



MANN+HUMMEL Centrifugal Oil Cleaners

High performance oil filtration for the bypass





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

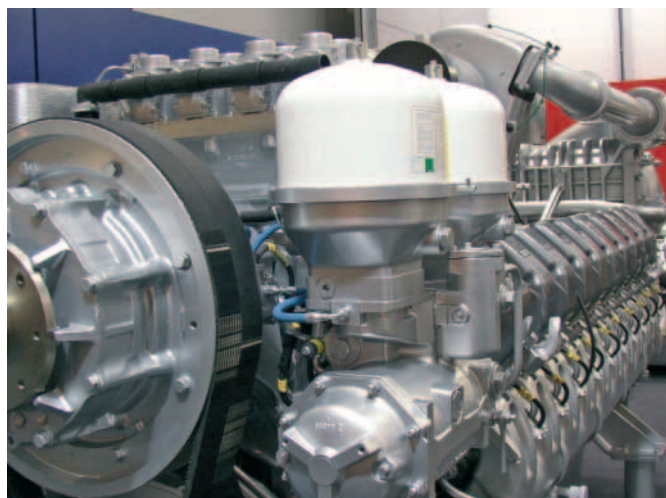
MANN+HUMMEL centrifugal oil cleaners are internationally recognised in providing superior bypass filtration for the removal of contaminant from the lubricating oil of diesel engines. The technology can also be successfully used for gearboxes, hydraulics and other industrial fluids. MANN+HUMMEL provide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

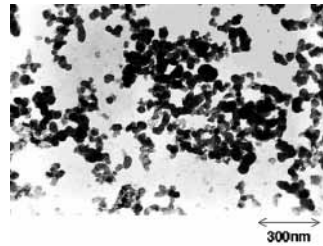
- Cleaner oil
- Extension of oil life
- Lengthens service intervals
- Reduces engine wear
- Enhances long-term preventative maintenance
- Reduces maintenance costs
- Cuts waste disposal costs
- Reduces application down time
- Maximises in service time for vehicle/engines/machine
- Reduces total cost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

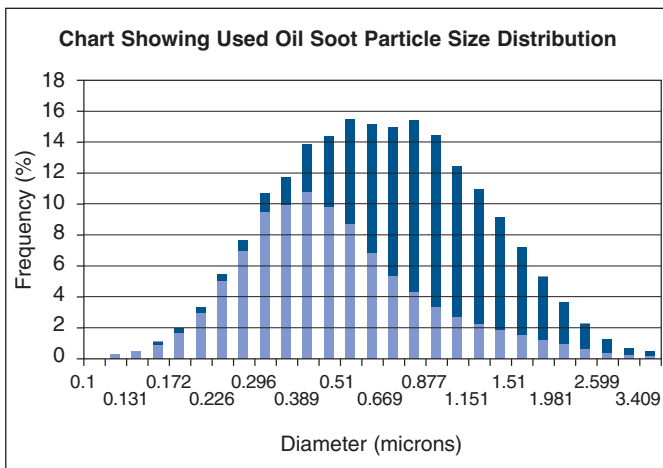
Oil is the life-blood of the engine and clean oil is essential if an engine is to operate efficiently throughout its working life. In response to environment and customer requirements engine manufacturers are adapting their designs to reduce harmful exhaust emissions and at the same time extend oil drain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

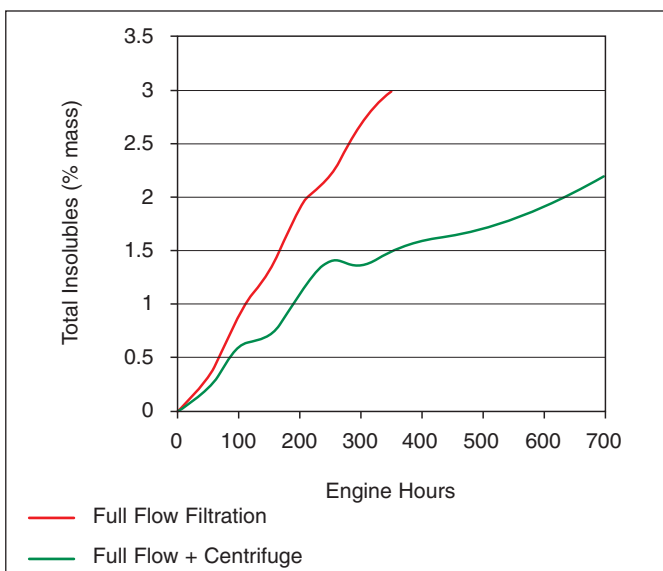
Soot particles are sub-micron in size. Soot is a hard pro-wear particle. High soot levels within a lubricating oil have been shown to be responsible for accelerated wear of critical engine components. Traditional full flow and bypass filters are unable to remove soot contaminant as it is too small to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



Used oil soot particle size distribution. Soot particle size distribution in starting sample and after 24 hours of passing through a MANN+HUMMEL centrifuge.

