Price Engineering said it has developed a new range of hydraulic reservoirs designed to be as much as 90% smaller and lighter than conventional hydraulic reservoirs. The Cyclone hydraulic reservoirs are engineered for mobile hydraulic systems up to 100 gpm.

BLOWING PAST CONVENTIONAL THINKING ABOUT RESERVOIRS

Price Engineering updates, expands Cyclone hydraulic reservoir product line; designed for up to 90% size reduction over conventional tanks

BY MIKE BREZONICK

While there has been a great deal of product development and technical advancement in mobile hydraulics over the last two decades — everything from electronic controls to ever more power-dense and high-pressure pumps and motors to hoses that can predict their own failure modes — the wave of innovation has appeared to bypass some component segments. Exhibit A might be hydraulic reservoirs.

Outside of the configuration of internal baffles and occasional changes in materials, hydraulic reservoirs haven't really changed much over the years and have essentially remained a developmental backwater within the mobile fluid power system.

That could be about to change.

Price Engineering, a fluid power and industrial products distributor based in Hartland, Wis., is launching an expanded range of reservoirs, branded Cyclone hydraulic reservoirs, which targets a broad range of mobile and stationary applications.

Engineered for systems up to 100 gpm, Cyclone hydraulic reservoirs are designed to be up to 90% smaller, and thus lighter, than conventional hydraulic reservoirs and are available in a range of sizes and flow rates (see related chart).

"We've actually been selling it over the last few years," said Dave Cerroni, chief sales and marketing officer at Price. "What we really did is technically advance it over the last year and a half, and we're at a point now where we're ready to go to market with a full line."

The original product is based on a patented design from Eaton Hydraulics. Price Engineering said it licensed the technology from Eaton eight years ago with an eye toward further developing and growing its capabilities and applications. That development reached critical mass when the company developed several patented and patent-pending features. That led to a new roto-molded plastic configuration, including new 20 and 40 gpm versions, which prompted the complete Cyclone launch.

"The premise under which it works hasn't changed," said Terry Glidden, managing director, Hydraulics at Price Engineering. "But the form factor has changed — how it's packaged, how it's put together, how it's manufactured. That's really what Price Engineering has brought to the table.

Price Engineering Cyclone Hydraulic Reservoirs

Model	10 gpm	20 gpm	20 gpm	40 gpm	40 gpm	60 gpm
Material	Nylon	Steel	Nylon	Steel	Nylon	Steel
Diameter (in.)	5.00	8.50	8.50	11.51	11.51	12.99
Height (in.)	11.93	14.94	15.43	17.26	16.875	21.38
Space Claim (cu.ft.)	0.136	0.49	0.51	1	1	1.64
Maximum Flow (gpm)	10	20	20	40	40	60
Minimum Flow (gpm)	5	10	10	20	20	30
Suction Head (psi)*	0.25	0.25	0.25	0.25	0.25	0.25
Make-up Volume (gal.)	0.18	0.7	0.63	1.3	1.11	2.7
Total Volume (gal.)	0.45	2	2	4.8	4.3	8
Dry Weight (lb.)	2.13	19.1	9.64	37	23.1	56.4

*At maximum flow
Custom sizes and shapes of Cylones available upon request.
Information from the manufacturer.

"Eaton has only one Cyclone reservoir. They gave Price Engineering a license agreement giving us the opportunity to expand on their technology as we saw fit. And that's what we've done."

All of the Cyclone reservoirs have a two-chamber configuration. The upper chamber serves primarily as a fluid storage area, and thus, according to Glidden, "the shape of the upper chamber is almost immaterial." This can provide a good deal of flexibility in terms of packaging, particularly concerning the nylon units, he said.

A cylindrical lower chamber incorporates suction and return ports. As fluid circulates through the hydraulic system during working operations, it enters the lower chamber, which imparts a high-speed rotational movement to the fluid by virtue of the shape and angle of the walls as well as the position of the port, Price Engineering said. The resulting cyclonic effect forces heavier, nonaerated fluid against the outside wall of the chamber where it exits via the suction port, the company said.

According to Price Engineering, aerated fluid, which is lighter because of the microscopic bubbles within it, moves to the center of the chamber. As the fluid moves inward, the microscopic bubbles coalesce into larger bubbles that pass through an opening at the center of the baffle separating the upper and lower chambers, the company said. From there, Price Engineering said the air is conducted into the space in the upper chamber above the stored fluid and ultimately into the atmosphere through a filler/breather cap.

