

1. Personnel engaged in the DG Set Installation, commissioning, operation and maintenance must be competent and experienced in these fields. They must also be conversant with all relevant, current statutory requirements and local regulations. Before installing the DG Set, read this manual carefully to get familiar with the equipment and its operation. (Including all systems and controls, manually operated valves and shut down devices). Correct DG Set installation, operation and maintenance is essential for safe and efficient operation. Many accidents result from a failure to observe fundamental safety rules and precautions.
2. There are many potential hazards that can occur during operation of DG Set which cannot always be anticipated. Therefore a warning cannot be included in this manual for every possible circumstance that might involve a potential hazard.
3. While unloading, shifting of DG Set please ensure proper care is taken so that no damage to men and material is done. Please use proper unloading equipment's, tools and tackles.
4. DG room should have proper escape routes. An escape map may be displayed in the DG room which should be clearly visible to all would be helpful during any accident or fire.
5. Please provide proper "Fire Extinguishers" in DG Set room area.
6. Please put Hazard Signs for Electricals Panels, Fuel and Lubricants etc.
7. Personal Protection gadgets like -Safety hand gloves, goggles and ear plug for protection of all operators, engineers and staff would make them safe, while working in DG Set room.
8. Ensure proper guards / protections for all moving parts.
9. Use of proper tools and tackles is recommended in the DG Set Room.

## **I. A. SAFETY GUIDELINES - General (Cont'd)**

10. Use of proper tools and tackles is recommended in the DG Set Room.
11. Electrical cables are fire Hazards during short circuits / failures - Please take proper care while routing of cables particularly power cables. (Refer Annexure 4 for safety precautions.)
12. DG Set exhaust gas temperature will be about 450 Deg. centigrade and exhaust pipes need proper cladding and insulation.
13. Ensure there is no fuel and lubricating oil leakages in the DG set room, as they are fire Hazards.
14. Diesel Fuel handling need proper care, as they are also fire hazards.
15. Please ensure proper care is taken while lifting Heavy parts of the DG Set. The capacity of the lifting cranes should be suitable.
16. Earthing of the DG Set is recommended and please refer to the specific recommendations.
17. Keep tools & other metallic objects away from uncovered batteries. Use tools covered with vinyl electrical tapes or suitable non - conducting material to avoid possibility of shorting battery connections while working near batteries.
18. In case of bulk diesel storage and liquid gas storage, proper signage like "NO SMOKING" boards should be prominently displayed.
19. Engine lubricating oil, engine coolant and grease are to be disposed at site as per site regulation requirement and considering MSDS (Material Safety Data Sheet).
20. Engine consumables replaced during maintenance like filters, are to be disposed at site as per site regulation requirement.
21. Batteries are to be disconnected, in case of persons working on the DG Set.
22. Please ensure following points on receipt of DG set at site and starting installation work,
23. Disconnect all wiring harness connections to the DG control panel & ECMs, to avoid failure of Electronic Control cards & ECMs due to welding currents.
24. DG Set starting batteries to be disconnected at battery end before any welding work or maintenance.
25. Exhaust bend after turbocharger opening to be closed with GI sheet to avoid rain water entry and welding spatters to engine. Please ensure to remove this GI sheet on completion of the installation work before starting the DG set.
26. During transportation of X Series engine mounted DG sets, kindly remove shipping brackets (solid restraints) before starting the DG Set.
27. Safety lockout and tag out process to be followed during maintenance.

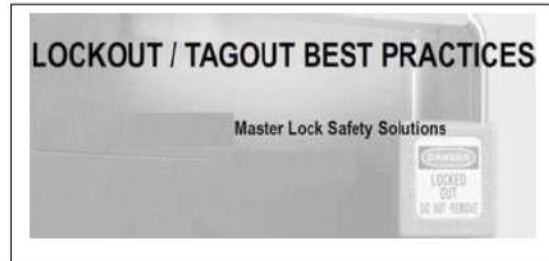
## I. B. SAFETY GUIDELINES – LOTO (Cont'd)

### LOTO - LOCKOUT/TAG OUT – BEST PRACTICES

Distribution Business Unit has released a process for Engineers (Best Practice): This safety process is very very important for each one and we request the same be followed by each members of the Cummins Family including GOEM and DBU engineers. (For all Engineers doing "A" check as well as attending engines/genset/equipment on all sites)

**LOTO** (Lock Out Tag Out) is the physical restraint of all hazardous energy sources that supply power to a piece of equipment, machinery or **system**. **LOTO** also includes applying a Warning Tag on the physical restraint device.

**Remove Negative Terminal First &  
then Positive Battery Terminal**



#### **Additional Safety Precautions:**

Press Emergency Stop on the Acoustic Enclosure as well as on the Engine Control Panel.

**LOTO** (Lock Out Tag Out) is the physical restraint of all hazardous energy sources that supply power to a piece of equipment, machinery or system. **LOTO** also includes applying a Warning Tag on the physical restraint device.

