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AXIAL AERODYNAMIC COLLECTOR FOR TRUCKS

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ABSTRACT: This paper presents a study concerning the improvement of airflow intake efficiency for a Volvo truck internal combustion engine. It was imagined and designed an axial aerodynamic collector involved in capturing and directing the airflow towards the filter supply route. To highlight the effectiveness of axial aerodynamic collector measurements were made of the air pressure in the supply circuit, both in its absence and presence.
KEYWORDS: Axial aerodynamic collector, airflow, intake, internal combustion engine

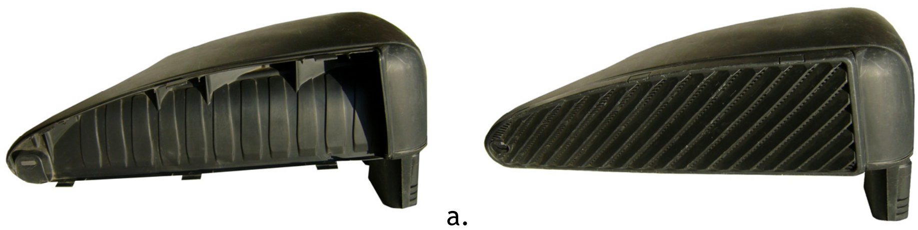
❖ ARGUMENT

At the initiative of a road transport company with a fleet of about 1000 Volvo 440 trucks, we started a study on the air intake efficiency of the internal combustion engine fitted to these models.

Since the classic filter location (Figure 1) in this truck model is under the cabin, on the chassis, behind the front direction wheels, there is no possibility of implementing a supra-suction filter without casing. At runtime, the supra-suction filter without casing would be exposed to dust, water and especially the mud thrown by the direction wheels, which would lead to early cogging and blocking of the filtering area. The gas-dynamic resistance (filter permissiveness) would increase considerably, resulting in severe reduction of the filling degree of the engine cylinders.

Given the air filter position described above, performing the genuine classical version of admission implies the existence of a supply route upstream the filter, which is designed to facilitate the aspiration of the relatively clean airflow (with minimal impurities) through the filter in the engine cylinders. This supply route begins (airflow-wise) with a chamber located in the upper left corner of the cabin, chamber which has a perforated grid attached (Figure 2).

Fig. 1. Position of the air filter



a. b.

Fig. 2. Room of the supply route. a - without perforated grid, b - with mounted perforated grid

The grid has holes (perforations) for air absorption oriented counter-airflow-wise (during truck motion). The blue arrows in Figure 3 represent the direction of airflow when the truck is moving, and the red arrows indicate the direction of the air sucked through the grid holes.

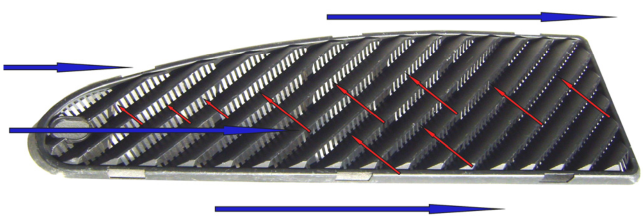


Fig. 3. Airflow over the grid

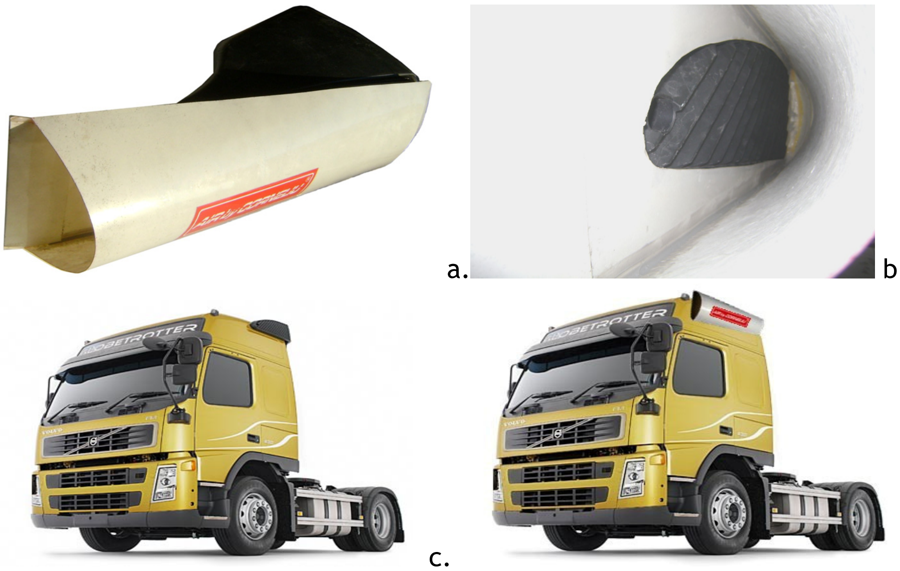
The drawback of this solution is that the position of the grid and its holes favours, during truck movement, the appearance of a slight depression in the holes, phenomenon that reduces the absorption capacity of the air towards the filter. Moreover, the chamber, together with the perforated grid, does not provide the function of air capture (or they do it in a too low degree).

