is broken, defaults the machine into its safe mode.

Block-and-bleed safety

When a pneumatic press is faulted, two things must occur. The machine must first stop immediately from executing its press function, hopefully before harm occurs. Also, during such a machine fault, accidental reactivation of the actuator(s) must be prevented. The term block and bleed is colloquially applied to components capable of both blocking off the incoming air supply and also bleeding off work side pressure to prevent possible actuator movement.

The block-and-bleed concept is so effective that various manufacturers such as SMC and Ross Controls make pneumatic safety valves that practice the concept as a specialty. The Ross Controls DM² Series valve (figure 1) employs multiple features to prevent energy from reaching a downstream actuator either intentionally or accidentally.

The valve block is essentially a 3-way, 2-position normally closed valve that blocks primary inlet pressure (either from the main receiver or a subcircuit at the machine) from reaching downstream, while keeping that downstream pressure vented to atmosphere. Mounting this valve at the supply of air to a machine, zone, or cell will provide a control reliable method of block and bleed.

The valve assembly consists of nearly a dozen internal valve components but can be best described as two pilot-operated 3-way, 2-position normally closed valves but with a crossflow arrangement. This means the supply to outlet paths are in series but outlet to exhaust paths are in parallel. Because of this arrangement, they must both be activated to allow flow from the inlet to outlet. If one valve or other fails to shift, no flow can occur. Control power is required for

both solenoid valves simultaneously or the valve faults and must be reset.

Should only one of the two valves shift, the air is vented to the atmosphere, providing an audible signal that there is a problem. Until the valve is reset the assembly remains in safe mode while air is vented to atmosphere. Only when power is removed from the active coils can the manual reset be activated to allow the valve to function once again.

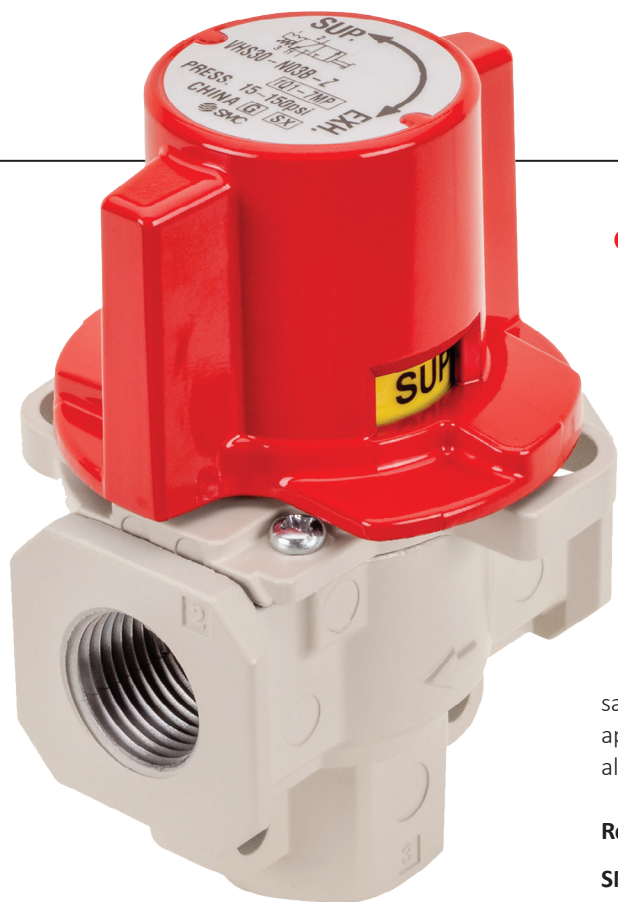
An additional feature of the safety valve is its ability to prevent activation when it senses low inlet energy from either low flow or pressure. When the incoming pressure is not high enough while the valve is energized the valve will fault but it cannot be reset until pressure is restored and the main coil signals removed. This is a safety function that ensures that only actuating the main coils can cause air to be supplied to the machine.

3/2 safety valves for maintenance

More simply, but no less important, are pneumatic lockout valves, such as the SMC VHS series in Figure 2. This is referred to as a pressure relief valve, but it's essentially a 3-way, 2-position valve that manually vents downstream air to atmosphere. It provides a similar block and bleed function as the Ross DM², but obviously with less complexity.

A 3/2 safety valve is often used for maintenance purposes to prevent accidental machine operation when a technician is servicing the machine. Once the machine is shut down and ready for service, the technician rotates the knob to block incoming air supply, but also direct any or all downstream air out the bottom exhaust port. This ensures no residual pressure is capable of accidentally powering downstream actuators.

To guarantee technicians are protected during servicing, the valve is constructed with locking holes, allowing them to "lockout" the valve with their own padlock, to which they hold the only key. This practice is common with electrical panels but is becoming more popular as people realize the potential for harm with compressed air.



● **Figure 2.** The SMC VHS series is a pneumatic lockout valve. This 3-way, 2-position valve manually vents downstream air to atmosphere and provides a lockout feature for technicians.

Although not self-monitored like the DM² Series, indicator windows show personnel if the downstream port is connected to the supply or vented to the exhaust. To prevent accidental turning of the handle, it must first be pressed downward before turning, similar to a childproof prescription bottle.

The safety valve can be installed at every airline drop, at machine FRLs or even at receiver outlets, should safety be the top concern. With ports up to 1 in. diameter, a C_v over 8 provides more than 60 scfm- serious flow for the majority of applications.

The potential for injury exists in nearly every pneumatic machine, so safety must be taken seriously to prevent harm. Intelligent design must apply not only to cycle times and efficiency but also to the safe control of all functions. To this end, safety valves are absolutely essential. 

Ross Controls | rosscontrols.com

SMC | smcusa.com



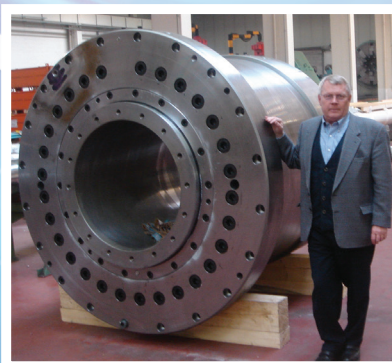
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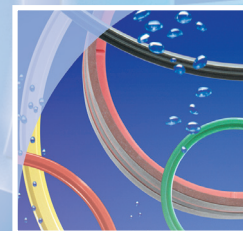


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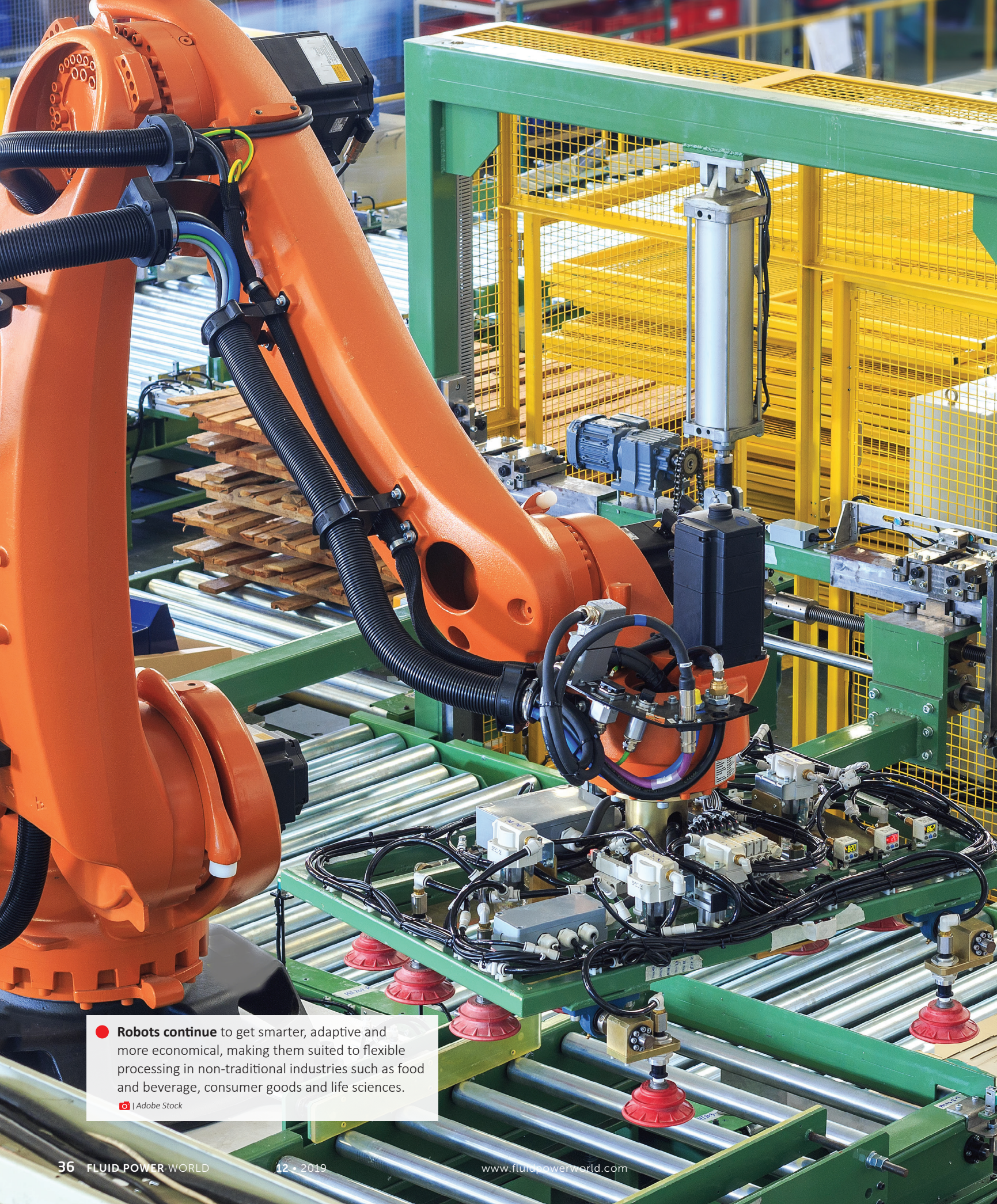
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● **Robots continue** to get smarter, adaptive and more economical, making them suited to flexible processing in non-traditional industries such as food and beverage, consumer goods and life sciences.

