LOAD BOX TEST

WHAT IS?

- This is a test to check the capability and performance of the engine by simulating the actual working condition of the locomotive at rated output, in static condition.
- During load box test, the output of the engine is measured in terms of electrical parameter (volt and ampere).In this, the output of the generator is connected across a set of resistance (Load Resistance) instead of connecting it with the Traction Motors.The output of the engine is dissipated in terms of heat across the resistance during Load Box test.

TYPES OF LOAD BOX

- Grid Resistance Load Box.
- Water Resistance Load Box.

COMPARISON

WATER RESISTANCE

1) Load resistance can be varied at infinite stages, hence a continuous HP curve can be plotted through this.
2) Load resistance can be changed during loaded condition.
3) Water load box can be conducted for a longer duration because of better heat dissipation facility
4) Requires permanent establishment to setup water load box, hence can not be shifted easily.

GRID RESISTANCE

1) Load Resistance can be changed only at limited stages (3 to 6). Hence a complete graph can not be plotted to understand the complete behaviour of the output.
2) To change the load resistance in grid type, the locomotive requires to be stepped down to lower notch as such load test gets interrupted as many times the resistance required to be changed.
3) Grid resistance load box can not be conducted for longer duration, as it gets heated up quickly causing hazardous environment and gives erratic reading.
4) Comparatively handy and can be shifted with lesser effort

WHY, WHEN AND WHERE

Why

1. To see whether the engine gives designed output or not.
2. Whether all systems are functioning properly or not.
3. Whether any problem is connected to any system or component.

When

1. After new manufacturing
2. Before and after major repairs
3. Before and after major schedule.
4. To diagnose any specific problem

Where

It is conducted on the specified Load Box area in the shed or in the workshop.

(In case of GM locomotive and latest micro processor controlled locos, the facility of Load Box Test exists within the loco itself)

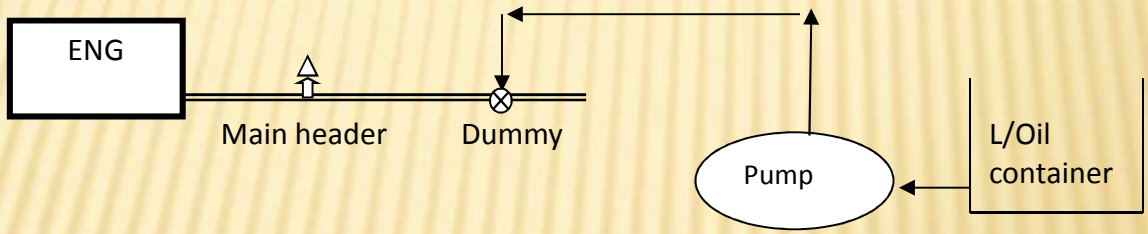
PROCEDURE OF STARTING ENGINE

- PREPARATION

1. Water filling
2. Fuel filling and bleeding test.
3. Supplement the engine with supplements e.g.T/G Gear Box oil, Gov. oil, Expressor Oil, Intake filter oil, Right Angle gear box oil and also greasing Rad fan bearings, Horizontal shaft coupling, universal shaft coupling, cardium compound filling in Expressor Coupling etc.
4. Pre lubrication & Filling of lubricant

PRE LUBRICATION.

Lube oil is not directly filled in the Engine sump. Instead , it is filled through an external pump by opening a dummy in the L/Oil main header (as shown in the figure below) so that the Lube oil can circulate through all the engine components and finally drops down to the sump.This is also termed as prelubrication.



**During prelubrication Test filters are necessary to be fitted to arrest the worn out metal particles and the metal chips left out in the process of overhauling or manufacture.

9 Nos are fitted in place of S-Pipes and 2 Nos. in the secondary headers.

CHECKING DURING PRELUBRICATION

The flow of lubricant during prelubrication will be as per the following pattern:

- Oozing : Con Rod bearings, M/Bearings, cam bush, valve lever bushes
- Spray like jets: Piston
- Pouring : F.P. Support, valve lever, Yoke
- Dripping : Liners
- Trickling : Cam Gear.

ENGINE STARTING

1) Engine is started immediately after prelubrication and run for a minute or two. Check for any unusual sound or leakage during running.

