



## **MANN+HUMMEL Centrifugal Oil Cleaners**

### **High Performance Bypass Oil Filtration**





## 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:

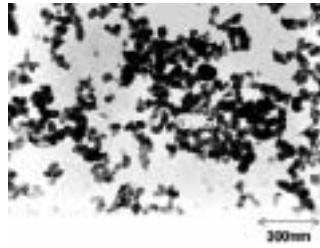
- Cleaner oil
- Extension of oil life
- Lengthens service intervals
- Reduces engine wear
- Enhances long-term preventative maintenance
- Reduces maintenance costs
- Cuts waste disposal costs
- Reduces application down time
- Maximises in-service time for vehicle/engines/machine
- Reduces total cost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

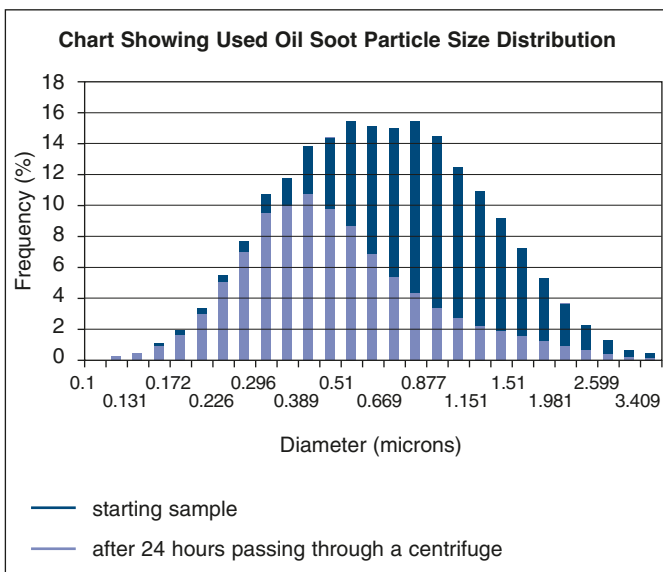
Oil is the life-blood of the engine and clean oil is essential if an engine is to operate efficiently throughout its working life. In response to environmental legislation and customer requirements engine manufacturers are adapting their designs to reduce harmful exhaust emissions and at the same time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

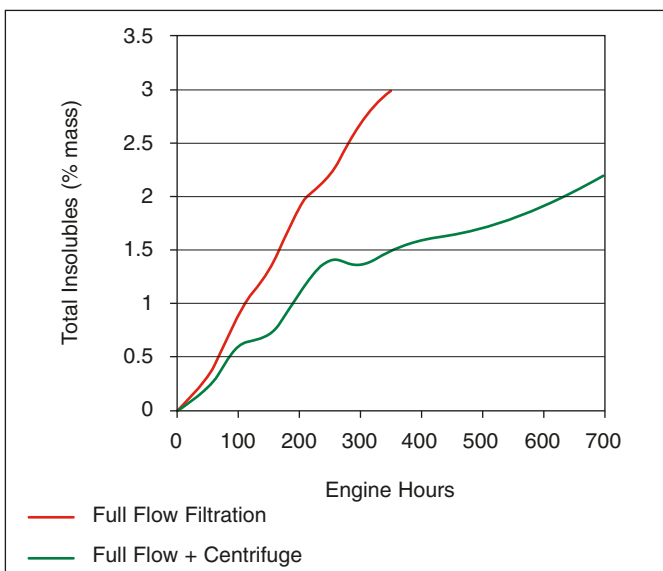


Photograph of soot.

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.

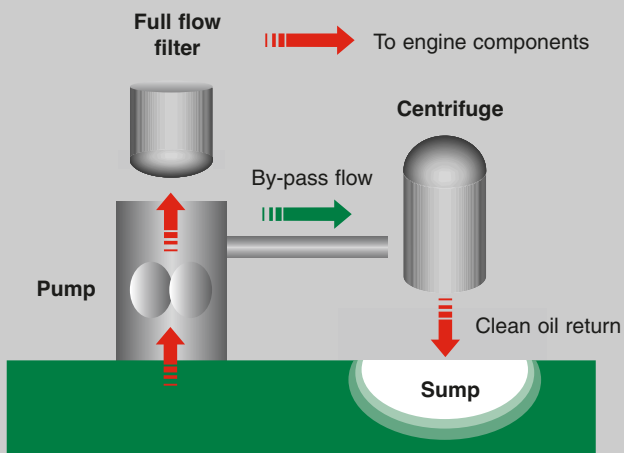


Sectioned Rotor with Contaminant



Heavy durability engine test – oil analysis results displaying contaminant increase with engine operation hours. Engine size 8 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