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ROBOTICS IS DRIVING A MANUFACTURING REVOLUTION

Robots of future will cost less, run safer, improve productivity and adapt their operations on the fly.

Donna Ritson • President, DDR Communications

I recently had the pleasure of collaborating with PMMI, The Association for Packaging and Processing Technologies, on a research study exploring the state of the robotics industry, its key markets, recent technology developments, and where the future lies.

Our project involved interviews with many interested parties that included robot builders, OEMs, technology providers and system integrators, processing and packaging professionals, academics and, of course, end users. Participants represented a variety of market sectors, from traditional heavy industries to manufacturers of pharmaceuticals and household products.

What did we learn? In brief, the robotics market is poised for a significant transformation, emerging beyond the automotive industry into new, non-traditional industries such as food and beverage, consumer goods, life sciences, electronics, and packaging. Here's a closer look at some of our findings.

Times are changing

Robotics is no longer just a tool on the plant floor. It is a force in the industry driving a revolution of change in manufacturing. We're now in the age of smart manufacturing, with advances such as the Industrial Internet of Things, artificial intelligence, augmented reality and machine learning. The explosion in e-commerce, and how it is changing the future of manufacturing, is a major driver.

A new culture and processes are pivotal when implementing smart manufacturing. According to our research, here are the top improvements users expect robots to achieve.

Reduce costs. The cost of robotics is going down, and some manufacturers say usage will likely double in the next 10 years. Robots and cobots are also filling the labor void. The absence of skilled workers is top-of-mind across the industry and will continue to drive the use of robotics to supplement and replace human labor. We constantly hear that labor is hard to find, and finding skilled labor is even harder. The trend is certainly driving an increased interest in robotics.

Improve safety. Workers doing repetitive tasks in a manufacturing operation could likely be taken over by a robot, and that will improve worker safety. And there are practical situations where it's just safer to rely on a robot, such as in many cutting, packing, picking and stacking applications.

Increase output and quality. Robots work tirelessly and don't need to stop for lunch breaks or shift changes. And they do the same thing all the time, exactly the same way. That can increase throughput and improve productivity, quality and consistency.

Enable flexible manufacturing. Users and consumers want more variety. We want convenience, quality, and we want six different sizes in one package. It's amazing what that does to the manufacturing mind when you must rely on shorter product runs. Especially with the emergence of AI and self-learning robots, this is creating a much more flexible manufacturing environment. The evolution of the Industrial Internet of Things, with devices being digital, connected, integrated, talking and learning together, is driving this as well. The declining cost of robots is encouraging that in the marketplace, as will 5G networking capabilities.

Technology advances

Robots continue to get smarter, more effective, and more integrated with the production line. Programming is getting easier — some people say not easy enough — but programming is certainly improving and not as complicated as it used to be.

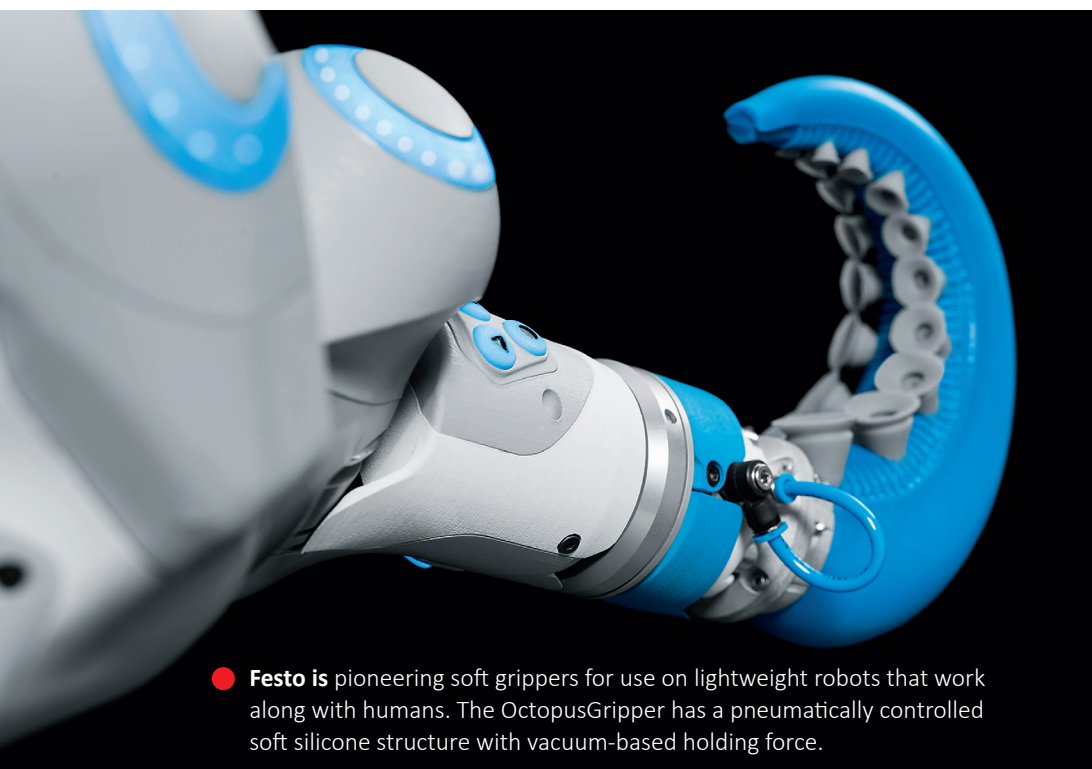
Smart robots equipped with advanced sensors feeding data to complex algorithms powering AI and machine learning will further improve work processes. AI is on the threshold of much wider adoption. As of last year, according to our research, only 11% of users have deployed artificial intelligence in their processing and packaging environment/equipment, so there's certainly a lot of room for growth. But many are embracing related concepts, as 32% report using digital twinning, a type of 3D modeling, and 40% of OEM engineering departments said they are using virtual simulation models.

Tooling is getting smarter, too. Incorporating an array of sensors, end-of-arm tooling (EOAT) now on the drawing board will communicate with a controller, learn from the feedback and make adaptive changes. It will have greater dexterity and agility, capable of performing a large number of tasks alongside human labor. And it will be more hygienic. Some EOAT has now been approved for direct food contact, so it's moving up the line, out of case packing and palletizing into actual food contact for pick-and-place applications.

Robots are also getting more perceptive. 3D vision and color cameras are able to recognize objects with greater precision and accuracy to perform repetitive tasks, freeing up humans for elevated responsibilities. Advanced software lets machines inspect, transfer and align products for much more consistent product quality across entire pick-and-place applications.

The advent of 5G network speeds means data-gathering is our future. With 5G wireless networks, the interaction of how data is transported and received at a robot becomes instantaneous, so systems can actually take corrective action in real-time. Establishing a comprehensive 5G wireless network will be a crucial step toward lights-out facilities.

That goes hand-in-hand with advances in AI capabilities that will pave the way for growth in autonomous robots. For instance, they'll be adaptive. Increasingly, robots aren't constrained to doing a single task but will be programmed to handle multiple functions. And they'll be capable of learning. If a process is inefficient they can, without human intervention, make changes on-the-fly to operate more efficiently.



