

AMENDMENT NO. 8 14 July 2015

TO

**AIS-024 (Version 3)
Safety and Procedural requirements for Type Approval of
CNG Operated Vehicles**

1. Annex VI, Page 1/2, in table Sl. No. A (3)

Substitute following text for the existing text:

“

3. Type of vehicle converted:	3-Wheeler/Quadricycles /Car/LCV/HCV, etc.
-------------------------------	---

”

2. Page No. 23, Annex VIII, in table Sl. No. A 2 (a)

Substitute following text for the existing text:

“

2(a) Type of vehicle (3 Wheeler /Quadricycles / Car/LCV/HCV)	
--	--

”

3. Page No. 22, Annex IX, clause No. 20 b (ii)

Substitute following text for the existing text:

“One number of dry chemical powder type / CO2 type fire extinguisher of 1 kg shall be provided in L7 and M1 category of vehicles such that it shall be easily accessible to all the occupants.”

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THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832, PUNE 411 004

ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLES RULES - TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

14 July 2015

AMENDMENT NO. 7 5 December 2014
TO
AIS-024 (Version - 3)

**Safety and Procedural requirements for Type Approval of
CNG Operated Vehicles**

1. Page no. 3, Table with title: **Safety and Procedural Requirements for Type Approval of CNG Operated Vehicles**,
Subtopic: Performance Tests as per CMVR:

In the column 2, Sr. No. (a)(iii) and (b) (iv);

In the column 3, Sr. No. (a)(ii) and

In the column 4, Sr. No. (a)(vii),

Substitute following text for existing text:

	For LPG Fitment by OE Manufacturer for New Vehicle	For Retro fitment of In-Use Vehicle	For Replacement of In- Use Diesel Engine by New LPG Engine
Performance Tests as per CMVR	(a) For Converted Gasoline Vehicles (iii) Constant Speed Fuel Consumption Test as per CMVR (b) For OE Dedicated CNG Vehicles (iv) Constant Speed Fuel Consumption Test as per CMVR	(a) For In-Use Gasoline Vehicles (iii) Constant Speed Fuel Consumption Test as per CMVR (a) For Retrofitment/ Modification of In-Use Diesel Vehicles (iv) Constant Speed Fuel Consumption Test as per CMVR	(a) For Replacement of In-Use Diesel Engine by New CNG Engine. (vii) Constant Speed Fuel Consumption Test as per CMVR

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SET-UP BY

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GOVERNMENT OF INDIA

5 December 2014

AMENDMENT RECORD

This document contains AIS 024, AIS 028

- Version 1 : Effective from 21st May 2001
Discontinued from 12th July 2001
- Version 2 : Effective from 12th July 2001
- Version 3 : Effective from 26th February 2002
- Amd. 1 to Version 3 : AIS-007 removed from the document :
Effective from 02nd Aug. 2002
 - Amendment No. 2 to AIS-024 (Version 3) : Effective from 1st June 2004
 - Amendment No.3 to AIS-024 (Version 3) : Effective from 1st June 2004
 - Amendment No.4 to AIS-024 (Version 3) : Effective from 1st October 2004
 - Amendment No.5 to AIS-024 (Version 3) : Effective from 10th December 2008
 - Amendment No.6 to AIS-024 (Version 3) : Effective from 1st December 2010
 - Amendment No.1 to AIS-028 (Version 3) : Effective from 1st December 2010

NOTE :

- Amendment No. 2 to AIS-024 (Version 3) is shown in red colour underlined text.
- Amendment No. 3 to AIS-024 (Version 3) is shown in blue colour underlined text.

AMENDMENT NO. 6
TO
AIS-024 (Version – 3)
Safety and Procedural requirements for Type Approval of
CNG Operated Vehicles

1. Annexure VII, Clause 16 (i):

Substitute “--- 450 sq. mm---” for “---- 550---- sq. mm.”

2. Annexure IX Sub-clause 20 (f) :

Substitute “----one copy---” for “----two copies---”.

