

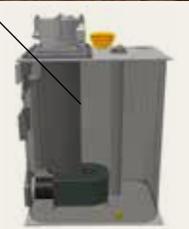
PMC cyclone reservoir

Saves space, money and the environment

pmcgroup™



Downsizing hydraulics – part of a winning concept page 7





Up to 90 % of the space (sometimes more) is left over when you replace a traditional hydraulic reservoir with the cyclone reservoir from PMC Group. Space that can be filled with new, competitive technology, or not be used at all – in that case, the compact reservoir reduces the total weight.

Much smaller, much better

Smaller and even better: industry is concentrating more and more on downsizing. The aim is to save resources, not least in the area of the environment. Demands for integration of new technology are also on the increase, often in order to comply with environmental laws and regulations.

A central part of hydraulic systems is the hydraulic reservoir. It fulfils a number of functions. One of the most important is to de-aerate the hydraulic fluid. Air (gas) in the fluid causes reduction in effect as well as cavitation (which can damage the hydraulic pump) and can contribute to the degeneration of the fluid.

The rule of thumb is that a stationary hydraulic reservoir is dimensioned for a volume of oil that is 3 to 4 times greater than the maximum pump flow. A mobile application, however, is made for a volume that is 1 to 2 times greater.

The larger the tank is in a hydraulic system, the more oil is spent, while increasing the weight and the requirement for space. A situation that is not in line with demands for downsizing.

However, the PMC Group have now created the necessary prerequisites for effective downsizing in the field of hydraulics.

Downsizing of hydraulic reservoirs – a cutting edge solution from the PMC Group

To meet the market's need for compact hydraulic reservoirs, the PMC Group have developed a reservoir based on cyclone technology. The size depends on the application but can be reduced by about 90% compared to traditional reservoirs.

Traditionally, a hydraulic system has ample oil and reservoir volume, allowing the oil to pass slowly through the reservoir and have time to de-aerate on its way to the pump and back into the system.

PMC's cyclone reservoir is based on technology that forces the de-aeration (degassing) of the oil, thus permitting a much more compact reservoir.

Advantages of the cyclone reservoir – some examples

- Less oil to fill and change
- Reduced environmental impact in case of leakage
- Compact – saves space and weight
- Positive suction pressure – reduces risk of damage to pump
- Robust – only one movable part in the reservoir – a spring
- Good accessibility – reliable due to robust construction
- Supplied together with all accessories
- Economical
- One purchase, one supplier contract, one article number
- Heats up more quickly in case of cold start, due to smaller volume of oil
- The oil is filtered more often

The heart of the cyclone reservoir in close-up

On inspecting the contents of the reservoir more closely, you find a cyclone insert. This is the heart of the construction, forcing the de-aeration, while the surrounding reservoir acts as a buffer for changes in volume. These occur due to variations in the flow and temperature. Traditionally, the maximum pump flow decides the size of the reservoir. But PMC's cyclone reservoir is dimensioned in accordance with the maximum return flow and the volume change that the reservoir has to handle.

The cyclone concept has been well tested over time. The first version was launched in 1999 with more than 35,000 having been supplied. The concept has been further developed into today's unique, patented, compact reservoir that is suitable for most hydraulic applications.

Using the cyclone principle to separate substances of different densities is an old, well known technique that had its main breakthrough in 1877 when Gustav de Laval launched the separator that separated cream from milk.

De-aeration 10 times more effective

Computer simulation has verified that hydraulic fluid (46 cSt) with 9% free air has already been de-aerated right down to 1–1.5% the first time the hydraulic fluid passes the cyclone insert. During simulation, the volume flow to pump was 650 l/min and the return flow to reservoir was 630 l/min. The difference is the quantity of oil (20 l/min) that is taken from the surrounding reservoir – a drainage flow that is not filtered. After only two passages through the cyclone insert, the air content of the hydraulic fluid going to the pump inlet is well under 1%.

Compared to a traditional reservoir, the de-aeration in the cyclone reservoir from PMC Group is about 10 times more effective.

An important innovation in PMC's new, compact cyclone reservoir is that it has a variable inlet. The advantage is that the velocity of the hydraulic fluid into the cyclone insert is constant and that de-aeration is therefore equally forced irrespective of flow.



In a cyclone insert, hydraulic fluid flows at high speed from the system's return line along the wall of the insert. In the resulting rotating airflow, the air is separated from the fluid due to its lower density. This insert is dimensioned for a return flow of up to 650 l/min. The size is approx. 250x130x185 mm. The insert is robust and of simple design – it does not have any moving parts other than a spring so is therefore very reliable.