● **Festo is** pioneering soft grippers for use on lightweight robots that work along with humans. The OctopusGripper has a pneumatically controlled soft silicone structure with vacuum-based holding force.

Pneumatics for future robotics

● **Piab's piSOFTGRIP robotic tooling** was developed especially for food industry automation. The vacuum-based soft gripper handles sensitive and lightweight objects with irregularly shaped geometries.

AI is also being used to advance EOAT self-changeovers. In the packaging and processing industries, production runs are getting shorter and downtime to reconfigure a line is costly. There is now the capability where a robot can understand what's coming down the line, change its own end-of-arm tooling to meet the immediate need, and then perform its task without missing a beat. These capabilities are remarkable in terms of increasing the speed of production, accuracy and quality.

Such machines will also have unified control systems. The number-one gripe from industry is the lack of a unified platform. Right now, the Open Industry 4.0 Alliance, a collaboration between OPC UA and TSN (OPC Foundation and CC-Link IE time-sensitive networking) are looking to bring greater device and system interoperability.

From a physical standpoint, many robots of the future will be smaller, and cobots are gaining acceptance. These downsized robots have gotten a lot of attention just because they're affordable (and are kind of cute), and are versatile enough to handle many different applications. They're moving into manufacturing areas targeted specifically for cobots' shorter movements, smaller products and interaction with humans. Newer versions will meet higher hygienic standards in the food and pharmaceutical industries.

We'll see more robots and cobots that are mobile: untethered and wireless, with 7th axis movements creating a flexible manufacturing environment. That's going to be interesting. If they're untethered and wireless, how will innovations in pneumatics keep up with an untethered robot? How will the air supply move with that robot to a different location in the plant?

And robots are going to be safer to operate around humans. The machines can learn tasks efficiently using AI to not only improve processes but to avoid collisions and reduce risk. Using this model, robots can be introduced almost anywhere.

For example, a robot will be aware if a worker walks into its space and will go into "safe modes" of slower speed, limited force and more controlled actions, but resume full performance when no humans are present. And sensors on workers' clothing let collaborative robots work side-by-side with humans and stop immediately if they make contact. End effectors might track human hands and identify safe distances with vision systems or reduce speeds and forces.

These are some examples of really interesting, game-changing technology. We know that Industry 4.0 is bringing a fully integrated collaborative system, and it's going to have real-time data response and analytics, and it's going to combine IT networks and systems, all coming together and working more cohesively. All of these innovations aren't typical of today's manufacturing facilities, quite yet. However, this technology will soon be available and become mainstream.

Robots are becoming more versatile,

adaptive and teachable. They're incorporating AI for self-learning servo drives that can adapt and correct machine conditions in real time, and setting new benchmarks for robot dexterity. Pneumatics needs to play a key role.

Certainly the Industrial Internet of Things is driving pneumatics, like other components and systems, to become more intelligent. Sensors are being added to pneumatic valves and actuators to provide more complete data about changes in device performance over time. The latest sensors designed to mount on cylinders, linear slides and grippers provide continuous position tracking and support fast and easy sensor maintenance or replacement.

Smart pneumatics can combine with a robot's vision and touch capabilities to accomplish machine learning, with systems capable of accurately locating and gripping an object, measuring force and adjusting counter-pressure with exacting precision. Pneumatic systems will be able to generate additional data points across production lines, gathering information such as diagnostics, usage statistics and lifetime data, and be invaluable in terms of robotics integration, interactiveness and communication across a manufacturing line.

The proliferation of the IIoT in general will increase the use of pneumatics due to robotics growth and a greater end-user focus on energy savings and operational efficiency. Pneumatics suppliers must ensure their products can communicate, exchange data and have smarter learning skills, and are ready to move seamlessly into this digital, transformative robotic world.

ROBOTICS

New opportunities

That said, where can we find opportunities for robotics? In this study, we looked at current robotics usage versus that in 2014. Some areas increased a little, some a lot. Overall, 88% of the companies surveyed are using robots somewhere on their manufacturing lines, and 26% of those companies were also using cobots. Areas of interest include:

Processing. Percent of companies using robotics and, in some cases, cobots in processing applications increased to 27% from 10%. Applications include cutting and shaping, dispensing, loading/unloading, sorting, cleaning, polishing and finishing. EOAT improvements for direct food contact are broadening the deployment of robots, and the upstream processing area is a target for cobots

Primary packaging use increased slightly to 53% from 44%. These are areas like pick-in-place, direct food contact, maneuvering a product into its primary package, as well as container loading, kit assembly and vision inspection.

Secondary packaging is where robotics really started, including carton loading, case packing and sealing, tray loading and variety packing/bundling. Use has jumped to 70% from 48% over the past five years. Such applications are moving towards smarter technology, often using pneumatics, controlling diverter gates on material handling and sorting systems; moving devices such as sealers and grippers on packaging machines; and controlling automated vision guided vehicles in warehousing. Cobot numbers at the end of the line are growing, and they're suited across the entire line.

Transport packaging. This involves building efficient pallet patterns, such as reducing palletizing time, minimizing carton gaps and increasing productivity and flexibility. Again, this is a significant area for robotics, now at 73% versus 66% in 2014.



This apple gripper picks fruit ready for market. It mounts on an intelligent robot platform that uses cameras and other sensors to detect the position and ripeness of the fruit as well as any obstacles, so it can navigate and harvest independently on farms and in greenhouses. The prototype gripper was developed by Festo for the EU's Clever Robots for Crops research project.

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Roadblocks to implementation

If robotics capabilities are quickly rising and costs are dropping, why isn't everyone adopting them? The top factor we see hindering greater robot implementation is justifying the investment cost with an acceptable ROI. ROI is typically expected in two years, but some companies realize the full return in less than one year. Variables used to justify ROI include lower labor costs, higher throughput, improved quality and reduced waste, fewer worker injuries, and measurable uptime.

Other obstacles to more-widespread use include lack of internal expertise, finding the right applications, the time required for installation and training, and overcoming skepticism.

Big companies have robots in all their facilities, and probably on every line. But the fact is small and medium-sized manufacturers, to keep pace, need to supplement manual processes with targeted robotics for greater flexibility and improved output. They need to create a manufacturing environment that is automated and robotic, particularly if prices are going down.

Nonetheless, a lack of expertise is a common denominator that challenges manufacturers. As the deployment of robotics continues across the plant floor, professionals with a tailored set of skills will be needed in the future to design, integrate, and maintain a fleet of robotics.

We've heard in our interviews that one of the biggest obstacles for manufacturers is the perception that, "I don't have the talent and the capability of installing robots." It takes time, and you have to do it right, so evaluate internal talent and partner with outside experts who can help put robotics in place. As an added benefit, it would help stimulate inventiveness and embrace the digital transformation coming to manufacturing.

Identifying the root cause of production losses is a way to start. Analyze bottlenecks and identify operational improvements that will have the biggest impact. Prioritize where it would make the most sense to add a robot or to add automation.

Cobots can be an entry point. Physically smaller robotics are gaining popularity as SMEs in particular show interest in utilizing flexible, intelligent robots to enhance their manufacturing processes, provide assistance to their human employees and alleviate labor shortages. More

cobot installations would be considered if cycle rates increased and users become more comfortable with the safety parameters of unguarded cobots.

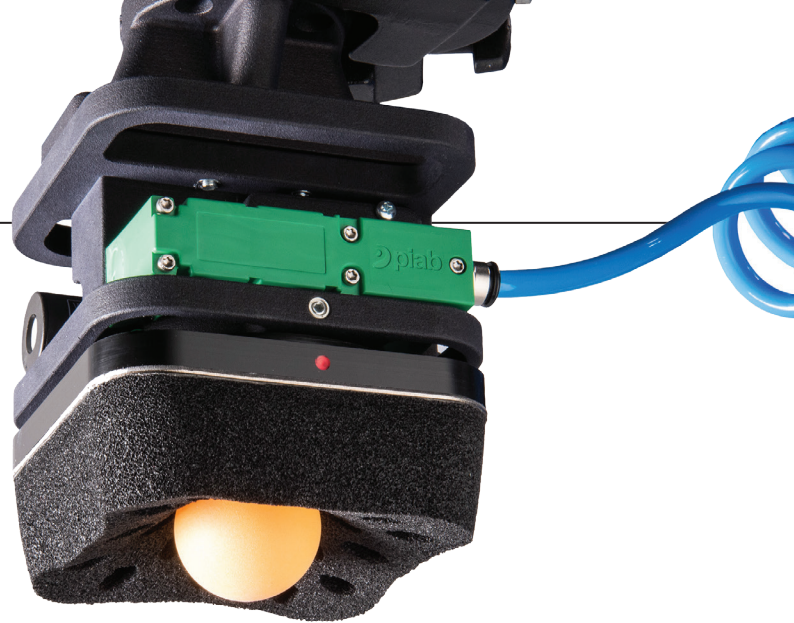
The majority of survey participants predict adoption of cobots will grow. But about a quarter felt cobots would be limited to niche applications, ideal for slower applications with a lighter payload — mainly for assembly and packaging. And 22% were hesitant or unsure. More development is needed, they indicated, to ensure human safety.

