



Automatic filtration and maintenance of engine lubricating oil in diesel locomotives



Strong partners offer perfect solutions

Reliable maintenance of lubricating oil quality

Lubricating oil is imperative for the correct function of an engine. It forms a separating oil film between adjacent moving parts to prevent their direct contact, decrease friction-induced heat and reduce wear. Therefore it protects the engine.

One of the most important characteristics of lubricating oil is its viscosity. This has to be high enough to maintain the lubricating oil film and low enough to enable the flow of oil around the engine.

During engine operation the characteristics of the oil change. Soot particles generated in the combustion process, contaminate the oil along with small metallic particles caused by mechanical abrasion. These contaminants increase the viscosity of the oil and as a result the oil can no longer completely carry out its protective function. This leads to increased fuel consumption, a loss of engine performance and increased wear or damage to engine components.

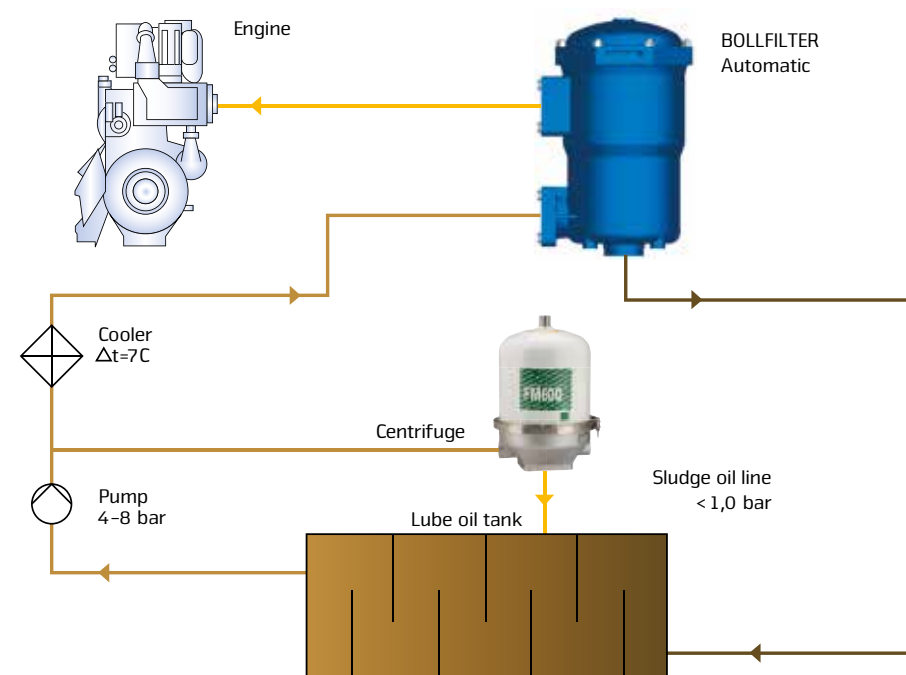
In order to exclude these risks, the lubricating oil has to be effectively treated. The focus of the treatment is the maintenance of the oil quality and protection of the engine which are two equally important requirements.



Lubricating oil care and filtration – separate processes perfectly combined

In terms of reliability and economic considerations, the most efficient and reliable method of treating lubricating oil is represented by the combination of oil care achieved by an oil centrifuge and oil filtration realised with an automatic back flushing filter. In this process the BOLLFILTER Automatic is fitted in the main flow with the task of filtering the oil which serves to lubricate all moving parts of the engine. The filter has to ensure a defined purity level of the lubricating oil at high flow rates and through low pressure drop maintain a constant operating pressure to enable uninterrupted engine operation. While the back flushing system is protecting the engine the centrifuge is continuously caring for the oil to extend its life. The separation of a full range of particles including soot or metal particles which are not retained by the filter is undertaken by the MANN+HUMMEL oil centrifuge fitted in the bypass flow. The centrifuge receives up to 10% of the pumped oil and after cleaning the oil is returned directly back into the lubricating oil tank. The centrifuge separates the dirt through exploitation of the difference in density between the dirt and the oil. As a result, there are no restrictions regarding the size of the particles to be separated.

