SYSTEMATIC APPROACH TO TROUBLESHOOTING AND FAULT RECTIFICATION

Cover Page – Slide 1

I welcome you all to this exciting session on Systematic Approach to Troubleshooting and Fault Rectification.

Learning Outcomes – Slide 2

At the end of this session, it is my belief that we would have achieved the following Learning Outcomes:

- Explain the basic approaches to troubleshooting.
- List the aids for troubleshooting, and,
- Describe the guidelines for fault Investigation.

Introduction – Slide 3

The use of diagnostic tools and equipment techniques to detect faults, or the physical approach by observations and the use of the five sensory organs, to carry out certain preventative maintenance measures, can save a great deal of time, sweat, and frustration for the technician.

A significant deterioration in the performance of a unit or component may be indicated by a change in a monitored parameter of the unit's performance, such as high or low temperature, malfunction sensors, ineffective actuators, partial electrical contact, bad switches, and so on.

A systematic approach to troubleshooting will allow you to keep track of the fault indication and take the necessary steps to restore the situation to normalcy. Maintenance technicians must be able to troubleshoot problems to make effective repairs. It is necessary to determine the exact cause of the breakdown. Although, in some cases, this may be readily apparent, in others, it may not be.

Systematic Troubleshooting is a logical system of investigation that is intended to identify the correct cause of a breakdown in the shortest amount of time and with the least likelihood of error.

Approaches to Basic Troubleshooting – Slide 4

Troubleshooting, like most skills, can be learned, and it is not necessary to assume that it is something for which only a select group of exceptionally gifted individuals are suitable.

For many people, developing the confidence to make judgments and then back them up is one of the most difficult aspects of problem solving. In contrast, self-assurance does not appear out of nowhere; rather, it is a result of several factors that work together.

Confidence can be gained and troubleshooting abilities can be improved by understanding and responding to the factors mentioned previously. Several factors influence one's ability to make sound decisions and to feel confident in one's ability to solve problems.

The basic approaches to troubleshooting are ***Technical Knowledge, Logic and Experience***. We would look at them in details as follows.

Technical Knowledge – Slide 5

If technicians are to be able to assess the condition of a motor vehicle and successfully diagnose the cause of a breakdown, they must have a thorough knowledge and understanding of the physical characteristics of the engine and its construction, the operating principles upon which the engine operates, and the function that the engine performs, among other things.

A person who does not understand how an engine works will be less likely to be able to diagnose the root cause of a malfunction if such a malfunction occurs. The greater one's knowledge and understanding of the principles of operation, characteristics, and functions of an engine, the greater one's confidence in making decisions about the engine's condition, and the greater the likelihood that those decisions will be correct.

Logic – Slide 6

When troubleshooting, a systematic approach is required if false conclusions and blind alleys are to be avoided, and if the root cause of the problem is to be identified in the most efficient manner.

The process of troubleshooting can be thought of as an iterative process. There could be a variety of factors contributing to a particular breakdown.

Troubleshooting, on the other hand, is the process by which all factors other than the actual causes are eliminated. Making your way from a situation with countless possibilities to the root of the problem requires a systematic, step-by-step approach that is logical and logically logical.

Experience – Slide 7

Even though, sound technical knowledge and a rational approach can accomplish a great deal, there is little doubt that someone with experience will be able to make reasonable guesses and connect cause and effect, whereas this may be difficult for someone who is inexperienced. Another resource that should be considered by a trouble-shooter is the knowledge and experience of other people.

Aids for Troubleshooting – Slide 8

It is unlikely that problems will be solved quickly and effectively if the relevant information is not available. Therefore, the first step in troubleshooting a problem is to collect all the necessary data pertaining to the problem.

The data requires falls into two categories and may be either background data (information regarding the function, design characteristics, maintenance instructions, etc., of the type of vehicle, model of the engine), or operational data (information regarding the running conditions at the time of breakdown). In both cases, the maintenance technician who is required to troubleshoot the problem should have the following additional sources of information:

a. Background Data Sources
b. Operational Data Sources

Background Data Sources – Slide 9

Background data sources can be found in the following:

a. Manufacturer's information manual.
b. Maintenance history record or card.
c. System and process drawings, and,
d. Troubleshooting charts.

Operational Data Sources – Slide 10

Operational data sources can be found in the following:

a. Operation logbook record.
b. Information from operating personnel/interview.
c. Reading of installed gauges and indicators.
d. Use of diagnostic tools and equipment to test operating parameters, and,
e. Analysis of failed component using close examination of failed components.