3. Annexure IX, Clause 20 (g), Second Bullet:

Substitute “----450 sq. mm---” for “----550---- sq. mm.”

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December 2010

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AMENDMENT NO. 5
TO
AIS-024 (Version - 3)
Safety and Procedural requirements
for Type Approval of CNG Operated Vehicles

1. Page No. 22, Annexure IX, clause No. 20, b:

Substitute following text for existing text:

- “ b. (i) One number each of dry chemical powder type / CO₂ type fire extinguisher (1kg), for 4 wheeler (LCV etc.) only, shall be provided in driver’s and passenger’s compartment.
- (ii) One number of dry chemical powder type / CO₂ type fire extinguisher of 1 kg. shall be provided in M1 category of vehicles such that it shall be easily accessible to all the occupants.”
- (iii) In case of 3 wheeler where the driver and passengers compartments are not isolated one number of dry chemical powder type/CO₂ type fire extinguisher (1 kg) shall be provided.”

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**AMENDMENT NO. 4
TO
AIS-024 (Version – 3)
Safety and Procedural requirements for Type Approval of CNG Operated Vehicles**

1. Replace existing “Amendment Record” by enclosed “ Amendment Record”

2. Page nos.6 and 7, Annexure VII , B. Detail of CNG System, 1., e. :

Replace existing text by following text :

“e. Check that the material of the padding / lining provided for inner side of cylinder mounting band (s) is made up of EPDM non-moisture retaining rubber (hardness Shore A 60 min.) and tested as per AIS-066 as approved by the test agency during type approval certification.”

3. Page nos. 15, Annexure IX, B. Detail of CNG System, 1., f. :

Replace existing text by following text :

“f. Check that the material of the padding / lining provided for inner side of cylinder mounting band(s) is made up of EPDM non-moisture retaining rubber (hardness Shore A 60 min.) and tested as per AIS-066 as approved by the test agency during type approval certification.”

AMENDMENT RECORD

This document contains AIS 024, AIS 028

**Version 1 : Effective from 21st May 2001
Discontinued from 12th July 2001**

Version 2 : Effective from 12th July 2001

Version 3 : Effective from 26th February 2002

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- **Amendment No.4 to AIS-024 (Version 3) : Effective from 1st October 2004**

NOTE :

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- **Amendment No. 3 to AIS-024 (Version 3) is shown in blue colour underlined text.**

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AMENDMENT NO. 3
TO
AIS-024 (Version – 3)
Safety and Procedural requirements for Type Approval of CNG Operated Vehicles

1. Page nos. 6 to12 Annexure VII and page nos. 13 to 22 Annexure IX :
Substitute “Converted / Retrofitted in-use” for “in-use” wherever it occurs.
2. Page nos. 6 and 7, Annexure VII , B. Detail of CNG System, 1., e. :
Replace existing text by following text :
e. Check for non-moisture retaining hard rubber/equivalent material padding/lining (as approved by test agency) provided for inner side of the cylinder mounting band(s) with silicon coated or silicon rubber tested as per AIS-066
3. Page nos. 15, Annexure IX, B. Detail of CNG System, 1., f. :
Replace existing text by following text :
f. Check for non-moisture retaining hard rubber/equivalent material padding/lining (as approved by test agency) provided for inner side of the cylinder mounting band(s) with silicon coated or silicon rubber tested as per AIS-066
4. Page no. 22, Annexure IX , 20, b.:
First line : Delete the words : “---3 &--”.
Add following sentence at the end :
“ In case of 3 wheeler where the driver and passengers compartments are not isolated one number of dry powder type/CO₂ type fire extinguisher (1 kg) shall be provided. ”

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**AMENDMENT NO. 2
TO
AIS-024 (Version – 3)
Safety and Procedural requirements for Type Approval of CNG Operated Vehicles**

1. Replace existing “ Annexure I ” by enclosed “ Annexure I. ”
2. Replace existing “ Annexure VII ” by enclosed “ Annexure VII ”
3. Add enclosed “ Annexure IX ” after “ Annexure VIII ”

