

DIRECTOR GENERAL BORDER ROADS
GENERAL MAINTENANCE INSTRUCTION NO 233
OF
SILENT DG SET 160 KVA MAKE KIRLOSKAR

INTRODUCTION:-

1. 'REDY POWER' 160 KVA generator set has been developed as a reliable source of 415V, 3phase, 50 Hertz, AC power supply, along with control panel, fuel tank and all other associated equipment mounted on the base frame through antivibration mounting pads various fault warning and protection circuits with provision for automatic audio alarm, visual indication and engine shut down have been incorporated to protect the DG set from any damage while it is in operation. Set is provided with necessary facilities for manual remote operation and set is suitable for (-) 10°C to (+) 55°C, relative humidity 100% at all temperature, Altitude operation 4500 meter above an climate condition: and dusty, extreme cold and hot environment.

Maintenance is the most important factor for both the life and keeping the engine/machine in the best operating conditions. Preventive maintenance is more economical than corrective repairs. Be sure to maintain engine /DG set/alternator according to schedule given in this GMI for running in period and later in regular interval, respectively.

This GMI as guide line describes procedures of maintenance, lubrication, handling, checking and adjustment. It will help the operator realize peak performance through effective, economical and safe equipment operation. This GMI requires to be read carefully before operating the equipment to prolong its service life.

Generator set has main three section parts.

- (a) Engine
- (b) Alternator
- (c) Control panel

ENGINE:- The prime mover of the set is a Kirloskar make diesel engine emission complaint type 6 SL 1500 TA, water cooled, turbocharged, after cooled,6 cylinder developing 254 BHP at 1500 Rpm. Engine speed is controlled by a system with mechanical back up.

ALTERNATOR- The alternator used is of brush less design, Kirloskar green make, Type KG 254 MD manufactured by M/s Kirloskar engine Ltd and is rated for 160 KVA 415 V, 3phase 50 Hz 0.8 PF 1500 rpm.

CONTROL PANEL:- Control panel is incorporated with all requisite facilities to control and monitor the function of 160 KVA DG set. Automatic activated fault warning and protection system with audio and visual indication, battery charging, and alternator for starting better is incorporated.

AIM:-

The instructions are issued as guide lines for schedule of preventive maintenance, lubrication of Generator set 160 KVA manufactured by Kirloskar Ltd for regular attention to keep the equipment in good mechanical condition and it must be strictly followed.

Action by

- (a) **User Unit:**

To carry out periodic inspection and monitor regular/periodical maintenance as laid down in this instruction and record the tasks done in the log book.

b) **Field Wksp (GREF)**

(i) To carry out and monitor, maintenance schedule and oil changes as per periodical maintenance laid down in the maintenance instructions and to check the record of maintenance including lubrication.

(ii) To advise the user unit in respect of any lapses noticed

(c) **Mobile Maintenance Team:**

To ensure that proper maintenance is carried out and report accordingly to Task Force Commander and OC Fd Wksp for necessary action.

4. **Details:** The details of maintenance and lubrication with their periodicity are as under :-

- | | | |
|-----|-----------------------|------------|
| (a) | Daily check | - Appx 'A' |
| (b) | Operating instruction | - Appx 'B' |
| (c) | Do's and Don'ts | - Appx 'C' |
| (d) | Maintenance schedule | - Appx 'D' |
| (e) | Regular maintenance | - Appx 'E' |
| (f) | Technical data | - Appx 'F' |
| (g) | Lubricants | - Appx 'G' |

5. Please ack receipt.

(Hari Prakash)
SE (E&M) FS
Dir (Tech)
for Dir Gen Border roads

Distribution

Normal

DAILY CHECK:-1. **Fuel Supply**

- (a) Check the diesel level in this tank.
- (b) When filling in fuel, be careful to add clean fuel only.
- (c) After prolonged stand still, of the engine unadulterated ventilate the fuel system.

2. **Oil Level**

- (a) Check the oil level every day before starting the engine.
- (b) Check the oil level when the engine is cold and in horizontal position.
- (c) When a dipstick is used, the oil level must be between the top mark and bottom mark of the dipstick.

3. **Coolant level**

- (a) Inspect the coolant level every day before starting.
- (b) If coolant has to be added, fill in only the prescribed coolant.