Guidelines for Fault Investigation – Slide 11

Before undertaking the troubleshooting process, the following guidelines are recommended to help avoid simple mistakes that can seriously interfere with finding a solution.

a. Start the investigation as soon as possible after breakdown has occurred. Time may obscure or obliterate vital evidence.
b. Ensure that no evidence is destroyed. Do not disturb or tidy up the scene of failure until a proper examination has been made.
c. Collect important pieces of evidence for more detailed examination. Handle and pack them carefully so that they cannot further damage accidentally. Accurately identify the parts and components collected.
d. Do not be too narrow in investigation. Check out the surroundings and environmental conditions and approach the point of failure gradually. The cause of failure can often be remote from the point of failure itself.
e. Avoid guesswork and drawing easy conclusions unless they are rigorously checked out.

Systematic Approach to Fault Diagnosis – Slide 12

Systematic diagnosis is the process of embarking on a fixed and organised plan and method of fault finding/diagnosis involving identified steps, sequence, and procedures.
It is generally accepted that the process of troubleshooting can be systematized into fundamental steps that are applicable to fault location for all types of vehicle's engines. These basic steps must be worked through sequentially and can be described as follows:

1 **Problem Analysis:** This step primarily involves collecting information from data sources referred to as "Aids to trouble shooting" they should be reviewed so that the nature of the breakdown can be described as accurately and precisely as possible.

2. **Preliminary Inspection:** Once the problem has been defined, a more detailed inspection of the equipment can be carried out. In particular, the general area in which the fault is most likely to occur should be investigated. In many cases where the problem is relatively straight forward, the cause of breakdown may be immediately apparent in which case a repair can be immediately undertaken. If this is not the case, then a number of preliminary questions should be considered before the investigation proceeds further. Such questions include:
   - ❖ Is there a fault-finding guide for the engine?
   - ❖ Has there been any changes or modification to the vehicle recently?
   - ❖ Has a similar fault occurred before?

   If the answer to any of these questions is "Yes", this opens up particular lines of inquiry which should be pursued before the process advances further. If the answer is "No", the investigation must move on to the next step.

3. **Fault Zone Location:** If the fault has not been located by this stage then the engine should be mentally divided into functional zones which can then be checked for operation. For example, if a petrol engine will not start and the problem is not obvious, it is normal practice to isolate the problem to either the fuel delivery system to the ignition system by checking each separately.

   The key to locating the fault zone is to check inputs and outputs rather than to examine the zone itself. The trouble-shooter just establishes key points in the system where tests can be made to eliminate those zones where operation is unaffected by the fault until, finally, the fault is isolated to one part of the engine or system.

4. **Zone Investigation:** Once the fault has been traced to a particular zone or system then a more thorough investigation can begin. In the case of a single unit element such as compressor, or alternator the component may now need to be dismantled and examined. If the fault has merely been isolated to a particular circuit or system, then input and output checks may again be required to pinpoint element in the circuit where the fault lies.

   The more elements that can be eliminated as operating correctly the simpler it becomes to find the faulty element.

5. **Finding the Cause:** The purpose of troubleshooting, it should be remembered, is not just to locate the fault but also to find the cause. If this is not done, then a repair may be made, and engine put back into service and a similar breakdown may reoccur within a very short time.

6. **Replacement or Repair**: The decision of whether to replace or repair a faulty component may depend on the overall maintenance decision of the individual or the organization. If a component is repaired, then it should be tested, if possible before it is reinstalled. If failure was identified as being due to either misuse or inherent weakness, then the repair made must include steps to avoid changes, or modifications to other parts of the engine or components, or system, or may involve the selection of different materials.

7. **Performance Checks:** Once the repair has been completed, it is essential that the performance of the vehicle is checked to ensure that the fault has been eliminated and the vehicle is functioning satisfactorily. Before finally returning the vehicle service, it is wise to ask the driver to test it to make sure that it is operating correctly.

Conclusion – Slide 13

Hey, so in the past few minutes, we have been able to at:

- *Approaches to Basic Troubleshooting,*
- *Guidelines for Fault Investigation, and,*
- *Systematic Approach to Fault Diagnosis.*

For any meaningful repairs to be carried out, systematic diagnosis and fault tracing is key to avoid trial and error which may damage the automobile.

Thank you and I will see you again in the next session. Stay Safe. Bye.