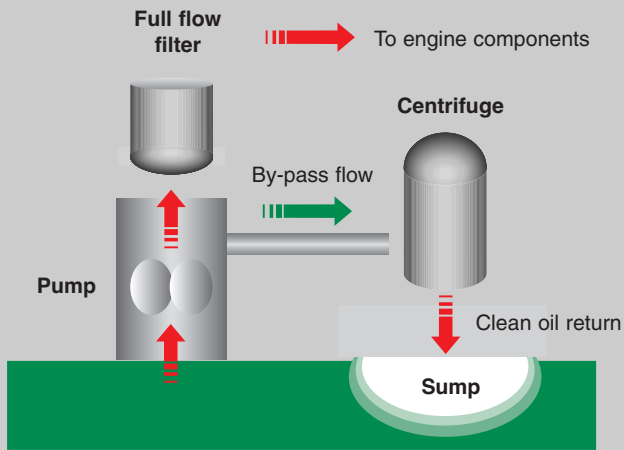


Sectioned Rotor with Contaminant



Heavy durability engine Test – Oil analysis results displaying contaminant increase with engine operation hours. Engine size 8 litre, 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



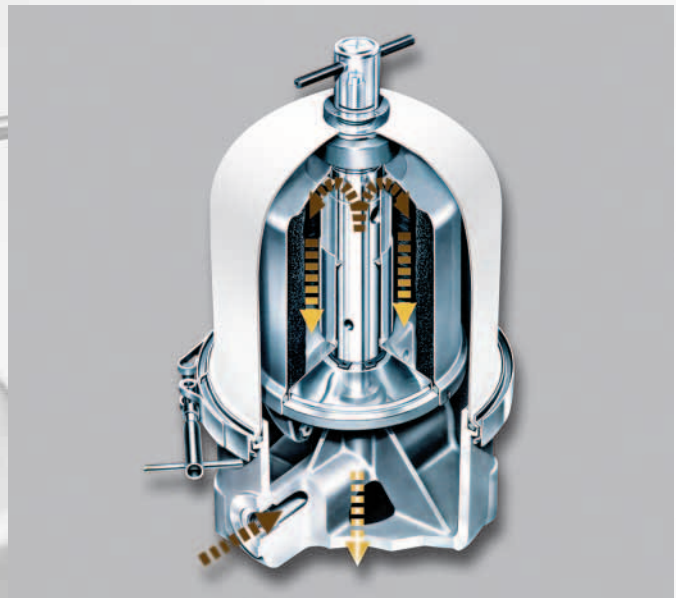
Full flow filters are designed to process all the oil used to lubricate the moving parts of the engine. However, the need to maintain a high flow and limit pressure drop across the filtration media restricts the ability to filter out sub-micron particles. This job is taken over by the centrifugal oil 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

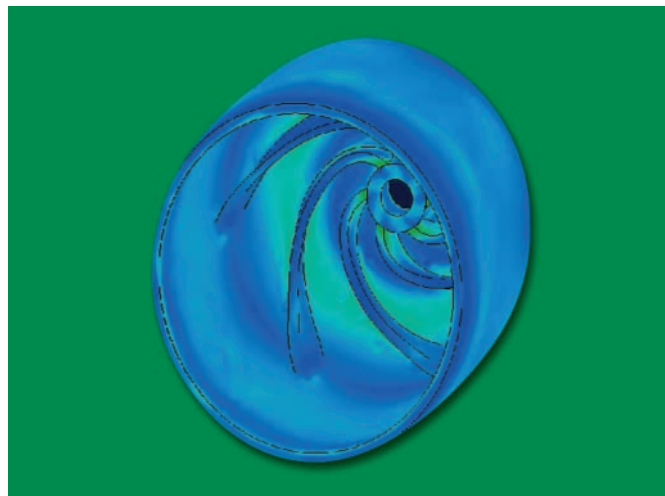
Oil is pumped into the centrifuge at engine pressure and directed into a hollow spindle where it exits via a cross drilling into the centrifuge rotor. The rotor becomes full of pressured oil that is then allowed to exit through two tangentially opposed nozzles in the rotor base. This causes rotation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

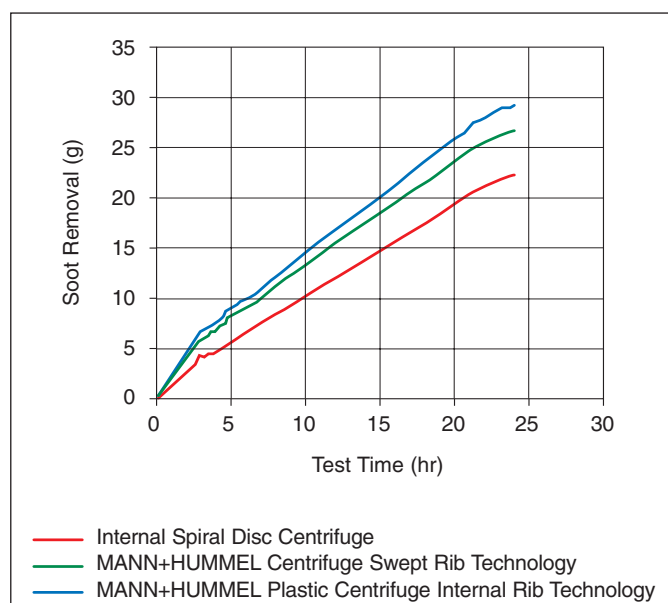


MANN+HUMMEL Internal Rib Technology

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. Section 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 the internal spiral disc.