We need to first take go to the PCC panel and put DG on Manual Mode and put a sign board - If you can also put a signage on the Breakers it is double safety. Please remember **SAFETY** Begins with "ME"



**PROTECTION IS A HABIT AND IT IS FOR YOU TO FOLLOW EVERY TIME.**

## II. DG SET INSTALLATION RECOMMENDATION

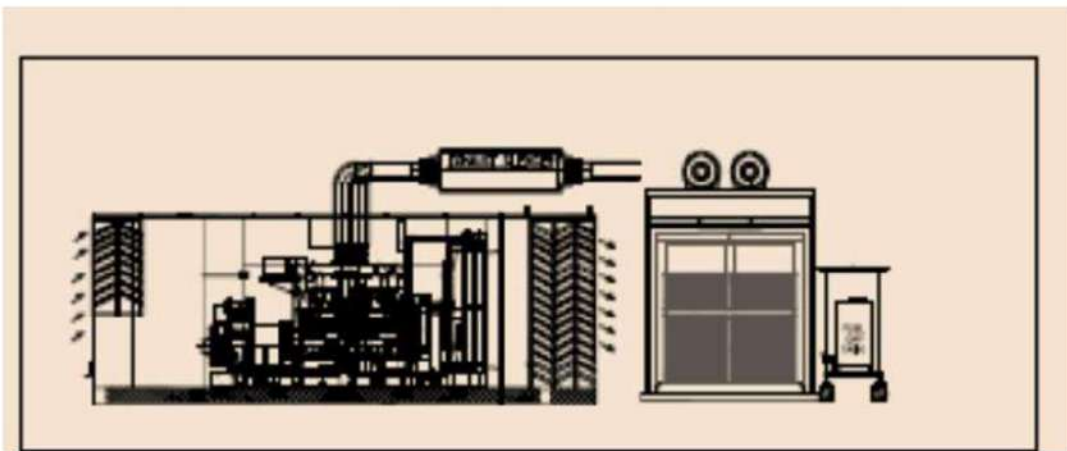
### A. LOCATION

Following options are applicable for DG set Configuration.

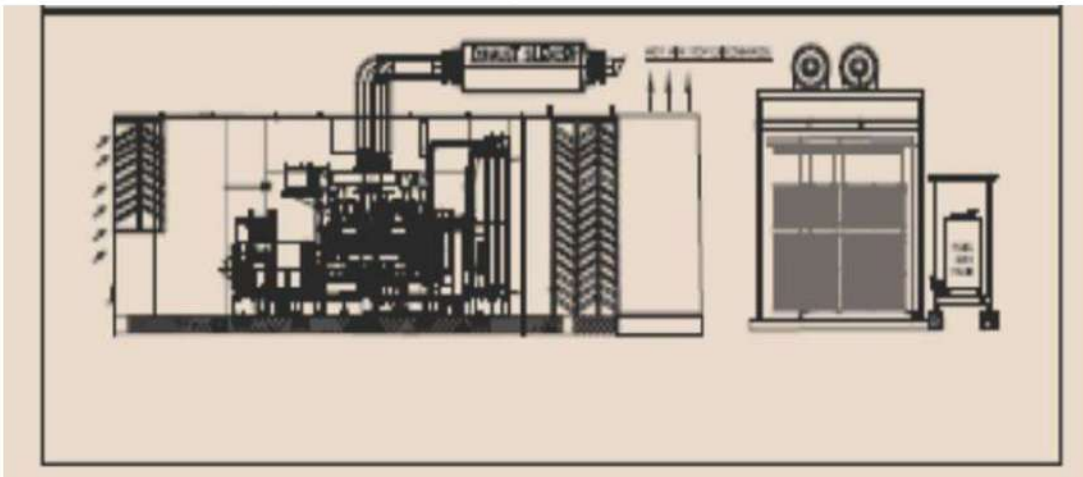
1. DG set with Acoustic Enclosure in open Area. (Refer Sketch. A1- 2 Options)
2. DG set with Acoustic Enclosure in covered Area. (Refer Sketch. A2- Two Options)
3. Open DG set in Room Acoustic. (Refer Sketch. A-3)

SKETCHES ARE SHOWN AS BELOW

1. DG set with Acoustic Enclosure in open Area. (Refer Sketch. A-1)
  - a. Option -1 Hot Air Discharge – Front of Acoustic Enclosure
  - b. Option – 2 Hot Air Discharge – Top of Acoustic Enclosure



Sketch A1. a - Option -1 Hot Air Discharge – Front of Acoustic Enclosure



Sketch A1.b - Option -1 Hot Air Discharge – Top of Acoustic Enclosure

## A. LOCATION – (Cont'd)

### A.6 Spacing Guidance

No.	Description	DG set with Acoustic Enclosure in Open Area.	DG set with Acoustic Enclosure in Covered Area.	Open DG set in room.
1	Free space on both sides	Min. 1m	Min. 1	Min. 2m
2	Free space at Radiator end (Radiator - - Hot air outlet front discharge)	Min. 2m	Min. 1m (No obstacle for hot air disbursement @ 2m)	Min. 1m (No obstacle for hot air disbursement @ 2m)
	Free space at Radiator end (Radiator - - Hot air outlet Top discharge)	Min. 1m	Min. 1m (Ducting to provide as applicable to avoid hot air recirculation to inlet air)	N/A
3	Free space at Alternator side.	Min. 1.5m (No obstacle for fresh air suction)	Min. 1.5m (No obstacle for fresh air suction)	Min. 2m (considering alternator hauling space requirement)
4	Fresh air inlet effective opening area	N/A	Effective open area - Min 1.5 times of the Radiator core area.	Effective open area -Min 1.5 times of the Radiator core area.
5	Hot air discharge effective opening area	N/A	Effective open area - Min 1 times of the Radiator core area.	Effective open area -Min 1 times of the Radiator core area.
6	Distance between two sets	Min 1m between two canopies.	Min 1m between two canopies.	Min1.5m between two foundations.

