Hydrocarbon Trap Alternative Test Procedure Proposal

Prepared by P. Treydte

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SUMMARY

Hydrocarbon traps (HCTs) are used by the OEMs to control evaporative emissions. They have become more prevalent in late model vehicles, and the Specialty Equipment segment of the automotive aftermarket desires a reasonable path forward for the evaluation of aftermarket solutions to HCT replacement.

The current state of the art for emissions testing is Full Vehicle SHED[1] testing. SHED testing evaluates evaporative emissions from the entire vehicle, including the fuel filling and containment system, fuel delivery system, fuel vapor retention system and the air filtration system. Evaporative emissions may also be elevated by interior components, tires, other fluids and surface treatments. While it is important to evaluate all of these sources of evaporative emissions, the cumulative effect of all the mentioned items on the evaporative emissions measurement makes it difficult to evaluate any single source with a SHED test. SHED testing may also be cost prohibitive for the size and nature of the automotive aftermarket industry.

PROPOSAL

For these reasons, an alternative test method is being proposed that would evaluate the hydrocarbon capacity of the intake system in isolation from the rest of the vehicle. If an aftermarket system demonstrates equal or greater hydrocarbon retention capacity than an OEM system, it can be assumed that the system will provide the necessary function when installed in the vehicle.

HYDROCARBON TRAP FUNCTION

A hydrocarbon trap is designed to capture loose hydrocarbons that may escape from the engine intake tract or PCV system of the engine during non-running conditions. All of the intake components including the hydrocarbon trap reside in an underhood environment with higher than ambient temperatures[2] after a drive cycle. Once the engine is restarted, the hydrocarbon trap is purged via airflow through the intake system and the hydrocarbons are consumed by the engine.

PROPOSED TEST

The intent of the proposed test is to simulate the operating conditions of the hydrocarbon trap and evaluate the full capacity of the entire intake system under these conditions. The proposed test method will require a test apparatus (see figures 1 and 2). The apparatus will consist of the following:

A. Temperature Controlled Enclosure
B. Intake System Mounting Flange
C. Fuel Vaporization Chamber[3]
D. Fuel Injector[4]
E. HC Measurement Device (FID)
F. Low Speed Circulation Fan[5]
G. 100 CFM Chamber Purge Fan with valve
H. 100 CFM Intake System Purge Fan with valve

