

Your Ref: GBF 3319G
Our Ref : CI/TP21013055/D

26 December 2021

Indeco Engineers Pte Ltd
39 Defu Lane 12
Singapore 539139

**TECHNICAL INVESTIGATION REPORT OF FIRE INCIDENT INVOLVING A
HYUNDAI STAREX POLICE VEHICLE GBF 3319G**

1. I refer to your request dated 17 December 2021.
2. My analysis, comments and opinions with respect to the cause of fire to the vehicle GBF 3319G are set out below.

Inspection of the Vehicle

3. The vehicle was physically inspected on 22 December 2021 at the premises of M/s Indeco Engineers Pte Ltd, 39 Defu Lane 12, Singapore 539139.
4. A static inspection was carried out to the vehicle where the following general information was recorded: -

Vehicle Registration No.	: GBF 3319G
Make / Model	: Hyundai Starex
Chassis No	: KMFWBX7KMGU818807
Year of Registration	: N.A (Information not provided)
Mileage	: N.A (engine unable to be started, several parts dismantled)

5. Firstly, the parts at the frontal body of the vehicle were observed to have been dismantled prior to my inspection. This had included several parts within the engine compartment. Notwithstanding this, the dismantling did not affect my findings as a similar make and model vehicle was made available for comparison in order for me to understand the positioning of the parts prior to dismantling.
6. In general, I had found damage of fire nature that was confined to the front right area of the vehicle's engine compartment. Parts that were found to have been burnt and/or had sustained heat/smoke damage include the front support panel, wiper washer tank, air intake duct, air intake shield, oil cooler pipe, aircon condenser, radiator, front right impact sensor and front wire harness amongst others. All major parts beyond the front support panel were generally found to be unaffected.

7. No visible damage of fire nature was observed to the exterior body of the vehicle apart for some relatively minor melting of the radiator grille, at the front of the vehicle. The rear body, left side body, right side body and interior compartment of the vehicle were all found to be without any fire damage. See photo 1 – 14 below.



Photo 1 shows a general view of the frontal body of the vehicle at the time of my inspection. The parts at the frontal body of the vehicle were observed to have been dismantled prior to my inspection. This had included several parts within the engine compartment. No visible damage of fire nature was observed to the exterior body of the vehicle apart for some relatively minor melting of the radiator grille, at the front of the vehicle.

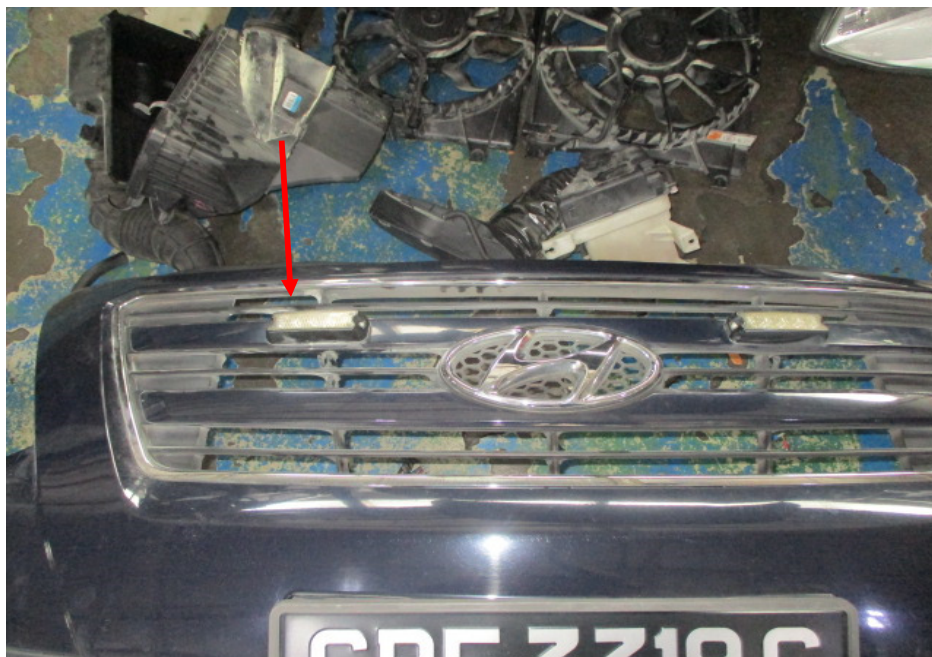


Photo 2 shows the radiator grille of the vehicle at the time of my inspection. I did not observe any damage of fire nature to the exterior body of the vehicle except for some relatively minor melting of the radiator grille (arrowed). The rear body, left side body, right side body and interior compartment of the vehicle were all found to be without any fire damage.



