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**AUTOSHOP / GSO**

**Welcomes You All**



**33<sup>rd</sup> DAE SAFETY MEET –  
2016 Organised by  
AERB & IPR, Gujarat.**

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Department of Atomic Energy  
Government of India  
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# OUR WORK SPOT – VEHICLE MAINTENANCE SHOP

Vehicle Clause	Light Commercial Vehicles	Medium Commercial Vehicles	Heavy Commercial Vehicles	Equipments	Two Wheelers	E-Bikes
No. of vehicles	48		22	09	15	129
Types of Vehicle	Cars Jeeps Vans	Ambulances Minibuses Mini Trucks	Passenger Buses Load Trucks	Forklifts Tractor Trailers Jo Trucks	100 CC 350 CC	Battery Operated
Makes / Model	Ambassador (P) Ambassador (D) Ford Fiesta (D) Maruti Dzire (D) Mahindra Armada Mahindra Bolero Mahindra Marshal Mahindra Commander Mahindra Scorpio Tata Sumo	Swaraj Mazda Tempo Traveller TATA Winger Tata 207 407, 709,410 Eicher	Ashok- Leyland	Godrej Voltas Leyland Hippo Mahindra Sarpanch Fabricated Trailers	Bullet Hero Honda CD HH Splendor TVS Victor TVS Scooty	EKO       ULTRA

Grand Total

92 + 129 = 224

Autoshop is a part of Mechanical Wing of ESG/GSO functioning with the vision of full fledged Automobile Service Solutions to all types of DAE Vehicles plying at Kalpakkam.

# PROBLEM FACED



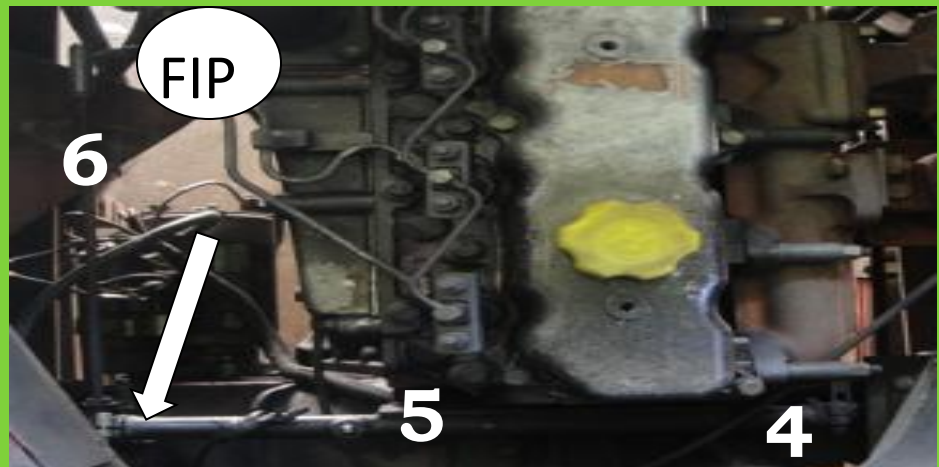
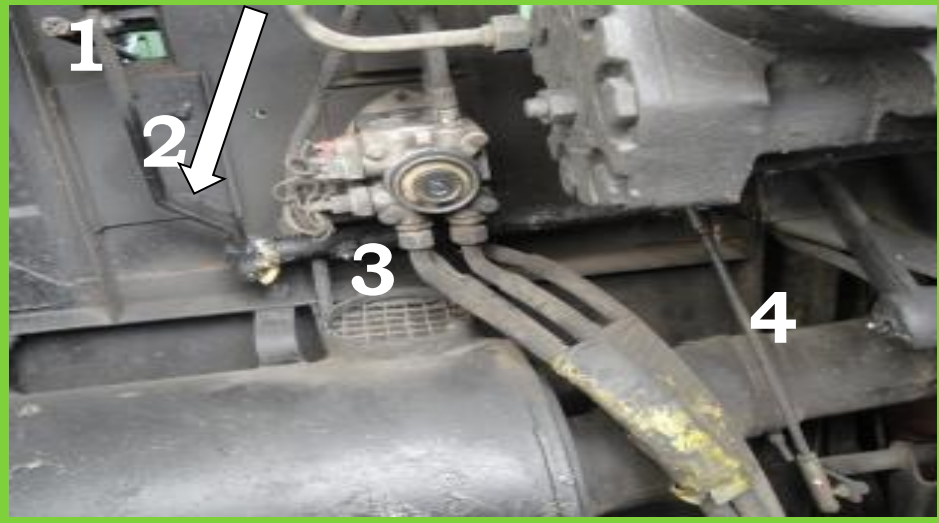
**ELECTRIC SHORT CIRCUIT DUE TO  
MECHANICAL FAILURE OF AN ACCELERATOR  
LEVER LINK ON A MOVING BUS**

