



## MANN+HUMMEL Centrifugal Oil Cleaners – the ingenious solution for many applications

MANN+HUMMEL centrifugal oil cleaners are internationally recognised in providing superior bypass filtration for the removal of contaminant from the lubricating oil of Diesel engines. The technology can also be successfully used for gearboxes, hydraulics and other industrial fluids.

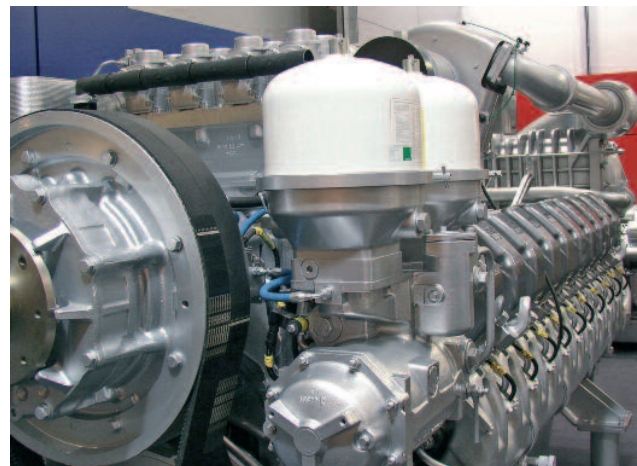
MANN+HUMMEL provide its centrifuge technology to the following market sectors:

- Trucks
- Buses
- Marine
- Power Generation
- Mining Machinery
- Locomotives
- Construction
- Agriculture
- Military
- Industrial Fluids

MANN+HUMMEL centrifuges clean oil by generating centrifugal force 2,000 times greater than gravity. It is this force that separates solid contaminant from the oil. This technology has been proven to remove contaminant down to a sub-micron size, which is advantageous to both engine producers and users.

### The Benefits:

- Cleaner oil
- Extension of oil life
- Lengthens service intervals
- Reduces engine wear
- Enhances long-term preventative maintenance
- Reduces maintenance costs
- Cuts waste disposal costs
- Reduces application down time
- Maximises in-service time for vehicle/engines/machine

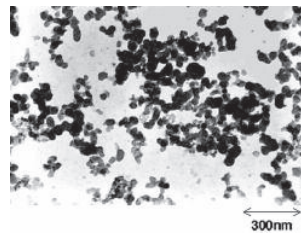


- Reduces total cost of ownership
- Helps ensure clean combustion and fuel efficiency
- Supports engine technology for the reduction of exhaust emissions (e.g. exhaust gas recirculation)
- Fast return on investment

# The Importance of Clean Oil

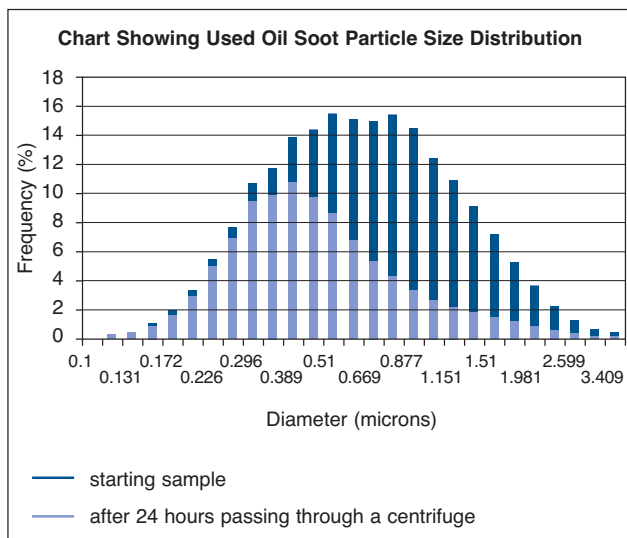
Oil is the life-blood of the engine and clean oil is essential if an engine is to operate efficiently throughout its working life. In response to environmental legislation and customer requirements engine manufacturers are adapting their designs to reduce harmful exhaust emissions and at the same time extend oil drain intervals. Emission reduction

technologies such as exhaust gas recirculation have been shown to increase the level of contaminant, especially soot in the lubricating oil. The net effect is modern oils are being required to work harder, last longer and contain higher levels of contamination. Therefore, advances in oil chemistry and filtration technology are essential to meet these needs.