Photo 3 shows a closer view of the minor melting (circled) of the vehicle's radiator grille. Apart for this minor melting of the radiator grille, I did not observe any damage of fire nature to the exterior body of the vehicle.



Photo 4 shows a general view of the parts that were dismantled prior to my inspection. The dismantled parts were mainly parts at the frontal body of the vehicle, including several parts within the engine compartment. Upon my examination of these parts, I had found some of these parts to be burnt and/or had sustained heat/smoke damage. The dismantling of these parts did not affect my findings as a similar make and model vehicle was made available for comparison in order for me to understand the positioning of the parts prior to dismantling.



Photo 5 shows the partially melted air intake duct of the vehicle.



Photo 6 shows the partially melted wiper washer tank of the vehicle.



Photo 7 shows the partially melted air intake shield of the vehicle.



Photo 8 shows the aircon condenser of the vehicle, which was found to be burnt.



Photo 9 shows a general of the vehicle's front wire harness, which was found to be burnt.



Photo 10 shows a closer view a stretch of burnt wirings from the vehicle's front wire harness.

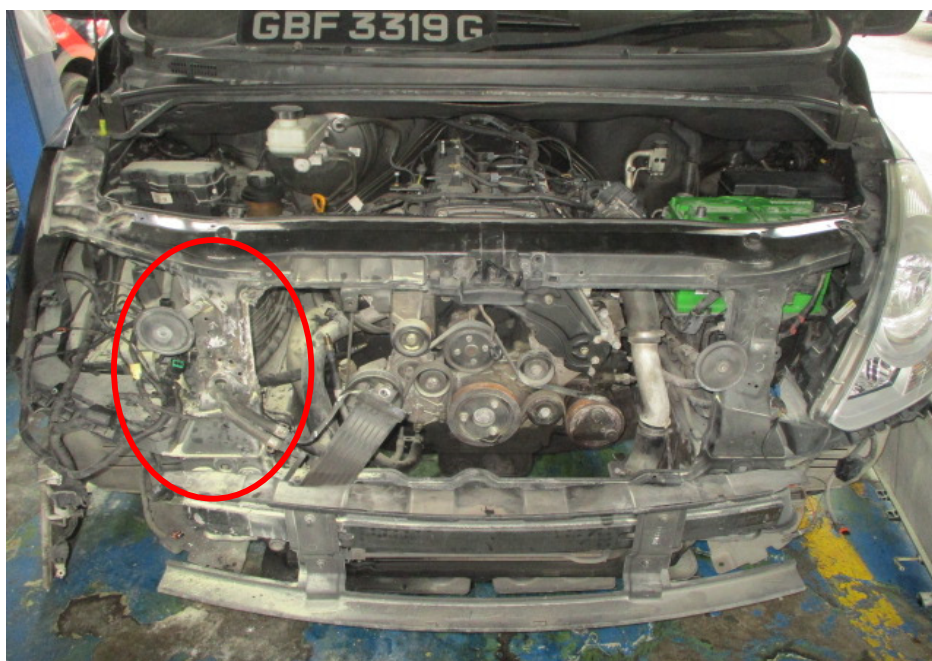


Photo 11 shows a general view of the vehicle's engine compartment. Several parts within the engine compartment were also dismantled prior to my inspection. The dismantling of the parts did not affect my findings as a similar make and model vehicle was made available for comparison in order for me to understand the positioning of the parts prior to dismantling. The front support panel was observed to be burnt, at the right side (circled). Overall, I had found all major parts beyond the support panel to be unaffected by the fire.

