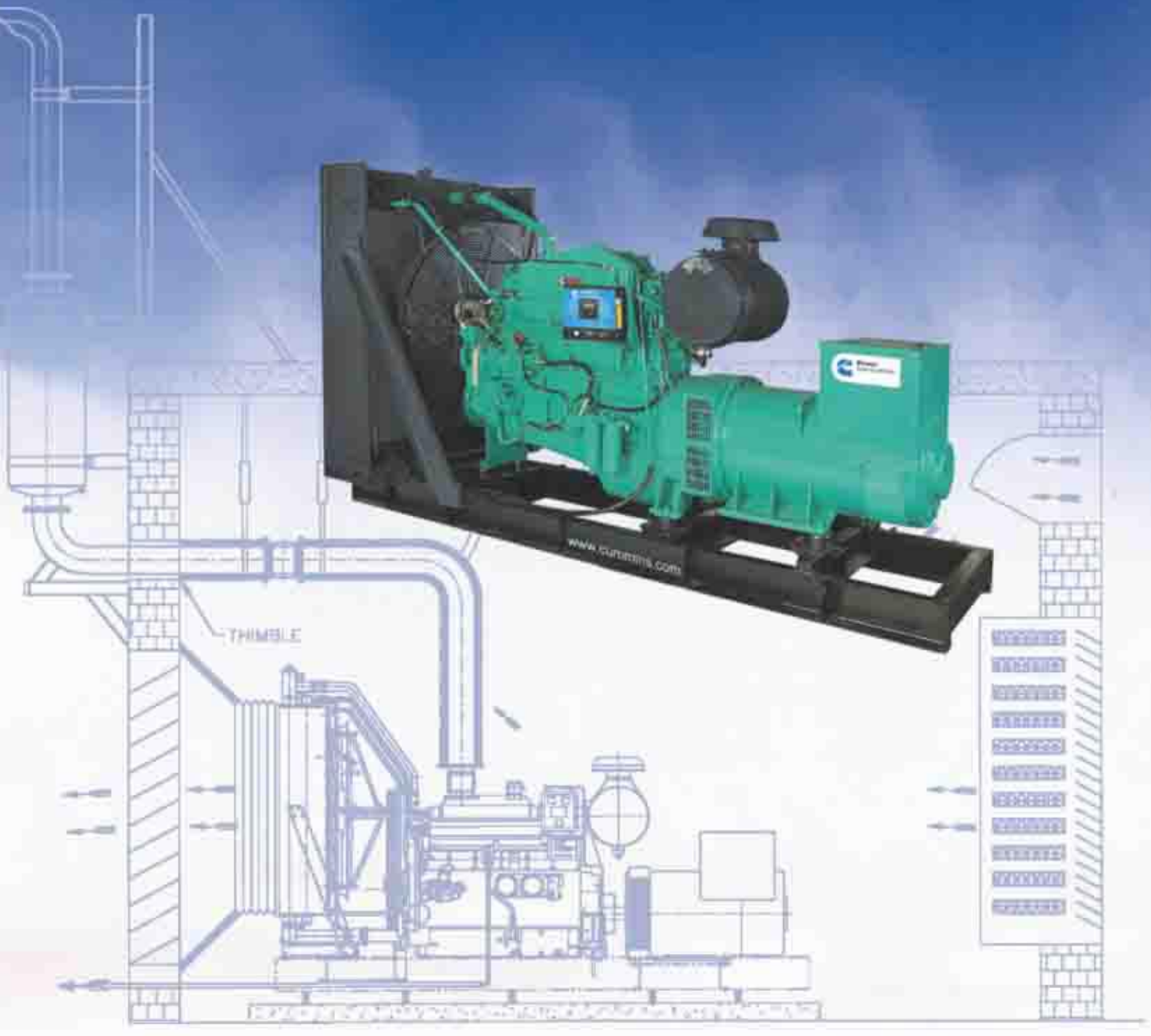
GENSET INSTALLATION RECOMMENDATIONS



Making People's Lives better by unleashing the Power of Cummins

Power
Generation

INTRODUCTION

Genset Installation requires proper engineering to ensure optimum / satisfactory performance from the DG set. This manual provides an installation guideline for Cummins Power Generating sets.

Proper installation of DG set leads to

- Improved reliability and durability
- Easy serviceability
- High uptime of DG set
- Improved aesthetic of DG set
- Better working condition

However, this manual details typical installations only as it is not possible to give specific details to many variables in an application. If you require any further advice or information, please consult Cummins or OEM's at the address given on the back cover.

The complete installation must comply with State / Central Government and other applicable statutory regulations.

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GENSET INSTALLATION RECOMMENDATION

A Location

A.1 D.G. room should be located considering wind direction and there should be no obstruction to natural wind flow.

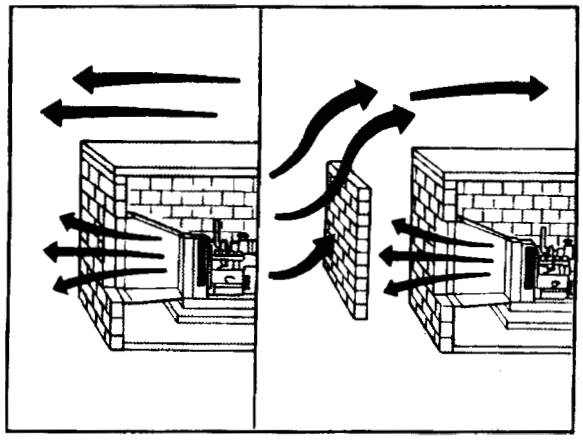
A.2 Position the generator set so that the prevailing wind do not enter into the radiator / exhaust outlet. If this is not possible, install a wind barrier. Distance of the wind barrier from the room should be atleast three times radiator core height.

A.3 Genset should be located away from polluted atmosphere like acidic fumes, cement dust, stone dust cotton fibres, furnace chemicals etc. wherever possible.

A.4 In case location is dusty or polluted, **contact OEM/ Cummins. Heavy duty air cleaner is must for such installations.** Heat exchanger cooled system is recommended for such installations as radiator gets clogged in dusty atmosphere.

A.5 For humid / coastal atmospheric applications, anti condensation heaters are mandatory for alternator.

A.6 Genset should be nearer to the load centre.



Ref. A.2

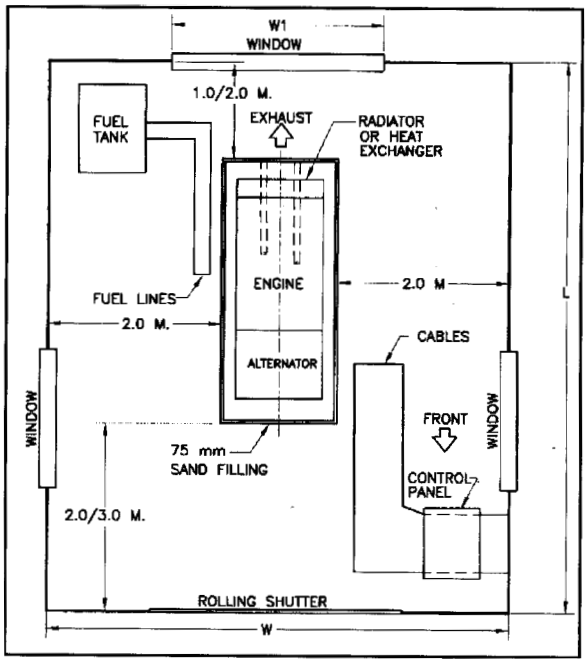
B Room Layout

B.1 Typical 2-meters free space around genset is recommended for proper heat dissipation and ease of service. However, to avoid hot air recirculation radiator cooled engines should have minimum possible space in the front. Minimum 1.5 meter free space is a must for 100 KVA and bigger gensets, for smaller gensets it should be 1 meter.

Room layout is important for :

- Serviceability
- Ventilation
- Ease in operation
- Genset room aesthetics

Please refer Table-1 for typical room sizes.



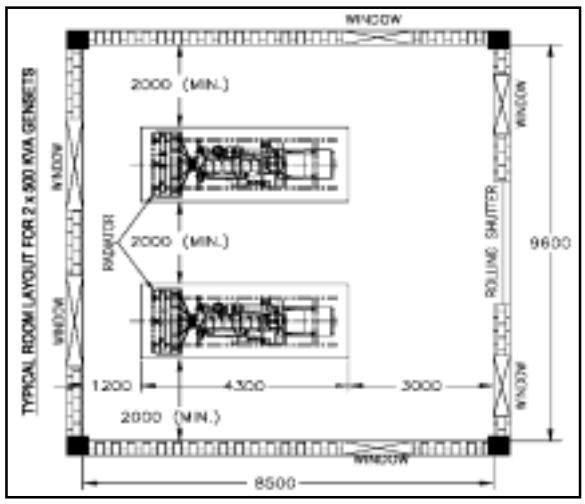
Ref. B.1

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

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

- Cables
- Fuel lines
- Breather vent
- Coolant / lub oil drain
- Raw water lines
- Oil / spares storage

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



Ref. B.2

B.5 Enough opening / shutters should be provided to the D.G. room so that entry and placement of D.G. set is possible easily.

C. Room Ventilation

C.1 Ventilation of the generator room is necessary to remove heat and fumes dissipated by the engine, alternator and its accessories and to provide clean and fresh combustion air. Ventilation requirement is mandatory for all engines.

Improper ventilation can lead to :

- Poor fuel efficiency
- Poor performance of genset
- Failures of rubber components
- High exhaust temperature and related failures
- Unbearable working conditions due to higher room temperatures
- High temperature rise in generator windings and possible failures / insulation properties deterioration

C.2 Cross ventilation and free flow of cool, clean and fresh air is must for satisfactory operation of DG set. Air should flow from alternator end to engine.

C.3 For radiator cooled engines opening in front of radiator should be 1.5 times radiator core and at back 2.25 to 3 times radiator core. Ducting in front of radiator is recommended, however it is not mandatory.

If exact opening in front of the radiator is not possible then ducting should be done to take out hot air.

If opening in the back side of genset is not possible then opening on both sides of genset at the rear of the alternator may be acceptable. In this case total openings in two side walls should be atleast 3 times radiator core.

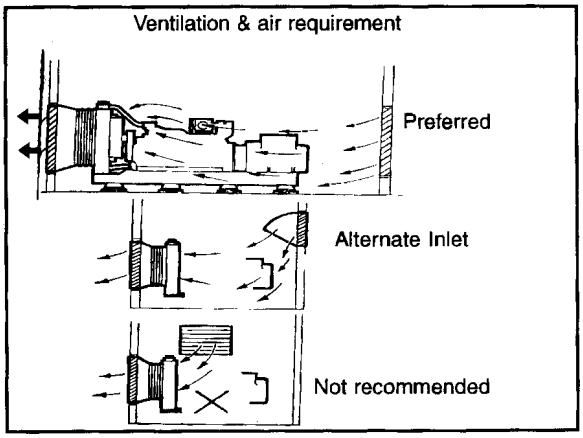
C.4 Additional ventilation arrangement may be required for radiator cooled engines installed in acoustic rooms/ enclosures. Typical arrangements is shown in C.4.

Radiator cooled engines may create slight negative pressure inside the genset room / enclosure. Maximum static restriction should not increase 6-mm of water column.

C.5 Typically for heat exchanger cooled engines, forced ventilation is required. This can be achieved by -

A) Providing forced air / axial flow fans at the rear side of the genset as shown in C.5 (A). Suitable openings in front (similar to that for radiator cooled genset) should be provided.

B) Suction fan/s at front as shown in C.5(B). Multiple exhaust fans may be required to generate sufficient air flow in the room. Suitable opening at rear side of genset (similar to that for radiator cooled genset) should be provided.



