

Identification of the Causes of Dirty Fuel Filters in Auto Workshops for Optimizing Vehicle Maintenance

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Abstract—Fuel is one of the tools to drive the machining system that moves from the fuel tank to the engine. Although there are several areas that have switched to using electric vehicles, vehicles that use fuel oil still dominate the public in various countries. The purpose of this research is to identify the causes of a dirty fuel filter in an auto repair shop. The methods used in this analysis are Failure Mode and Effect Analysis (FMEA) and fishbone diagram analysis. Based on the results and discussion, the cause of the dirty fuel filter is the causal factor from the method side, namely due to negligence in maintenance, from the material side because the fuel tank is dirty and the fuel is not good, from the engine side because of continuous use without maintenance, from the human side because it is not routine maintenance, due to carelessness in maintenance, and due to frequent changes in the type of fuel.

Keywords—FMEA; fishbone diagram; fuel filter

I. INTRODUCTION

Fuel is a system that functions to supply fuel from the storage tank to the engine. Currently, even though electric vehicles have been introduced, vehicles that use fuel still dominate Indonesian society. Only in certain cities that have started to switch to electric vehicles, this is of course very much influenced by the readiness of the existing infrastructure in the city and the economic stability of the people in the area.

There are various companies operating to sell fuel in Indonesia, but the company that dominates in fuel sales is Pertamina. Where Pertamina is a State-Owned Company (BUMN) which has various kinds of fuel products. There are three product specifications offered by Pertamina, namely (1) Product specifications for Oil Fuel (BBM), (2) Product specifications for Biofuels (BBN), and (3) Product specifications for LPG. Of the three specifications, there are many types offered to the public according to their needs, namely in table 1 below (Pertamina Draft):

TABLE I. VARIOS TYPES OF FUEL FROM THE PERTAMINA COMPANY

Type	Type Detail
Product specifications Fuel Oil (BBM)	<ol style="list-style-type: none"> 1. Pertamina Turbo 2. Pertamina 3. Pertalite 4. Premium (already rare) 5. Pertamina Dex 6. Dexlite B30 7. Dexlite B0 atau B20 8. Solar B30 9. Solar B0 atau B20 10. Minyak Tanah (already rare) 11. Avtur 12. MDF 13. LSFO 180 14. LSFO 380 15. MFO 180 dan 380 16. IFO 180 dan 380
Bio-fuel product specifications (BBN)	<ol style="list-style-type: none"> 1. FAME
LPG product specifications	<ol style="list-style-type: none"> 1. LPG Mixed 2. LPG Propana 3. LPG Butana

Apart from Pertamina, there are still many private companies operating in Indonesia such as Shell and others. Where shell also has many types of fuel offered to the people of Indonesia.

Some of the components in the fuel system include storage tanks, transfer pumps, fuel filters, pressure regulators, fuel amperage floats and then to the engine. The working principle of the fuel system on a Honda engine is that the fuel from the storage tank is filtered into the gasoline filter using commands from the transfer pump and the air pressure is regulated by the pressure regulator then goes directly to the main engine. The function of each component in the fuel system is as follows:

1. **Storage tank** is the initial fuel storage before it is supplied to the main engine.
2. **Transfer pump** is a pump that functions to distribute fuel to the main engine.
3. **Gasoline filter** is to clean and reduce fuel from the influence of impurities in the fuel.
4. **Pressure regulator** is to maintain the air level in the fuel storage tank.
5. **Fuel ampere buoy** is to show the amount of fuel contained in the storage tank.

Since the use of oil-fueled vehicles is still very dominant, this research is still very much needed as information to the public in maintaining their vehicles. Where is the scope of this research around the fuel system components that need to be anticipated. Some of the problems that often occur in fuel system components include the frequent occurrence of dirt deposits and blockages.

II. METHODS

In this study, there are two methods used, namely Failure Mode and Effect Analysis (FMEA) to analyze the details of component functions, component failures, the effects that occur and their causes. The FMEA function has been widely used by several researchers in analyzing, such as FMEA used to minimize can defects [2], then FMEA for product defect analysis on the OKT 501 table at PT. Kurnia Persada Mitra Mandiri [3], and FMEA are used for work accident risk analysis [4].

Then the fishbone diagram method to analyze in more detail, looking for the causes of very detailed problems. Where the fishbone diagram was introduced by a Japanese named Dr. Kaoru Ishikawa. Apart from the name fishbone diagram, there are also

those who call it a causal diagram, or some who call it an Ishikawa diagram according to the name that introduced it [5], [6], [7].

