LKK Auto Consultants Pte Ltd
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Your Ref: E/IP/00505/2019 05 July 2019
Our Ref: CI/SPF19010231/D

Tanglin Division
Singapore Police Force
21 Kampong Java Road
Singapore 228892

Attn: Investigation Officer Peh Wei Bin

MECHANICAL INSPECTION REPORT OF AN ELECTRIC SCOOTER

1. I refer to your request on 29 April 2019 to conduct a physical inspection of an electric scooter.

2. The objective of the inspection is to determine if there was any possible mechanical issue to the operating behaviour of the electric scooter.

3. Following the request, the electric scooter was transported to Block 5035 Ang Mo Kio Avenue 3 #01-355 Singapore 569538, by the Investigation Officer on 04 June 2019. A physical inspection, which includes dismantling of several parts and components of the electric scooter, was thereafter carried out.

4. I now set out below my observations and comments with respect to this inspection.

General Condition

5. The electric scooter was observed to be without any physical damage. It was fitted with 2 wheels. The tyres wrapped around the 2 wheels were observed to be of serviceable condition with the tread pattern clearly visible. Both tyres were also sufficiently inflated for operation. See photo 1 – 11 below.

6. The approximate length, width and weight of the electric scooter were recorded as follows: -

Length	80cm	(leading edge of front tyre to trailing edge of rear tyre)
Width	58cm	(edge of left side to edge of right side of handle bar)
Weight	12.80kg	

7. The electric motor and battery fitted on the electric scooter were checked and found to be the original standard electric motor and battery.

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Photo 1 shows a general view of the electric scooter that I had inspected. The electric scooter was observed to be without any physical damage.

Photo 2 shows a general view of the handle bar of the electric scooter. The width of the electric scooter was measured to be approximately 58cm. This was the length of the handle bar from one side to the other side, which typically represents the width of an electric scooter given that the handle bar extends laterally out from the body of an electric scooter.

Photo 3 shows a general view of the front tyre of the electric scooter. The front tyre fitted on the electric scooter was observed to be of serviceable condition with the tread pattern clearly visible. It was also sufficiently inflated for operation.

Photo 4 shows the rear tyre that was fitted on the electric scooter. The rear tyre was observed to be of serviceable condition with the tread pattern clearly visible. Similar to the front tyre, the rear tyre of the electric scooter was sufficiently inflated for operation.

Photo 5 shows measurements being carried out to the electric scooter. The length of the electric scooter (leading edge of front tyre to trailing edge of rear tyre) was measured to be approximately 80cm while the width of the electric scooter was measured to be approximately 58cm.

Photo 6 shows the electric scooter being weighed on a digital weighing scale. The digital weighing scale was first calibrated to zero prior to the weighing.

Photo 7 shows the weight of the electric scooter that was recorded by the digital weighing scale. The weight recorded was 12.80kg.

Photo 8 shows dismantling of the rear wheel being carried out to check on the electric motor and rear brake of the electric scooter.

Photo 9 shows the electric motor that was fitted on the rear wheel of the electric scooter. The motor in this electric motor turns/rotates when electric power is supplied from the battery of the electric scooter. From the serial number (arrowed) engraved on the electric motor, the electric motor fitted was a standard original electric motor.

