Cost of Ownership as the Central Driver in Power Pack design for the Fluid Power Industries.

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Global competition forces all of us to strictly control production costs. Investments in production equipment and **the ongoing cost of ownership** have a major impact on production costs. Maintenance plays a significant role in cost of ownership and so maintenance friendly designs and components are key to keeping costs under control.

Some real and spurious benefits of modern equipment

With more emphasis on maintenance requirements, modern technology allows maintenance friendly power pack designs. But there are some real and some spurious benefits:

Of real benefit is the standardised design of controllers and their standardised menu structure (based on VDMA recommendation 24574) which relieves maintenance crews from having to attend to different, brand-dependent operation modes. This makes not only for easier operation, but also allows for a reduced inventory of spare parts.

Microprocessor based electronics may tempt designers to select equipment offering a wide range of functions, but here again discipline is necessary to stay with the essentials for ease of maintenance. It is good to gain additional information from a controller - but does it really help to increase the systems performance and/ or efficiency?

Of doubtful benefit is the requirement for dirt clogging indicators on filters to provide an analogue 4-20mA signal. Will such a signal help to improve maintenance or the more efficient use of the filter elements? - The answer is no, because typically, the build up of a pressure loss (whether caused by differential pressure on in-line filters or back pressure on tank top return line filters) more or less exactly follows an exponential curve. Accumulated dirt causes pressure deviations to rise only very slowly. To the operator this means that there will be almost no changes to the signal for weeks or even months. The filter indication remains ‘static’, the information has no value, but the investment for this static signal is significantly high.

Against this background the components described in this article offer the opportunity to system designers to produce more competitive solutions.

Wasted money and time in fluid control systems is most typically due to poor accessibility to check points and filters as well as poor visibility of gauges and / or their scattered locations within the system.

Bühler Technologies made the first attempt to gradually change this situation by developing products with a greater integration of functions. It was our target to combine essential basic equipment such as breather filters, temperature gauges and liquid level controls in one installation unit, and in this way helping the power pack designers to produce better organised solutions. Bühler’s next step was to enhance these units with further essential items like oil sample points and standardised filling ports. And so our **Fluidcontrolterminal** was born and has increasingly found due recognition. It has become the standard solution in many applications. Maintenance professionals realised very quickly its advantages and specify it in their system requirements.

Within the system

Today’s pressure controls are mainly designed for on the spot use and display. When it comes to complex systems where a central arrangement of displays is required, these pressure controls become very expensive because they must be piped or hosed up from the sample point to the position where the controls are installed.

Bühler's **Pressotronic** offers a much more advanced solution. It can act as the traditional on the spot display and control, or as an ingenious simple rail installation where controller and transducer are separated and connected by simple cable. This is a real step forward, reducing installation cost, improving visibility and so increase operational safety.

The **Multitronic** is based on the same technology and allows the remote installation of different transducers and the central installation of the controllers. Whether they display and control pressure, temperature or volume, the controllers provide the same operational mode and just need to be set to the desired standard and programmed to the required set values.

Around the reservoir

The contemporary state of reservoir design almost always includes a breather/ filler strainer, a tank top return line filter and a sight glass for visual control of liquid level. By observing operational details like the initial charging of the tank with oil, we can observe outdated practices like the time consuming filling of 100 litres of oil through the breather cap using just a can. It is only with a bit of luck that the breather is located at the easily accessible front corner, but in many cases it is located on the opposite side. Even if filling is done by a pump in a fairly professional manner oil spills are very likely due to the delay between the visual observation of replenishment and pump shut off.

During operation, when it comes to oil care, it is another challenge to draw suitable oil samples from the tank that truly represent the actual oil condition. In many cases one must dig through accumulations of dirt on the tank cover to get to the breather, with the likelihood of dirt dropping into the oil when removing the filler strainer to get access to the fluid. Unsuitable syringes and tools add particulates to the oil, consequently leading to severely distorted and even irrelevant readings.

The **Multiterminal** is a real 'problem solver' for this type of application. It features tank top return line filters in sizes that allow the employment of this solution for systems with up to 150 litres tank volume. The very compact design integrates the return filter and the breather filter with the most common 73 mm standard flange. The filter housing accommodates the filter element, the filling port and the capacity (filter clogging) indicator as well as sample ports for taking oil samples from both the return flow and the tank. The filling port can come with a cartridge type shut off valve as an option. This valve is controlled directly by the level switch via an electric closed loop and shuts off the filling channel after the maximum liquid level has been reached. With the integration of a level/ temperature controller from the Nivovent series, the functions of breather, liquid level and temperature control are added. Various options allow just level and temperature switches or combinations of continuous controls, even with digital temperature display. A visual capacity (clogging) indicator to control the breather element is an available option.