Cross section of hydraulic reservoir with cyclone insert. Note that there are no baffle plates or nets etc in the reservoir. The return oil that passes the filter and cyclone insert undergoes forced de-aeration (see the computer simulation here).

Over-pressure benefits the pump

The significance of de-aeration (de-gassing) is an important issue that has been highlighted in Swedish trade press. Too much air can damage the pump's inlet and reduce efficiency.

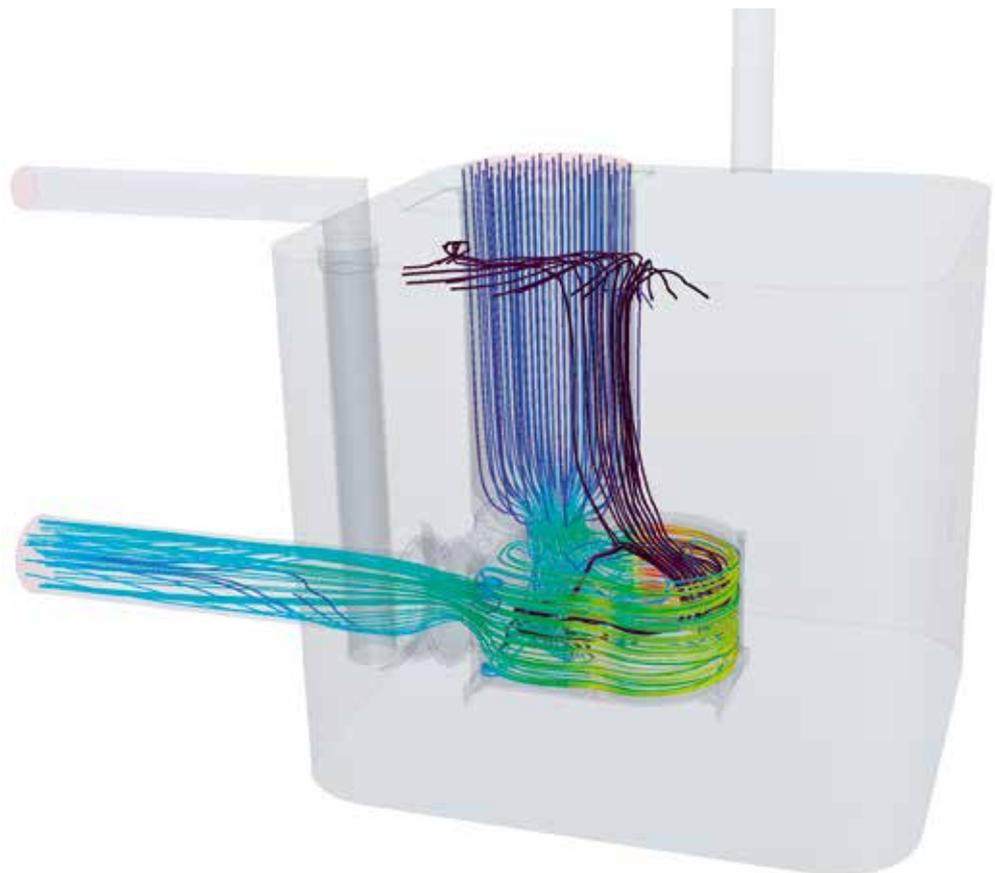
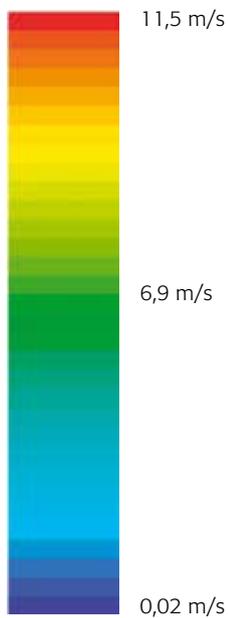
If under-pressure arises in the suction part of the pump, gases are released. This can cause cavitation and increase the risk of oil degeneration (the temperature can amount locally to 900°C on implosion). In both cases, there may be damage to the pump.

PMC's solution reduces this risk in that the oil is led directly from the cyclone reservoir to the pump's suction port with a small amount of over-pressure that decreases the release of air.

With a compact reservoir and a smaller amount of fluid, the introduction of air is also reduced since the surface of fluid exposed to air is less. There is less condensation too, as a result of the smaller reservoir volume.

