

Part – A4

Safety code of practice

Part – A4

Safety Code of Practice Applicable for engines other than Gasoline and Diesel

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1. SCOPE

This **A4** document lays down safety code of practice requirements for compliance to the rules vide notification no. GSR 804(E.) dated 3-Nov-2022 on emission limits for new internal combustion engine up to 800 kW gross power used for power generating set (Genset) application, issued by Ministry of Environment, Forests & Climate change, Government of India.

This document covers general safety, installation and Component testing requirements and methods of test for checking the functionality of NG/LPG Gensets as per various categories as mentioned below,

- a) Dedicated Genset means a Genset powered by a mono-fuel SI engine started and operating with only one fuel at a time. i.e. NG/LPG*
- b) A bi-fuel Genset means a Genset powered by an SI engine started and operating either on any one type of fuel at a time i.e. Petrol or NG/LPG*
- c) Dual fuel engine operation means a two-fuel system having diesel as a primary combustion fuel and NG/LPG as supplementary fuel, both in a certain proportion, throughout the engine operating zone. Such dual fuel Genset engine may operate on diesel stand-alone mode in absence of supplementary gaseous fuel i.e. NG/LPG*

*Alternate fuels - Natural Gas/Bio-methane, LPG (Fuel Specification of these fuels shall be as notified under CMVR as amended from time to time)

Genset to be certified as per safety code of practice as defined in this document at the time of applying for Type Approval of NVH certification. NVH TA certificate shall be issued only after successful completion of safety code of practice certification of the Genset.

2. REFERENCES

The following standards contain provisions, which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

Standard	Title
1364(Part 1): 2002	Hexagon head bolts, screws and nuts of product grades A and B Part 1: Hexagon head bolts (Size range M1.6 to M 64) (fourth revision)
1364(Part 3): 2002	Hexagon head bolts, screws and nuts of product grades A and B Part 3: Hexagon nuts, style 1 (Size range M1.6 to M 64) (fourth revision)
IS 2171:1999	Specification for portable fire extinguishers, dry powder (cartridge type) (fourth revision)
IS 3224:2002	Valve fittings for compressed gas cylinders excluding liquefied petroleum gas (LPG) Cylinders – Specification (third revision)
IS 2379:1990	Pipelines – Identification – Colour Code
IS 6044:2000	Code of practice for liquefied petroleum gas storage installations
GSR 1109 (E) dtd. 13.10.2015	Stationary and Mobile Pressure Vessels (Unfired) Rules (SMPV)
Gas Cylinder Rules, 2016	Released by Petroleum & Explosives Safety Organization (PESO)
IS 2878:2004	Fire Extinguisher, carbon di-oxide type (portable and trolley mounted) specification
IS 7285 (Part 1):2004	Refillable Seamless steel gas cylinders – Specification
Indian Explosives Act- 1884	Indian Explosives Act- 1884
	Stationary and Mobile Pressure Vessels (Unfired) Rules (SMPV)
IS 5844: 2014	Hydrostatic stretch testing of compressed gas cylinders - Recommendations
IS 5903:1970 (2006)	Recommendation Safety Devices of Gas Cylinders
IS 15720: 2008	Road vehicles - Compressed natural gas (CNG) fuel system components - Compartments/sub-compartments
IS 15715:2008	Road vehicles - Compressed natural gas (CNG) fuel system components - Conduits
IS 15716:2006	Road vehicles - Compressed natural gas (CNG) fuel system components - CNG high Pressure fuel line (RIGID) with end connections having pressure exceeding 2.15 MPa
IS 3224:2002	Valve Fittings for Compressed Gas Cylinders

3. DEFINITIONS

1. **“Applicable emission limit”**: Means an emission limit to which an engine is subject to for approval
2. **“Approval of an engine (engine family)”**: Means the approval of an engine type with regards to the level of the emission of gaseous, particulate and smoke pollutants;
3. **“Approval of an engine”**: Means the approval of an engine type or family with regard to the level of emission of gaseous and particulate pollutants by the engine;
4. **“Authorized Person”**: A person, normally a well-acquainted workshop person, authorized by the Genset manufacturer for specially trained for installation, maintenance and periodic inspection of bi-fuel / dedicated /Dual fuel Gensets
5. **“Bi-fuel Genset”**: Means a Genset powered by an SI engine started and operating either on any one type of fuel at a time i.e. Petrol or NG/LPG
6. **“Compressed natural gas (CNG / BIO CNG)”**: Means a compressed gaseous fuel composed predominantly of Methane (CH₄) shall be used as specified by the Government of India from time to time.
7. **“Declared power (kWm)”**: Means rated gross mechanical power declared by manufacturer for type approval at declared rated speed.
8. **“Dedicated Dual fuel engine”**: Dedicated Dual fuel engine operation shall mean a two – fuel system having diesel as a primary combustion fuel and CNG or Bio CNG or LPG as supplementary fuel and such dedicated dual fuel engine shall not operate on diesel stand-alone mode in absence of gaseous fuel or operation of the engine in diesel mode only shall be restricted by reduced power output to 40 percent to cater limp home mode and in such dedicated dual fuel engine, mass emission test will be carried out in dual fuel mode only.”
9. **“Dedicated NG or LPG (Alternate Fueled) Genset engine”**: Shall mean a mono-fuel engine starting and operating with only one fuel, i.e., NG or LPG
10. **“Dual fuel engine”**: Shall mean a two – fuel system having diesel as a primary combustion fuel and CNG or Bio CNG or LPG as supplementary fuel. Such dual fuel engine may operate on diesel stand-alone mode in absence of gaseous fuel.
11. **“Electronic control unit (ECU)”**: Means an engine’s electronic device that uses data from engine sensors to control engine parameters as primary function. ECU may contain more functionality than stated above of interest;

12. **“For Domestic products”**: Date of Manufacture means the date on which the engine is invoiced;
13. **“For Imported products”**: Date of Import means the date of payment of custom duties applicable to the engine or Genset;
14. **“GENSET manufacturer”**: Every manufacturer, importer or assembler (hereinafter referred to as the ‘manufacturer’) of the dedicated NG or LPG engine (hereinafter referred to as ‘engine’) for genset application manufactured or imported into India or dedicated NG or LPG genset (hereinafter referred to as ‘product’), assembled or imported into India.
15. **“Liquefied Natural Gas (LNG)”**: Means a Natural gas that has been cooled to -259 degrees Fahrenheit (-161 degrees Celsius) and at which point it is condensed into a liquid which is colorless, odorless, non-corrosive and non-toxic. Characterized as a cryogenic liquid. Fuel quality for GENSET use shall meet the requirements of BIS specification as notified from time to time by MoPNG, Govt. of India.
16. **“Liquefied Petroleum Gas (LPG)”**: Hereinafter referred as LPG: means a mixture of certain light hydrocarbons derived from petroleum which are gaseous at normal ambient temperature and atmospheric pressure but may be condensed to the liquid state at normal ambient temperature by the application of moderate pressure and meet specification as notified by the Government of India from time to time.
17. **“Manufacturer”**: Means engine or Genset manufacturer, importer or, assembler (as noted in notification);
18. **“Placing on the market”**: Means the action of making available a product covered by this Regulation on the market of a country applying this Regulation, for payment or free of charge, with a view to distribution and/or use in the country
19. **“Power generating set or Genset”**: Means any equipment which is used for electric power generation in absence or failure of grid power utilizing engine system defined in this document as prime mover;
20. **“Type approval”**: Means the approval of an engine type with regard to its emissions measured in accordance with the procedures specified in this regulation.

4. ABBREVIATIONS

BIS	Bureau of Indian Standards
CC	Cubic Centimetre
CI	Compression-ignition (Engine)
COP	Conformity of Production
COP-Year	Period starting 1st July of year till 30th June of subsequent year
CPCB	Central Pollution Control Board
ECM	Electronic control module
EGR	Exhaust gas recirculation
GOEM	Genset Original Equipment Manufacturer
ISO	International Organization for Standardization
LPG	Liquefied Petroleum Gas
PI	Positive Ignition (Engine)

5. SAFETY REQUIREMENTS

5.1 General Design Requirements

- 5.1.1 The NG/LPG fuel system components shall comply with this standard. The Equipment and systems, approved by the relevant Test Agency notified by MoEF/CPCB, shall be used.
- 5.1.2 The high-pressure system shall be designed on the basis of the service pressures.
- 5.1.3 For bi-fuel Gensets, provision shall be made to avoid accelerated deterioration of the non - NG/LPG fuel system as a result of sustained operation on NG/LPG. Such measures shall be as recommended by the original Genset manufacturer (for example, fuel hoses etc.).
- 5.1.4 All fuel system, Genset and its engine components shall fulfil the following conditions:
They shall withstand the environmental temperatures and other environmental conditions safely during their operational life.
- a) They shall be located with full guard for anticipated damage while the Genset is being used safely. Such damage may be caused by the Genset itself, by extraneous factors such as heat, Genset engine chemical splash (Fuel, oil, cooling liquid, etc.) or by rust.
 - b) They shall be located so that they will not suffer corrosion damage by accumulation of water or any type of chemicals.
 - c) The blow by of Gaseous fueled engine shall be properly vented out of Canopy of the Genset assembly.
 - d) All the fuel lines used for Genset application shall have color coding as per IS 2379
 - e) Confirmatory of Production (CoP) testing and its periodicity for NG/CNG/LPG regulators or any other kit components for Genset application shall be as per CMVR applicable for Genset run on NG or LPG, from time to time as per policy of Government of India.
- 5.1.5 Gas cylinder valve(s) shall be approved by PESO & it shall be located with suitable protection in an accessible and safe place.
- 5.1.6 Cylinder valves
- 5.1.6.1 The NG fuel system shall include:
- a) An automatic shut off valve.
 - b) A manual or manual override valve located on each gas cylinder or PNG line.
- 5.1.6.2 LPG valve(s)

LPG valve assembly / cylinder valve and its manifolding system used for Genset application shall conform to requirements of IS:6044-Part 1(amended from time to time). Cylinder Valve shall be approved / endorsed by Petroleum Explosive Safety Organization (PESO) Govt of India.

5.1.7 The NG fuel system may include a device (excess flow valve) inside the gas cylinder or a functionally equivalent system to control gas leakage in the event of a rupture in the fuel supply system.

5.1.8 The automatic shut off valve shall be in closed position when engine is not running and only be open when:

- a) NG/LPG operation has been selected, either manually or automatically, and
- b) The engine is cranking or running.

5.2 Cylinder for CNG/LPG or PNG

5.2.1 Design approval.

5.2.1.1 CNG Cylinder(s) used in Cascade form for Genset application shall be approved / endorsed by the Petroleum Explosives Safety Organization (PESO), Govt of India as per Gas Cylinder Rules, 2016 (as amended from time to time).

5.2.1.2 LPG Cylinders (Industrial/Commercial) used for Genset application shall be approved / endorsed by the PESO. Single LPG cylinder shall not be used for Genset application. Usage of Domestic LPG cylinder(s) for Genset application is strictly prohibited.

5.2.1.3 PNG line including its joints and connection for Genset application shall be approved / endorsed by the City Gas Distribution Company (CGD) or Gas Dispensing Agency, as approved by Govt of India from time to time.

5.2.2 Periodic retesting of CNG/LPG cylinder (s) shall be carried out as per Gas Cylinder Rules 2016 as amended from time to time.

5.3 Fittings on CNG cylinders & its Cascades and filling connection

5.3.1 CNG Cylinder Valve - Each cylinder shall have a manual cylinder shut off valve mounted directly on it capable of shutting off all gas flow from that cylinder. Cylinders and shut-off valve assemblies shall be approved / endorsed by PESO, (including for storage/ refilling permission) as per IS 3224 and Gas Cylinder Rules, 2016 (as amended from time to time).

5.3.2 CNG Filling Connection - The filling connection shall be of the NZS/NGV-1 or any other type as specified by the Government of India from time to time. The filling connection shall be provided on structure of Cascade of CNG cylinder(s).

The basic dimensions for NZS for CNG type are as given in AIS 028 and recommended sizes of NGV – 1 type of filling connections are SAE 9/16” and 7/8”. However, the Genset manufacturer / kit installer may seek the guidance from The Gas Authority of India Ltd. / Ministry of Petroleum and Natural Gas about the use of specific type of NGV – 1 nozzle.

