

Your Ref : FBN 1804T
Our Ref : CI/TP19015539/D

03 September 2019

Hong Leong Corporation Holdings Pte Ltd
178 Paya Lebar Road #01-01/02
Singapore 409030

Attn: Mr Lee Kwan Meng
(General Manager)

AUTOMOBILE TECHNICAL REPORT OF A YAMAHA XMAX SCOOTER FBN 1804T

1. I refer to your request dated 25 July 2019 to comment on whether the abnormal engine oil consumption (engine oil loss) experienced by a Yamaha Xmax scooter with registration number FBN 1804T (herein referred to as "**Scooter**") was due to the non-original rear shock absorbers that were fitted on the Scooter.
2. For this case, I was not able to carry out any physical inspection of the Scooter as attempts by Hong Leong Corporation Holdings Pte Ltd to arrange with the owner of the Scooter were unsuccessful. I was instead provided with several photographs that were taken by Hong Leong Corporation Holdings Pte Ltd at the time when the Scooter was sent in for checks with regard to the abnormal loss of engine oil.
3. In the preparation of this report, I had reviewed these photographs and also inspected a similar make and model scooter as the Scooter. My comments and opinions are set out in the below paragraphs.

Comments & Opinions

4. Firstly, photographs taken by Hong Leong Corporation Holdings Pte Ltd had showed engine oil accumulation at the piston crown after the engine top block of the Scooter was separated from its engine lower block. The presence of engine oil at the piston crown is an indication that engine oil had seeped into the combustion chambers of the Scooter's engine. See photo 1 below.