The image shows computer simulation of the hydraulic fluid's route and speed through the reservoir. The dark blue lines show the aerated volume flow on the way to the cyclone insert. The black lines rising from the cyclone insert are the separated air that is released into the surrounding reservoir. The green and lighter blue lines show how the hydraulic fluid is de-aerated and continues to the pump.

Speed of the oil



Saves oil, space and weight

If an existing reservoir is reduced from 500 litres to 100 litres...

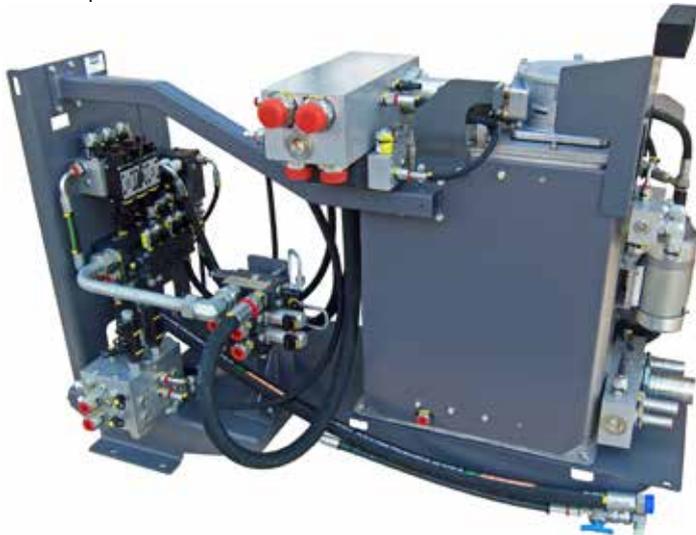
... the oil requirement decreases by 400 litres. At 2,5 €/litre, the saving is 1,000 € per refill + any cost for destruction of used oil.

... the weight is reduced by $400 \text{ dm}^3 \times 0.9 \text{ kg}$ (hydraulic fluid) and about 150 kg (reservoir), resulting in a total reduction of 500 kg.

... the weight reduction of 500 kg means a significant decrease in energy requirement for a vehicle. Or the weight equivalent can be used instead for useful load.

The cyclone reservoir, part of the PMC Group's offering

The cyclone reservoir is not supplied as a separate component but is an integrated part of the PMC Group's offering of hydraulic systems. The PMC Group has long, deep experience of working closely together with its customers. The goal is to develop and offer custom-made solutions in accordance with the customer's specific requirements, with the cyclone reservoir being just one part of the total solution.



Example of turnkey solution: a complete reservoir that has been mounted in a frame with valve blocks and hoses. In this case the hydraulic reservoir has been adapted to handle the customer's largest application (with a volume flow of 620 l/min) but it is compact enough to fit into the smallest application. The same hydraulic reservoir can thus be used in several different applications and does not need to be custom-made for each individual purpose.



No larger than this: PMC's compact cyclone reservoir can be seen in the middle of the opening. The image shows a pump aggregate mounted in a container. The reservoir holds just 120 litres but serves a system mounted with two 200 kW electric motors that each drive an Eaton Hydrokraft TVW-250. The transmission pumps each have an Eaton wing pump VMQ3525 as feed pumps and for supplying pilot oil. A Kawasaki K3VL80 is used as a working pump.

Award-winning drilling rig developed in cooperation with the PMC Group

The PMC Group worked in close partnership with Atlas Copco Rock Drills during development of a new hydraulic, pneumatic platform for overground rigs. The PMC Group supplies a number of hydraulic functions including the patented cyclone reservoir. The drilling rig normally requires a reservoir of about 400 litres. Atlas Copco's new system, with the cyclone reservoir from the PMC Group, only needs about 80 litres – a reservoir around 80 per cent smaller than a traditional one. Atlas Copco is unique in its field with this solution. Atlas Copco was awarded the Hydraulics and Pneumatics Prize 2011 for its new platform that reduces energy consumption by as much as 50 %.



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PMC Group is the Nordic region's leading provider of total solutions in the PMC segment – Power, Motion, Control. PMC Group has specialist competence in hydraulics, pneumatics, lubrication, electromechanics. The group develops, produces and sells both systems and components. The customers are mainly active in the Energy, Offshore & Marine, Industrial and Mobile systems areas.

Would you like more information about our hydraulic and lubrication systems? Visit our website www.pmcgroup.se

The logo for PMC Group, featuring the letters 'pmc' in a stylized, lowercase, blue font, followed by the word 'group' in a grey, lowercase, sans-serif font, with a trademark symbol (TM) to the right.

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