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OFFICE OF DEFECTS
INVESTIGATION



HYUNDAI·KIA MOTORS

December 22, 2006

Via Federal Express

Thomas Z. Cooper, Chief
Vehicle Integrity Division
Office of Defects Investigation
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington D.C. 20590

Re: Preliminary Evaluation (PE06-042) re Engine Cooling
Fan in 2002 Kia Sportage Vehicles

Dear Mr. Cooper:

This letter contains Kia's supplemental response to Request Numbers 8, 9,10 and 12 of your letter dated November 8, 2006 (Reference NVS-213kmb/PE06-002) pursuant to the extension you granted in November, 2006.

REQUEST NO. 8:

Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, "actions") that relate to, or may relate to, the alleged defect in the subject vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, Kia. For each such action, provide the following information:

- a. Action title or identifier;
- b. The actual or planned start date;
- c. The actual or expected end date;
- d. Brief summary of the subject and objective of the action;
- e. Engineering group(s)/supplier(s) responsible for designing and for conducting the action; and
- f. A brief summary of the findings and/or conclusions resulting from the action.

For each action identified, provide copies of all documents related to the action, regardless of whether the documents are in interim, draft, or final form. Organize the documents chronologically by action.

RESPONSE TO REQUEST NO. 8:

Kia first became aware of potential cracking of the fan blades in May 2002. As a result, Kia investigated and evaluated the issue and eventually issued two parts bulletins dated August 2003 and December 2003 and a technical service bulletin in November 2003. Kia further investigated and evaluated this issue in response to your IR letter initiating this PE. KMC conducted testing and evaluations specifically intended to assist it in responding to that inquiry. Attached are copies of KMC's reports. **(See Tab 1).**

1.
 - a. 2002MY Sportage Cooling Fan Damage NVH evaluation
 - b. October 20, 2006
 - c. November 1, 2006
 - d. To evaluate effect of fan blade separation.
 - e. KMC Function Test Team 3, Noise Vibration Group
 - f. Key Findings: Steering wheel vibration is detectable upon separation of one of the eight fan blades at certain engine rpm levels, and the vibration levels become impossible to ignore once a second blade separates. Vibration also generates significant noise levels which are readily detectable.

2.
 - a. MY 2002 Sportage Cooling Fan Crack, Separation Reconstruction Testing Report
 - b. November 6, 2006
 - c. November 30, 2006
 - d. To determine whether customers are given consistent and increasing notice of a developing problem with their vehicle, in the form of both vibration and/or noise and to evaluate the engine structures for their protective value in the event of fan blade separation.
 - e. KMC Quality Assurance Team 2
 - f. Key Findings:
 1. Driver awareness.
 - Drivers have notice of a developing problem through increased and distinctive noise and by feeling vibrations through the vehicle structures including the steering wheel. These occur without vehicle drivability impairment..
 - If the driver chooses to ignore the noise and vibration, reduced engine cooling performance will cause engine temperatures to rise which will be recorded on the engine temperature gauge.

2. Human exposure to fan blade separation with hood open.
 - Geometry of radiator assembly. The fan blade is not open to the engine compartment. A shroud placed around the fan blade spinning area to assist air flow also has the effect of protecting persons from any separated blades. An air duct above the shroud prevents any upward movement of the blades. In real world incidents, the shrouds and ducts have consistently remained intact when contacted by separated fan blades.
 - Materials. The fan blades are made of a polypropylene plastic in a shape which is designed to avoid significant injury to a person who contacts the blades, in spite of the force generated by the fan clutch assembly. Once separation of a blade occurs, the forces generated by an unattached fan blade are greatly reduced.
 - Engine compartment layout. The engine compartment layout catches separated fan blades after contact with the shroud, absorbing the remaining energy of the plastic blade and allowing it to fall to the bottom of the engine compartment or ground.

3. **Customer Contacts:**

As a result of this IR, KMA has contacted customers who reported related problems to the CA department in order to develop further information about those incidents. Those contacts have been consistent in confirming that customers were able to continue to operate their vehicles after hearing a blade separating or otherwise becoming aware of the problem, and were thus able to reach a safe location to deal with the issue.