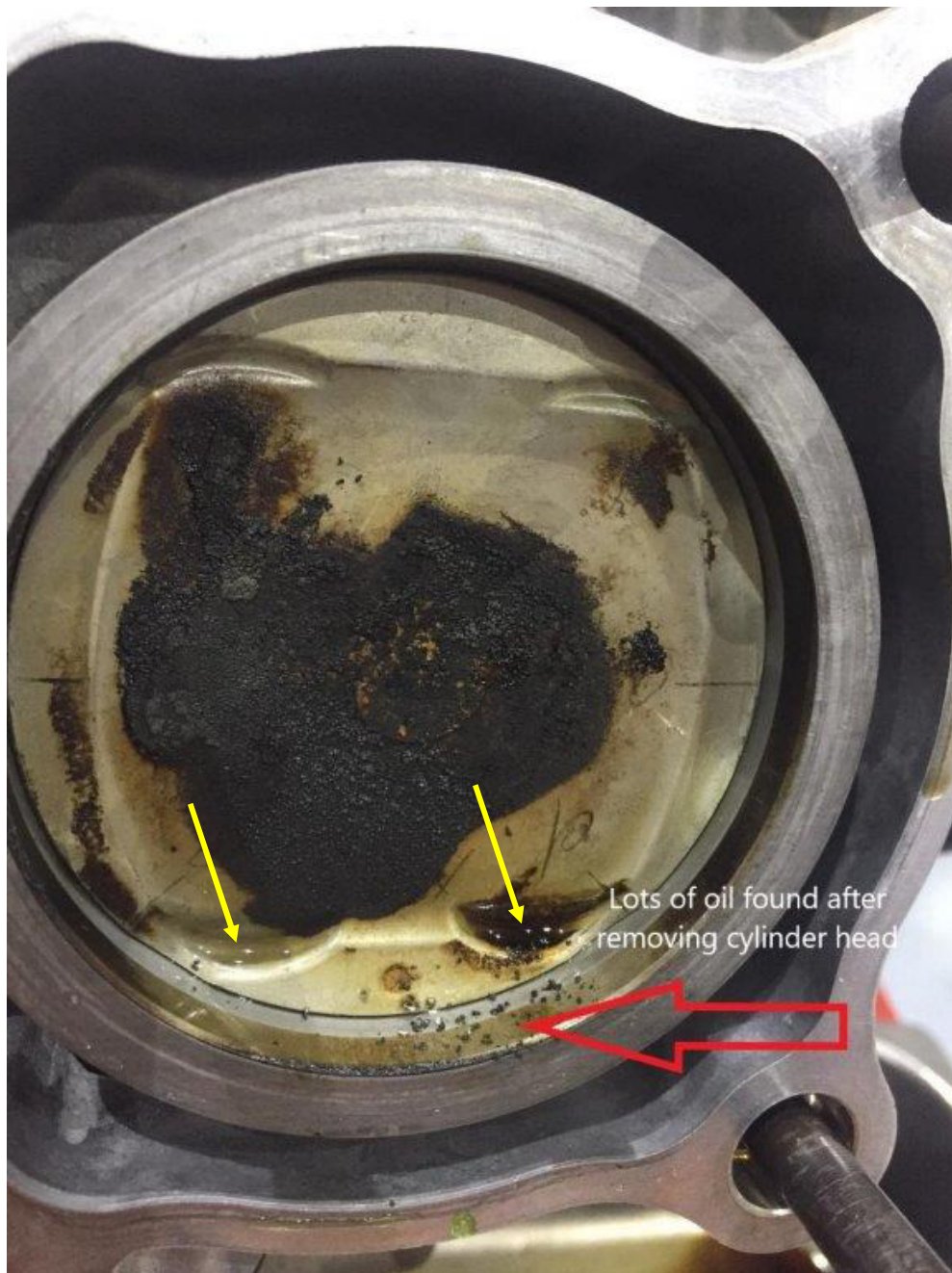


Photo 1 shows the engine oil accumulation (yellow arrow) at the piston crown after the engine top block of the Scooter was separated from its engine lower block (photograph taken by Hong Leong Corporation Holdings Pte Ltd during their checks of the Scooter). The presence of engine oil at the piston crown is an indication that engine oil had seeped into the combustion chambers of the Scooter's engine.

5. Under normal circumstance, engine oil flows in a closed circuit within the engine block through oil passages for lubricating purposes and cooling purposes. The main area of flow within the engine block is around the lower part of the engine lower block, lubricating the connecting rod and crank shaft. It also flows around the engine top block providing lubricant for the camshaft and valve. Engine oil is prevented from entering the combustion chambers by rubber seals and rubber rings, which provide a sealing effect surrounding the valve and piston respectively. Any engine oil flowing or seeping into the combustion chamber(s) of an engine does not represent a normal engine oil flow path.
6. The engine oil, accumulated at the piston crown, will eventually burn off during engine combustion (when the engine is in operation). The seepage of engine oil into the combustion chambers of the Scooter, and thereafter getting burned off through engine combustion, was the reason for the abnormal loss of engine oil. However, this process needs to occur over a period of time for the engine oil to reach a level of reduction where the owner will be able to reasonably notice.
7. The photographs taken by Hong Leong Corporation Holdings Pte Ltd had also showed that the rear shock absorbers fitted on the Scooter were non-original. Measurements carried out revealed that the height of the non-original rear shock absorbers of the Scooter was 2cm shorter as compared with the height of an original rear shock absorbers. See photo 2 – 5 below.



Photo 2 shows the rear right shock absorber (arrowed) of the Scooter (photograph taken by Hong Leong Corporation Holdings Pte Ltd during their checks of the Scooter). The rear shock absorbers fitted on the Scooter were non-original. Refer to photo 4 below for comparison.



Photo 3 shows measurement of the rear right shock absorber of the Scooter. The height of the non-original rear shock absorbers was measured to be 33cm (arrowed). This was 2cm shorter as compared to the height of an original rear shock absorbers. Refer to photograph 5 below.



Photo 4 shows the rear right shock absorber (arrowed) of a similar make and model scooter as the Scooter for comparison purposes (photograph taken by Hong Leong Corporation Holdings Pte Ltd during their checks of the Scooter). The rear shock absorbers fitted on the Scooter were non-original. Refer to photograph 2 above



Photo 5 shows measurement of the rear right shock absorber of the similar make and model scooter as the Scooter. The height of an original rear shock absorbers was measured to be 35cm (arrowed). The non-original rear shock absorbers fitted on the Scooter was 2cm shorter as compared to the height of an original rear shock absorbers. Refer to photograph 3 above.