# Definition of Problem

## Fuel Supply Modulation System in a Bus (Acceleration / Deceleration)

When the driver presses the Accelerator pedal the fuel injection pump lever will be activated through a series of linkages 1 to 6 as shown in figure.

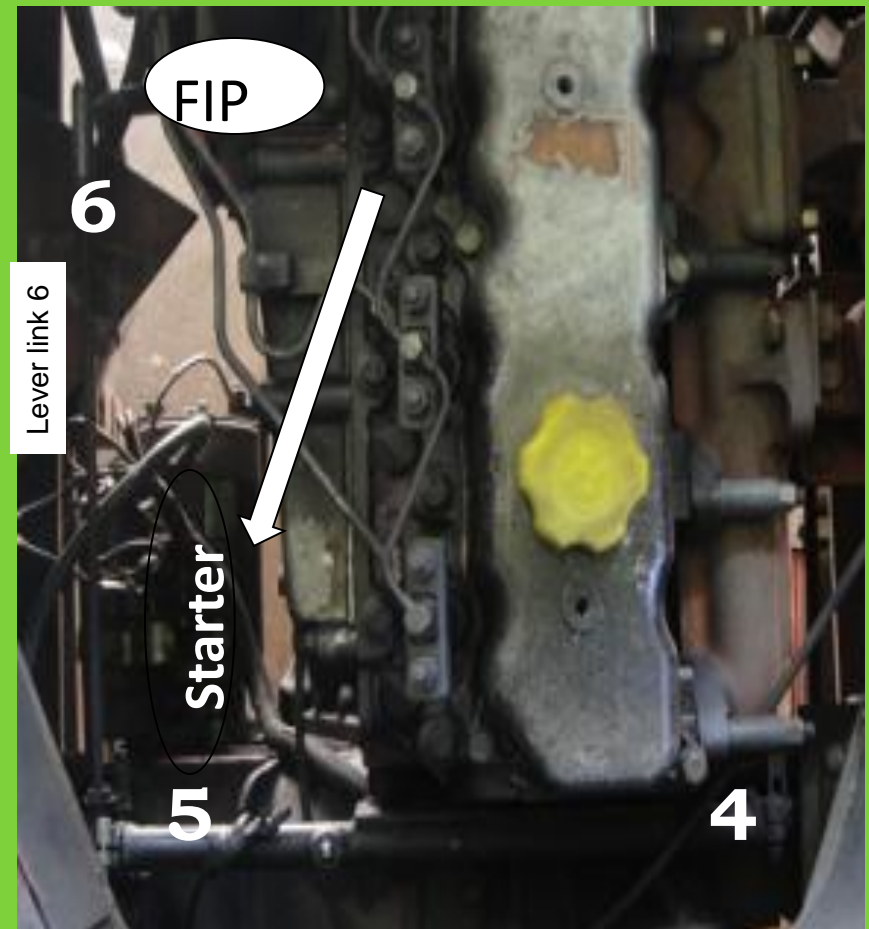
The modulation of the pump lever is controlled by the driver based on the requirement of the speed.



# Definition of Problem

## Position of Starter Motor in a Bus

Position of the Starter Motor Assembly is **exactly below the lever link 6** as shown in the photo.



# Analysis Of Problem

## RESULT OF FAILURE OF LEVER LINKS

Lever link 6

When the levers in the link (1 to 5) fail:

The effect will be a stoppage of vehicle. **No other secondary effects** for these levers failures.



