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Your Ref: SDZ 8008S
Our Ref : CI/TP18018087/D

05 October 2018

INSPECTION REPORT OF MOTOR CAR SDZ 8008S

Requested By
Performance Motors Limited
303 Alexandra Road
Sime Darby Performance Centre
Singapore 159941

A. Introduction & Background Information

1. I refer to your request dated 20 August 2018.

2. By way of introduction, I set out below a brief description of my professional qualifications and professional work experiences.

3. I am a Senior Technical Investigator and certified Accident Reconstructionist with LKK Auto Consultants Pte Ltd. I have been carrying out assessments, valuations, inspections and technical investigations of motor vehicles involved in, among other things, accident since 2007. I have also carried out accident reconstruction basing on the laws of dynamics and physics by applying mathematical equations with technique competencies aligned with international standards, ensuring proper cause analysis. Some of my clients include the Singapore Police Force, NTUC Income Insurance Co-Operative Limited, AIG Asia Pacific Insurance Pte Ltd, AXA Insurance Singapore Pte Ltd, Cycle & Carriage Industries Pte Ltd and Performance Motors Limited amongst others. I also have experience in providing analysis and commentaries on damages and faults of motor vehicles.

4. I have given oral evidence as an expert witness in both the State Court and High Court, for both the prosecution and the defence for criminal proceedings and also for both the plaintiff and the defendant in civil proceedings. For instance, in MC Suit 17701/2010/Q, I acted as an expert witness in proceedings which involved among other things, a claim by an owner of a Mercedes sedan against the dealer for allegedly carrying out negligent works on the Mercedes sedan; in Suit 760/2011, I was asked by the dealer to provide my expert opinion on whether a brand new BMW sedan sold to a customer was defective. I have also been jointly appointed by both a car dealer and a car owner to provide my expert opinion as to whether the transmission of a brand-new car was defective.

5. My testimony as an expert witness for accident reconstruction and speed analysis cases involving criminal proceedings for the prosecution include amongst others, MAC 2350-51/2011, an accident involving four motor cars and a motorcycle resulting in the death of the motorcyclist; DAC 039421-2011, a motor car and motorcycle accident resulting in the death of the motorcyclist; MAC 3935/12, a motor lorry and pedal bicycle accident resulting in the death of the cyclist.

6. Cases where I have been engaged by an accused person include amongst others, DAC 60889-90/10, a motorcycle and motor car accident resulting in the death of the pillion rider; DAC 049130-2013 & DAC 049131-2013, self-accident involving a SMRT bus resulting in the death of one of its passengers.

7. I have also carried out numerous line of sight simulation, in close replication of an accident scenario, to determine a driver's view and sighting capability.

8. I hold a certificate in Technical Accident Investigation and Reconstruction from the Society of Automotive Engineers Australasia and a National ITE Certificate (Intermediate) in Automotive Technology (Light Vehicle) from the Institute of Technical Education. I have also attended training and passed a practical examination on correct repair methods, safe and cost-effective assessment of damaged motor vehicles (Thatcham Escribe System).

9. I am an affiliate member of the Society of Automotive Engineers Australasia; an affiliate member of the Institute of Automotive Engineer Assessors (UK); an associate member with the Society of Operations Engineers (UK).

10. For this case, I was requested by Performance Motors Limited (herein referred to as "**PML**") to carry out an inspection of a BMW 318i motor car with registration number SDZ 8008S (herein referred to as "**Subject Motor Car**") with regard to a complaint raised by the owner in respect of hissing noise and flapping noise emanating from the air conditioning vents.

11. My scope of instructions include, but is not limited to the following: -

    a. whether the hissing noise and flapping noise, and/or any other similar type noise (herein referred to as "**Noises**") are present in the Subject Motor Car; and

    b. whether, if in my opinion, any of the Noises were present, whether the Noises are fault or defect in the Subject Motor Car or whether the Noises constitute normal operating characteristics of the Subject Motor Car.

B. Methodology & Scope of My Report

12. I conducted a physical inspection of the Subject Motor Car to determine whether the Noises were present.

13. I conducted a physical inspection of a motor car (herein referred to as "**Comparison Motor Car**") that is of similar model and/or with certain materially similar equipment as the Subject Motor Car to determine whether the Noises observed to be present in the Subject Motor Car during my inspection were also present in the Comparison Motor Car.

14. I used sound recording equipment to measure the sound levels inside the passenger compartment of the Subject Motor Car and the Comparison Motor Car (herein referred to as "**Sound Measurement Tests**").

15. Finally, I conducted an analysis of my findings of the inspections carried out to the Subject Motor Car and the Comparison Motor Car and the Sound Measurement Tests.

C. Summary of Conclusion

16. The Noises were found to be present in the Subject Motor Car but were barely audible and could only be heard when I put my ears directly at the outlet of the air conditioning vents. Whilst seated in a normal driving position, the Noises were not heard.