5.3.3 The NZS type filling connection shall be provided with a captive dust plug and NGV-1 type filling connection shall be provided with dust protection cap.

5.3.4 Position of filling connection - The filling connection shall be located in suitably protected and ventilated location of Cascade or CNG/LPG Cylinder mounting structure, and shall comply with the following:

- a) The filling connection is made and filling is supervised from outside the Cylinder mounting Structure.
- b) The filling connection is protected by being located by providing suitable mean.
- c) The filling connection shall be mounted in such a manner as to resist, without permanent deformation of the mounting attachment, a proof load of 50 kgf applied in any direction. The proof load shall be applied by full engagement of the filling connection and shall be representative of attempted movement of the Cylinder/ its Structure while refueling.
- d) The filling operation can be carried out without requiring the operator to lie or crawl or be otherwise subjected to inconvenience, discomfort or hazard.

5.3.5 Non-igniting material: Filling connections material shall be of non-igniting material.

5.3.6 Non-Return Valve: There shall be a non-return valve fitted on the refuelling line to prevent the return flow of gas from the cylinder to the filling connection. The non-return valve shall be located as close to the filling connection as it is practicable.

5.3.7 Excess Flow Valve: A device may be fitted in the fuel line preferably at the inlet or outlet of the NG/LPG cylinder valve which prevents the total contents of the cylinder from discharging to atmosphere in the event of rupture to any part of the fuel line or components.

5.4 Location, Ventilation and Mounting of NG/LPG Cylinders

5.4.1 Cylinders, Fittings and Pipe work

5.4.1.1 Cylinders shall be located so that the safety characteristics shall not be adversely affected

5.4.1.2 Shielding to NG/LPG cylinders or NG/LPG joints & connection:

In case of NG/LPG cylinder or NG / LPG line shall be routed such that, it shall not get damage from loose metal or other objects being thrown up from the outside, effective shielding against these shall be provided.

5.4.1.3 The cylinder shall be situated and vented so that any gas escaping due to leakage from the cylinder valve shall not enter the Canopy space of Genset. Leak sensors shall be provided to avoid any fire hazard in case of leakage.

5.4.1.4 The clearance between the cylinder(s) and the exhaust shall not be less than 75 mm. or Heat shielding is must.

5.4.1.5 Cylinders and/or NG /LPG pipeline shall not be fitted in any inaccessible position.

5.4.2 Effective protection to Cylinder/NG/LPG line:

- a) The whole body of the cylinder(s) together with its attached components Shall not be fitted inside the Canopy of Genset
- b) The valves and pipe connections associated with or attached to the cylinder shall be well ventilated to the atmosphere. Provision shall be made for ready access to the cylinder valve in all installation arrangements.

5.5 Cylinder(s) installation

5.5.1 LPG Cylinders Mounting Safety:

LPG Cylinders, valve assembly and manifolding system used for Genset application shall conform to requirements of IS:6044 (amended from time to time) and following requirements shall be met:

- a) Those responsible for the installation of cylinders, equipment and piping should understand the characteristics of LPG and be trained in good practice of handling, installing and maintaining installations.
- b) Cylinders and cylinder valves shall comply with the standard approved by the Chief Controller of Explosives (CCoE). All other equipment such as pressure regulators and other installation material shall comply with distributing company's stipulations and meet IS specifications, wherever available. Wherever any thread joint is provided, a suitable jointing compound be used on male thread.
- c) Gas piping shall be of the color stipulated by the explosive authorities to distinguish it from other piping and the piping shall be painted silver grey with red band of 150 mm width.
- d) Fire extinguishers of dry powder type (see IS 2171) or carbon dioxide (see IS 2878) type shall be provided in places where LPG cylinder installations are situated and shall be located near

such installations. Two buckets filled with sand and two with water shall also be installed nearby. The number, type and size of the fire extinguishers for LPG shall be as per IS 6044 (Part 1) amended from time to time

- e) If total weight of gas exceeds 100 kg, then license is required to be obtained from PESO as per Gas Cylinder Rule 2016 (amended from time to time)
- f) Before any system of gas piping is finally put into service, it shall be carefully tested to ensure that it is gas-tight.
- g) Naked flames shall never be used for checking gas-tightness of the installation.

5.5.2 CNG Cylinders & its Cascade Safety:

5.5.2.1 Cylinders conforming to IS :7285 duly approved by PESO shall be used in CNG Cascade form. The Cascade shall be equipped with safety devices such as shut off valve, excess flow valve (if required), Check valve (if required), Pressure gauge etc.

5.5.2.2 The design, construction, manufacture, testing and other general requirements of the Storage Cascades should be strictly in accordance with the Applicable Standards and Codes and should comply fully with relevant Indian / International standards, Gas Cylinder Rules 2016, Indian Explosives Act- 1884, Stationary and Mobile Pressure Vessels (Unfired) Rules (SMPV), CNG Cylinder Design Code IS:7285 , CNG Cylinder Valves as per IS:3224, Hydrostatic Stretch Test as per IS: 5844, Safety Devices of Gas Cylinders as per IS : 5903, etc. and their amendments time to time.

5.5.2.3 CNG cascade and its storage area shall be equipped with the following safety equipment / firefighting equipment:

- a) The burst disc shall rupture on excess pressure as well as excess temperature either individually or in combination. Discharge from the burst discs shall be manifolded to a common header for safe venting.
- b) The sizing of connecting tubing between each outlet and its associated cylinder shall be such that where they join the total incoming flow areas shall not be less than the total outgoing area. The loops in the tube work shall be provided for absorbing contraction, expansion and vibration. Piping/ tubing shall be suitably clamped to the frame structure.
- c) Cylinders installed horizontally should be separated from one another in each storage unit by a distance of not less than 30 mm. The material used to separate the cylinders should be sufficiently strong enough and should not absorb moisture. Special precautions should be taken to avoid corrosion at the point of contact.
- d) CNG cascade structure shall be made of corrosion resistant material and to be protected by painting or other equivalent means necessary to prevent corrosion. All structural items

used in the frame shall be weather proof. Frame shall be suitably covered with canopy from top to avoid the ingress of rain water.

- e) All manifold piping to be tested after assembly to a pressure equal to that of the pressure relief device setting and shall be leak free.
- f) Every CNG storage unit including each manifold group or bulk storage tank should be provided with a suitable pressure gauge for each bank. The pressure gauge should be directly connected to the tank or storage system. The dial gauge should be graduated to read approximately double the operating pressure. Pressure gauge should be equipped with 3-way relief/ isolation valve.
- g) All cylinder tubing, manual isolation valves and pressure relief valves should be protected from hitting by any moving object and should not protrude outside the metal frame or brackets.
- h) Flame proof light shall be used inside Cascade area.
- i) Leak Detection Sensor(s) shall be used.
- j) Fire Extinguishers and sand buckets shall be used as per Gas Cylinder Rules 2016.
- k) Remote Operated valve / Solenoid valve shall be used.
- l) Quick release Coupling (if required) and Vent to release pressure before disconnection of quick release coupling hose shall be used.
- m) Water Sprinkling arrangement shall be used, if required, above cascade storage area.
- n) Safety Sign board, such as - No smoking, No mobile, Entry Restricted for Authorized Person Only, etc. - shall be displayed on all four sides of the storage area.
- o) If total number of CNG cylinders exceed 25 Nos and/or the total weight of CNG exceeds 200 kg., then license is required to be obtained from PESO as per Gas Cylinder Rules 2016 (amended time to time).

5.5.2.4 CNG Cylinders shall be securely attached to structure of Cascade to prevent slipping; rotating and jarring loose, in accordance with the following requirements:

- a) The method of attachment shall not cause undue stresses or wear in the cylinder shell;
- b) The mounting method shall not significantly weaken the mounting structure, and reinforcement shall be added where necessary to ensure compliance with (c) below. An air gap of not less than 5 mm shall be provided between the cylinders and its mounting structure and in between cylinders.
- c) The force necessary to separate the cylinder from the e shall not be less than 20 times the mass of the full cylinder in any direction.
- d) The strength of the anchorages may be established by static test (forces directed through the center of mass of the cylinder).

- e) In the absence of testing or where calculations are impracticable, the following design requirements shall apply:
- i. There shall be at least 4 points of attachment to the mounting structure. The spacing between these shall be sufficient to ensure the stability of the cylinder. These bands shall not mask the identification markings of the cylinder.
 - ii. Where a cylinder is anchored to steel sheet metal the sheet metal shall be reinforced by a plate of not less than 3600 mm² and a thickness of not less than 2.5 mm or appropriate thickness supported by the calculation or test report. It is preferred that a round washer be used but where a square plate is fitted the corners shall be rounded. Any such reinforcement plate/washer shall be contoured to the shape of the sheet metal or mounting structure.
 - iii. Where anchorage bolts pass through a hollow section, provision shall be made to prevent collapse of that section under load.
 - iv. Anchorage bolts or studs shall have a diameter not less than that shown in Table 1 and shall conform to strength grade 8.8 of IS 1364 (Part 1) and nuts also to IS: 1364 (Part 3).
 - v. Where clamping bands are used, at least two steel bands per cylinder shall be provided, the dimensions, of which shall not be less than those in Table 1.
 - vi. Screwed fasteners or clamping devices shall either be inherently resistant to loosening or be locked or pinned after tightening.

Table 1: Band and Bolt or Stud Dimensions

Cylinder size (water capacity in l) Over, up to and including (l)	Band dimensions – Minimum nominal size (mm)	Bolt or stud diameter for strap or flange mountings minimum nominal size (mm)
0 -30	30 x 2	10
30-100	30x3	10
100 150	50 x 6	12
Above 150	Specific design required	--

NOTE: To prevent possibility of external corrosion where clamping bands are used, check that the material of the padding / lining provided for inner side of cylinder mounting band (s) is made up of EPDM rubber (hardness Shore A 60 min.) as approved by the test agency during type approval certification. Similar adequate protection to the cylinder shall also be provided wherever the cylinder rests against other metal objects such as the mounting frame.

5.5.3 Cylinder Manifolding

CNG Cascade cylinders to be manifolded together in such a way that all cylinders can be simultaneously filled from any filling point. Each cylinder shall retain its required individual NG/LPG cylinder valve/MFV respectively.

In case of LPG cylinders and its Manifolding, Non-Return Valves (NRVs) shall be used to avoid flow of gas from one cylinder to another and installation shall meet requirements of IS:6044 (part 1) as amended from time to time

5.5.4 Cylinder identification markings should be capable of being read when in the installed position.

5.6 Shielding

Cylinders/ NG/LPG joints shall be installed to ensure that valves and connections on cylinders/NG/LPG line shall be protected to minimize the possibility of damage due to accidental contact with stationary objects or from loose objects thrown up from outside.

5.7 Construction of compartments and sub-compartments

5.7.1 A cylinder compartment or sub-compartment shall be provided if cylinder is mounted in the enclosed space & comply with the following requirements & shall meet component test requirements as per IS 15720.

- a) Construction shall be such that any gas which might leak from any fittings, component or piping, cannot pass to any other enclosed compartment canopy space.
- b) It shall be possible to operate the cylinder service shut-off valve in the installed position. The valve may be arranged so that it can be operated from some internal area ~~of the Genset Canopy~~. Gas installation provided that the sealing of the compartment or sub-compartment shell is maintained by one of the following means, as appropriate:
 - i. If a valve actuating device passes through the shell a gas-tight seal shall be provided.
 - ii. If the actuating handle is wholly within the shell, access shall be a gas-tight captive hatch. The design shall not need tools to open the hatch.
- c) A compartment or sub-compartment shall not contain ignition sources or electrical equipment or wiring unless it is intrinsically safe.

5.7.2 Ventilation

One or more vents to the outside of the enclosed space shall be provided, the aggregate area of which shall not be less than 550 mm². The vent line shall be so located as to exhaust any gas, which may accumulate in the compartment or sub- compartment to atmosphere and shall not exit less than 75 mm from an exhaust pipe or other heat source of Genset.

5.7.3 Ducting

5.7.3.1 All piping or hoses that pass through an enclosed space shall be within a conduit gas-tight, vented unobstructed to outside atmosphere and protected from external damage and shall meet component test requirements as per IS 15715 (for NG/CNG) /AIS 26(LPG) and comply with the following requirements:

- a) The ducting shall be as short as practicable.
- b) The connections shall be mechanically clamped and shall not depend on adhesives or sealing compounds to retain them in place. Protection in the form of a gasket shall be provided to prevent damage to the ducting material by the clamping device.