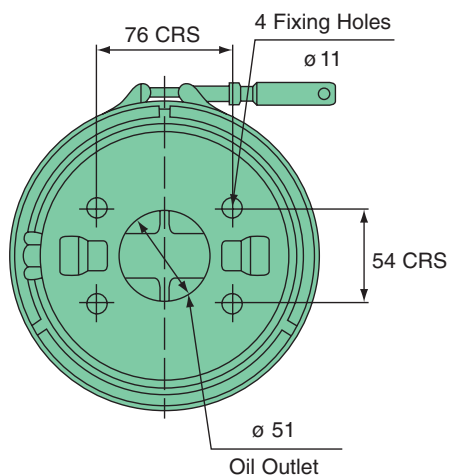


Plastic rotor and cover

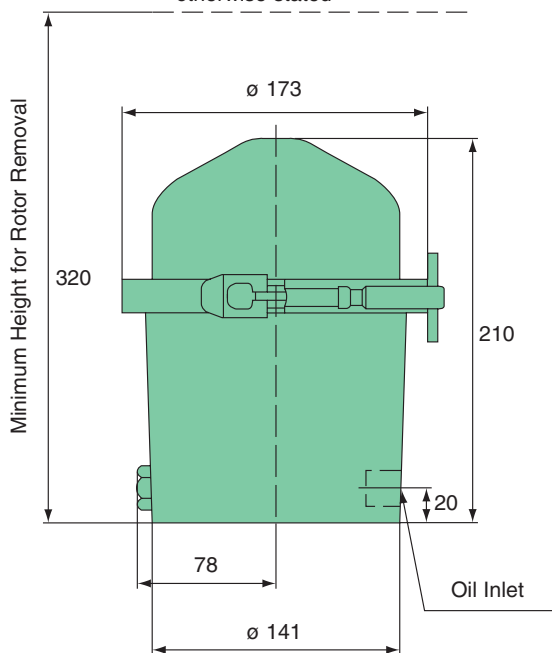
MANN+HUMMEL were the first to introduce to market a centrifugal oil cleaner with a 100 % metal free rotor. The MANN+HUMMEL plastic rotor is fully combustible and can be incinerated at disposal. This design contains patented Internal rib technology throughout its complete length. Internal rib plastic 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. This two effects provides an even greater cleaning efficiency without compromising contaminant holding capacity.

Technical Datas

FM090 Centrifuge



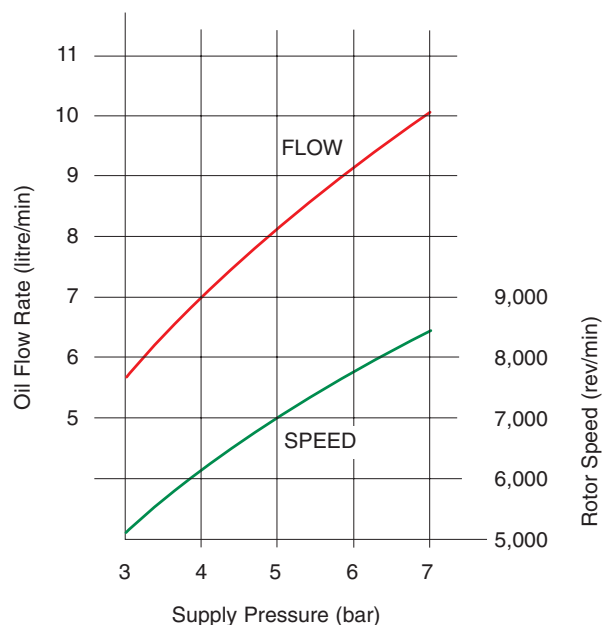
All measurements are in mm unless otherwise stated



- Suitable for system capacity from 15 to 90 litres
- Rotor dirt capacity 0.9 litres
- Rotor oil capacity 1.125 litres
- Minimum oil feed pipe size 9.5 mm internal diameter
- Minimum oil drain pipe size 38 mm internal diameter
- This model is available with a cleanable rotor, and is supplied with paper insert 33301A to improve serviceability
- Other features can be included to suit specific customer requirements
- The net weight of the FM090 is 3.5 kg

Performance Curves

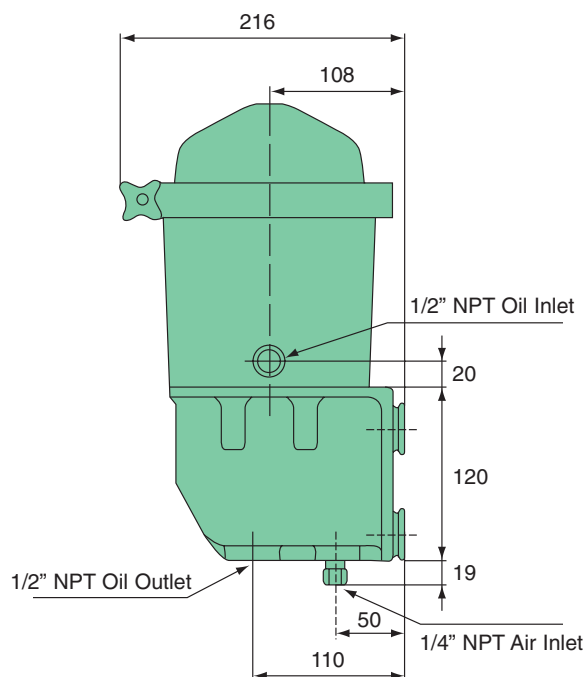
Typical Rotor Performance for SAE 30 Oil @ 100 °C