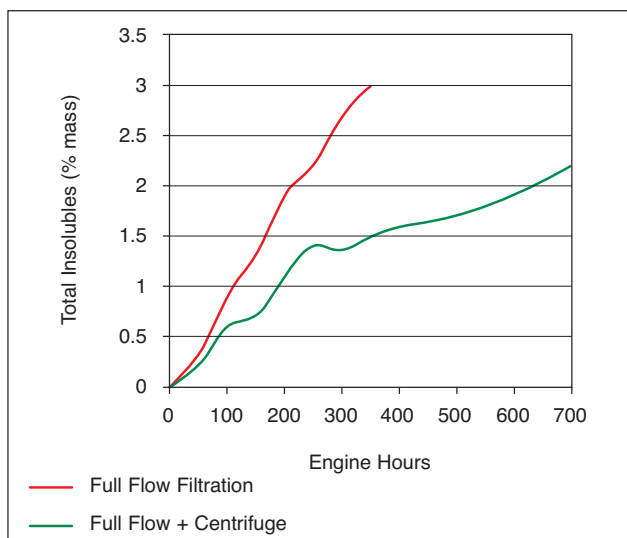


Photograph of soot

Soot particles are sub-micron in size. Soot is a hard pro-wear particle. High soot levels within a lubricating oil have been shown to be responsible for accelerated wear of critical engine components. Traditional full flow and by-pass filters are unable to remove soot contaminant as it is too small to be captured by the media. MANN+HUMMEL bypass centrifugal oil cleaners are proven to be effective at removing soot.

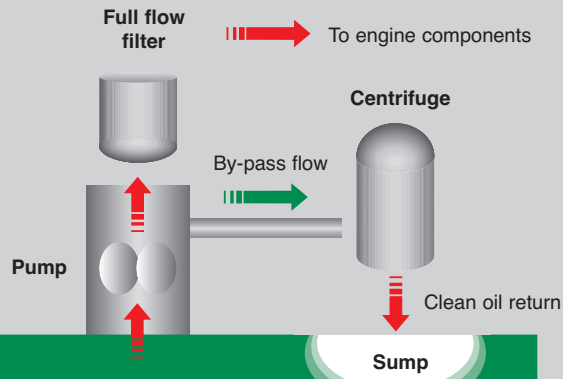


Sectioned Rotor with Contaminant



Heavy durability engine test – oil analysis results displaying contaminant increase with engine operation hours. Engine size 8 litres, 250 kW Industrial Diesel. The result concluded that the MANN+HUMMEL centrifuge controlled total contamination levels within the lube oil at a level below the engine manufacturers condemnation limit for more than double the standard drain interval.

# Centrifugal Oil Cleaners – Principle of operation



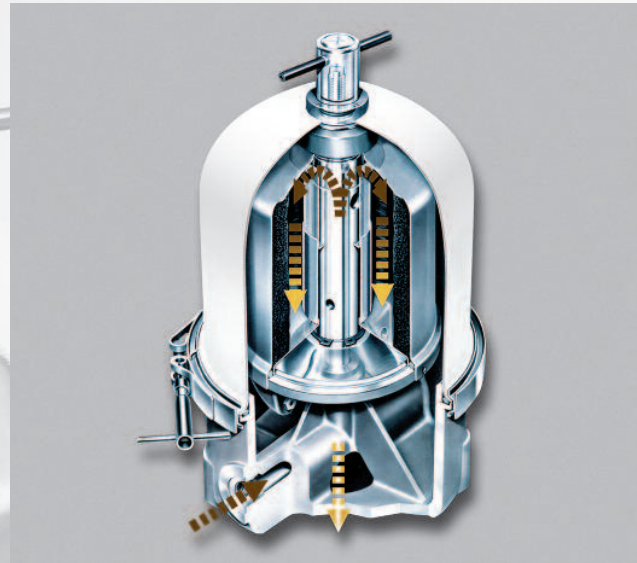
Full flow filters are designed to process all the oil used to lubricate the moving parts of the engine. However, the need to maintain a high flow and limit pressure drop across the filtration media restricts the ability to filter out sub-micron particles. This job is taken over by the centrifugal oil cleaner in the bypass. The MANN+HUMMEL centrifugal oil cleaner processes approximately 10 % of the oil flow provided by the engine pump before returning it directly to the engine sump.

The removal of particles by centrifugal force is based on their relative density and therefore there is no restriction on contaminant size.