- c) The material of the conduit used for ducting shall be sufficiently strong to resist mechanical damage, preserve venting integrity, protect the piping or hose within it, shall not support combustion

5.7.3.2 Where the sub-compartment is removed to initiate repairs or at the periodic inspection special attention shall be given to the inspection of the material to ensure that no degradation of material has taken place. Any sub-compartment showing signs of degradation shall be replaced.

5.7.3.3 The cylinder valve actuating device position shall be clearly identified and shall have provided adequate material to allow closing of the valve without damage to the sub-compartment sealing.

5.7.3.4 The pliable sub-compartment (for NG) shall be shielded or installed in a protected location to prevent damage, from unsecured objects and abrasion. The material shall be sufficiently strong to resist mechanical damage, preserve venting integrity, shall not support combustion.

5.8 NG/CNG/LPG Fuel Line

5.8.1 NG/CNG fuel line - pressure exceeding 100 kPa (high pressure fuel line)

5.8.1.1 Rigid piping and connections for use with pressures exceeding 2.15 MPa shall be made up of cold Drawn Steel/ SS and conform to IS 15716. In case of PNG, the pipeline shall be approved by CGD company.

5.8.1.2 CNG/PNG fuel line and connections for use with pressures exceeding 100 kPa but less than 2.15 MPa shall be tested as per IS 15722 or the pipeline shall be approved by CGD company.

5.8.2 Flexible hose exceeding 2.15 MPa

5.8.2.1 NG Flexible hose shall meet the requirements of AIS 028. Each flexible hose assembly shall be permanently and clearly marked with the manufacturer's name and trademark, type, size and design working pressure. It shall be identifiable as being suitable for CNG/PNG use either by marking it with 'CNG/PNG' or with a specification mark.

5.8.3 LPG pipe line shall meet requirements as specified in IS:6044(part 1) as amended from time to time.

a) **Inspection:** At the time of periodic inspection the hose shall be inspected for twists, kinks and damage or abrasions to the cover which expose the wire. The hose shall be condemned on detection of any one of these defects. At no time shall flexible hose be placed back into service after removal from the Genset Engine.

b) Joints and connections:

- i. The number of joints and connections shall be the minimum for the inclusion of all components.
- ii. Joints or connections in LPG fuel lines shall be in accessible positions for easy inspection.

c) Flexibility

- i. Low pressure hose shall be of sufficient length and flexible to accommodate engine movement.
- ii. High pressure fuel line shall be installed so as to accommodate any relative movement between chassis/body and fuel system components or temperature variations in the fuel line.

5.8.4 All runs or rigid fuel line piping between any two components shall be installed with a 'pigtail' or U bend to provide this essential flexibility.

5.8.5 Inspection

5.8.5.1 The hose shall be inspected for twists, kinks and damage or abrasions to the cover, which expose the wire. The hose shall be condemned on detection of any one of these defects.

5.8.5.2 At no time shall flexible hose be placed back into service after removal for service.

5.8.5.3 Joints and connections for CNG.

5.8.5.4 Every joint or connective fitting in rigid high-pressure fuel line shall be as per IS 15716.

5.8.5.5 The number of joints and connections shall be the minimum for the inclusion of all components.

5.8.5.6 Joints or connections in a CNG/PNG fuel line shall be in accessible positions for easy inspection.

5.8.5.7 Connection means shall provide positive retention of the fuel line in the fitting (e.g. by double inverted flaring of the tube end or by ferrule type compression fitting).

5.8.6 Securing and location.

CNG/PNG /LPG pressure piping and hoses shall comply with the following:

- a) CNG/PNG/LPG fuel line inside the part of any Canopy shall have leak free joints.
- b) All CNG/PNG/LPG fuel lines shall be positioned for protection from the possibility of damage by impact, accident or loose objects.

- c) CNG/PNG/LPG fuel lines shall not be located inside box sections or in other inaccessible locations nor shall they be installed in any location, which is not adequately protected from sources of heat, abrasion, or from impact.
- d) Fuel lines shall follow the shortest practical route considering the requirements
- e) Rigid fuel lines shall be effectively secured by clips spaced not more than 600 mm apart. In order to prevent the possibility of fretting corrosion or erosion of the fuel line cushioning must be provided to protect the fuel line from both the mounting structure and the clips themselves. Suitable grommets must be provided where the fuel line passes through any panel of Canopy.
- f) PNG/LPG pipe line & Manifolds used in multi-cylinder shall be installed in a protected location. Manifold branch pipelines shall be sufficiently flexible to prevent damage to the lines, valves and fittings due to vibration, expansion or contraction.
- g) In no case shall the clearance between the exhaust system and the fuel line be less than 75 mm.
- h) Fuel lines shall not be installed where any part will be permanently hidden from sight or cannot be inspected or easily replaced.

5.8.7 All CNG/PNG fuel lines for use for service pressure not exceeding 100 kPa (low pressure hose) shall be of flexible material and shall meet requirements of IS 15722. Joints and connections for low pressure fuel lines shall be suitable for use with CNG/PNG and shall meet requirements of IS 15722.

5.8.8 Flexibility

5.8.8.1 Low pressure hose shall be of sufficient length to accommodate engine movement.

5.8.8.2 High pressure fuel line shall be installed so as to accommodate any relative movement between engine and fuel system components or temperature variations in the fuel line.

5.8.8.3 All runs of rigid fuel line piping between any two components shall be installed with a 'pigtail' or U bend to provide this essential flexibility. The dimension for U bend shall be not less than 50 mm radius at the bend portion of U or 100 mm diameter for the pig tail coil and number of coils shall not be more than two.

5.9 CNG/PNG/LPG Control Equipment

5.9.1 Definition

The CNG/PNG/LPG fuel control equipment includes all the equipment necessary to convert PNG/CNG/LPG at high pressure at the cylinder/PNG line to CNG/PNG air mixer/fuel injector for supply to the engine & shall meet requirements of corresponding component standards as applicable.

The Genset engine control equipment includes all the equipment used to convert a compression ignition engine to run on a dedicated gaseous fuel or Dual fuel (diesel + Gas). This includes devices such as fuel provision and control device, the ignition system (if one is used), the speed and/or load governing device (if any), and any engine protection devices such as temperature and pressure alarms, and knock detection systems.

5.9.2 Control Equipment

5.9.2.1 Filter

At the termination of every CNG/PNG/LPG service fuel line immediately prior to any regulator component there shall be a properly designed filter capable of removing all particulate matter from the fuel that could cause malfunction of such regulator components.

5.9.2.2 CNG/PNG/LPG shut-off valve

This valve shall shut-off fuel supply to the engine when activated by the fuel change over control on bi-fuel operation and by the ignition switch on single fuel operation. Normally this is a regulator component but, in any case, it shall be located downstream of the filter. This valve shall automatically shut-off the fuel supply to the engine unless the following conditions are satisfied:

- a) The ignition is on;
- b) The engine is turning;

5.9.2.3 Service shut-off valve

A service shut-off valve shall be installed in the high-pressure line between the cylinder valve and any other valve or component within the engine compartment and as close as practicable to the Regulator/vaporizer (for LPG), however it is acceptable to install the valve at the refuelling point. It shall be possible to readily operate the valve in the installed position at all times in particular during the refuelling operation. A permanent label shall be provided 'CNG/PNG/LPG service shut- off valve' or similar wording to positively indicate its purpose and a positive indication of "Closed" and "Open" positions of the valve shall be clearly marked.

5.9.2.4 Regulator (NG/CNG)/Vaporizer (LPG) system for Genset Engine

The regulator/vaporizer system shall not permit gas to pass after the engine has stopped turning, irrespective of whether the ignition is on or off. The regulator shall be installed so that:

- a) It is securely mounted as far as practical from the extremities of the Genset engine.
- b) It is mounted securely and as close to the engine Gas Air Mixer or Injector position as convenient.

- c) It is easily accessible for routine maintenance, adjustment and inspection.
- d) It is situated as far from the exhaust system as practical. Where this distance is less than 150 mm it shall be shielded from radiant heat and any impingement from exhaust gases due to exhaust system failure.
- e) It is reasonably protected from impact in a collision.
- f) It allows sufficient free movement of all hoses.
- g) The water circulating system (where required) is connected in accordance with the manufacturer's instructions, and no flow control valve in the system can shut-off original equipment water flow.
- h) Where possible, the regulator should be at lower level than top of the radiator, as insufficient water may cause freezing.

5.9.2.5 The regulator/vaporizer assembly shall not be attached to the engine assembly unless otherwise specified by the manufacturer and then shall be fitted only in accordance with the manufacturer's recommended instructions.

5.9.2.6 Gas air mixer /Injector

5.9.2.6.1 A backfire deflector to arrest back-fire shall be installed in the air intake immediately prior to the mixer/injector. The back-fire deflector shall meet the requirements of Annexure 2 of this standard.

5.9.2.6.2 In case of Genset engines more than 19kW & up to 800 kW, there shall be installed in the air intake prior to the mixer a backfire deflector (original air filter acceptable). In turbo charged applications where rigid piping is fitted from the turbo charger to the intake manifold a pressure relief valve shall be fitted as close as practicable to the intake manifold. Where a volume of gas/air mixer, due to turbo charging or inter/after coolers is contained downstream of the mixer, special precautions will need to be applied to avoid damage to components downstream of the mixer/injector due to backfire.

5.9.2.6.3 Genset manufacturer / kit manufacturer / kit supplier shall submit test report or certificate complying with the above requirement. It is not necessary to carry out the test if declaration is not submitted.

5.9.2.6.4 The mixer/injector shall be securely mounted and when remotely fitted shall be suitably bracketed to support its own weight and applied working forces.

5.9.2.6.5 There shall be no filter element fitted downstream of the gas air mixer/injector.

5.9.2.7 Bi- fuel /Dedicated/Dual fuel system.

Bi- fuel type.

- a) A bi-fuel system is defined as a system equipped to operate with either on CNG/PNG/LPG or some other fuel e.g. petrol.
- b) Dedicated fuel type. A dedicated system is defined as a system equipped to operate wholly on CNG/PNG/LPG.
- c) Dual fuel engine operation means a two-fuel system having diesel as a primary combustion fuel and CNG/PNG/LPG as supplementary fuel, both in a certain proportion, throughout the engine operating zone. Such dual fuel Genset engine may operate on diesel stand-alone mode in absence of supplementary gaseous fuel i.e. NG/CNG/LPG

For bi-fuel type

5.9.2.8 A shut-off device shall be installed in the bi-fuel fuel system. This device shall shut-off the optional fuel supply to the engine when this fuel is not required.

5.9.2.9 If the shut-off device is in the form of a solenoid operated shut-off valve it must be fitted between the fuel pump and the carburettor. The valve shall be mounted securely so that its weight is not transferred to any part of the carburettor or fuel lines.

5.9.2.10 Where the shut-off device is mounted remotely from the engine, flexible hose shall be used of sufficient length to accommodate engine movement. In all cases the device shall be mounted in a position reasonably protected from damage in a collision and shall be as far as practicable from high tension electrical equipment.

5.9.2.11 Bypass relief device

A bypass relief device shall be installed in the fuel pump or between the fuel pump and the automatic shut-off valve in the liquid fuel line to the carburettor on Genset engine equipped with bi- fuel systems for the use of petrol and gaseous fuel. The relief device need not be installed on fuel pumps containing a bypass relief device as original equipment.

5.9.2.12 Fuel selection control

A fuel selection control shall be provided which shall have at least three positions in case of bi fuel and two positions in case of Dual fuel, clearly marked for the selection of each of the two fuels or two mode of operation. The selection control shall be placed within easy reach of operator.

5.9.3 Installation

The CNG/PNG/LPG control equipment shall be:

- a) Installed in positions that are accessible for routine inspection, maintenance adjustment.
- b) Mounted securely and reasonably protected from damage in a collision.
- c) Remote from the Genset engine exhaust system or protected therefrom by a metal shield.
- d) No closer than is avoidable and practicable to any electrical equipment capable of sparking.