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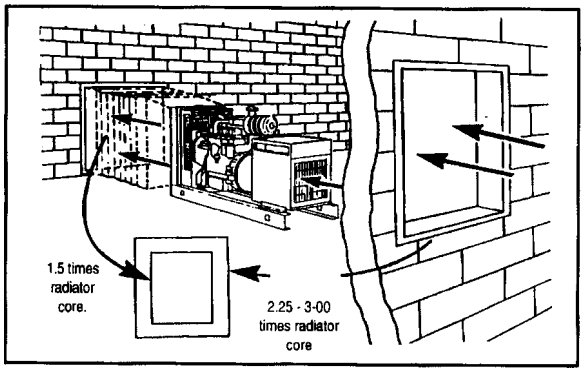

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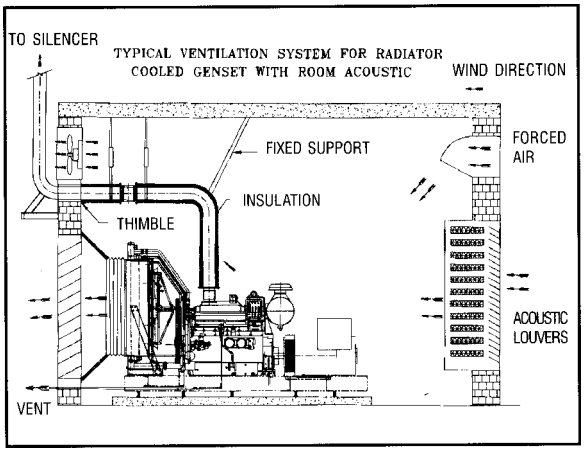

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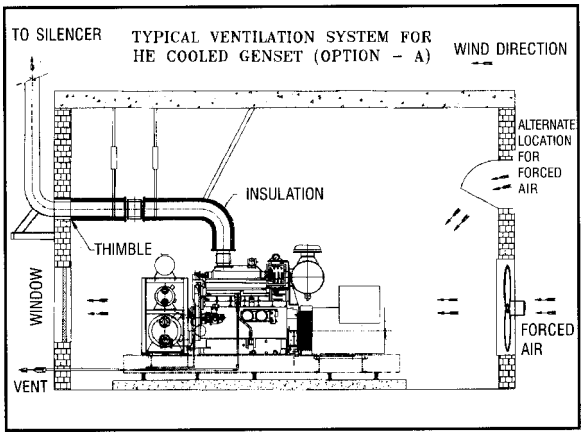


Ref. C.5 (A)

In both the cases care should be taken to avoid re-circulation of hot air.

In some cases, it may also be achieved by proper natural ventilation.

C.6 For basement installations, supply of fresh air and forced ventilation through air ducts is required to remove heat.

C.7 **Please refer to Table 1 for values of air required and fan flows for various gensets rated at 1500 rpm.** Values mentioned in table are with lagged exhaust piping in the room and silencer fitted outside the room.

C.8 **Maximum allowed temperature rise above ambient in genset room / enclosure is :**

Max. ambient	Allowable temp. rise
Upto 40° C	10° C
Above 40° C	5° C

Please note that appropriate deration may be applicable considering altitude and temperature for a particular engine/ alternator model.

For higher ambient temperature, it is suggested to use ambieter (air handling system with cooler) to reduce genset room temperature and ventilation air requirement.

C.9 **Field Check for Proper Ventilation**

1. Run the engine on full load / typical load for about 1 hour so that temperature in the genset room gets stabilised.
2. Measure the ambient air temperature (ambient temperature should be measured outside the genset room in shade).
3. Measure the temperature inside the genset room. Genset room temperature should be measured near air cleaner inlet of engine.
4. Calculate temperature difference between genset room temperature and ambient i.e. delta T.

Sometimes to ensure proper ventilation, it may be necessary to measure actual airflow by anemometer.

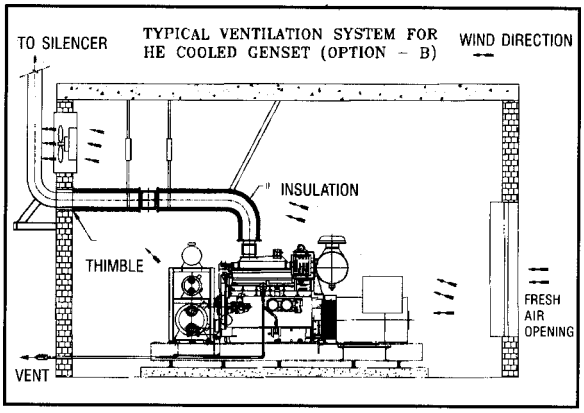
C.10 Suitable deration is required in case of ducting of alternator air inlet and outlet. For details please refer to OEM.

D Foundation

D.1 Do not install genset on loose sand or clay.

D.2 Foundation should be designed considering safe bearing capacity of soil. Vibration isolators (AVMs) reduce generator set vibration and noise transmission to the surrounding structure. Hence they are recommended, however they are not mandatory.

D.3 If foundation is with anchor bolts, higher depths of foundation is required as compared to mounting on AVMs. Please refer attached table for depths of PCC (Plain Cement Concrete) for typical soil condition, however structural engineer should be consulted to verify the data depending upon soil condition. If RCC (Reinforced Cement Concrete) is used the depth of foundation can be reduced as per recommendation of structural / civil engineer. Pockets (150 mm x 150 mm) are required if foundation bolts are to be used. For AVMs plain foundation is adequate. Static and dynamic load data for foundation design can be furnished on request.



Ref. C.5 (B)

Engine room ventilation can be estimated by the following formulas :

$$V\ (cfm) = \frac{H}{0.070 \times 0.24 \times \Delta T} + \text{Engine Combustion Air}$$

or

$$V\ (m^3/min) = \frac{H}{1.099 \times 0.017 \times \Delta T} + \text{Engine Combustion Air}$$

V = Ventilating air (cfm) (m^3/min).

H = Heat radiation (Btu/min) (kW).

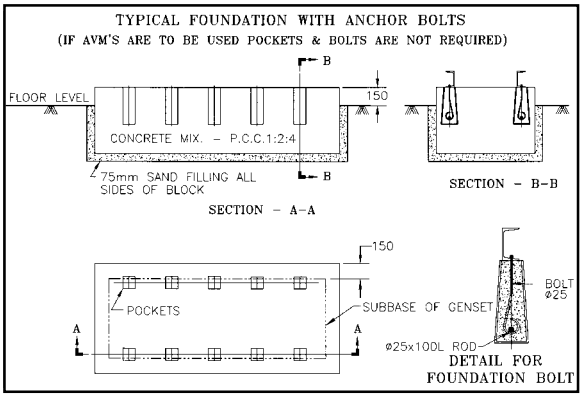
ΔT = Permissible temperature rise in engine room (°F) (°C).

Density of air at 100°F = 0.070 lb/cu ft (1.099 kg/m^3).

Specific heat of air = 0.24 btu/°F (0.017 kW/°C).

Assuming 38°C (100°F) ambient air temperture.

Ref. C.7



Ref. D.3

	Typical Depth of PCC Foundation (For soil bearing capacity 5000 kg/m 2 i.e. 1025 lb./ft.2)	
Model KVA	**Without AVM (mm)**	**With AVM (mm)**
750-2000	1500	600
625	1200	400
320-500	1200	400
200-320	1000	400
Upto 200	900	400
82.5	450	200

Ref. D.3

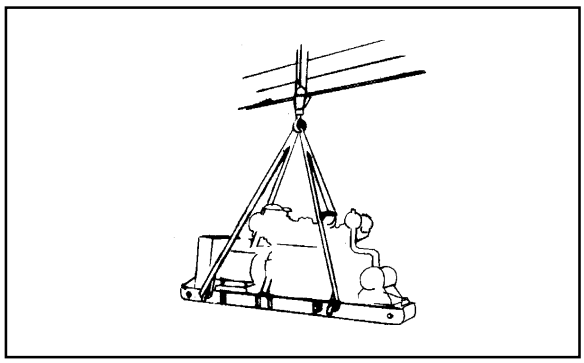
D.4 The length and breadth of foundation should be at least 150-300 mm (6-12") more than base rail length and breadth respectively.

D.5 Ensure that the concrete is completely set and hardened before positioning the generator set.

D.6 It is recommended to have foundation height about 100-150 mm above ground level, it helps to maintain cleanliness of genset.

D.7 Check the foundation level diagonally as well as across the length for even flatness. The foundation should be within $\pm 0.5^{o}$ of any horizontal plane.

D.8 The base rail of genset should be leveled using shims before grouting with foundation bolts. Care should be taken so that the shims are placed on both sides of foundation bolts. If shims increase above 1.5 mm then machined spacer plates should be used in combination with shims.



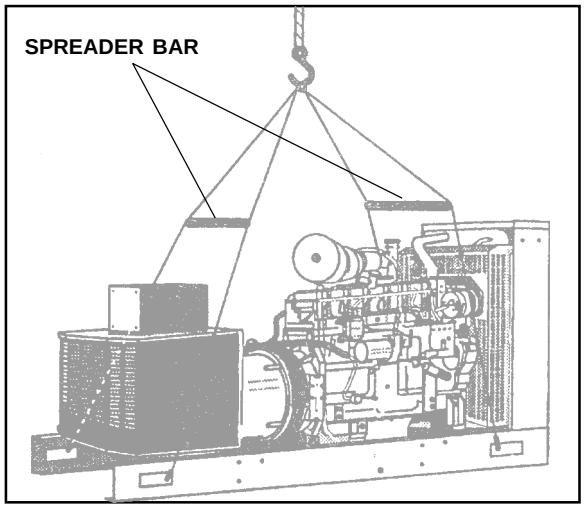
E Unloading

E.1 Provision for genset lifting is provided on base-rails. Unload the genset from base rail by lifting with proper genset lifting tackle or nylon sling / steel rope of suitable capacity and crane so as to ensure no damage to oil sump, air cleaner, radiator pipes etc.

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

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

E.4 **Spreader bar / spacer plate of suitable size may be required to avoid damages to genset components.**



Ref. E.4

F. Air System

F.1. Vacuum indicator is supplied with all engines to indicate choked filter.

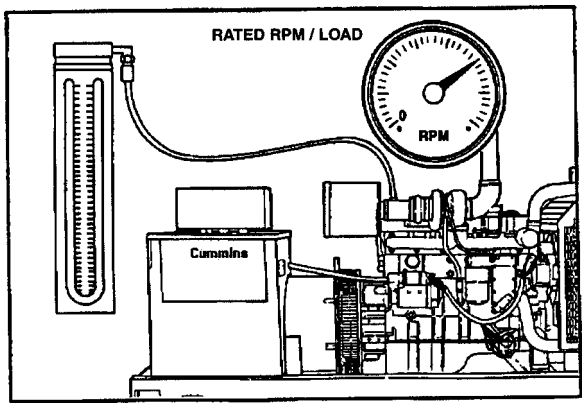
Max air intake restriction with clean and choked filter is as follows :

	X-Series	S-Series (Naturally Aspirated	S-Series (Turbo-charged)	All Engines with Medium duty A/c	All Engines with Heavy duty A/c	Gas Engine
	mm of water column (Inches of water column)					
Clean filter	250 (10)	250 (10)	250 (10)	250 (10)	380 (15)	200 (8)
Choked filter	400 (15.7)	380 (15)	500 (20)	635 (25)	635 (25)	380 (15)

Higher restrictions leads to :

- Early choking of air filter
- Low power
- Black smoke
- Turbocharger failure

F.2 Heavy duty air cleaners should be used for dusty environment. Contact OEM / Cummins if genset is to be installed in dusty environment. Please note that gensets are supplied with medium duty air cleaners as standard scope.



Ref. F.1

F.3 If fibrous conditions exist then care should be taken to prevent the fibers from getting sucked into the air cleaner. Provide air ducts, air curtains, nets etc. In such cases consult OEM / Cummins.

F.4 Care to be taken, that no such fibre element shall enter/ block the air flow of alternator.

G. Exhaust System

G.1 Exhaust system should create minimum back pressure.

Higher back pressure leads to :

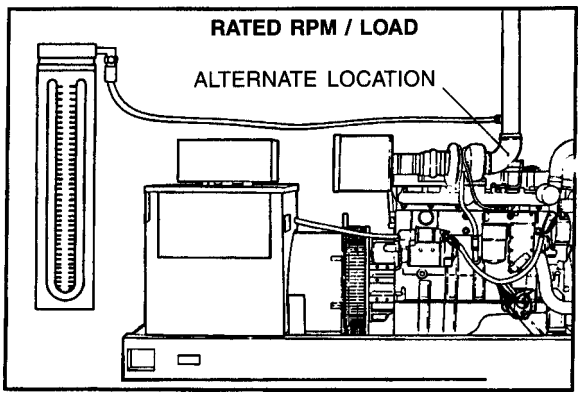
- Lower fuel economy
- High exhaust temperatures and related failures
- Poor performance of the engine
- Less durability of the engine

G.2 **Limits for exhaust back pressure**

Model	mm (Inches) of Hg
KTA50G8/QSK60/S Series/ Gas Engines	51 (2)
KTA50G3/KT2300G/VTA28/K19/ NT/N14/B/C/X Series	76 (3)

For new installations it is recommended to have back pressure lower by 12 mm (0.5") of Hg than limit.