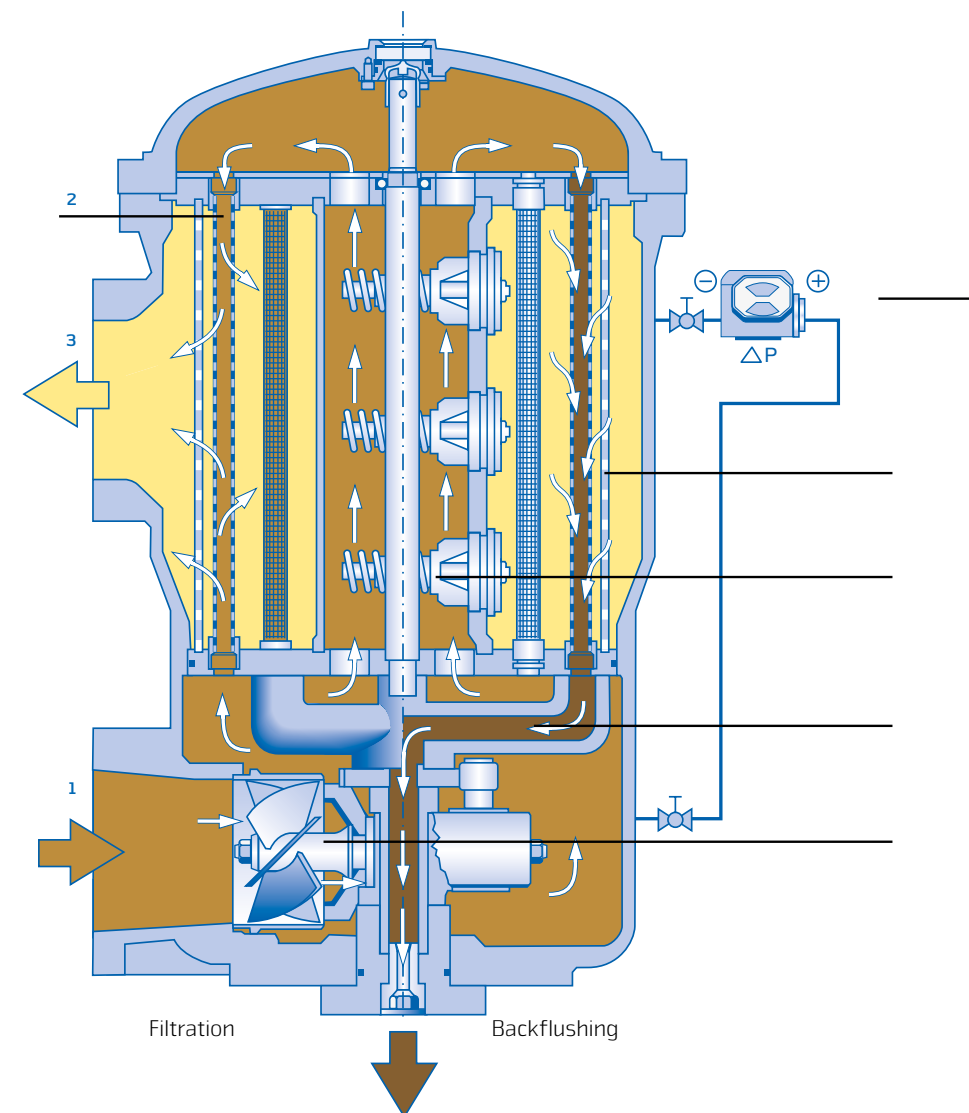
The separation of the oil circuit into a main flow with protective filtration and a bypass flow for oil care results in a permanent ideal lubricating oil quality with a low maintenance requirement and represents the best attainable protection for the engine. A further argument for this solution is the large variety of possibilities to arrange the components in the area of the engine. The BOLLFILTER Automatic can be fitted to the engine as a vertical or horizontal flange-mounted or slide-in filter. Depending on the available installation space, the MANN+HUMMEL oil centrifuge can be fitted directly to the filter or installed at another preferred position.