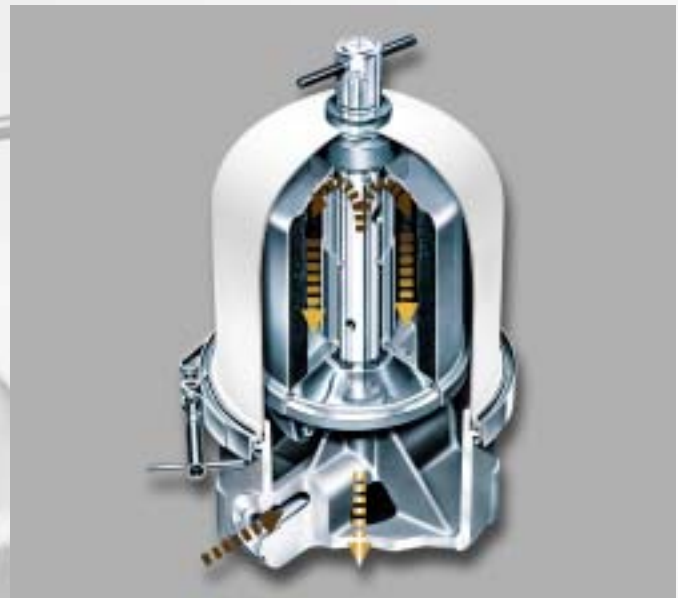
Full flow filters are designed to process all the oil used to lubricate the moving parts of the engine. However, the need to maintain a high flow and limit pressure drop across the filtration media restricts the ability to filter out sub-micron particles. This job is taken over by the centrifugal oil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

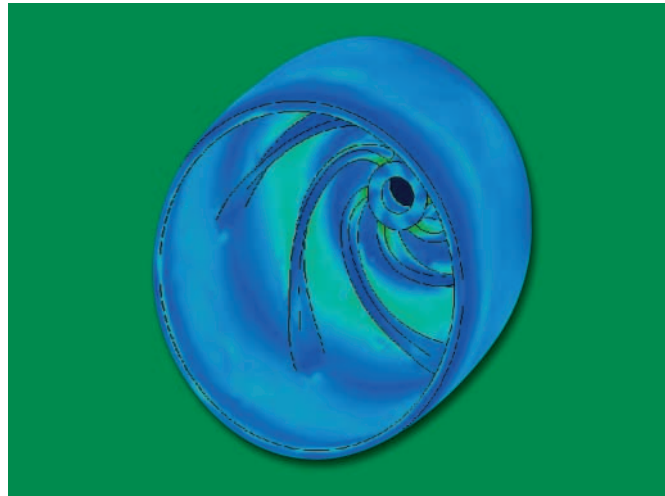
Oil is pumped into the centrifuge at engine pressure and directed into a hollow spindle where it exits via a cross drilling into the centrifuge rotor. The rotor becomes full of pressured oil that is then allowed to exit through two tangentially opposed nozzles in the rotor base. This causes rotation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

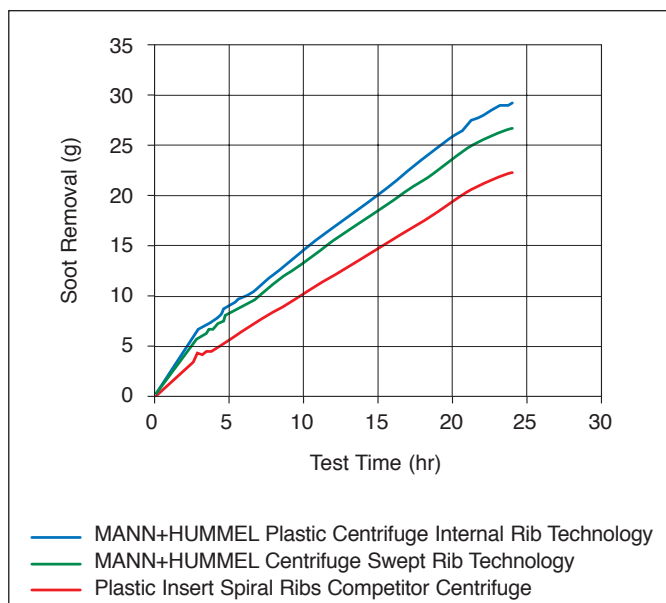


MANN+HUMMEL Swept Rib Technology

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.

