



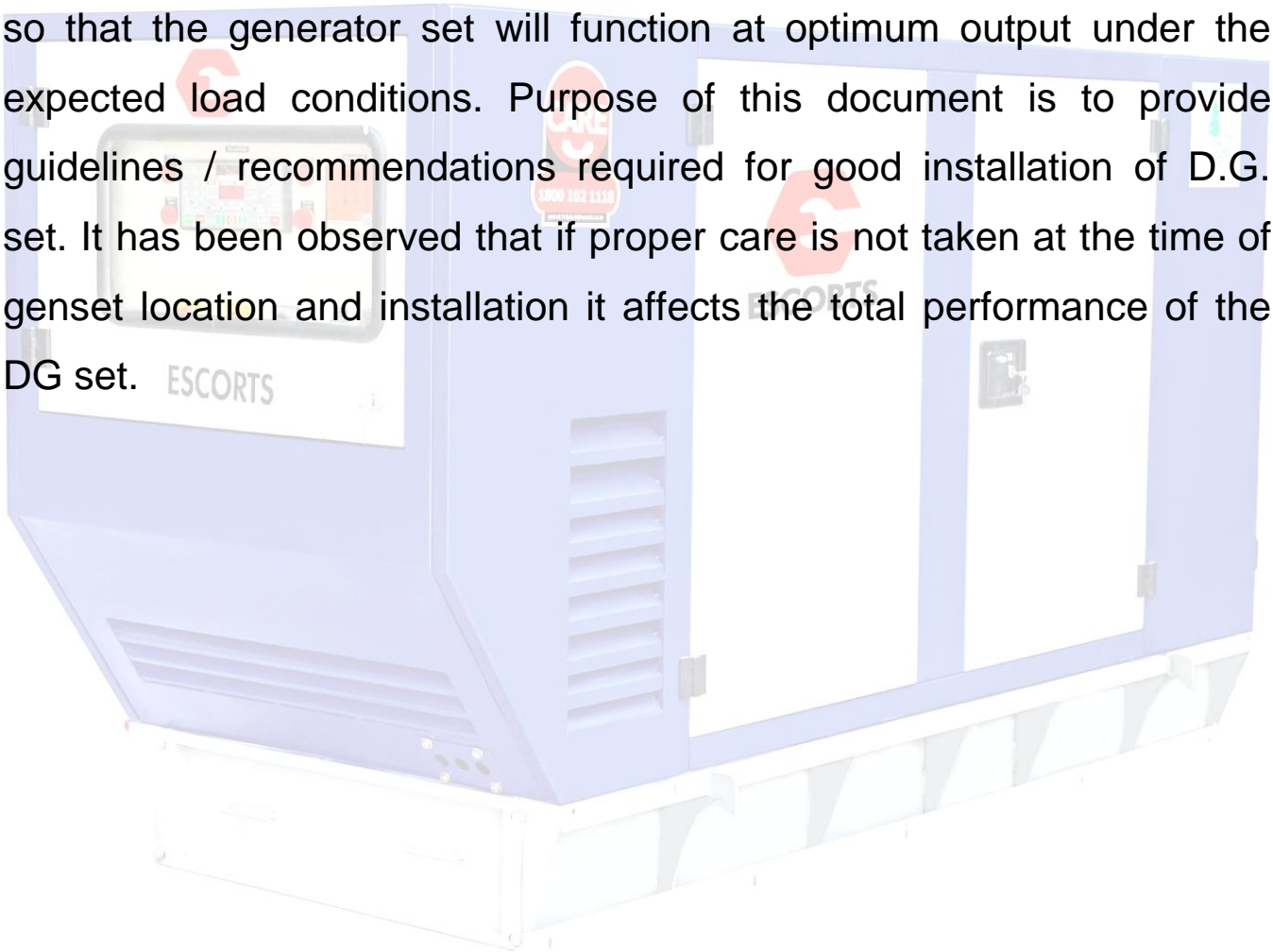
ESCORTS
ENGINES & GENSETS

Genset Installation Manual

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Introduction

Escorts engines are used on many other applications like Generator set, tractors etc. Most generators set installation must be engineered, so that the generator set will function at optimum output under the expected load conditions. Purpose of this document is to provide guidelines / recommendations required for good installation of D.G. set. It has been observed that if proper care is not taken at the time of genset location and installation it affects the total performance of the DG set.