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TECHNICAL SPECIFICATION OF CNG CONVERSION KIT

<p>1. Details of Kit Manufacturer / Supplier / Installer</p> <p>a. Name of the Manufacturer b. Address c. Telephone No. & Fax No. d. Contact person</p>	
<p>2. CNG Kit Identification</p> <p>a. Identification No. b. Variants, if any</p>	
<p>3. CNG Cylinder (DOE approved/endorsed)</p> <p>a. Name of manufacturer b. Identification No. c. Type d. Working pressure (kg/cm²) <u>/(MPa)</u> e. Max. test pressure (kg/cm²) <u>/(MPa)</u> f. Cylinder capacity (water equivalent) g. Approval reference from DOE</p>	
<p>4. Cylinder Valve(s)(DOE approved/endorsed)</p> <p>a. Name of manufacturer b. Model name/Identification No. c. Type h. Working pressure (kg/cm²) <u>/(MPa)</u> i. Max. test pressure (kg/cm²) <u>/(MPa)</u> e. Approval reference from DOE</p>	
<p>5. CNG Solenoid Valve</p> <p>a. Name of manufacturer b. Model Name/Identification No. c. Type j. Working pressure (kg/cm²) <u>/(MPa)</u> k. Max test pressure (kg/cm²) <u>/(MPa)</u></p>	
<p>6. Petrol Solenoid Valve</p> <p>a. Name of manufacturer b. Model Name/Identification No. c. Type l. Working pressure (kg/cm²) <u>/(MPa)</u> m. Max test pressure (kg/cm²) <u>/(MPa)</u></p>	
<p>7. Refilling valve</p> <p>a. Name of the manufacturer b. Model name/Identification No. c. Type n. Working pressure (kg/cm²) <u>/(MPa)</u> o. Max test pressure (kg/cm²) <u>/(MPa)</u></p>	

Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	Sheet No.-----of-----

<p>8. Pressure Regulator</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>p. Inlet pressure (kg/cm^2) <u>/(MPa)</u></p> <p>q. Outlet pressure (kg/cm^2) <u>/(MPa)</u></p> <p>d. No. of stages</p>	
<p>9. CNG Filter</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>r. Inlet pressure (kg/cm^2) <u>/(MPa)</u></p> <p>s. Outlet pressure (kg/cm^2) <u>/(MPa)</u></p>	
<p>10. Oil Pump or Lubrication System, if any</p> <p>a. Name of manufacturer</p> <p>b. Type</p>	
<p>11. High Pressure Tubing</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>t. Working pressure (kg/cm^2) <u>/(MPa)</u></p> <p>u. Max. test pressure (kg/cm^2) <u>/(MPa)</u></p> <p>d. Outer diameter/Inner Diameter</p> <p>e. Protection quality (material used)</p>	
<p>12. Low Pressure Tubing</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>v. Working pressure (kg/cm^2) <u>/(kPa)</u></p> <p>w. Max test pressure (kg/cm^2) <u>/(kPa)</u></p> <p>d. Outer diameter/Inner Diameter</p> <p>e. Protection quality (material used)</p>	
<p>13. Gas-Air Mixer</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No</p> <p>c. Type & drawing</p> <p>d. Venturi Size</p>	
<p>14. ON/OFF Switch</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No</p> <p>c. Type</p>	

Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	
		Sheet No.-----of-----

15. Ignition System & Wiring Harness (for CNG system) (Ref. Clause A11 of Table 2 of AIS 007) a. Name of manufacturer a. Type of Ignition System b. Spark plug gap, mm c. Electrical circuit diagram <u>/Detail layout</u>		
16. Interfacing Unit (for closed loop engines) a. Name of manufacturer b. Model name/Identification No. c. Type		
17. Ignition Timing Advancer a. Name of manufacturer b. Type c. Timing on CNG mode d. Timing on baseline fuel.		
18. Brief Description of System Including Dimensional Layout for Cylinder and other kit components installation, <u>ventilation details etc.</u>		
19. Catalytic Converter Make & Model		
20. <u>Refilling valve interlocking switch</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Type</u>		
21. <u>Current limiting Device (Fuse)</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Voltage/current rating</u> d. <u>Type</u>		
22. <u>Pressure Indicator</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Type</u>		
23. <u>Service shut off valve</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Type</u>		
Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	
		Sheet No.-----of-----