2) If O.K, continue run for 5 minutes and stop. Check the following:

Main Bearing temperature, it should not vary more than 5°C from one bearing to another.

leakage in L/oil system (specially S pipes) or water system etc.

Inspect lube oil sump strainer for any foreign particle, metal dust etc.

3) Run for 30 minutes, observe unusual sound, leakage, smoke etc. if any.

4) Stop engine and check M/Brg temperature, internal leakage of water, L/ oil etc. Exam crank case for any foreign material or worn out metals.

5) Continue run until temperature reaches 120°F and check between two stretch of runs.

6) Run the engine for 6 to 8 hours to complete idle run.

NOTCH UP

- Engine is then notched up to 8 th notch with the continuation of 15 minutes run in each notch.
- After notch up remove all the test filters and connect the original pipes before conducting load box. Check all the test filters for any foreign materials or worn out metal particles, if any. Take remedial measures accordingly.

PRE LOAD TESTING

SHUT DOWN CONDITION

Electrical testing

Conduct insulation test (Meggar test) between Power circuit to earth. Control circuit to earth. Power to Control and also in all cards.(Range: 1 to 5 Mega Ohm)

Check all C- Brushes of rotating equipments.

Mechanical testing

a)Exam crank case for the following:

i) Foreign material, split pin, loose nut etc.

ii) Internal leakage, if any.

PRE LOAD TESTING

RUNNING CONDITION

Electrical testing

- Notch wise voltage at No Load to be checked connecting voltmeter across GA2&GA11 (fixed contact)
- Check engine speed notch wise.
- Check reference volt across wire No 29 A&4 : 24.4 volt (E type)
- Check AC Volt across 31L-31M,31M-31N,31N-31L: 100 to 105 V on 8^{th} notch.
- Check Battery Volt (across CK1&CK2 moving contact): 72 ± 2 volt.
- Check correct operation of LOPS, LWS, T1 T2 &ETS, PCS, GROUND RELAY, WSR etc.

Mechanical testing

- Check correct setting of OST.
- Check Turbo Rundown Test : 90 to 180 secs

LOAD CONNECTION

Mechanical

i) Fit adopter for KIENE gauge removing all decompression plugs.

ii) Fit temperature gauge removing exhaust plugs.

iii)Fit temp gauge before and after TSC.

iv)Connect temp gauge before and after After Cooler.

v) Connect temp gauge before and after L/Oil Cooler.

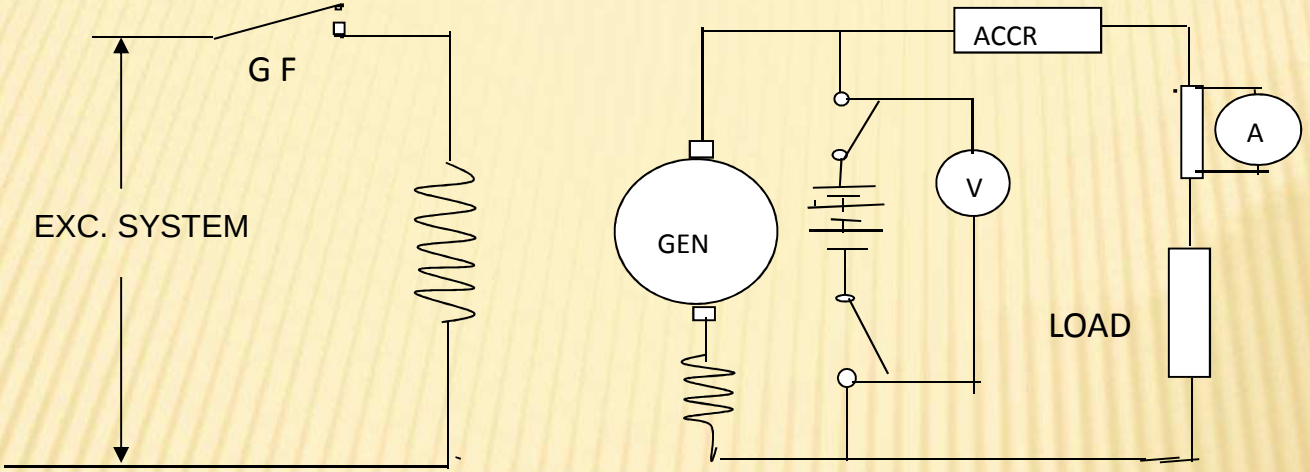
vi)Fit Pressure Gauge before and after L/Oil Filter tank.

vii) Fit Pressure Gauge at Water Pump outlet and Water Headers.

viii) fit Vacuum Gauge at Expressor Crank case.

ix) Fit Water Manometer at crank case cover for measuring Crank case Vacuum.(Specially fabricated for taking crankcase vacuum.

