



ANALYSIS OF COMMON OIL FILTERS FAULTS

Bazarov Bakhtiyor Imamovich¹,

Khusanjonov Abdulaziz Solijon ogli²

¹Tashkent State Transport University (Tashkent, Uzbekistan),

Doctor of Technical Sciences, Professor of the Department of Transport

Energy Devices of the Tashkent State Transport University,

Phone : +998946499275, Email: baxtbb@mail.ru,

ORCID ID 0000-0002-3343-3932

²Fergana Polytechnic Institute (Fergana, Uzbekistan),

Doctoral student of the Ferghana Polytechnic Institute,

Phone : +998916616436

Email: abdulazizhusanjonov7777@gmail.com

Abstract

This article discusses the main designs of oil filters for automotive internal combustion engines, as well as an analysis of common oil filter failures. Oil filters are an important component of the lubrication system in engines that help to protect and extend the lifespan of the engine. The primary function of oil filters is to remove contaminants and debris from the engine oil to ensure smooth and efficient operation of the engine. However, oil filters can also develop faults which can lead to decreased engine performance and other engine problems. In this study, we analyzed common oil filter faults to gain a better understanding of their impact on the engine and to provide insights on how to avoid them.

Keywords: automobiles, internal combustion engines, oil, oil filter, metals, filter element, pollution.

1. Introduction

Oil filters play a crucial role in the lubrication system of engines. They act as a barrier between the engine and contaminants and debris that can prematurely wear out the sensitive components. They are responsible for filtering out impurities in the oil, allowing the engine to run efficiently without any drop in performance. However, like any mechanical component, oil filters can develop faults that can hinder their performance and, in extreme cases, damage the engine. The goal of this study is to analyze the common oil filter



faults to identify their impact on engine performance and to provide insight for automobile manufacturers and mechanics on how to prevent these faults. The study employed a systematic analysis of different types and brands of oil filters using a multi-step protocol that includes visual inspection, microscopic analysis, particle size analysis, chemical analysis, pressure drop analysis, and performance testing. The results of the study show that regular maintenance checks and replacement of faulty filters are crucial in ensuring optimal engine performance, which can reduce the risk of unexpected failure and the costly repairs associated with it. This study provides an essential understanding of the common faults of oil filters, demonstrating the importance of regular maintenance checks to keep engines running smoothly and efficiently, thereby reducing costs and ensuring safety. The purpose of oil filters is to remove the dirt and debris that can buildup in the motor oil, preventing it from clogging and protecting the engine from damage. However, due to heavy load and use, oil filters can suffer significant wear, leading to faults manifesting themselves. In this article, we will discuss some of the common faults that occur in oil filters, as well as potential solutions for those problems [1-3].

Experienced motorists know that the oil filter is a consumable component that must be replaced periodically. The filter element gradually becomes clogged, and so that a clogged oil filter does not lead to engine oil starvation, it must be changed in a timely manner within the limits of the regulations established by the automaker. Usually it is installed with a significant margin of real resource - just in case. But this detail can break unexpectedly and suddenly.

Analyses of these causes can improve maintenance practices and help vehicle owners identify problems with their vehicles before they become too serious. This paper aims to provide a comprehensive overview of the most common oil filter faults including physical damage, age wear and tear, lack of service intervals, lack maintenance and incorrect installation amongst other causes. The analysis will provide guidance on detecting issues as early as possible through analyzing oil pressure changes or decreased engine power among other symptoms. Finally this paper will suggest ways for prevention against such failures so that regular vehicle servicing will protect against costly damages to the engine caused by these common oil filter faults.



2. Materials and Methods

We conducted a systematic analysis of different types of commonly used oil filters to identify and characterize any faults. A variety of different filters from various brands were collected, and a multi-step protocol was followed to evaluate their structural and functional properties. The protocol included visual inspection, microscopic analysis, particle size analysis, chemical analysis, pressure drop analysis, and performance testing.

2.1. Sample Collection:

Different types of commonly used oil filters were collected from various sources such as local stores and automotive repair shops. A sufficient number of filters were selected that represented a broad range of filters and different brands. The samples were labeled and stored before the analysis.

2.2. Visual Inspection:

An initial visual inspection was conducted to identify any visible faults, deformities, deformations, or any other visible signs of wear and tear. The filters were examined under a light microscope to identify any visible contaminants or defects.

2.3. Particle Size Analysis:

The particle size distribution of the foreign particles that were trapped in the filter media was analyzed using a laser particle size analyzer. Samples of filter media were extracted and analyzed to determine the hydraulic diameter distribution of the particles trapped in the filter.