Importance

The high degree of operational reliability and long service life of the DG sets depends on the following factors:

1. The Genset should be located away from polluted atmosphere (i.e. cement, dust, fiber, gases of furnace etc.)
2. Radiator gets clogged if atmosphere is full of dust or fibrous material.
3. Cross ventilation for radiator cooled engines is mandatory.
4. Enclosure temperature should not be >5 deg. above ambient. Ensure that there are proper area of opening and their locations.
5. Sufficient space around genset is to be provided for maintenance.
6. If Gensets is installed in a building above ground floor, recommendation / clearance is required from R.C.C Consultant.
7. Trailer mounted gensets should be kept on leveled ground and across the direction of wind.

Proper installation of D.G. set:

- Improve reliability and durability.
- Better fuel economy.
- Easy serviceability.
- Improved aesthetic of D.G. set room.
- High uptime of D.G. set.
- Better working conditions.

Please refer applicable Rule / Regulations issued from state / central and other applicable statutory regulations time to time.

Pre-requisite of D.G. Set installation:

- Location of D.G. Set .
- Accessibility for operation and service.
- Ventilation
- Adequate ventilation
- Adequate fresh combustion air.

- Discharge of circulated air..
- Foundation – Vibration Isolation.
- Exhaust system
- Cooling system
- Electrical connections
- Noise level

Recommendations

A. Location:

A.1 Always locates the genset in an area that will provide adequate ventilation & physical protection for the unit.

A.2 always locate the genset away from scrap yards and rubbish dumps.

A.3 Do not install in the path of smoke fumes etc. from near by works.

A.4 Location should be clean, dry & have good drainage capabilities.

A.5 For acoustic enclosures ensure that the opening provided for fresh air inlet & outlet are not blocked.

The doors can be opened whenever required to ensure access to attend the engine or genset.

A.6 Arrangement is required for protecting Genset located in open space against rainwater, mishandling adequate attention to be paid on safety concern of equipment & Electrical accidents.

B. Layout:

B.1 It is recommended to ensure around 1.5 to 2.0 meters space should be ensured around the genset unit. This allows easy movement for maintenance & inspection of genset. Good lay out will full fill following requirements:

1. Serviceability

2. Ventilation

3. Ease of operation

B.2 In case of multiple sets provide minimum 2 meters clearance between genset.

B.3 While making room layout provision should be made for

- Cables
- Fuel lines
- Breather vents
- Coolant / Lub. oil drain

- Raw water lines
- Oil / spares storage.

4 Future expansion plans should be considered while deciding room size.

C. Room Ventilation:

C.1 The radiated heat given off by the engine, generator and exhaust piping can result in a temperature high enough to adversely affect operating and maintenance personal and the performance of the genset. Ventilation provides clean and fresh combustion air. Improper ventilation can lead to:

- **Poor fuel efficiency.**
- **Poor performance of Genset.**
- **Failure of rubber components.**
- **High exhaust temp. related failures.**

C.2 From where will the air enter the room ?

- a. The cool, clean, fresh air should come into room from the electric alternator side. This is must for satisfactory application of DG set.
- b. The air inlet ventilator should be as low as possible so that only cool air enters the room.

C.3 If acoustic enclosures are placed in an enclosed place, ensure that enclosure is well ventilated and exhaust gases are routed out of the enclosure.

C.4 Points to Remember in Any Type of Installation:

1. Ensure that hot air is positively discharged from the building by fitting a flexible connection between the radiator and the duct.
2. The size of the openings should be calculated to ensure that excessive restriction is not imposed on the flow of cooling air. Front opening should at least be as big as the radiator core area but, as a guide, an area on 150% and at back 2.25 to 3 times radiator core should be allowed for.
3. If opening exactly in the front of radiator is not possible then ducting should be done to take out hot air.
4. If the opening in backside of genset is not possible then opening at both sides of genset at the rear of alternator may be acceptable. In this case total opening should be at least 3 times radiator core.
5. For weather protection, louvers should be fitted to the intake and exhaust openings. These can be either of the fixed or movable type. Manually operated movable louvers may be acceptable in some cases, but they are not acceptable for automatic standby units. Radiator air should not depended upon to move the lower vanes.