17. Basing on my findings, the Noises are not a fault or defect of the Subject Motor Car or caused by a fault or defect in the Subject Motor Car. I am of the view that it is likely the normal operating characteristic of the air conditioning system that is fitted in the Subject Motor Car.

18. I set out below my full and detailed analysis:

D. Inspection of the Subject Motor Car

19. The Subject Motor Car was physically inspected on 10 September 2018 at the premise of PML. The mileage of the Subject Motor Car recorded was 29,822km.

20. I sat on the driver seat of the Subject Motor Car with engine running and radio switched off. The air conditioning system was then switched on with the blower speed turned to low (1 bar). Sitting in a normal driving position, I did not hear any noise coming out from the air conditioning vents. The blower speed was progressively increased from an initial low speed to medium speed and to high speed. As the blower speed increases, the air blowing sounds emitting from the air conditioning vents becomes louder naturally. I did not hear any noise other than the air blowing sounds.

21. The blower speed was then reduced back to low speed (1 bar) and this time, I had put my ears directly at the outlet of the air conditioning vents at the centre of the dashboard panel. Some sounds akin to “water flowing through pipe” sound was faintly heard. The blower speed was then progressively increased and the “water flowing through pipe” sound was gradually covered by the air blowing sounds as the blower speed increases. See photo 1 - 3 below.

Photo 1 shows a general view of Subject Motor Car at the time of my inspection on 10 September 2018. The mileage recorded was 29,822km.

Photo 2 shows a general view of the passenger compartment of the Subject Motor Car at the time of my inspection on 10 September 2018.

Photo 3 shows a general view of the control panel (circled) for the air conditioning system of the Subject Motor Car.

E. Inspection of the Comparison Motor Car

22. The Comparison Motor Car was also physically inspected on 10 September 2018 at the premise of PML. The mileage of the Comparison Motor Car was 3,492km. The same method (paragraph 20 and 21) used to identify whether the Noises were present in the Subject Motor Car was also carried out to the Comparison Motor Car.

23. Whilst seating on the driver seat in a normal driving position with the engine running, I switched on the air conditioning system with the blower speed turned to low speed (1 bar). The same "water flowing through pipe" like sound was heard. The sound was more audible as compared to the Subject Motor Car. I did not need to put my ears directly at the outlet of the air conditioning vents to hear this sound.

24. The blower speed was then progressively increased from an initial low speed to medium speed and subsequently to high speed. As the blower speed increases, the air blowing sounds emitting from the air conditioning vents correspondingly becomes louder naturally, covering the "water flowing through pipe" sound. See photo 4 – 6 below.

Photo 4 shows a general view of Comparison Motor Car at the time of my inspection on 10 September 2018. The mileage recorded was 3,492km.

Photo 5 shows a general view of the passenger compartment of the Comparison Motor Car at the time of my inspection on 10 September 2018.

Photo 6 shows a general view of the control panel (circled) for the air conditioning system of the Comparison Motor Car.

F. Sound Measurement Tests

25. The equipment used to measure the sound level emitting from the air conditioning vents of the Subject Motor Car and the Comparison Motor Car as part of the Sound Measurement Tests was a Extech Sound Level Meter (herein referred to as "**Sound Recording Equipment**"), which was calibrated prior to the start of the Sound Measurement Tests. See photo 7 below.

Photo 7 shows the Extech Sound Level Meter that was used in the Sound Measurement Tests to measure the sound level emitting from the air conditioning vents of the Subject Motor Car and the Comparison Motor Car. The meter was calibrated prior to the Sound Measurement Tests.

26. The Sound Measurement Tests were carried out by placing the Sound Recording Equipment directly at the outlet of the air conditioning vents at the centre of the dashboard panel of the Subject Motor Car and the Comparison Motor Car. The peak sound level was then recorded when the air conditioning system was switched on from a low speed (1 bar) to medium speed and to high speed.

27. I wish to highlight that the Sound Recording Equipment will also record other sounds from within the passenger compartment, in particular the air blowing sounds emitting from the air conditioning vents. Purely isolating the "water flowing through pipe" sound that I heard was not possible. See photo 8 & 9 below.

Photo 9 shows the Sound Measurement Tests being carried out to the Subject Motor Car using the Extech Sound Level Meter. The Sound Measurement Tests were carried out by placing the Sound Recording Equipment directly at the outlet of the air conditioning vents at the centre of the dashboard panel of the Subject Motor Car.

Photo 10 shows the Sound Measurement Tests being carried out to the Comparison Motor Car using the Extech Sound Level Meter. The Sound Measurement Tests were carried out by placing the Sound Recording Equipment directly at the outlet of the air conditioning vents at the centre of the dashboard panel of the Comparison Motor Car, a similar method to the Subject Motor Car.