*N/A - Not applicable*

Note: Above guidelines are specified considering technical aspects, however local statutory compliance norms, regarding space provision needs to be followed as per site requirement.

## D. FOUNDATION (Cont'd)

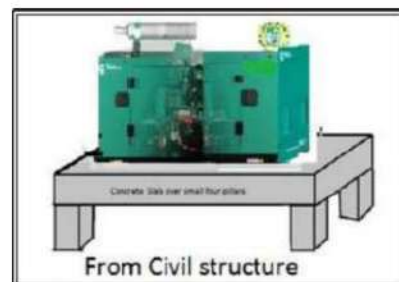
### D.14. Guidelines for Installation of Low kVA DG set. (7.5-62.5 kVA)



- DG sets location area / foundation should be capable to bear the Static load and Dynamic Load which is typically 1.5 times the static load during running.
- Raise level by 150 mm above finish floor to ensure that the Rain water does not enter the acoustic enclosure and rust the base/base rail.
- There are various options where we can either install the Acoustic enclosed DG Set.
  1. Re-enforced floor (See Option 1)
  2. Create a structure from the base civil structure (See Option-2). Necessary space for serviceability and accessibility should be provided all around the DG sets.
  3. Consult civil structural engineer to ensure that the civil structure, capable of taking the genset static & dynamic load, vibrations, structural resonance.



Option- 1



Option- 2

## **E. UNLOADING**

- E.1** Provision for DG Set lifting is provided on base-rail/enclosure. Unload the DG Set from the base rail/enclosure by lifting with proper DG Set lifting tackle or nylon sling /steel rope of suitable capacity and crane to ensure no damage to oil sump, air cleaner, radiator pipes etc.
- E.2** Do not lift the DG Set from engine and alternator hooks. These are designed for lifting individual items only.
- E.3** Keep the DG Set covered with polyethylene or tarpaulin during installation to ensure that water does not enter inside.
- E.4** Spreader bar / spacer plate of suitable size must be used to avoid damages to DG Set components. While unloading/ shifting of DG set. Refer the three different sketch E4.

- a. Photographs- Center Lifting- smaller DG sets



- b. Photograph- Spreader lifting Open DG sets



- c. Photograph – Canopy lifting. \*



Sketch E.4

## J. COOLING SYSTEM (Cont'd)

### Cooling Water properties

Water used in cooling system should have properties as mentioned in below table

Water Properties	
Hardness as CaCO <sub>3</sub>	170 ppm max
pH - Raw water -Engine water	6.5-7.5 5.0-9.0
Chlorides	40 ppm max
TDS	400 ppm max
Sulphates	100 ppm max

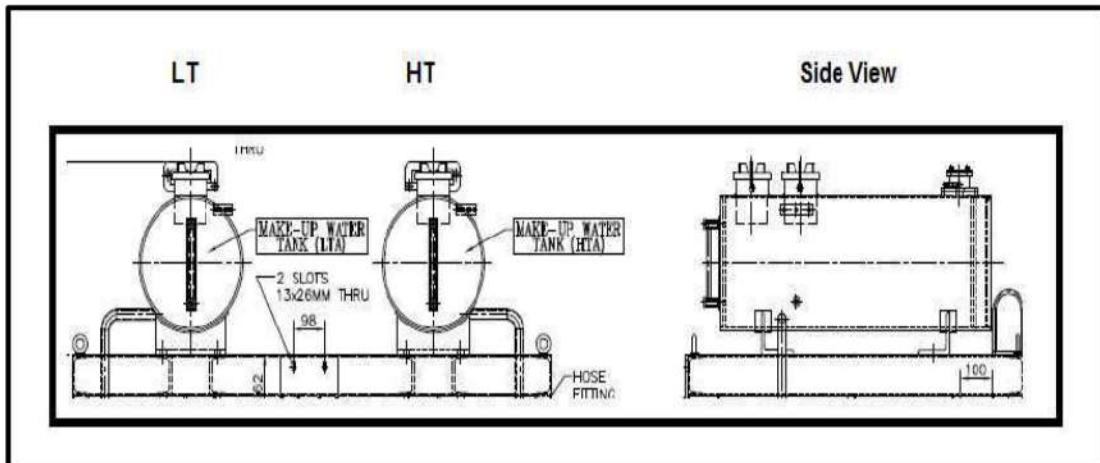
- If properties are outside the limits then it can result in
- Scale formation
- Overheating
- Corrosion
- If raw water quality is not acceptable, then install Water softening / demineralizing plants.

### EXPANSION / DE-AERATION TANK

#### J.4 For Remote radiator in Primary circuit

A suitable expansion / deration tank must be used (Normally 15% of the system volume capacity). The tank should be located at the highest point (min. 0.5 m from radiator top) of entire cooling system.