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5. For basement installations, supply of fresh air and forced ventilation through air ducts is required to remove heat.

6. Maximum allowed temperature rise above ambient in enclosure is 5 deg. Centigrade. Please note appropriate de-rating may be applicable considering altitude and temperature for particular Model

7. Field Check for proper Ventilation

1. Run the engine on full load/typical load for about 1 hour so that temperature in the genset/ enclosure gets stabilized.

2. Measure the ambient air temperature (ambient air temperature should be measured outside the Genset room in shade.

3. Measure the temperature inside the Enclosures, temperature should be measured near air cleaner inlet of engine.

4. Calculate temperature difference between Genset Enclosure and ambient i.e. delta T.

D. Unloading:

D.1 Provision for DG lifting is provided. Unload the genset by lifting with proper genset lifting tackle or nylon sling / steel rope of suitable capacity and crane so as to ensure no damage to Enclosure etc.

D.2 Do not lift the genset from engine hook and alternator hook. These are designed for lifting individual items only.

D.3 Keep the genset covered with polyethylene or tarpaulin during installation to ensure that water does not go inside.

E. Foundation:

E.1 Do not install Genset on loose sand or clay.

E.2A reinforced concrete pad makes the best foundation. A pad with sufficient mass in proportion to the size of the genset will provide the rigid support necessary to minimize deflection & vibration. Length and breadth of foundation should be at least 200 to 300 mm (8-10") more than the Enclosure length and breadth respectively. It is also recommended to have foundation height about 100-150 mm above ground level, it helps to maintain cleanliness of genset.

E.3 Typically pad should be 150 mm to 200 mm (6 to 8") deep & mass at least equal to that of genset.

E.4 The foundation may be located on soil, structural steel, building floor etc. provided. The total weight of foundation and genset do not exceed the allowable bearing loads of the support. Allowable bearing loads of structural steel can be obtained from engineering handbooks while load bearing codes will provide the allowable bearing loads for different types of soil.

E.5 Check the foundation level diagonally as well as across the length for even flatness.

E.6The base rail of genset should be leveled using shims before tightening with foundation bolts.

E.6 Isolation: It is advisable that the principal foundation each machine rests on bedrock or solid earth completely independent of other foundations, cement works walls or opening platforms.

E.7 Vibration: The design of the genset is such that only minimum vibration is transmitted to the foundation. Anti vibration mounts (AVM's) are fitted between engine alternator and baseframe. Vibration isolators reduce generator set vibration and noise transmission to the surrounding structure, hence they are recommended however they are not mandatory.

E.8 In generator rooms situated on upper floors special attention to vibration isolation is necessary. It is necessary to ensure that building structure (Beam / Column location to be identified) is capable of supporting the genset, fuel storage & accessories.

E.9 Grounding: Grounding should be done in accordance with applicable national, local or federal standard code or regulations.

F. Air inlet system:

F.1 Inlet air must be sufficient clean & as cool as possible. These conditions will drastically effect both engine life and performance. Higher restriction leads to:

- **Low power**
- **Black smoke**

F.2 Normally the inlet can be taken from the area surrounding the installation site. However, in some cases the condition of the surrounding the machine may warrant ducting the air from outside or another room.

F.3 When it become necessary to duct air in, the air filter should remain mounted to the engine as opposed to a remote mounting (such as on a roof or in another room). This will eliminate the possibility of dirt leaking through the ductwork upstream of the air filter.

G. Exhaust:

G.1 The exhaust system is used to direct exhaust gases to non-confined areas and reduce the noise to tolerable levels. When designing a system the main objective is to minimize backpressure. Higher Backpressure leads to:

- **Lower fuel economy.**
- **High exhaust temp and related failures**
- **Poor performance of engine**
- **Less durability of engine**

G.2 Exhaust Backpressure should be as per the specification in the Genset manual model wise.

G.3 Use of thimble is must while pass the pipe through concrete wall. The clearance around the pipe in wall is must for free movement and expansion/ contraction of piping.