ELECTRICAL CONNECTION



BREAK IN ON LOAD

25% of rated load 60 min / 30 min (New / Overhauled Engine)
50% of rated load 60 min / 30 min (- do -)
75% of rated load 120 min/ 60 min (- do -)
100% of rated load 120 min/ 60 min (-do -)

READINGS TAKEN IN ALL NOTCHES

Notch	Lube oil Pressure			Fuel oil Pressure	Booster Air pressure	Engine Speed RPM	Rack Position in mm	LCP position	Excitation current
	Eng	Com	Exh						
1	2	3	4	5	6	7	8	9	10
Idle 1st 2nd 3rd 4th 5th 6th 7th 8th									

READINGS TAKEN IN 1ST & 8TH NOTCH

Notch	Auxiliary Voltage	Reference Voltage	AC Voltage between 3φ			Load Current	Load Voltage	Horse Power	Corrected HP	Water Temp
	11	12	13	14	15	16	17	18	19	20
Idle & 8th notch						I	V	V.I/ 700 (700= 746 x Gen η)	Cal HP/ a.b.c (a,b,c are correction factors)	

Notch	Colour of smoke	Current limit	Specific Fuel Consumption (gms / bhp.hr)	Efficiency	Crank case vacuum		Remarks
					Engine	Expr./ Comp	
	21	22	23	24	25	26	27
Idle & 8th notch							

READINGS TAKEN IN 8TH NOTCH

Cyl. No	Compression Pressure	Firing Pressure	Exhaust Gas Temp	Cyl. No	Compression Pressure	Firing Pressure	Exhaust Gas Temp
1R				1L			
2R				2L			
3R				3L			
4R				4L			
5R				5L			
6R				6L			
7R				7L			
8R				8L			

- **Turbo Supercharger**

  Take exhaust gas temp before and after TSC
- **Lube Oil Cooler**

  Take Lube Oil Temp Before and after lube Oil Cooler

  Take water inlet temperature
- **After Cooler**

  Take charge air temp before and after After Cooler

  Take water inlet temperature into A/ Cooler
- **L/Oil Filter Tank**

  Check Lube oil pressure before and after filter tank
- **Cooling Water pressure**