REQUEST NO. 9:

Describe all modifications or changes made by, or on behalf of, Kia in the design, material composition, manufacture, quality control, supply, or installation of the subject component, from the start of production to date, which relate to, or may relate to, the alleged defect in the subject vehicles. For each such modification or change, provide the following information:

- a. The date or approximate date on which the modification or change was incorporated into vehicle production;
- b. A detailed description of the modification or change;
- c. The reason(s) for the modification or change;
- d. The part numbers (service and engineering) of the original component;
- e. The part number (service and engineering) of the modified component;
- f. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
- g. When the modified component was made available as a service component; and

- h. Whether the modified component can be interchanged with earlier production components.

Also, provide the above information for any modification or change that Kia is aware of which may be incorporated into vehicle production within the next 120 days.

RESPONSE TO REQUEST NO. 9:

- a. After the end of production of the 2002 Kia Sportage, modifications were made to the fan assembly which affected the service parts for that model year. This was the last production year for the Sportage, before its re-introduction as a new vehicle several years later. The modification of the fan blade for the service parts occurred in December 2002.
- b. The material composition for the 2002 MY Kia Sportage fan blade was changed from a heat deformation temperature of 100° C (PP JI-360) to a heat deformation temperature of 210° C (PA 6+ GF33%).
- c. The heat endurance of the original fan blade was determined to be too low, which was resulting in deformation induced cracks in the fan blades.
- d. 0K 048 15 140.
- e. Kia originally provided dealers with a new fan assembly as the replacement part for the cracked fan blades which is identified by 0K 048 15 140A. Kia later determined the only affected part was the fan blade itself and replacement of the entire fan assembly was unnecessary. Kia assigned a new part number for the fan blade only and is identified by 0K 048 15 142.
- f. The original unmodified part was not withdrawn from production, but in August 2003 a stop sale was placed on the original part when the new one become available.
- g. The modified fan blade was made available as a service component in August 2003.
- h. Yes. The dimensions of the modified component is the same as the original component. The modified fan blade has a different color than the original blade.

REQUEST NO. 10:

Produce one of each of the following:

- a. Exemplar samples of each design version of the subject components;
- b. Field return samples of the subject component exhibiting the subject failure mode;

- c. Any kits that have been released, or developed, by Kia for use in service repairs to the subject component/assembly which relate, or may relate, to the alleged defect in the subject vehicles.

RESPONSE TO REQUEST NO. 10:

The requested samples will be shipped simultaneously with this submission.

REQUEST NO. 12:

Furnish Kia's assessment of the alleged defect in the subject vehicle, including:

- a. The causal or contributory factor(s);
- b. The failure mechanism(s);
- c. The failure mode(s);
- d. The risk to motor vehicle safety that it poses; and
- e. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the alleged defect was occurring or subject component was malfunctioning; and
- f. The reports included with this inquiry.

RESPONSE TO REQUEST NO. 12:

- a. **Causal or contributory factors for cracking/separation:** The material composition of the fan blade for the 2002 Sportage does not have sufficient heat durability.
- b. **The failure mechanism for such cracking/separation:** The heat generated by the engine causes repeated bending deformation of the blade, and this in turn stresses the polypropylene blades in an unanticipated manner, initiating cracking.
- c. **The failure mode for such cracking/separation:** The centrifugal forces generated by the fan clutch motor can cause those cracks to further separate and propagate until complete separation occurs.
- d. **Possible risk to motor vehicle safety:** There is no record of any injury issues in the available investigation materials. Kia has therefore looked for potential safety issues in general and it has evaluated two specific scenarios where it could theoretically create a safety risk.

(1) Does fan blade separation lead to vehicle operating failures which endanger vehicle occupants by exposing their vehicles or their persons to the risk of accidents?

This issue focuses on the immediacy of the consequences of one or more separated fan blades from a vehicle damage standpoint. Kia has determined that separated fan blades do not directly interfere with the operation of the vehicle and that any mechanical consequences of separation should not lead to the operational failure of a vehicle under any reasonably identifiable circumstances. Specifically, there is substantial noise and vibration information which is provided to the driver to let them know that the vehicle should be serviced. A decision by the driver to ignore that information leaves the vehicle in operating condition. The impairment of the cooling system will then lead to increased operating temperatures, which can be observed on the instrument panel gauge. Eventually the gauge pointer will enter the red zone, indicating an immediate need for servicing. If all designed-in information is ignored, and the engine does overheat, the driver will be confronted with steam coming from under the hood, but will have time to maneuver their vehicle to a safe location to allow the engine to cool down. During that time, the driver will be able to make a decision to try to drive to a service location after cooling, or to call for a tow. There is no substantial risk to highway safety in these scenarios.