Two separate tanks to be provided for LTA & JW systems. Venting lines from engine to be connected to expansion tank without any loop and sloping upwards to vent out air from the cooling system. Refer to Sketch J.4.



Sketch J.4

Typical Expansion Tank for Cooling System



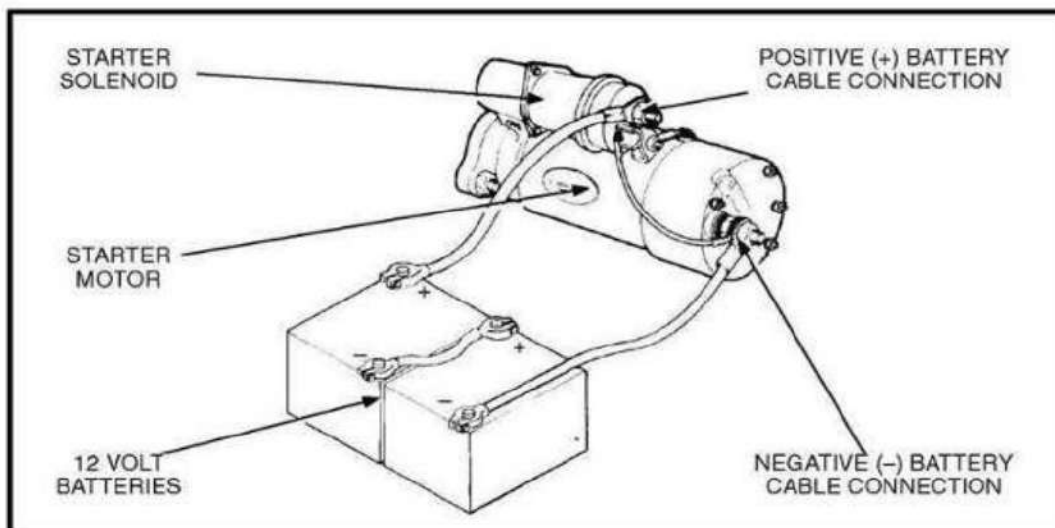
## **K. DG STARTING BATTERIES**

- K.1** Generally, DG Set starting batteries are supplied along with DG sets, Cummins Pulse lite type specially designed for cranking application. The batteries are dry charged and this pre-charge of the batteries will remain for around 6 months. If DG commissioning is delayed beyond this period, these batteries need charged again as per the Battery manufacturers recommendation.
- K.2** In case of batteries other than Cummins supply Batteries, they are also generally supplied in charged condition.
- K.3** Batteries should be placed on wooden stands and preferably near the starting motor. A wooden/acrylic top cover with proper venting can also help protect the battery leads/terminals. Refer Sketch K3.



Sketch K.3

- K.4** Please refer Table K.4 for battery capacity and cable sizes for various engine models. Cable sizes are for maximum length of 2 meter. If a length is more, size the cable to be increased to minimize overheating of the cable and minimum voltage drop.
- K.5** For AMF applications, an external battery charger should always keep the batteries fully charged.



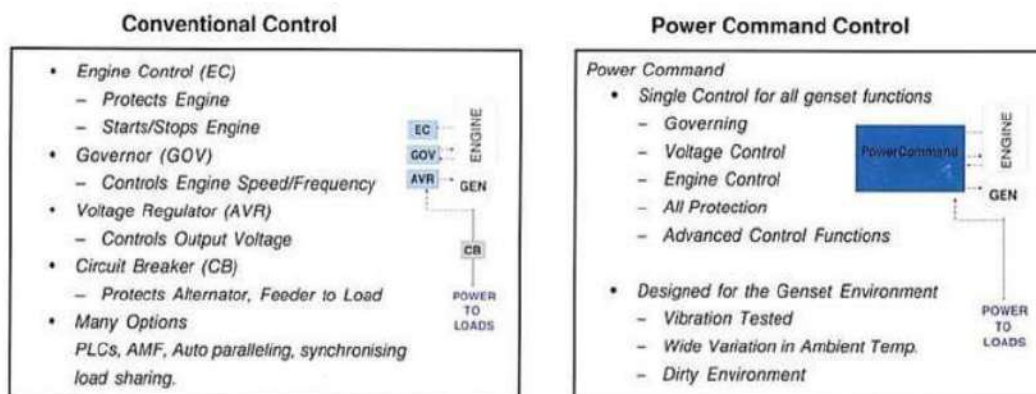
## L. DG SET/ ENGINE CONTROLS ARCHITECTURE (Cont'd)

- L.1 Make sure that the polarity of the battery connections is correct before connecting any harnesses/applying power to the PCC Controls.
- L.2 Do not short test wire leads to see if they are 'live' by flashing on engine body.
- L.3 **Disconnect all harness connections to the f & Engine control system before doing any welding work on DG set. Controller & PCB can get damaged due to welding currents. DG Set starting batteries to be disconnected at battery end before any welding work or maintenance.**
- L.4 Make sure the battery area is well ventilated before servicing the battery. Arcing can cause explosion due to hydrogen gas given off by batteries
- L.5 Always refer to the wiring Sketch and product manual supplied with the engine/ DG Set for details.
- L.6 For CT Ratios to be used with different options of controls refer to GOEM's.
- L.7 Load sharing cable (shielded 1.5 sq. mm copper) to be connected between all DG sets PCC panels with master start logic.
- L.8 BMS integration:
- PC 3.3 is having inbuilt feature for BMS integration thru Modbus protocol (RS485), register mapping to be provided to BMS integrator to display data. Refer Table L.8