<p>24. <u>Compartment/Sub-compartment/Gas tight housing</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Type</u></p>	
<p>25. <u>Conduit</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Inner & outer diameter</u> d. <u>Type</u></p>	
<p>26. <u>Details of Seat/Upholstery/roof and side lining</u> a. <u>Name of manufacturer</u> b. <u>Model name/Identification No.</u> c. <u>Type</u></p>	
<p>27. <u>Details of non-moisture retaining hard rubber/equivalent material padding/lining provided for inner side of the cylinder mounting band(s)</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Type</u></p>	
<p>28. <u>Battery cut off switch(if applicable)</u> a. <u>Name of manufacturer</u> b. <u>Identification No.</u> c. <u>Type</u></p>	
<p>29. Any other information</p>	

Note: In case of OE fitment, if any of the above information is already covered in the information submitted as per AIS 007, only the reference need be given and it is not necessary to duplicate the information.

Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	Sheet No.-----of-----

Annexure VII

CHECKLIST FOR THIRD PARTY CHECKING / INSPECTION OF BUILT UP CNG BUSES (NEW AND IN-USE) BEFORE REGISTRATION

This checklist is for third party inspection of fully built CNG buses before registration by RTOs. Reference to relevant clauses of Safety Code of Practice, e.g. AIS 028, and guidelines issued by Central Government from time to time should be made wherever appropriate.

A. Details of CNG Bus	
1. (a) Name and address of chassis manufacturer <u>(applicable for new & in-use)</u> <u>(b) Name and address of retrofitter (applicable for in-use)</u> <u>(c) Name and address of engine manufacturer (applicable for in-use)</u>	
2. Name of type approval agency	
3. Details of type approval certificate	
4. Name and address of bus body builder	
5. Name and address of approved inspecting agency at R.T.O.	
6. Chassis and engine No.	
7. Year of manufacture	
B. Detail of CNG System	
1. Checking of Cylinders as per DOE/ vehicle testing agency approvals	
<ul style="list-style-type: none"> • <i>Validity of DOE Certificate</i> 	
<ul style="list-style-type: none"> • <i>Safety checks</i> <p><u>a.</u> Check for corrosion on any CNG components / mountings of gas circuit</p> <p><u>b.</u> <u>Check whether</u> cylinder is securely mounted within the vehicle and check tightness of nuts and bolts</p> <p><u>c.</u> <u>Check whether</u> minimum 5 mm clearance is kept between cylinders and vehicle body structure</p> <p><u>d.</u> Distance between cylinder valve and bus body extremities shall not be less 200 mm <u>unless valves are protected (as per the details provided by the kit/vehicle manufacturer/kit supplier and duly vetted and approved by test agencies) to minimize the possibility of damage due to collision, overturning/ other accident.</u></p> <p><u>e.</u> <u>Check for non-moisture retaining hard rubber/equivalent material padding/lining (as approved by test agency) provided for inner</u></p>	