(2) Is a person standing adjacent to an open engine hold exposed to a substantial risk of injury from a separating fan blade?

Kia recognizes that a person confronted with the information identified in item (1) might lift up the hood of their vehicle to look for the source of the problem. It is possible that they would do so with the engine running. Similarly, a service technician could potentially look at the engine while it was running without first inspecting it for damage. These are not likely scenarios, but the potential is present.

It is clear from Kia's testing that the noise and vibration resulting from a separated fan blade is pronounced enough to ensure that the source of the problem is immediately identified once the hood is opened. Once the source area is identified, the engine must be turned off to permit a more detailed inspection. Thus, potential exposure times are limited.

The fan blades themselves are made from a polypropylene plastic which is flexible and has been chosen as a material and shaped with the understanding that inadvertent contact with hands and arms may occur. Thus, both the material and shape of the fan blades are designed not to cause significant injury, even when the blades are being driven by the fan clutch assembly.

The radiator assembly has been designed so that a strong shroud will be the first contact point for any separated fan blade. Moreover, directly above the fan, an even stronger plastic air duct protects the area where a person would most likely be standing and which would be potentially the most dangerous

route for any blade to travel. See Owners Manual page 7-15, attached as Tab 2. The shroud and duct are able to absorb the forces of any separated fan blade without any penetration. In no instance has Kia identified any failure or disruption of that shroud or the air duct when impacted. As a result, it is certain that any separating fan blade will have most of its energy absorbed as soon as separation occurs and then simply deflect rearwards into the engine. There is a consistent pattern of separated fan blades being found in the bottom of the engine compartment or on the ground.

This analysis tends to be confirmed by the fact that there has not been a report of injury during the six years since the first MY2002 Sportage was sold in the United States. A total of 46,887 such vehicles were sold that model year.

e. **The warnings received by the operator and the other persons both inside and outside the vehicle as to the presence and growth of such cracking:**

A cracked fan blade(s) generates clear abnormal engine noise and vibration through the body structures and the steering wheel. Such noise and vibration is progressive as more than one blade separates. Testing has shown that the driver would be aware of such noise and vibration as soon as separation occurs. A choice by the customer to ignore the noise and vibration will allow them to drive the vehicle while the cooling of the engine loses capacity. Engine operating temperatures will rise, which will be visible on the engine temperature gauge. A decision to continue to ignore all information will result in the engine overheating. In circumstances where a radiator is damaged by a separated fan blade, leaking coolant will trigger the information and warnings previously mentioned without causing the vehicle to stop.

f. **The VOQ reports included with this inquiry:** The VOQ reports are consistent with KMA's CA files and field reports in establishing that consumers receive feedback of the cracking due to various warning signs including, noise, vibration, rise in engine temperature and illumination of the Check Engine Light.

1. **VOQ No. 10165314; 08/12/06 (VIN: KNDJA723325** [REDACTED]

"Fan blade cracked in several places."

There is no indication in Kia's investigation that the fan blades in fact separated. Attempts to contact the customer for more details have been unsuccessful.

2. **VOQ 10164928; 08/08/06 (VIN: KNDJB723125** [REDACTED]

“...while accelerating through the intersection from a stop sign at 5 mph, a loud thud was heard and the vehicle jerked forward. The vehicle was driven home the remaining two miles with the hazard lights illuminated. Upon inspection of the engine, the fan blades were scattered across the engine compartment and some were caught in the wiring. The vehicle was towed to a service dealer where the fan was replaced and the damaged wiring to the air conditioning was replaced.”

Kia recently contacted customer and she confirmed that the vehicle did not stall or otherwise cease operating.

Kia does not have any explanation for the claim that the vehicle “jerked forward” and believes that would not have happened. Rather, Kia believes that this was the customer’s mental reaction to the loud noise and impact vibration.

