

Research on Automatic Air Filter Cleaning System

Swapnil M. Dhok

Department Of Mechanical Engineering, KDK College of engineering Nagpur, India.

Mahesh A. Meshram

Department Of Mechanical Engineering, KDK College of engineering Nagpur, India.

B.D. Sarode

Department Of Mechanical Engineering, KDK College of engineering Nagpur, India.

Abstract – Air filter cleaners are used in a wide range of automotive applications. From passenger cars to heavy duty trucks, there is always an air cleaner to keep inlet air free of impurities and air flow passage obstruction in low levels. The air filters in an air intake system permanently removes foreign particles such as dust, dirt and soot from the intake air, thereby maintaining the performance of the engine and protecting it from damage. Proper maintenance can help vehicles perform as designed, thereby positively affecting fuel economy, emissions, and overall drivability. This paper addresses the issues of air filters proper cleaning. In contrast, a recent study showed that the fuel economy of modern gasoline vehicles is virtually unaffected by filter clogging due to the closed loop control and throttled operation of these engines. Because modern engines operate without throttling, a different result could be anticipated. This paper describes the measured results with focus on changes in vehicle fuel economy but also includes performance. So we fabricated a type of machine which avoids a more time consumption and more human efforts to clean the air filter. The present air filter is works on the principle of pneumatic system. Nowadays, so many industries are interested to work on the base of automation that's why concerned with this concept of automation we fabricated an air filter cleaner whose nominated as “ ENHANCED APPROACH FOR CLEANING AIR FILTER”.

Index Terms – Air filter, Automotive, Engines, Throttling.

1. INTRODUCTION

An air filter cleaner is a device which removes solid particulates such as dust, pollen, mold and bacteria which is collected from the air. Air filters are used in application where air qualities is important, notably in building ventilation system and in engines such as internal combustion engines, gas compressor gas turbine and other. An air filter is an important part of intake system of an automobile because it is through the air filter that the engine “Breaths”. An engine needs an exact mixture of fuel and air in order to run, an all of the air enters the system first through the air filter. The air filter purpose is to filter out the dust and other foreign particles in the air, preventing them from entering the system and possibly damaging the engine. An air filters is a generally made up of fibrous material, pleated accordion-style. An air filter can also

be made of cotton or fabric like materials which is then oiled in order to increase air flow to the filters. The effects of air filter performance were studied carried out with the different diesel engine of cleaned air filter. This process was very time consuming and costly in terms of amount paid by the contractor to a mechanic for other person to have a filter clean. This manual cleaning of filter also often resulted in a pin holes or other damage to the pleated material of the filter. If the pleated material of the filter where damage, the filter would be useless and time invested in the cleaning of air filter would be a complete loss. Therefore in the view of this hazards and the high cost of labour. The present invention eliminates the problem previously encountered. The air filter cleaner is a de-clogging device. It is composed of two main components i.e. pressure vessel (storing air pressure/ air compressor) and triggering mechanism (high speed release of compressed air). It is a machine which clean the air filter automatically by using c-programming and electronic circuit. The present project is directed to an air filter cleaner which may be used on a job site to clean the air filter of construction equipment and vehicle during normally scheduled downtime. In the past, this air filter element where either cleaned by the process of spraying the compressed air from the hoses.

2. LITERATURE REVIEW

Air filters serve the primary needs of removing airborne particulate contaminants from outdoor air prior to introducing the cooling resource into the data hall. Additionally, they serve to increase reliability of mechanical equipment such as fans and spray cooling systems. However, the process of removing dust and particulates presents impedance to airflow that must be accounted for as it may significantly increase the power required to operate supply fans. Darcy's Law, the first law of filtration, states that pressure drop across a filter is proportional to the flow rate of the fluid moving through it [1]

The data center supplying the used air filters for this study is located in central Oregon in a high desert climate. The cool, dry environment allows for year-round utilization of outdoor air and a direct evaporative cooling system eliminating need for

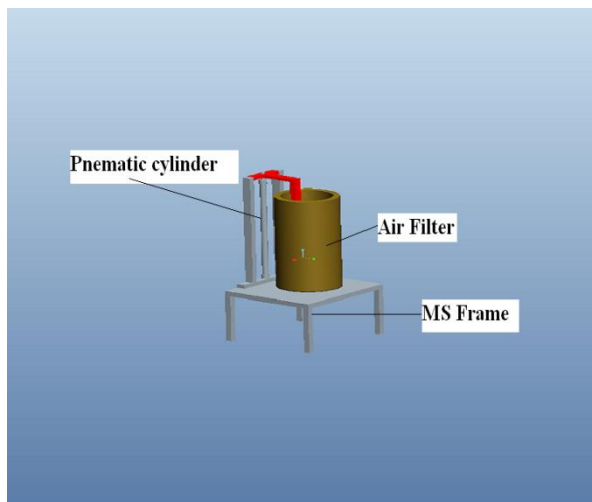
chillers and compressors. No historical data is present for the specific location; however the closest city reports a 50 year extreme maximum dry bulb and wet bulb temperatures of 105.6°F (40.9°C) and 70.3°F (21.3°C) respectively. Extreme minimum data is given as -30.8°F (-34.9°C) dry bulb temperature at 50% relative humidity and 0.55 grains of moisture [2].