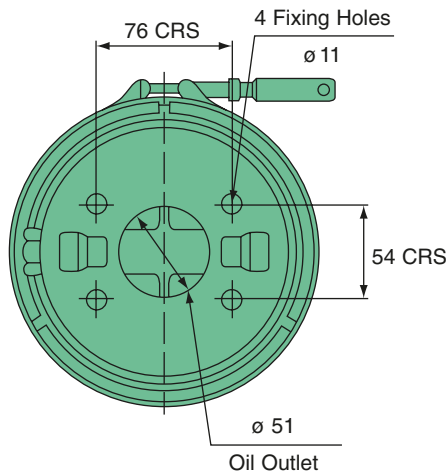


Plastic rotor and cover

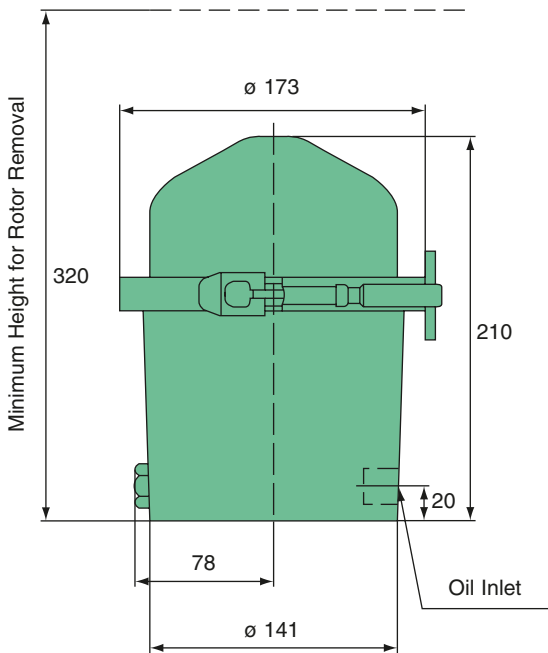
MANN+HUMMEL were the first to introduce to market a centrifugal oil cleaner with a 100 % metal free rotor. The MANN+HUMMEL plastic rotor is fully combustible and can be incinerated at disposal. This design contains patented Internal rib technology throughout its complete length. Internal rib plastic 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.

# Technical Data

## FM090 Centrifuge



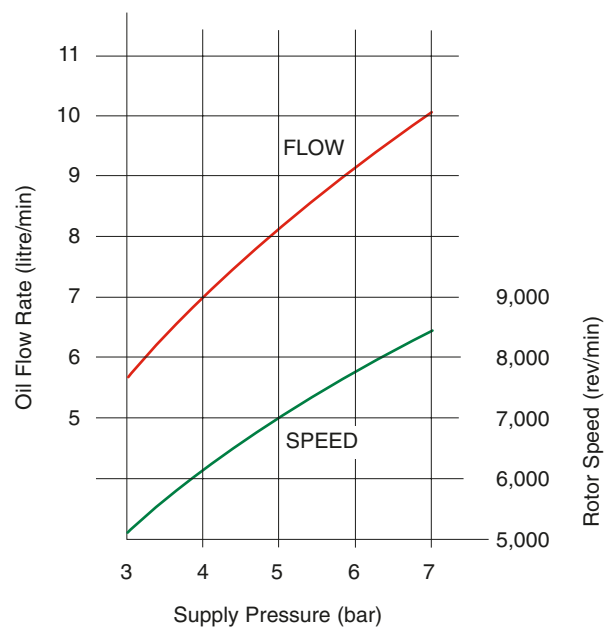
All measurements are in mm unless otherwise stated



- 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 68 933 30 101 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

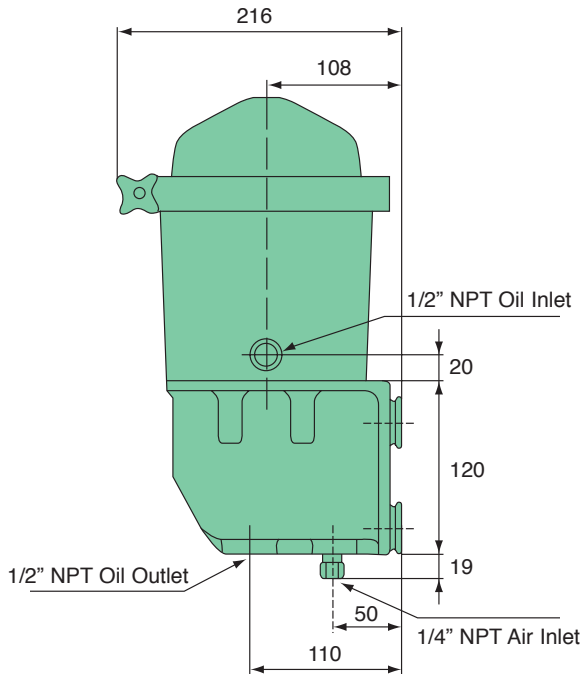
Typical Rotor Performance for SAE 30 Oil @ 100 °C