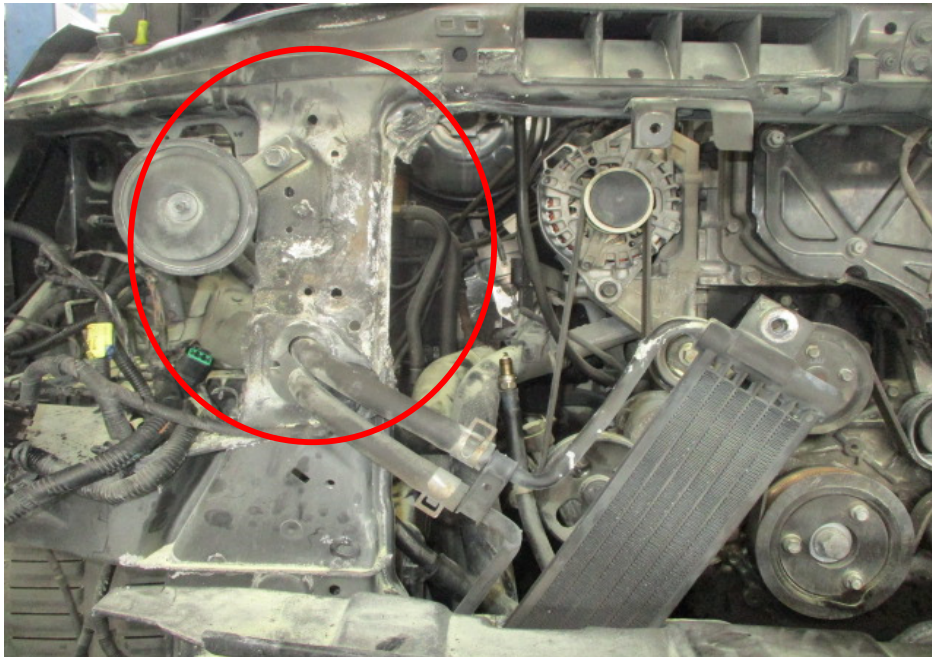


Photo 12 shows a closer view of the burnt front support panel (circled), at the right side of the vehicle.



Photo 13 shows the area behind the burnt front support panel, at the right side of the vehicle. Parts surrounding this area were removed prior to my inspection. Some of these parts like the air duct, aircon condenser and radiator were burnt and/or had sustained heat/smoke damage. Refer to photograph 5 & 8 above.



Photo 14 shows a general view of the vehicle's engine compartment. Several parts within the engine compartment were dismantled prior to my inspection. The dismantling of parts did not affect my findings as a similar make and model vehicle was made available for comparison in order for me to understand the positioning of the parts prior to dismantling. Overall, I had found all major parts beyond the support panel to be unaffected by the fire.

Analysis, Comments & Opinions

8. Using a similar make and model vehicle as comparison, I note that the parts that had sustained damage of fire nature were all confined to the front right portion of the vehicle. Since there were no other areas of fire damage, the fuel source of the fire or in other words where the fire had originated, would hence be at the front right portion of the vehicle.
9. For a fire to occur, it would typically require 3 main elements. These are heat, fuel source and oxygen. Briefly, heat is what ignites a fuel source. Fuel source refers to anything that will burn when exposed to heat ie combustible. Oxygen supports the burning through chemical process.
10. One of the main causes of vehicular fire is abnormality of electrical current along its circuitry path. In this case, I had found greenish residue on a stretch of burnt wirings from the vehicle's front wire harness. This stretch of burnt wirings is located at the middle section area of the vehicle's front support panel.

11. The presence of greenish residue indicates internal heating of copper wires, a sign of an electrical abnormality. Such greenish residue is normally left behind from oxidation as result of chemical reaction involving copper wires, heat and oxygen. Discoloration of wire connector(s) is also sometimes seen in an electrical abnormality situation. Hence, the greenish residue found on the stretch of burnt wirings from the vehicle's front wire harness would suggest to me that the cause of fire to the vehicle was of electrical in nature. This is further supported by discolouration found to one of the wire connectors along this same front wire harness. See photo 15 – 23 below.