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



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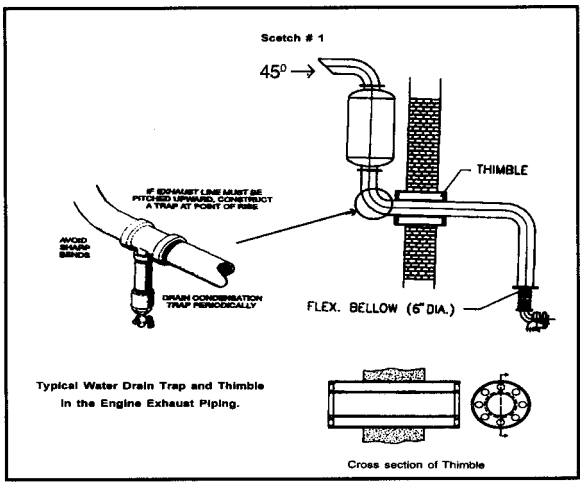

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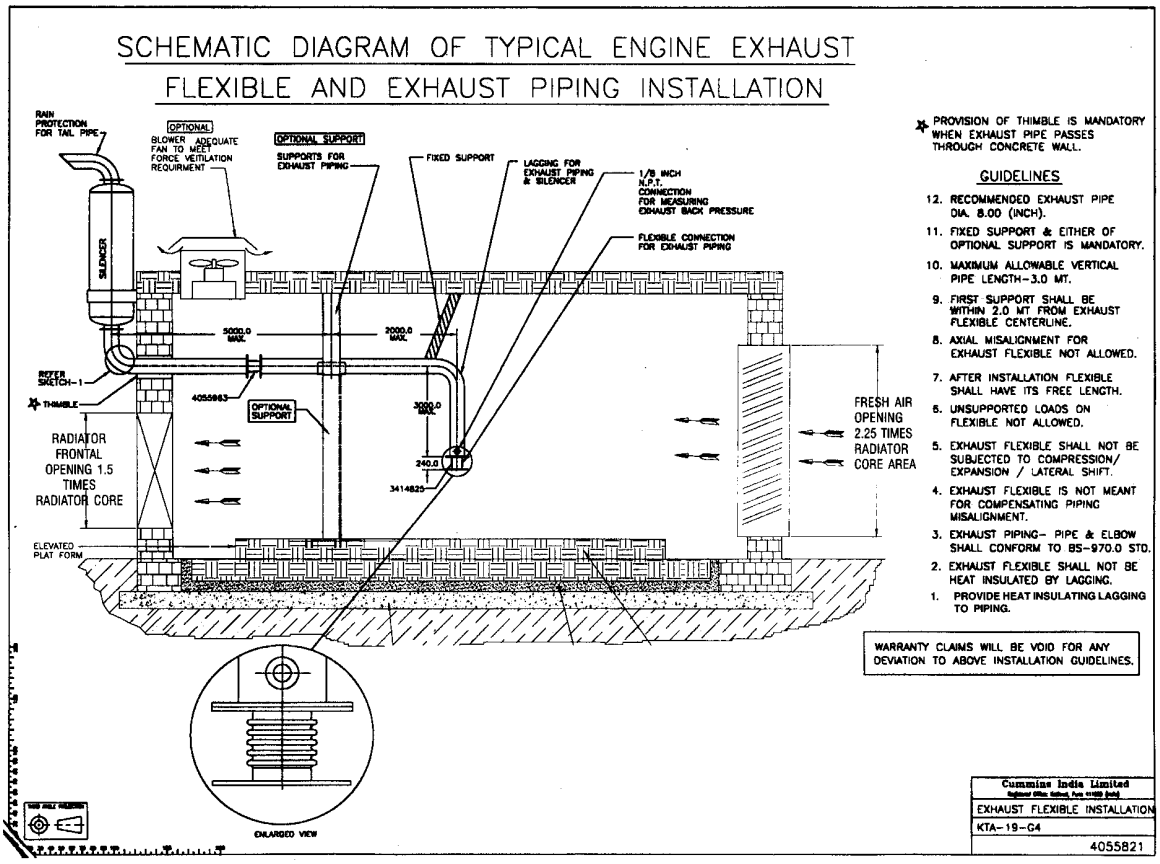


Ref. G.5

G.4 Exhaust piping inside the genset room should be lagged along with aluminum sheet cladding to avoid heat input to the room. Typical thickness of lagging is 50 mm.

G.5 Exhaust flexible shall have its free length when it is installed. Recommended piping arrangement with support locations for KTA19G4 engine is shown in G-5.

For K6 and bigger engines 2 flexible bellows per bank and residential silencer is supplied as standard scope.

For engines upto KTA1150 only one bellow is supplied. However, if exhaust pipe length is more than 7 m then additional bellow / provision for expansion should be provided.

G.6 It is recommended to use 'Schedule B' MS pipes and long bend elbows. **Please refer Table 1 for pipe sizes. If number of bends are more than 4 or pipe length is more than 10 meters than contact OEM / Cummins for piping arrangement. Please refer back pressure nomograph for calculating exhaust piping back pressure, if required.**

G.7 The exhaust outlet should be in the direction of prevailing winds and should not allow exhaust gases to enter air inlet / windows etc.

G.8 There should be rain trap to avoid rain water entry. If rain cap is used the distance between exhaust pipe and rain cap should be higher than 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.

Above covers general guidelines for exhaust system installation. For model-wise details regarding installation and scope of supply, please refer to service information bulletin SIB 00-2, available with Cummins network.

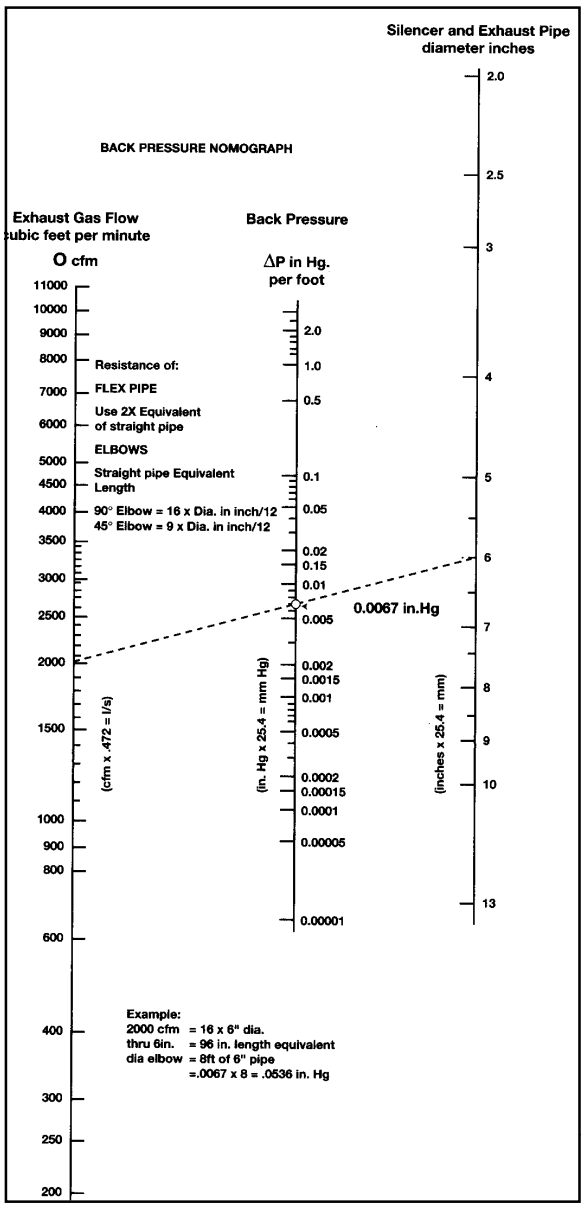
G.9 Optimum Silencer Location : Location of the silencer in exhaust system has very definite influence on both silencing and back pressure imposed on the system. The preferred silencer locations are given in the Table G.9, where L is length of the total exhaust system measured from exhaust manifold in meters. Please note that locating the silencer as per optimum silencer location is not mandatory. For high rise buildings suitable arrangements may have to be provided in consultation with acoustic engineer.

G.10 Exhaust stack height : In order to dispose exhaust above building height, minimum exhaust stack height should be,

$H = h + 0.2 \times \sqrt{KVA}$

Where H = height of exhaust stack

h = height of building.



Ref. G.6

Optimum Location of Silencer (in meters)		
	In-line Engine	'V' Engine Engine
Best	2 L/5	$\frac{4 L - 1.5}{5}$
Second best	4 L/5	$\frac{2 L - 4.5}{5}$

Worst Location of Silencer

	$\frac{L}{5}$ or $\frac{3 L}{5}$	$\frac{3 L - 10}{5}$

Ref. G.9

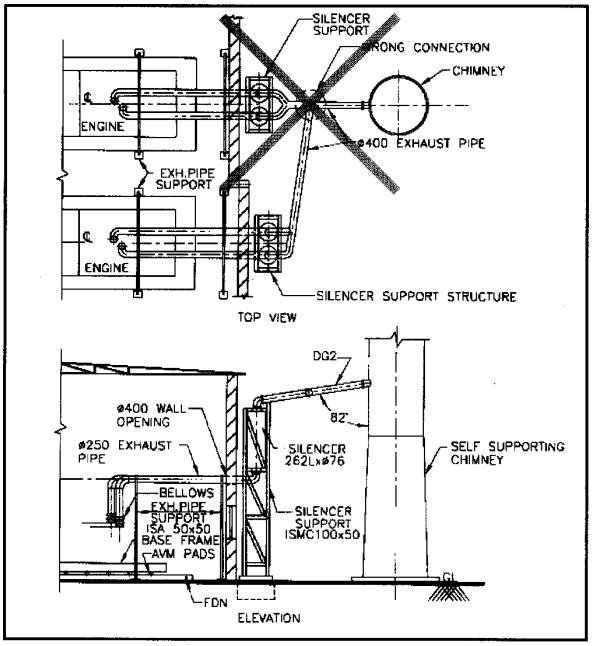
G11 Care should be taken to ensure that no carbon particles emitted due to exhaust leakage enters and deposits on alternator windings and open connections

Common exhaust system for multiple engines

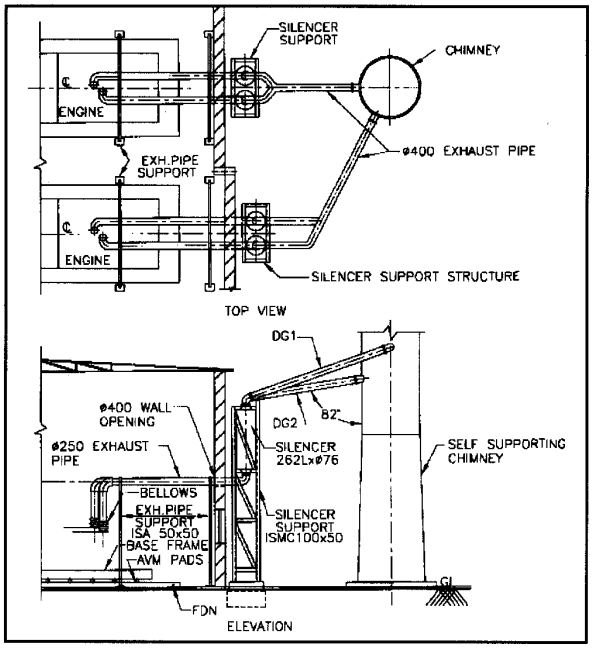
G.12 Common exhaust system for multiple sets is not recommended due to condensation, excessive suction pressure, entry of exhaust gases in non working engine, increased back pressure and lack of fail safe system availability. However exhaust of two banks of V-engines can be connected, after silencer. Ensure that area of common pipe is greater than sum of the areas of individual pipes.

G.13 Exhaust of engines can be directly connected to chimney at different levels as shown.

NOT RECOMMENDED (REF. G.12)



RECOMMENDED (REF. G.13)



H. Fuel System

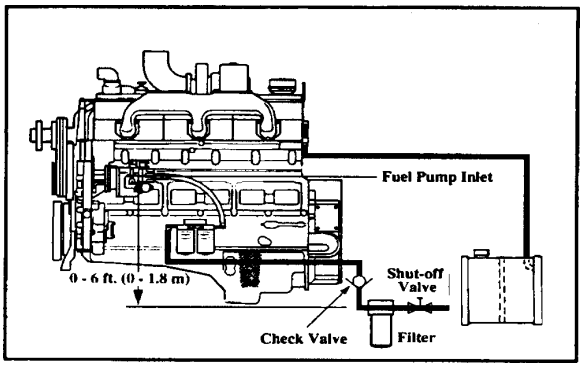
H.1 Fuel supply and return line restriction for PT fuel system is max. 100 mm Hg.