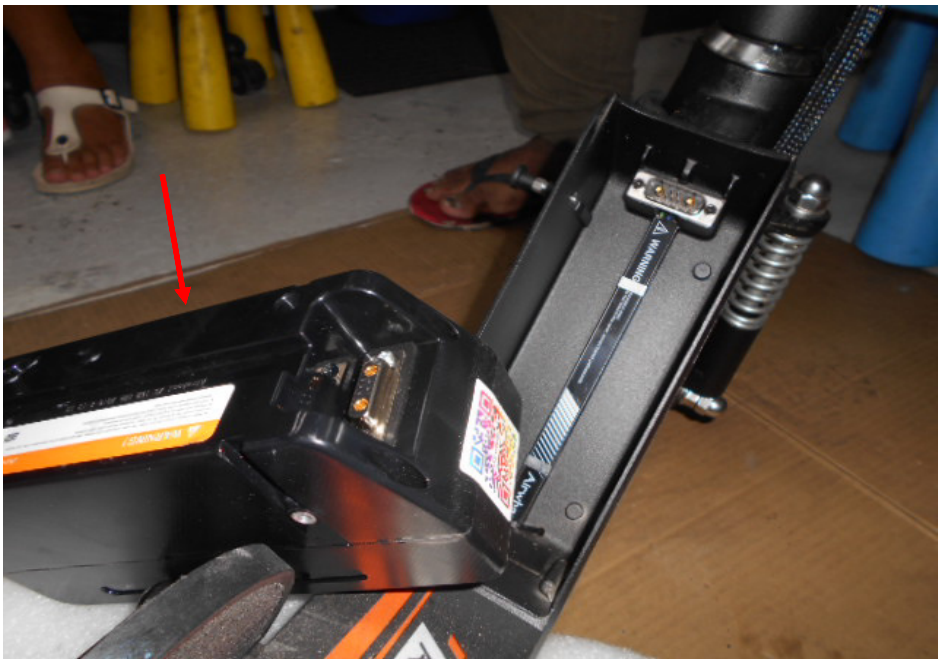

Photo 10 shows the battery (arrowed) that was fitted on the electric scooter after it was removed from within the battery housing of the electric scooter. The battery was located at the front of the standing board of the electric motor.

Photo 11 shows the battery that was fitted on the electric scooter This battery supplies the electric power to the electric motor in order for the electric scooter to accelerate/move. The capacity of the battery was indicated as 162.8 Watt/hour (arrowed), a standard original battery for the electric scooter.

Operating Description of the Electric Scooter

8. The acceleration/movement function of the electric scooter is via a lever which acts as a throttle. This lever is located towards the right side of the handle bar, just below the on/off power button of the electric scooter. When the lever is manually depressed, the electric scooter will accelerate/move. To maintain acceleration/movement, the lever will have to be continuously depressed.

9. When this lever is depressed, electric power from the battery of the electric scooter is supplied to the electric motor that is fitted at the rear wheel. The motor in the electric motor then turns/rotates, resulting in the rear wheel of the electric scooter to also turn/rotate. This allows the electric scooter to accelerate/move. See photo 12 below.

Photo 12 shows the lever (red arrow) for the acceleration/movement function of the electric scooter. When this lever is depressed, electric power from the battery of the electric scooter is supplied to the electric motor that is fitted at the rear wheel. The motor in the electric motor then turns/rotates, resulting in the rear wheel of the electric scooter to also turn/rotate. This allows the electric scooter to accelerate/move. To maintain acceleration/movement, the lever will have to be continuously depressed. The on/off power button of the electric scooter is shown by the yellow arrow.

10. The stopping function of the electric scooter is via a lever that is located at the left side of the handle bar. The lever is operated manually. When depressed, the brake is activated by cable and spring pushing the brake shoe outwards to clamp onto the brake drum at the rear wheel of the electric scooter. Frictional resistance from this clamping action reduces the rotation of the rear wheel, hence creating the braking effect for the electric scooter.

11. I note that the braking system of the electric scooter was only to its rear wheel. There was no brake component(s) fitted onto its front wheel. Hence the braking function of the entire electric scooter is dependent on the reduction in rotation of its rear wheel. See photo 13 & 14 below.

Photo 13 shows the lever (arrowed) that operates the braking function of the electric scooter. The lever is operated manually. When depressed, the brake is activated by cable and spring pushing the brake shoe outwards to clamp onto the brake drum at the rear wheel of the electric scooter. Frictional resistance from this clamping action reduces the rotation of the rear wheel, hence creating the braking effect for the electric scooter.