And there's still some skepticism. Do I really want to replace my workers with a robot? That can be a serious concern as many people fear robots will eliminate jobs. The fact is, more workers will be needed to run the robots.

Robotics is quickly transforming manufacturing. If you're considering adding robots, but are unsure and put off the decision for a year or two, you might miss the window of how quickly that could have advanced your manufacturing processes, and improved your competitive standing and the bottom line. 

DDR Communications
ddrcommunications.com

PMMI
pmmi.org



The Kenos KCS gripper developed by Piab enables a collaborative robot to flexibly handle various goods. It uses vacuum-ejection technology and technical foam to mold around and safely grip, lift and handle objects. Standard interface (ISO) adapters let the unit easily attach to most any commercial cobot.

Get a close-up look at robotics

PACK EXPO East 2020, scheduled for March 3 to 5 in Philadelphia, provides a great opportunity to explore robot technology and how it relates to packaging challenges. Produced by PMMI, the event will host 7,000 attendees and 400 exhibiting companies and offer a range of educational and networking opportunities. For more information, visit www.packexpoeast.com.

Hydraulics innovations *in concrete pump trucks*

Carl Dyke • CD Industrial Group, Inc.



● DY Concrete Pumps

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Hydraulics provide the load-holding strength, precision and predictability to keep complex concrete pumps operating smoothly and reliably.

If you've ever placed concrete using a wheelbarrow or a crane-hoisted skip, you'll understand why concrete pumps are an amazing invention. Concrete pumps can easily outpace the delivery from ready-mix trucks, emptying even the large, trailer-mounted ready mix drums in less than 5 minutes at full pump capacity!

Like a crane, concrete pumps have a boom and outriggers, but the similarities end there. Since the primary task of a concrete pump is placing concrete, a concrete pump must also excel at:

- safely reaching long distances, even in tight surroundings.
- reliably pumping a heavy, perishable product at low boom angles that a crane would never support.
- delivering the product evenly with minimal surging to protect the placement worker at the end hose from injury.

I recently visited DY Concrete Pumps in Calgary, Alberta, to get a firsthand look at the hydraulics and the innovative design solutions that make these jobs possible. I'd like to extend my gratitude to Darcy and the crew at DY who walked me through their pump designs and patiently answered questions so that I could bring *Fluid Power World* readers along.

A look at the plunger pump

Starting at the hopper, (where the concrete is added from the mixing truck), the concrete pumper employs a duplex plunger pump to draw in and discharge the product. Here in Alberta, we're used to seeing 3- and 5- cylinder plunger pumps on oilfield equipment, pushing thin cement mixes and proprietary solutions down-hole against high

pressures. The concrete pump, though, has an inverse purpose. Rather than working against high pressure, the concrete pump is more concerned with achieving high flow to place as much concrete as possible, as quickly as possible. Instead of the (relatively) short pistons in triplex and quintuplex plunger pumps, the dual plungers in the concrete pump measure as much as 8 ft long. In fact, they are so long that they must be mounted on an angle to fit between the vehicle chassis rails. Because of their size, concrete pumps are limited to a duplex pump; there simply isn't room between the rails for another cylinder. At the far end of the boom, this translates into manageable product flow surges as the pistons reciprocate.

The concrete pump utilizes a swivelling S-valve buried deep below the wet concrete in the hopper to feed and discharge the plungers. This design cleverly removes the need for an inlet manifold and check valves, which simplifies the overall mechanics and helps to speed cleanout tasks after a job.

Hydraulic systems with proportional directional control valves provide the smooth, multi-function boom motions required once a concrete pump truck is set up on-site. Hydraulic valves are also responsible for locking the machine solidly in place.

The plungers of the concrete pumping mechanism itself are operated by long hydraulic cylinders. It takes the most reliable of hydraulic pumps with accurate displacement controllers to move those cylinders smoothly throughout their entire stroke at the desired speed. It is the cylinder stroke speed that produces the production-critical concrete pumping rate.

Two large, closed-loop, hydrostatic pumps are connected in parallel for redundancy in order to reliably drive the two, 8-ft-long, single-rod cylinders that stroke the concrete pump plungers. The choice of a quick-response, swash-



● **Concrete pumps** use hydraulics for a vast array of complex operations, including on all these systems and components.

plate controlled, closed-loop piston pump removes pressure drop issues that can accompany a proportional, directional valve in a conventional open-loop system. The maximum displacement of the pump for each direction of flow is regulated by an external, electrically-controlled, proportional pressure valve. This valve can be adjusted by an operator as a means to set a desired rate of concrete pumping.

There are two main concrete pumping plungers being driven at the same time but in opposite directions. Driving single rod cylinders with closed loop pumps means having to account for the differential volumes between extend and retract.

Cylinders ensure even flow

Closed-loop pumps, commonly used with hydraulic motors, expect the same rate of flow to return to the pump as was sent out. When retracting a single rod cylinder with hydrostatic pump flow, the volume leaving the base end of the cylinder is much greater than the incoming cylinder-retract volume. But that's no problem, as the fluid volume leaving the base of one stroking cylinder during retract is exchanged directly to extend the other concrete pumping cylinder.

This means that base-flow-out on one cylinder becomes base-flow-in on the other cylinder. The closed-loop pump sends out flow only to the rod end of a cylinder, and receives return oil from the rod end only, of the other cylinder.

What if oil leaks across the pistons of the driving cylinders? The closed loop arrangement on the base ends of the cylinders seems very vulnerable to oil loss, which would lead to incomplete cylinder strokes. The designers have this covered! A clever arrangement of ports uncovered by the piston as one cylinder is driven to the retracted position allows for any needed make-up oil to be added via a check valve to the extend stroke of the opposing cylinder.

On the production end of this assembly, while one concrete plunger is drawing in a charge of wet concrete from the hopper, the other is discharging to the pipe that follows the boom and out to the operator's final placement hose. The S-valve's oscillations make this possible by alternately connecting each plunger either to the boom or to the hopper. This curvy piece of pipe is submerged in the wet concrete inside the hopper. A shaft protruding forward from the S-valve and outward from the hopper

Hopper	1
Agitator motor	2
S valve cylinders	3
S valve (not visible)	4
Discharge to boom manifold	5
Boom	6
Outlet	7
Cylinder with counterbalance valve	8
Swing motor	9
Outrigger cylinder	10
Pilot-operated check valve	11
Plunger pump	12
Hydrostatic pumps	13

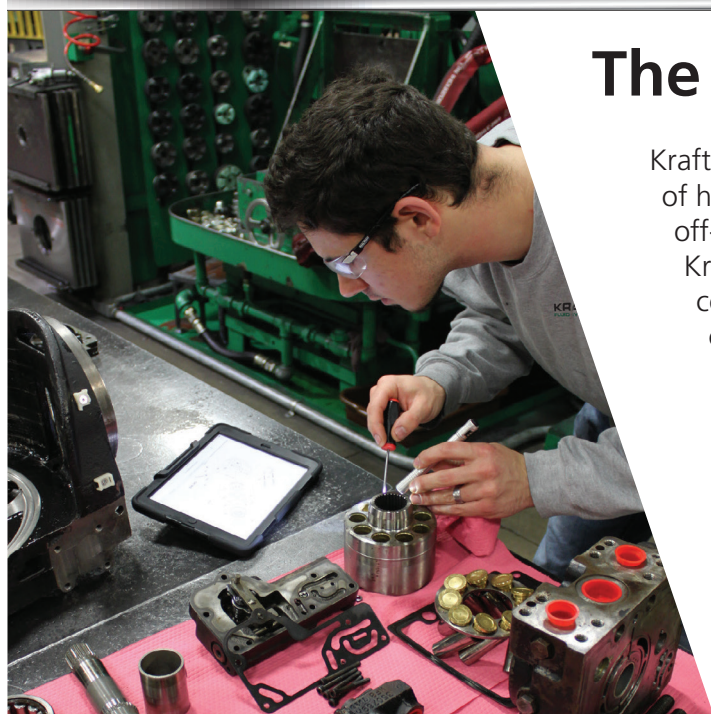
is connected to crank arms and driven by a pair of opposing single rod cylinders. This back-and-forth action of the S-valve as it slides along a wear-resistant spectacle plate is supported by exclusive flow from a heavy duty, pressure compensated, piston pump. Immediate flow and steady pressure to the base end of the S-valve cylinders is supported by a nitrogen pre-charged, bladder-style accumulator.

