



Facts about Compressor Oil Filtration

1 Importance of Compressor Oil filtration

The compressor oil filter's task is to remove all wear-promoting impurities from the oil without separating any special additives.

In both oil free and oil injected compressors the compressor oil is used for lubrication of the compressor element bearings and drive shaft bearings as well as the gears, any dust or dirt ingress will damage the rollers of these bearings and the gear contact surfaces. Wear of the bearings or damage to the gears will eventually result in rotor contact, this will result in performance loss and reduced compressor element life.

Further damage to the bearing rollers will result in cage-breakage and ultimately complete destruction of the compressor element.

In oil-injected screws where the oil is used for sealing between the rotors and heat removal, the dust and dirt in the compressor oil will end up between the rotors and compressor element housing and result in damage of the rotors and therefore performance loss.

Atlas Copco compressor oil filters are specifically designed to meet the toughest running conditions of the compressor.



It also goes without saying that the quality of the oil being used is equally as important to guarantee good cooling and lubrication. For long service life and trouble-free operation, Atlas Copco oils are always recommended.



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2 Characteristics and Features

2.1 Filter fineness (extraction efficiency)

The filter media and the resulting filter fineness depend either on the size of the particles that passes through the filter or on the extraction probability for the various particle sizes.

Typical values for the extraction efficiency are (single pass):

50% of 18 μm size particles

99% of 30 μm size particles

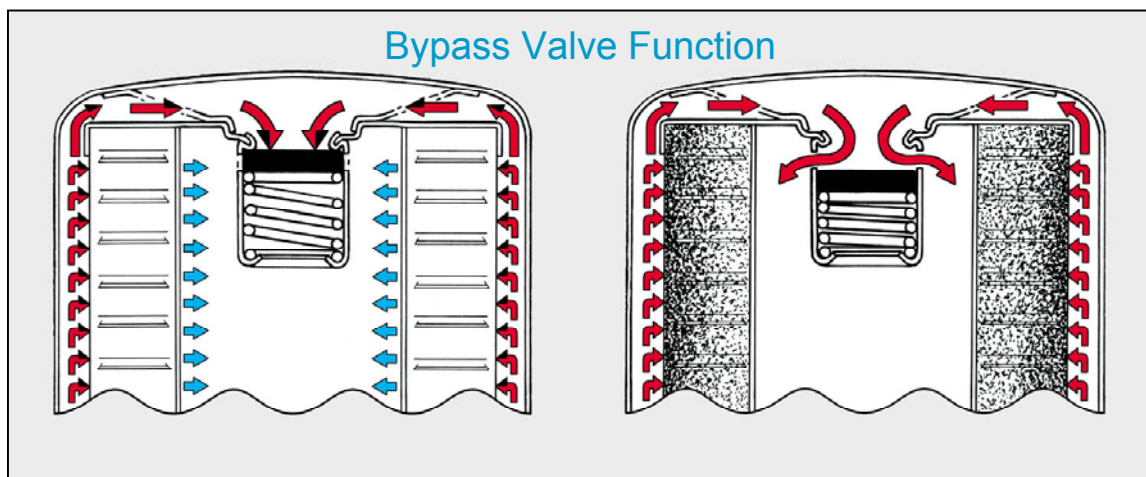
This means that from each two particles of 18 μm one will pass through the filter, but particles bigger than 30 μm will be filtered with almost 100% certainty.

As with any filter medium, the greater the filter surface area, the more filtration possible without increasing the pressure drop.

Thus the number and depth of the pleats are important considerations in determining the quality of the compressor oil filter.

2.2 Bypass valve

The compressor oil absorbs the heat generated by compressing the air. If a clogged filter would disturb the oil flow, the temperature of the rotors and rotor housing would rise instantly and result in a catastrophic failure of the compressor element.



It is less harmful to supply unfiltered oil to the element than to supply no oil at all.

A bypass valve in the filter will open ensuring sufficient lubrication when a certain differential pressure is reached (e.g. upon cold start or when the filter element is clogged).

If you start the unit and the oil is still cold, (high viscosity) this will create a pressure drop and the bypass valve opens. At this moment unfiltered oil will pass



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temporary to the element. It is important that this valve opens at the correct pressure, if it opens too soon, which can happen in pirate filters, a high quantity of unfiltered oil will have passed to the bearings and gears increasing the risk of premature wear.

2.3 Pressure resistant housing

As the compressor oil filter has to withstand the unload pressure of the compressor, it is important that the housing can withstand this pressure. During a normal working cycle the compressor working pressure will fluctuate between load and unload, this can result in a temporary pressure over-shoot; the compressor oil filter also needs to withstand this temporary overpressure.

Pirates often save money on the mechanical construction of the filter with the risk that the filter cannot withstand the pressure and might burst.

The Atlas Copco compressor oil filter is made with corrosion resistant material. In humid working conditions water is formed during the air compression, part of this water will go together with the compressor oil through the oil filter. Filters made with non corrosive resistant material will corrode. Corrosion also drastically reduces the flash point of the compressor oil and can result in compressor fires.