4. **AT TEMPRATURE BELOW 0°C:-**

- (a) When cold starting device is provided on engine, separate instruction for engine starting are provided depending upon the starting aid provided based on the needs of environmental conditions.
- (b) Optimum operating range of the coolant is from 80°C to 95°C , operation below coolant temp of 80°C will result in the excessive wear of the engine, loss of the life of the engine and increase fuel consumption.
- (c) Temperature above 95°C and up to 110°C as max indicate overloading of the engine or clogged radiator and are permissible only up to a maximum time of 10 minutes.

OPERATING INSTRUCTIONS:-

At the time of initial commissioning of a new or overhaul engine and before daily starting of the engine.

- (a) Check the fuel, coolant and oil level, replenish if necessary.
- (b) Check electrical and battery connections.
- (c) Check condition of belt.
- (d) Ensure utmost clearness when handling fuel, lubricants and coolants.
- (e) Check all nut and bolts for tightness.

For an overhauled engine or for an engine after long periods without use,

- (a) On first starting press shut down lever in 'Stop' position and operate starter motor for a few second till oil pressure is indicated and then start the engine in the normal way.
- (b) Engine should be run at rated rpm 25% load until the temp of the engine comes to normal operating condition.
- (c) Over load, continuous full load operation and continuous no load should be avoided.
- (d) Abrupt start and stop of the engine should be avoided.
- (e) Engine load should not exceed 70% of its prime rating.
- (f) Maintenance and inspection must be accomplished thoroughly.
- (g) Check engine oil level frequently.
- (h) Check water level on indicator located on radiator.
- (j) Check battery charging.
- (k) Check leakage if any and rectify.

CHARGING ALTERNATOR:-

In order to avoid damage to the alternator, observe the following instruction while the engine is running.

- (a) Don't disconnect the battery or pole terminal or the cables.
- (b) If during operation the battery charge lamp suddenly light, Stop the engine and rectify the fault in the electrical system.
- (c) Don't short circuit the connections of the alternator with those of the regulator or with ground.

COLD STARTING AIDS:-

Cold starting aids facility is provided on the engine, When DG set are accepted to operate at sites when ambient temperature goes down to 0°C and below.

DO's AND DON'Ts:-**DO'S:-**

1. First study the operator s and technical manual before handling or operating the power plant.
2. Ensure good ventilation around the power plant.
3. Ensure all protective guards and covers are securely in place before starting the DG sets.
4. Ensure proper and effective earthing or DG set and control panel frames.
5. Be attentive to any unusual sound from a running DG set and find out the cause of such sound.
6. Apply or remove load a gradual manner.
7. Use only proper tool and testers while carrying out repair and maintenance.
8. Ensure all filter elements/ strainers are replaced cleaned at recommended intervals.
9. Use only genuine parts.
10. Carry out frequent and regular monitoring of all meters indicators while the power plant is running.
11. Clean the centrifugal cleaner at every 250 hrs or at the time of oil changing.
12. Daily check the condition of rubber hoses and hose clip before starting the engine. Damage hoses / clip must be replaced immediately.

DON'Ts

1. Don't Operate the DG set with any parts of the protective guards or covers removed or loose.
2. Don't switch on load immediately after starting the sets. Allow at least five minutes of no load running.
3. Don't stop the engine immediately after switching off the load allow at least 10 minutes of 'No load running'.
4. Don't bring a naked flame near the battery while it is on charge.
5. Don't run the DG set without load for long periods.
6. Don't load the set beyond its capacity.
7. Don't turn off the fuel supply to stop the engine.
8. Don't use the decompressor to stop the engine.
9. Don't try to carry out any repairs while the set is running.
10. Don't allow untrained persons to operate the power plant.
11. Never try to clean and re-use the old filter inserts.
12. Don't tamper with FIP, concern authorize dealer if any trouble.

MAINTENANCE SCHEDULE FOR RUNNING -IN- PERIOD**DAILY:-**

1. Check engine oil level, top up if necessary.
2. Drain sediments from fuel tank.
3. Fill up the fuel tank at the end of each working day.
4. Remove dust accumulated in the dry type air filter bowl, through vacuator valve.
5. Check coolant in the radiator, top up if required.
6. Draining of water is absolutely necessary, if temperature below freezing point.
7. Clean radiator and change air cooler externally every after 1200 hour's operation.
8. Check battery electrolyte.
9. Check the battery terminal; apply acid proofing grease for protection against corrosion.