5.9.4 Electrical wiring used for CNG/LPG system.

5.9.4.1 All wiring shall be properly installed, taped, clipped or contained in a loom along its length.

5.9.4.2 Wiring cables shall comply with the requirements of IS 15719 or clause No 4.3 of AIS 028 or clause No 12 of 026. The kit supplier / kit manufacturer or Genset manufacturer shall submit test certificate / test report complying with requirements of IS 15719.

5.9.4.3 The electrical circuit shall be provided with a current limiting device conforming to IS 15723 or clause No 4.3 of AIS 028 or clause No 12 of 026. This equipment or fuse shall be dedicated to the CNG/PNG/LPG fuel system.

5.9.5 Connectors and terminals.

Connectors and terminals shall be insulated to prevent accidental earthing during operations or routine servicing.

5.9.6 Pressure indicator (NG)/ Level indicator (LPG)

5.9.6.1 A pressure/level indicator to indicate pressure in the CNG/PNG/LPG (in case of LPG ref IS:6044 requirements) system shall be fitted in an easily visible position to service personnel at the regulator or fill point preferably within the engine compartment.

5.9.6.2 A supplementary gauge or electronic gauge may be placed in the Genset Control panel provided any gauge shall be gas isolated from the cylinder or piping to prevent gas leaking into the compartment.

5.10 COMPLIANCE PLATE

In addition to Label as prescribed, a compliance shall be provided on LPG/CNG cylinder(s) structure/Cascade, displaying the following information, shall be installed near the filling connection and be clearly visible to the re-fueller:

NG/CNG CASCADE COMPLIANCE PLATE FOR GENERATOR • CNG cascade Cylinder Identification Number(s) • Date of Installation • Water Capacity (liter) of the individual cylinder of Cascade • water capacity (liter) of the Total Installation • Date of the Last test • Genset /engine identification No. • Next Due Date of Testing of each cylinder The NG installation complies with the safety requirements of Code of Practice issued by CPCB • Installed by

5.11 LABELS

5.11.1 Identification labels

Genset using a CNG/PNG/LPG system shall be labelled as follows:

Labels conforming with the following specification shall be affixed in a vertical position on Canopy & shall ensure visibility from the front sides.

Gensets, individually or as part of the product shall be clearly labelled on Canopy 'Dedicated NG/LPG Genset' 'bi-fuel NG/LPG Genset' or 'Duel fuel LPG/NG Genset' as the case may be.

5.11.2 The label shall always be in position, shall be in good condition, and the shape, colour and lettering shall be easily visible.

LPG COMPLIANCE PLATE FOR GENRATOR
• Date of Installation • Water Capacity (liter) of the individual cylinder • water capacity (liter) of the Total Installation • Genset /engine identification No. The LPG installation complies with the safety requirements of Code of Practice issued by CPCB and LPG Installation meets requirements of IS:6044 (Part 1) • Installed by

- a) All the engines, individually or as part of the product shall be clearly engraved on the cylinder block for respective Genset, as the case may be.
- b) The engine or the product shall be affixed with a conformance label meeting the following requirements namely: -
- i. The label shall be durable and legible.
 - ii. The labels shall be affixed on a part necessary for normal operation of the engine or the product and not normally requiring replacement during the life of the engine or the product.
- c) The conformance label shall contain the following information, namely: -
- i. Name and address of the manufacturer of engine or product, as the case may be;
 - ii. Statement that the engine or product conforms to the stipulation in the Environment (Protection) Rules, 1986;
 - iii. Type Approval certificate number for emission standards and Noise Limits;
 - iv. Date of manufacture of engine and the product or, the date of import of the engine and the product, as the case may be; and
 - v. Rated speed and corresponding gross power in kW for engine and 'Noise Limit viz. 75 dB(A) at 1m' for product.

6. INSTRUCTIONS TO BE PROVIDED BY THE GENSET MANUFACTURER

- a) Clear, concise printed instructions and diagrams, stated in terms clearly understandable and adequate for proper assembly, installation, maintenance and safe operation, shall be made available by the Genset manufacturer for CNG/PNG/LPG kit component and component package.
- b) Instructions for periodic maintenance of components, as required, shall be provided. Parts, which require replacement, shall be identified.
- c) Printed instructions shall state that the installation shall be in accordance with the prevailing regulations of Govt. of India or, in the absence of which, in accordance with this standard.
- d) This information shall be easily understood.
- e) An instruction manual shall be provided including specific instructions regarding NG/LPG operation and alerting the owner to the cylinder inspection and expiry date.

7. INSPECTION, TESTING AND COMMISSIONING BY GENSET MANUFACTURER OR AUTHORIZED PERSON APPOINTED BY GENSET MANUFACTURER

7.1 Commissioning

Prior to initial use, an inspection of the CNG/PNG/LPG system and components shall be carried out by, or under the supervision of trained person, who shall also carry out a complete examination to ensure the system complies of all relevant sections of this standard and any other statutory requirements as specified by the Central Government.

7.2 Initial inspection and installation certificate

The system shall be leak tested. The installation shall be inspected for compliance with this Standard and all components shall be checked for operational performance. In the case of bi-fuel/dual fuel installations, the ability for the Genset engine to operate on the optional fuel shall also be tested.

When the system conforms to this standard, an installation certificate, as per Annex D of this standard, signed by Genset Manufacturer/its authorized person shall be issued to the owner.

7.3 Periodic Inspection /preventive maintenance

The cylinder or NG/LPG manifold, piping and all components of the system shall be examined for corrosion, deterioration and for any modification affecting compliance with this Standard, at least once in a year or in case of malfunction or accident. The inspection shall include leak testing

NOTE: Every NG/CNG /LPG Genset manufacturer shall incorporate periodic inspection schedules in the operation and owner's manuals.

7.4 Leak Test

7.4.1 Initial Test

At the time of commissioning, the complete pressure system shall be subjected to a pressure test of 20 ± 1 MPa by using CNG or pressure of NG/LPG or a gas inert to NG/LPG such as Nitrogen.

Procedure:

- a) With vapor sealing removed from cylinder valve area, and cylinder valve closed slowly pressurize the system.

WARNING. The system must not be subjected to a shock loading as insecure fittings could blow out with dangerous results, and burst discs could rupture.

- b) Leak test lines, fittings and components using a non-corrosive foaming agent and when leak free.
- c) Open valve, pressurize system and check for leaks at valve and all joints.
- d) When the system is passed leak free seal venting area.

7.4.2 Where CNG/PNG/LPG is used for testing, the following precautions shall be observed:

- a) Testing shall be carried out under adequately vented conditions.
- b) Testing shall be carried out at least 5 m from any open flame or other source of ignition.

7.4.3 The operation of the equipment and controls shall also be tested with PNG/CNG/LPG under normal working conditions to prove satisfactory performance of the entire system and a further leak test shall be carried out using a non- corrosive foaming agent.

7.4.4 BCF fire extinguisher and dry powder fire extinguisher conforming to IS 2171 and each of 5 kg shall be kept ready within a safe distance. If ignition occurs the service valve should be closed and the extinguisher(s) used to quell any fire, which may continue.

7.5 Repair of NG/LPG System

7.5.1 Repairing of NG/LPG System

- a) There shall be no leaks in the fuel system
- b) There shall not be any ignition source within 3 m
- c) CNG/PNG/LPG fueled engines being repaired, unless the fuel is required for engine operation, shall have the shut-off valve closed and the CNG/PNG/LPG fuel in the service line exhausted by running the engine or depressurizing the line in a well-ventilated area
- d) Such NG Gensets undergoing repairs involving welding or the application of heat, to any part within 1 m of the cylinder/PNG connection, shielded from the source of heat.

7.5.2 Repair Operation

- a) Repair operation involving heat shall be carried out with due regard to fire safety.
- b) Damaged fuel lines shall not be repaired; in all cases they shall be replaced.
- c) Welding, brazing and the application of heat shall not be carried out on any part of the cylinder/PNG line subsequent to manufacture.

7.6 Scrapping of Cylinder

- 7.6.1 A Cylinder of Genset, which is about to be scrapped, shall have its cylinder removed prior to disposal.
- 7.6.2 Where the cylinder has been subjected to impact or fire damage the cylinder shall be inspected and re-tested by the owner of the Genset as per Gas Cylinder Rules, 2016, as amended from time to time.

NOTE: There will always be combustible gas in the cylinder until it has been cleared of all traces of flammable vapour or gas.

8. STATUTORY AUTHORITY APPROVAL

The type of component in question and its use determine the Statutory Authority Approval in respect of CNG/PNG/LPG fuel system components for Genset application. The Statutory areas of responsibility are:

Government Agency	Statutory powers	Scope of application
Ministry of Environment and Forest, Government of India. (MoEF) Central Pollution Control Board (CPCB) Test Agencies as notified by CPCB	Environment (P) Act 1986	All CNG/LPG kit components (excluding CNG/LPG cylinder & its valve(s)) and systems used for Genset application.
Petroleum and Explosive safety Organization (PESO), Government of India	Gas Cylinder Rules	CNG/LPG cylinder with valves and their accessories.
Ministry of Petroleum & Natural Gas (MoPNG) or CGD Company approved by PNGRB/MoPNG.	Petroleum Act	PNG Pipeline & its joints / connection

9. TYPE APPROVAL ADMINISTRATIVE PROCEDURE

9.1 Selection of Certifying Agency

9.1.1 Following test agencies are currently approved by the Nodal Agency Central Pollution Control Board (CPCB) for purpose of type approval and subsequently conformity of production compliance process and may be revised from time to time.

- a) Automotive Research Association of India (ARAI, Pune)
- b) International Centre for Automotive Testing (ICAT, Manesar)
- c) Indian Institute of Petroleum (IIP, Dehradun)
- d) Indian Oil Corporation Research and Development Centre (IOCL R&D, Faridabad).

9.1.2 One supplier shall submit application for Type Approval to only one certification agency for all its families / models out of those approved.

9.1.3 The same certification agency shall be responsible for carrying out the verification of Conformity of Production (COP) for that manufacture

9.1.4 For a new OEM or importer, selection of technical agencies for type approval certification and subsequently conformity of production shall be applicant's choice among the technical agencies published by central pollution control board (CPCB) and as amended from time to time.

9.1.5 For any reason if any manufacturer wants to change the certification agency, he shall apply to the nodal agency well in advance with justifiable reason. The nodal agency, after consultation with the existing certification agency/ standing committee, may approve the change, if found justified. If approved, the nodal agency shall inform to the parties concerned.

9.1.6 On receipt of information for change in certification agency from the nodal agency, the previous certification agency shall authenticate all the relevant document of the model (type approval as well as COP verification) and forward the same to the new certification agency. The certification agency shall be responsible for carrying out the type approval testing and COP verification for the manufacturer, in future.

9.2 Application of type approval

- 9.2.1 To apply for the safety type approval of the Genset, the engine should be certified for emission compliance first.
- 9.2.2 The noise certificate shall be granted to supplier once the safety certification is accomplished.
- 9.2.3 The application shall be made in the format prescribed in this document and must be complete in all respect.
- 9.2.4 For each engine family, the manufacturer must submit, an application to the certification agency.
- 9.2.5 The application must be signed by the authorized representative of the manufacturer.
- 9.2.6 It shall be accompanied by the undermentioned documents and the following particulars:
- 9.2.7 A description of the engine type comprising the particulars and all the necessary documents related to engine certification, fuel system test reports, Genset layout, etc. For the purpose of identification, the manufacturer shall designate the engines families as F1, F2, F3 Fn in consultation with technical agency;
- 9.2.8 The Testing agency shall intimate its decision to the applicant within a fortnight of receipt of the application, indicating need and plan (schedule) of testing for type approval.

9.3 Type Approval

- 9.3.1 No person or agency shall sale, import or use an engine for Genset application in India without valid Type Approval Certificate and Conformity of production Certificate
- 9.3.2 No person or agency shall sale, import or use a Genset in India containing an Engine without valid Type Approval Certificate and Conformity of production Certificate
- 9.3.3 The manufacturer may use of commercial fuels or reference fuels, provided to be declared in the information document.
- 9.3.4 Additionally, in order to receive type approval of a Genset with an approved engine with regard to emissions or a type approval of a Genset with regard to emissions the manufacturer shall ensure compliance with the installation requirements.