The fact that legionellae are found in hot-water tanks or thermally polluted rivers emphasize that water temperature is a crucial factor in the colonization of water distribution systems. The mode of transmission varies with the variety of bacteria but the disease is usually transmitted through inhalation of aerosols as carriers of small bacteria to the lungs, allowing its deposition in the alveoli [3].

One more air filtration system is electrostatic air filtration system used for household or commercial purpose and uses electrostatic and carbon filters to clean the air. It is most effective filtration system to get relieved of pollutants and micro particles from the air. The functioning of the electrostatic air filtration is different from the HEPA but is more effective in filtering the air clean. An electrostatic carbon filtration system also cleans tobacco smoke and other such odors and keeps your lungs healthy by giving clean air for breathing [4].

In order to evaluate the performance of air filters an air flow chamber with maximum capacity of 3000cfm (1.42m³/s) was employed. The air flow bench consists of a 36in (0.91m) inside diameter chamber with a 60Hz blower connected to one end. The opposite end is open for attachment of a device under test. A nozzle plate at the center of the chamber has three 6in (0.15m) diameter nozzles that may be opened and closed to obtain the desired air flow rate. Pressure taps on each side of the nozzle plate are used to record differential pressure across the nozzles and, along with nozzle effective diameter and loss coefficient, calculate air flow rate [5].

3. CONSTRUCTION AND WORKING



- Arrangement of an air filter on disc connected by the rotor which is mounted on the base of the assembly and fixed with the help of clamp.
- The aluminium frame mounted on the base which consist of pneumatic cylinder having solenoid valve switched by the ATmega-16 microcontroller with c- programming for reciprocating motion of pneumatic cylinder. Incoming air from the compressor is distributed to the nozzles through pipe.
- After switching on the solenoid will activate and control the reciprocating motion of pneumatic cylinder and at same time motor also start and rotate the air filter in same direction
- Air pump is used to run the pneumatic cylinder.
- The external compressor connected to the pipe which supply the compress air through the pipe and finally through the nozzle.
- Because of rotating motion of an air filter and reciprocating motion of the nozzle, the incoming compress air from the external compressor helps to remove maximum amount of particulate collected on the air filter from the environment within short interval of time. And hence the air filter will be clean.

4. SPECIFICATIONS

1. Conventional air filter :- standard for diesel and petrol engine
2. D.C. motor :- 18 watt.
3. Frame :- 760cm*460cm
4. MDFsheet :7750mm*4650mm
5. Aluminiumsquare pipe :- 4.7cm*2.1cm
6. Pneumatic cylinder :- mal. 16*400, 600 mm stroke length
7. Pvc pipe :- 1/2"
8. Pneumatic pipe :- 6mm*8mm
9. Telescopic channel :-2 feet long.
10. Compressor :- length-500mm, dia-300mm, pressure-8 bar
11. Solenoid valve :- 1/2 dc valve
12. Nozzle :- inlet-6mm, outlet-1.6mm
13. SMPS :- AC I/P110/220v. DC O/P 12v10amp.
14. Adaptor :- I/P 100-240v AC, o/p 9v DC.
15. Microcontroller :- ATmega-16 (Atmel)
16. Air pump:- 12V-13.5V DC, Max Amp-15,
17. Max Pres- 150 psi,Disp:-35L./min.
18. Voltage regulator :- 7805
19. Motor driver IC :- L293D

5. CONCLUSION

- Thus we conclude that by using this setup it reduces the human effort as well as time required for cleaning per unit.
- In a minimum of time this set up can be used to clean many units of air filter at a time.
- Thus it reduces the wastage of air filters which we used to replace earlier

REFERENCES

- [1] R.C. Brown, *Air Filtration*, Tarrytown, NY: Pergamon Press, 1993.
- [2] Park, J., "Data Center V1.0," Open ComputeProject. <http://opencompute.org>, 2011.
- [3] The determination of Legionella bacteria in water and other environmental samples-Part 1- Rationale of surveying and sampling. Environment Agency, 2005
- [4] Alexander H., Brunski J.B., Cooper S.L., Hench L.L., Hergenrother R.W., Hoffman A.S., Kohn J., Langer R., Peppas N.A., Ratner B.D., Shalaby S.W., Visser S.A., and Yannas I.V., Classes of materials used in medicine. In *Biomaterials Science: An Introduction to Materials in Medicine*, Ratner, B.D., Hořman, A.S., Schoen, F.J., Lemons, J.E., (eds.) Academic Press, New York, NY (1996), pp. 37–130].
- [5] Instruction Manual for AMCA 210-99 Airflow Test Chamber Airflow Measurements Systems.