The **VSA** 'intelligent' capacity (filter clogging) indicator opens up a new avenue in filter element monitoring. Traditionally, the dirt holding capacity of the filter element is not monitored pro-actively. But with the **VSA,** if the capacity is full, a visual or electrical signal is generated for the operator to change the filter element. The electrical signal is normally initiated by a si mple pressure switch which is preset to either a certain pressure increase (tank top return line filters) or a pressure loss (delta P for inline filters). Since oil

changes its viscosity depending on its temperature, simpler devices are frequently misled by viscosity induced pressure variations rather than fully clogged filter elements. The new **VSA** capacity indicator stays inactive until the fluid has reached a certain operating temperature, and so eliminates a false indication during cold start. A corona of green, yellow and red LED's signal the actual status whilst self locking electrical outputs transmit the status of the remaining dirt holding capacity to the main controls. Since the signals are generated electronically, and designed with pre-warning, the signal pressure settings can be increased, giving filter elements a longer life span. With the pre warning signal settings the element change can be planned pro-actively **without an abrupt and unplanned machine shut down**.

For larger sized systems or where there is a demand for larger sized return filters, the standard **Fluidcontrolterminal** mentioned before is still the best choice. It offers basically all the above mentioned functions. Typically it will be combined with a separate return line filter of appropriate size. An integrated automatic filling device is also available as an option.

Although it is common understanding that better controls can help to simplify maintenance, it is amazing to see how much ignorance still rules system design. It is considered more important to prevent the pump from running dry than to prevent a massive spill of oil in the case of a major leakage. It is even more amazing to see how many systems are still designed without any electrical control at all, trusting that the operator's eyes are constantly everywhere! Modern technologies, like programmable electrical controls as in the XP versions of the **Nivotemp** or **Nivovent** series, are very cost effective. They allow the standardising on one single type, but still allowing the opportunity to adjust the contact position and function to the individual needs of the application. Pro-active leakage control is possible without an extraordinary high budget. Programmable frequency out puts of level and temperature allow very cost effective continuous monitoring without the need for analogue signals or ac/dc converters. For traditional applications where a series of sight glasses are preferred we offer the **NS-AM 1**, manufactured to the robust quality of all Bühler products.

There is an increasing demand for a fairly precise stabilisation of a fluid's operating temperature and it is clear that heat dissipated by radiation alone is not sufficient to answer this demand. If radiation alone is used as the state of the art, the surface area of the reservoir must be balanced accordingly. This means in reality that the system oil volume must be significantly larger than effectively required. A much better answer is to design the system based on the oil volume required and dissipate the heat using a cooler. Depending on the local availability or preferences, the cooler could either use water or ambient air as its cooling agent. In all cases, the sizing of the cooler must be as precise as possible - more than 70% of all coolers in use are wrongly sized - over sizing will cost money, either through too much water consumption or physical dimensions cause unnecessary space consumption. Leading on from the sizing problem, the required maintenance is either completely neglected, underestimated or costly preventive arrangements are made. Bühler offer a range of cooling options that can be tailored to specific circumstances of the system covered by two main product types:

- In the fluid power industry the contemporary state of the art of oil/ water coolers are braced plate coolers. With the help of fairly accurate calculation programs for sizing we can optimize either the size or the water consumption to whatever parameter is more important to the individual application. Provided cooler needs are correctly calculated and sized, the precipitation of particulates, dirt or scale is almost negligible thanks to smooth surface interfaces and the turbulent flow of both water and oil.

  For this option the Bühler **BWT** type coolers can be combined with the **BNF** off line filter units. These filter loops provide very compact physical dimensions and can therefore

easily be installed directly on the tank top, which again results in a very cost effectively designed solution with good accessibility.

- For applications where ambient air is preferred as the cooling agent, the **BLK** and **BNK** types are the state of the art.

  Instead of using tube and fin matrixes, these types employ rugged industrial type braced matrixes. The advantage of this design is good heat dissipation per square inch of surface area and a very limited tendency to agglomerate dirt from the ambient air stream on the fins.

  The actual Bühler fin design uses unperforated, fairly smoothly profiled fins. This guarantees high heat dissipation on one side and an almost free particulate flow on the other. There is no need for louvers and filters which seriously hampers the performance of the cooler matrixes in a completely unpredictable manner and usually leads to over sizing and extra maintenance costs.

  Even for harsh environments a more open fin design rather than filter mats is preferred.

  Since air blast cooler matrixes will inevitably catch some dirt, it is important that they are very easy accessible and cleanable. The Bühler design therefore allows dismantling the matrixes within minutes leaving all other major components in place.

  With the **BNK** series we offer the compact integration of a circulation pump with a filter option. In many cases these units allow a more favoured system design, because they deliver a predictable cooling performance, compared with return line coolers which never see a constant flow and thus have problems delivering a reliable temperature control range.

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