3. VOQ No. 10165692; 08/07/06 (VIN: KNDJB723925 [REDACTED])

“radiator fan fractured to pieces while traveling 20mph. A noise was heard prior to the incident. The vehicle was pulled over and inspected. 4 fan blades were fractured and one the blades had flown into the radiator.”

On August 8, 2006, customer contacted the CA department and stated the car was at an independent shop addressing other repairs when the cooling fan was identified as “coming apart”. Kia’s best estimate is that the customer heard the noise of a fan blade separating while traveling at 20mph and subsequently took it to a service facility. There they identified the cracks and separation.

4. VOQ No. 10159921; 06/15/06 (VIN: KNJB723225 [REDACTED])

“while driving 60mph a scrapping noise came from under the hood. [Customer] discovered radiator fan was scrapping against the fan casing. There was a stress fracture in the center of the fan blades. . .”

Kia recently contacted the customer and he stated that he was driving down the highway when he heard a loud noise. He had thought he had run over something and continued driving home. The next morning when he turned the vehicle on he heard something scrapping coming from the engine. With the engine on, he lifted the hood and noticed the “central hub” was cracked. There was no damage to any other parts of the engine. The vehicle was towed to the dealer.

5. VOQ No. 10087572; 09/08/04 (VIN: KNDJB723425 [REDACTED])

“While driving three blades of the fan broke off and flew into the radiator. Vehicle was towed to the dealer”

Kia recently contacted this customer and she stated that immediately after she had started driving, she heard a “big bang” come from under the hood. She pulled over, turned off the ignition and when she looked under the hood, she noticed fan blades in her radiator and on the floor.

6. VOQ No. 10083140; 08/02/04 (VIN: KNDJB723225 [REDACTED])

“After pulling out from a drive . . .my cooling system fan(s) broke apart putting a hole in my radiator and causing the loss of all my antifreeze.”

Kia has been unable to reach this customer to interview her further, but damage to the radiator and loss of coolant is consistent with Kia’s analysis.

7. VOQ No. 10082465; 07/22/04 (VIN: KNDJB723625 [REDACTED])

“Plastic fan blades broke off cooling fan and struck radiator. . . . We have two vehicles bought at the same time and the other vehicle had same problem. Both fan blades replaced. This failure could hurt someone working on the vehicle.”

On August 9, 2004, customer contacted the CA depart and stated that he had bought two vehicles from Kia and the fan blades on each of the vehicles were about to break and so he replaced them.

Kia recently contacted this customer. He stated he purchased 2 Sportages for the security department of his company. Each day, the Sportages were inspected before being driven. During one of these inspections, customer noticed fan blades were missing from one of the Sportages. He drove the Sportage to a nearby repair shop and had the fan replaced.

8. VOQ No. 10070922; 01/15/04 (VIN: KNDJB723925 [REDACTED])

“Fan cracked in 3 spots.”

This customer could not be reached for an interview.

9. VOQ No. 10040952; 09/30/03 (VIN: KNDJB723X25 [REDACTED])

“My radiator fan motor literally blew up. All the fan blades fell off and caused my temperature to rise, after it [sic] the temp. rose then the engine light came on and the vehicle shut down. This has cracked my radiator and possibly the engine as well.”

This customer could not be reached for an interview, but the comments are generally consistent with Kia’s analysis. However, it is not believed that the fan motor “blew up” or that the engine itself cracked from a plastic fan blade hitting it.

10. VOQ No. 10166685; 08/28/06 (VIN: KNDJB723225 [REDACTED])

“When checking oil level on August 13, 2006, I noticed cracks between each blade on the engine cooling fan. Upon further inspection the cracks were found to go from front to back on 6 blades. I removed the fan, took it to the dealership and asked if there was a bulletin. I was told no. Bought new fan and installed myself.”

This customer could not be reached for an interview.

Conclusion

Kia investigated this issue near the time of production and believes that it correctly identified this as a quality problem without any risk to highway safety. It has diligently looked at this issue again as a result of your IR and it has again concluded that neither the consequences of the blade separations to the vehicle, nor the actual movements of the blades in the engine compartment, create a safety risk to the occupants of the Sportage vehicles.

Sincerely yours,



Robert Babcock
Manager—Corporate Affairs