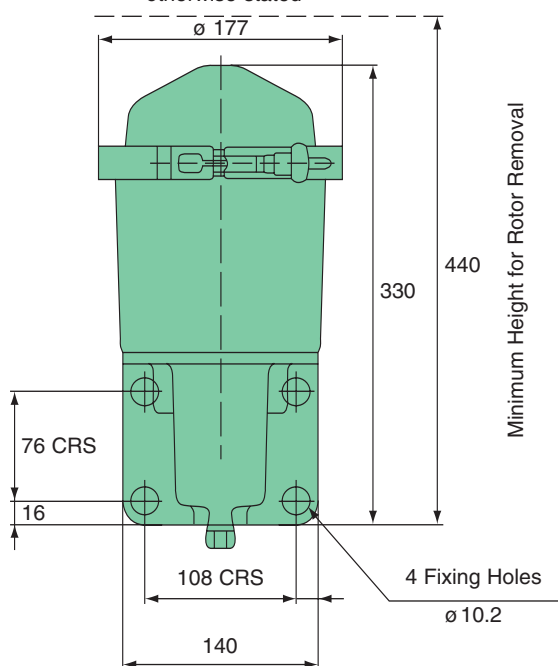
Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar
68 900 00 521	FM090-31	3/8" B.S.P.	1.3

Technical Datas

FM090-LCB Centrifuge



All measurements are in mm unless otherwise stated



Part No.	Type	Oil Connection	Air Connection	C.O.V. Rating, bar
68 900 00 390	FM090-LCB Transit	1/2" NPT	1/4" NPT	1.3



The FM090-LCB centrifuge incorporates a remote mounting base. This uses compressed air and float valve assembly to force return the cleaned oil to the engine sump, enabling remote mounting with a small diameter return hose (e.g. on a vehicle chassis). Air consumption is almost nil, air flow to the sump being prevented by the float mechanism. Oil flow to the air

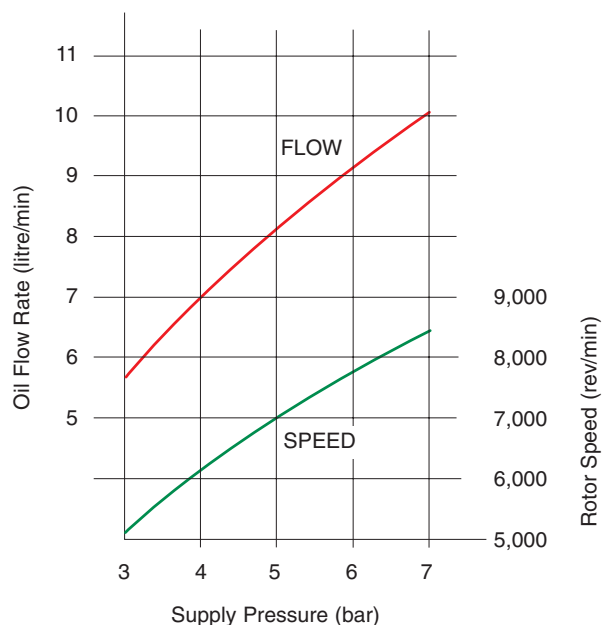
system is prevented by a non-return valve.

Suitable for lubrication systems with capacity from 15 to 90 litres, where a compressed air supply is available. Filter dirt capacity 0.90 litres. Filter oil capacity 1.125 litres. Minimum oil drain pipe size 12 mm internal.

Maximum air consumption 36 litres/hour.

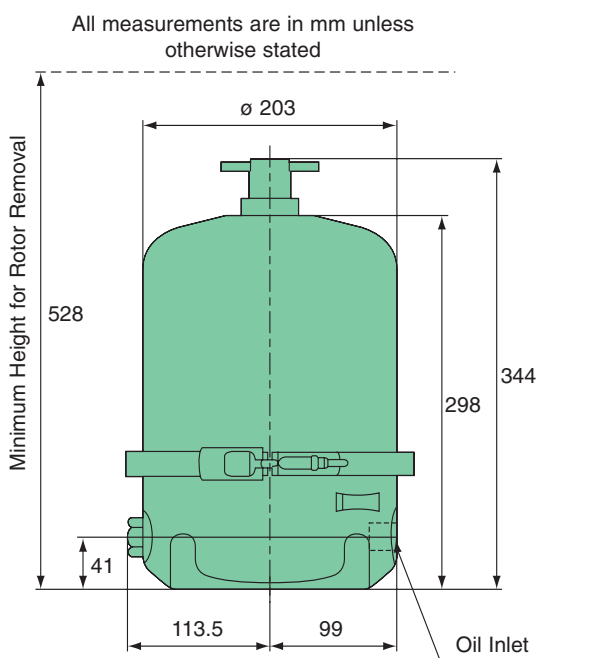
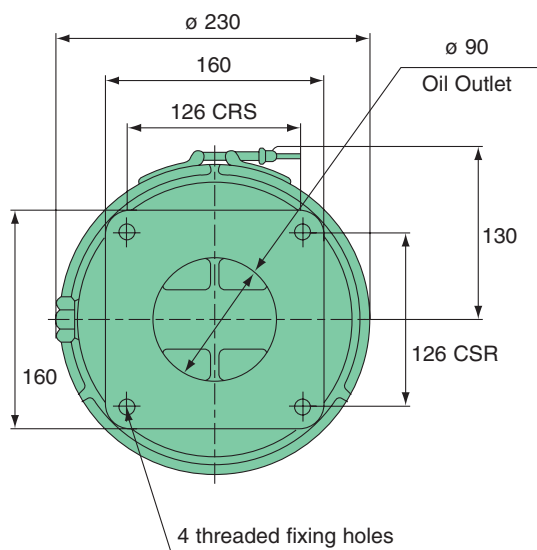
Performance Curves