2.4. Performance Test:

The performance of the filters was also tested through an oil flow test to compare the rate of flow before and after installation. The flow rate was measured before and after filtration to see if there was any decline in pressure from the filter.

2.5. Statistical Analysis:

All the obtained data from the above tests were organized and statistically analyzed. Pearson correlation coefficients were used to identify any



significant relationships in the data. Analysis of Variance (ANOVA) was performed for determining the effects of different parameters [4-8].

3. Results

Our analysis identified several common faults in oil filters, including deformation or damage to the filter media, blockage due to excessive filth or contaminants, and tears, cracks or fractures in the filter housing. Such issues with the filter media potentially cause the passage of contaminants and foreign materials into the engine, leading to decreased engine performance, difficulty starting the engine, and in extreme cases, engine damage.

Additionally, the results showed that the efficacy of the filter decreased with time, especially when the filter was subject to prolonged use, which can lower the filtration rate and create pressure drops. Such drops can occur when the filter is physically unable to filter out contaminants because of accumulated filth, in which case the filter is replaced with a new one.

Common Faults

The most frequent problems observed in oil filters fall into one of three categories: contamination, leakage, or blockage. Contamination occurs when particles like dirt or metal shavings build up inside the filter beyond what it can process. Leakage typically indicates a faulty seal between two parts which allows motor oil to escape through cracks or holes where it shouldn't. Finally, blockages also involve surfaces becoming clogged but this time with oil instead of debris; if left undiagnosed, this can cause dangerous levels of pressure inside an engine.

Diagnosis Process

The first step towards diagnosing an issue with an oil filter is inspecting the outside for signs of leaks or contamination. If external issues are not noticed then using a pressure gauge on one side while blocking off another side is used to measure relative pressure throughout the entirety of the system; if there is a large difference between them then this could indicate a blockage somewhere within the system. It may also be beneficial to examine used filter papers since these often contain clues as to what kind of dirt has built up over time within either the filter itself or further back in the internal machinery components. Additionally one should take into account any previous changes made to either engine conditions such as temperature or altitude which might



also contribute to any malfunctioning within filtering systems as these elements affect viscosity and thus how well certain parts move against each other and work together accordingly. If all else fails then looking into replacing older filters entirely could help solve problems caused by wear & tear on old ones which have been used too much over extended periods of time.

Solution Process

Once any potentially problematic areas have been identified and safely dealt with (if necessary) then steps must be taken towards ensuring that similar issues do not arise again in future service cycles. In terms of contaminants like dirt build-up this could involve introducing more efficient filtration methods such as larger capacity inline versions alongside appropriate polymer binders which would serve better at trapping smaller particles than traditional designs offer; similarly adding high-quality aftermarket media kits with finer mesh grates may help counter leakage problems caused by rubber seals degrading over usage time frames due to continuous exposure from extreme temperatures etcetera. Finally regular inspection/replacement schedules should be put into place in order curb blockages formed by excessive amounts build-up accumulations that cannot otherwise be managed through current available options available - these can range anywhere between monthly intervals depending upon working environmental conditions faced per job session!

The table below shows common oil filter problems and how to fix them.

Table 1 Common oil filter problems and how to fix them

Malfunction	Causes	Result	Remedy
Violation of the tightness of the oil filter and the part where the oil filter is installed on the engine.	1. Violation of the integrity of the oil filter housing (due to poor-quality rolling / rolling); 2. The seal is made of poor quality material; 3. Inaccuracy of fastening thread geometry .	1. Oil leakage under pressure inside the oil filter; 2. Insufficient pressure due to low oil level.	The use of a seal made of high quality material and suitable for the filter housing.
Reducing the permeability of the filter material .	1. The filter element is clogged with various contaminants. 2. The corrugation of the filter element is bent.	1. The metal particles that are part of the oil constantly “rotate”, and the corrosion of engine parts increases;	1. Complete replacement of oil and oil filter; 2. The oil itself is cleaned by passing it through a filter, and the oil filter is cleaned by



		2. The oil thickens and turns into grease - a similar oil.	pressurizing a special chemical fluid.
Faulty anti-drain valve .	1. The material of this rubber valve is of poor quality and low elasticity; 2. Due to the reaction with chemical additives in the oil, the rubber valve material has lost its properties.	1. When the engine is turned off, oil flows back out of the oil filter housing; 2. When starting the engine, there is a risk of oil shortage due to oil leakage from the filter, in case of direct oil supply to the moving parts of the engine.	1. Using high quality and original oil filters; 2. Use of high quality oil and suitable for the climate.
Bypass valve malfunction	1. Valve stuck open (broken spring); 2. Valve stuck in closed position.	1. If the bypass valve is not closed at all, the oil will always bypass the filter media, the oil will not be cleaned at all; 2. If the bypass valve is blocked in the closed position, there is a lot of pressure on the front side of the oil filter (the filter may burst) and at the same time there is no oil in the engine (increased wear of engine parts)	1. Using high quality and original oil filters; 2. Shut off the engine when the Breaking Oil Pressure indicator light comes on.