  Check pressure at pump outlet

Check pressure at the headers also

CORRECTION FACTOR

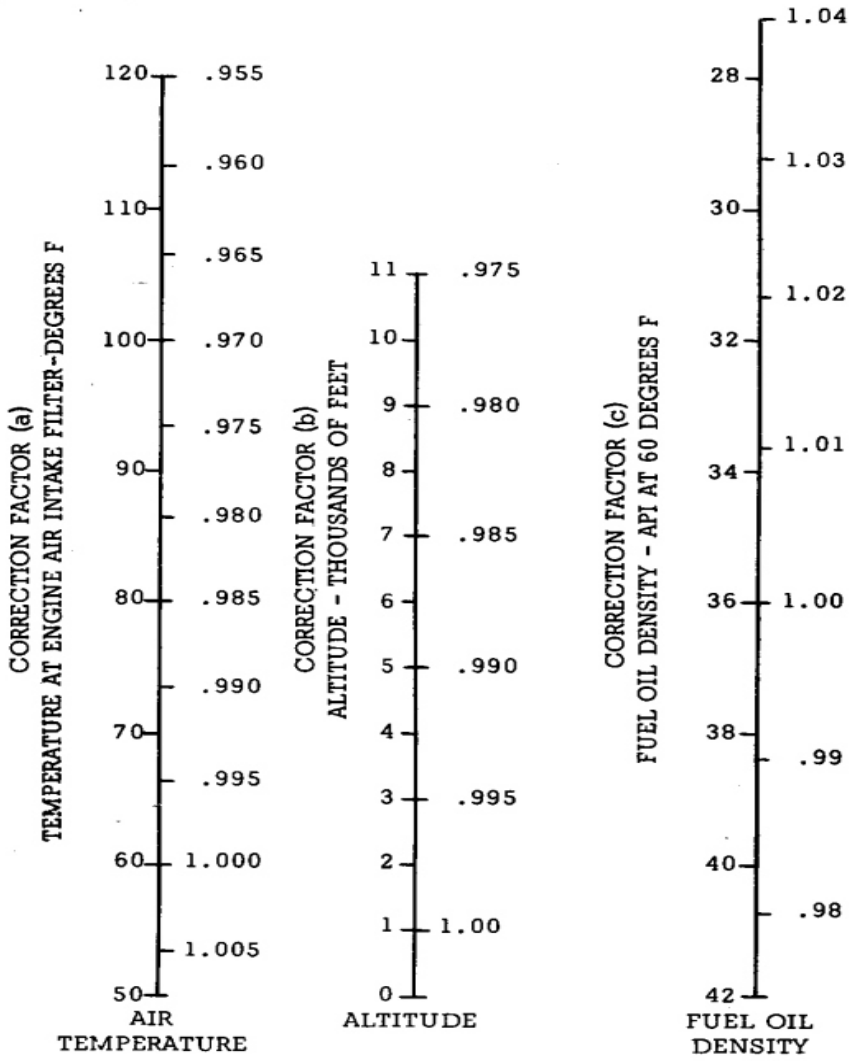
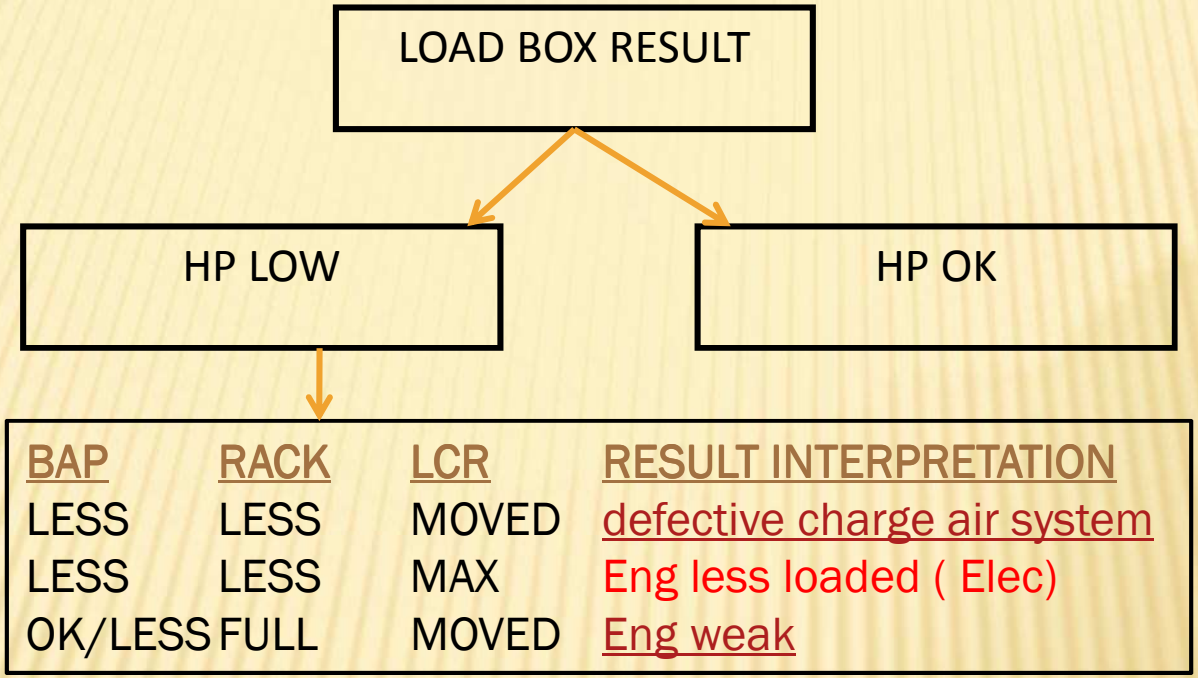
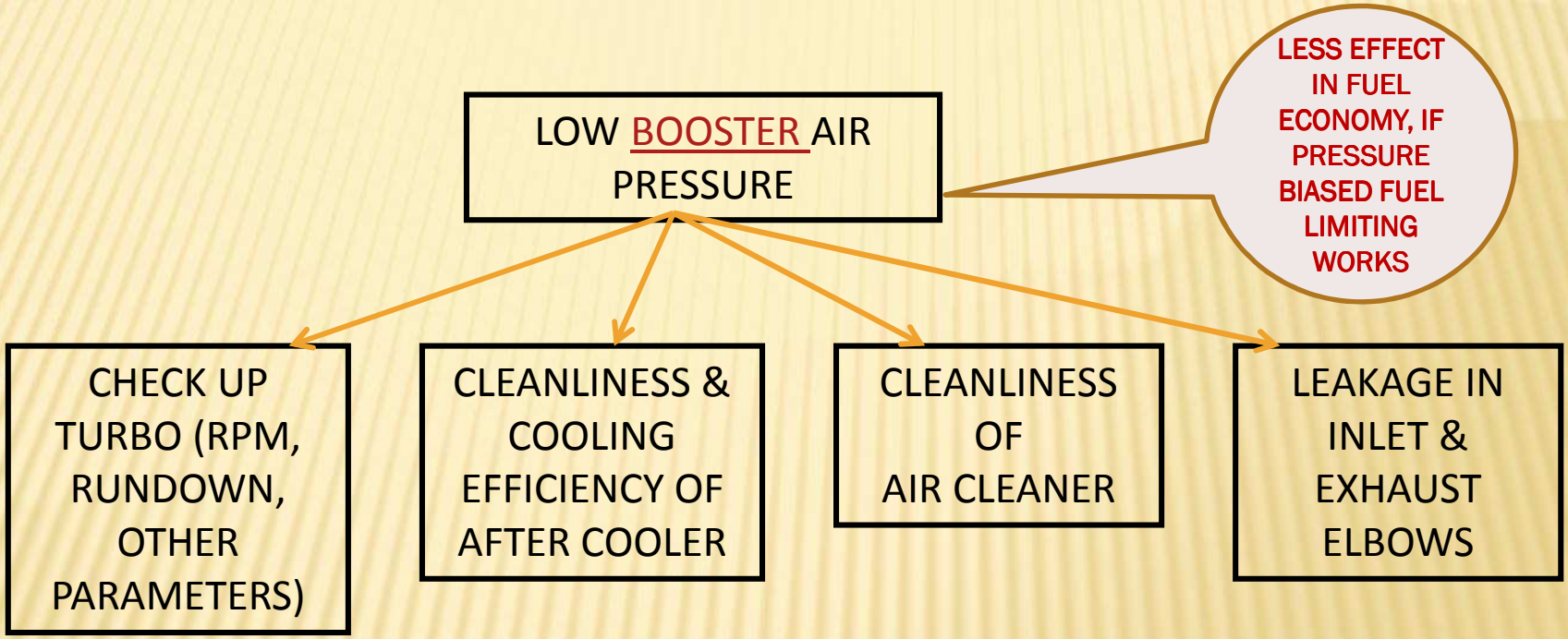