### Standard Features of Cummins DG Set Controllers.

DG Sets Controller	Features			
	Solo	Paralleling	BMS protocol	Remarks
PSO-500	√	×	RS485	
PSO-600	√	×	RS485	AMF included
PC1.1	√	×	RS485	
PC1.2	√	×	RS485	
PC 3.3	√	√	RS485	

Table L 8



## **M. CABLE CONNECTIONS**

- M1. Always use flexible / armored cables for inter connecting the DG Set Controllers with the switchgear and other equipment's and avoid mechanical strain.
- M.2 Power cabling between alternator and control panel and change over switch to mains should be done with recommended cable sizes and avoid mechanical strain during connecting cables and thereafter. It would prevent failure of lugs, cables & terminals.
- M.3. While terminating cables avoid any tension on the bus bars/terminals.
- M.4.Local Isolator Panel: In case of power panel is located away from the DG Set, local Isolator panel is to be provided near the DG Set as per CEIG/local approval agency requirements.
- M.5.While terminating R.Y.B. phase sequence should be maintained in the alternator and control panel for easy maintenance.
- M.6 Power/Control cables should always be connected with proper lugs. Also, all cables should have double compression and Ni-plated glands.
- M.7 All Cables should be properly tagged on both sides. (Refer Table M.7 for XLPE cable sizes.)
- M.8 Alternator termination extension box with flexibility. Refer Attached Photo below A terminal extension box is recommended for multiple power cable termination with proper support and care to ensure that weights of cables should not get transferred to alternator terminals.
- M.9 Overheating due to loose thumbing / undersize cables causes most of electrical failures, hence ensure that correct size of cables and gland is used.
- M.10 For AMF application, use suitable core 2.5 sq.mm copper cable for control cabling.
- M.11 Typical cable sizes for 415 V applications are provided in Table M.7. The sizes given are Indicative. Please refer to the cable manufacturers for more details
- M.12 For HT cables, kindly contact GOEM's for details on cable sizing.



### **Bus Duct**

1. Bus duct can also be provided as per site specific requirement.
2. When Bus ducts are provided – Flexible connection between alternator terminal and Bus duct shall be provided. (For Bus bar termination, and flexible canvas/rubber between Alternator terminal box and bus duct box.)
3. Bus ducts are available for indoor and outdoor applications/installations.
4. Flexible canvas joint to be provided between alternator top cover plate and extension box to accommodate DG movement of genset during start & stopping. (For Bus bar termination, and flexible canvas/rubber between Alternator terminal box and bus duct box.)

## M. CABLE CONNECTIONS (Cont'd)

### TYPICAL XLPE CABLE SIZES FOR DG SETS - Copper

2 Core copper conductor  
7.5 to 62.5 kVA, 230 V, 50 Hz, 1 Phase

kVA	Amp	Cable size X No of runs
7.5 (1 phase)	33	6 x 1
10 (1 phase)	44	10 x 1
15 (1 phase)	65	25 x 1
20 (1 phase)	87	35 X 1
25 (1 phase)	109	50 X 1
30 (1 phase)	131	70 X 1
35 (1 phase)	152	70 X 1
40 (1 phase)	174	95 x 1
50 (1 phase)	217	150 x 1
62.5 (1 phase)	272	185 x 1

4 Core copper conductor  
7.5 To 40 kVA, 415 V, 50 Hz, 3 phase

kVA	Amp	Cable size X No of runs
7.5	11	4 x 1
10	14	4 x 1
15	21	4 x 1
20	28	4 X 1
25	35	6 X 1
30	42	10 X 1
35	49	10 X 1
40	56	16 X 1

#### Notes:

1. Use 3.5 core XLPE insulated armored power cables with aluminum conductor (AYFY) for rating from 50 to 3350 kVA 3 phase as per site requirement.
2. AYFY: Aluminum conductor, Steel strip armor.
3. Use 2 core insulated armored power cable with copper conductor for rating from 7.5 to 62.5 kVA 1 Phase as per site requirement.
4. Use 4 core insulated armored power cable with copper conductor for rating from 7.5 to 40 kVA for 3 Phase as per site requirement
5. For multiple runs of cables, applicable deration factor as specified by Cable manufacturer is Considered.
6. Cable sizes mentioned are in square mm.
7. Earthing to be provided as per IEC/IS standards/guidelines.
8. Typical cable sizes for 415 V, 3 phase/ 230 V, 1 phase application are provided.  
Core Aluminum armored conductor XLPE 3 phase.