Higher restriction leads to :

- Lower power
- Late stopping
- Engine die down

H.2 Typically fuel tank should be placed on the level as that of engine i.e. floor mounted. Locate fuel tank such that fuel outlet point (at bottom of fuel tank) is maximum 1.8 m (6 feet) below the fuel pump inlet or for top mounted fuel tank, top side of fuel tank is max 1.5 m (5 feet) above fuel return line. In case of Top Mounted tanks non return valves are must in fuel supply and return lines of specified value. Please contact OEMs / Cummins for necessary details.

For AMF critical start engines, minimum 0.45 m (18") of gravity fuel feed needs to be provided to fuel pump at inlet connection.



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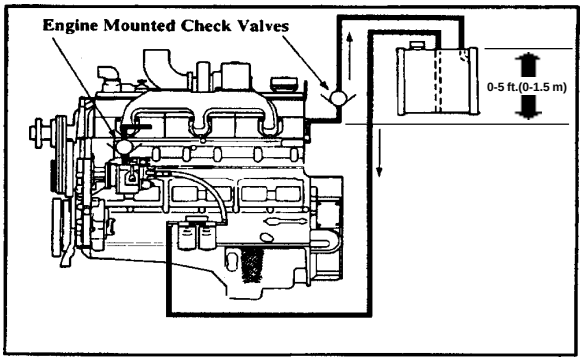
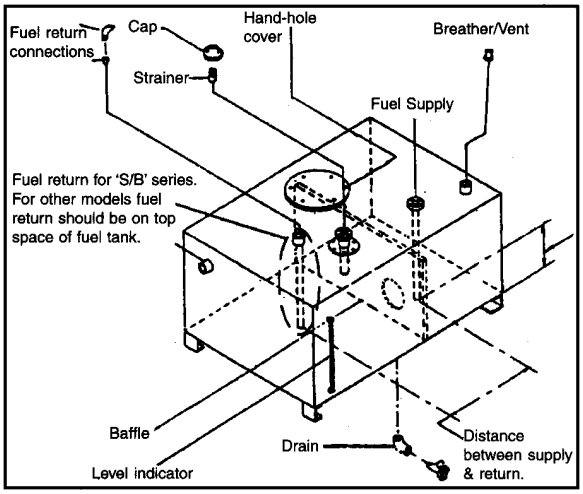


Ref. H.2

H.3 **Fuel tank design requirements**

- Size to suit atleast one shift operation or maximum 990 ltrs. (Material MS for fuel tank and piping)
- Drain fittings to bleed water condensate at lowest point of tank.
- Fill neck to be provided to allow min. 5% expansion space.
- Breather is mandatory.
- Use pipe sealant Loctite Type 577 for all connections, for sealing. No teflon tape to be used.
- Suction and return line to be separated by at least 300 mm.
- Galvanizing not recommended, inside fuel tank.



Ref. H.3

- Hand hole, Wire mesh filter screen at filling point.
- Fuel suction pipe should be 50 mm (2") inside the bottom of the fuel tank for B Series and above engines. For S3.8 engine 25 mm (1") is acceptable.
- **For PT fuel system, fuel return line should be on top of fuel level and for X / S / B / C series engines with high pressure fuel system fuel return should be dipped in fuel.**

H.4 Schedule B MS pipe should be used for fuel piping from fuel tank upto the engine. Flexible hoses supplied with the engine should do the terminal connection between MS pipe and engine.

H.5 Fuel piping should be free from leaks. GI and copper pipes react with diesel and can't be used.

H.6 **Please refer Table 1 for recommended fuel line sizes for fuel piping lesser than 10 m. If piping length is more than 10 meters, contact OEM / Cummins for detail engineering.**

H.7 Fuel tank location should be such that it does not obstruct free movement of service personnel or ventilation air.

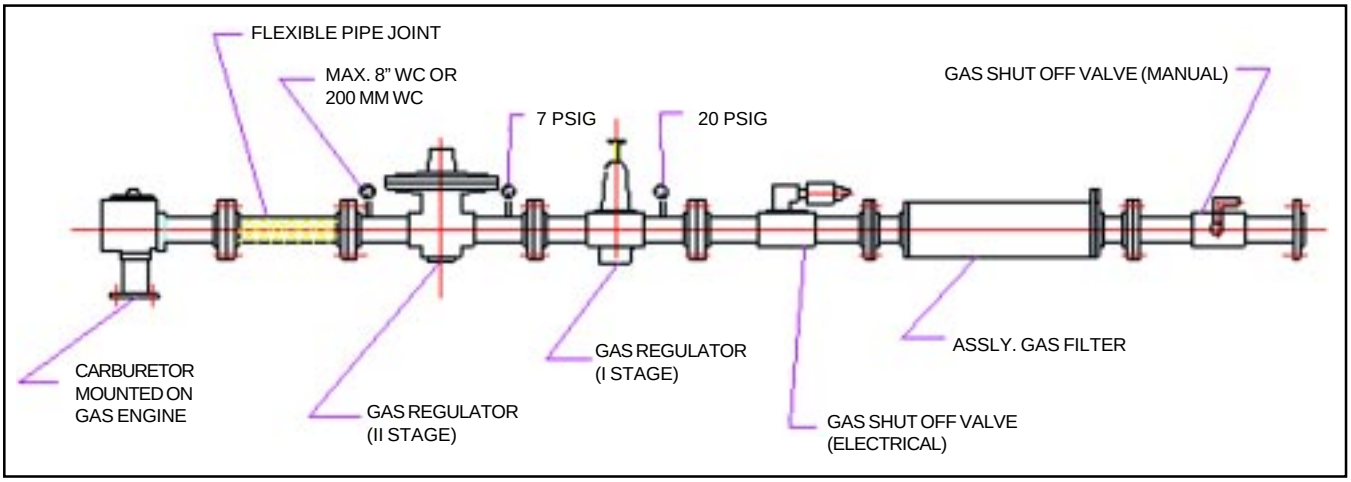
GAS ENGINES FUEL SYSTEM RECOMMENDATIONS

With the increased availability of Natural Gas all over the country, more and more customers are opting for Gas Gensets. As such it is necessary to have a brief overview of the various components used in the gas supply line prior to getting connected to the gas engines.

Various components used in gas supply piping to the engine inlet and installation recommendations are as follows :

The fuel system for gas engine includes following :

1. Manual shut-off valve (Main line Valve)
2. Gas Filter
3. Gas shut-off valve (Electrical)
4. 1st stage regulator
5. 2nd stage regulator
6. Carburettor



Typical Gas Pipe Line Arrangement.

1 Manual shut off valve (Main Line Valve)

This is used as interface between main gas supply line and the engine gas piping. This can be used for isolating main gas supply line for any repairs on gas supply system parts

2 Gas Filter

This filter is provided to remove any dust, rust or solid particles entering the gas supply system.

3 Gas shut-off valve (Electrical)

This valve is electrically operated by 24 volts DC supply. This provides electrical on / off operation and is connected in series with engine safety shut off system (viz. High water temperature, low lub oil pressure, over speed).

4 First Stage Pressure Regulator

This regulator is smaller in size and is red in colour. This main line regulator is mounted in gas line near engine. While setting outlet pressure, the brass spindle should be rotated clock wise to increase the pressure and anti-clockwise to decrease the pressure so as to adjust the outlet pressure to 0.5 Kg/cm^2 (7 psi). Proper care should be taken during installation of this regulator by ensuring the IN/OUT markings are properly connected.

5 Second Stage Pressure Regulator

The second stage regulator is bigger in size as compared to 1st stage (main line) regulator and is in blue colour. This regulator should be mounted near the engine carburettor. It should be supported firmly and a flexible connection should be provided between the regulator and the carburettor. Provide necessary connection on piping for pressure measurement before and after this regulator.

Unscrew the top cover for setting the outlet pressure. The outlet pressure can be adjusted by means of a 14 mm allen key. The gas pressure just before should be set as follows :

Gas Filter

Element Gas Filter

First Stage Regulator

Second Stage Regulator

When engine is stopped, the gas pressure should be set to 200 mm of water column. When the engine is running at rated load and speed, the gas pressure should be re-adjusted to 75 mm of water column.

The gas pressure before carburettor inlet is to be set to 75 to 100 mm (3 to 4 inches) of water column when engine is running at rated load and speed.

Please ensure fluctuation free gas flow at inlet of regulator.

Care to be taken while installing the gas pipe line components

1 Ensure that the arrow is in the direction of GAS FLOW

2 After the gas line pipe welding / fabrication is complete ensure that the entire line is flushed by air. After installation ensure no leak

3 Ensure that the gas pressure before the main line regulator (1st stage) is within 1.4 to 2 Kg/cm^2

4 Recommended pipe sizes for main line and inlet outlet diameter of regulators are listed in Table-3. Please ensure the pipe specifications are matched

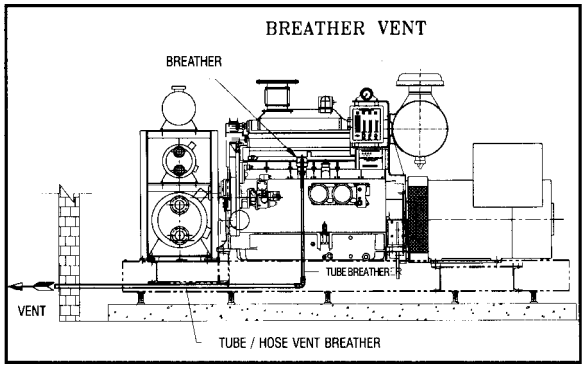
5 The schematic diagram shows typical gas pipe line. Please ensure to adopt pressure gauges between the gas shut-off valve and first stage regulator 1.4 kg/cm^2 (20 PSIG). Also install 0.5 kg/cm^2 (7 PSIG) pressure gauge between first stage pressure regulator and second stage pressure regulator

6 The part number details of the components used in the gas train components are given in the Table-3.

I Engine Breather Vents

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

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



Ref. I.1

J Cooling System

J.1 Systems are designed for ambient temperature of 50^{O}C.

J.2 Water used in cooling system should have properties as mentioned in Table J.2. If properties are outside the limits then it can result in

- Scale formation
- Overheating
- Corrosion

Water softening / demineralizing plants should be used, if raw water quality is not acceptable.

Please refer Table J.2A for coolant to be used in various engine models.

Water Properties	
Hardness as CaCO3	170 ppm max
PH - Raw water	6.5-7.5
- Engine water	5.0-9.0
Chlorides	40 ppm max
TDS	400 ppm max
Sulphates	100 ppm max

Ref. J.2

Coolant for various engines	
B/S/X Series	50-50 Water and Ethylene glycol
C Series	AL Plus (DCA4) Premix
All other engines (Including N14)	CAC (DCA2) + Water

Ref. J.2A

J.3 Raw water inlet temperature should be 32^{O} C with typical temperature rise of 7-11^{O} C. Cooling tower should be selected based on this temperature difference and wet bulb temperature of site. Typical recommendations are given in Table-1.

J.4 It is mandatory to install raw water temperature and pressure gauges at inlet and out let connections to H.E.

J.5 Recommended raw water pressure at inlet of heat exchanger should be 3.5 kg/cm^2 (50 psi) max. **There should be positive pressure on suction of raw water pump.**

J.6 Strainer, non-return valve should be used in cooling tower circuit as shown. It is mandatory to use pressure and temperature gauge in both supply and return lines.

J.7 **Please refer Table 1 for typical raw water pipe sizes, cooling tower capacities, raw water flows etc.**

J.8 Raw water piping should be connected to engine HE by flexible connection / hose in order to isolate engine vibrations and to avoid undue stress on H.E. and piping.

J.9 For multiple sets, piping should be designed to handle the required flow rate. In some cases, balancing valves may be required to branch flow.

J.10 For sea water application in raw water circuit, special cooling system is required. Please contact OEM/ Cummins.