Typical Rotor Performance for SAE 30 Oil @ 100 °C



Technical Datas

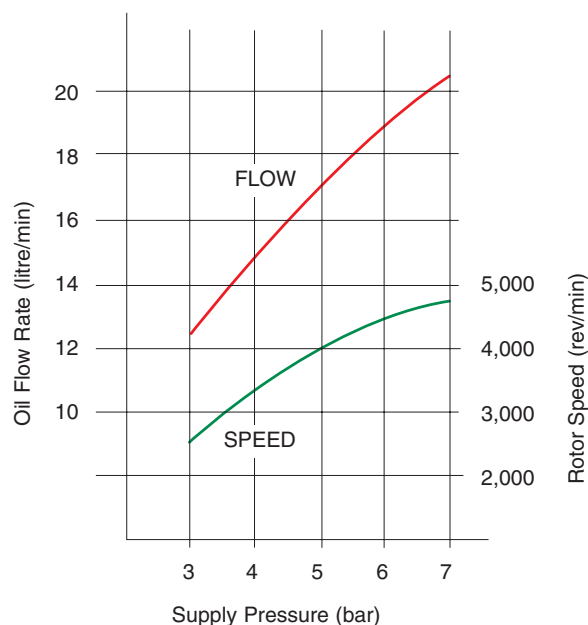
FM200 Centrifuge



- Suitable for system capacity from 40 to 170 litres
- Rotor dirt capacity 2 litres
- Rotor oil capacity 2.3 litres
- Minimum oil feed pipe size 12 mm internal diameter
- Minimum oil drain pipe size 50 mm internal diameter
- This model is available with a cleanable rotor, and is supplied with paper insert 3220A to improve serviceability
- Oil inlet threads and Cut Off Valve (C.O.V.) ratings can be tailored to suit customer requirements
- For this centrifuge the following items are available: Remote mounting base with air assisted drainage 09111A, Rotor disassembly tool 6906A, Standtube extraction tool 6906A
- The net weight of the FM200 is 9.5 kg

Performance Curves

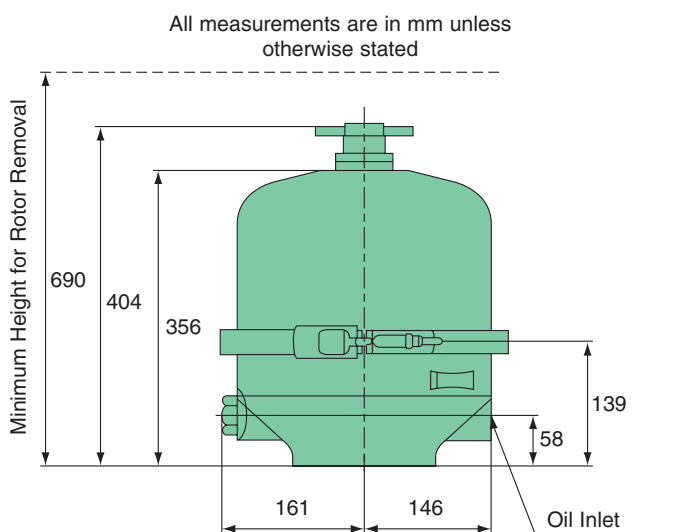
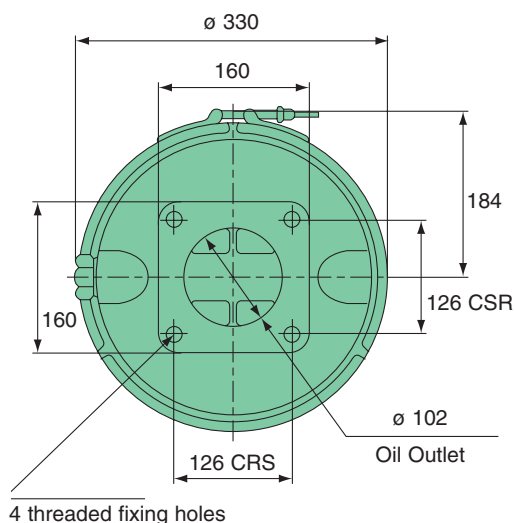
Typical Rotor Performance for SAE 30 Oil @ 75 °C



Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar	Threaded Fixing Holes
68 900 00 847	FM200-21	1/2" B.S.P.	2.5	M12
68 991 19 801	FM200-22	7/8" UNF	2.1	1/2" UNC
68 900 00 848	FM200-25	M22 x 1.5	2.5	M12
68 991 20 001	FM200-28	M22 x 1.5	2.1	M12