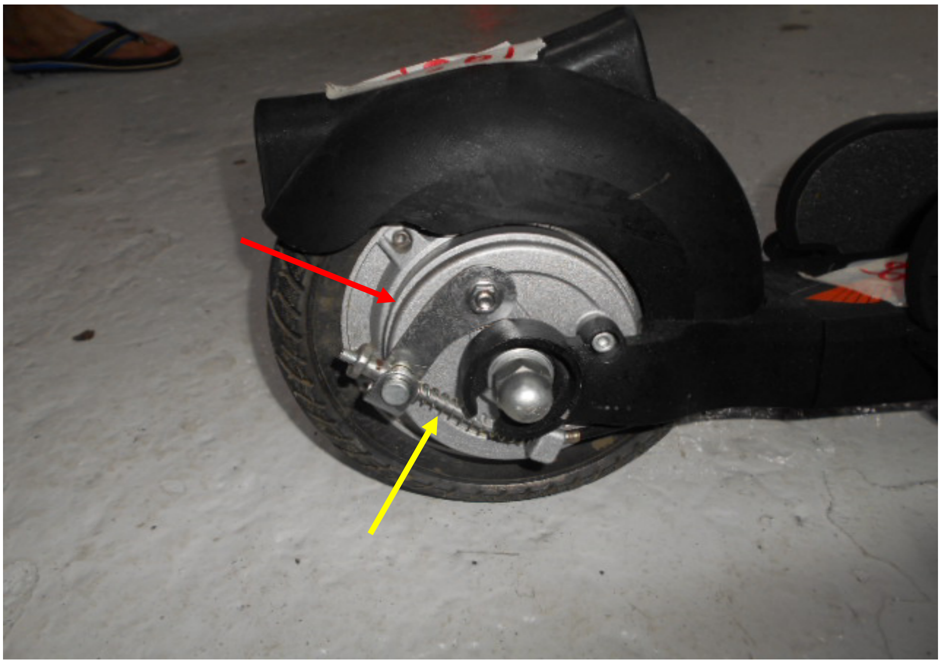

Photo 14 shows the braking components at the rear wheel of the electric scooter. When the brake lever of the electric scooter is depressed, the brake is activated by cable and spring (yellow arrow) pushing the brake shoe outwards to clamp onto the brake drum (red arrow) at the rear wheel of the electric scooter. The braking system of the electric scooter was only to its rear wheel.

Steering System

12. The steering system of the electric scooter was tested by turning the handle bar to full left and full right. I did not feel any abnormal resistance and/or free-play during this action. The front wheel of the electric scooter was able to turn in the same direction to the turned direction of the handle bar. The steering system of the electric scooter was in serviceable condition.

Braking System

13. A static test to the braking system of the electric scooter was carried out during my inspection. The test carried out was purely to check on the operating behaviour and functionality of the electric scooter's braking system.

14. For the static test, the electric scooter was suspended from the ground ie wheels not touching ground. The throttle lever was depressed causing the rear wheel to rotate, simulating movement of the electric scooter. I then depressed the brake lever and it was noted that a slightly more effort was required to stop the rotation of the rear wheel. The brake lever had to be fully depressed in order for the rear wheel to stop rotating. Note that fully depressed refers to the brake lever almost touching the handle bar. This is an indication that the brake of the electric scooter needs to be adjusted/serviced.

15. The rear brake of the electric scooter was than dismantled for my further examination. Upon touching the frictional material of the brake shoe and the inner surfaces of the brake drum, dust had accumulated on my finger. This dust is commonly referred to as brake dust and is a normal phenomenon caused by the grinding of the frictional material of the brake shoe against the inner surfaces of the brake drum. Periodic cleaning to remove brake dust is required to maintain optimal braking efficiency, especially for brake drum type of braking system where the brake shoe is housed within a closed brake drum.

16. If brake dust is allowed to accumulate within the brake drum, the brake dust could form a layer between the frictional material of the brake shoe and inner surface of the brake drum, preventing the frictional material from coming into contact directly with the inner surface of the brake drum. More effort would then be needed to press the brake shoe outwards against the inner surface of the drum. This was the case for the electric scooter that I had inspected where a slightly more effort was required to stop the rotation of the rear wheel. See photo 15 & 16 below.

