Improvement of Methodology is the solution for Solving Problems

What is the particular cause of the failure? – There is no pin pointing answer of this question which lead to improvement because failures are mostly due to a chance combination of multiple factors. The chances of failure occurring will reduce if the practices/systems/procedures influencing these factors are improved. Therefore, the question should be, "What improvements can be made in the practices to reduce chances of the failure / problem occurring?" And the answer is improvement in methodology, they are:

1. Correct approach for investigating problem
2. List out factors influencing the failure / problem.
3. List out the practices, which have influence on the factors in order of priority.
4. Detail step by step the important practices to be followed i.e.
    - Study the maintenance practice normally followed in Shed/ Workshops.
    - Compare what is happening vs. what should happen.
    - Identify what often goes wrong.
    - Develop the system to be followed for improvement.

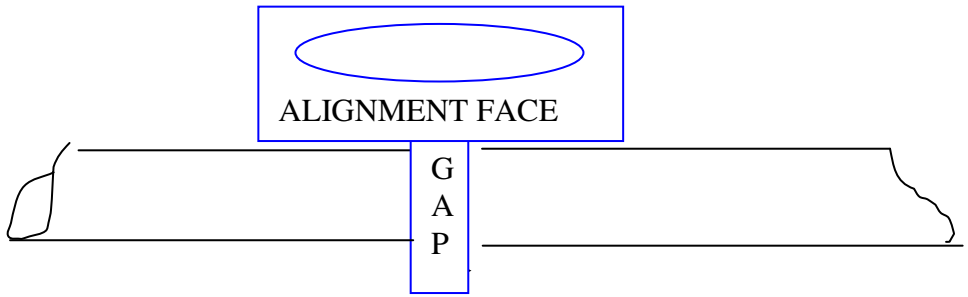
Objective of this write up:

To provide guidelines for the field personnel/ trainees about the practices / methods to be followed for reducing the incidence of recurring problems associated with any system or component. Also to give an indication of what may often goes wrong. Let us take a problem on excess lube oil consumption in Diesel Locomotive and develop methodology for its improvement.

Problem: High Lube oil consumption
Solution: Stepwise activities to follow:

- Investigating problem (Chronological approach)
  - Check the history of the locomotive as per Lube Oil consumption. (For a permanently low category loco it needs thorough investigation to identify the problem)
  - Check the last report endorsed by the driver in the repair book
  - Check the condition of Liner and Piston rings during last overhauling.
  - Check thoroughly for any external leakage and attention to be given at every trip schedule. The probable areas of leakages are:
    - From pipe joints. The leak prone joints are: Dresser joints at strainer housing and at Lube oil cooler.
  - Excess leakage between X-head and FP Support housing.(due to excess clearance or ovality in x head bore)
    - Leakage through Free end oil seal or Gen end oil seal (May be due to excess clearance between extension shaft or flange and oil seal, Oil return passage clogged/ less open or due to low crank case vacuum)
    - Leakages due to damaged Oil Seal of Oil Filter housing.
    - Leakage from weld joint or gasket joint of lube oil cooler.
    - Leakage at the union joint of lube oil pipe connection to vibration damper.
    - Leakage from the joint gasket of cam vibration damper with housing.
    - Oil throw through Turbo Chimney (This may be due to excess clearance between thrust collar and oil seal, eccentric fitting of oil seal or oil carried through exhaust gases due to internal leakages as explained below.)
  - Check for internal leakages, which causes burning of lube oil in combustion chamber and carrying away of oil through exhaust gases
    -- Conduct blow-by test to understand condition of liner and piston ring (may be due to ovality in liner bore, worn out piston rings or ring gap aligned).
    -- Conduct Load box test to check crank case vacuum. Low crank case vacuum may lead to high lube oil consumption
- After pinpointing the problem, identify the factors influencing problem.
- Study the practice normally followed vs. what should be followed.
- Identify what often goes wrong and advice for correct method to be followed, as tabulated below:

Problem	**Factors influencing problem**	**Systems/ Practices which influence the factors. Sheds should study what should be Vs what is with reference to the practices.**	**What often goes wrong**
External leakage of Lube oil	leakage from pipe joints	• Method of alignment of pipes and clamping	• Rough and damaged surface of pipes and joining face --to be made true or replace the damaged pieces. • Misalignment of pipes • Improper fitting / wrong setting of pipe joints • Loose/ defective clamping • Normally there is a tendency of compromising alignment and gap setting at the pipe joints because of retention of old pipe clamps, which keeps the joint under tension and leads to leakage from joints during working. Suggestion: For accurate setting of alignment and gap ″T” gauge can be used. • After alignment and completion of pipe joints fresh clamping should be done to make tension free joint



External leakage	2. Oil throw from turbo chimney due to defective turbo or oil carried through exhaust gases.	1.Proper maintenance practice of turbo to be followed 2. Oil hoses should be properly inspected and renewed, if necessary 3. Proper maintenance practice should be followed in other related areas e.g. cylinder head, liner, piston rings etc.	• Air passage from blower to turbine end oil seal is not cleaned properly • Excess clearance between thrust collar and oil seal. - Ovality in oil seal - Concentricity of oil seal is not maintained during fitment • Turbo oil drain hose bulged internally, which is normally overlooked • It may also be due to oil carried away with the exhaust gases. Which may be due to: - Defective cylinder head (dealt separately). - Defective liner and piston ring (dealt separately).

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Internal leakage	1.Oil burning due to: • Excess clearance between valve guide and valve stem of cylinder head • Ovality in Liner • Worn out ring/ ring gaps aligned	• Identification of weak area by blow-by test: -If excess blow of exhaust gas takes place through sump it gives the indication of ovality in liner bore or worn out rings or ring gaps have been aligned • Method of inspection maintenance and assembly of cylinder head, piston and liner	• Excess clearance between valve guide and stem due to worn out guide. Old valve guides are not replaced during overhauling if bore size is found OK by checking through pilot gauge. But pilot gauge cannot detect ovality inside the bore. Hence it is advisable to replace all the guides during overhauling of cylinder head if oil leakage is witnessed through exh. Elbows. • Allowing excess runout of valve seat insert with respect to guide during grinding/ overhauling of cyl heads, which leads to eccentric positioning of valve stem inside the guide. (Runout should be strictly maintained within 0.002") • Ovality in liner • Worn out Piston rings • Piston ring gaps should not be aligned in line should be at 180° interval between two consecutive rings.

	2.Low crank case vacuum	• Checking of Crank Case vacuum on load. • Method of maintenance and testing of crank case exhauster. • Method of checking of leakages affecting Crank Case Vacuum	• Crankcase Vacuum should not be less than ¾" of water column on full load. • Weak crank case vacuum is compromised normally if performance of crank case exhauster motor is ok. Proper attention should be given to identify and rectify the weak area that destroys the crank case vacuum, like lose fitment of dowels, damaged crank case cover gaskets and head cover gaskets etc. **Suggestion:** Leakages affecting crank case vacuum to be identified by putting the crankcase exhauster motor off for 5 minutes on 8^{th} notch and check the areas of leakages, remedial action to be taken accordingly.