9.4 Certificate of Type Approval and Validity

- 9.4.1 After verification of engine(s) for the type approval, the technical agency shall issue a type approval report to manufacturer within one month from date of testing completion indicating acceptance or rejection decision and reason thereof.
- 9.4.2 The certificate shall be deemed to be valid for the model(s) included herein, unless explicitly withdrawn by separate written order by the Nodal Agency;
- 9.4.3 The Type Approval certificate for an engine family issued to the manufacturer shall be valid for the same model(s) manufactured at any other manufacturing plant of the same manufacturer. The Nodal Agency or technical agency concern with type approval may visit the new plant to verify adequacy of the infrastructure;
- 9.4.4 Validity of Type Approval Certificate issued by type approval authority shall remain valid further as long as following conditions are met:
 - a) Till the engine specifications unchanged
 - b) Till the further amendments to the notification;

9.5 Modification and Extensions of approved type

- 9.5.1 If an engine type or engine family is type approved and valid, manufacturer may approach type approval certificate issuing technical agency for modifications pertaining to parent or any engine type in the certified engine emissions family. Such modifications shall be ascertained by manufacturer utilizing defined guidelines.
- 9.5.2 Manufacturer shall submit technical document in line with type approval procedure prescribed in this Regulation;
- 9.5.3 Subjected to scrutiny of manufacture's application, technical agency shall approve or seek more data pertaining but not limited to engine architecture, parameters, similarity with existing engine type from emissions and performance perspective along with evidences. Decision of technical agency will remain finally binding for allowing such amendments to existing type approval certificate of an engine family through extension(s) vs asking manufacturer to type approve as new engine family or new engine type;
- 9.5.4 Technical agency retains all rights to ask manufacture to demonstrate modified engine type for emissions conformity through applicable type approval test procedures. Submission of

manufacturer run emissions data with valid test facility and procedure followed is mandatory where changes are directly or indirectly pertaining to emission affecting components, engine and after treatment system control algorithms and engine performance specifications.

9.6 Type Approval Process

Genset to be certified as per safety code of practice as defined in this document at the time of applying for Type Approval of NVH certification. NVH TA certificate shall be issued only after successful completion of safety code of practice certification of the Genset.

Following are the logical steps for the type approval process flow chart described in brief stepwise -

- a) Application to nodal agency (CPCB) in the form of affidavit seeking permission for type approval of Genset engine family through submission provided as draft specimen.
- b) Upon written approval of nodal agency to manufacturer and chosen technical agency; (This could be decision making node with “Yes” / “No” loop).
- c) Submit type approval certification application to chosen test agency. Based on provisions such application can be written or online through their secured portal.
- d) Obtain technical agency approval (This could be decision making node with “Yes” / “No” loop with NO means, provide additional data).
- e) Upon agencies application scrutiny and negotiations, submit detailed technical documentation as per requirements described in Annexure 1.
- f) Obtain documentation approval from technical agency
- g) Obtain test plan / schedule from technical agency.
- h) Upon approval from technical agency plan for safety procedural demonstration.
- i) Review of all test results with manufactures and decision about compliance, in case of failure manufacture to follow guidelines provided by test agency.
- j) Technical agency carries out part verification of critical engine components, CNG/LPG/NG components, safety layout with document submission, take final review of technical document and ask manufacture to resubmit if necessary.
- k) Manufacture submit the corrected technical document if found necessary.
- l) Examine corrected document submitted in line with the requirement.
- m) Technical agency prepares technical report based on the observations.
- n) Technical agency gives clearance to NVH for issuing the NVH certificate.

APPENDIX A.1

Template for submission of engine technical specification (Template for information document)

PART A

1. GENERAL INFORMATION

- 1.1. Make (trade name(s) of manufacturer):
- 1.2. Commercial /Brand Name name(s) (if applicable):
- 1.3. Company name and address of manufacturer:
- 1.4. Name and address of manufacturer's authorized representative (if any):
- 1.5. Name(s) and address(es) of assembly/manufacture plant(s):
- 1.6. Engine type designation/engine family designation/FT:
- 1.7. Category Constant speed or variable speed:
- 1.8. Rated Power

PART B

2. COMMON DESIGN PARAMETERS OF ENGINE FAMILY (1)

- 2.1. Combustion Cycle: four stroke cycle/two stroke cycle/other (specify):
- 2.2. Ignition Type: Compression ignition / Spark Ignition
- 2.3. Configuration of the cylinders:
 - 2.3.1. Position of the cylinders in the block: Single/V/in-line/opposed/radial/ other(specify):
 - 2.3.2. Bore center to center dimension (mm):
- 2.4. Combustion chamber type/design
 - 2.4.1. Open chamber/divided chamber/other(specify):
 - 2.4.2. Valve and porting configuration:
 - 2.4.3. Number of valves per cylinder:
- 2.5. Range of swept volume per cylinder (cm³):
- 2.6. Main Cooling medium: Air/Water/Oil:
- 2.7. Method of air aspiration: naturally aspirated/pressure charged/pressure charged with charge cooler:
- 2.8. Fuel:
 - 2.8.1. Fuel Type: Diesel / Gasoline/ CNG/ LPG
 - 2.8.1.1. Reserved.
 - 2.8.2. Fueling arrangement: Dual-fuel type 1A/Dual-fuel type 1B/Dual-fuel type 2A/Dual-fuel type 2B/Dual-fuel type 3B
 - 2.8.3. List of additional fuels, fuel mixtures or emulsions compatible with use by the engine declared by the manufacturer (provide reference to recognized standard or specification):
 - 2.8.4. Lubricant added to fuel: Yes/No

- 2.8.5. Fuel supply type: Pump (high pressure) line and injector/in-line pump or distributor pump/Unit injector/ Common rail.
- 2.9. Engine management systems: mechanical/electronic control strategy
- 2.10. Miscellaneous devices: Yes/No (if yes provide a schematic diagram of the location and order of the devices)
 - 2.10.1. Exhaust gas recirculation (EGR): Yes/No (if yes, complete section 3.10.1 and provide a schematic diagram of the location and order of the devices)
 - 2.10.2. Water injection: Yes/No (if yes, complete section 3.10.2 and provide a schematic diagram of the location and order of the devices)
 - 2.10.3. Air injection: Yes/No (if yes, complete section 3.10.3 and provide a schematic diagram of the location and order of the devices)
 - 2.10.4. Others: Yes/No (if yes specify, complete section 3.10.4 and provide a schematic diagram of the location and order of the devices):
- 2.11. Exhaust after-treatment system: Yes/No (if yes provide a schematic diagram of the location and order of the devices)
 - 2.11.1. Oxidation catalyst: Yes/No
(if yes, complete section 3.11.2)
 - 2.11.2. De NOX system with selective reduction of NOX (addition of reducing agent): Yes/No
(if yes, complete section 3.11.3)
 - 2.11.3. Other De NOX systems: Yes/No
(if yes, complete section 3.11.3)
 - 2.11.4. Reserved
 - 2.11.5. Particulate after-treatment system with passive regeneration: Yes/No
(if yes, complete section 3.11.4)
 - 2.11.5.1. Wall-flow/non-wall-flow
 - 2.11.6. Particulate after-treatment system with active regeneration: Yes/No
(if yes, complete section 3.11.4)
 - 2.11.6.1. Wall-flow/non-wall-flow
 - 2.11.7. Other particulate after-treatment systems: Yes/No
(if yes, complete section 3.11.4)
 - 2.11.8. Other after-treatment devices (specify):
(if yes, complete section 3.11.5)
 - 2.11.9. Other devices or features that have a strong influence on emissions Yes/No (specify):
(if yes, complete section 3.11.7)

PART C

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.1	Engine Identification						
3.1.1	Engine type designation						
3.1.2	Engine type designation shown on engine marking: yes/no						
3.1.3	Location of the statutory marking:						
3.1.4	Method of attachment of the statutory marking:						
3.1.5	Drawings of the location of the engine identification number (complete example with dimensions):						
3.2	Performance Parameters						
3.2.1	Declared rated speed(s) (rpm):						
3.2.1.1	Declared rated gross power (kW):						
3.2.1.2	Fuel delivery/stroke (mm ³) for diesel engine, fuel flow (g/h), at rated gross power						
3.2.6	Idle speed (rpm)						
3.2.7	No load speed (rpm):						
3.2.8	Overload load speed (rpm):						
3.3	Run-in procedure						Optional at choice of manufacturer
3.3.1	Run-in time:						
3.3.2	Run-in cycle:						
3.4	Engine test						
3.4.1	Specific fixture required: Yes/No						For NRSh only
3.4.1.1	Description, including photographs and/or drawings, of the system for mounting the engine on the test bench including the power transmission shaft for connection to the dynamometer:						
3.4.2	Exhaust mixing chamber permitted by manufacturer: Yes/No						For NRSh only
3.4.2.1	Exhaust mixing chamber description, photograph and/or drawing:						If applicable