A closed-loop piston pump is driving the concrete pump plungers, yet an open-loop piston pump is providing the flow for the S-valve cylinders.

Getting the change in direction for the plungers coordinated with the change in position of the S-valve is a matter of timing via some shared valve pilot functions. Use of cleverly sized and tested damping orifices helps as well.

After a plunger discharge stroke is complete, and while the S-valve is changing over to line up with the other plunger, the static head of wet concrete in a raised boom can start to slip backwards against a fully extended plunger. The extended plunger would be momentarily unsupported against the force of this concrete, if not for an extra boost of hydraulic cylinder pressure

● **Outriggers plant** the concrete trucks securely to the ground, relying on telescopic cylinders for extension and pilot-operated check valves to keep the down-cylinders locked against the ground.



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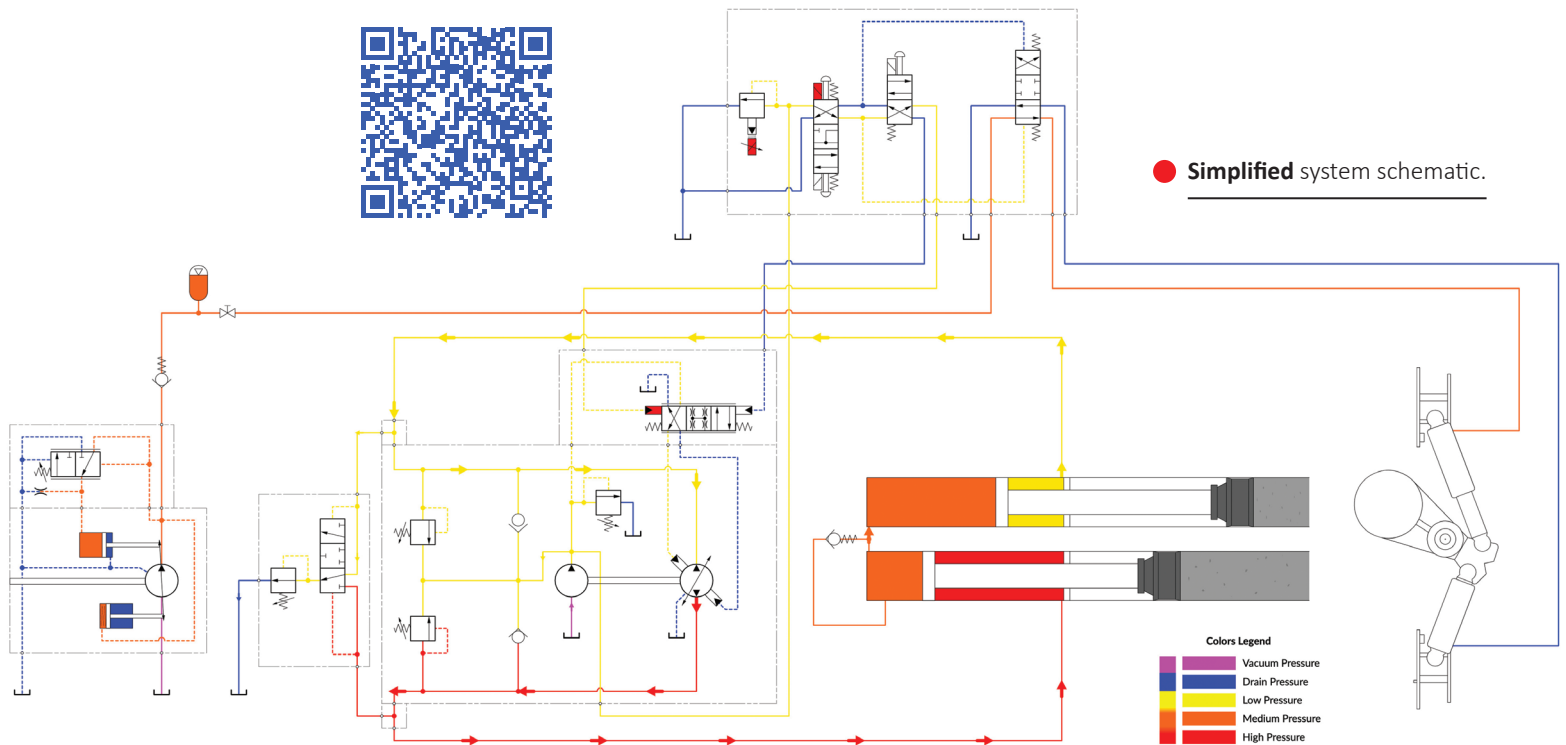
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to help hold it in place. This is the equivalent of a last “shove” from the closed-loop pump, before the swash plate reverses to power the alternate plunger.

At the end of a job, when it’s time for the operator to clean up, a sponge is drawn backwards through the boom piping. The concrete pump system is put in reverse and the cleaning sponge is sucked into the system from the end of the placing hose. A clever hydraulic valve reverses the closed-loop hydraulic pump’s swash plate control in relation to the S-valve position.

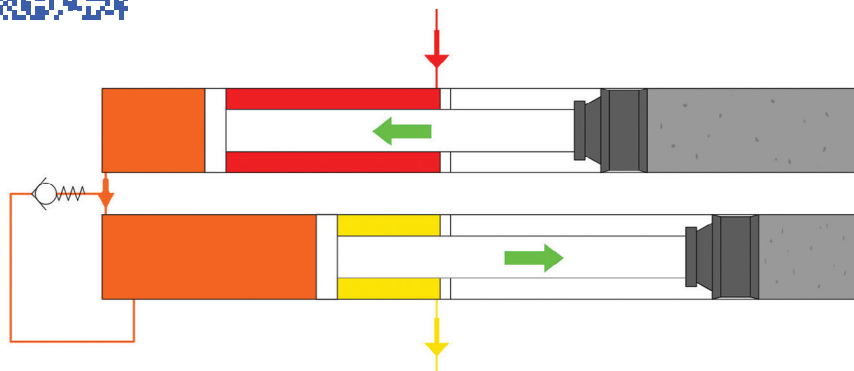
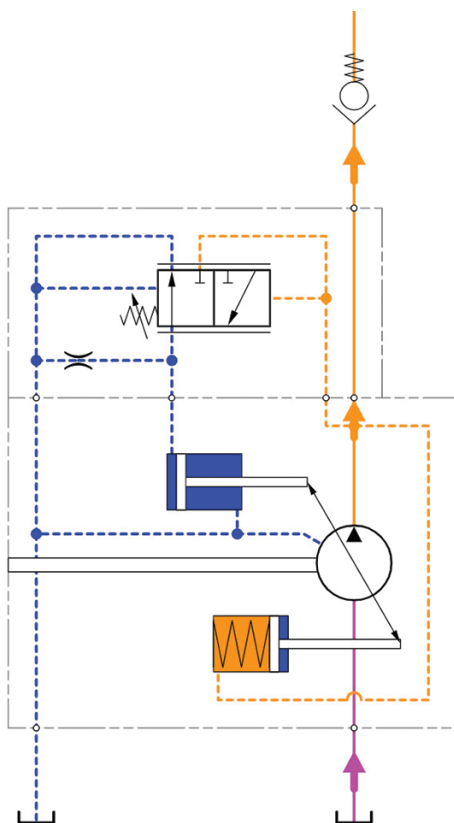
Secure and safe outriggers

Pumping concrete is the unit’s main job, and hydraulics help to get it done. But concrete placement only happens successfully if the truck is firmly planted on the ground. The boom may reach out 100 ft or more. To keep the unit from tipping, a set of outriggers reach out from the truck much further than on most cranes. These long-reach outriggers typically need telescopic cylinders to extend them and later to tuck them away.

High quality, pilot-operated check valves keep the down-cylinders locked against the ground.

The operator’s remote pendant gives them control of the pumping rate described earlier, and also fine control of the various sections of the boom as well as swing motion. A separate open-loop piston pump is configured with a load-sensing (flow compensated) controller, which limits the pump to a pressure margin just higher than the most demanding boom function. The pump flow path for this circuit is open loop (tank to tank), but the control of flow rate and pressure is closed-loop. The load sense shuttle valve network inside the electro-proportional valve bank sends the highest function pressure back to the pump compensator/controller to make continuous adjustments. Pre-pool compensators in each section of the valve bank help to keep flow steady to lighter loaded boom cylinders already in motion, as the pump up-strokes in response to a heavier loaded boom section. This well-designed and tuned system gives the operator the ability to make smooth motions with the boom to move the placement hose to where it is needed during a pour, without wasting extra energy.





● **Schematic shows** how retraction of one cylinder provides fluid to extend the other.