28. The table 1 below sets out the peak sound levels recorded during the Sound Measurement Tests for the Subject Motor Car. Photographs taken when these sound levels were recorded are shown in Appendix 1 of this report.

	Sound Level (dB)
Engine off, air conditioning system off	35.4
Engine on, air conditioning system off	41.6
Blower speed 1 bar	45.6
Blower speed 2 bar	46.4
Blower speed 3 bar	50.1
Blower speed 4 bar	55.2
Blower speed 5 bar	61.7

Table 1 shows the peak sound levels recorded throughout the Subject Motor Car's Sound Measurement Tests. The recorded sound levels were for all sounds coming out from the air conditioning vents, including the "water flowing through pipe" sound.

29. The table 2 below sets out the peak sound levels recorded during the Sound Measurement Tests for the Comparison Motor Car. Photographs of these recorded sound levels are shown in Appendix 2 of this report.

	Sound Level (dB)
Engine off, air conditioning system off	35.5
Engine on, air conditioning system off	42.0
Blower speed 1 bar	46.4
Blower speed 2 bar	48.6
Blower speed 3 bar	52.4
Blower speed 4 bar	56.8
Blower speed 5 bar	62.0

Table 2 shows the peak sound levels recorded throughout the Comparison Motor Car's Sound Measurement Tests. The recorded sound levels were for all sounds coming out from the air conditioning vents, including the "water flowing through pipe" sound.

G. Analysis of Findings

30. I note that the Noises from the Subject Motor Car, while present, was also emitted from the Comparison Motor Car under the same condition ie air conditioning switched on. The Noises were in fact more distinctively heard in the Comparison Motor Car. In the premises, I am of the view that the Noises are not likely to be a fault or defect of the Subject Motor Car or caused by a fault or defect in the Subject Motor Car. I am also of the view that the Noises are likely a normal operating characteristic of the air conditioning system fitted in the Subject Motor Car and the Comparison Motor Car.

31. A comparison of the peak sound levels recorded during the Sound Measurement Tests for the Subject Motor Car and the Comparison Motor Car is shown in the table 3 below: -

	Subject Motor Car's Sound Level (dB)	Comparison Motor Car's Sound level (dB)
Engine off, air conditioning system off	35.4	35.5
Engine on, air conditioning system off	41.6	42.0
Blower speed 1 bar	45.6	46.4
Blower speed 2 bar	46.4	48.6
Blower speed 3 bar	50.1	52.4
Blower speed 4 bar	55.2	56.8
Blower speed 5 bar	61.7	62.0

Table 3 shows the comparison between the peak sound levels recorded during the Sound Measurement Tests for the Subject Motor Car and the Comparison Motor Car. These recorded sound levels were for all sounds coming out from the air conditioning vents, including the "water flowing through pipe" sound that I heard.

32. From the table above, it is clear that the Subject Motor Car is in fact quieter than the Comparison Motor Car across all the blower fan speed range. At blower speed 1 bar and 2 bar, when the Noises were heard before it gets covered by air blowing sounds as the blower speed increases, the sound level recorded was 45.6dB and 46.4dB respectively for the Subject Motor Car.

33. To put things into perspective, the sound levels at blower speed 1 bar and 2 bar (45.6dB and 46.4dB) for the Subject Motor Car are considered to be above the sounds emitted from a whisper in a quiet library to below the sounds emitted from a normal conversation. Refer to a printout titled "Decibel (Loudness) Comparison Chart", annexed as Appendix 3 in this report. In fact, the highest decibel recorded for the Subject Motor Car, 61.7dB, is akin to the sound of a normal conversation.

H. Conclusion & Duty

34. To summarise, "water flowing through pipe" like sound was faintly audible emitting from the outlet of the air conditioning vents of the Subject Motor Car. This sound could only be heard when I put my ears directly at the outlet of the air conditioning vents. Whilst sitting in a normal driving position, this sound was not audible.

35. The sound levels recorded of the air conditioning system, during Sound Measurement Tests of the Subject Motor Car when the "water flowing through pipe" sound was heard, falls between the sound level range of a whisper in a library to a normal conversation. This, in my view, can reasonably be described as "fairly quiet".

36. The "water flowing through pipe" sound is not a fault or defect of the Subject Motor Car or caused by a fault or defect in the Subject Motor Car. I am of the view that the sound is likely the normal operating characteristic of the air conditioning system fitted in the Subject Motor Car since the same sound was also heard (more audibly) from the Comparison Motor Car.

37. I have rendered these opinions and conclusions after careful evaluation and analysis, based on my education, training and experience. The factual matters stated in the report are, as far as I know, true and I have made all enquiries which I consider appropriate.

38. The opinions stated in this report are genuinely held by me and the report contains reference to all matters I consider significant. I understand and acknowledge my duty to the Court and believe I have complied with that duty.

Ang Bryan Tani
Senior Technical Investigator
Technical Investigation & Reconstructionist (SAE-A)

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