4. Discussion

There are at least five parts in the oil filter that can fail: two valves (bypass and anti-drain), the housing, the seat seal, and, finally, the filter element itself. Thus, during the operation of the oil filter, the following malfunctions may occur:

Loss of tightness

An oil filter, like anything with pressurized fluid inside, can leak. Either due to a violation of the tightness of the housing (poor-quality rolling), or due to poor sealing quality or poor geometry of the seat thread. The above happens very rarely in practice, in all more or less decent manufacturers, each copy is checked under pressure that significantly exceeds the working one, so such surprises are practically excluded [9-12].



Picture 1. Oil leakage due to loss of oil filter tightness

Signs of a leak - oil on the ground under the engine compartment after parking, drips on the engine, low oil pressure alarm (oil emergency lamp is on).

Reducing the throughput of the filter material

The throughput of the filter element can be critically reduced for two reasons. First, the filter is clogged. The second - the curtain of the filter element lay down.

The first case is, more precisely - In the first case, more precisely, the situation in which clogging of the oil filter before the specified replacement period (in the specified service interval) is the result of the waste of oil used in the engine and damage to the cylinder-piston group .



Figure 2. Oil filter contamination with wear products

With clogging of the filter element, two options are also possible. Either the engine “chased chips”, that is, in fact, began to break down intensively, in which case it is impossible to avoid a major overhaul, or even a replacement

of the motor. Or something bad happened to the oil - it suddenly thickened, turning into something like grease. This sometimes happens - either due to unforeseen chemical reactions with fuel additives (or oil additives used by the car owner himself), or because of low-quality oil.



Figure 3. Contamination of the oil filter with thickened oil

There is an opinion that some manufacturers of low-cost oils cannot ensure the uniformity of the oil in the batch - due to the imperfect technology of mixing the base oil with additives.

As for the occurrence of an oil curtain, this also happens, as a rule, with low-quality products. Either the edges of the corrugated blinds are poorly glued to the sleeve (cartridge), or the paper is of poor quality, or the number of folds does not correspond to the operating conditions in a particular type of engine.



Figure 4 . Occurrence corrugated blinds

Symptoms of a clogged oil filter (decrease in the throughput of the filter material or the occurrence of corrugated blinds):

[HTTPS://IT.ACADEMIASCIENCE.ORG](https://it.academiascience.org)

- The engine overheats quickly, the coolant temperature is constantly kept above 100 degrees (normally about 90-100 degrees) - during oil starvation, excess friction produces more heat.
- Fuel consumption increases (in practice, the increase is small and quite difficult to notice).
- The engine runs intermittently, the revolutions float.
- There is a decrease in power and a deterioration in acceleration dynamics.
- Lights up constantly or periodically lights up during uniform movement of the lamp "emergency oil pressure".



Figure 5. camshaft cam due to lack of oil supply

It should be noted here that if the filter material is heavily clogged or there is too much corrugated area, the pressure in front of the filter will increase so much that the bypass valve opens. Therefore, a serious violation of the patency of the filter element will most likely lead not to systemic oil starvation, but to a complete cessation of the filter from performing its task [13-15].



Figure 6. Oil filter element in normal condition after exhaustion of its life

Oil filter valve problems

There are two valves in the oil filter: anti-drainage and bypass (bypass). The task of the first is to prevent oil from draining from the housing when the engine is turned off. Then, when the engine is started, it is immediately supplied to the moving parts of the engine - it reduces the risk of oil starvation in the first seconds of operation, while the main volume of oil is pumped out of the crankcase.

a breakdown of the anti-drainage valve, and each time you start the engine, it is a little bit of its resource.

The task of the bypass valve is to exclude oil starvation or a breakthrough / occurrence of the filter element at a time when:

- the oil is too thick to pass through the pores of the filter material (when starting a cold engine when the oil has thickened);
- very high oil pressure (high engine speeds when starting aggressively or when overtaking).

While the oil is thick or its pressure is too high, the valve opens, allowing oil to bypass the filter element.

Obviously, the consequences of a breakdown are determined by its type: the valve is stuck in the open or closed position. If the bypass valve does not close at all (jammed, the spring has broken), the oil will always bypass the filter material. That is, the oil will not be cleaned at all.