To the casual onlooker, a concrete pump might look like a crude machine that simply needs to extend a boom and provide a path for wet concrete from the ready-mix truck. This couldn't be farther from the truth; cement pumps require all the skills of crane operation, and extra difficulties! Multi-section booms, static concrete heads, and, of course, a perishable product all add extra complication to the job. The concrete pump must be completely reliable, not only in its ability to pump concrete, but also in the load-holding strength of the outriggers and the smoothness and predictability of boom motion, so that the operator can perform complex movements in tight job sites. My hat is off to the hydraulic system designers who build these incredible systems, and who continue to surprise us with ongoing innovations in concrete placement. 

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Look for changes at IFPE 2020

By Paul J. Heney, VP, Editorial Director

Expanded education options and a tweaked Tech Experience are just some of the new highlights for IFPE 2020 attendees.

Every three years, fluid power and mobile machinery users and manufacturers descend on the Las Vegas Convention Center as IFPE and CONEXPO-CON/AGG take over the city for five days. The next iteration of these events will take place from March 10-14, 2020, and changes are coming to the event.

The Las Vegas Convention Center is in the midst of a huge renovation, and that means that for this event, the Gold Lot will be unavailable. So, the CONEXPO-CON/AGG portion of the show is expanding its 2020 footprint to include the Las Vegas Festival Grounds, adjacent to the Circus Circus hotel. Organizers are calling this the connected campus, and there will be new and expanded transportation options — including more buses to help get attendees to and from the show.

Additionally, there will be more golf carts and Pedicabs to shuttle people around. Organizers are also offering more food outlets and other creature comforts to help enhance the attendee experience. The types of exhibits in the festival grounds

will include aerial equipment and cranes, including NCCCO's Lift Safety Zone; earth-moving; hauling; and underground construction. Exhibitors in the festival grounds include brands such as Caterpillar; JLG Industries; Manitou, North America; and Volvo Construction Equipment, North America.

In all, there will be 2,800 exhibiting companies and 2.6 million square feet of exhibit space. More than 400 exhibitors will be showcasing their latest products and innovations in the South Hall at the IFPE show. IFPE exhibits showcase the latest technologies and innovations in equipment, products and services for fluid power/motion control/power transmission. The show also features product-focused exhibit pavilions and international exhibit pavilions.

In 2017, the shows introduced a "tech experience" and accompanying exhibit dedicated solely to presenting new construction innovations and emerging technologies that will drive change and improvement across the construction industry. In 2020, that journey to the future of the construction industry will continue in a slightly different way.



“Never before have we witnessed the converging of so many technologies at once. Artificial intelligence, augmented reality, virtual reality, 3D printing, thousands of sensors all over the machines, all over the world and robotics. All of which will drive efficiency in our industry,” said Al Cervero, senior vice president of construction, mining and utility at AEM. “The main goals of the tech experience are to drive awareness and adoption of new technologies and innovations, engage and attract the next generation of attendees and position the show as a thought leader. The tech experience is focusing on three areas that will impact the future of the industry — modern mobility, sustainability, and sustainable building and smart cities.”

In 2017, there was a large focus on jobs of the future, where attendees could go to a kiosk, decide what your assets and attributes are and figure out what you could be, career-wise. But show organizers decided not to go back down that road in 2020.

“Our feeling is that as technology evolves, jobs may evolve, but there’s going to continue to be plenty of work out there for us,” he said. “I will tell you, one of the reasons we focused on that in 2017 is all the concern was about all these people losing their job because of autonomous call trucks and everything else. We’re finding more and more that there’s a different need, but there will still be a lot of jobs.”

And let’s not forget that IFPE is a whole show unto itself, and one that’s unique.

“Unlike its slightly larger co-located counterpart CONEXPO-CON/AGG, IFPE brings the products and the technology that goes well beyond just construction industry,” said John Rozum, IFPE show director. “IFPE gets into those who are manufacturing anything related to fluid power transmission or motion control. And those engineers that are designing equipment for construction, agriculture, aerospace, automotive — even amusement parks — they’re all coming to IFPE. For example, the same company that might be looking for a hydrostatic drive for a new loader may be sending two people to the show. One to shop

for those parts and another to look for factory automation solutions for the manufacturing line where that loader will be built.”

Education is still key

Education has always been an important part of both CONEXPO-CON/AGG and IFPE to help attendees not only survive, but thrive in a changing and global industry.

Attendees at the 2020 shows can take advantage of more than 180 education sessions packed with timely and actionable information, developed with the guidance of leading industry groups, and delivered by industry experts.

New for this iteration of the show are mix-and-match sessions between CONEXPO-CON/AGG and IFPE for company teams to cost-effectively obtain learning sessions targeted to their needs. Attendees will be able to pay one price and select education from both shows. Presenters for IFPE’s education sessions come from across the U.S. from distinguished universities as well as experts from manufacturers.

“The line-up of programming is not only larger than it has ever been but includes a fresh line-up of speakers stacked side-by-side with core programming that is always highly attended,” said Eileen Dickson, VP education, National Ready Mixed Concrete Association and CONEXPO-CON/AGG Education Committee chair.

CONEXPO-CON/AGG 2020 education features 10 tracks covering a variety of equipment applications, site development, fleet management, business best practices, technology, safety, and attracting and retaining talent.

IFPE education is grouped in two tracks: Hydraulics & Pneumatics at Work and The Business of Fluid Power. Its popular College Courses return, and new is an IFPE Research Symposium.

The IFPE College Courses emphasize hands-on technical knowledge on the effective use of hydraulics in mobile equipment. Content includes Fundamentals of Hydraulic Systems; Electro Hydrostatic Actuation; Safety Hydraulics; Best Practices for Modern Machinery; Hydraulics in the Digital Age; Hydraulic Fluid Properties, Efficiency and Contamination Control; and Digital Design.

The IFPE Research Symposium is hosted by IFPE co-owner National Fluid Power Association (NFPA) and runs during lunch (11:30 a.m. - 12:30 p.m.) on March 11-13. Sessions will showcase the latest fluid power research at U.S. universities being funded by the U.S. Department of Energy to improve energy efficiency of off-road vehicle hydraulic systems.

“We focused on developing education programs that offer attendees the latest ideas and innovations in fluid power technology, applications and research. Our classes and sessions deliver critical information for engineers and others involved in the design and manufacturing process,” said Eric Lanke, president/CEO, NFPA.



More than 180 education sessions will be presented at the co-located IFPE and CONEXPO-CON/AGG shows next March, where attendees can pay one price and select education sessions from both shows.



IFPE 2020 education includes the following highlighted sessions, among others:

- Additive Manufacturing – Vince Anewenter, Milwaukee School of Engineering
- Industry of the Future – Prasad Ganorkar, McKinsey & Company
- IoT – Sharing Data Across Customer Boundaries – Adam Livesay, Elevat-IoT
- Mobile Hydraulic Robotics – Autonomous Machines – Chris Woodard and John O’Neill, Danfoss
- Workforce Development – Lynn Beyer, NFPA

New networking opportunities

New this year will be IFPE’s Fluid Power Hour, presented by Bosch Rexroth, a networking reception for engineers and executives, right on the show floor. IFPE’s Fluid Power Hour will be held on March 11 from 4 to 6 p.m. on the IFPE show floor. The event includes a bonus hour on the IFPE show floor, complimentary hors d’oeuvres and cocktails and entertainment.

“We encourage all exhibitors to bring their top engineers and executives to take advantage of a great networking experience and interact with industry peers,” said Rozum.

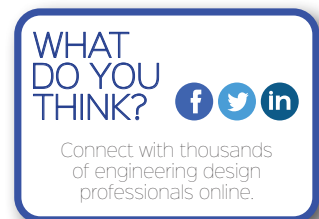
Early bird registration is currently available until January 17. Advance pricing is available from January 17 until March 9. Three passes are available for the event. The general pass at \$149 early bird, \$195 advance, or \$249 standard includes admission, show/hotel shuttle and three day Monorail pass. The All Access Pass at \$539 early bird, \$589 advance or \$639 standard includes the General Badge and a full education conference pass. Finally, the

All Access Plus Pass at \$739 early bird, \$789 advance, or \$839 standard, includes the All Access Pass plus a USB recording of education sessions.

Education passes can also be purchased separately for the following:

- Full Conference Pass: \$395
- Day Pass: \$195
- Single Session Pass: \$69
- IFPE College Courses: \$250 per course
- Post-Show USB (All Sessions Recording): \$300

Full descriptions of IFPE educational sessions will be included in *Fluid Power World’s* February coverage of the event. You can learn more and register online at www.conexpoconagg.com and www.ifpe.com.