<p><u>side of the cylinder mounting band(s).(e.g. silicon coated or silicon rubber)</u></p> <p><u>Notes:</u></p> <ul style="list-style-type: none"> <u>In case of doubt, Inspecting Agencies will request the OE vehicle manufacturer/retrofitter to supply the sample of material for padding rubber which has been type approved by the testing agencies.</u> <u>Rubber packing if found damaged during inspection it should be replaced by the new material having revised specification</u> 	
<p>2. Cylinder Valves</p>	
<p><u>a. Check specific type & model approved by Vehicle testing agency for the vehicle under inspection.</u></p>	
<p><u>b. Check for operation</u></p>	
<p><u>c. Check for Shield / protection</u></p>	
<p><u>d. Check for physical damage to valves</u></p>	
<p><u>e. Check for burst disc with fusible plug as approved by DoE</u></p>	
<p><u>f. Leak test using non corrosive foaming agent (e.g. snoop of M/s Swagelok, collin etc) or Methane leak detector</u></p>	
<p>3. Refilling Valve</p>	
<ul style="list-style-type: none"> Safety checks - <p><u>a. Check for dust cap / plug</u></p> <p><u>b. Check that engine should not start when dust cap / plug is removed or open</u></p> <ul style="list-style-type: none"> <u>Check for proper make & type of interlocking switch as approved by testing agencies.</u> <p><u>c. Check leakage for non-return valve using non corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc) or Methane leak detector</u></p>	
<p>4. Fuel Line</p>	
<ul style="list-style-type: none"> Safety checks <p><u>a. Check for corrosion, <u>damage</u> on CNG fuel line</u> <u>(In case of PVC sleeved fuel line, corrosion shall be inspected at the ends, wherever it is exposed. Also inspect for any damage to the sleeving. Sleeve should be firmly gripped to the CNG fuel line)</u></p> <p><u>b. Check whether fuel line is securely mounted</u></p> <p><u>c. Check for deformation of U and Pigtail bends provided in high pressure piping for flexibility as per approved layout</u></p> <p><u>d. Distance between fuel line and exhaust <u>pipe / shield</u> shall not be less than 75 mm <u>and the fuel line should also be properly</u></u></p>	

<p><u>clamped and routed so as not to touch the engine block</u></p> <p><u>e. Check whether effective protection is provided, as per approved layout, to prevent the possibility of damage due to loose objects from road.</u></p> <p><u>f. Check the distance between any two clips which shall not be more than 600mm</u></p> <p><u>g. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector</u></p>	
<p>5. Shut Off Valve (Solenoid Valve(s)) wherever separately provided</p>	
<p style="text-align: center;">• Safety checks</p> <p><u>a. Verify the following as per type approval specification</u></p> <ul style="list-style-type: none"> ➤ <u>Make</u> ➤ <u>Type (if applicable)</u> ➤ <u>Identification No.</u> <p><u>b. Check whether</u> shut off valve is securely mounted</p> <p><u>c. Check operation for “Close & Open” as required</u></p> <p><u>d. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector</u></p>	
<p>6. Regulator</p>	
<p style="text-align: center;">• Safety checks</p> <p><u>a. Verify the following as per type approval specification</u></p> <ul style="list-style-type: none"> ➤ <u>Make</u> ➤ <u>Type (if applicable)</u> ➤ <u>Identification No.</u> <p><u>b. Check whether</u> regulator is securely mounted</p> <p><u>c. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector</u></p>	
<p>7. Gas-Air Mixer</p>	
<p style="text-align: center;">• Safety checks</p> <p><u>a. Verify the following as per type approval specification</u></p> <ul style="list-style-type: none"> ➤ <u>Make</u> ➤ <u>Type (if applicable)</u> ➤ <u>Identification No.</u> <p><u>b. Check whether</u> gas-air mixer is securely mounted</p> <p><u>c. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector</u></p>	

8. Electrical wiring: Safety checks

8.1 FOR OE & IN-USE VEHICLES –

- a.** Check whether that current limiting device (fuse) is fitted as per manufacturer specifications and make
- b.** *Terminals are insulated to prevent shorting*
- c.** *Wiring are taped and clipped with loom & mounted securely.*
- d.** Battery shall be securely mounted and battery terminal shall be locked properly by means of suitable nut & bolt with washers.
- e.** *Check installation of battery cut-off switch as per chassis manufacturer's recommendations. Location of Battery cut-off switch should be within the reach of driver in seating posture in driving seat.*
- f.** *Check routing of high tension cable to avoid accidental earthing and to be placed away from any heat source – as per chassis manufacturer's recommendations/ layout*
- g.** *Check for proper make of high tension cable as per chassis manufacturer's recommendation as well as check for tight fitment of its terminal to the spark-plug*