**M. CABLE CONNECTIONS (Cont'd)**

**TYPICAL XLPE CABLE SIZES FOR DG SETS – Aluminum**

<b>Polycab Make- 3.5 Core Aluminium armoured conductor XLPE - 3 phase ( for reference)</b>			
<b>kVA</b>	<b>Amp</b>	<b>Current Density of cable laid in Trench</b>	<b>Cable size X No of runs</b>
50 (P)	70	77	35 x 1
62.5 (P)	87	95	50 x 1
70 (P)	97	115	70 x 1
82.5 (P)	115	115	70 x 1
100 (P)	139	140	95 x 1
125 (P)	174	200	185 x 1
140 (P)	195	200	185 x 1
160 (P)	223	235	240 x 1
180 (P)	250	260	300 X 1
200 (P)	278	140	95 x 2
225 (P)	313	175	150 X 2
250 (P)	348	175	150 X 2
275 (P)	383	200	185 x 2
300(P)/330 (S)	459	235	240 x 2
365 (P)	508	175	150 X 3
400 (P) /440 (S)	612	235	240 x 3
500 (P)/520 (S)	723	200	185 x 4
600 (P)/ 625(S)	869	235	240 x 4
640 (P)/660 (S)	918	235	240 x 4
700 (S)/750 (P)	1043	260	300 x 4
810 (P)/830 (S)	1155	235	240 x 5
910 (P)/900 (S)	1265	260	300 x 5
1010 (P)	1404	235	240 x 6
1250 (P)/1400 (S)	1946	260	300 x 8
1500 (P)	2294	290	400 x 8
1750 (P)/1900 (S)	2641	290	400 x 9
1800 (P)	2502	290	400 x 9
1800 (P)/1975 (S)	2745	290	400 x 10
2000 (P)/2063 (S)	2868	290	400 x 10
2250 (P)/2250 (S)	3128	290	400 x 11
2250 (P)/2500 (S)	3475	290	400 x 12
2750 (P)/3000 (S)	4170	290	400 x 15
3350 (P)/3750 (S)	5216	290	400 x 18

Note: Above cable sizes are given for guidance, depending on cable availability at site proper selection to be carried out.

For other routing of cables please get in touch with GOEM.

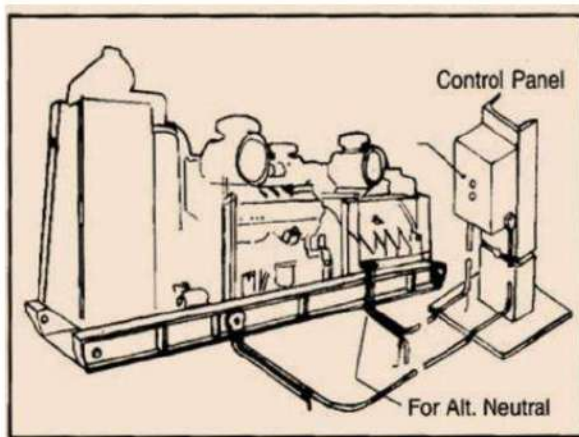
## **N EARTHING SYSTEM**

**N.1.** The generating set and all associated equipment control and switch gear panels must be earthed before the set is put into operation. PCC panel should have separate earthing strip connection of suitable size connected to DG Set body earthing.

**N.2.** Four numbers earth pits are required as per Indian Electricity rules or local electricity board.

- 2 earthing pits for DG Set/ control panel body
- 2 earthing pits for neutral.

Minimum distance between the two earth pits should be @800 mm, numbers of earth pits are to be determined by fault level calculation.



**N.3** Copper or GI strips of suitable size may be used for earthing. Please note that as a standard Practice earth resistance should not exceed one ohm. Earthing should be checked at earth pit location and resistance should be maintained within 1 ohm.

For DG Sets with AVM's between engine/ alternator and base rail, the earthing **MUST** be done at the engine/ alternator and **NOT** at base rail.

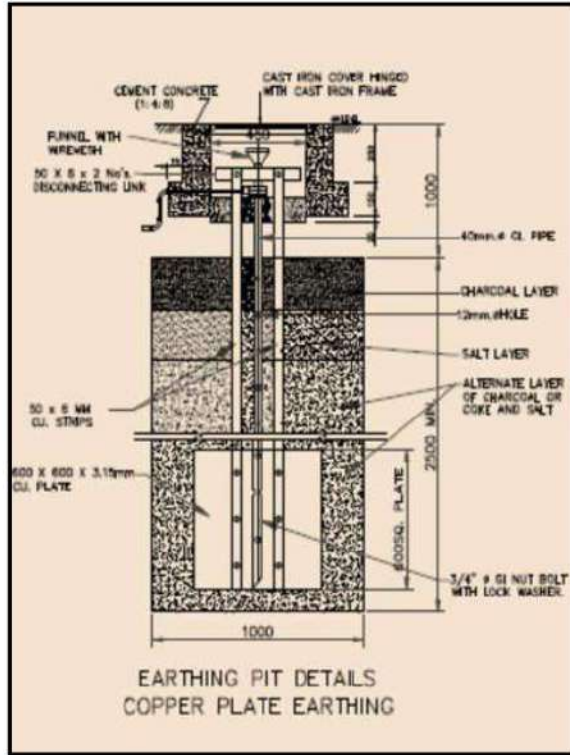
**N.4** DG Set should be earthed at two distinct points through a GI/ Copper Strips/ conductor heavy enough to carry the short circuit current without burning. (Sketch N.4)

Note: In case of multiple DG sets check with GOEM project team on earthing pits design and earthing grids/rings