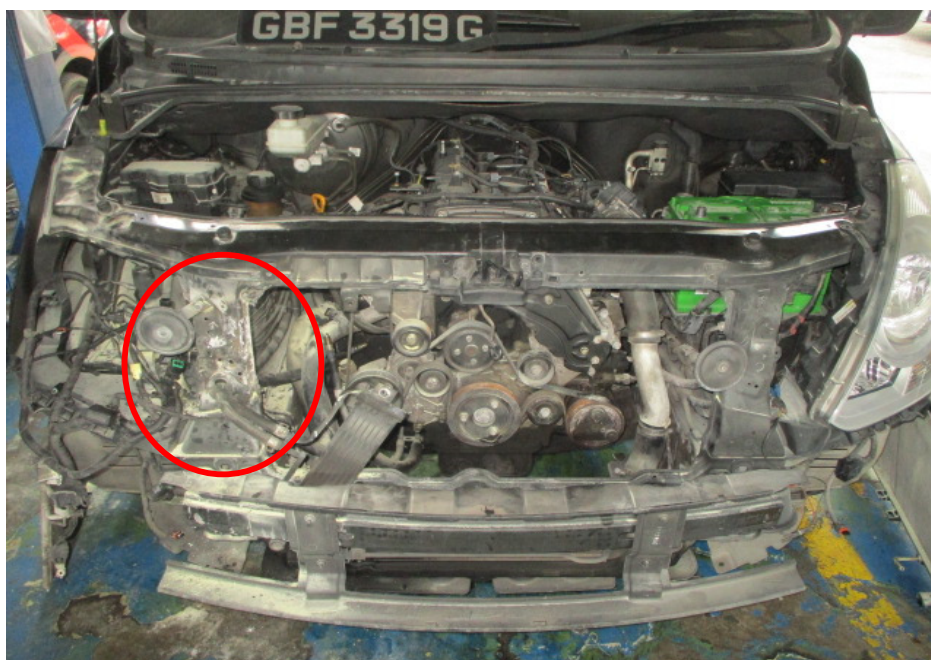


Photo 15 shows a general view of the vehicle's frontal portion. By comparing the positioning of the parts that had sustained damage of fire nature (refer to photograph 16 below), I had noted that the parts that had sustained damage of fire nature were all confined to the front right portion of the vehicle. Since there were no other areas of fire damage to the vehicle, the fire to the vehicle can be established to have occurred at the front right portion (circled) of the vehicle.

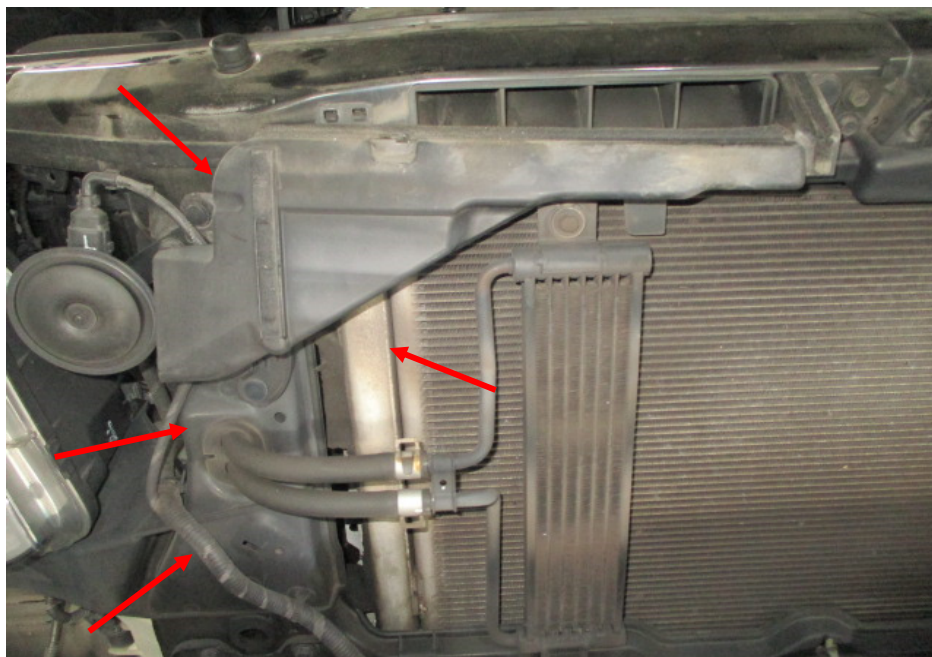


Photo 16 shows the front right portion of a similar make and model vehicle that was made available to me for comparison in order to understand the positioning of the parts that were dismantled from the vehicle prior to my inspection. Basing on the positioning, I note that the parts that had sustained damage of fire nature (highlighted by the red arrows) were all confined to the front right portion of the vehicle. The fire to the vehicle can then be established to have occurred at the front right portion of the vehicle (refer to photograph 15 above). Correspondingly, the fuel source of the fire would also be at the same front right portion of the vehicle.