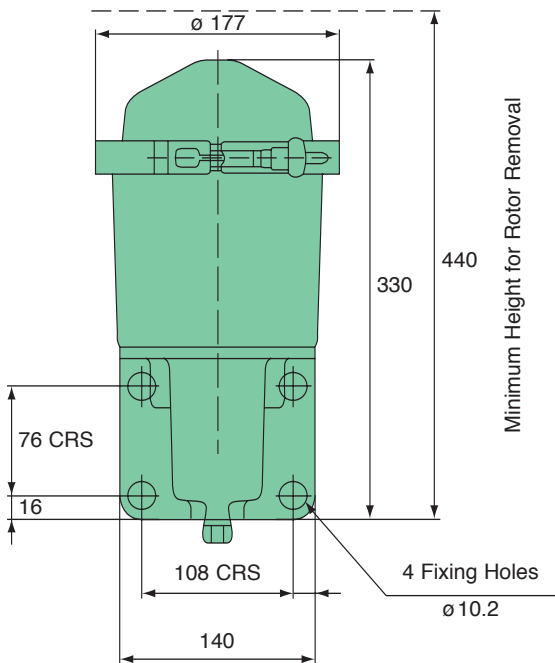
Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar
68 991 42 101	FM090-31	3/8" B.S.P.	1.3

# Technical Data

## FM090-LCB Centrifuge



All measurements are in mm unless otherwise stated



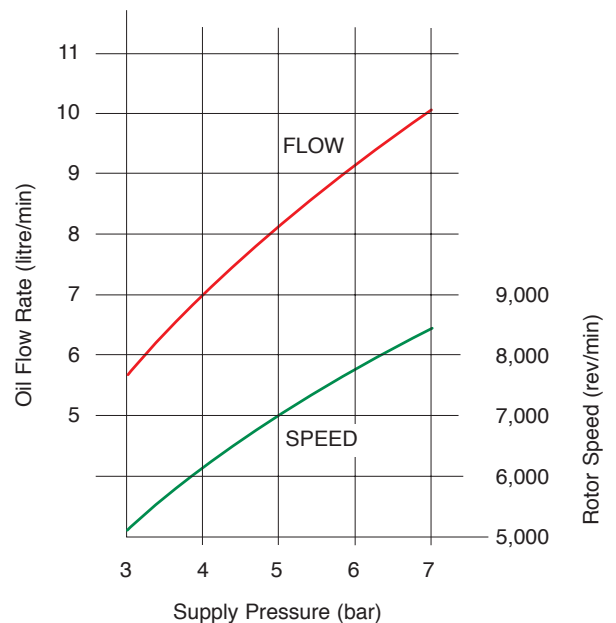
Part No.	Type	Oil Connection	Air Connection	C.O.V. Rating, bar
68 991 39 301	FM090-LCB Transit	1/2" NPT	1/4" NPT	1.3



- Incorporates a level control base for remote mounting
- Rotor dirt capacity 0.9 litres
- Rotor oil capacity 1.125 litres
- Minimum oil drain pipe size 12 mm internal
- Maximum air consumption 36 litres/hour
- This model is available with a cleanable rotor, and is supplied with paper insert 68 933 30 101 to improve serviceability.
- The net weight of the FM090-LCB is 6 kg
- Full technical details can be found on page 13

