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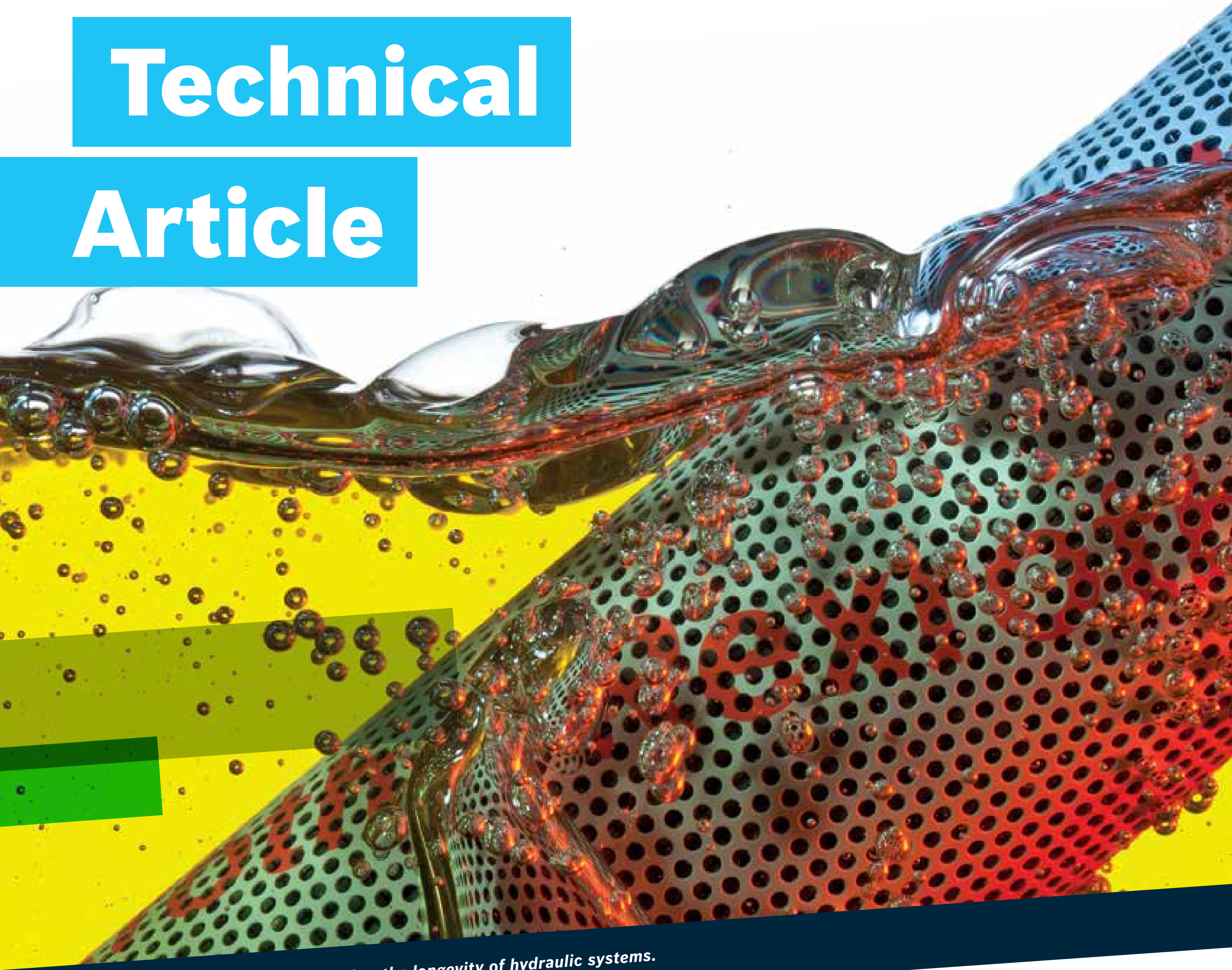
Technical Article



Selecting the right filter is essential to the longevity of hydraulic systems.

Five Must-Knows for Successful Hydraulic Filter Sizing

Proper filtration is essential to the longevity of hydraulic systems. But, selecting the right filter for the job isn't a cut-and-dry task. Every industry, component and machine brings its own set of requirements, each influencing the other, eventually making its way to affect the seemingly simple filter element. Before setting yourself up for unintentional higher operating costs, here are five crucial pieces of information to know before sizing and selecting a filter.