**N EARTHING SYSTEM (Cont'd)**

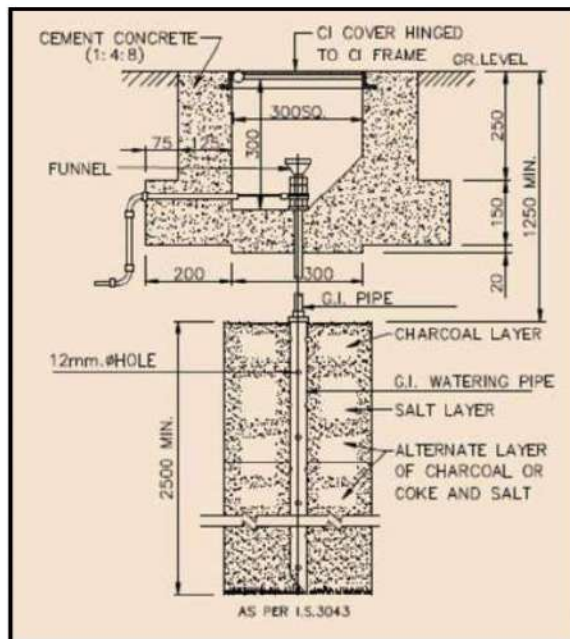
**N.5 Different type of earthing stations**

- i) Plate Type Earthing station



Sketch N.4

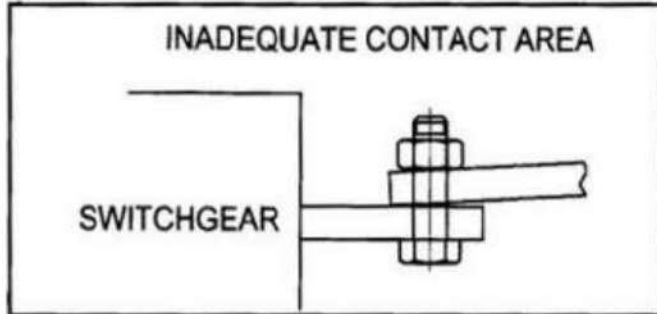
- ii) Pipe Type Earthing station



Sketch N.4

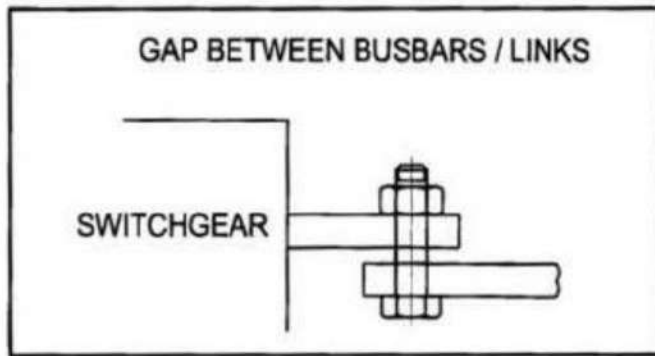
**O. ALTERNATOR TERMINAL LINKS:**

O.1 Proper terminations between links and switchgear terminals, the contact area must be adequate. The following situations should also be avoided as they lead to creation of heat sources at the point of termination: - Point contact arises out of improper positioning of links with switch gear terminals.



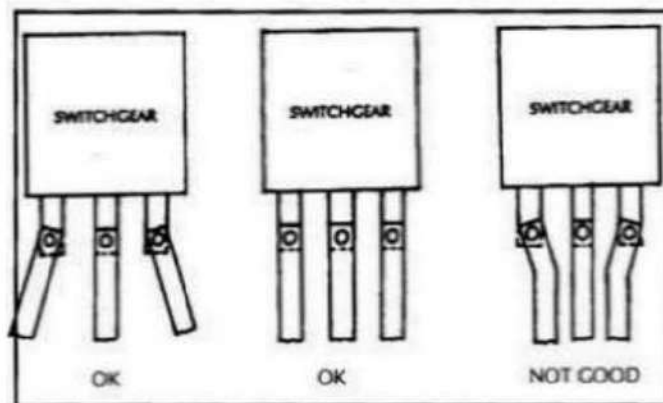
Sketch Ref. O.1

O.2 Gaps between bus bars/ links and terminals being remedied by connecting bolt/ stud. (Ref. O.2) In such case the bolt will carry the load current. Normally these bolts/ studs are made of MS and hence are not designed to carry currents.



Sketch Ref. O.2

O.3 Adequate clearance between bus bars/ links at terminals should be maintained (IS: 4232 may be referred to for guidelines). Ref. O.3 ranks the quality of different configurations. Improper termination will lead to local heat generation which may lead to failure.



Sketch Ref. O.3



### Annexure 1

#### EARTHING SCHEME FOR MOBILE DG SET

Where a supply is taken from a **mobile generator**, the following recommendations shall apply:

- The generator neutral should be connected to the vehicle chassis.
  - The earth terminal at each outlet on the generator vehicle should be connected separately to the alternator neutral where the latter is bonded to the vehicle chassis.
- c) If Mobile DG set is **in Stationary location**, the earthing of the local control panel available at site should be used. Where an electricity board protective earth terminal or exposed structural metalwork is present, it should be connected to the earthing conductor on the mobile generator. In case there is no such provision then alternatively gel/spike earthing can be done in the ground.