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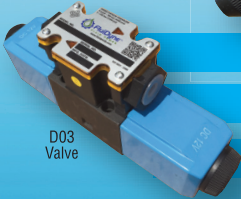


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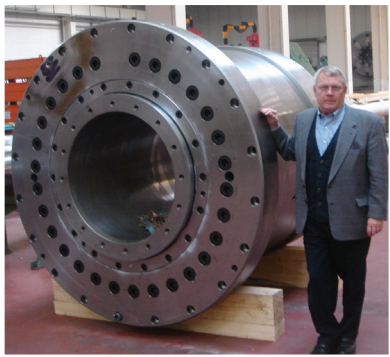
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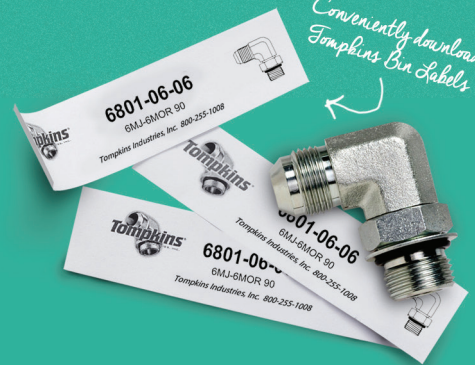


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A review of hydraulic fluids and contamination control

Edited by Mary C. Gannon, Editor

It's critical for equipment manufacturers

and the engineers they employ to possess a sound understanding of the composition of oils, the properties of lubricants, and how hydraulic fluids can impact machine performance.

With that fact in mind, IFPE 2020 will offer attendees an education session entitled "Hydraulic Fluid Properties, Efficiency and Contamination Control." The Association of Equipment Manufacturers (AEM) recently spoke with the session's presenter, Paul Michael, manager of Tribology Research at the Milwaukee School of Engineering (MSOE), to discuss hydraulic fluids, equipment, what attendees can expect him to share at IFPE 2020, and what key takeaways they'll get from participating in his education session.

AEM: You are scheduled to speak at the upcoming IFPE 2020 show in Las Vegas, on the topic of hydraulic fluid properties, efficiency and contamination control. Can you briefly outline the topic and what attendees of your session can expect to learn?

Paul Michael: I think it's important for both equipment manufacturers and end users to have a sound understanding of the fundamental principles by which hydraulic fluids function in a system.

There have been many upgrades in the quality of oils – in general – in the last two decades. Improvements in refining practices have led to the doubling of the life of oil. Oils are so much better now than before. Getting the maximum benefit out of a high-quality hydraulic fluid that has a great deal of longevity potential requires a good understanding of contamination control and filtration. It's also necessary to understand the sources of contamination in hydraulic systems, as well as their impacts on a system.

Many of the more advanced hydraulic machines that are used in the industry these days have very sophisticated filtration systems to help keep the fluid clean throughout the life of the fluid. This is beneficial in that it provides the opportunity to extend oil change intervals through the use of oil analysis and other condition-monitoring technologies.

In my presentation at IFPE 2020, I'll be talking about the fundamentals of hydraulic fluids, how they function, and their composition. I'll discuss some of the more advanced technologies and fluids – synthetic fluids, fire-resistant hydraulic fluids and biodegradable fluids. After talking about the nature of the fluids, and how to validate their performance through standard testing, I'll discuss contamination control, how to assess contamination level in terms of particle count, and present some case studies that look at the debris that's found in the hydraulic oil filters, in order to identify the root cause of machine problems.

Some of the advanced technologies that will be discussed include the use of multi-grade hydraulic fluids and how advanced surface-active chemistries can improve the low-speed efficiency of hydraulic motors and reduce leakage flows throughout the hydraulic system, which is important for controlling energy usage and maximizing the productivity of the equipment.

AEM: Do you feel there are any notable misconceptions related to hydraulic fluids that are especially prevalent in the industry today?

Paul Michael: I think one of the biggest misconceptions out there right now is it's a good idea to frequently change your oil. Often what happens when new oil is put into a hydraulic system, is that clean oil that has been circulated through a filter many times is replaced with marginal oil from a drum that has been filtered once at best. Several major original equipment manufacturers report that warranty claims spike after an oil change, so extending the oil change interval turns out to improve machine reliability.

AEM: Efficiency is always a point of emphasis for manufacturers as it relates to equipment today. However, when it comes to hydraulic fluid, what are some other ways in which equipment can be impacted?



Paul Michael, MSOE

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Paul Michael: There are two measures of efficiency that apply. One is energy efficiency, which is basically the amount of energy required per work cycle. The other is productivity, which is the time required per work cycle. Fluids can affect energy consumption and productivity. In off-highway machines, productivity is generally the higher priority and fuel use is secondary. Since reliability impacts productivity, equipment users want equipment that is reliable, low-maintenance and, when maintenance is required, they want it to be predictable. Because — and it almost goes without saying — unplanned downtime is very expensive.

AEM: As technology continues to evolve with time, and the fluids that go into equipment changes, what will the industry need to keep front-of-mind in order to ensure machinery operates efficiently and effectively?

Paul Michael: There's a trend towards using electrification in off-highway equipment and construction equipment to reduce emissions, noise and other concerns with heavy equipment. It turns out that the most expensive part of an electric machine is the battery. And in order to drive down the size and cost of the batteries used in those machines, you want to have the most efficient hydraulic system possible. Since the fluid can help maximize the hydraulic system efficiency, fluid optimization will play a role in driving future technology.

In most industries the value of clean hydraulic fluids is well recognized. And, as a result, modern hydraulic systems incorporate highly efficient filtration systems to purify the oil. It's been repeated many, many times over and over again that 75% of all hydraulic system problems are caused by contamination in the fluid. My experience is that's not accurate because of improvements in filtration practices. I would venture to say the No. 1 cause of "failures" in fluid power systems these days is leaks — leaky seals, leaky hoses, leaky

fittings. Seal performance is an area that is getting more attention in our laboratory these days.

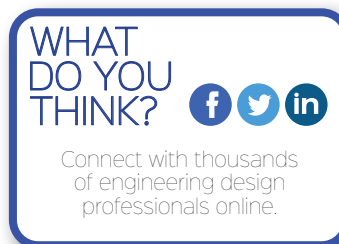
AEM: What knowledge do you want attendees of your session at IFPE 2020 to walk away with and be able to implement at their own companies?

Paul Michael: I would like attendees to come out of the presentation and become legitimate experts on fluid in their own organizations. My session covers a very broad landscape of hydraulic fluid properties, performance testing and maintenance requirements. And those in attendance can expect a very practical training program that provides a good understanding of the nature of the fluids, as well as how fluids impact system performance.

Learn More

Paul Michael, manager of Tribology Research at the Milwaukee School of Engineering, will conduct this education session entitled "Hydraulic Fluid Properties, Efficiency and Contamination Control" scheduled for Tuesday, March 10 from 8 a.m. to 12 p.m in West Gate Ballroom E-F. 

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- Vacuum pumps
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- Bulk feed trucks

Not only does the Hydraulic Conditioning Unit cool hydraulic oil, but it also stores and filters the oil as well. This feature eliminates the need for large reservoirs that store excess oil. This elimination allows the HCU35 to offer a considerable weight saving to the vehicle, which translates to better fuel efficiency.



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Upgraded crimper

Gates
gates.com

The GC20 with Gates Cortex Intelligence takes the guesswork out of hose assembly fabrication with touch-screen controls, on-board training, integrated eCrimp settings, and remote support. The patent-pending GC20 Cortex is a smart and versatile solution for operational efficiency in both the factory and the field.

The GC20 Cortex is a purposeful upgrade to the Gates Power Crimp 707 (PC707) crimper and, while it retains all of the former crimper's capabilities, this product features new technological advances designed to further safeguard crimper operations:

- **Onboard Training Content:** Easily and efficiently train new operators to confidently operate the GC20 Cortex and produce safe hydraulics assemblies with the addition of animations, videos, and PDF documents to guide the user through product functionality.
- **Integrated Crimp Information:** GC20 Cortex is three times faster than traditional PC707 when selecting crimp settings; crimp data for new products is available immediately; and it provides a quick and efficient way to select the right hose, coupling, and die combination.
- **Web-Enabled Updates:** Data updates automatically when connected to WiFi; off-line operations are also permitted for areas without WiFi.



Tubular hydraulic hose sleeve

Suburban Manufacturing Group
gosuburban.com



The new Diamondback tubular sleeve is part of the Python line of protective sleeves and covers. The sleeve material is pin hole protection tested to 4,000 psi and burst tested to 12,000 psi. Its ultra tight construction reduces oil spillage. Diamondback is constructed using a proprietary fiber, tightly woven, providing highly effective abrasion protection. The weave produces a very sleek finish allowing Diamondback to easily slide over hoses and hose ends without snagging. It meets operator "Line of Sight" specification EN982 norm 833 EN414, ISO Reg. 3457:2003 and is MSHA approved # IC-289/01. It offers excellent UV, chemical, and abrasion protection, and meets abrasion standards (ISO 6945 and ASTM D6770) tested to over 1 million cycles.