Working principle of the backflushing filter and oil centrifuge

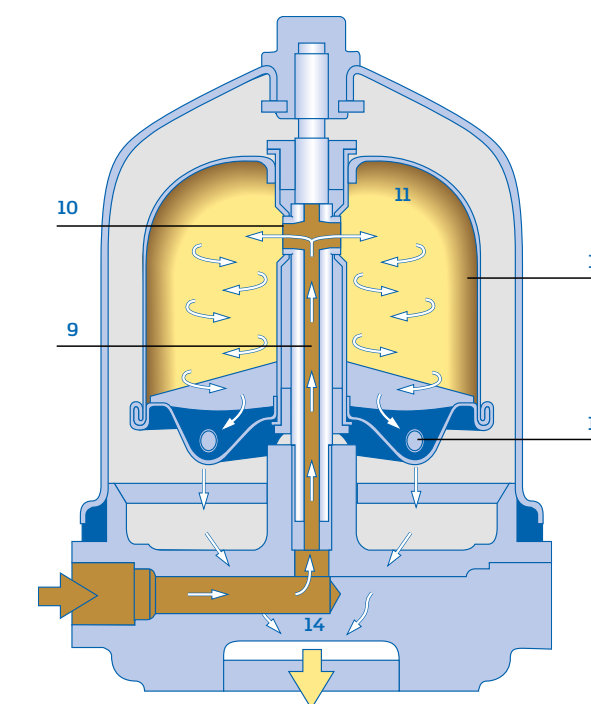
The use of filter mesh on the one hand and centrifugal forces in excess of 2,000 G on the other hand allow the filter and centrifuge to use completely different mechanisms to separate the contaminants from the oil. Both these mechanisms have in common that they do not require additional energy to function.

During filter operation, the lubricating oil to be filtered passes through the inlet flange **1** into the filter housing section and is directed from above and below into the filter candle **2** which is open at both ends. The filter mesh of the candle with the oil flowing from the inside to the outside retains dirt particles down to 25 microns on the inside of the candle. The cleaned lubricating oil reaches the filter outlet and is directed to the engine **3**. The candles are cleaned continuously in sequence without interruption to the filtration process. A turbine **4** mounted in the inlet flange drives the backflushing mechanism. It moves the flushing arm **5** continuously from filter candle to filter candle. Throughout



the flushing process a high surface cross-flow occurs on the inside of the candles which are separated from the filtration. In addition, the reduced inside pressure of the candles produces a counter-flow of the cleaned oil from the outside of the filter candle back to the inside. These flows effect a thorough cleaning of the layer of dirt which has built up on the inside of the candle and serves to protect the filter mesh. Backflushing over a long period is also possible with a low volume of backflushing oil and prevents a drop in the operating pressure. In case there is an interruption to operation, the differential pressure indicator **6** signals a fault, the overflow valves **7** open and the lubricating oil is filtered via an integrated protective mesh **8**.

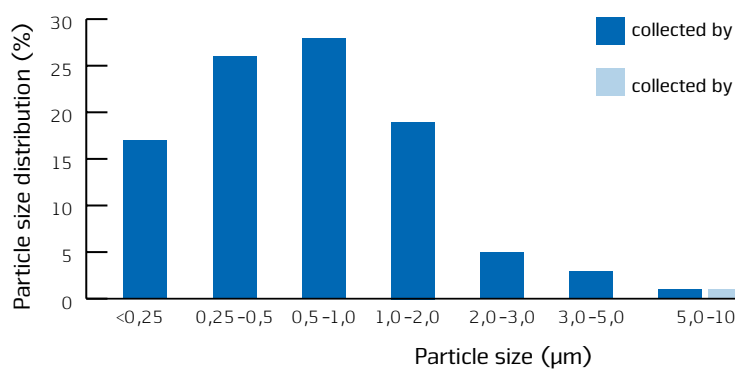
The oil in the centrifuge is pumped by the engine oil pressure and directed to a hollow spindle **9** from which it is pressed via a transverse bore **10** into the rotor **11** of the centrifuge. When the rotor has filled with oil, the resulting pressure causes the oil to exit via two tangentially positioned, opposite nozzles **12** in the bottom of the rotor. This results in the rotor turning very quickly. The dirt particles entering the rotor are accelerated radially by the acting centrifugal force to deposit themselves on the internal wall of the rotor **13** where with increasing operating time they form a dense filter cake. The cleaned oil flows through an opening in the lower part of the centrifuge **14** back to the lubricating oil tank.