J.11 Raw water pump sizing is to be done on friction, static head (location of cooling tower) and piping layout. Table J.11 provides typical raw water pump sizes as guidelines only. **However proper selection of pump model is based on friction and static head (location of cooling tower) and piping layout, at a particular installation.**

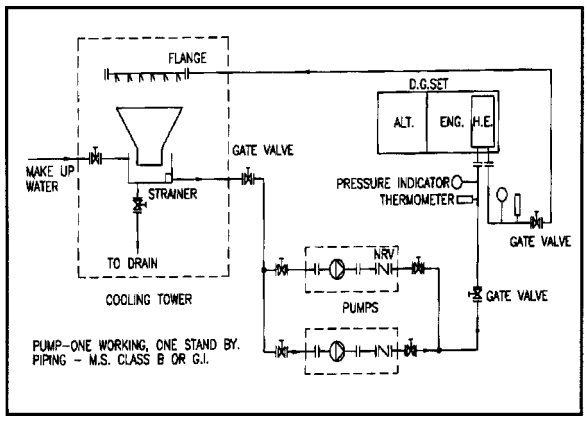
J.12 Typically MS pipes should be used for raw water. If GI pipes are used, those must be threaded at flanges. The welding will destroy galvanising properties.

J.13 Radiator fan flow should be free from any obstruction.

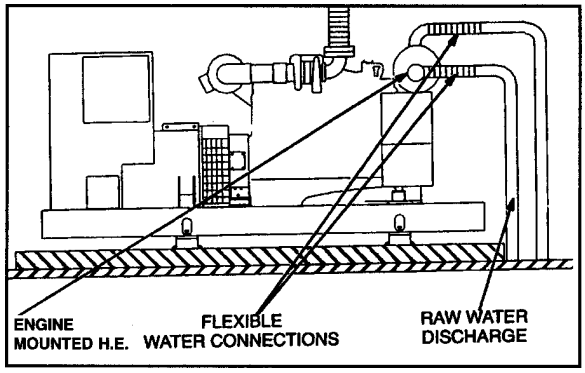
J.14 **Remote Radiator**

Location of remote radiator

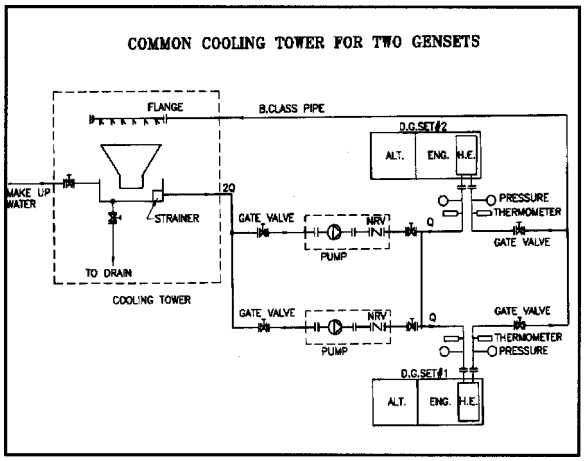
The proper location of remote radiator is very essential for the successful and efficient operation of remote radiator. In this the cooling media is ambient air. So in order to obtain maximum efficiency from remote radiator it is necessary to get fresh air in its surrounding. The air to be sucked in should not have any external hot



Ref. J.5



Ref. J.8



J.9

Typical Raw Water Pump Size (Diesel engine) (20 m total head on pump)	
1875 to 2000 KVA	7.5 kW (10 HP)
750 to 1500 KVA	5.5 kW (7.5 HP)
400 to 625 KVA	3.7 kW (5 HP)
Upto 380 KVA	2.2 kW (3 HP)

Ref. J.11

medium such as engine exhaust, furnace exhaust etc. Coil cooler is type of remote radiator.

- There should be no restriction at the fan outlet (from where the hot air is going out) such as ceiling.
- If the remote radiator is connected in primary circuit care should be taken that **maximum vertical distance from engine water pump to highest point in cooling system should not exceed 5 m.**

  The max. horizontal distance of remote radiator from engine should not exceed 10 m.

Mounting

- No special masonry is necessary except to keep the remote radiator in leveled surface. Normally 150 to 200 mm (6" to 8") foundation should be made to place the remote radiator. It is preferable to elevate the remote radiator as additional protection from drainage, for easy installation and to minimise the chances of dust / dirt getting attracted from ground. Pillar or mounting structure of approx. 1 m is usual practice in such case.
- In case of roof top installations, check your building specifications for permissible floor loading as mentioned above.

Expansion / Deaerating Tank

A suitable expansion / deration tank **must** be used along with remote radiator (Normally 20% of the system capacity). The tank should be located at the highest point (min. 0.5 m from radiator top) of entire cooling system. Due to the requirement of positive pressure at water pump inlet the expansion tank is usually installed in cold water line. i.e. the outlet of radiator and near to the engine pump suction line. Ensure proper venting of total cooling system.

Water Piping and Connections

The most important factor in the piping layout of remote radiator is the size of the pipe. The exact size of the pipe is essential so as to get proper flow rate of water and for achieving the pressure drop within prescribed limits. It is advisable to use MS pipe of Schedule 20. It is recommended to use flexible joints in the pipeline close to the DG set.

Piping size should be such that external restriction of piping and remote radiator is within limit. The maximum pressure drop allowed in HT and LTA circuit is 0.35 kg/cm^2 (5 psi) and 0.28 kg/cm^2 (4 psi) respectively.

Valves and Fittings

Butterfly valves should be used in the pipe line for isolating the engine so that the entire system does not have to be drained during maintenance in the DG set or Remote radiator.

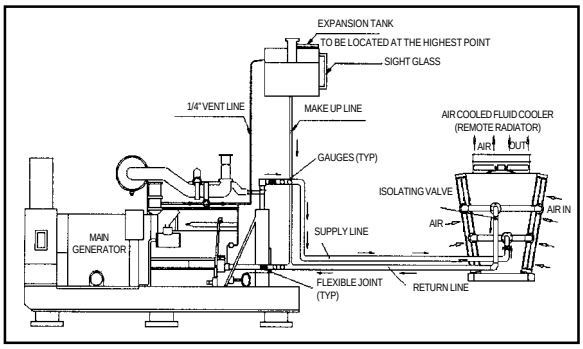
Coolant Treatment

Cooling system capacities with remote radiator are high. It is mandatory to use additional coolant additive to treat high volume of water.

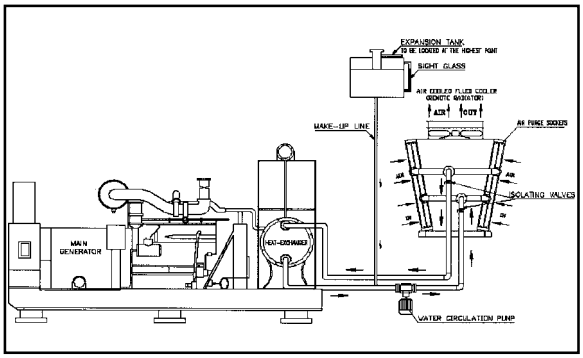
Note : Remote radiator can also be used in secondary circuit in place of cooling towers.

Quick Selection of Remote Radiator for Cummins Engine

Engine Model	Prime rating KVA	Remote Radiator	
		Primary Circuit	Secondary Circuit
QSK60G4	2000	FCW-160 (LT + HT)	FCW-200
KTA50G8-I	1500	FCW-140 (LT + HT)	FCW-180
KTA50G3	1250	FCW-120	FCW-140
KTA50G3 1P2L	1250	FCW-120 (LT + HT)	FCW-140
KTA38G5	1000	FCW-100 (LT + HT)	FCW-120
KTA2300	750	FCW-080	FCW-100
VTA28G5	600/625	FCW-060	FCW-080
KTA19G4	500	FCW-060 (LT + HT)	FCW-080



REMOTE RADIATOR IN PRIMARY CIRCUIT



REMOTE RADIATOR IN SECONDARY CIRCUIT

K Battery / Electrical System

K.1 Batteries supplied with genset are generally dry and uncharged. First charging of uncharged batteries is very important and should be done from authorised battery charging center. It takes about 72-80 hours.

K.2 Batteries should be placed on stands and relatively at cool place.

K.3 Please refer Table K.3 for battery capacity and cable sizes for various engine models. Cable sizes are for maximum length of 2 m. If length is more, size the cable, so that voltage drop does not exceed 2V.

K.4 For AMF applications, a static battery charger working on mains supply is recommended to keep the batteries charged at all times.

Ref. K.2

Model	Battery Capacity AH	Cable Size mm²	Electrical System Volts
KV and above	360	70	24
V28 / K19	180	70	24
N14/855/N8/C	180	50	24
B-5.9	150	50	12
S-3.8	120	50	12
X-Series	88	35	12

Ref. K.3

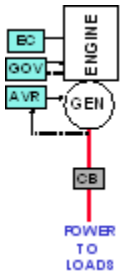
L Genset / Engine Controls

The generator set is controlled locally by a dedicated Generator Control Panel. This incorporates the control systems, metering, alarm indications and customer connections.

Two types of control system are currently available; conventional and Power Command control.

Conventional Control

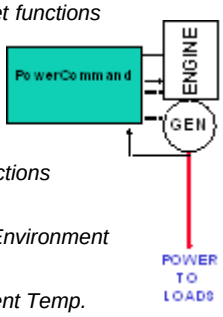
- *Engine Control (EC)*
  - *Protects Engine*
  - *Starts/Stops Engine*
- *Governor (GOV)*
  - *Controls Engine Speed/Frequency*
- *Voltage Regulator (AVR)*
  - *Controls Output Voltage*
- *Circuit Breaker (CB)*
  - *Protects Alternator, Feeder to Load*
- *Many Options*
  PLCs, AMF, Auto paralleling, synchronising load sharing.



Power Command Control

Power Command

- *Single Control for all genset functions*
  - *Governing*
  - *Voltage Control*
  - *Engine Control*
  - *All Protection*
  - *Advanced Control Functions*
- *Designed for the Genset Environment*
  - *Vibration Tested*
  - *Wide Variation in Ambient Temp.*
  - *Dirty Environment*



L.1 Make sure that the polarity of the battery connections are correct before applying power to the all Electronic Controls.

L.2 Do not test wire leads to see if they are 'live' by flashing them on either engine body or the ECP mounting stand.

L.3 Disconnect all connections to the control system on engine / genset before doing any welding work on set.

L.4 There are no user serviceable parts inside the various controls supplied along with Cummins engine / genset. Call the nearest Cummins office / dealer for help.

L.5 Turn off or remove AC power from the battery charger and then remove –ve battery cable from the engine / genset battery. This will avoid possible PCB damage and someone else starting engine / Genset accidentally.

L.6 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.7 Always refer to the wiring diagram and product manual supplied with the engine / genset for details.

Genset with PCC

L.8 Please refer Table L.8 for details and CT Ratios to be used with PCC1 (PCC3100) controls.

L.9 Gensets above 500 kVA has option of "Power Command Control (PCC)" for genset control. 500 kVA to 1500 kVA gensets can be supplied with PCC 3100 (PCC-1) and 1875 / 2000 kVA gensets with QSK 60 engines can be supplied with PCC 3200 (PCC-2).

DETAILS FOR PCC1 (PCC 3100)				
ENGINE MODEL	**KW Rating**	**FILE NAME**	**CT RATIO**	**PART NOS.**
KTA50G8	1200	DFLF-50	4420/1	4084989
KTA50G3	1000	DFLC-50	3867/1	4084245
KTA38G5	800	DFJD-50	2839/1	4084175
KTA2300G	600	DFJB-50	2141/1	4084244
VTA28G5	500	DFGC-50	1893/1	4107379
VTA28G3	500	DFGC-50	1893/1	4107379
KTA19G4	400	DFED-50	1419/1	4104378

Ref. L.8

AMF Operation :

There are three types of AMF operations as below :

A) Operational system is automatically restored to operation within 10 seconds after interruption of normal power source - with sudden load on the engine. This operation exerts a 'Thermal shock' to the engine. For example UPS.

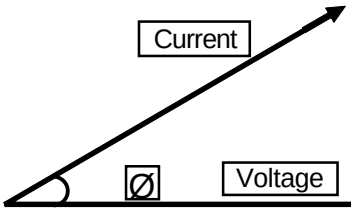
B) Operational system is automatically restored to operation within 10 seconds after interruption of normal power source - but with gradual load (in steps) on the engine with low initial load. There is no 'Thermal shock' to the engine.

C) Operational system is manually restored to operation after interruption of normal power source - with gradual load on the engine. There is no - 'Thermal shock' to the engine.

No changes in engine are required for AMF operations described in B and C above.

For 'A' type of AMF operation :

No oil heaters are required, coolant heaters are required. (For details contact OEM / Cummins.)



Cosine of angle Ø is the power factor.

Power Factor (P.F.)

Power Factor is the cosine of the angle between current vector and the voltage vector.

The power factor of the electrical system depends upon the nature of characteristics of the load. e.g. Induction motors, Furnaces etc.

- PF is lagging for inductive load.
- PF is leading for capacitive load.
- PF is unity for (purely) resistive loads.