8.2 FOR OE VEHICLES -

- a.** *Check wiring harness layout under the floor and in the engine compartment to be in accordance with chassis manufacturer's layout / specifications / approval*
- b.** *Check wiring harness in cabin and passenger compartment to be as per chassis manufacturer's guidelines / approval*
- c.** *Cable harness has to be as per the recommendations of OE chassis/ vehicle manufacturers*

8.3 FOR IN-USE VEHICLES –

- a.** Check wiring harness layout under the floor / cabin and passenger compartment for proper sleeving and routing in order to avoid accidental sparking.

9. Service shut-off valve:

- Safety checks -

a. Make & type

b. Check operation

c. Check whether service shut off valve is securely mounted

d. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector

10. CNG Filter:

a. Check whether CNG filter is securely mounted

b. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector

11. CNG Pressure Gauge:

a. Make & type

b. Check whether CNG pressure indicator is securely mounted

c. Leak test using non-corrosive foaming agent (i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector

12. Compliance Plate:

12.1 Installation Check

Check for following	<u>Details for no. of Cylinders</u>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>.....</u>	<u>...</u>
a. <u>Cylinder identification No.</u>						
b. <u>Date of last testing and the name of certifying agency</u>						
c. <u>Water capacity (ltr)</u>						
d. <u>Next due date of testing</u>						
e. <u>Date of Installation</u>						
f. <u>Water capacity (ltr) of total installation</u>						
g. <u>Vehicle registration/ identification No. (to be furnished after registration)</u>						
h. <u>Seal /Identification of the checking /inspection agency(who carries out the 3rd party inspection)</u>						

i. Check whether compliance plate is installed near filling connection & be clearly visible to the filling agency

<p>13. Identification label in front and rear:</p> <p><u>a.</u> <i>Located on left side of the front and rear safety glass and shall ensure visibility from front and rear sides</i></p>	
<p>14. <u>Catalytic Converter(whenever it is part of kit)</u></p> <p><u>a.</u> <u>Verify make and type of the catalytic converter as per the vehicle manufacturer's specification and / as given in the type approval certificate as the case may be.</u></p>	
<p>15. <u>Low pressure hose</u></p> <p><u>a.</u> <u>Verify make and type of the low pressure hose as per the Type Approval specification.</u></p> <p><u>b.</u> <u>Check for kinks, damage or abrasion to the cover</u></p> <p><i>(Note: In case of doubt, Inspecting Agencies will request the OE vehicle manufacturer/retrofitter to supply the sample of material for low pressure hose which has been type approved by the testing agencies.)</i></p>	

16. Following additional points are to be complied at the time of registration/ before endorsement by the competent authority (after conversion) of CNG vehicle for enhancement of safety of vehicle.
- a. Fire retardant material conforming to FMVSS 302 for seat/upholstery/roof & side lining & IS:2465 for wiring cables shall be used. The OE / Vehicle manufacturer /retrofitter shall submit declaration with respect to design, manufacturing processes and material conforming the use of fire retardant materials.
- (Notes:
- For OE fully built vehicles,type approval is subjected to meeting the requirements as mentioned above.In case of type approval of drive-away chassis,declaration from chassis manufacturer for above tests shall be verified by inspection agency.
 - In case of doubt, Inspecting Agencies will request the OE vehicle manufacturer/retrofitter to supply the sample of material for cables/Seat/upholstery/roof & side lining which has been type approved by the testing agencies.
- b. One number each of dry powder type fire extinguishers (2 kg) shall be provided in driver's and passenger's compartment.
- c. For servicing of CNG vehicle proper instructions, detail operational & service manual with Dos & DON'Ts shall be provided by chassis manufacturer and body builder/retrofitter.Vehicle / chassis manufacturer/retrofitter should devise training module and impart training to drivers and technicians for safe operation of CNG system.
- d. Check for First-Aid kit as per CMVR.
- e. Distance between the exhaust line , muffler and fuel line shall be a minimum of 75 mm. If not a radiant heat shield of 2mm thickness shall be welded inbetween-
- f. Safety plates / shield below the pipe joints shall be welded and proper inspection windows shall be provided near the cylinder joints.
- g. Minimum two copies of safety instructions shall be displayed in passenger's compartment.
- h. Check for proper venting provided by louvers / holes / mesh on the side skirt so that in case of any leakage the entrapped gas under the floor escapes to the atmosphere.
- i. The bus body builder/retrofitter to provide at least two (total minimum area of 550 sq. mm) vent pipes connecting the under floor of the bus to the rooftop for CNG gas to vent out in case of leakage. The vent pipes to be located close to the cylinder valves cluster as per recommendations of chassis manufacturer. Construction should be such that leakage into passenger compartment is avoided.
- j. Any other safety recommendations provided or advised by the chassis manufacturers to be complied with.