8. During my inspection of a similar make and model scooter as the Scooter, I had observed that the engine of the Scooter was a horizontal incline engine. In contrast to a vertical incline engine, the mechanical components inside a horizontal incline engine are also horizontally aligned. In this position, what is commonly referred to as an engine top block, is now referred to as an engine front block. This engine front block houses the camshaft and valve. The engine lower block, which is referred to as engine rear block, houses the piston, connecting rod and crankshaft.
9. Notably, it was observed that the engine of the similar make and model scooter was tilted slightly upwards at the engine front block when the centre stand is applied/engaged. In other words, from a side view perspective, the engine front block is higher than the engine rear block, above ground level. The engine oil sump was observed to be fitted onto the end of the engine rear block, and is the lowest part of the engine, above ground level. See photo 6 – 8 below.



Photo 6 shows a similar make and model scooter as the Scooter. The engine area is highlighted by the red circle. From my observations, the engine of the Scooter was a horizontal incline engine. The mechanical components inside a horizontal incline engine are all horizontally aligned. When the centre stand is applied/engaged, I had observed that the engine front block is tilted slightly upwards.

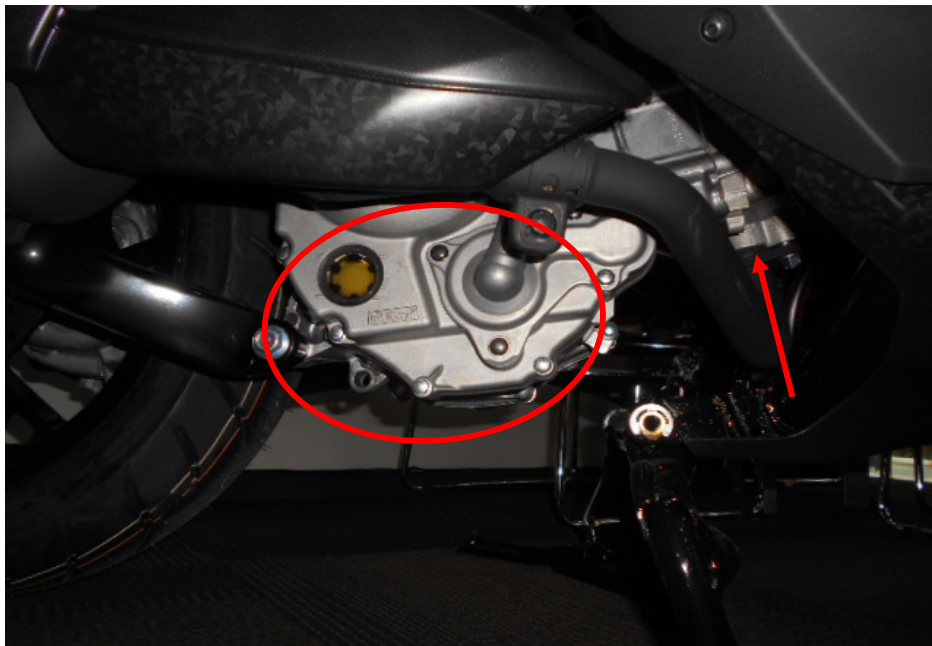


Photo 7 shows a closer view of the engine of a similar make and model scooter as the Scooter. From a side view perspective, the engine front block (arrowed) is higher than the engine rear block, above ground level. The engine oil sump (circled), fitted onto the end of the engine rear block, is the lowest part of the engine, above ground level. In general, the engine was tilted slightly upwards at the engine front block.