Technical Datas

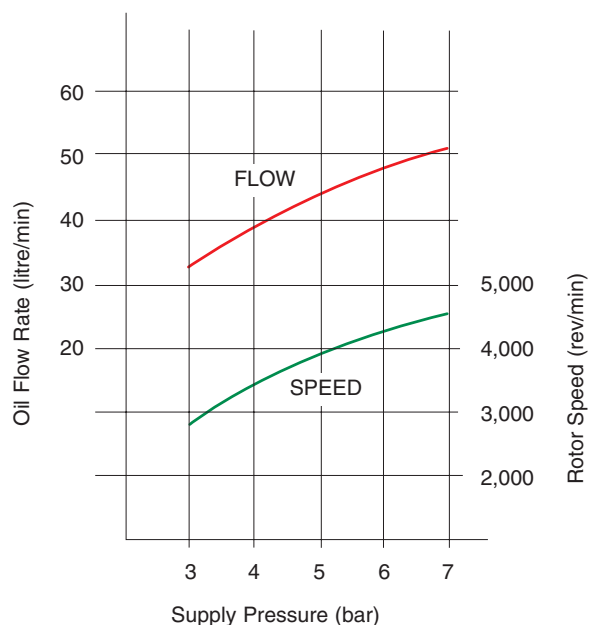
FM400 Centrifuge



- Suitable for system capacity from 200 to 1500 litres
- Rotor dirt capacity 4 litres
- Rotor oil capacity 4.5 litres
- Minimum oil feed pipe size 19 mm internal diameter
- Minimum oil drain pipe size 76 mm internal diameter
- This model is only available with a cleanable rotor and is supplied with paper insert 33226A to improve serviceability
- Oil inlet threads and Cut Off Valve (C.O.V.) ratings can be tailored to suit customer requirements
- Remote mounting base 09111A with air assisted drainage is also available for use with this model
- The net weight of the FM400 is 22 kg

Performance Curves

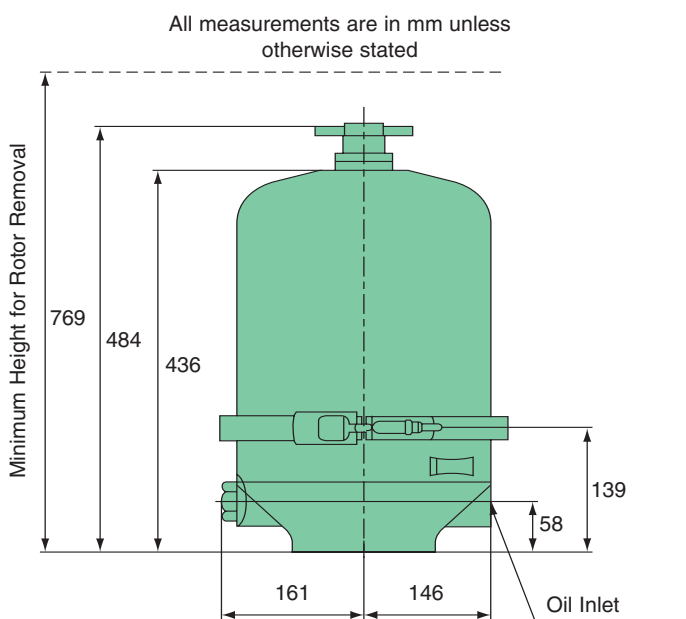
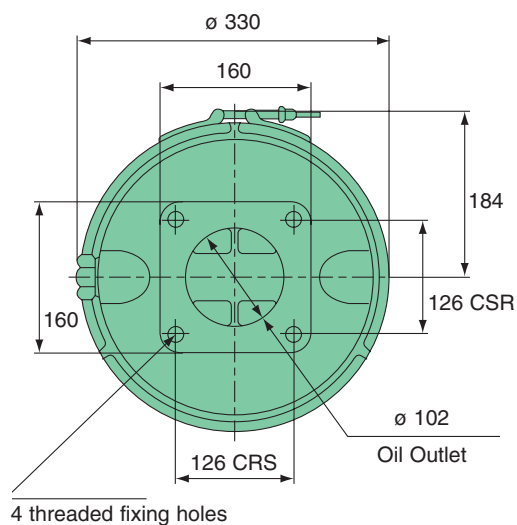
Typical Rotor Performance for SAE 30 Oil @ 75 °C



Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar	Threaded Fixing Holes
68 900 00 849	FM400-21	3/4" B.S.P.	—	M12
68 900 00 223	FM400-23	3/4" B.S.P. 1	2.5	M12
68 991 36 801	FM400-24	5/16" UNF	2.5	1/2" UNC
68 991 34 701	FM400-26	M27 x 1.5	2.5	M12