## Annexure-2

### GUIDELINES FOR DG SET INSTALLATION AT BUILDING ROOF TOP



Sr No	Area	Recommendation	Remark
<b>A.</b>	<b>Civil works</b>		
1.		Civil RCC slab & structural design needs to be checked & verified as per DG set static weight & dynamic weight	
2.		DG set mounting area needs to be selected at structural columns & beams area to load structural members.	
3.		Structural steel members to be installed on RCC column & beam area. Foundation level to be maintained +/-3mm.	
4.		Rubber sheet of @10mm thickness to be provided below DG enclosure frame area to absorb DG vibrations transfer to foundation.	
<b>B.</b>	<b>DG Installation</b>		
1.		Free space of @1m to be provided around DG Set for proper access & air ventilation.	
2.		Check for restriction at air suction side & hot air outlet side from DG set enclosure.	
3.		Check for any possibility of hot air recirculation back to suction side of DG enclosure.	
4.		Connect power outgoing cables as per sizing calculations.	
5.		Provide proper Earthing connection for DG set.	
6.		DG set exhaust outlet direction to be checked as per site requirement.	
7.		Diesel storage & charging in day tank scheme at site	
8.		Electrical cables laying, terminations & dressing with provision of proper cable trays.	
<b>C.</b>	<b>DG Commissioning</b>		
1.		DG performance to be checked at site at rated capacity.	
2.		AMF mode operation to be checked.	
3.		DG Vibrations needs to be measured at site on DG enclosure base as per IS8528-9.	

## **Annexure 5**

### **SPECIFIC GUIDELINE FOR RENTAL DG SETS**

#### **Rating up to 650 KVA with subbase fuel tank - DG Enclosure**

##### **A. Space provision, Foundation & location:**

1. DG location must be flat, levelled and firm enough to prevent the generating set from sinking.
2. Load bearing capacity of soil must be capable to bear DG set static and dynamic loads.
3. Overall slope for DG Installation space must be 2" maximum, considering overall length of foundation / diagonally opposite corners.
4. Free space of 1m minimum must be available surrounding to DG Set, at all sides for safety compliance, accessibility, serviceability and maintenance.
5. DG Set need to be installed on foundation made of concrete or large wooden planks or concrete sleepers to support DG Enclosure base structure uniformly and across the overall length of DG Frame. Provide plank/sleeper support at every @1m overall length of DG Set base fame, with two supports at both end edges.
6. If DG set frame is not rest firmly on bedplate, will be subjected to excessive vibrations that may cause equipment to suffer.
7. DG Set to be installed at least 6" above the finish ground level to avoid rain water entry to DG enclosure.
8. Preferably DG Location must be free from dust, moisture and corrosive atmosphere.

##### **B. Fresh Air & ventilation:**

1. Proper fresh air ventilation must be ensured at DG Location, there must not be any hot air recirculation, which may affect equipment performance and reliability.
2. Exhaust gases must escape freely and gas to be terminated such a way that to avoid entry of exhaust gases to engine suction or cooling system.
3. Bend or rain cap to be provided for exhaust pipe to avoid rain water entry to exhaust system/ engine.

##### **C. Electrical & Safety:**

1. Proper earthing pits and earthing strips of required size must be provided for DG Set body and electrical panel, as per technical compliance requirement at site. Earth pit resistance value to be measured and recorded in commissioning report.
2. Power cabling must be done with proper glands and gland plate.
3. 3.5 Core power cables to be used and no. of cable runs to be provided as per current carrying capacity of cables.
4. Dedicated set of DG Starting batteries of required AH rating to be provided for each DG set.

##### **Start up and commissioning:**

1. Check for last B-check maintenance / preservation and due date.
2. Measure and record the alternator IR value and resistance value before connecting power cables.
3. Visually inspect for excessive vibrations or any abnormality during DG set running.

## **Annexure 6**

### **RAIN WATER ENTRY PROTECTION IN EXHAUST SYSTEMS**

#### **1 Rain water Protection during DG installation stage at site:**

- All exposed openings on the DG Sets need to be properly blanked to avoid rain water entry in engine thru turbocharger/pipe/silencer/alternator terminal box, etc., while working on the exhaust pipe /silencer installation. This is to be done till completion of exhaust system erection work.
- Proper rain protection mechanism/sealing to be provided at exhaust duct/pipe outlet from acoustic enclosure.
- Rain protection rail to be provided on acoustic enclosure over top of the doors /opening.
- A rain shed can be provided for DG set to improve the serviceability and operator convenience during rainy season. Care should be taken to ensure sufficient height of this rain shed to blow out hot air in case of hot air duct outlet at top of acoustic enclosure.
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#### **2 Rain water Protection during DG Operation stage at site:**

- Rain water entry in engine can occur thru damaged exhaust silencer/exhaust piping.
- There may be rain water carryover at air intake area.
- A/ B / C check on engine / alternator (air filter replacement and tappet setting) should be possible without dismantling acoustic enclosure. Care should be taken for Air cleaner element replacement it should not be like opening air cleaner for removing element.

#### **3 Rain water Protection during DG set transportation:**

- During transportation silencer / exhaust openings on the DG set to be blanked to avoid rain water ingress.
- All openings on Engine and Alternator to be blanked / sealed properly to avoid rain water ingress.
- Diesel day tank to be covered by polythene / stretch wrap to avoid rain water ingress.
- Open DG set to be completely covered with polythene / stretch wrap to avoid rain water ingress.