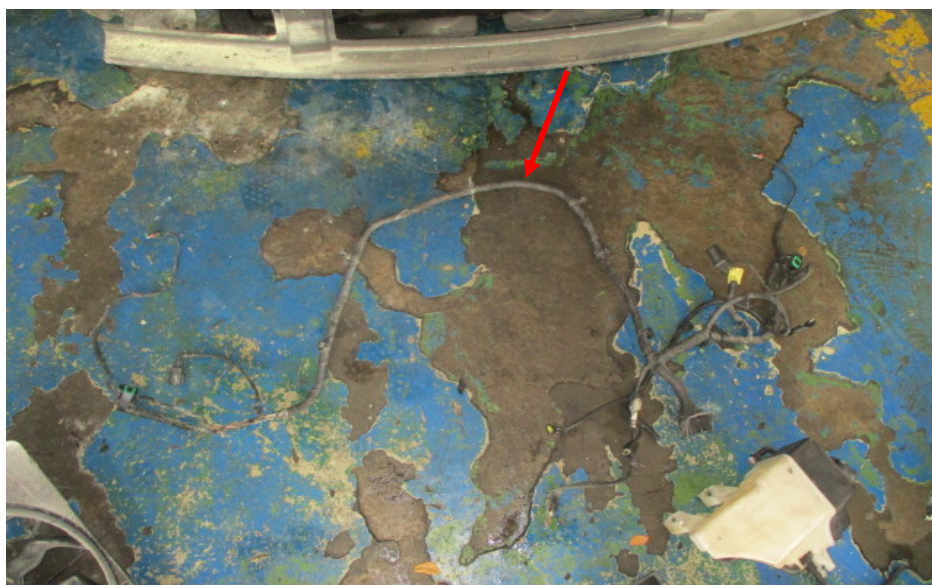


Photo 17 shows a general view of the front wire harness (arrowed) of the vehicle. Upon examination, I had found greenish residue on a stretch of burnt wirings of this front wire harness. Discoloration of one the wire connectors along this same front wire harness was also observed.



Photo 18 shows a general view of the burnt wirings (circled) from the front wire harness of the vehicle. Upon closer examination, I had found greenish residue on a stretch of burnt wirings. The presence of greenish residue indicates internal heating of copper wires, a sign of an electrical abnormality occurring. Such greenish residue is normally left behind from oxidation as result of chemical reaction involving copper wires, heat and oxygen.



Photo 19 shows a closer view of the greenish residue (circled) that was found on a stretch of burnt wirings from the front wire harness of the vehicle. The presence of greenish residue indicates internal heating of copper wires, a sign of an electrical abnormality occurring. Such greenish residue is normally left behind from oxidation as result of chemical reaction involving copper wires, heat and oxygen. This stretch of burnt wirings is located at the middle section area of the vehicle's front support panel (refer to photograph 22 & 23 below).



Photo 20 shows another view of the greenish residue that was found on a stretch of burnt wirings from the front wire harness of the vehicle. The presence of greenish residue indicates internal heating of copper wires, a sign of an electrical abnormality occurring. Such greenish residue is normally left behind from oxidation as result of chemical reaction involving copper wires, heat and oxygen. This stretch of burnt wirings is located at the middle section area of the vehicle's front support panel (refer to photograph 22 & 23 below).



Photo 21 shows the discolouration that was observed on one of the wire connectors along the front wire harness of the vehicle. The greenish residue found on the stretch of burnt wirings from the vehicle's front wire harness (refer to photograph 19 & 20 above) and this discolouration to one of the wire connectors along the same front wire harness would suggest to me that there was an electrical abnormality to a stretch of wirings of the vehicle's front wire harness. This electrical abnormality was the cause of fire to the vehicle.