AFTER 50 HOURS:-

1. Check engine oil.
2. Clean centrifugal filter.
3. Change spin-on type filter.
4. Check and tighten fuel pipe.
5. Check valve tappet clearance.
6. Check 'V' belt tension.
7. Check electrolyte level and specific gravity in the battery.
8. Check all fasteners, especially those of manifolds, bends, turbo chargers, and engine mounting and rubber hoses.
9. Check leaks, if any and rectify.
10. Top up radiator every day before starting the engine.

REGULAR MAINTENANCE**A. DAILY:-**

1. Check engine oil level, top up if necessary.
2. Drain water and sediments accumulated at the bottom of fuel tank before starting the engine.
3. Fill up the fuel tank at the end of each working day.
4. Remove dust accumulated in the dry type in filter bowl, through vacuator valve.
5. Check coolant in the radiator, top up if required.

B. AFTER 50 HRS

1. Check engine oil level, top up if necessary.
2. Drain water and sediments accumulated at the bottom of fuel tank before starting the engine.
3. Fill up the fuel tank at the end of each working day.
4. Remove dust accumulated in the dry type in filter bowl, through vacuator valve.
5. Check coolant in the radiator, top up if required.
6. In very dusty condition, clean the bowl of dry type air cleaner and if necessary change the element.
7. Check 'V' belt tension and adjust if required.
8. Check electrolyte level in battery.
9. Check the cable connection at starter, battery, dynamo/alternator and control panel.

C. AFTER 300 HRS

1. Check engine oil.
2. Clean centrifugal filter.
3. Drain sediments and water accumulated at the bottom of fuel filter bowls.
4. Clean the filter and sieve with clean diesel, fitted on feed pump inlet.
5. Check tightness of fine drive pulley.
6. Replace pre-filter and micro filter insert first at 200 hrs to 250 hrs.
7. Check and tightness of the drive belt after every 300 hrs.

D. AFTER 600 HRS

1. Check engine oil level, top up if necessary.
2. Drain water and sediments accumulated at the bottom of fuel tank before starting the engine.
3. Fill up the fuel tank at the end of each working day.
4. Remove dust accumulated in the dry type in filter bowl, through vacuator valve.
5. Check coolant in the radiator, top up if required.
6. In very dusty condition, clean the bowl of dry type air cleaner and if necessary change the element.
7. Check V belt tension and adjust if required.
8. Check electrolyte level in battery.
9. Check the cable connection at starter, battery, dynamo/alternator and control panel.
10. Clean centrifugal filter.

11. Drain sediments and water accumulated at the bottom of fuel filter bowls.
12. Clean the filter and sieve with clean diesel, fitted on feed pump inlet.
13. Check tightness of fine drive pulley.
14. Replace pre-filter and micro filter insert first at 200 hrs to 250 hrs.
15. Check and tightness of the drive belt after every 300 hrs.
16. Change main oil filter.
17. Replace the pre-filter insert of fuel filter.
18. Change air cleaner element.
19. Check valve tappet clearance, adjust if required.
20. Grease fan drive pedestal.

E. AFTER 1200 HRS

1. Check engine oil level, top up if necessary.
2. Drain water and sediments accumulated at the bottom of fuel tank before starting the engine.
3. Fill up the fuel tank at the end of each working day.
4. Remove dust accumulated in the dry type in filter bowl, through vacuator valve.
5. Check coolant in the radiator, top up if required.
6. In very dusty condition, clean the bowl of dry type air cleaner and if necessary change the element.
7. Check V belt tension and adjust if required.
8. Check electrolyte level in battery.
9. Check the cable connection at starter, battery, dynamo/alternator and control panel.
10. Clean centrifugal filter.
11. Drain sediments and water accumulated at the bottom of fuel filter bowls.
12. Clean the filter and sieve with clean diesel, fitted on feed pump inlet.
13. Check tightness of fine drive pulley.
14. Replace pre-filter and micro filter insert first at 200 hrs to 250 hrs.
15. Check and tightness of the drive belt after every 300 hrs.
16. Change main oil filter.
17. Replace the pre-filter insert of fuel filter.
18. Change air cleaner element.
19. Check valve tappet clearance, adjust if required.
20. Grease fan drive pedestal.
21. Check fuel injector and adjust if required.
22. Check the fuel tank thoroughly.
23. Clean radiator externally.
24. Check thermostat element.
25. Check electrical unit, starter motor Dynamo/alternator, regulator etc. replace as required.