Fig. 4. The axial aerodynamic collector

❖ THE AXIAL AERODYNAMIC COLLECTOR

In light of the facts presented above, we have imagined and designed an axial aerodynamic collector (Figure 4) involved in capturing and directing the airflow towards the filter supply route.

This is mounted on the supply route chamber grid, as shown in Figure 5, neutralizing the depression effect occurred in its absence.



a. b.

c. d.

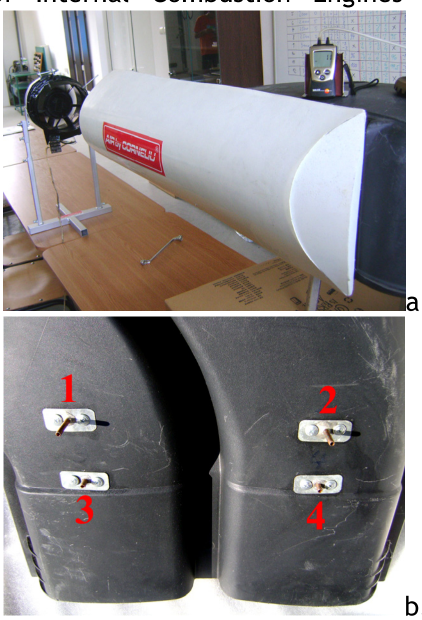
Fig. 5. Details regarding the collector anchorage. a - general view, b - detail inside the collector, c - Volvo tractor head without collector, d - Volvo tractor head with mounted collector

❖ EXPERIMENTAL STAND FOR MEASUREMENTS

To highlight the effectiveness of axial aerodynamic collector measurements were made of the air pressure in the supply circuit, both in its absence and presence. The trials have been made in the Laboratory of Internal Combustion Engines of the Faculty of Engineering of Hunedoara, University "Politehnica" of Timisoara.

The experimental stand (Figure 6.a) is made up of a fan, the original supply pipe chamber (Volvo 440 truck), the axial aerodynamic collector and TESTO 510 digital gauge (Figure 7).

On the supply piping 4 pressure plugs were implemented (Figure 6.b) to measure the static (plugs 1 and 2) and dynamic pressures (plugs 3 and 4).



a.

b.

Fig. 6. The experimental stand.
a - general view, b - detail regarding the pressure plugs

Fig. 7. TESTO 510 digital gauge

Differentiated measurements were performed for three cases:

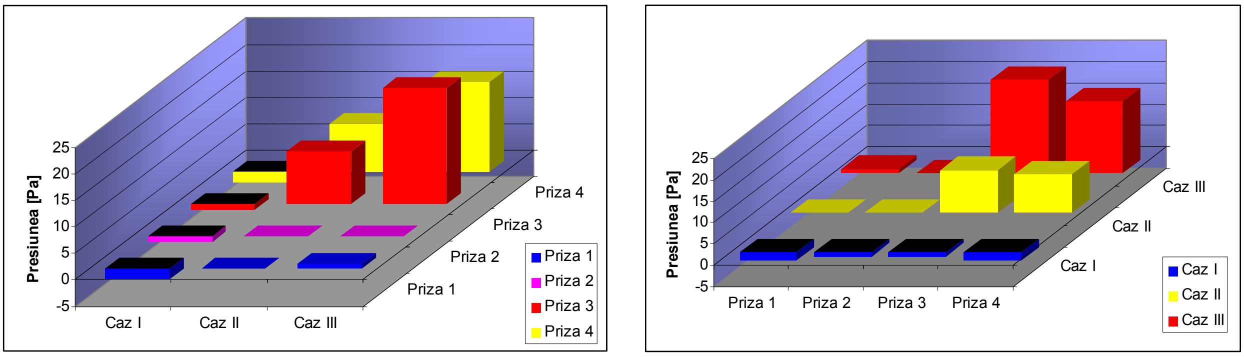
I. In the presence of the grid and without the axial aerodynamic collector, situation identical to that used by Volvo 440 trucks;

II. In the presence of the grid and the axial aerodynamic collector;

III. In the absence of the grid and in the presence of the axial aerodynamic collector.

❖ RESULTS AND CONCLUSIONS

Following the measurements performed, the following conclusions can be drawn (Figure 8):
a. The capture effect is the greatest for case III;
b. For case I there is no capture effect, a slight depression effect being noticed;
c. Case II is a compromise by overlapping the axial aerodynamic collector over the grid, but the gas-dynamic resistance is twice when compared to case III.



a. Fig. 8. Results of the measurements performed b.

❖ REFERENCES

[1.] BIRTOK-BĂNEASĂ, C., RAŢIU, S. – Admisia aerului în motoarele cu ardere internă – Filtre supraaspirante – Sisteme dinamice de transfer, Editura Politehnica, Timişoara, 2011;
[2.] RAŢIU, S., MIHON, L. – Motoarele cu ardere internă pentru autovehicule rutiere – Procese şi caracteristici, Editura Mirton, Timişoara, 2008;
[3.] RAŢIU, S. – Motoarele cu ardere internă pentru autovehicule rutiere – Procese şi caracteristici – Experimente de laborator, Editura Mirton, Timişoara, 2009;
[4.] www.corneliugroup.ro

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