If the PF of the load is less than the standard (0.8) the alternator gets overloaded.

If the PF of the load is more than the standard (0.8) the engine gets overloaded.

If the PF is low, then use capacitor banks of suitable capacity to improve the power factor.

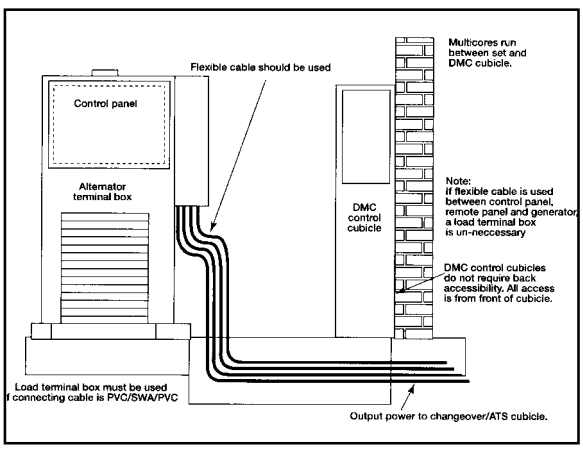
For current at various power factors, refer Table-4.

M Cabling

M.1 Always use flexible cables for inter connecting the PCC3100 / PCC3200 controls with the switchgear and other equipments.

M.2 Power cabling between alternator and control panel and control panel and change over switch to mains should be done with recommended cable sizes.

M.3 While terminating cables avoid any tension on the bolts / busbars.



Ref. M.1

M.4 While terminating R.Y.B. phase notations should be maintained in the alternator and control panel for easy maintenance.

M.5 Crimped cables should be connected to alternator and control panel through cable glands.

M.6 Overheating due to loose thumbing / undersize cables causes most of electrical failures, hence ensure that correct size of cables and thimbles is used.

M.7 For AMF application, use 8/10 core 2.5 sq. mm armoured copper cable for control cabling.

M.8 Typical cable sizes for 415 V application are provided in Table M.7. The sizes given are indicative, please refer to cable manufacturers for details.

M.9 For HT installations, kindly contact OEM's for details on sizing.

M.10 Care to be taken, that weights of cables should not fall on alternator / base rail. It is recommended to support output cables on separate structure on ground.

M.11 External wirings, when provided for remote voltage / excitation monitoring / droop CT etc. shall be screened sheathed type. Maximum length of such wiring shall not exceed 5 meters.

N Earthing

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

N.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

N.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.

Earthing should be checked with multimeter (one probe at genset / Alternator / baserail and another at earth strip. The resistance should be less than 1 ohm.

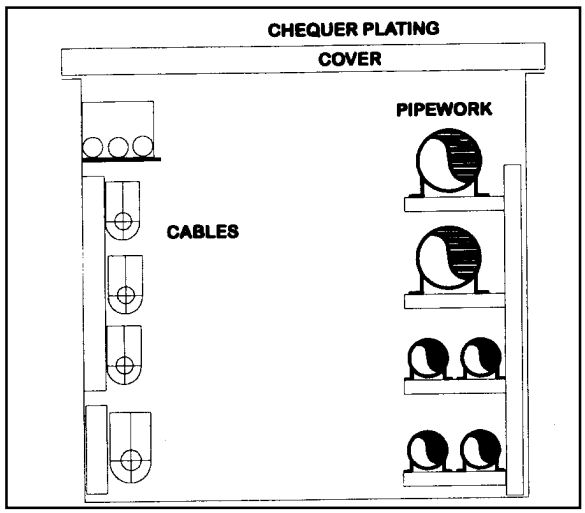
For gensets with AVM's between engine / alternator and base rail. The earthing MUST be done at the engine / alternator and NOT at baserail.

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

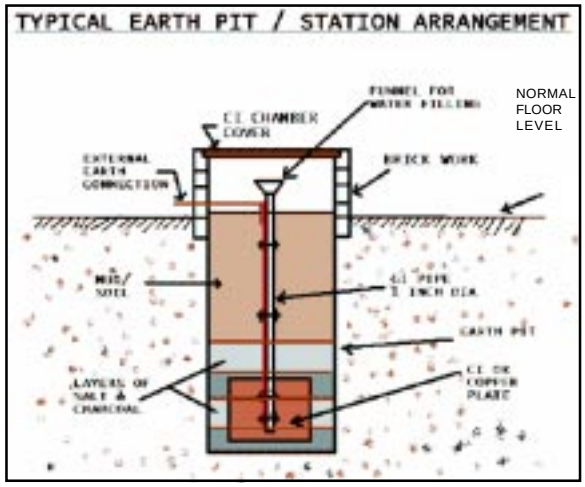
O. Alternator Termination Links

O.1 For 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 :

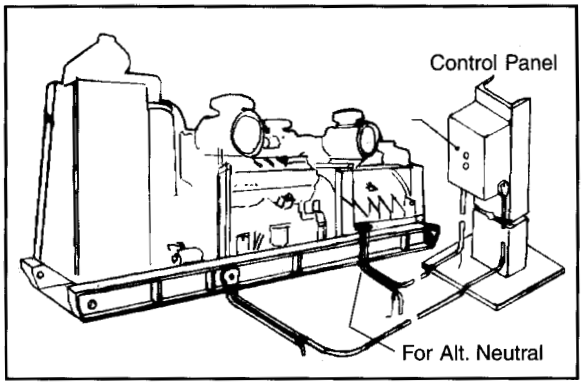
- Point contact arising out of improper positioning of links with switchgear terminals (Ref. O.1).



Trench Construction



Ref. N.2



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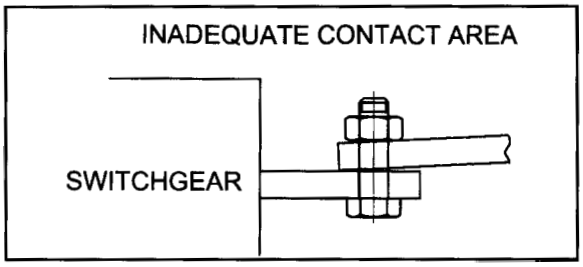


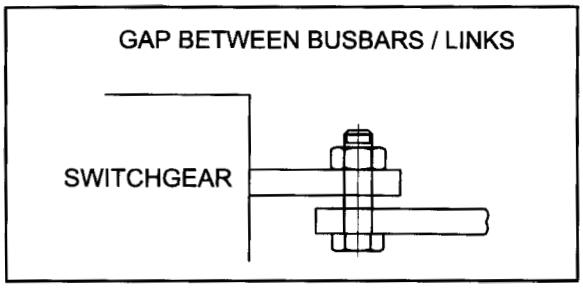
Ref. O.1

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

O.3 Adequate clearance between busbars / 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.



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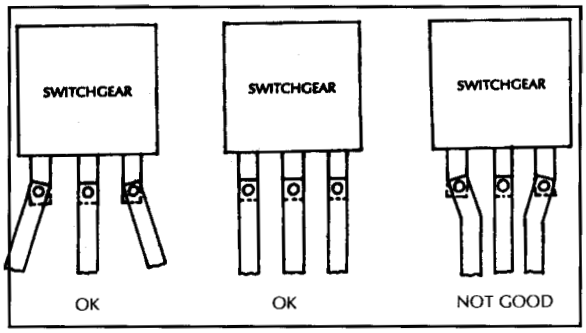


Ref. O.3

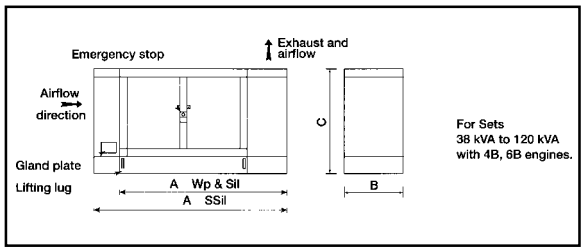
P Genset with Acoustic Enclosure

Installation

P.1 Acoustic enclosures are supplied with built in AVMs. As such genset can be installed directly on the leveled surface.

P.2 Exhaust piping outlet should not be turned towards window / ventilator of home or occupied building. Ensure provision of rain cap.

P.3 The acoustic enclosure placement should be such that there is no restriction in front of air inlet and outlet from canopy.



Typical Acoustic Enclosure Layout

Service Accessibility

P.4 Genset / Engine control panel should be visible from outside the enclosure.

P.5 A / B / C check on engine / alternator (filter replacement and tappet setting) should be possible without dismantling acoustic enclosure.

P.6 For major repairs / overhaul, it may be required to dismantle the acoustic enclosure.

P.7 Sufficient space should be available around the genset for inspection and service.

General Design Guidelines

P.8 To avoid re-circulation of hot air, durable sealing between radiator and canopy is must.

P.9 Sufficient capacity ventilation fans are required if radiator fan flow is not sufficient. Please note that the fan flows given in Table-1 are for open room installation. Fan flows

Ref. P.3

in acoustic enclosure will be less due to higher restrictions.

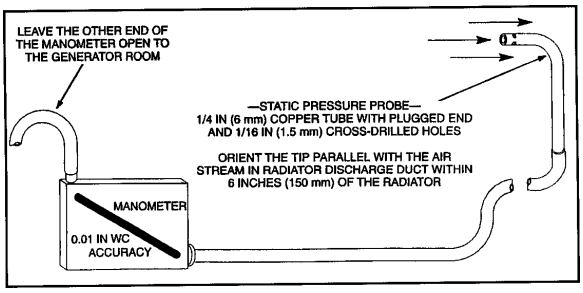
Ventilation fans are must for HE cooled gensets.

P.10 Exhaust piping inside the enclosure must be lagged (except bellow).

P.11 Temperature rise inside the enclosure should not be more than 5^0 C for maximum ambient above 40^0 C and it should be below 10^0 C for ambients below 40^0 C.

P.12 Radiator cooled engines may create slight negative pressure inside the enclosure. Maximum static restriction should not increase 6 mm of water column.

P.13 There should be provision for oil, coolant drain and fill. Fuel tank should have provision for cleaning.



Ref. P.12

ROOF TOP INSTALLATION

Roof top installations should be considered when there is no ground or basement level room available or when the cost of high level installation - including structural work - is cheaper than normal installations.

Advantages

- ☞ No air flow problems
- ☞ No expensive duct work
- ☞ No lengthy exhaust runs
- ☞ No problems with exhaust fume emissions
- ☞ No noise problem
- ☞ No space limitation problems

Roof structure

The structure of the roof area must be suitable for an installation. The strength of the flooring structure is vital. Should the floor be found unsuitable the problem can often be overcome by installing a floating floor of structural steel platforms across the building's main columns.

Vibrations

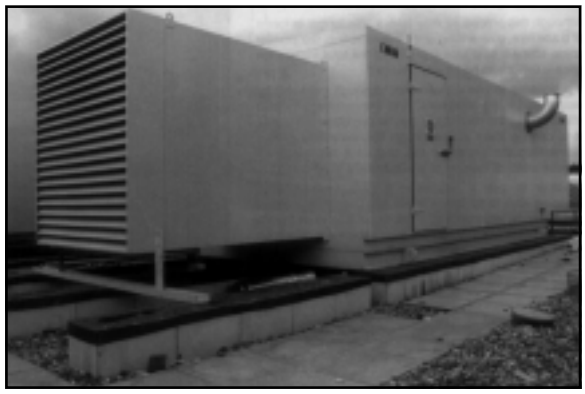
Transmitted vibration through the building can be drastically reduced by :

a) Having built-in anti-vibration units within the design of the generating set. This eliminates up to 75-80 % of transmitted engine vibrations.

b) Installing additional vibration dampers between the generating set chassis and the roof. This combination eliminates up to 98% of the vibration.

c) It is recommended to use spring AVMs for roof top installation.

Roof Top Installation



Roof Top Installation

Noise

It is recommended that all generating sets installed at roof level have sound proof enclosures fitted or are installed in room with full inlet and outlet sound attenuators and critical grade residential silencers. A sound level of 75 dB (A) at 1 m. is a substential reduction and equal to a normal office environment.

Fuel Supply

A very limited amount of fuel storage is permitted at roof level. Weight and fire considerations are paramount. In general, a 'day tank' for each set is permitted but even this may be limited to 450 liters by some local planning and Fire Authorities. It is essential to obtain the approval from Authorities for the fuel system.

The bulk storage will be at ground level and subject to the Fire Regulations governing all safety aspects. Fuel will be pumped up to the day service tank which will normally have high and low float level regulator fitted to control the pump motor.