Technical Datas

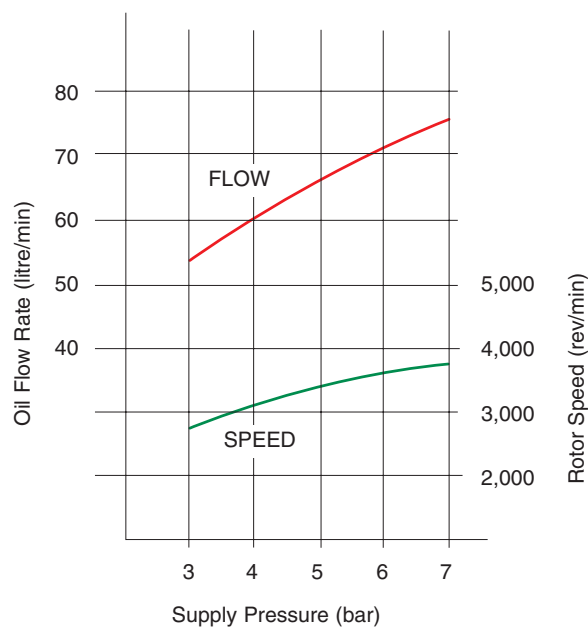
FM600 Centrifuge



- Suitable for system capacity from 200 to 1500 litres
- Rotor dirt capacity 6 litres
- Rotor oil capacity 6.5 litres
- Minimum oil feed pipe size 19 mm internal diameter
- Minimum oil drain pipe size 76 mm internal diameter
- This model is only available with a cleanable rotor and is supplied with paper insert 3028A to improve serviceability
- Oil inlet threads and Cut Off Valve (C.O.V.) ratings can be tailored to suit customer requirements
- Remote mounting base 09111A with air assisted drainage is also available for use with this model
- Rotor disassembly tool 6905A is required to service this product
- The net weight of the FM600 is 25 kg

Performance Curves

Typical Rotor Performance for SAE 30 Oil @ 75 °C



Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar	Threaded Fixing Holes
68 900 00 814	FM600-21	3/4" B.S.P.	—	M12
68 991 18 801	FM600-22	3/4" B.S.P.	3.5	M12
68 900 00 850	FM600-23	3/4" B.S.P.	2.5	M12
68 991 19 001	FM600-24	15/16" UNF	2.5	1/2" UNC
68 991 19 201	FM600-25	3/4" NPT	2.5	1/2" UNC
68 991 19 301	FM600-26	M27 x 1.5	2.5	M12

Installation

A MANN+HUMMEL centrifuge can be designed onto an engine as original equipment or retrofitted to an existing engine by the end user. The by-pass centrifuge requires a supply of pressurised oil. In the majority of applications the oil supply is obtained at engine pressure via the lube oil pump. In cases where oil pressure is insufficient a slave pump can be installed.

The centrifuge should be mounted at an angle of no more than 15 degrees from the vertical. Temporary increases in tilt angle due to vehicle operation are not important. For OEM applications where tilt performance is essential MANN+HUMMEL will design the centrifuge arrangement to meet the required specification.

Oil leaving the centrifuge needs to be able to fall back to the engine's oil sump under gravity. It is therefore important that the drain is free from restrictions and that the return is of the correct diameter and above the oil level within the sump.

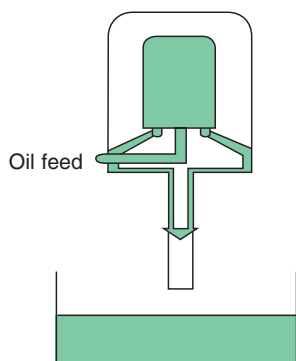
When specifying a centrifuge for an application it is vital to ensure the oil system can support the extra flow taken in bypass by the centrifuge in order not to starve the full flow lubrication of engine components. In the majority of cases engine oil pumps have sufficient excess oil

capacity to support a bypass a correctly sized centrifugal oil cleaner. Please consult with MANN+HUMMEL or your local distributor for centrifuge selection and installation advise.

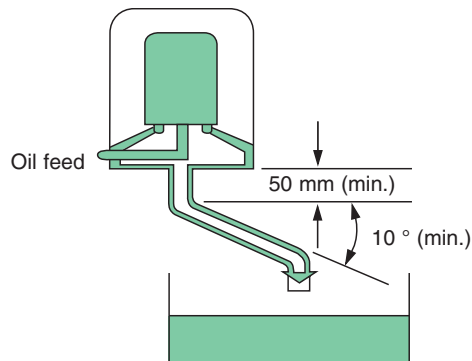
For retrofit applications where direct engine mounting of the centrifuge is difficult MANN+HUMMEL offer remotely mounted designs which use air pressure to assist the clean oil to return to the sump. This option is applicable only for applications where a supply of compressed air is available.



Installation



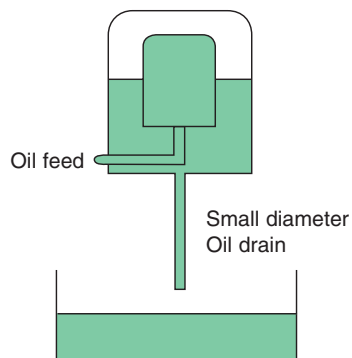
Acceptable



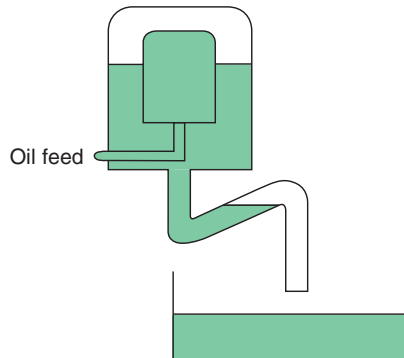
Large diameter oil return pipe means the oil will drain and the rotor will be free to turn



A centrifuge is not a normal filter, it needs a larger oil return pipe.