MAINTENANCE FUEL TANK

To avoid ingress of dirt during operation, always use a proper full tank cap with good rubber sealing. To minimize water contamination due to condensation of moisture, it is advisable to fill the fuel tank in the evening, after the day work is over. Drain the fuel tank to remove the sediment, accumulated at the bottom of the tank. Ensure that the breather hole is not blocked. Clean the tank thoroughly after every 1200 hrs or 6 months with diesel, do not use water for cleaning, it will lead to rusting and scale formation.

FUEL FEED PUMP MAINTENANCE

Push rod of the fuel feed pump is lubricated with oil from the engine or the fuel injection pump.

CHANGE ENGINE OIL

On new engine after first 50 hrs change the engine oil. Thereafter every 300 hrs the oil is to be changed.

TECHNICAL DATA

Engine	: 6SL-1500TA
Bore stroke	: 118x135
No of cylinder	: Six
BHP	: 254
Rpm	: 1500
Compression ratio	: 17.5:1

COOLING SYSTEM

Type of cooling	: Liquid circulation cooling with centrifugal pump
Thermostat	: Heat expansive material governor Opening begin at 95°C Full open at 95°C

LUBRICATING SYSTEM

Type of lubrication	: Forced feed lubrication with gear pump
Filters	: 2-spin on, paper filter in main stream and 1 centrifuge filter in by pass stream.

FUEL SYSTEM

Fuel injection pump	: Motorpal make, in-line injection pump
Fuel filter	: Mico make, two stages filter, first primary filter element of left type and second micro filter element of paper type.

TIMING GEAR

Firing order	: 1-5-3-6-2-4
Valve clearance	Intel valve 0.24 mm Exhaust valve 0.40 mm

AIR SYSTEM

Turbocharger (For turbocharged engines)	: Make Schwitzer
Air Filter	: Dry air filter with one way paper filter cartridge and restriction indicator

ELECTRICAL SYSTEM

Voltage	: 24 V (-ve earth)
Starter motor	: Lucas / Autolek
Alternator	: Lucas / Autolek

LUBRICANTS**RECOMMENDED (MONO GRADE OIL) FOR TURBO CHARGED ENGINES**

ATMOSPHERIC TEMP °C	VISCOSITY NO	DETERGENCY GRADE	BHARAT PETROLEUM	HINDUSTAN PETROLEUM	CASTROL	TIDE WATER OIL CO.	GULF OIL	CHEMOLEUMS	INDIAN OIL COY	PENNZ OIL INDIA LTD
-15 to -5	SAE20W	E-DL3	-	-	Castrol DUESOL super 20W/40	-	GULF super duty motor oil 20	CHEMOLEUMS DLO 300 oil SAE 20/20W	-	PENNZ oil LLMO 20
-5 to 10	SAE30	E-DL3	Bharat ACTUMALTRA super 30 (TCA)	HYLUBE MILCY 30	CASTROL CRD30 (Xtra)	-	GULF super duty motor oil 30	CHEMOLEUMS DLO 300 oil SAE 30	SERVO PRIDE 30	PENNZ oil LLMO 30
Above 10	SAE40	E-DL3	Bharat ACTUMALTRA super 40 (TCA)	HYLUBE MILCY 40	CASTROL CRD40 (Xtra)	-	GULF super duty motor oil 40	CHEMOLEUMS DLO 300 oil SAE 40	SERVO PRIDE 40	PENNZ oil LLMO 40
-0 to 30	SAE30	E-DL3	-	-	-	VEEDOL HDC 30	-	-	-	-
-Above30	SAE40	E-DL3	-	-	-	VEEDOL HDC 40	-	-	-	-

RECOMMENDED (MULTI GRADE OIL) FOR TURBO CHARGED ENGINES

ATMOSPHERIC TEMP °C	VISCOSITY NO	DETERGENCY GRADE	BHARAT PETROLEUM	HINDUSTAN PETROLEUM	CASTROL	TIDE WATER OIL CO.	GULF OIL	CHEMOLEUMS	INDIAN OIL COY	PENNZ OIL INDIA LTD
-15 to 45	SAE10W30	E-DL3	-	-	-	-	-	-	-	-
-5 to 45	SAE20W40	E-DL3	Bharat ACTUMASULT RAS super oil 20W (E-DL2)	HYLUBE EXTRA 20W 40	Castrol DUESOL super 20340 or Castrol CRD 20W40 (E-DL2)	VEEDOL HDC 20W40	GULF super duty motor oil 20W40	CHEMOLEUMS DLO 300 oil SAE 20W40	Servo pride 20W 40 or servo premium 20W 40 (E-DL2)	PENNZ oil LLMO 20W40