Note: *The instructions issued by OE manufacturer/retrofitter for third party evaluation, in their instruction manual ,shall contain all the necessary details on the methodology & the procedure for carrying out these checks.*

Signature & Seal with date

Annexure IX

CHECKLIST FOR THIRD PARTY CHECKING / INSPECTION OF CNG VEHICLES(OTHER THAN CNG BUSES) BEFORE REGISTRATION (NEW AND IN-USE)

This checklist is for third party inspection of CNG vehicles (other than CNG Buses) i.e. two, three and four wheeler etc before registration by RTOs. Reference to relevant clauses of Safety Code of Practice, e.g. AIS 028, and guidelines issued by Central Government from time to time should be made wherever appropriate.

<u>A. Details of CNG Vehicle</u>	
<u>1(a) Name and address of OE Vehicle manufacturer</u>	
<u>1(b) (i) Name and address of the Drive Away Chassis Manufacturer(applicable for new & in-use)</u>	
<u>1(b) (ii) Name of the Retrofitter holding the type approval certificate</u>	
<u>1(c) Name of the authorized kit installer duly authorized by the original retrofitter</u>	
<u>1(d) Name and address of Body builder (if applicable)</u>	
<u>2. Name of type approval agency</u>	
<u>3. Reference number of type approval certificate</u>	
<u>3.1 Validity</u>	
<u>3.1.1 Gasoline Vehicles(In-use):</u>	
<u>a. CC of base model tested</u>	
<u>b. Flexibility available for conversion +/- 25% of the base model</u>	
<u>c. Period of validity, i.e. from ---- to ----</u>	
<u>3.1.2 Diesel Vehicles(In-use):</u>	
<u>a. Type and make of model</u>	
<u>b. Year of manufacture</u>	
<u>c. Period of Validity , i.e. from --- to ---</u>	
<u>3.1.3 In the case of OE,</u>	
<u>a. Validity will be for the base model and its variants given in the type approval certificate</u>	
<u>b. Period from --- to -- (as given in the type approval certificate)</u>	
<u>4. Name and address of approved inspecting agency at R.T.O.</u>	

<p><u>5. a) Vehicle Registration No:(if applicable)</u></p> <p><u>b) Vehicle type & model</u></p>	
<p><u>6. Chassis and engine No.</u></p> <p style="text-align: center;"><u>❖ Original as per RCTC</u></p> <p style="text-align: center;"><u>or</u></p> <p style="text-align: center;"><u>❖ New in case of replacement of engine</u></p>	
<p><u>7. Year of manufacture</u></p> <p>a)<u>Chassis in case of drive-away chassis</u></p> <p>b)<u>Fully built up vehicle</u></p> <p>c)<u>Month & year of conversion</u></p>	
<p><u>B. Detail of CNG System</u></p>	
<p><u>1. Checking of Cylinders as per DOE/ vehicle testing agency approvals</u></p>	
<p><u>Validity of DOE Certificate</u></p>	
<p><u>Safety checks</u></p> <p>a. <u>Check for corrosion on any CNG components / mountings of gas circuit</u></p> <p>b. <u>Check whether cylinder is securely mounted within the vehicle and check tightness of nuts and bolts</u></p> <p>c. <u>Check whether minimum 5 mm clearance is kept between cylinder and vehicle body structure and also in between the cylinders, if applicable.</u></p> <p>d. <u>Distance between cylinder valve and vehicle body extremities shall not be less 200 mm unless valves are protected (as per the details provided by the kit/vehicle manufacturer/kit supplier and duly vetted and approved by test agencies) to minimize the possibility of damage due to collision, overturning/ other accident.</u></p> <p>e. <u>Check for reinforcement if cylinder is mounted on floor of the vehicle (minimum dimension of reinforcement thickness & surface area shall not be less than 2.5 mm & 3600 mm² respectively). The reinforcement shall be provided on the top & bottom of the floor.</u></p>	