**LEVER LINK 6 IS A LONGEST LINK WITHOUT MIDDLE SUPPORT IN THE SYSTEM**

When the lever **link 6** failed,

**PRIMARY:**

1. Further fuel supply modulation would not be possible by the driver. The vehicle will come to stop gradually.

**SECONDARY:**

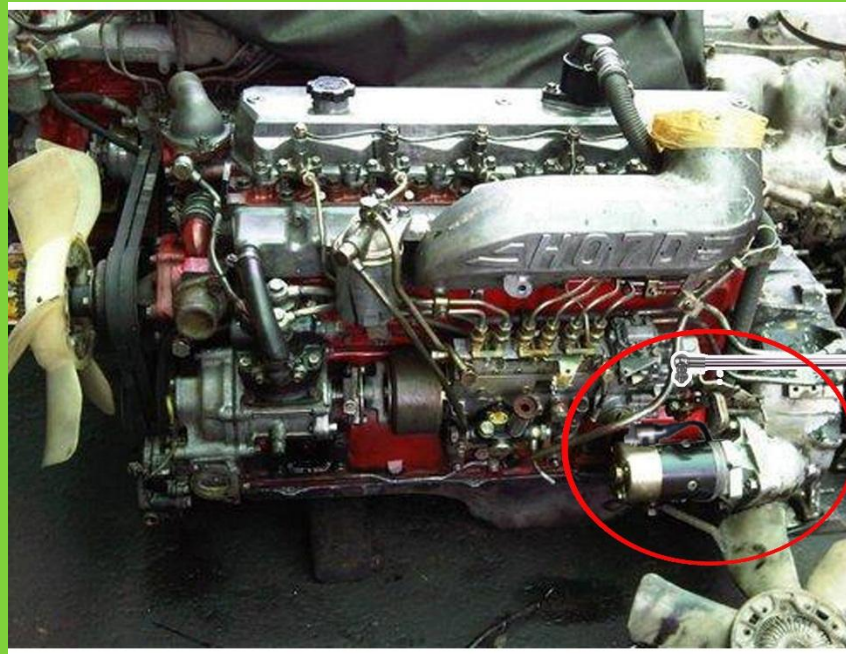
1. The lever **link 6 will fall/hang from one side hinged and touches** the starter motor power connections.

2. Since the whole body of the vehicle (including lever link 6) is connected with the negative terminal for the wiring advantage by the manufacturer, **the falling lever link 6 will create a short circuit** with the positive terminal of the starter motor.

3. Because of this short circuit of the battery power source, the complete wires may be burnt and may **result in a fire accident.**

# INTENSITY OF THE PROBLEM

## Animation of Problem Explanation





# INTENSITY OF THE PROBLEM

## REAL TIME EXPERIENCE IN A BUS

One of the GSO Bus TN 19 B 5325 faced with this lever link 6 failure and the complete wiring of the vehicle got burnt. The vehicle stopped on road and heavy smoke filled the vehicle. The fire extinguisher in the vehicle was used to extinguish the burnt wire & smoke, the short circuit was removed by the battery terminal cut off switch operation by the driver. There was no injury to any of the passengers.



# ROOT CAUSE ANALYSIS

As guided by the vehicle manufacturer, the lever links are lubricated & condition of the ball joints are also assessed once in **2000 kms** running of the vehicle.

## REASON FOR FAILURE EVEN WITH PREVENTIVE MAINTENANCE

Since the ball joint is at the middle portion of the engine, it is **continuously exposed to heat**. The continuous heating reduces the lubrication partly. Hence, the insufficient lubrication led to **the ball wear out, accumulate, slip** from its position and leave the lever link to fall down.

At present, there is no fixed replacement schedule followed for the ball joints in the levers



Style of Operation & the Material Failures are also root causes which cannot be ruled out.