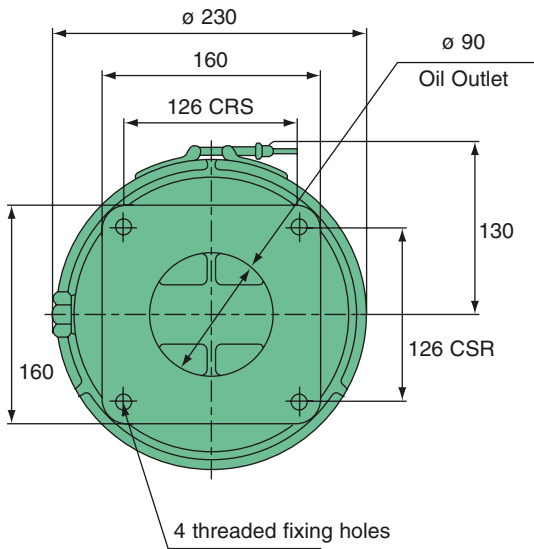
### Performance Curves

Typical Rotor Performance for SAE 30 Oil @ 100 °C

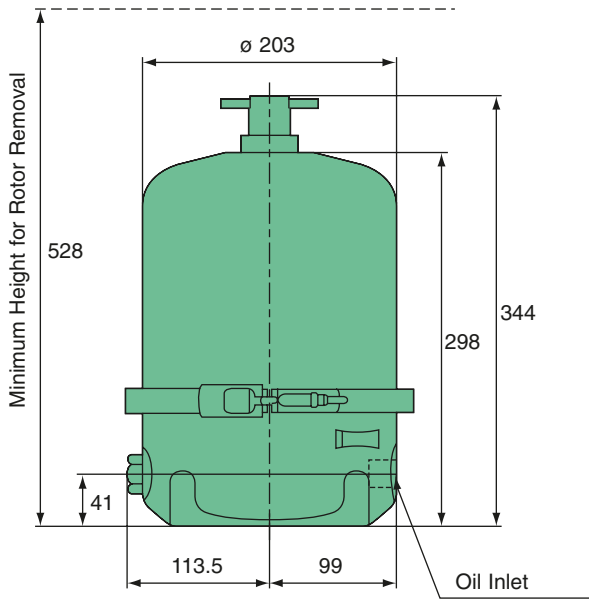


# Technical Data

## FM200 Centrifuge



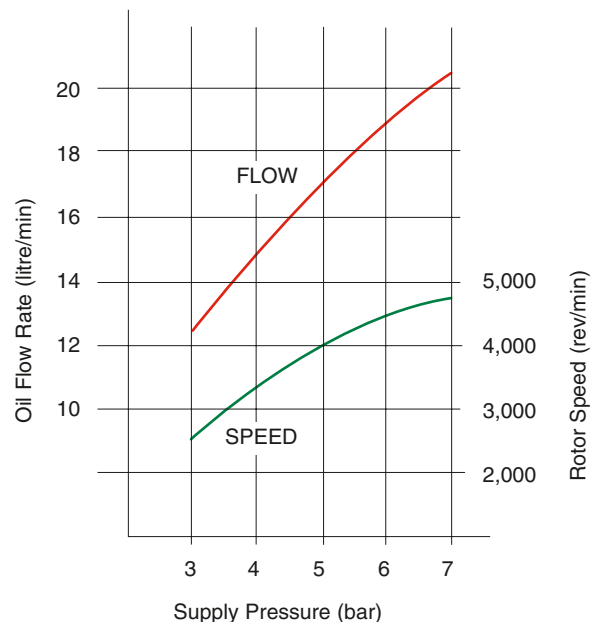
All measurements are in mm unless otherwise stated



- 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 68 903 22 001 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 68 999 11 101, Rotor disassembly tool 68 906 90 601, Standtube extraction tool 68 906 90 901
- The net weight of the FM200 is 9.5 kg