Not acceptable



Small diameter oil return pipe will prevent oil from draining from the centrifuge and will stop it working



Note: Some models are available with air assisted drains to allow them to be installed without the need for a large diameter oil return pipe.

Installation

How to fit a 090-LBC centrifuge

Locating and Mounting

The centrifuge should be fitted vertically ABOVE SUMP LEVEL to a rigid part of the chassis, as close to the engine and a convenient auxiliary air protection valve as possible, to minimise pipe runs.

Air Feed (Connection 1/4" NPT)
Air feed to the centrifuge should be taken from the auxiliary air protection valve 6 mm O/D nylon tube.

Note: The air pressure to the centrifuge should not exceed 125 psi.

Note: Codes of practice state

Auxiliary Air Pressure Operated Equipment

Auxiliary equipment shall not be connected to an air brake system, except through a device which protects the service and secondary brake system, at a pressure of not less than 70 % of the design pressure corresponding to a declaration of 0.6 g.

Oil Feed (Connection 1/2" NPT)

Oil feed should be taken from a suitable point on the engine that results in maximum oil pressure to the centrifuge. This is usually from the full flow filter head at a point between the oil pump and

the element filter, using FC300-8 Aeroquip type hose.

Oil Drain (Connection 1/2" NPT)

Oil drain from the base of the mounting bracket is via an Aeroquip type FC300-8 hose, returning to a suitable point in the engine block or oil sump. This return line can enter above or below the sump level, but must not have a vertical rise from centrifuge to oil return point greater than 1/2 metre.

Note: The centrifuge must be mounted above sump level.

General

All hose connections should be made with the appropriate Aeroquip type high pressure hose fittings.

Ensure that the centrifuge is mounted rigidly to the chassis and all pipes are fixed into position and are not likely to scuff against moving parts. When connection is complete, start engine and check for oil or air leaks. Check engine oil pressure. Switch off engine and the audible sound of the rotor will be heard slowing down, thus ensuring that oil is reaching the centrifuge and it is working effectively.

Simple Operation – Dependable Service

The FM090-LCB centrifugal oil cleaner consists of two major sections: the centrifuge and a control mechanism.

Centrifuge

- **Rotor** – At the top is the dirt removing rotor with its removable bowl. Dirty oil from the engine enters the side of the housing and travels up through the hollow spindle to the rotor, where it is uniformly distributed by a baffle. The rotor is accelerated to a high speed. The resulting

centrifugal force slings the dirt particles on to the wall of the rotor in a compact, easy-to-remove mass.

- **Drive Chamber** – The clean oil leaves the rotor through the screen and enters the drive chamber. The oil is expelled through twin jets which spin the rotor at speeds up to 9,000 rev/min.

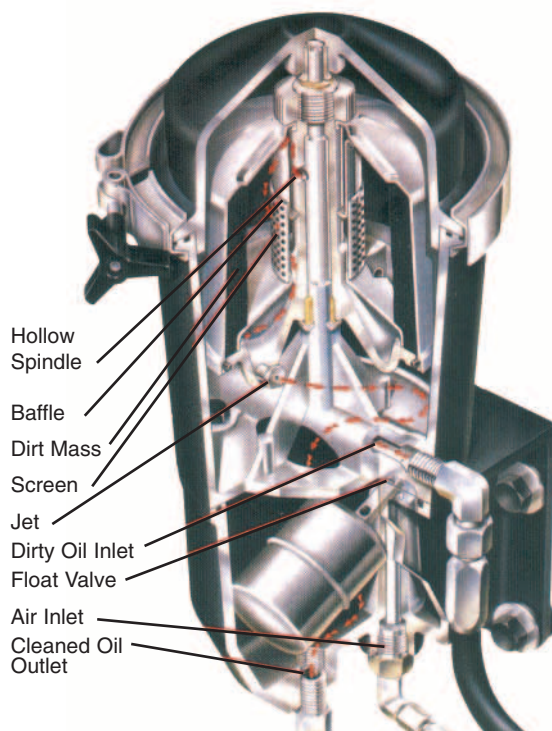
Control Mechanism

- **LCB** – FM090-LCB can be mounted in almost any location and uses hoses and fittings common to other by-pass filters. A simple control mechanism in the base maintains exactly the right oil level for maximum speed and dirt removal.

The control operates on air from the truck systems and air consumption is so small (0.01 l/s STP) as to be hardly measurable.

When the oil begins to rise, the float valve admits a small amount of air to control the oil level. As the level drops, the air is cut off to prevent bubbles from entering the drain line.

Clean oil from FM090-LCB then returns to the engine crankcase.



MANN+HUMMEL Industrial Filters worldwide

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MANN+HUMMEL Industrial Filters Business Unit

The MANN+HUMMEL Group is an international company with its headquarters in Ludwigsburg, Germany. The group employs approx. 9000 people worldwide at more than 40 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 OEM business with global market leaders and producers of vehicles, machines and installations defines the quality and performance of the group. Filters for the international aftermarket are sold under

numerous international brands as well as under the MANN-FILTER brand.

The Industrial Filters Business Unit has its headquarters in Speyer, Germany. It focuses its attention on off-highway vehicle and engine applications, compressed air and vacuum technology, mechanical engineering and machine building.

For these and other industrial fields MANN+HUMMEL Industrial Filters offers high performance products for the filtration and separation of air, gases and liquids.



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