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.4.3	Pre-conditioning for: Steady-state operation						
3.5	Lubrication system						
3.5.1	Lubricant temperature						If applicable
3.5.1.1	Minimum (°C):						
3.5.1.2	Maximum (°C):						
3.6	Combustion Cylinder						
3.6.1	Bore(mm):						
3.6.2	Stroke(mm):						
3.6.3	Number of cylinders:						
3.6.4	Engine total swept volume (cm ³):						
3.6.5	Swept volume per cylinder as % of parent engine:						If engine family
3.6.6	Volumetric compression ratio:						Specify tolerance
3.6.7	Combustion system description:						
3.6.8	Drawings of combustion chamber and piston crown:						
3.6.9	Minimum cross-sectional area of inlet and outlet ports (mm ²):						
3.6.10	Valve timing						
3.6.10.1	Maximum lift and angles of opening and closing in relation to dead center or equivalent data:						
3.6.10.2	Reference and/or setting range:						
3.6.10.3	Variable valve timing system: Yes/No						If applicable and where intake and/or exhaust
3.6.10.3.1	Type: continuous/(on/off)						
3.6.10.3.2	Cam phase shift angle:						
3.6.11	Porting configuration						2-stroke only, if applicable
3.6.11.1	Position, size and number:						
3.7	Cooling system						Complete relevant section
3.7.1	Liquid cooling						
3.7.1.1	Nature of liquid:						
3.7.1.2	Circulating pumps: Yes/No						
3.7.1.2.1	type(s):						
3.7.1.2.2	Drive ratio(s):						If applicable
3.7.1.3	Minimum coolant temperature at outlet (°C):						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.7.1.4	Maximum coolant temperature at outlet (°C):						
3.7.2	Reserved						
3.8	Aspiration						
3.8.1	Maximum allowable intake depression at rated engine speed and at 100% load (kPa)						
3.8.1.1	With clean air cleaner:						
3.8.1.2	With dirty air cleaner:						
3.8.1.3	Location, of measurement:						
3.8.2	Pressure charger(s): Yes/No						
3.8.2.1	Type(s):						
3.8.2.2	Description and schematic diagram of the system (e.g. maximum charge pressure, waste gate, VGT, Twin turbo, etc.):						
3.8.3	Charge air cooler: Yes/No						
3.8.3.1	Type: air-air/air-water/other(specify)						
3.8.3.2	Maximum charge air cooler outlet temperature at rated speed and 100% load (°C):						
3.8.3.3	Maximum allowable pressure-drop across charge cooler at rated engine speed and at 100% load (kPa):						
3.8.4	Intake throttle valve: Yes/No						
3.8.5	Device for recycling crankcase gases: Yes/No						
3.8.5.1	If yes, description and drawings:						
3.8.5.2	If no, compliance with paragraph 5.7. of this Regulation: Yes/No						
3.9	Exhaust system						
3.9.1	Description of the exhaust system (with drawings, photos and/or part numbers as required):						
3.9.2	Maximum exhaust temperature (°C):						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.9.3	Maximum permissible exhaust backpressure at rated engine speed and at 100% load (kPa):						
3.9.3.1	Location of measurement:						
3.9.4	Exhaust backpressure at loading level specified by manufacturer for variable restriction after-treatment at start of test (kPa):						
3.9.4.1	Location and speed/load conditions:						
3.9.5	Exhaust throttle valve: Yes/No						
3.10	Miscellaneous devices: Yes/No						
3.10.1	Exhaust gas recirculation (EGR)						
3.10.1.1	Characteristics: cooled/uncooled, high pressure/low pressure/other (specify):						
3.10.2	Water injection						
3.10.2.1	Operation principle:						
3.10.3	Air injection						
3.10.3.1	Operation principle						
3.10.4	Others						
3.10.4.1	Type(s)						
3.11	Exhaust after-treatment system						
3.11.1	Location						
3.11.1.1	Place(s) and maximum/minimum distance(s) from engine to first after-treatment device:						
3.11.1.2	Maximum temperature drops from exhaust or turbine outlet to first after-treatment device (°C) if stated:						
3.11.1.2.1	Test conditions for measurement:						
3.11.1.3	Minimum temperature at inlet to first after-treatment device, (°C) if stated:						
3.11.1.3.1	Test conditions for measurement:						
3.11.2	Oxidation catalyst						
3.11.2.1	Number of catalytic converters and elements:						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.11.2.2	Dimensions and volume of the catalytic converter(s):						Or drawing
3.11.2.3	Total charge of precious metals (g):						
3.11.2.4	Relative concentration of each compound (%):						
3.11.2.5	Substrate (structure and material):						
3.11.2.6	Cell density:						
3.11.2.7	Type of casing for the catalytic converter(s):						
3.11.3	Catalytic exhaust after-treatment system for NOX or three-way catalyst						
3.11.3.1	Type:						
3.11.3.2	Number of catalytic converters and elements:						
3.11.3.3	Type of catalytic action:						
3.11.3.4	Dimensions and volume of the catalytic converter(s):						Or drawing
3.11.3.5	Total charge of precious metals (g):						
3.11.3.6	Relative concentration of each compound (%):						
3.11.3.7	Substrate (structure and material):						
3.11.3.8	Cell density:						
3.11.3.9	Type of casing for the catalytic converter(s):						
3.11.3.10	Method of regeneration:						If applicable
3.11.3.10.1	Infrequent regeneration: Yes/No:						If yes, complete section 3.11.6.
3.11.3.11	Normal operating temperature range (°C):						
3.11.3.12	Consumable reagent: Yes/No						
3.11.3.12.1	Type and concentration of reagent needed for catalytic action:						
3.11.3.12.2	Lowest concentration of the active ingredient presents in the reagent that does not activate warning system (CDmin) (%vol):						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.11.3.12.3	Normal operational temperature range of reagent:						
3.11.3.12.4	International standard:						If applicable
3.11.3.13	NOX sensor(s): Yes/No						
3.11.3.13.1	Type:						
3.11.3.13.2	Location(s)						
3.11.3.14	Oxygen sensor(s): Yes/No						
3.11.3.14.1	Type:						
3.11.3.14.2	Location(s):						
3.11.4	Particulate after-treatment system						
3.11.4.1	Type of filtration: wall-flow/ non-wall-flow/other (specify)						
3.11.4.2	Type:						
3.11.4.3	Dimensions and capacity of the particulate after-treatment system:						Or drawing
3.11.4.4	Location place(s) and maximum and minimum distance(s) from engine:						
3.11.4.5	Method or system of regeneration, description and/or drawing:						
3.11.4.5.1	Infrequent regeneration: Yes/No						If yes, complete section 3.11.6.
3.11.4.5.2	Minimum exhaust gas temperature for initiating regeneration procedure (°C):						
3.11.4.6	Catalytic coating: Yes/No						
3.11.4.6.1	Type of catalytic action:						
3.11.4.7	Fuel borne catalyst (FBC): Yes/No						
3.11.4.8	Normal operating temperature range (°C):						
3.11.4.9	Normal operating pressure range (kPa)						
3.11.4.10	Storage capacity soot/ash (g):						
3.11.4.11	Oxygen sensor(s): Yes/No						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.11.4.11.1	Type:						
3.11.4.11.2	Location(s):						
3.11.5	Other after-treatment devices						
3.11.5.1	Description and operation:						
3.11.6	Infrequent Regeneration						
3.11.6.1	Number of cycles with regeneration						
3.11.6.2	Number of cycles without regeneration						
3.11.7	Other devices or features						
3.11.7.1	Type(s)						
3.12	Fuel feed for liquid-fuelled CI or, where applicable, dual-fuel engines						
3.12.1	Feed pump						
3.12.1.1	Pressure (kPa) or characteristic diagram:						
3.12.2	Injection system						
3.12.2.1	Fuel Pump						
3.12.2.1.1	Type(s):						
3.12.2.1.2	Rated pump speed (rpm):						
3.12.2.1.3	mm ³ per stroke or cycle at full injection at rated pump speed:						Specify tolerance
3.12.2.1.4	Reserved						
3.12.2.1.5	Reserved						Specify tolerance
3.12.2.1.6	Characteristic diagram:						As alternative to entries 3.12.2.1.1. to 3.12.2.1.5.
3.12.2.1.7	Method used: on engine/on pump bench						
3.12.2.2	Injection timing						
3.12.2.2.1	Injection timing curve:						Specify tolerance, if applicable
3.12.2.2.2	Static Timing:						Specify tolerance
3.12.2.3	Injection piping						
3.12.2.3.1	Length(s) (mm):						
3.12.2.3.2	Internal diameter (mm):						
3.12.2.4	Common rail: Yes/No						
3.12.2.4.1	Type:						
3.12.3	Injector(s)						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.12.3.1	Type(s):						
3.12.3.2	Opening pressure (kPa):						Specify tolerance
3.12.4	ECU: Yes/No						
3.12.4.1	Type(s):						
3.12.4.2	Software calibration number(s):						
3.12.4.3	Communication standard(s) for access to data stream information: ISO 27145 with ISO 15765-4 (CAN-based)/ISO 27145 with ISO 13400 (TCP/IP-based)/SAE J1939-73						
3.12.5	Governor						
3.12.5.1	Type(s):						
3.12.5.2	Speed at which cut-off starts under full load:						Specify range, if applicable
3.12.5.3	Maximum no-load speed:						Specify range, if applicable
3.12.5.4	Idle speed:						Specify range, if applicable
3.12.6	Cold-start system: Yes/No						
3.12.6.1	Type(s):						
3.12.6.2	Description:						
3.12.7	Fuel temperature at the inlet to the fuel injection pump						
3.12.7.1	Minimum (°C):						
3.12.7.2	Maximum (°C):						
3.13	Reserved						
3.14.	Fuel feed for gaseous fuel engines or where applicable, dual-fuel engines (in the case of systems laid out in a different manner, supply equivalent information) (Need to check if something missed out)						
3.14.1.	Fuel: LPG /NG-H/NG-L /NG-HL/LPG						
3.14.2.	Pressure regulator(s)/vaporizer(s)						
3.14.2.1.	Type(s)						
3.14.2.2.	Number of pressure reduction stages						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.14.2.3.	Pressure in final stage minimum and maximum. (kPa)						
3.14.2.4.	Number of main adjustment points:						
3.14.2.5.	Number of idle adjustment points:						
3.14.3.	Fuelling system: mixing unit/gas injection/liquid injection/direct injection						
3.14.3.1.	Mixture strength regulation						
3.14.3.1.1.	System description and/or diagram and drawings:						
3.14.4.	Mixing unit						
3.14.4.1.	Number:						
3.14.4.2.	Type(s):						
3.14.4.3.	Location:						
3.14.4.4.	Adjustment possibilities:						
3.14.5.	Inlet manifold injection						
3.14.5.1.	Injection: single-point/multi-point						
3.14.5.2.	Injection: continuous/simultaneously timed/ sequentially timed						
3.14.5.3.	Injection equipment						
3.14.5.3.1.	Type(s):						
3.14.5.3.2.	Adjustment possibilities:						
3.14.5.4.	Supply pump						If applicable
3.14.5.4.1.	Type(s):						
3.14.5.5.	Injector(s)						
3.14.5.5.1.	Type(s):						
3.14.6.	Direct injection						
3.14.6.1.	Injection pump/pressure regulator						
3.14.6.1.1.	Type(s):						
3.14.6.1.2.	Injection timing (specify):						
3.14.6.2.	Injector(s)						
3.14.6.2.1.	Type(s):						
3.14.6.2.2.	Opening pressure or characteristic diagram:						
3.14.7.	Electronic Control Unit (ECU)						
3.14.7.1.	Type(s):						
3.14.7.2.	Adjustment possibilities:						
3.14.7.3.	Software calibration number(s):						

Item Number	Item Description	Parent engine/ engine type	Engine types within the engine family (if applicable)				Explanatory notes (not included in document)
			type 2	type 3	type ...	type n	
3.14.8.	Approvals of engines for several fuel compositions						
3.14.8.1.	Self-adaptive feature: Yes/No						
3.14.8.2.	Calibration for a specific gas composition: NG-H/NG-L/NG-HL/ LNG/Fuel specific LNG						
3.14.8.3.	Transformation for a specific gas composition: NG-HT/NG-LT/NG-HLT						
3.14.9.	Fuel temperature pressure regulator final stage						
3.14.9.1.	Minimum (°C):						
3.14.9.2.	Maximum (°C):						
3.15.	Ignition system						
3.15.1.	Ignition coil(s)						
3.15.1.1.	Type(s):						
3.15.1.2.	Number:						
3.15.2.	Spark plug(s)						
3.15.2.1.	Type(s):						
3.15.2.2.	Gap setting:						
3.15.3.	Magneto						
3.15.3.1.	Type(s):						
3.15.4.	Ignition timing control: Yes/No						
3.15.4.1.	Static advance with respect to top dead center (crank angle degrees):						
3.15.4.2.	Advance curve or map:						If applicable
3.15.4.3.	Electronic control: Yes/No						

Part D – For Gaseous Fuel System

1. Details of Kit Manufacturer / Supplier / Installer	
a) Name of the Manufacturer	
b) Address	
c) Telephone No. & Fax No.	
2. Gas Kit Identification	
a) Identification No.	
b) Variants, if any	
c) Fuel system (Dedicated / Bi-Fuel / Dual Fuel / Dedicated Dual Fuel)	

d) Type of Dual- fuel system (Type 1A / 1B / 2A / 2B / 3B)	
e) Fuel (Gas Fuel (Specify Name of fuel)	
3. Solenoid Valve / Automatic shutoff valve	
a) Name of manufacturer	
b) Model Name / Identification No.	
c) Type	
d) Working pressure (kg/cm ²)	
e) Max test pressure (kg/cm ²)	
f) Approval reference (Test Report / Approval Number)	
4. High Pressure Regulator	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type	
d) Inlet pressure (kg/cm ²)	
e) Outlet pressure (kg/cm ²)	
f) No. of stages	
g) Approval reference (Test Report / TAC compliance with Date)	
5. Low Pressure Regulator	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type	
d) Inlet pressure (kg/cm ²)	
e) Outlet pressure (kg/cm ²)	
f) No. of stages	
g) Approval reference (Test Report / TAC compliance with Date)	
6. Zero Pressure Regulator	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type	
d) Inlet pressure (kg/cm ²)	
e) Outlet pressure (kg/cm ²)	
f) Approval reference (Test Report / TAC compliance with Date)	
7. Vaporizer / Heat exchanger (for LNG)	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type	

d) Inlet pressure (kg/cm ²)	
e) Outlet pressure (kg/cm ²)	
f) Approval reference (Test Report / Approval Number)	
8. Filter	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type	
d) Inlet pressure (kg/cm ²)	
e) Outlet pressure (kg/cm ²)	
9. High Pressure Tubing	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type (rigid / flexible)	
d) Working pressure (kg/cm ²)	
e) Max. test pressure (kg/cm ²)	
f) Outer diameter / Inner Diameter (mm)	
g) Material	
h) Approval reference (Test Report / Approval Number)	
10. Low Pressure Tubing	
a) Name of manufacturer	
b) Model name / Identification No.	
c) Type	
d) Working pressure (kg/cm ²)	
e) Max test pressure (kg/cm ²)	
f) Outer diameter / Inner Diameter (mm)	
g) Material	
h) Approval reference (Test Report / Approval Number)	
11. Gas-Air Mixer	
a) Name of manufacturer	
b) Model name / Identification No	
c) Type & drawing	
d) Venturi Size (mm)	
e) Approval reference (Test Report / Approval Number)	
12. Gas Injector	
a) Name of manufacturer	
b) Model name / Identification No	
c) Type & drawing	

d) Injector flow specs	
e) Approval reference (Test Report / Approval Number)	
13. Wiring Harness	
a) Name of manufacturer	
b) Electrical circuit diagram / Detail layout	
c) Approval reference (Test Report / Approval Number)	
14. Interfacing Unit (ECU)	
a) Name of manufacturer	
b) Identification No.	
c) Type	
15. Fuel selector switch	
a) Name of manufacturer	
b) Model No	
c) Type	
16. Fuel flow actuation mechanism (Mechanical / Electronic)	
a) Brief description of system (Attach Annexure)	
b) Schematic layout (Attach Drawing)	
c) Identification of critical components of Kit, including ECU, Lambda sensor, Pressure sensor, temperature Sensor etc. with Make and Identification number) (attach Annexure)	
17. Brief Description of System Including Dimensional Layout for kit components installation ventilation details etc.	
18. Joints and connections	
a) Name of manufacturer	
b) Type	
c) Number of Joints and connections represented on Drawing (Attach Drawing)	
19. Current limiting Device (Fuse)	
a) Name of manufacturer	
b) Identification No.	
c) Voltage / current rating	
d) Type	
e) Approval reference (Test Report / Approval Number)	
20. Indicator	
A. Pressure Indicator	

a) Name of manufacturer	
b) Identification No.	
c) Type	
B. Temperature Indicator (for LNG)	
a) Name of manufacturer	
b) Identification No.	
c) Type	
21. Service shut off valve	
a) Name of manufacturer	
b) Identification No.	
c) Type	
22. Compartment/Sub-compartment / Gas tight housing	
a) Name of manufacturer	
b) Identification No	
c) Type	
d) Material used	
e) Approval reference (Test Report / Approval Number)	
23. Conduit	
a) Name of manufacturer	
b) Identification No.	
c) Inner & outer diameter	
d) Type	
e) Approval reference (Test Report / Approval Number)	
24. Battery cut off switch (if applicable)	
a) Name of manufacturer	
b) Identification No.	
c) Type	
25. Labels - Number and position	
26. Any other information	
* Mention NA wherever not applicable	