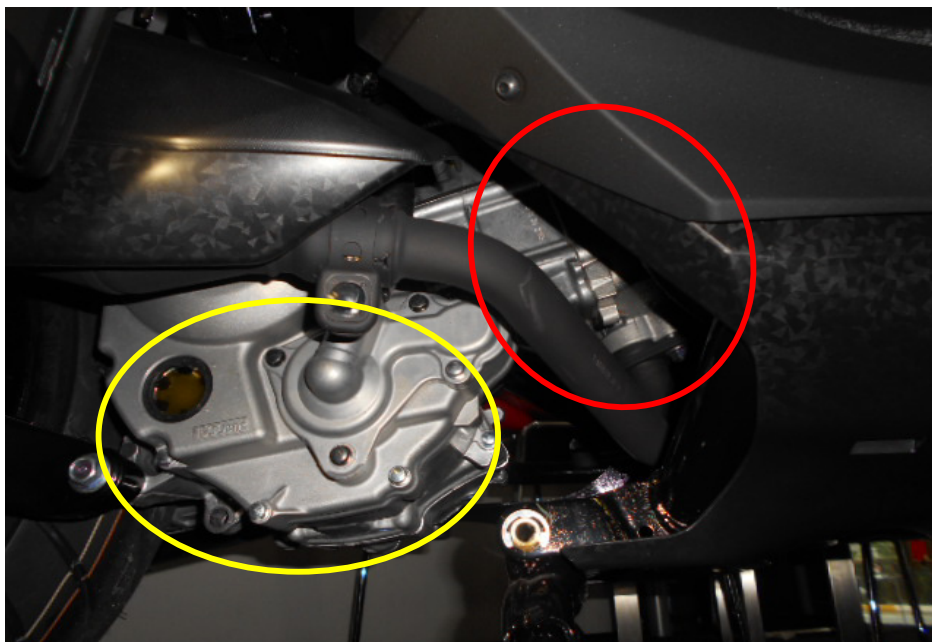
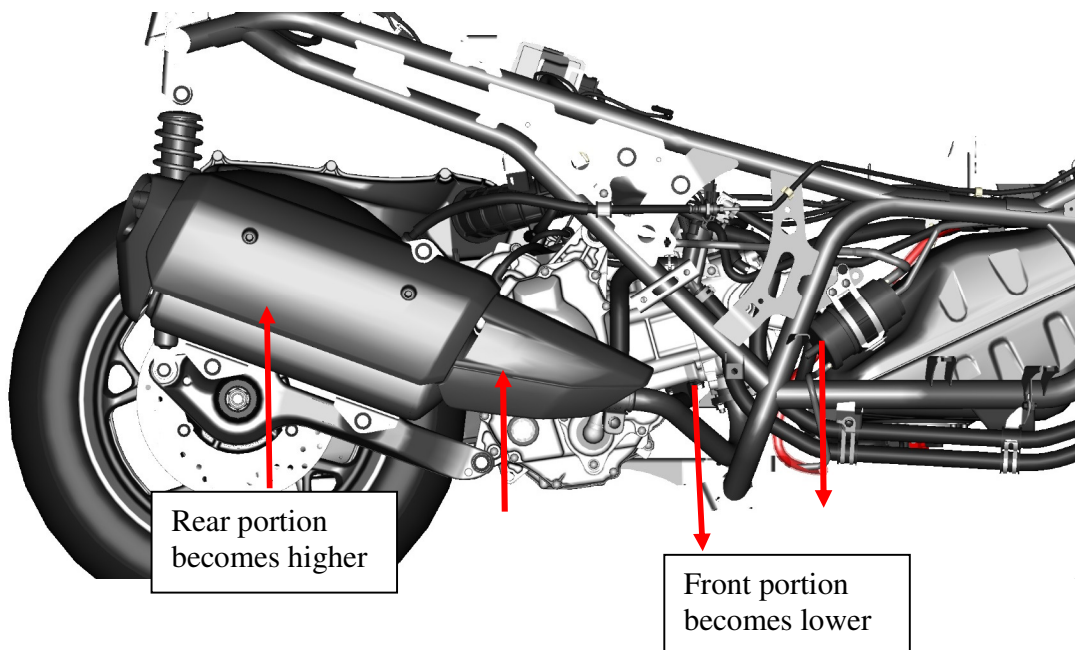


Photo 8 shows a closer view of the engine of a similar make and model scooter as the Scooter. From a side view perspective, the engine front block (red circle) is higher than the engine rear block, above ground level. The engine oil sump (yellow circle), fitted onto the end of the engine rear block, is the lowest part of the engine, above ground level.