Exhaust and Air flows

Few problems are likely to be encountered with either exhaust or air flows at roof top levels and this is a major advantage with this type of location. If the roof level is below adjoining buildings, the direction of the exhaust system should be carefully sited and prevailing winds taken in to consideration. A vertical stack with a weather cap is occasionally recommended if offices with open windows are in close proximity.

Air flow inlet areas should be kept clear of any obstructions likely to restrict the air intake passage. Air outlet is unlikely to cause any problems but again prevailing winds should be considered as gale force winds blowing straight into the air outlet may cause restriction. As a solution use angled outlet louvers to overcome this problem

Cabling

Cabling is the most expensive item as a result of roof top installation. It is recommended that the control cubicle containing the change over contractors be located as close to the buildings incoming public power supply as possible. This will limit main power cable run to minimum.

Control cables will still have to be run up to the roof level but these considerations are small core cables. It is recommended that the generator's control system, sensing and instrumentation, be retained in close proximity to the installed generator.

IMPORTANT CONVERSIONS

Length

1 m = 3.28 ft.
= 39.37 inch
= 100 cm.

1 Inch = 25.4 mm

Area

1 m^2 = 10.76 ft^2
= 1550 sq. inch.
= 10000 cm^2

1 sq. Inch = 645.2 mm^2

Volume

1 m^3 = 35.31 ft 3
= 1000 ltrs.

1 ft^3 = 28.32 ltrs.

1 gallon = 3.78 ltrs.

Mass

1 kg = 2.2 lb.

Velocity

1 m/sec = 3.28 ft/sec.
= 196.85 ft/min.

Flow

1 lt/sec = 2.12 CFM
1 lt/min = 0.2642 GPM
1 m^3 /min = 35.3 CFM
= 16.7 ltrs./sec.

Power

1 kW = 1.34 HP
= 56.92 BTU/min
1 HP = 0.746 kW

1 KCAL/min = 14.34 kW

$$\text{Engine HP} = \frac{\text{KVA x P.F.}}{\text{0.746 x Alt. efficiency}} + \text{Fan HP + bat. alt. HP}$$

$$\text{KW (Three Phase)} = \frac{1.732 \times V \times I}{1000} \times \text{P.F.}$$

$$\text{KW (Single Phase)} = \frac{V \times I}{1000} \times \text{P.F.}$$

Pressure

1 kg/cm^2 = 14.2 PSI
= 32.81 ft. of water
= 10 m of water

1 Atm = 1.033 kg/cm^2
= 14.7 PSI

1 PSI = 0.7 m of water
= 2.3 ft of water
= 6.89 kPa

1" of Hg = 13.6" of water

TYPICAL CABLE SIZES FOR DG SETS (Ref. M.7)

kVA Rating	Amp Rating	Cable size sq. mm. X runs		
2000	2782	500 x 10	—	—
1800	2504	400 x 10	—	—
1500	2087	400 x 8	300 x 9	240 x 10
1250	1739	400 x 7	300 x 8	240 x 9
1000	1391	300 x 6	225 x 7	—
750	1043	400 x 4	240 x 5	185 x 6
650	904	300 x 4	225 x 5	150 x 6
625	870	300 x 4	185 x 5	120 x 6
600	835	240 x 4	185 x 5	120 x 6
500	696	300 x 3	185 x 4	120 x 5
450	626	240 x 3	150 x 4	95 x 5
380	529	400 x 2	185 x 3	120 x 4
320	445	300 x 2	150 x 3	95 x 4
285	396	225 x 2	120 x 3	70 x 4
250	348	400 x 1	185 x 2	95 x 3
225	313	400 x 1	150 x 2	—
200	278	300 x 1	—	—
180	250	240 x 1	—	—
160	223	185 x 1	—	—
140	195	150 x 1	—	—
125	174	120 x 1	—	—
100	139	95 x 1	—	—
82.5	115	70 x 1	—	—
75	104	50 x 1	—	—
62.5	87	35 x 1	—	—
50	70	25 x 1	—	—
30	42	16 x 1	—	—
25	40	10 x 4	—	—
20	40	10 x 4	—	—
15	32	6 x 4	—	—
25 (Single Phase)	125	50 x 2	—	—
20 (Single Phase)	80	35 x 2	—	—
15 (Single Phase)	63	25 x 2	—	—

Notes :

1. Use 3-1/2 core armored power cables with aluminium conductor. (AYFY)
2. Current rating of cables are taken based on operating temperature of 70^{o} C.
3. For multiple runs of cables deration factor of 0.75 is considered i.e. 25% deration applied.
4. AYFY : Aluminium conductor, PVC insulation, Steel strip armour, PVC outer sheath.
5. Cable sizes mentioned are in square mm.
6. For sets above 1000 kVA use of proper busbars in bus ducts is recommended.
7. Earthing as per IEC rules to be provided.

TABLE 1 : MODEL- WISE RECOMMENDATIONS (DIESEL ENGINE)

Engine Model	Rating (0.8 pf)	Typical Room Size L X W X H	* Exhaust pipe size max. 4 Bends Max. Length 10 mtrs. Min. ID	Exh. Gas flow (No. of banks x flow per bank)	Fuel supply/ return pipes upto 10 mtrs. Min. ID	Lub Oil System Capacity	Coolant Capacity (H for HE R for Radiator)	Total Air (Ventilation + breathing) requirement for Genset		Radiator Fan flow in Genset room	Radiator Core Area H X W	Heat Exchanger		
								Max. amb. above 40°C (rise 5°C)	Max. amb. below 40°C (rise 10°C)			Min. raw water flow at engine HE	* Typical cooling tower capacity (wbt 26°C)	* Raw water pipe size (ID)
	KVA	m x m x m	No. x mm	No. x lt/sec	mm	lt	lt	lt./sec.	lt./sec.	lt./sec.	m x m	lt./min.	TR	mm
QSK60-G4	2000	12.5 x 7.5 x 6.5	2 x 325	2 x 2805	50	400	550 (H) 750 (R)	41915	22090	32285	2.3 X 2.4	1760	200	125
QSK60-G3	1875	12.5 x 7.5 x 6.5	2 x 325	2 x 2700	50	400	550 (H) 750 (R)	38525	20310	32285	2.3 X 2.4	1760	200	125
KTA50-G8-I	1500	12.0 x 7.0 x 6.5	2 x 250	2 x 2220	25	177	320 (H) 555 (R)	34955	18275	28400	2.2 X 1.95	1300	150	125
KTA50-G3	1250	12.0 x 7.0 x 6.5	2 x 250	2 x 1910	25	177	310 (H) 440 (R)	31475	16420	27375	2.1 x 2.0	1300	125	125
KTA38-G5	1000	11.0 x 7.0 x 6.5	2 x 250	2 x 1460	25	145	199 (H) 260 (R)	26980	14050	23855	1.9 x 1.8	900	100	100
KTA38-G2-I (2300)	750	9. 0 x 6.0 x 5.0	2 x 200	2 x 1245	25	118	230 (H) 300 (R)	21795	11395	22655	1.9 x 1.65	625	70	100
VTA28-G5	625	8.5 x 6.0 x 5.0	2 x125	2 x 945	20	95	212 (H) 250 (R)	17770	9270	22655	1.9 x 1.65	540	60	75
VTA28-G3	600	8.5 x 6.0 x 5.0	2 x 125	2 x 930	20	95	210 (H) 240 (R)	17405	9060	18880	1.9 x 1.6	480	60	75
KTA19-G4	500	8.5 x 5.5 x 5.0	1 x 200	1 x 1600	20	55	125 (H) 175 (R)	14410	7480	20280	1.48 x 1.58	** 385 + 150	60	75 + 40
KTA19-G3	450	8.5 x 5.5 x 5.0	1 x 200	1 x 1460	20	55	125 (H) 165 (R)	13110	6800	13000	1.48 x 1.58	385	45	75
KTA1150-G	380	8.0 x 5.5 x 5.0	1 x 125	1 x 1095	20	55	80 (H) 115 (R)	12070	6255	10385	1.14 x 1.22	300	35	65
NTA14-G3	380	8.0 x 5.5 x 5.0	1 x 125	1 x 1055	20	39	45 (H) 76 (R)	11110	5750	10385	1.58 X 1.48	300	35	65
NTA855-G2 BC	320	7.5 x 5.0 x 5.0	1 x 125	1 x 990	20	39	40 (H) 95 (R)	9385	4855	10070	1.18 X 1.22	** 275 + 125	35	65 + 40
NT855-G6 BC	285	7.5 x 5.0 x 5.0	1 x 125	1 x 1160	20	39	47 (H) 80 (R)	8975	4650	10070	1.08 X 1.27	275	30	50
NT855-G5 BC	250	7.5 x 5.0 x 5.0	1 x 125	1 x 960	20	39	47 (H) 80 (R)	8285	4300	10070	1.08 X 1.27	240	25	50
NT855-G4 BC	225	7.5 x 5.0 x 5.0	1 x 125	1 x 860	20	39	47 (H) 80 (R)	7305	3795	10070	1.08 X 1.27	240	25	50
6CTAA8.3-G1-I	200	6.5 x 4.5 x 3.5	1 x 100	1 x 610	15	24	28 (R)	6245	3225	7385	0.7 x 1.0	NA	NA	NA
6CTA8.3-G2-I	180	6.5 x 4.5 x 3.5	1 x 100	1 x 550	15	24	27 (R)	6035	3115	5540	0.73 X 0.74	NA	NA	NA
6CTA8.3-G1-I	160	6.5 x 4.5 x 3.5	1 x 100	1 x 540	15	24	27 (R)	5565	2880	5540	0.73 X 0.74	NA	NA	NA
6CT8.3-G2-I	140	6.5 x 4.5 x 3.5	1 x 100	1 x 470	15	24	27 (R)	4955	2555	5540	0.73 X 0.74	NA	NA	NA
6BTA5.9-G2-I	125	6.0 x 4.0 x 3.5	1 x 100	1 x 225	15	14.3	25 (R)	4920	2525	4000	0.7 X 0.7	121	—	45
6BT5.9-G1-I	82.5	6.0 x 4.0 x 3.5	1 x 100	1 x 225	15	14.3	22 (R)	3420	1760	2880	0.7 X 0.7	NA	NA	NA
S3.8-G7	62.5	6.0 x 3.5 x 3.0	1 x 75	1 x 190	10	9	13 (R)	2450	1260	1880	0.6 X 0.6	NA	NA	NA
S3.8-G6	50	6.0 x 3.5 x 3.0	1 x 75	1 x 150	10	9	11 (R)	2090	1075	1880	0.5 X 0.5	NA	NA	NA
S3.8-G5	45	6.0 x 3.5 x 3.0	1 x 75	1 x 150	10	9	11 (R)	2090	1075	1880	0.5 X 0.5	NA	NA	NA
S3.8-G4	40	6.0 x 3.5 x 3.0	1 x 75	1 x 150	10	9	11 (R)	1715	890	1880	0.5 X 0.5	NA	NA	NA
S3.8-G3	35	6.0 x 3.5 x 3.0	1 x 75	1 x 115	10	9	11 (R)	1420	730	1880	0.5 X 0.5	NA	NA	NA
S3.8-G2	30	6.0 x 3.5 x 3.0	1 x 75	1 x 115	10	9	11 (R)	1240	640	1880	0.5 X 0.5	NA	NA	NA
X2.5-G2	25	4.0 x 1.5 x 2.0	1 x 50	1 x 75	10	6.5	7.5 (R)	1060	542	1250	0.4 X 0.4	NA	NA	NA
X2.5-G1	20	4.0 x 1.5 x 2.0	1 x 50	1 x 75	10	6.5	7.5 (R)	930	475	1250	0.4 X 0.4	NA	NA	NA
X1.7-G1	15	4.0 x 1.5 x 2.0	1 x 50	1 x 50	10	5	6 (R)	670	345	1050	0.4 X 0.4	NA	NA	NA

* Typical Sizes, actual specifications may change as per site condition. ** Separate raw water connections for LTA and main circuit. NA = Not Applicable

Note : Lub oil for C Series / N14 engines is **CH4 15W-40** and for all other engines **CF4 15W-40.**

TABLE 2 : MODEL- WISE RECOMMENDATIONS (GAS ENGINE)