### Performance Curves

Typical Rotor Performance for SAE 30 Oil @ 75 °C

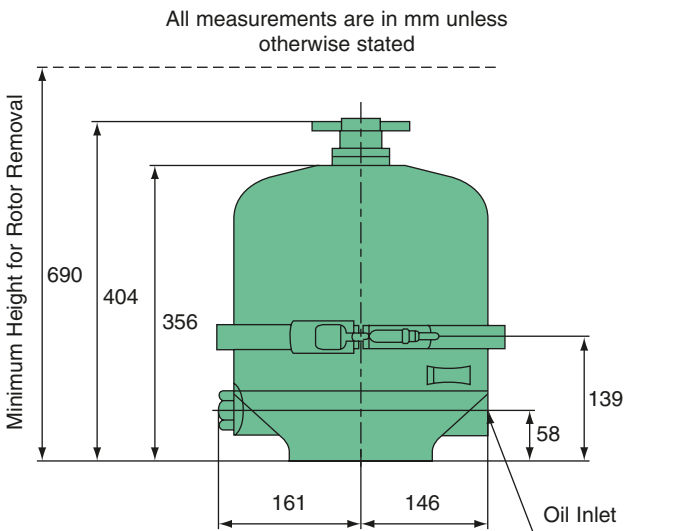
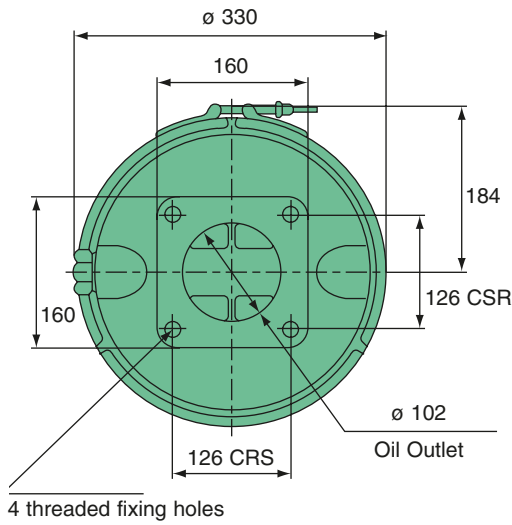


Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar	Threaded Fixing Holes
68 991 19 701	FM200-21	1/2" B.S.P.	2.5	M12
68 991 19 801	FM200-22	7/8" UNF	2.1	1/2" UNC
68 991 19 901	FM200-25	M22 x 1.5	2.5	M12
68 991 20 001	FM200-28	M22 x 1.5	2.1	M12



# Technical Data

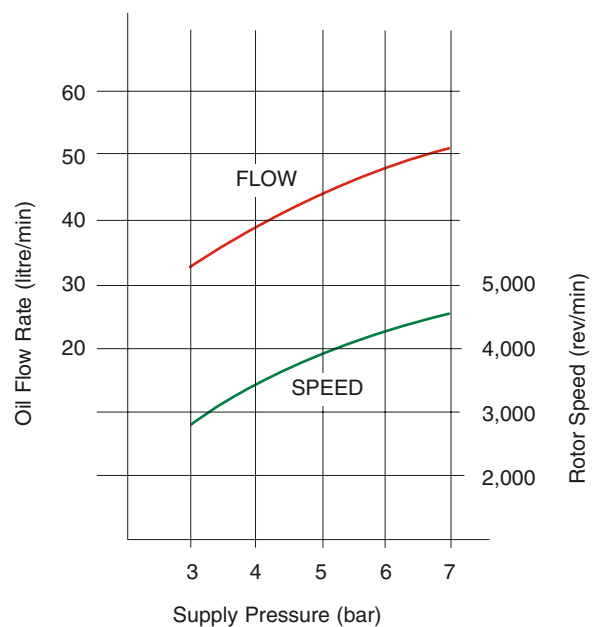
## FM400 Centrifuge



- 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 68 933 22 601 to improve serviceability
- Oil inlet threads and Cut Off Valve (C.O.V.) ratings can be tailored to suit customer requirements
- Remote mounting base 68 999 111 08 with air assisted drainage is also available for use with this model
- Rotor disassembly may be aided by rotor disassembly tool 68 906 91 301
- The net weight of the FM400 is 22 kg

### Performance Curves

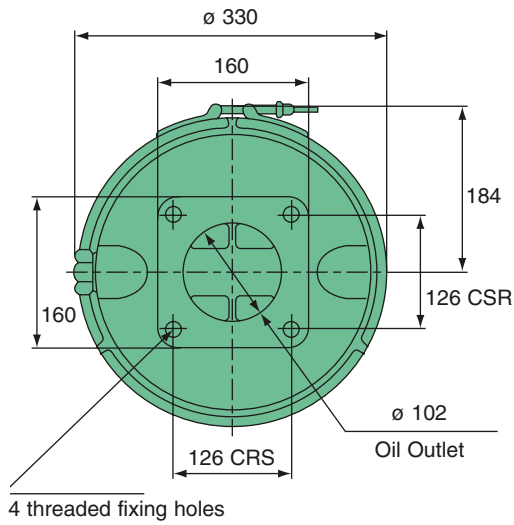
Typical Rotor Performance for SAE 30 Oil @ 75 °C