Keep particles of all sizes away from the engine

The vast majority of contaminants contained in the oil of diesel engines are smaller than 2 microns – including the especially hard and abrasive acting soot particles. A filter with a mesh insert is just unable to remove these particles. A filter system with disposable paper cartridges struggles to separate particles sizes of less than 10 microns. Already due to these considerations, the use of an oil centrifuge for the efficient treatment of lubricating oil is the better option. This technology is able to remove a full range of particles down to below a micron.

Due to its limited flow capacity, however, the centrifuge cannot function as the only mechanism to clean the oil. In order to protect the engine, an additional high performance filter is absolutely essential. The comparison of many alternatives has clearly shown that automatic back flushing filter is a perfect partner to the centrifuge. Arguments in favour of the back flushing filter are that it is maintenance-free, it works continuously without consumables. Therefore, due to its high cleaning performance and low maintenance requirement, an automatic filter in connection with a centrifuge represents the ideal combination for treating lubricating oil.



The MANN+HUMMEL centrifuges and the BOLL & KIRCH automatic filters clearly stand out against the competition. The patented rotor cover with its spiral shaped, curved ribs allows the MANN+HUMMEL centrifuges to achieve a higher dirt holding capacity than other solutions and in terms of economy the BOLLFILTER Automatic as a unique continuous backflushing unit with its own medium has no direct competitor in the market.

Limited costs result in enormous benefits

The combined use of an automatic filter plus centrifuge for the filtration of lubrication oil is easy to realise for new engines and easy to retrofit to existing engines. This solution has many advantages for operators of engines in terms of technical and economic considerations such as:

- higher oil purity,
- longer engine life,
- longer lubricating oil service life, due to care of sump oil,
- longer service intervals,
- lower fuel consumption through improvement of the combustion process,
- less required maintenance,
- less spare parts,
- higher availability of the locomotive through shorter downtimes,
- higher operational reliability of the locomotive,
- longer operational use of the locomotive,
- lower personnel and material costs,
- reduced disposal costs.

In total these advantages lead to a very short amortisation period for the additional investment. Depending on the type of engine and locomotive, this can be between 6 months and 2 years.



Two co-operate, many benefit

In order to jointly develop and realise a technically superior lubricating oil treating system with an automatic filter and oil centrifuge, two German technological companies with complementary areas of activity and global leaders in their fields have brought together and combined their expertise for the benefits of buyers and users.



The company BOLL & KIRCH Filterbau GmbH has been developing and producing high quality systems since 1950 for the filtration of liquids and gases on an industrial scale. The company employs around 550 workers at its headquarters in Kerpen and seven international subsidiaries. The flagship of the product range is the automatic backflushing filter series developed in-house which is protected by international patents and utility models. The application areas of BOLLFILTER products include many different industrial fields such as marine and engine construction, the steel industry, the automotive and chemicals industries, energy generation and agriculture including many varied media which must be filtered such as, for example, fuels, oil, chemicals, gas, cooling lubricants, cleaning agents and water.



The MANN+HUMMEL Group is a company with international operations and employs 15,231 people worldwide at around 60 international locations. The company develops, produces and sells technically complex components for the automotive industry and many other fields. A key area is high quality filtration products for vehicles, engines and industrial applications. The industrial filtration business unit is specialised in meeting the requirements of off-highway vehicle and engine applications, compressed air and vacuum technology, mechanical engineering and plant construction. For these and other industrial fields MANN+HUMMEL Industrial Filters offers high performance products for the filtration and separation of air, gases and liquids. The company also manufactures and distributes filtration solutions for comfort and process air applications via the Vokes Air brand.

Both partner companies are characterised by a high degree of specialisation, highly qualified employees, uncompromising quality and customer orientation together with the aim of technological leadership in their respective field of activity.



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