Engine Model	Rating (0.8 pf)	Typical Room Size L X W X H	*Exh. Pipe Size max. 4 Bends Max. Length 10 mtrs. min. ID	Exh. Gas Flow (No of banks x flow / bank	Gas supply line min ID	Estimated Gas Consumption	Total (Cal value 8730 Kcal/m³)	Lub Oil System Capacity	Coolant Capacity	Total Air (Ventilation + breathing) requirement for Genset		Radiator fan flow in genset room	Heat Exchanger		
										Max. amb. above 40°C (rise 5° C)	Max. amb. below 40°C (rise 10° C)		Min. Raw Water Flow at engine HE	*Typical Cooling tower capacity (wbt 26°C)	*Raw Water Pipe Size (ID)
	KVA	m x m x m	No. x mm	No. x lt/sec	mm	SM3/Hr	K Cal/min	lt	lt	lt/sec	lt/sec	lt/sec	lt/min	TR	mm
GTA3067-G	625	12.0 x 7.0 x 6.5	2 x 250	2 x 838	65	187	27209	177	320	25873	13221	NA	1300	200+20	125
GTA2300-G	500	11.0 x 7.0 x 6.5	2 x 200	2 x 647	65	135	19643	118	260	18918	9695	NA	1300	150+15	125
GTA1710-G	380	8.5 x 6.0 x 5.0	2 x 125	2 x 488	50	103	14987	95	250	14398	7388	NA	1052+333	100+15	100
G1710-G	250	8.5 x 6.0 x 5.0	2 x 125	2 x 324	50	76	11058	95	210	7578	3885	NA	727	75	100
GTA1150-G	250	8.5 x 5.5 x 5.0	1 x 125	1 x 710	50	77	11204	55	125	11124	5693	NA	757+190	80+10	100
GTA855-G	180	7.5 x 5.0 x 5.0	1 x 125	1 x 475	50	52	7566	36	75	7824	4006	NA	511+151	80+10	65
G885-G	125	7.5 x 5.0 x 5.0	1 x 125	1 x 312	40	37	5384	36	80	5486	2793	10070	344	30	NA
G743-G	100	7.5 x 5.0 x 5.0	1 x 125	1 x 284	40	31	4511	36	75	4578	2336	8025	314	30	NA
G495-G	70	6.5 x 5.0 x 4.0	1 x 100	1 x 170	25	21	3056	27	62	3293	1675	3775	193	20	NA

* Typical Sizes, actual specifications may change as per site condition.

NA = Not Applicable.

Note : Lub oil for Gas engines is **GEO 15W-40.**

TABLE-3 : GAS LINE COMPONENT DETAILS

	G495 / G743 / G855	GTA855	GTA1150	G1710	GTA1710	GTA2300 / GTA3067
Gas Shut Off Valve (Manual)	3872383 (25 mm)	3875553 (50 mm)	3873933 1.5" BSP	3873933 1.5" BSP	3875553 (50 mm)	3875553 (50 mm)
Range of Pressue Gauge for inlet line Assembly Gas Filter	1 to 3 Kg/cm2 3392533	1 to 3 Kg/cm2 3392533	1 to 3 Kg/cm2 3392533	1 to 3 Kg/cm2 3392533	1 to 3 Kg/cm2 3392533	1 to 3 Kg/cm2 3392533
Gas Shut Off Valve (Electrical)	3872384	3875535	3872384	3872384	3875535	3875535
1st stage Regulator	3875040 1" BSP	3875040 1" BSP	3875041 1.5" BSP	3875041 1.5" BSP	3875041 1.5" BSP	3875042 2" BSP
Gas Flow m3/h 1st stage regulator	60-80	60-80	100-120	100-120	100-120	200-220
Range of Pressue Gauge 1st stage	0 to 1 Kg/cm2	0 to 1 Kg/cm2	0 to 1 Kg/cm2	0 to 1 Kg/cm2	0 to 1 Kg/cm2	0 to 1 Kg/cm2
2nd stage Regulator Gas Flow / regulator	3875043 (1.5" BSP) Qty.1 60-80	3875043 (1.5" BSP) Qty.1 60-80	3875044 (1.5" BSP) Qty.1 100-120	3875043 (1.5" BSP) Qty.2 60-80	3875044 (1.5" BSP) Qty.1 100-120	3875044 (1.5" BSP) Qty.2 100-120
Range of Pressue Gauge 2nd stage	0-400 mill bar	0-400 mill bar	0-400 mill bar	0-400 mill bar	0-400 mill bar	0-400 mill bar

NOTE : Part Nos. are for reference only. It may change without notice.

TABLE - 4 : MAXIMUM CURRENT AT VARIOUS POWER FACTORS FOR 415V ALTERNATOR (3 PHASE)

SN	KVA	KW	Current @ 0.8 PF		Current @ 0.85 PF		Current @ 0.9 PF		Current @ 0.95 PF		Current @ 1.0 PF	
			100 % Load	80 % Load	100 % Load	80 % Load	100 % Load	80 % Load	100 % Load	80 % Load	100 % Load	80 % Load
1	2000	1600	2782	2226	2619	2095	2473	1979	2343	1875	2226	1781
2	1875	1500	2609	2087	2455	1964	2319	1855	2197	1757	2087	1669
3	1500	1200	2087	1669	1964	1571	1855	1484	1757	1406	1669	1336
4	1250	1000	1739	1391	1637	1309	1546	1237	1464	1172	1391	1113
5	1000	800	1391	1113	1309	1048	1237	989	1172	937	1113	890
6	750	600	1043	835	982	786	927	742	879	703	835	668
7	625	500	870	696	818	655	773	618	732	586	696	556
8	500	400	696	556	655	524	618	495	586	469	556	445
9	450	360	626	501	589	471	556	445	527	422	501	401
10	380	304	529	423	498	398	470	376	445	356	423	338
11	320	256	445	356	419	335	396	317	375	300	356	285
12	285	228	397	317	373	299	352	282	334	267	317	254
13	250	200	348	278	327	262	309	247	293	234	278	223
14	225	180	313	250	295	236	278	223	264	211	250	200
15	200	160	278	223	262	210	247	198	234	187	223	178
16	180	144	250	200	236	189	223	178	211	169	200	160
17	160	128	223	178	210	168	198	158	187	150	178	142
18	140	112	195	156	183	147	173	139	164	131	156	125
19	125	100	174	139	164	131	155	124	146	117	139	111
20	100	80	139	111	131	105	124	99	117	94	111	89
21	82.5	66	115	92	108	86	102	82	97	77	92	73
22	62.5	50	87	70	82	65	77	62	73	59	70	56
23	50	40	70	56	65	52	62	49	59	47	56	45
24	45	36	63	50	59	47	56	45	53	42	50	40
25	40	32	56	45	52	42	49	40	47	37	45	36
26	35	28	49	39	46	37	43	35	41	33	39	31
27	30	24	42	33	39	31	37	30	35	28	33	27
28	25	20	35	28	33	26	31	25	29	23	28	22
29	20	16	28	22	26	21	25	20	23	19	22	18
30	15	12	21	17	20	16	19	15	18	14	17	13

Note : 1. For H.T. alternators, please refer manufactures specifications.

2. Resistive and water loads have unity power factor.

PRE-INSTALLATION CHECK LIST

Customer Name :_____DG Set Rating_____ ESN :_____

Is room layout / system drawings available with customer/GOEM? If yes attach one copy to this checksheet.	Yes	No

Genset Location

Location : Ground Level / Basement (First / Second) / Roof top / Acoustic enclosure Genset should be located considering local wind flow direction. There should not be obstruction to natural wind flow.	Yes	No

Genset should be located away from dusty atmosphere (acidic fumes/dust/fibers/chemical etc.)

Room Layout

Size : Length _____ Breadth_____ Height_____

For multiple sets ensure minimum distance between DG sets as per guidelines

Proper & sufficient openings in engine room for ventilation as per guidelines.	Yes	No

Remarks:

Room Ventilation :

Recommended openings for radiator cooled engines. Actual size at front & rear_____	Yes	No
Provision for forced ventilation in HE cooled engines	Yes	No

Remarks:

Foundation:

Size: Length_____ Breadth_____ Height_____

DG Set placement provides area for service personnel to move around the DG set	Yes	No

Remarks:

Air system :

Heavy duty air cleaners for dusty environment	Yes	No
Fresh air ducting for fibrous conditions to prevent early choking of air cleaner	Yes	No
Suitable orientation of Radiator cooled sets to avoid fiber/ Dust entry in DG room	Yes	No

Exhaust system:

Correct size of exhaust piping as per model /KV Rating to ensure back pressure within specs.

Pipe size._____

Silencer should preferably be located outside DG Room.	Yes	No
Insulation & lagging of exhaust pipes/ silencer inside DG Room (except elbow & bellow).	Yes	No

Provide shortest exhaust pipe routing with minimum number of bends	Yes	No
Thimble in side wall	Yes	No
Exhaust pipe should be properly supported to avoid load on Bellow/Turbo	Yes	No
Exhaust outlet orientation in wind flow direction	Yes	No
Chimney / Common ducting as per recommendations	Yes	No

Remarks:

Cooling system:

No immediate obstruction in front of radiator

Location of cooling tower to ensure shortest possible pipe routing with minimum number of bends	Yes	No
Size of raw water piping to ensure flow as per recommendations _____	Yes	No
Raw water as per recommendations	Yes	No
HE raw water plumbing as per recommendations for multiple set installation	Yes	No
Ensure use of strainer / Cleaners / Valves / Instrumentation in raw water piping	Yes	No
Cooling tower selection as per recommendations / site conditions.	Yes	No

Remarks:

Tank location as per recommendation (should not obstruct free movement)	Yes	No
Shortest fuel pipe routing with minimum number of bends	Yes	No
Gravity feed of minimum 300 mm (12 inch) above fuel pump inlet line for critical start AMF sets	Yes	No

D. G. Control Panel:

Location should not obstruct flow of fresh air

Should not obstruct movement

Proper visibility

Cabling as per recommendation

NOTE: Following Installation discrepancies to be corrected, prior to Genset installation.

1) .....
2) .....
3) .....
4) .....

The above recommendations have bee discussed.

(Name, Signature & Designation)	**(Name, Signature & Designation)**	**(Name, Signature & Designation)**
OEM Engineer	**Dealer Engineer**	**Customer**

Suggested Log Book Format

DG # 1 **LOG SHEET**

CUSTOMER NAME :	DG SET RATING :	DATE:

ENGINE SR. NO. :	ENGINE MODEL :	ALTERNATOR MAKE :	ALTERNATOR FRAME :	ALTERNATOR Sr. No. :

BY CLOCK	LUBE PRESS	LUBE OIL TEMP.	WATER TEMP.	CURRENT (AMPS)			VOLTAGE (V)			POWER	POWER FACTOR (LEAD / LAG)	FREQ	UNIT GENERATION	HOUR METER READING
Start Time	kg / cm^2	Deg. C.	Deg.C.	R	Y	B	R-Y	Y-B	B-R	KW		Hz.	KWH	
0700														
0800														
0900														
1000														
1100														
1200														
1300														
1400														
1500														
1600														
1700														
1800														
1900														
2000														
2100														
2200														
2300														
2400														
0100														
0200														
0300														
0400														
0500														
0600														

DG STARTING TIME :	
DG STOPPING TIME :	

SUMMARY

Hours Run	Today	
	Cumulative	
Units Generated (KWH) (based on Multiplying Factor)	Today	
	Cumulative	
Total Diesel Filled Today	Ltrs.	
Total Oil Topped Today	Ltrs.	
Coolant Topped Today	Ltrs.	
B Check – Last Carried	Date	
	Hrs.	
B Check – Next Due @ Hrs.	Date	
	Hrs.	
Air cleaner Element – Changed	Date	
	Hrs.	
Air cleaner Element – Cleaned	Date	
	Hrs.	

Room Temp (Deg. C) :		Ambient Temp (Deg. C) :	
Leakage's / Condition (If Not OK, give details)			
Fuel System		Belts & Hoses	
Lube Oil System		Safety Controls	
Cooling System		Battery / Chrg. Alt.	
Air Intake / Exh. Systems		Main Alt. / Panel	

Remarks :

Operators Name / Sign. / Date	Supervisors Name / Sign. / Date

Cummins Diesel Sales & Service (I) Ltd.

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Chennai	044-24416429, 24423412	044-24911120
Mumbai	022-22663566, 22662247	022-22660790
Raipur	0771-2521301, 2521311	0771-2521103
New Delhi	011-26431051, 26445756	011-26212817
Jaipur	0141-2370201, 2370356	0141-2363746
Lucknow	0522-2786718, 2787704	0522-2787880
Kolkota	033-22478065, 22472481	033-22473833
Guwahati	0361-2520399, 2635686	0361-2515604
Ranchi	0651-2241948, 2241521	0651-2242815

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Cummins has always been a pioneer in product improvement. Thus specifications may change without notice.

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