For further information about products on these pages visit the Fluid Power World website @ www.fluidpowerworld.com



New family of air preparation products

Bimba
bimba.com

AIROS family of air preparation products expands Bimba's air preparation catalog by adding a Premium series (PG) to the existing MG series of filters, regulators, lubricators, and accessories.

The PG series of compressed air filters, regulators, lubricators, and accessories offers:

Micro-fog lubricator options – Micro-fog lubricators create a fine mist of oil, which can travel longer, more complex circuit paths than traditional lubricants.

Vapor removal filter options - Vapor removal filters remove hydrocarbon odors from the air, providing filtration for ultra-sensitive applications.

Enhanced safety features - All bowls utilize dual locks to ensure the bowl is in the correct

position every time. Bayonet pressure locks make it nearly impossible to remove a bowl under pressure.

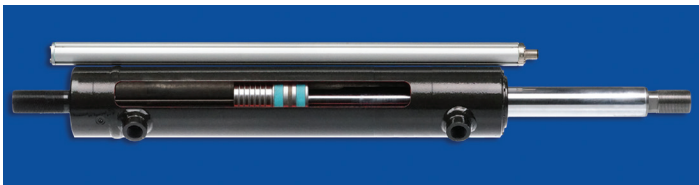
Easier maintenance - Filters employ a single complete element assembly that can be easily removed for replacement.

Compact footprint - The PG series is designed to fit in compact spaces while ensuring easy removal of components in that tight space, enabling a more compact machine design.

Configurability - Modular design allows for standalone or combined units to adapt to any pneumatic application's needs. Additionally, the metal bowl option with corrosion-resistant interior paints offers improved visibility and durability.

Sensor solution for hydraulic cylinders

ASM
asmsensors.com



This new sensor solution for hydraulic cylinders simplifies installation and maintenance. The posichron EasyMount is an absolute, non-contact, and wear-free linear position sensor system with measurement ranges up to 5,750 mm.

The core part of the sensor solution is a maintenance-free magnet fixed inside the cylinder. With this new magnet solution, the sensor itself is mounted on the outside of the hydraulic cylinder and not inside the cylinder, as is the case with commercially available solutions. No deep hole drilling is necessary for sensor installation. In case of maintenance or repair, the sensor is easily accessible from the outside. With this new design, hydraulic cylinders can now be equipped with displacement sensors much more cost-effectively. Small piston diameters with insufficient installation space can be equipped with sensors for the first time. Installation in synchronous cylinders is possible.

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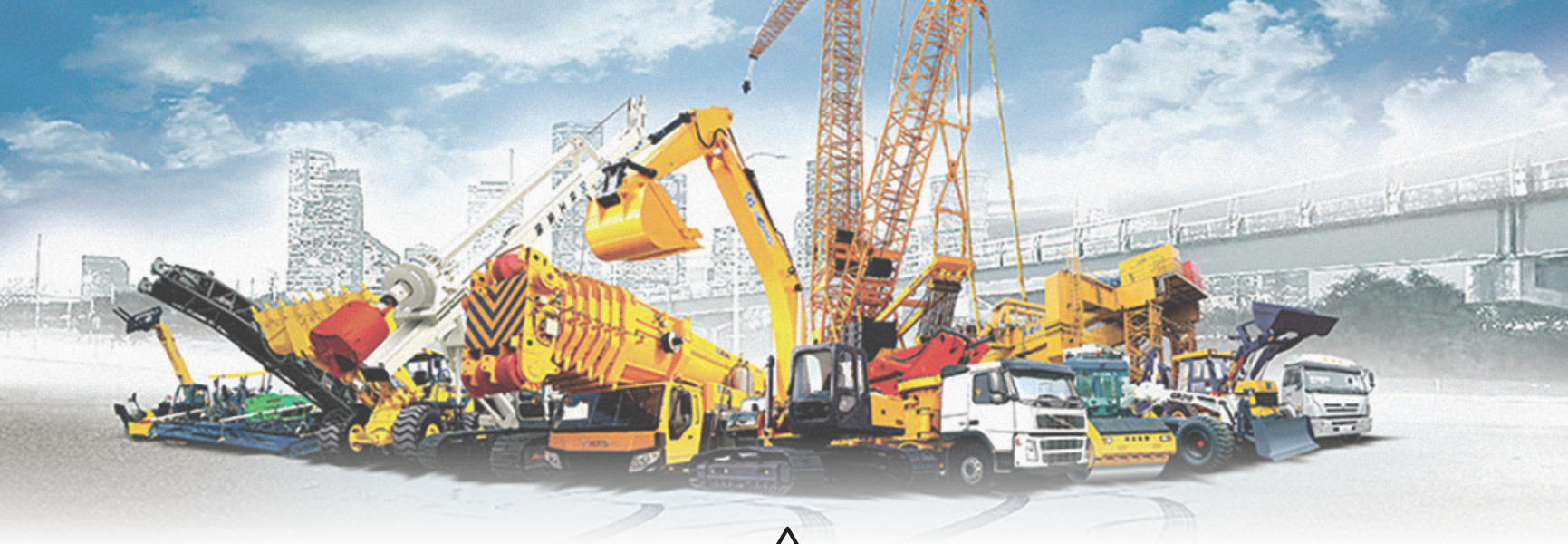
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- Monoblocks
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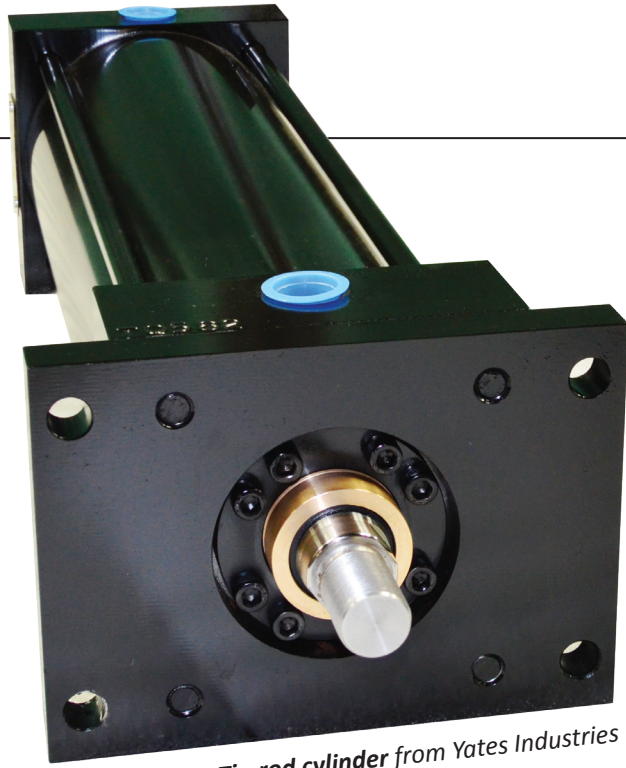
Browse through our webpage and look through our literature, factory video footage, extensive stock list, prices and other market information.



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Tie-rod cylinder from Yates Industries



Welded cylinder from Yates Industries

What is the difference between tie-rod and welded cylinders?

Although both types of cylinders are used in fluid power systems, the end caps used to hold the cylinder together make the difference. Welded cylinders are designed with each end cap welded to the barrel. Mounts and other fittings will also be welded to a cap. Static seals are used to seal the head or gland of a welded cylinder. These designs are permanent.

Tie-rod cylinders are held together by four or more threaded tie bolts that run the length of the entire cylinder tube. These bolts hold the baseplate and head together. Tie-rod cylinders are more common in the U.S. They usually feature static seals to prevent leakage between the barrel and end-cap interface.

Welded cylinders tend to be more complex but offer several advantages. They are typically more compact and usually can withstand higher pressures, often greater than 5,000 psi,

so are often used on mobile machinery where space is at a premium. They also are more durable, so thus are used in harsh environments where longer lifecycles are required, such as hydraulic presses, steel mills and offshore settings. These designs are also more easily customizable for each application. However, they are generally more difficult to repair.

Tie-rod cylinders are usually a bulkier design but are more often offered as standard series with short delivery times, so are more readily available. High-strength threaded steel rods are used, so most cylinders of this design are rated for no higher than 3,000 psi. These designs are most often used in plastics or machine tools for industrial use.

Tie-rod cylinders are typically built to NFPA standards so can be easily interchanged. They also offer the advantage of being easily disassembled and replaced in the field by using a standard wrench. 

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Max. Speed : 2800rpm



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: 11 - 100 cm³/rev
Max. Speed : 2800rpm



Model: VT6GCC

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Max. Disp. : 1.32 - 12.20 in³/rev
: 22 - 200 cm³/rev
Max. Speed : 2800rpm



Model: VT6CCM

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For more Information on above, please contact us.

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