G.4 Exhaust piping inside Canopy should be lagged along with aluminum sheet Cladding is required to avoid heating input to the enclosure.

G.5 Flexible connections: The exhaust piping should be connected via a flexible joint located on the engine exhaust outlet. The exhaust connection serves following three purposes.

- Compensate thermal expansion of exhaust pipe
- It isolates the exhaust system from vibration.
- It allows for some movement of either the genset or exhaust system

Components.

Exhaust below shall not be used to compensate the misalignment between piping. Flexible shall not be under any undue piping load and should not be subjected to any compression / expansion / lateral movement during installation.

G6.It is recommended to use 'Black MS class-A pipe & Bend of $2.5 D= r$ (long bend elbows). Uses of Galvanized water pipes are not recommended. For installation and operating efficiency, Engine location should make Exhaust piping as short as possible (When bend radii are required in an exhaust system, always make the radius at least 150% of the inside diameter of the pipe.)

G.7 By locating the silencer as close to the engine as possible you will be able to minimize the noise level in the exhaust piping. Location of silencer in exhaust system has very definite influence on both silencing and backpressure imposed on system.

G.8 Each machine installation should have it's own exhaust system and should not be connected to a system accommodating more than one genset as the possibility of exhaust gas and condensation back flow may cause permanent damage to an idle engine.

G.9 The exhaust out let should be in the direction of prevailing winds & should not allow exhaust gases to enter inlet/windows etc.

G.10 There should be rain trap to avoid rainwater entry. If rain cap is used the distance between exhaust pipe & rain cap should be higher than the diameter of pipe. It is also recommended that horizontal run of exhaust piping should slope downwards away from engine to the condensate trap.

Silencer should be installed with drain plug at bottom.

G.11 Generating sets with acoustic enclosure are provided with exhaust outlets having connecting flanges. Exhaust gases from the outlet can be routed away to desired location. For up to 3-meter distance exhaust pipe size same as provided on the outlet can be used. For longer lengths total exhaust competent person should do system assessment.

G.12 Other recommendation-

-Inspect and clean exhaust pipe & silencer once in a year or after 2500-3000 hr. whichever is earlier.

H. Fuel Systems:

H.1 The fuel system must be capable of delivering to the engine a clean and continuous supply of fuel.

H.2 When designing a fuel system, always incorporate the requirements of Local, State, Federal or National Codes, which may pertain to either the fuel system or the electrical apparatus utilized by the system.

H.3 Diesel Tank Typically fuel tank should be placed on the level as that of engine i.e. floor mounted.

Diesel tank requirement

- Size to suit at least one shift operation
- Drain fittings to bleed water condensate at lowest point of the tank.
- Fill neck to be provided to allow min 5% expansion space.
- Breather is mandatory
- Suction line and return line to be separated by least 300 mm.
- Galvanizing not recommended in side fuel tank.
- Hand hole, wire mesh filter screen at filling point.

H.4 The fuel lines can be made of any fuel compatible material such as steel pipe or fuel line tube that will tolerate ambient conditions. Overflow piping should be of the same material and one size larger.

H.5 The fuels return line should enter the tank at the top and contain/no shut off valve. This line should be designed with a minimum amount of bends or dips to prevent an air lock in the system. The fuel delivery line should pick up the fuel from the point no lower than 2 Inch from the bottom of the tank. If at all possible locate this line at the end of the tank opposite that of the return line and at the high end of the tank.

H.6 Flexible fuel lines should be used at a point between the tank and engine (preferably adjacent to the genset) to avoid the potential damage that could be created by vibration.

I. Engine breather Vents

I.1. Crankcase gases should be piped outside the DG Canopy ,so those oil fumes don't accumulate on the engine/radiator. Oil fumes affect appearance, performance of radiator and early choking of air cleaner.

I.2 Vent tube / hoses should continuously slope downwards to avoid oil accumulation.

J. Fire Precautions: When designing a genset installation the following points should be noted:

1. The DG Canopy should be designed so that there is an easy escape route for operating personnel in the event of fire .

2. A recommended type of fire extinguisher or fire extinguishing system should be provided to fight the fire.

3. The DG should be kept clean and free from accumulated rubbish, which can be a fire hazard.

K. Starter & batteries:

J.1 The batteries should be located as close as possible to the genset to avoid Resistance in starting circuit (batteries should be accessible for servicing).