Key Insights & Considerations

- **Understand the performance requirements of your application.**
- **The hydraulic components installed in the circuit directly affect your filter choice.**
- **Fluid viscosity has a significant impact on filter sizing.**
- **Create an appropriate target for a clean pressure drop during the sizing process.**
- **Know your maximum flow rate before choosing and sizing a filter.**

1. Know your application

Let's start broad. First and foremost, understand the performance requirements of your application. When it comes to accurately sizing a filter, these performance requirements are often expressed in terms of Beta ratio, which is simply the ratio of particles entering the filter versus exiting the filter. Beta ratios can also be expressed in terms of percentage efficiency. For example, take an application requiring a high-performance element. This type of application will often have a Beta ratio exceeding 1000, where 1000 particles will enter the filter but only one particle will make it through. Element performance in this scenario would be expressed in terms of a 99.9% efficiency. A reputable filter manufacturer will have documentation defining their element performance by the element's micron rating. But, having a strong understanding of the application's performance requirements empowers you to enter the filter sizing and search stage equipped for success.

2. Know your hydraulics

Once you've established the performance requirement of the application, it's time to evaluate the hydraulic system. The hydraulic components installed in the circuit directly affect the type of hydraulic filter needed to function according to industry standards. This criterion drives an ISO-cleanliness code requirement that helps dictate the proper filter element type. As an example, a proportional valve in the circuit might require a 20/18/15 ISO-cleanliness code. To meet the standard set by the ISO code, this circuit requires a filter with either three-or-six-micron absolute filtration. Or, perhaps there is just a gear pump and directional control valve in the circuit. Because there are no high-performance valves in the circuit, a more course, lower performance filtration option, such as paper or wire mesh nominal filtration, could be a suitable option. Knowing what hydraulic components will accompany the filter and understanding how they impact filter performance requirements can save unnecessary costs in the long run.

3. Know your viscosity

A variable that is often underestimated when selecting a filter is fluid viscosity. In reality, it has a significant impact on filter sizing. Fluid viscosity is seldom considered in the early stages of the filter-sizing process and as a result, causes unnecessarily high operating costs nationwide. Misunderstanding the importance of knowing your fluid viscosity can

A) Oversizing filters is a commonly-used practice to ensure the highest amount of protection but results in higher costs to the circuit. systems.
B) The hydraulic components installed in the circuit drives an ISO-cleanliness code requirement that helps dictate the proper filter element type.

lead to under sizing the filter, high-pressure drop and premature tripping of the clogging indicator. Conversely, oversizing the filter can contribute to increased costs, a larger footprint and higher replacement costs. Users should understand their hydraulic system enough to estimate the normal temperature range so that the most accurate minimum temperature is selected for sizing purposes. Properly selecting the correct operating temperature range will ensure that the filter doesn't prematurely go into bypass mode and will avoid oversizing and higher costs of a larger filter.

4. Know your clogging indicator

Assuming your filter has a clogging indicator, whether analog or digital, users should create an appropriate target for a clean pressure drop during the sizing process. Generally, clogging indicators range between 1-8 bar. As a rough rule of thumb, the ratio of the clogging indicator setting to the clean pressure drop should be a minimum of 3-to-1. Example: if the filter has a 5-bar optical clogging indicator. Based on our ratio, the highest acceptable clean pressure drop target would be approximately 1.7 bar. By not understanding the impact of this principle, users are at risk of sizing their filters incorrectly, whether too large or too small. While oversizing filters is a commonly-used practice to ensure the highest amount of protection, the consequence is that it adds higher costs to the circuit.

5. Know your flow rate

Last, but certainly not least, the flow rate is an important factor when sizing filters. We recommend that the maximum flow rate should be considered in this measurement and users should understand that some circuit designs can have instantaneous flows higher than just the pump flow. A good example of this principle would be an accumulator circuit where the accumulator stores pressurized volume and then releases it to the system upon demand, therefore supplementing pump flow. The flow rate through a

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pressure filter immediately downstream of the accumulator should take this supplemented flow into account.

Clean pressure drop through a filter element will be a direct consequence of the fluid flow rate and underestimating the amount of flow through the filter can result in a higher pressure drop and the risk of under sizing the filter for the application.

Correctly sizing a hydraulic filter not only saves money, it increases the life of the hydraulic system. Outside of the top five factors explained, there are even more variables that can be considered to make an educated choice. When faced with this task, utilize the expertise of a partner like Bosch Rexroth to guide you through the process. In an effort to make the task less overwhelming, Rexroth developed a **free online tool** called **Filter Select**. Simply open the application, enter the necessary information as guided by the tool and let Rexroth make the recommendations. Filter sizing is crucial but it does not have to be overwhelming. Determine these must-knows and you are well on the way to filter success.

***Rexroth's Filter Select tool** can be used to quickly determine the best filter and provide Rexroth part numbers, model codes, pressure drop curves, dirt holding capacities, spare parts and related components.*

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