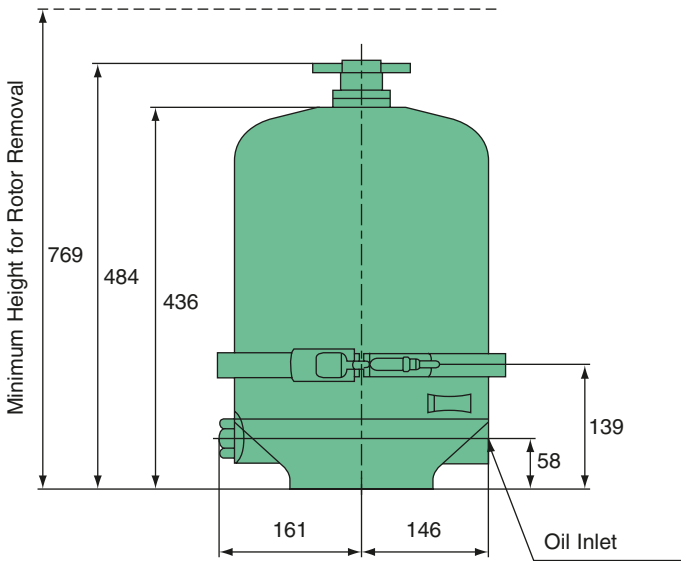
Part No.	Type	Oil Inlet Thread	C.O.V. Rating, bar	Threaded Fixing Holes
68 991 34 401	FM400-21	3/4" B.S.P.	–	M12
68 991 38 801	FM400-23	3/4" B.S.P.	2.5	M12
68 991 36 801	FM400-24	5/16" UNF	2.5	1/2" UNC
68 991 34 701	FM400-26	M27 x 1.5	2.5	M12

# Technical Data

## FM600 Centrifuge



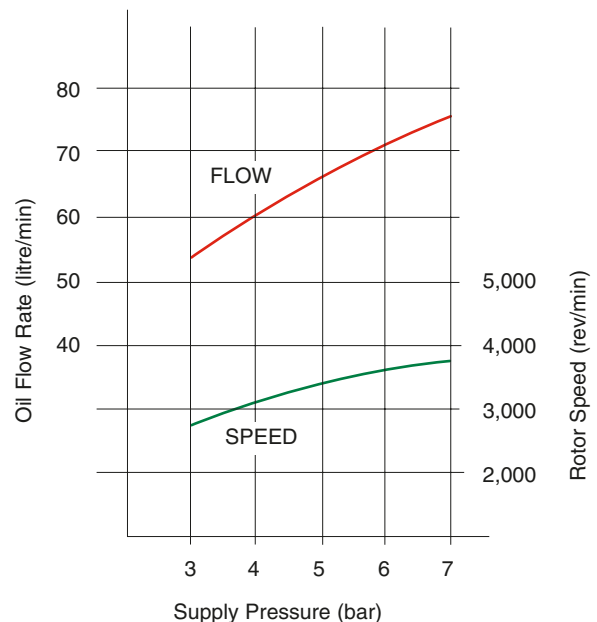
All measurements are in mm unless otherwise stated



- 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 68 900 00 815 to improve serviceability
- Oil inlet threads and Cut Off Valve (C.O.V.) ratings can be tailored to suit customer requirements
- Remote mounting base 68 999 11 101 with air assisted drainage is also available for use with this model
- Rotor disassembly tool 68 906 91 201 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
68 991 18 701	FM600-21	3/4" B.S.P.	-	M12
68 991 18 801	FM600-22	3/4" B.S.P.	3.5	M12
68 991 18 901	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.

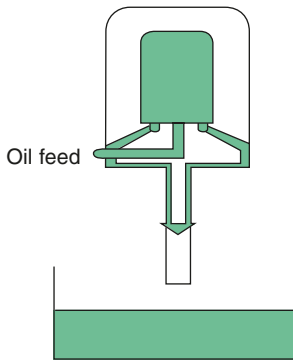
Oil leaving the centrifuge needs to be able to fall back to the engine's oil sump under gravity. It is therefore important that the drain is free from restrictions and that the return is of the correct diameter and above the oil level within the sump. When specifying a centrifuge for an application it is vital to ensure the oil system can support the extra flow taken by the centrifuge in bypass, 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 with a correctly sized centrifugal oil cleaner. Please consult with MANN+HUMMEL or your local distributor for centrifuge selection and installation advice.