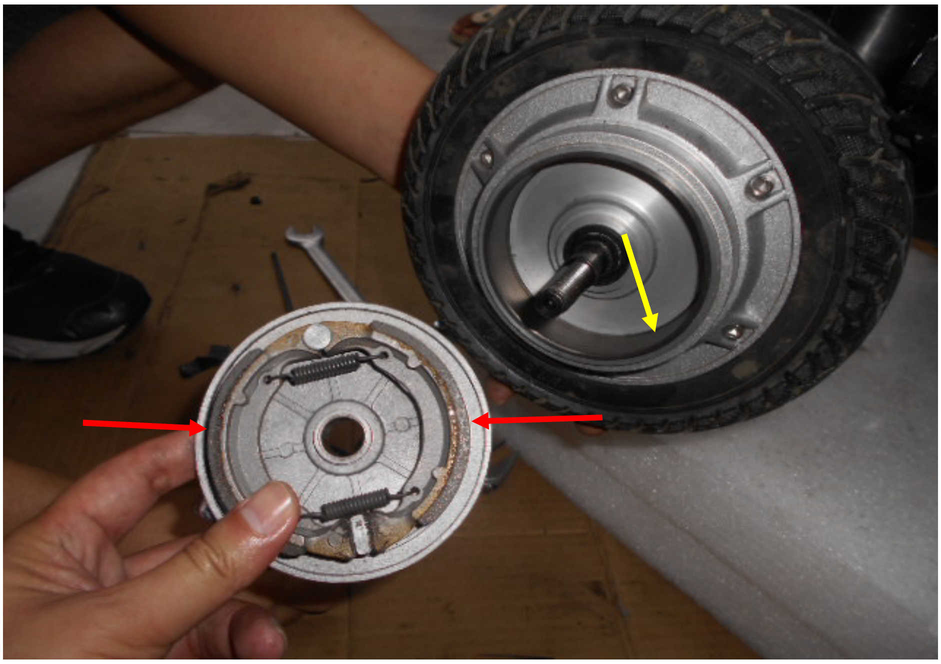

Photo 15 shows the rear brake of the electric scooter after it was dismantled. When the brake is activated, cable and spring actions pushes the brake shoe (red arrow) outwards to clamp onto the inner surface (yellow arrow) of the brake drum. Frictional resistance from this clamping action reduces the rotation of the rear wheel, hence creating the braking effect for the electric scooter.

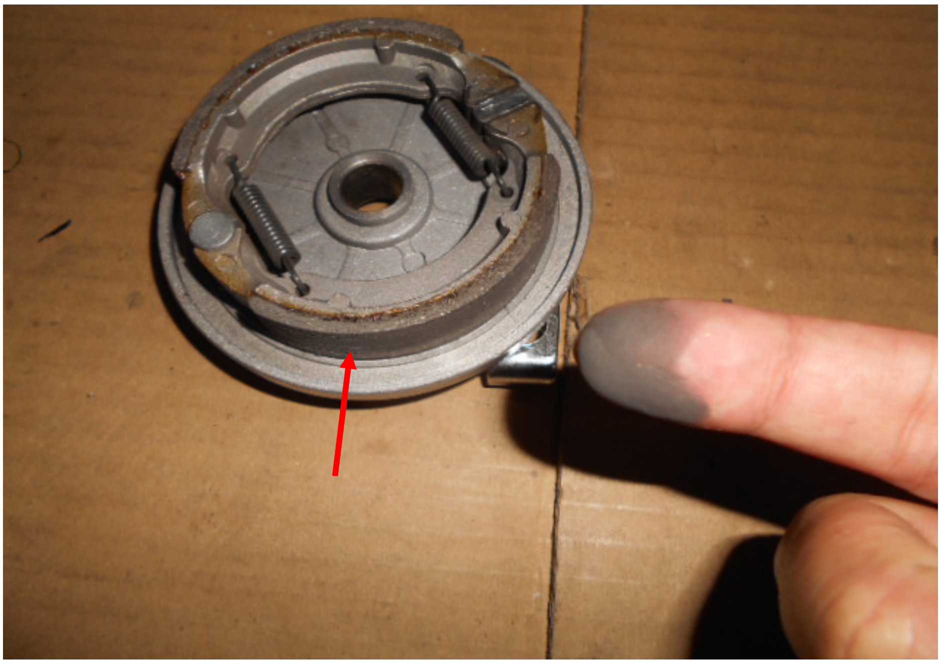

Photo 16 shows the brake dust that had accumulated on my finger upon touching the frictional material (arrowed) of the brake shoe. Brake dust is a normal phenomenon caused by the grinding of the frictional material of the brake shoe against the inner surfaces of the brake drum. Periodic cleaning to remove brake dust is required to maintain optimal braking performance.

17. For this case, although a slightly more effort was required, the braking system of the electric scooter was still able to stop the rotation of the rear wheel during my static test. It will however translate to an overall increase in the stopping distance for the electric scooter when the brake is applied by the operator whilst riding the electric scooter. Simply put, the additional time needed for the frictional material of the rear brake shoe to contact directly onto the inner surface of the brake drum (due to the accumulation of brake dust), causes the electric scooter to travel more distance before the rear brake becomes engaged.

Conclusion

18. From the observations gathered during my physical inspection of the electric scooter, its steering system and its 2 tyres were of serviceable condition.

19. The braking system of the electric scooter was found to be in a condition that requires adjustment/servicing. Accumulation of brake dust within the brake drum of the electric scooter had affected its braking efficiency. Notwithstanding this, an operator riding the electric scooter will still be able to bring the electric scooter to a complete stop with a slightly more effort when depressing the brake lever. The slightly more effort needed would however lead to a slightly longer stopping distance.

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