J.2 Maintenance procedures should be carried out rigorously to keep engine electrical circuit healthy.

J.3 Batteries supplied with genset manufacturer are generally dry and uncharged. First charging of uncharged batteries is very important and should be done from authorized battery charging center. It takes 72 – 80 hours.

L. Cabling:

K.1 Power cabling between alternator & control panel and control panel & changeover switch to mains should be done with recommended cable sizes.

K.2 While terminating cables avoid any tension on the bolts / busbars.

K.3 While terminating R. Y.B. Phase notations should be maintained in the alternator and control panel for easy maintenance.

K.4 Crimped cables should be connected to alternator and control panel through cable glands.

K.5 Overheating due to loose thimbling / undersize cables causes most of electrical failures, hence ensure that correct size of cables and thimbles is used.

L. Earthing:

L.1 The generating set and all associated equipment, control and switchgear panels must be earthed before the set is put into operation.

L.2 4 numbers earth pits are required as per Indian Electricity rules or local electricity board.

- 2 Earthing pits for genset / control panel body

- 2 Earthing pits for neutral

L.3 Copper or GI strips of suitable size may be used for earthing. Please note that for normal soil, earth resistance should not exceed one ohm.

L.4 Genset should be earthed at two distinct points through a conductor heavy enough to carry the short circuit current without burning out.

M. Guidelines for DG Canopy Enclosure:

M.1 Engine control panel should be visible from outside the enclosure.

M.2 Filter replacement and tappet setting should be possible without dismantling acoustic enclosure.

M.3 For major repairs/overhaul, it may be required to dismantle the acoustic enclosure.

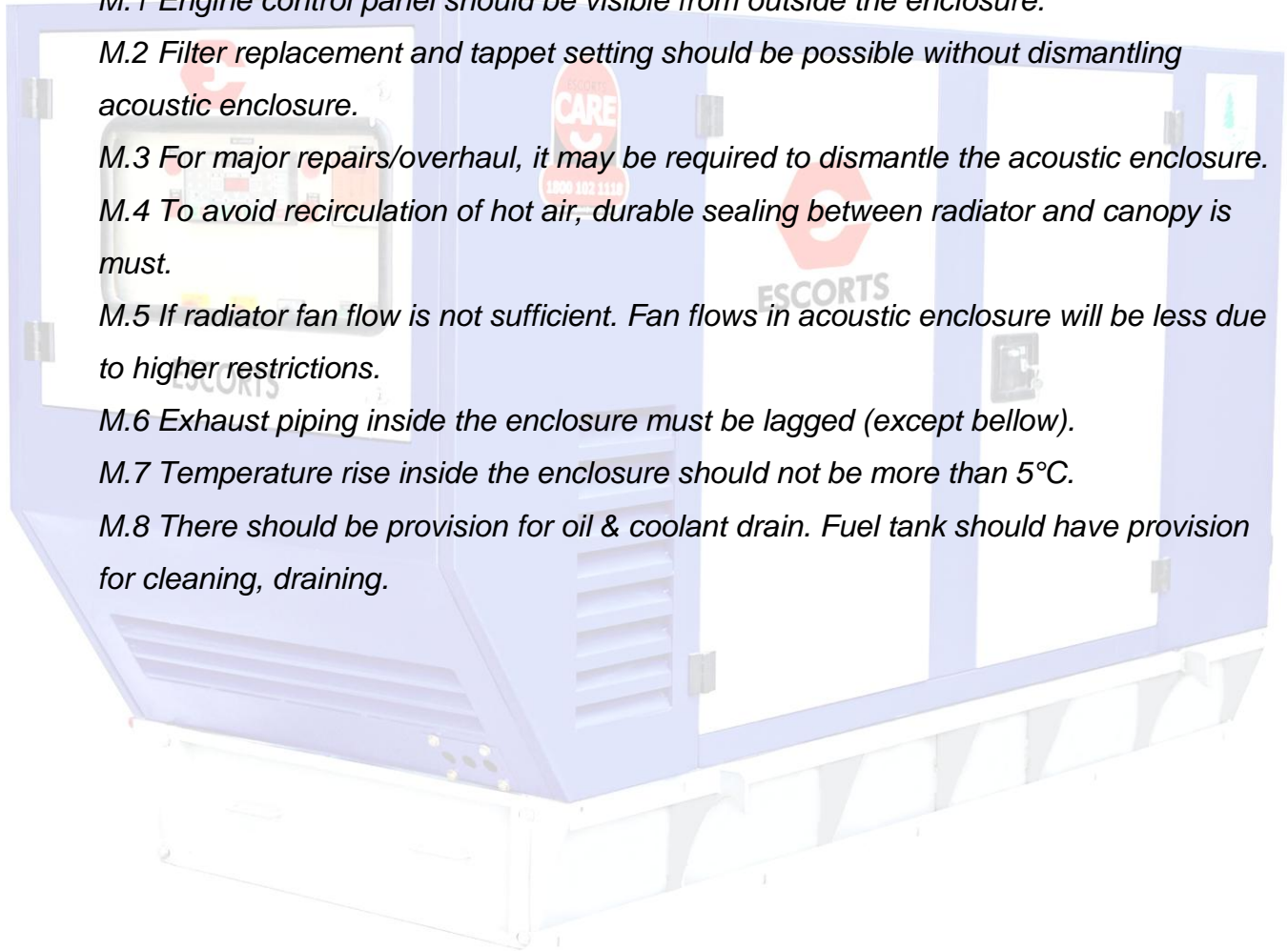
M.4 To avoid recirculation of hot air, durable sealing between radiator and canopy is must.