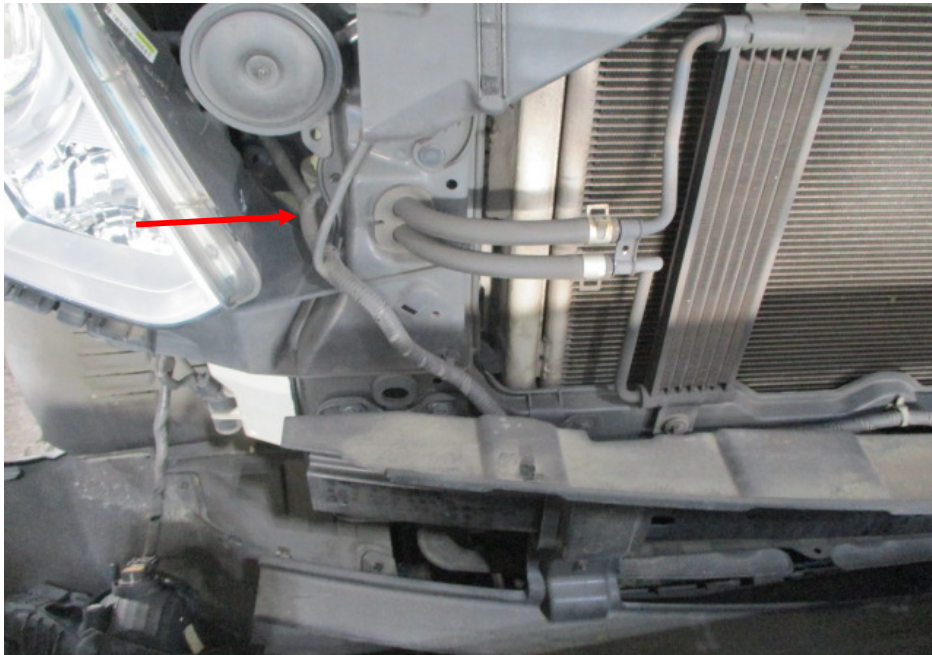


Photo 22 shows the front right portion of a similar make and model vehicle that was made available to me for comparison in order to understand the positioning of the parts that were dismantled from the vehicle prior to my inspection. The stretch of burnt wirings from the vehicle's front wire harness where greenish residue was found (refer to photograph 19 & 20 above) is highlighted by the red arrow. As seen in the photograph, the stretch of burnt wirings is located at the middle section area of the vehicle's front support panel. Note that most of the parts found to have been burnt and/or had sustained heat/smoke damage were all located in the immediate vicinity upwards of the burnt wirings.

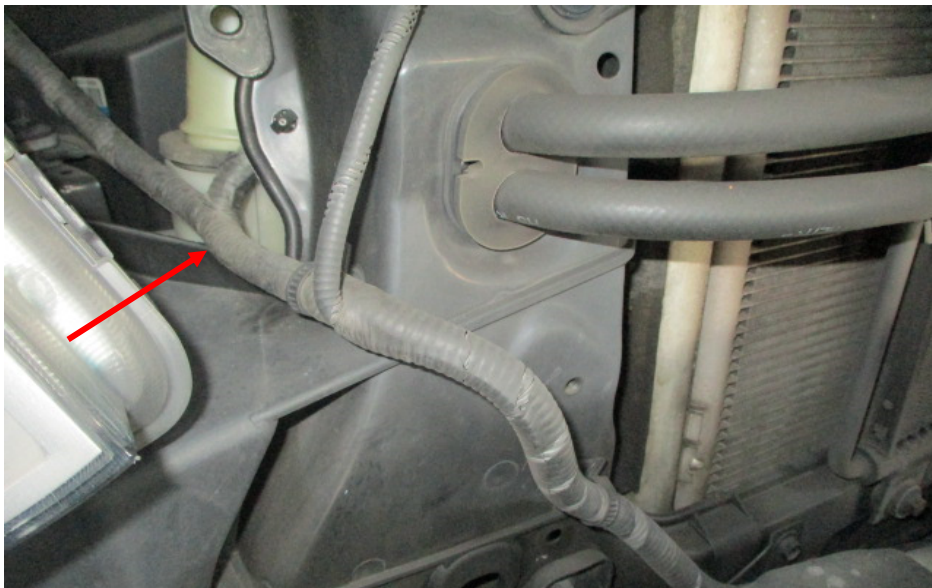


Photo 23 shows a closer view of where the stretch of burnt wirings with green residue (refer to photograph 19 & 20 above) was found. The stretch of burnt wirings is located at the middle section area of the vehicle's front support panel.

12. The location of where the stretch of burnt wirings with green residue is located, as shown in photograph 22 & 23 above, also corresponds to the characteristic of heat rising upwards. Most of the parts that were found to have been burnt and/or had sustained heat/smoke damage were all located in the immediate vicinity upwards of the burnt wirings.
13. To put things into perspective, the burnt stretch of wirings of the vehicle's front wire harness had possibly experienced an abnormal spike in electrical current. This created excessive heat and/or continuous electrical arcing along the stretch of wirings leading to the melting of wire insulations. A fire then ignited when the surrounding air becomes energised by the exposed electrical arcing.

Conclusion

14. Having physically inspected and technically analysing the damages of burnt nature to the vehicle, I am of the view that the cause of fire to the vehicle was of electrical in nature. For this particular case, there was likely to be an abnormality of the electrical current and/or continuous electrical arcing to a stretch of wirings of the vehicle's front wire harness.



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