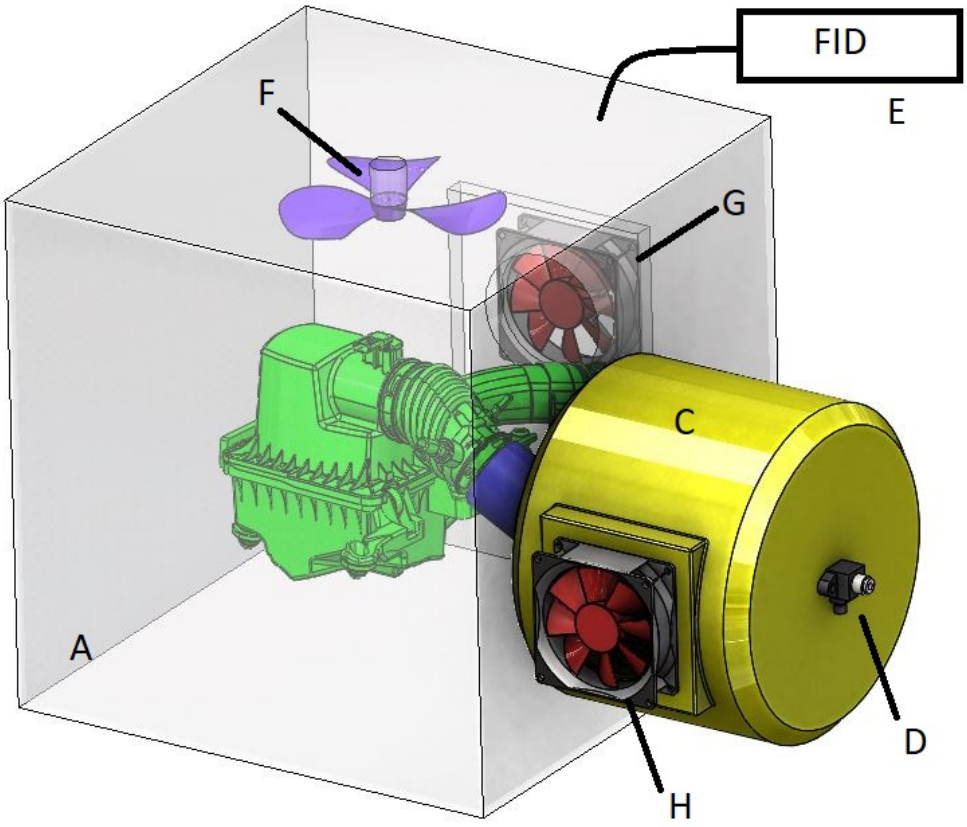

Figure 1

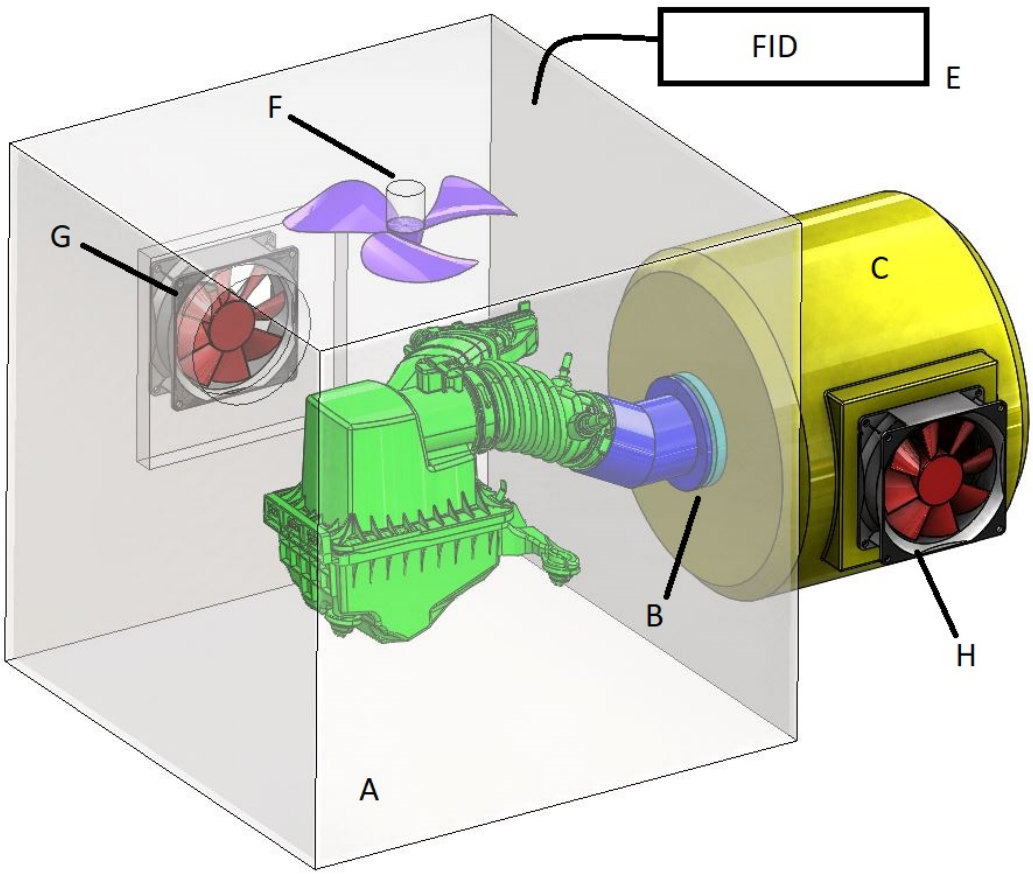

Figure 2

The system under test shall be installed in the apparatus in the same orientation as it would sit in the vehicle. The Intake System Mounting Flange (B) will have sufficient bolt patterns and adapters to allow for a variety of systems to be mounted. The system under test shall have any other ports that would have connection in the vehicle, such as PCV, sealed for the purposes of the test. All testing shall be conducted at a predetermined temperature[2], simulating appropriate underhood conditions.

TEST SEQUENCE

1. Start Low Speed Circulation Fan (F)
2. Inject fuel *FV* into fuel vaporization chamber, where *FV* is a quantity greater than the anticipated capacity of the hydrocarbon trap
3. 15 minute soak period[6]
4. Measure HC, note as *FA*
5. Note measured HCT capacity FH_1 , where $FH_1 = FV - FA_1$
6. Purge Sequence- open Purge Fan valves and run Purge Fans for 15 minutes
7. Close Purge Fan Valves
8. Repeat steps 2-7, incrementing measurements (FA_2, FA_3…)

Testing sequence shall be repeated until *FH* values reach stabilization. The final 3 measurements may be averaged to establish a final capacity.

EVALUATION

Hydrocarbon capacity *FH* may be compared between the OEM system and the aftermarket system to determine if the aftermarket system has sufficient capacity to meet or exceed that of the OEM system.

NOTES

1. *SHED= Sealed Housing for Evaporative Determination*
2. *For the purposes of our discussion, a reasonable estimation of underhood temperature would likely be around 200°F (93°C).*
3. *The Fuel Vaporization Chamber would have a heating element in it sufficient to quickly vaporize the fuel quantity.*
4. *A motorcycle fuel injector should be ideal for a metered delivery in an appropriate quantity.*
5. *The purpose of this fan is to allow sufficient air movement to allow for adequate diffusion and therefore meaningful measurement.*
6. *Time period needs to be sufficient to allow for diffusion and for HCT activity.*