Part E
Gaseous Fuel Safety Component – Test Applicability

Sr. No.	Gas Kit Component	Certifying / Verifying Authority	Applicable Standards
1	Regulator (For CNG & BIO-CNG) / Regulator and Vaporizer (LNG)*	Testing of the component as per IS: 15713 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15713 or ISO -15500

		LNG regulator and Vaporizer / heat exchanger shall meet requirements of UN R110 or equivalent standard	UN R 110 or equivalent standard
2	Gas-Air Mixer*	Testing of the component as per IS: 15714 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15714 or ISO-15500
3	Gas Injector*	Testing of the component as per ISO-15500-7 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	ISO-15500-7
4	Gas Solenoid Valve / Automatic Shutoff valve*	Testing of the component as per IS: 15712 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15712 or ISO-15500
		Automatic shutoff valve of LNG System (which comes in contact with LNG shall meet requirements of UN R110 or equivalent standards)	Automatic shutoff Valve for LNG System: UN R110 or equivalent standards
5	Testing of Conduit*	Testing of the component or verification of certificate or test report as per IS: 15715 by test agency.	IS: 15715
6	CNG / BIO-CNG / LNG fuel line		
6.1	High pressure exceeding 100 kPa*		
6.1.1	Exceeding 2.15 MPa		
	Rigid pipe	Testing of the component or verification of certificate or test report as per IS: 15716 by test agency.	IS: 15716
		LNG rigid pipeline shall meet requirements of UN R 110 or IS: 15716 or equivalent standard.	UN R 110 or IS: 15716 or equivalent standard.
	Flexible hose	Testing of the component or verification of certificate or test report as per IS 15718 by test agency.	IS 15718 or AIS-028 (Rev. 1) (Part A)
		LNG flexible pipeline shall meet requirements of UN R110 or IS: 15718 or equivalent standard.	UN R 110 or IS: 15718 or equivalent standard

6.1.2	Pressure up to 2.15 Bar	Testing of the component or verification of certificate or test report as per IS: 15722 by test agency.	IS: 15722 with amendments
		LNG pipeline shall meet requirements of UN R110 or IS: 15722 or equivalent standard.	UN R 110 or IS: 15722 or equivalent standard
6.2	Joints and connections*	Testing by test agency.	Clause 3.1.4.1, 3.2.1 (b) of AIS-028 (Rev. 1) (Part A)
		LNG joints & connection shall meet requirements of UN R 110 or equivalent standard	UN R 110 or equivalent standard
7	Compartment or Sub-compartment*	Testing of the component or verification of certificate or test report as per IS: 15720 by test agency.	IS: 15720
8	Specific LNG components	Following specific components, as applicable shall meet requirements of UN R 110 or equivalent standard LNG Fuel pump, Pressure Relief valves, Pressure sensor, check valve, excess flow valve, manual valve and non-return valve.	UN R 110 or equivalent standard
9	Safety check for installation of Gaseous fuel system	Safety checks to be carried out by test agency as per AIS-028 (Rev.1) (Part A)	Relevant clauses of AIS-028 (Rev. 1) (Part A)
10	Electrical wiring and harness		AIS 028
11	Non-moisture retaining hard rubber/equivalent material		AIS 028
12	Electrical fuses		AIS 028

* Certificate issued by accredited testing agency of the country of origin or a report issued by internationally accredited test laboratory may also be accepted.

Note 1 - Only the standards, as amended from time to time, as mentioned above, shall be referred for compliance.

Note 2 - Components downstream the Heat exchanger / vaporizer shall be considered as CNG components and prevailing Indian standard / ISO standard or equivalent standards shall be acceptable.

Note 3 - Test agency to conduct applicable CMVR test with LNG fuel as notified by Govt of India.

ANNEXURE - 1

Freezing conditions and corrosive conditions

- 1.1 Where regulator heat is drawn from the engine cooling water, care should be taken to ensure that the water does not freeze in the regulator during cold weather. Expansion of the water on freezing can cause serious damage to the pressure regulator assembly.
- 1.2 Most CNG/PNG/LPG regulators are made from non-ferrous alloys, which can suffer pinhole corrosion under certain conditions. If this is allowed to take place CNG/ PNG/LPG can be admitted to the cooling water system where it will pressurize the radiator and cause a potential hazard. It is important, therefore, to have an effective anticorrosion additive present in the cooling water.
- 1.3 It is important to ensure that the coolant additive and the dilatant ratio comply fully with the engine manufacturer's requirements.

ANNEXURE - 2

Backfire – Deflector tests

- 2.1 A backfire deflector under backfire conditions shall contain a visible flame front within its confines and shall not be displaced, physically damaged or distorted, or show evidence of burning or smoldering of internal parts. If the deflector is of the oil-bath type, it shall be free of any overflow or discharge permitting accumulation of oil on electrical, hot-engine or exhaust system parts.
- 2.2 A complete Genset engine is to be used for this test. Tests are not required on backfire deflectors employed diesel engines.
- 2.3 The backfire deflector (air cleaner, oil-bath or dry element type) and connecting hose are to be removed from the engine. The spark timing is to be advanced (approximately 8 degrees) and the spark plug leads are to be interchanged to obtain sharp backfires under the following conditions. The engine is to be alternately raced and idled and the ignition switch is to be operated to alternately energize and de-energize the ignition system. During the test, the intensity of the backfire and the issuance and extent of the accompanying flame are to be noted.
- 2.4 The backfire deflector (air cleaner) is then to be installed on the truck in the intended location. An oil-bath type deflector (air cleaner) is to be filled to the marked “full level-line” of the bowl. Paper is to be placed beneath the intake orifices of an oil-bath type and over adjacent surfaces of parts likely to be affected by accumulations of oil.
- 2.5 The engine is then to be operated in the several manners determined in the preliminary test to provide for the most severe backfire conditions. At least ten and not more than twenty backfires are to be produced.
- 2.6 Observations for containment of flame are to be made under semi-darkened conditions by at least two observers. No visible flame is to be in evidence at any time during the tests. In the tests of an oil-bath type, paper is not to show evidence of oil deposits in the form of droplets.
- 2.7 A dry-type filter element is to be tested in the above manner, then removed and then subjected to five consecutive washing and drying cycles. Washing is to consist of immersion in plain water together with sufficient agitation to remove bulk material adhering to the outside surface. The test element is then to be remounted as intended in operation, and the backfire test is to be repeated.

- 2.8 The side of the filter media normally exposed to backfire is then to be subjected to a flame source of sufficient intensity to cause the media to burn or glow. The flame source is then to be removed and an acceptable filter media is not to continue to burn or smolder.

ANNEXURE - 3

Checklist for installation for NG/LPG GENSET

This checklist is a guide for the installer when carrying out the inspection prior to issuing installation Certificate. Reference to relevant clauses in this Standard and guidelines issued by Central Government from time to time should be made where appropriate.

- 3.1 **Cylinder/ PNG connection:** Approved by PESO / CGD Company as applicable Validity of Certificate Free from corrosion Mounted securely
Mounting points free from corrosion and fractures Shielded and valves protected where necessary 5 mm clearance in between cylinders.
- 3.2 **Valves/MFVs:** Approved by PESO / CGD Company as applicable Cylinder valve/MFV operating correctly, burst disc fitted.
- 3.3 **Filling connection:** Refueling connection made external to Genset Engine/Canopy interior Captive dust plug fitted Meets proof loading of 50 kgf.
- 3.4 **Refueling interlock:** Operation corrects
- 3.5 **Non-return valve:** Operation correct free from bypass leakage
- 3.6 **Leak test:** All valves and fittings leak free
- 3.7 **Vapor sealing:** Gas tight
- 3.8 **Ducting:** Free from damage and secure to outlets
- 3.9 **Pliable sub-compartment:** Ease of operation of cylinder valve satisfactory Position identified
- 3.10 **Fuel line:** Free from damage and corrosion Secured to Genset Engine Protected and shielded where necessary
- 3.11 **Joints and connections:** Leak free
- 3.12 **CNG shut off valve/solenoid valve:** Mounting secure Operation Correct Leak free
- 3.13 **Service shut off valve:** Operation satisfactory Mounted Securely Leak Free Identified and operation clearly marked
- 3.14 **Regulator/Vaporizer:** Mounting secure No gas bypass after engine has stopped turning Shielded where necessary Leak free
- 3.15 **Control equipment:** Approved type
- 3.16 **Gas air mixer:** Securely mounted Backfire deflector where applicable
- 3.17 **Bi-fuel /Dual fuel shut-off device:** Operation correct Petrol lock off where fitted is mounted securely Petrol hose secure joints leak free and free from cracks Sufficient flexibility for engine movement Bypass device fitted where applicable

- 3.18 **Electrical wiring:** Current limiting device fitted Connections secure. Terminals insulated to prevent shorting Wiring taped and clipped securely.
- 3.19 **Compliance Plate/label:** Installed and carries correct markings
- 3.20 **Identification labels:** Located front on Genset Engine and Canopy

ANNEXURE -4

Installation certificate for converted CNG/PNG/ LPG GENSET engine manufacturer/ authorized person of genset manufacturer

A. Details of Installer Approval	
1. Installation Certificate issued by	Name and address of Authorized Person
2. Approval details	Name of Genset manufacturer
3. Rating of Genset and its engine	
4. Approval of the CNG /PNG/LPG kit	
a) Name of the Test Agency	
b) Approval Certificate No. & Date	
B. Details of Genset Engines	
1. Sr. No. & year of manufacture	
2. Engine No.	
3. Type of Operation	Bi-fuel / dedicated fuel/Dual fuel
C. Details of CNG/PNG/LPG Kit	
1. Cylinders:	
a) No. of Cylinder/s	
b) Type of Cylinder/s	
c) Cylinder No/s.	
d) Make	
e) Water Capacity (liters)	
f) Working Pressure (kg/cm ²)	
g) Approval reference of PESO	
h) Validity of PESO Certificate	
2. Cylinder CNG/PNG/LPG Valves	
a) Make	
b) Valve No.	
c) Working Pressure (kg/cm ²)	
d) Approval reference of PESO	
3. Refilling Valve:	
a) Make	
b) Type	
4. Fuel Line	
a) High pressure pipe dia (ID/OD)	
b) Low pressure pipe dia (ID/OD)	
5. Shut Off Valve (Solenoid Valves)	
a) Make	
b) Type	
c) Operation Voltage	

6. Fuel selection switch	
a) Make	
b) Type	
7. Regulator/Vaporizer	
a) Make	
b) Type	
c) Sr. No.	
8. Gas-Air Mixer/Injector	
a) Make	
b) Type	
<i>Note: This certificate shall be filled and provided to NG/LPG Genset owner</i>	
Signature & Seal of Installer	