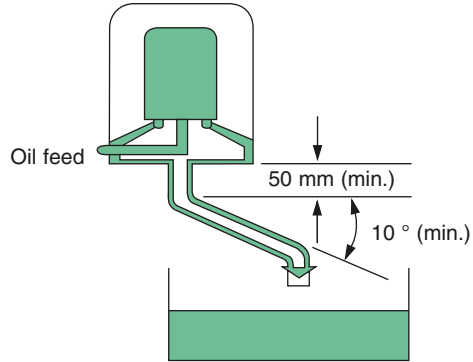
For retrofit applications where direct engine mounting of the centrifuge is difficult, MANN+HUMMEL offer remotely mounted designs which use air pressure to assist the clean oil to return to the sump. This option is suitable only for applications where a supply of compressed air is available.



# Installation



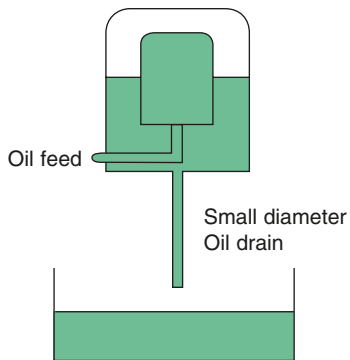
Acceptable



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



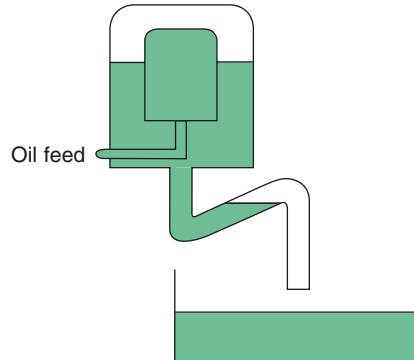
A centrifuge is not a normal filter, it needs a larger oil return pipe.



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-LCB centrifuge

### Locating and Mounting

The centrifuge should be fitted vertically ABOVE SUMP LEVEL to a rigid part of the chassis and 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
- 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

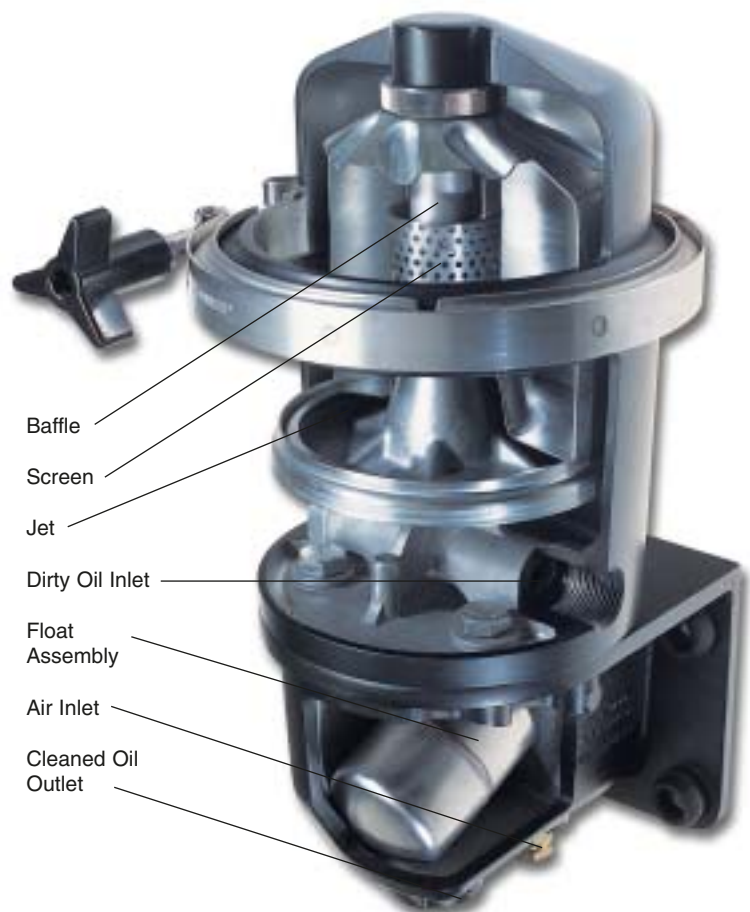
**Rotor** – At the top is the dirt removing rotor with its removable bowl. Dirty oil from the engine enters the side of the FM090-LCB housing and travels up through the hollow spindle to the rotor, where it is uniformly distributed by a baffle. The rotor is accelerated to a high speed. The resulting 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

The MANN+HUMMEL Group is an international company with its headquarters in Ludwigsburg, Germany. The group employs approx. 9100 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 with its headquarters in Speyer, Germany 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.



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