## SOLUTION DEVELOPED

**1. REPLACEMENT OF BALL JOINT ONCE IS A YEAR**

**Frequency standardised in FC Works Check List.**



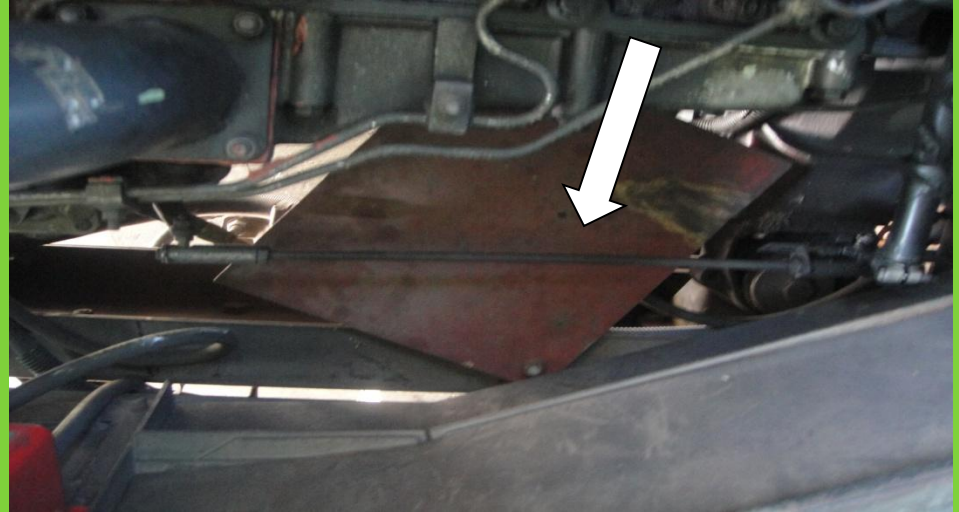
**2. SPECIAL SHAPED WOODEN BOARD (Insulator) INTRODUCED IN BETWEEN LEVER LINK 6 AND THE STARTER MOTOR.**

**All 15 Nos. of GSO Buses & 7 Trucks are provided with the wooden board.**

## SOLUTION IMPLEMENTED

Insulating material a **wooden board** is placed in between the starter motor and the lever link 6. Hence, there is no short circuit.

The insulation layer can **swing aside for the repair** of starter motor from the top side. After the repair, the insulation layer will be put in position to make the fall protection of lever link 6. Even in the swing open position also the fall protection is ensured by the shape of the insulation layer as shown in the picture .



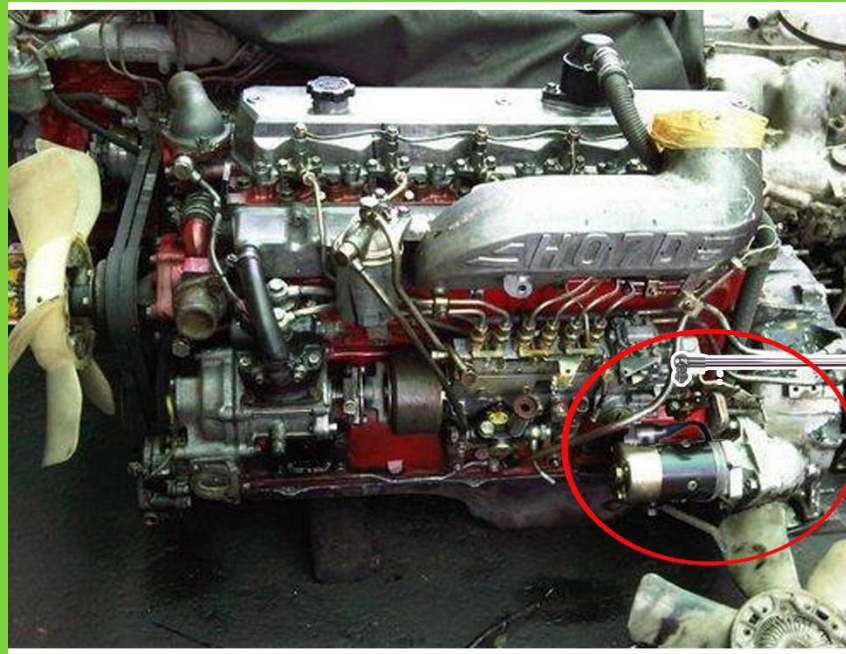
CLOSE POSITION



OPEN POSITION TO REPAIR ACCESS

# SOLUTION IMPLEMENTED

## Animation of Solution Explanation



# BENEFITS OF MODIFICATION

## Benefits of the Solution

**BY PREVENTING LEVER LINK 6 FAILURES**

**NO SHORT CIRCUIT OF STARTER ELECTRICAL SYSTEM, HENCE, NO FIRE ON MOVING BUS. SAFETY ENHANCED**

**NO PANIC SITUATION TO THE PASSENGERS**

**SAFETY OF PASSENGERS ENSURED**

**NO BREAKDOWN OF VEHICLE**



For the excellent opportunity to  
present this Case Study

**Save Trees, Plant Trees**  
each one of us can be an Ashoka!  
A tree not only provides beauty, shade, shelter and food,  
but also acts as a lifetime sink of carbon dioxide