2.4 Paper quality

Only genuine Atlas Copco compressor oil filters have specially impregnated filter paper to provide excellent resistance to water and aggressive synthetic oils up to 140 °C. The impregnation protects the paper from mechanical, thermal and



climatic attack.

The Atlas Copco compressor oil filter is constructed in such a way that paper pleats provide a high resistance to avoid collapsing under fluctuating pressures. During the manufacturing of the Atlas Copco compressor oil filter, pleat continuity is maintained and pleats are uniformly spaced to assure full usage of the entire filter surface. Because the radius of each pleat fold is consistent and controlled, the pleats do not touch and therefore do not eliminate effective filtering area.

Pirate filters are mostly designed for engine oil filtration. As such the filter paper has not been tested for resistance against hot synthetic compressor oil.



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Most pirates have fewer pleats, which will significantly reduce filtration capacity; also the spacing of the pleats is not consistent.

2.5 High sealing quality

Special rubber seals ensure absolute tightness of connecting elements. If inferior/badly fitting rubber is used or bad gluing is done, this can easily lead to compressor oil leaks, which will jeopardize the compressor oil flow to the compressor element resulting in overheating.





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How to recognize Pirates



To the untrained eye, all filters may appear to be similar. In most cases there can be no visual differentiation made from the outside.

The materials used and the care taken during the manufacturing process, determines the quality and performance of the filter.

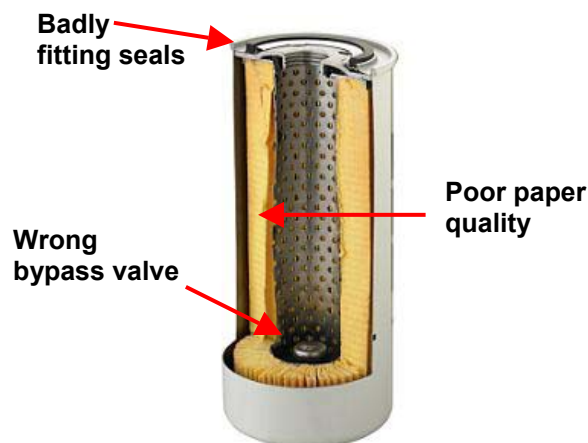
Therefore filters can only be compared by opening them, or by technical performance testing.

Atlas Copco has a compressor oil filter that has been specifically designed for compressor applications. This means that the filter paper is fully compatible with the chemical composition of the compressor oil and that the filter is designed to withstand high operating pressures.

Most of the pirate filters are regular oil filters, which are also used for engine oil filtration. The paper of the pirate filter does not withstand synthetic compressor oil at high operating temperatures and will dissolve faster.

Some of the quality differences that can be noticed on pirate filters:

- Bypass valve does not exist or opens too quickly





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- Paper pleat spacing



Pirate filter paper



Atlas Copco filter paper

The pirate filter pleats are not uniformly spaced and are deformed, this means that the effective filtering area is reduced and that the mechanical strength of the paper might not be able to withstand pressure fluctuations.

- Mechanical construction differences



The pirate filter has more filtering medium to have the same filter efficiency, this will result in a higher initial pressure drop. At the same it can be noticed that the free space between housing and filter paper is smaller on the pirate filter. The oil flow, that needs to pass through this area, will be more obstructed resulting in a higher-pressure drop over the filter.



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- Metal treatment



Pirate metal treatment



Atlas Copco metal treatment

The metal housing of the pirate filter already shows signs of corrosion, while only having been exposed to storage atmosphere.

The Atlas Copco filter housing is made of corrosion resistant material.

- Poor seal quality resulting in leakage's
- Paper length (smaller filter surface area)



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3 Consequences of using Pirates

3.1 Filter fineness (extraction efficiency)

With an Atlas Copco filter only clean oil reaches the lubricating points and bearings. With pirate filters bigger dust particles and more dirt will enter the compressor element/bearings, causing premature damage.



Visible traces of dirt on the rotors and inner bearing ring.

3.2 Bypass valve

There are a few possible scenarios:

- Bypass valve is not present

This will result in insufficient oil flow to the element (oil flooded screw) when the filter gets clogged.

The temperature of the compressor element (and compressor oil) will rise instantly and result in a catastrophic failure of the compressor element.



Insufficient cooling led to thermal expansion of the rotors, which came in contact with the housing.



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- Bypass valve is installed but the opening pressure is too low unfiltered oil will flow to the compressor bearings, resulting in premature wear & failure of the bearings.



3.3 Pressure resistant housing

The filter housing can burst under pressure when not constructed properly. A highly flammable oil mist will be sprayed in the compressor, which creates a high risk for a fire.

3.4 Paper Impregnation

The special additives for anti-foam, anti-oxidant and anti-wear characteristics may attack the paper if it is not impregnated properly. Genuine Atlas Copco compressor filters and oil, work perfectly together giving you the best results.

If the filter paper has no resistance against hot synthetic compressor oil, it will dissolve. Under these circumstances all dirt trapped in the filter paper will be released and flow to the compressor bearings and rotors.

3.5 High sealing quality

Pirates might have seals that are not compatible with the compressor oil, which can result in leakages. Oil spillage due to leakage can result in overheating of the compressor element or fires.