III. RESULTS AND DISCUSSION

Based on the results of observations in the field, it can be summarized in the FMEA table regarding the fuel system in the XYZ car repair shop, which is in table 2 as follows:

TABLE II. HONDA ENGINE FUEL SYSTEM FMEA

Item	Function	Failure	Effect	Cause
Storage tank	Main tank of the entire fuel needed by the engine	Often there is a deposition of dirt	There is a blockage in the engine components so that the engine chokes	Impurities from fuel
Transfer pump	The pump functions to drain fuel from the storage tank to the engine	Clogging of the transfer pump	The trans pump is damaged and does not work and the engine cannot start	Impurities from fuel
Gasoline filter	Serves to filter fuel from impurities and then distributed to the engine	Clogging of the fuel filter	Fuel can not flow optimally	Impurities from fuel
Pressure regulator	Serves to regulate the air pressure in the fuel tank	Clogging of the pressure regulator	The air pressure in the fuel tank is irregular	Impurities from fuel
Fuel ampere buoy	Serves to show the amount of fuel in the tank	Clogging of the fuel ampere float	Gasoline amper not working	Impurities from fuel

Based on the FMEA table above, it can be concluded that dirt from fuel is not very good, therefore a very critical gasoline filter can cause the transfer pump to malfunction or be damaged and result in the engine not starting.

Furthermore, based on the FMEA analysis in table 2 above, the researcher wants to identify the causes of dirty fuel filters using the fishbone diagram as shown in Figure 1 below:

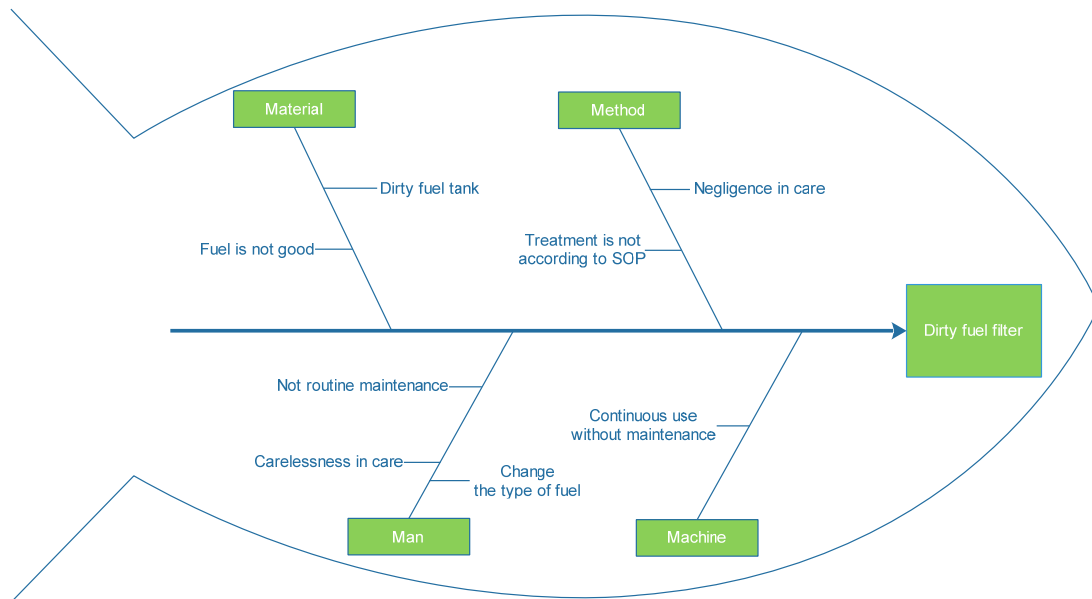


Fig. 1. Fishbone diagram of fuel filter

Based on Figure 1 above, several factors cause dirty fuel filters, namely from method, material, machine, and human factors. The causes and consequences arising from these factors can also be seen in the form of table 3 as follows:

TABLE III. CAUSE AND EFFECT OF A DIRTY FUEL FILTER

Causative factor	Cause details	Consequence
<i>Metode</i>	1. Negligence in care 2. Treatment is not according to SOP	
<i>Material</i>	1. Dirty fuel tank 2. Fuel is not good	Dirty fuel filter
<i>Machine</i>	Continuous use without maintenance	
<i>Man</i>	1. Not routine maintenance 2. Carelessness in care 3. Change the type of fuel	

From table 3 above, it is very important for people who own vehicles to be able to take precautions so that the fuel filter doesn't get dirty quickly, this is an optimization in vehicle maintenance.

IV. CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the dirty fuel filter is the causative factor from the method side, namely due to negligence in maintenance, from the material side because the fuel tank is dirty and the fuel is not good, from the engine side because of continuous use without maintenance, from the humans because they do not routinely carry out maintenance, because of carelessness in maintenance, and because they often change the type of fuel.

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