"It works on the basis of cyclonic activity, which has been used for fluid clarity for about 100 years," said Bob Doll, senior application engineer at Price Engineering. "We essentially create a situation where centrifugal force is used to force air particles toward the middle. It's really a deaeration device that gets rid of the air in the oil, which is one of the most important things that reservoirs are supposed to do."

The process takes a matter of seconds, depending on the size of the reservoir. "Dwell time in a conventional reservoir for mobile application can run one minute or more," Doll said. "Dwell time in the Cyclone tank is about 3.6 seconds."

The Cyclone reservoirs are available in 10, 20, 40 and 60 gpm sizes, with the units also able to accommodate lower system flow rates.

"Each tank has an optimum flow rate at which it deaerates effectively," Glidden said. "But they all typically have a 2:1 turndown ratio — a 10 gpm Cyclone will deaerate effectively down to 5.0 gpm, etc.

"Below 5.0 gpm, the cyclonic activity is not very strong so it doesn't deaerate. Once the flow rate goes back up to more than 50% of the rated volumetric flow of the reservoir, it begins deaerating again."

The original Cyclone product licensed from Eaton was of three-piece nylon construction that was sonically welded together. Price Engineering built its second-generation units of steel and aluminum, but the newest versions are one-piece nylon. "We were approached by several OEMs (original equipment manufacturers) to come up with a less expensive version," Glidden said. "Steel could get rather costly due to the amount of welding involved. So we found a way to one-piece mold the design, and that is actually the crux of one of our patents."

The roto-molded units have been extensively tested to ensure their durability in off-highway applications, Glidden said. "One of the design metrics on the nylon tanks was that we had to make sure that they would not shake themselves apart in the mobile application," he said. "So they've all been designed to handle modal frequencies of 3600 rpm gas engines."

Doll said upgrade brackets were available that would ensure the nylon tanks could endure frequencies equivalent to those generated by 6000 rpm engines. "Because of our analysis, we know that the tank will be mounted on a machine and it will not come off if exposed to that kind of vibration," Doll said.

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A steel Cyclone hydraulic reservoir packaged on a Midwest General Repair live-bottom trailer. The 20 gpm unit is designed to be significantly smaller than a standard reservoir, which can be a benefit in space-constricted applications, Price Engineering said.

In developing the Cyclone reservoirs, Glidden said that Price Engineering had to overcome a number of preconceptions concerning reservoir functions. "There are three common thoughts about hydraulic tanks," he said. "Number one, it's a heat sink. Number two, it's a filter. And number three, it's just a convenient place to store oil. The last one is true. The prior two are false in today's modern hydraulic systems."

In terms of heat dissipation, Doll said testing indicates that the frequently imagined thermal benefits to conventional reservoirs are basically nonexistent.

"If you have a 20 gpm system, you require 13 or 15 hp of heat rejection — between about 25 and 30%," Doll said. "If you calculate what a conventional reservoir will provide, it equals about 0.5 hp, if that. So in reality, you're looking at a very small amount of heat being dissipated by the reservoir.

"The Cyclone reservoir will still dissipate heat, just not quite at the same rate as a conventional reservoir because there is not the same surface area. It will dissipate a quarter to a third of the heat that a conventional reservoir dissipates. But in the overall big picture, it doesn't matter because it's not nearly enough for any reasonable hydraulic system."

The fact that there is not significant heat dispersal is also an advantage in some instances, Doll said. "The weight savings and space claim are usually the things that people find attractive about these," he said. "But another advantage, especially when you get a larger hydraulic system, is that when some of these machines with large reservoirs start up, it takes time to heat the oil.

"In one example, I did a calculation showing it took 20 to 30 minutes to heat the oil sufficiently before the machine could start doing work. A Cyclone reservoir in this application would have done it in about four minutes.

"From the point of view of lost productivity, your operators go out and start a machine in the morning, wait for it to warm up and get ready to go. A Cyclone reservoir can do it in one-fifth the time."

The other notion that Price Engineering said it had to combat was the idea that reservoirs effectively serve a filtration function. Conventional wisdom is that fluid dwells in the tank long enough to allow particulates to settle to the bottom of the tank and entrained air to rise to the surface and dissipate.

"That whole sedimentation concept is a problem," Doll said. "If you do have sediment at the bottom of the tank, it can be jarred loose from shock and get sucked into the pump. This tank doesn't allow sediment to build — the velocity of the chamber is too high. Any particles that are there go back out and should be captured by the return filters."