ANNEXURE - 5

Component testing and safety checks for use of NG/CNG fuels in internal combustion engine for generator

No.	CNG Kit Component	Certifying / Verifying Authority	Clause of Safety code of practice / Other Rules, Standards, etc.
1	Cylinder*	PESO, Nagpur to certify or endorse in case of foreign make	Gas cylinder rules, 2016
1.1	Fitment of cylinder	Verify as per Safety Code of practice	Clause no. 5.2 to 5.5 of Safety Code of Practice
2	Cylinder valves*	PESO, Nagpur to certify or endorse in case of foreign make	IS: 3224 or Gas cylinder rules 2016
3	Regulator*	Testing of the component as per IS:15713-2006 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15713-2006 or ISO-15500
4	Gas-Air Mixer* / Injectors	Testing of the component as per S:15714-2006 or ISO-15500 by test Agency. Injectors to be tested as per ECE R110/ISO 15500 Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15714-2006 or ISO-15500
5	Petrol Solenoid Valve*	Testing of the component as per IS:15717-2006 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15717-2006
5.1	Gas Solenoid Valve*	Testing of the component as per IS: 15712-2006 or ISO-15500 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS: 15712-2006 or ISO-15500
6	Filling Connection (NZS & NGV- 1 type) (if Applicable)	Installation to be checked by test agency as per Safety code of practice	Clauses 5.3.2 to 5.3.6 of Safety Code of Practice
7	Ventilation (if Applicable)	Test agency to verify.	5.7.2 of Safety Code of Practice
8	Testing of Conduit* (if Applicable)	Testing of the component or verification of certificate or test report as per IS: 15715-2008 by test agency.	IS: 15715-2008
9	CNG fuel line		

No.	CNG Kit Component	Certifying / Verifying Authority	Clause of Safety code of practice / Other Rules, Standards, etc.
9.1	High pressure exceeding 100 kPa*		
9.1.1	Exceeding 2.15 MPa		
	Rigid pipe	Testing of the component or verification of certificate or test report as per IS: 15716-2006 by test agency.	IS: 15716-2006
	Flexible hose	Testing of the component or verification of certificate or test report as per AIS -028 by test agency.	3.1.3.1, 3.1.3.2 and 3.1.3.3.1 of AIS-028
9.1.2	Exceeding 100 kPa and less than 2.15 MPa	Testing of the component or verification of certificate or test report as per IS: 15722-2006 by test agency.	IS: 15722-2006
9.2	Low pressure – Not exceeding 100 kPa*	Testing of the component or verification of certificate or test report as per IS: 15722-2006 by test agency.	IS: 15722-2006
9.3	Joints and Connections*	Testing by test agency.	Clause 5.8 of Safety Code of Practice
10	Compartment or Sub compartment* (if Applicable)	Testing of the component or verification of certificate or test report as per IS: 15720-2008 by test agency.	IS: 15720-2008
11	Safety check for installation of CNG system	Safety checks to be carried out by test agency as per AIS 028.	Relevant clauses of Safety code of Practice

* Certificate issued by accredited testing agency of the country of origin or a report issued by internationally accredited test laboratory may also be accepted.

Note 1: - Even though all above standards are applicable for automotive applications, considering the use of same or equivalent fuel for Generator application these standards shall be used for CNG components certifications of Generator.

Note 2: - Only the standards, as amended from time to time, as mentioned above, shall be referred for compliance.

Note 3: - Approvals issued prior to implementation of these rules shall be extended for compliance to above requirements without revalidation.

ANNEXURE - 6

Safety checks for use of LPG fuels in internal combustion engine for generator

Sr. No.	LPG Kit Component	Certifying /Verifying Authority	Clause of Safety code of practice / Other Standards, Rules, etc.
1	Cylinder*	PESO, Nagpur to certify or endorse in case of foreign make	Gas cylinder rules, 2016
2	Cylinder valves / Multi-Functional Valve*	PESO, Nagpur to certify or endorse in case of foreign make	Gas cylinder rules, 2016
3	Regulator/Vaporizer *	Regulators which are used to reduce the pressure in LPG installation shall meet the requirements of IS :6044(Part 1) as amended from time to time. Regulator/ Vaporizer which is used to meter Gas for Genset engine shall be Tested as per ECE Regulation No. 67 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	IS:6044 (Part 1) ECE Regulation No. 67
4	Gas-Air Mixer/Injectors*	Testing of the component as per ECE Regulation No. 67 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	ECE Regulation No. 67
5	Petrol and Gas Solenoid Valve*	Testing of the component as per ECE Regulation No. 67 by test agency. Alternatively, test agency to verify the test certificate or report conforming to the above standard issued by accredited testing laboratory.	ECE Regulation No. 67 Note: Petrol solenoid valve is to be tested, as per ECE Regulation No. 67, for endurance only at a pressure 1.5 times the working pressure for 6,000 no. of cycles.
6	Inspection, Testing & Commissioning Certificate Leak testing Excess flow valve test* Automatic fill limiter* Compartment / sub compartment	To be as per Safety Code of Practice	
7	Filling Connection (if Applicable)	Installation to be checked as per Safety Code of Practice	Clauses 5.3.2 to 5.3.6 of Safety Code of Practice
8	Ventilation (if Applicable)	to be checked as per Safety Code of Practice	5.7.2 of Safety Code of Practice

Sr. No.	LPG Kit Component	Certifying /Verifying Authority	Clause of Safety code of practice / Other Standards, Rules, etc.
9	Testing of Conduit* (if Applicable)	To be tested as per AIS 026	AIS 026
10	LPG fuel line	Shall be tested as per IS:6044 (Part 1)	
a)	Fuel line	Shall be tested as per IS:6044 (Part 1)	
	Pressure testing	Testing/Verification of Certificate with Test Report by Test Agency as per equivalent standard.	
	Size of tube as per Engine capacity	Manufacturer's declaration to be verified by Test Agency	
	On site Fitment on Genset	Installer shall meet the installation requirements as per IS: 6044 (Part 1) and this standard	
b)	Flexible Hose / fuel line	Shall be tested as per IS: 6044 (Part 1)	
	Material	Testing/Verification of Certificate with Test Report by Test Agency as per IS :6044 or equivalent standard.	
c)	Fitment on Genset	Installer shall meet the installation requirements as per IS: 6044 (Part 1) and this standard.	
	Pressure	Shall be tested as per IS: 6044 (Part 1)	
d)	Joints and connections to Withstand Pressure without any leakage	Installer shall meet the installation requirements as per IS: 6044(Part 1) and this standard	
11	Compartment or Sub compartment* (if Applicable)	Test to be carried out by test agency as per Safety Code of Practice	Relevant clauses of Safety code of Practice
12	Safety check for installation of LPG system	Safety checks to be carried out by test agency as per Safety Code of Practice	Relevant clauses of Safety code of Practice

* Certificate issued by accredited testing agency of the country of origin or a report issued by internationally accredited test laboratory may also be accepted.

Note 1 - Even though all above standards are applicable for automotive applications, considering the use of same or equivalent fuel for Generator application these standards shall be used for LPG components certifications of Generator.

Note 2 - Only the standards, as amended from time to time, as mentioned above, shall be referred for compliance.

Note 3 - Approvals issued prior to implementation of these rules shall be extended for compliance to above requirements without revalidation.

ANNEXURE - 7

Roles & responsibility of various stakeholders

Sr No	Activity	Responsibility	Remark
1	Getting the approval of NG/LPG/CNG Kit components, approval of cylinders and valves,	Genset / Engine manufacturer as the case may be.	
2	Getting the Type approval of engines / Gensets for emission and noise compliance.	Genset / Engine manufacturer as the case may be.	
3	Getting the approval of PNG lines, joints and connections for NG Gensets.	Genset manufacturers / its authorized person or agency.	
4	Approval of NG/LPG/CNG Kit components	Test agencies approved by MoEF / CPCB	
5	Approval of Cylinders and valves	PESO, Govt of India	
6	Type approval of engines / Gensets for emission and noise compliance	Test agencies approved by MoEF/ CPCB	
7	Installation of Genset with CNG/NG/LPG system at site as per type approved specifications. Installation of LPG cylinders and its manifolding system at site as per IS 6044 (Part 1) as amended from time to time.	Genset manufacturer / its authorized person or agency	
8	Issue of Installation Certificate	Genset manufacturer / its authorized person or agency	
9	Re-testing of CNG/LPG cylinders as per Gas Cylinder Rules after installation	End User	
10	Training to end user about safety and operation of Genset using gaseous fuels in any combination – dedicated / bi-fuel / dual-fuel	Genset manufacturer/ its authorized person or agency	
11	Scrapping of CNG/LPG cylinders as per Gas cylinder rules	End User	
12	Periodic leak testing and inspection of gaseous fuel system as per training imparted by Authorized person / Genset manufacturer	End use	
13	Approval of PNG lines and its joints and connections	City Gas Distribution companies approved by PNGRB, Govt of India	
14	System Procedure and Safety Procedure documents	CPCB (Nodal agency)	

ANNEXURE - 8

Labelling requirements

The engine or the product must be affixed with a conformance label meeting the following requirements.

8.1 General Requirement

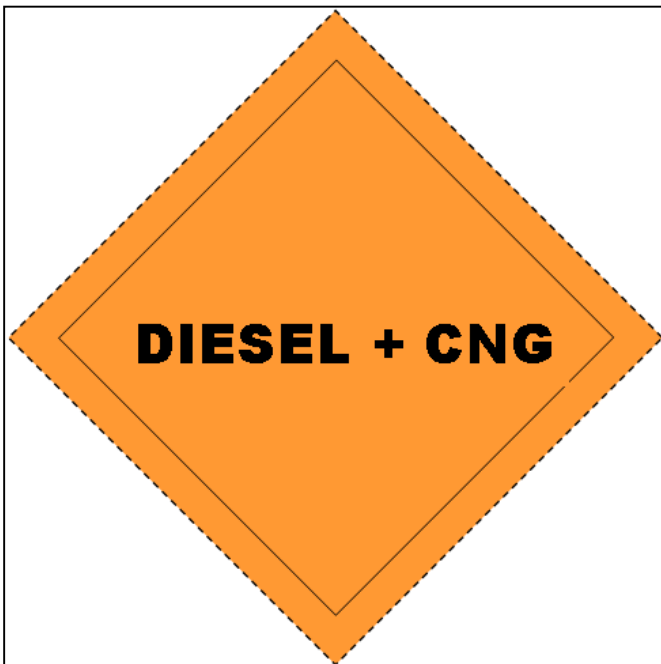
- a. The label shall be durable and legible;
- b. The label shall be affixed on a part necessary for normal operation of the engine or the product and not normally requiring replacement during the life of the engine or the product;
- c. Statement that 'this engine or product conforms to the Environment Protection Rule 1986;
- d. All the information mentioned in the conformance label must be in English language;

8.2 Conformance Labelling Content Requirement

- a. Name the engine manufacturer or the engine or product importer
- b. Manufacturing plant address from where engine is manufacture
- c. Engine Model name;
- d. Rated speed and corresponding gross power in kW;
- e. Engine Unique Identification Number (Serial Number, etc.);
- f. Date of manufacturing and in case of import, date of import of engine or Genset product;
- g. Type Approval certificate number;
- h. Letter 'G' to denote that the engine is belongs to Genset application. The Letter 'G' shall be engraved on the conformance label. The letter(s) should have a minimum size of 7 mm.

Compliance name plate model			
Manufacturer			
Mfg. Plant			
Engine Model		Rated Speed (rpm)	Power (kW)
Engine Sr No			Date of Mfg.
Type Approval Cert. No.			
This engine or product conforms to the Environment Protection Rule 1986			

APPENDIX 8.1

LABEL	
	
The sign consists of a sticker which shall be weather resistant.	
The color and dimensions of the sticker shall fulfil the following requirements:	
Colors:	
Background:	Orange
Letters:	Black or black reflecting
Dimensions:	
Border width:	4 - 6 mm
Character height:	≥ 25 mm

Character thickness:	≥ 4 mm
Sticker width:	110 - 150 mm
Sticker height:	80 - 110 mm
The word "DIESEL+CNG" shall be centered in the middle of the sticker.	

∞∞ **End of The Document** ∞∞