## Working principle

Oil is pumped into the centrifuge at engine pressure and directed into a hollow spindle where it exits via a cross drilling into the centrifuge rotor. The rotor becomes full of pressured oil that is then allowed to exit through two tangentially opposed nozzles in the rotor base. This causes rotation of the free spinning rotor assembly thus genera-

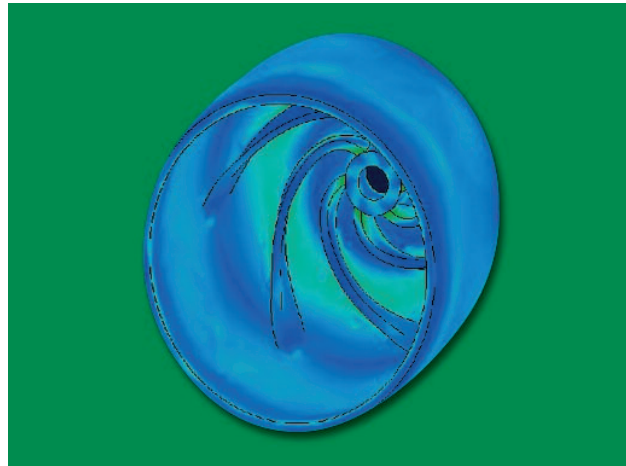
ting the centrifugal force within the rotor. As contaminant particles enter the rotor they are subjected to a centrifugal force causing them to migrate radially outwards to the inner surface of the rotor wall where, over time they compact to form a dense cake. MANN+HUMMEL offers both cleanable and disposable rotor designs.





# Centrifugal Oil Cleaners – Principle of operation

MANN+HUMMEL cleanable and disposable metal centrifuges contain patented Swept Rib Technology in the rotor cover. These ribs are used to displace the contaminated fluid from the rotor core to the outer edge where the contaminants are acted upon by higher centrifugal forces, hence aiding cleaning efficiency. Competitor centrifuges use inserts inside of the rotor in an attempt to achieve the same result.

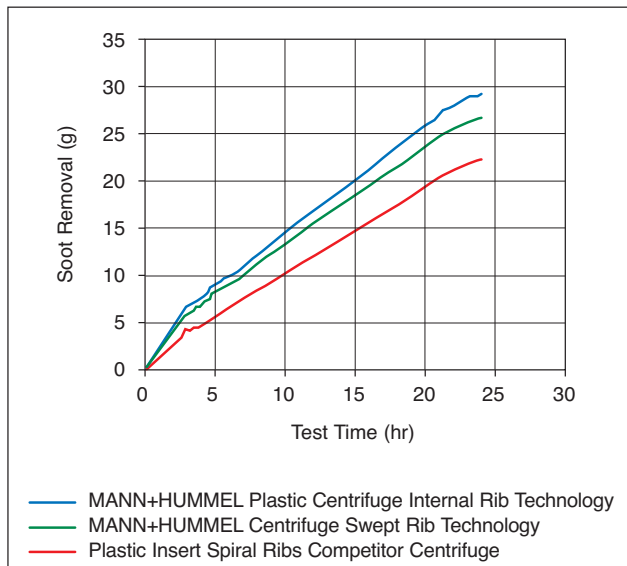


MANN+HUMMEL Swept Rib Technology

Extensive comparative testing of various insert designs has shown there to be no noticeable advances in cleaning efficiency for the removal of sub-micron soot coupled with a greatly reduced contaminant holding capacity.



Sectioned rotor full with contaminant. Sectioned rotor displaying the internal ribs.



OEM used engine oil draw-down comparative test. The graph displays soot removal by the centrifuge with time. Three centrifuge concepts were tested. The MANN+HUMMEL Swept and Internal rib designs provided a greater soot removal over the test period when compared with a centrifuge using a plastic insert of spiral ribs.



Plastic rotor and cover

MANN+HUMMEL were the first to introduce to market a centrifugal oil cleaner with a 100 % metal free rotor. The MANN+HUMMEL plastic rotor is fully combustible and can be incinerated at disposal. This design contains patented Internal rib technology throughout its complete length. Internal rib plastic rotors ensure that all of the oil and hence the contaminant is rotating at the same speed as the rotor. As with the swept rib design, internal rib technology also helps displace the oil and contaminant from the rotor core to the outer edge. These two effects provide an even greater cleaning efficiency without compromising contaminant holding capacity.