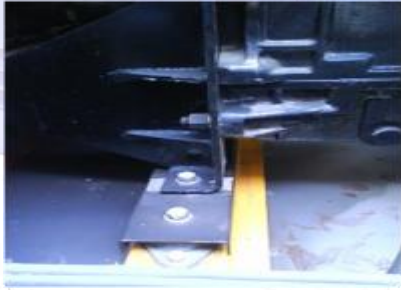

M.5 If radiator fan flow is not sufficient. Fan flows in acoustic enclosure will be less due to higher restrictions.





M.6 Exhaust piping inside the enclosure must be lagged (except bellow).





M.7 Temperature rise inside the enclosure should not be more than 5°C.

M.8 There should be provision for oil & coolant drain. Fuel tank should have provision for cleaning, draining.



Installation & Commissioning Guideline			
Sr. No.	Checking Parameter	Does	Don't
1	Foundation :		
		Engine Foundation must be labeled, concrete based &	Don't Keep genset on unlabelled surface or on brick .
2	Condition of Canopy		
		Check the condition of Canopy & doors, & door lock before installation.	Don't Keep canopy at such location where canopy doors will not open .
3	Engine mounting		
		Checked the condition of engine mtg pad & tightness of mtg bolt	Don't forget to check torque on all engine mtg bolt
4	Alternator Mounting		
		Checked the alternator mtg bolt torque before commissioning	
5	Radiator Mounting		

		Checked the condition of radiator mtg pad & radiator mtg bolt torque	
6	Coolant Hoses & clamps		
		Checked the condition of all coolant hoses & hoses clamps before starting the engine	Don't leave coolant hose in rubbing condition
7	Drive Belt		
		Checked the condition, tension & alignment of drive belt .	Don't start engine with loose or damage belt.
8	Coolant level & Reservoir		
		Checked the coolant level, condition of reservoir , reservoir hose & radiator cap	Don't ignore reservoir bottle. Never run engine a low level or without coolant condition
9	Air Cleaner Housing		

		Checked mtg of air cleaner. Also checked the condition of all rubber hose & Clamps	
			Don't put air cleaner inlet downwards
10	DG Set Earthing		Checked proper tightness of earthing earthing of DG set
11	Oil Drain Plug & leakages		Checked proper torque on oil drain Plug. Checked complete engine for engine oil leakage. Insure no oil leakage from engine
12	Exhaust Below		Don't ignore any oil seepage during commissioning.



Checked proper alignment of exhaust below. Exhaust below must be straight & tension free

Don't run engine with tilted or damage below



13

Proper Cladding of Cables

Checked & insure proper use of rubber or metallic glading on power cable.



Don't leave out put cable without proper glading