The company said it often had to work through another preconception concerning how much fluid the reservoir should be able to hold. "The adage we've all been trained on is that hydraulic reservoirs, especially in industrial applications, should be three to five time the displacement of the pump," Glidden said. "If you had a 10 gpm pump, the reservoir should have 30 to 50 gal. of oil in the tank. We've all lost track of why that is, but it's probably because that's what Harry Vickers told us in 1960.

"Mobile equipment people have led the charge in reducing the size of the tank, and typically 1:1 is very common — a 10 gpm pump means a 10 gal. reservoir — but we've seen it as low as 0.5:1 — a 10 gpm pump and a 5.0 gal. tank. In some cases, the OEMs doing that haven't had any problems because they're likely intermittent-operation machines. They run for 15 minutes and then they stop for an hour. By that time, some of the air has precipitated out, the fluid has cooled and they're able to survive."

The Cyclone reservoirs reduce the volume of fluid even further, Price Engineering said. On a 20 gpm system, for example, the total volume of the Cyclone reservoir, including make-up oil, can be as little as 2.0 gal., the company said.

"If it's an all-motor circuit, you can theoretically get by with a very small amount," Doll said. "We design the tanks with a little bit of make-up volume. That's why, for example,

The Price Engineering Cyclone hydraulic reservoirs were developed from an Eaton Hydraulics design. Price has incorporated new patented features along with different materials and manufacturing processes.

if you look at the original Eaton 20 gpm tank and put it next to our 20 gpm tank, it looks a little bigger. That's intentional because we have a little extra oil in it so that it can handle a range of customers and accommodate some make-up volumes for things like cylinders."

According to Price Engineering, the only real limitation to the application of the Cyclone reservoir technology centers on the overall volume of fluid that might be required by a machine system. "There is a size over which the technology does not work," Glidden said. "It's not a factor of size or the material, it's more a factor of the application.

"There are certain applications that employ large cylinders, like a large hydraulic excavator with large cylinders that consume large volumes of oil. Those are not in our wheelhouse because we only have a finite amount of oil.

"Certainly up to 100 gpm — things like vibratory compactors, any kind of application that has a predominance of rotary actuators, hydraulic motors and so forth, with a moderate amount of cylinder activity — they would be fine."

The Cyclone hydraulic reservoirs will be available through Price Engineering and Solar Plastics, the Delano, Minn.-headquartered company that does the roto-molding for the new units.

"We know the hydraulics side, but when it comes to working with national OEMs, Solar already has a lot of relationships," Cerroni said. "They build a lot of plastic tanks and reservoirs for large OEMs of the world, so we're working with them to bring these products to market at a very high level." **dp**

diesel Weblink

www.cyclonehydraulics.com

PRODUCT PIPELINE

Electronic Controller

Murphy by Enovation Controls has introduced the PowerCore TEC-10 electronic controller, designed for industrial applications where cost and quality are key requirements as well as the need for auto-start or auto-throttling control, the company said. It joins the PowerCore MPC-10 and MPC-20 in the PowerCore controller line.

The TEC-10 — TEC stands for Turnkey Electronic Controller — is designed as a plug-and-play solution for use with a Murphy industrial harness. It supports J1939 CAN protocols for electronically governed engines as well as I/O in mechanical engines for fault and safety shutdowns.

The controller offers three levels of menu security that can be set with the free PowerVision for Controllers configuration tool, Enovation Controls said. It supports the latest Tier 4/Stage 4 engines as well as earlier engines. The TEC-10 is sealed to meet IP67 and carries CE approval.

www.fwmurphy.com

New CAN Keypads From HED

HED Inc. has released a new family of sealed CAN keypads. The new CL 613/614 keypads, part of the company's CANLink product range, are IP67 rated and designed to meet the harsh environment of off-highway applications, both inside and outside the cab, the company said.

The CL 613/614 keypads have rubber membrane pushbuttons and utilize metal actuation domes for long life exceeding 2 million actuations, HED said. They are offered in two standard form factors — two rows of four buttons or two rows of eight — and are available with a variety of LED colors for each button or indicator. The LEDs are dimmable, both as indicators and icon backlights, HED said, and icons are laser-etched and customizable or available off-the-shelf as circular white icons.

The CL 613/614 family provides one onboard input — digital STB — and one sinking output. The keypads communicate seamlessly through a single CAN port via J1939, CANopen or HED's CANLink protocol, the company said. Buttons can be programmed to flash codes for simple troubleshooting and warning indications, HED said.

www.hedonline.com