*FIG. 9 - PHOTO 5921
HORSEPOWER CORRECTION GRAPH-251 ENGINE WITH AFTERCOOLER



BAP	RACK	LCR	RESULT INTERPRETATION
LESS	LESS	MOVED	defective charge air system
LESS	LESS	MAX	Eng less loaded (Elec)
OK/LESS	FULL	MOVED	Eng weak

FUEL ECONOMY (ENG)



FUEL ECONOMY (ENG)

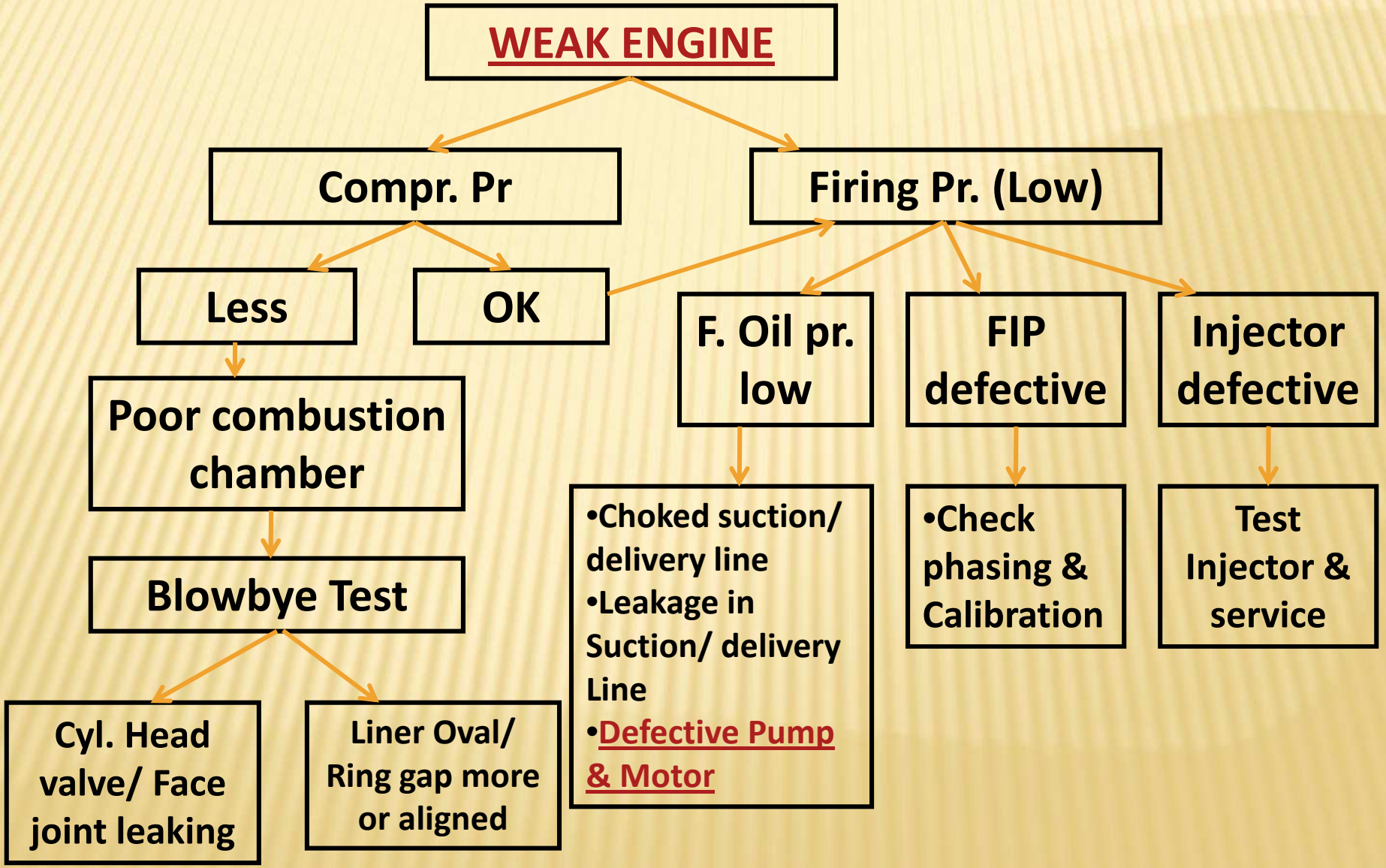


Photo 1. Ensure LoveJoy coupling allenscrew Tightness

Photo.2 Lock Fuel Injection Pump Rack to stop the Leakage from High pressure pipe line.

Photo 3. Tapping Fuel Regulating Valve

SMOKE ANALYSIS

TSC chimney-

Black Smoke- Incomplete combustion

Blue Smoke – L/oil burning in combustion chamber.

Blue smoke with L/oil- TSC Oil Seal damage.

Fire- Air Starvation / Air Filter choked.

Crank Case Exhaust-

Black Smoke- Less Blow Bye

White Smoke- Water leakage in Crank Case.

Grey Smoke- Seizure chance of Piston or Main Bearing.

Fire- Piston or Main Bearing seized already.


THANKS