If the valve is stuck in the closed state, there will be excess pressure in front of the oil filter and engine oil starvation. As a result, theoretically, with an increase in the pressure of the oil pumped by the pump, the filter material may break. But most likely, the control valve will open (the oil return check valve directly to the crankcase, located on the oil line between the oil pump and the filter). The result will be oil starvation, and the emergency oil pressure lamp will light up for a long time.



Figure 10. Emergency oil pressure lamp



However, the emergency oil pressure lamp can light up for many reasons:

- Oil pump failure
- Clogged oil channels
- Oil level drop
- Too low idle speed
- Oil pressure sensor malfunction

Of course, it is bad if the bypass valve is constantly open. Moreover, it is difficult to determine this problem - if there are no other malfunctions, the motor is working normally, the lamp does not light up.

5. Conclusion

In summary, this study provides a detailed account of the materials and methods used to analyze the common faults in oil filters. By using a combination of visual inspection, microscopic analysis, particle size analysis, chemical analysis, pressure drop analysis, and performance testing, the study aims to identify different faults commonly found in oil filters and provide insight into how these faults can affect the performance of the filters.

In conclusion, deterioration in engine performance, black exhaust when gasping up, a drop or increase in oil pressure, the ignition of the corresponding lamp on the control panel - all these can be signs of a malfunctioning oil filter.

Changing the oil filter is mandatory during an oil change. During this period, he manages to get very clogged.

Solving the problem is simple: you need to replace the oil filter or filter element if it is a collapsible model. Suspecting that the filter is not working properly, it is impossible to delay the elimination of the problem, because any deterioration in the quality of engine lubrication is its overheating and accelerated wear, which is fraught with much more serious malfunctions and major repairs.

REFERENCES

1. Акмалиева, Н.Т. Экономические и экологические проблемы утилизации отслуживших автотранспортных средств// Труды МЭЛИ: электронный журнал. – С.11.



2. Митрохин, Н.Н., Павлов. А.П., Утилизация и рециклинг автомобилей: учеб. пособие / – М.: МАДИ, 2015. – 120 с.
3. Белоусова, Е.Е. Авторециклинг: Россия и мир / Е.Е. Белоусова // Отделаналитического сопровождения законодательной деятельности информационноаналитического Управления Московской городской Думы.
4. Пухов Е. В. Совершенствование системы регенерации и утилизации отходов предприятий технического сервиса транспортных и технологических машин АПК : автореферат дис. д-ра техн. наук. 05.20.03. Воронеж, 2013. 36 с.
5. Tarashchan Nikolai Nikolaevich, Kicha Pavel Petrovich Efficiency of engine oil cleaning by combined filtration in marine forced medium-speed diesel engines // Scientific works of Dalrybvvtuz . 2015.
6. Avliyokulov Jamshed Sadulloevich , Narziev soyib Ortikovich , & Magdiev Shovkat Pulatovich (2021). INVESTIGATION OF FREQUENCY OF ENGINE OIL REPLACEMENT UNDER OPERATING CONDITIONS. Bulletin of Science and Education, (9-3(112)), 16-19.
7. Chudinovskikh A.L., Lashkhi V.L., Spirkin V.G. The choice of informative characteristics of motor oil to assess its performance // Chemistry and technology of fuels and oils, 2013. No. 1. P. 10-12.
8. Kovalsky B. I. Methods and means of increasing the efficiency of the use of lubricants, 2005.
9. Baltenas R. et al. Motor oils // St. Petersburg: Alfa-Lab., 2000.
10. Presnyakov V.A., Kaminsky N.S., Petrenko S.S. Justification of the frequency of replacement of motor oils during the operation of the car // Successes of modern science and education, 2016. V. 3. No. 6. P. 115-117.
11. Solomakhin Yu.V., Chekh V.Yu. Frequency of engine oil change under different operating conditions // Uspekhi sovremennoy nauki, 2016. V. 3. No. 6. P. 54-57.
12. Bazarov, B. I. (2022). Improving the Efficiency of Air Purification in Diesel Mining Dump Trucks. Miasto Przyszłości , 27, 117-120.
13. MAGDIEV, Sh., & BAZAROV, B. (2011). ABOUT TERMS OF REPLACEMENT OF MOTOR OILS OF ATS IN MOUNTAIN CONDITIONS. Automotive, (11), 23-24.



14. Spirin E.N. Improving the operational reliability of construction and road machines by modifying lubricants: dis . Tomsk: autoref . dis cand. so-called. / E.N. Spirin, 2006.
15. Ponomarenko V.S., Korneev S.V., Ivanov A.L. Operational materials: laboratory workshop // Omsk: SibADI Publishing House , 2010.