10. Co-relating the characteristics of the Scooter's engine layout, as observed from a similar make and model scooter, with the non-original rear shock absorbers that were fitted on the Scooter, when the Scooter is parked with its centre stand applied/engaged, the rear portion of the Scooter will be lifted higher above ground level. This is due to the shorter height of the non-original rear shock absorbers.
11. When the rear portion of the Scooter becomes higher, the engine oil sump also becomes higher above ground level as compared to a similar make and model scooter that is fitted with original rear shock absorbers. When this occurs, the engine front block will correspondingly tilt downwards from its original upward angled tilt position. In other words, instead of a slight upward tilt at the engine front block, the position of the engine will be altered from its original position, where the entire engine of the Scooter becomes more parallel to ground. See illustration below.



12. The engine oil sump of the Scooter, fitted onto the end of the engine rear block and originally lower in height to the engine front block, now becomes more similar in height above ground level with the engine front block due to the shorter non-original rear shock absorbers. This allows the engine oil to flow towards the engine front block when the centre stand of the Scooter is applied/engaged. Some engine oil could then seep into the piston crown area through gaps between the piston ring and the walls of the combustion chambers when the piston ring and piston contracts after the engine of the Scooter is cooled down.
13. It is also noted that apart from the centre stand, the Scooter has a side stand that can be used to support the Scooter when not in use. When the side stand is applied/engaged, the Scooter will lean towards its left. In this position, the rear portion of the Scooter will not be lifted higher above ground level despite the shorter non-original rear shock absorbers. The engine front block will also not tilt downwards from its original upward angled tilt position. Since there is no alteration to the engine's position, engine oil will not seep into the engine front block when the Scooter is supported by its side stand. There will not be any abnormal loss of engine oil experienced by the Scooter and there will not be any complaint in this aspect made by the owner.
14. Following paragraph 15, it can be established that the owner had used the centre stand to support the Scooter when the Scooter was not in use and therefore experienced abnormal loss of engine oil through seepage into the combustion chamber. This is also taking into consideration that there was no external leakage of engine oil (no such sign(s) or indication(s) was found by Hong Leong Corporation Holdings Pte Ltd at the time when the Scooter was sent in for checks); and also given that the loss of engine oil was through combustion process after engine oil had seep into the combustion chamber when the engine is cooled down.
15. The accumulation of engine oil found at the piston crown of the Scooter is an indication that engine oil had seeped into the combustion chamber when the engine was not in operation. As previously commented in paragraph 6 above, when the engine is in operation, engine oil that had seeped into the combustion chamber will burn off through engine combustion without leaving any accumulation. In other words, if the Scooter is supported on its centre stand with its engine in operation, engine oil will not seep into the combustion chamber as the various mechanical parts inside the engine expands due to heat.

Conclusion

16. Having reviewed the photographs provided to me and physically inspecting a similar make and model scooter as the Scooter, I am of the opinion that the abnormal engine oil consumption (engine oil loss) experienced by the Scooter was due to the shorter non-original rear shock absorbers that were fitted on the Scooter. This had allowed engine oil to seep into the combustion chamber of the Scooter when the Scooter was on its centre stand with its engine not in operation and cooled down.
17. The engine oil, accumulated in the combustion chamber, burns off when the engine of the Scooter is operated. The engine oil, thereafter, continues to seep into the combustion chamber again whenever the Scooter was on its centre stand with its engine not in operation and cooled down. As this process continues, the level of engine oil of the Scooter gradually reduces leading to abnormal loss of engine oil to the Scooter.

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