<p><u>f. Check for non-moisture retaining hard rubber/equivalent material padding/lining (as approved by test agency) provided for inner side of the cylinder mounting band(s).(e.g. silicon coated or silicon rubber)</u></p> <p><u>Notes:</u></p> <ul style="list-style-type: none"> • <u>In case of doubt, Inspecting Agencies will request the OE vehicle manufacturer/retrofitter to supply the sample of material for padding rubber which has been type approved by the testing agencies.</u> • <u>Rubber packing if found damaged during inspection it should be replaced by the new material having revised specification</u> 	
<p><u>2. Cylinder Valves</u></p>	
<p><u>a. Check specific type & model approved by Vehicle testing agency for the vehicle under inspection.</u></p>	
<p><u>b. Check for operation</u></p>	
<p><u>c. Check for physical damage/distortion to ___ valves</u></p>	
<p><u>d. Check for Shield / protection</u></p>	
<p><u>e. Check for burst disc with fusible plug as approved by DoE</u></p>	
<p><u>f. Check for the vent pipe outlet routing away from exhaust in case of cylinder fitting in the enclosed compartment.</u></p>	
<p><u>g. Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or methane leak detector</u></p>	
<p><u>3. Refilling Valve</u></p>	
<ul style="list-style-type: none"> • <u>Safety checks -</u> <ul style="list-style-type: none"> <u>a. Check for dust cap / plug</u> <u>b. Check that engine should not start when dust cap / plug is removed or open</u> <ul style="list-style-type: none"> • <u>Check for proper make & type of interlocking switch as approved by testing agencies.</u> <u>c. Check leakage for non-return valve using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or Methane leak detector</u> 	

<p>4. <u>Fuel Line</u></p>	
<ul style="list-style-type: none"> • <u>Safety checks</u> a. <u>Check for corrosion, damage of CNG fuel line</u> <i>(In case of PVC sleeved fuel line, corrosion shall be inspected at the ends, wherever it is exposed. Also inspect for any damage to the sleeving. Sleeve should be firmly gripped to the CNG fuel line)</i> b. <u>Check whether fuel line is securely mounted</u> c. <u>Check for U and Pigtail bends provided in high pressure piping for flexibility as per approved layout</u> d. <u>Check whether effective protection is provided, as per approved layout, to prevent the possibility of damage due to loose objects from road.</u> e. <u>Distance between fuel line and exhaust pipe / shield shall not be less than 75 mm and the fuel line should also be properly clamped and routed so as not to touch the engine block</u> f. <u>Check the distance between any two clips which shall not be more than 600mm (500mm & 300mm incase of 3/2 wheeler respectively).</u> g. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector</u> 	
<p>5. <u>Shut Off Valve (Solenoid Valve(s)) wherever separately provided)</u></p>	
<ul style="list-style-type: none"> • <u>Safety checks</u> a. <u>Verify the following as per type approval specification</u> <ul style="list-style-type: none"> ➤ <u>Make</u> ➤ <u>Type (if applicable)</u> ➤ <u>Identification No.</u> b. <u>Check whether shut off valve is securely mounted</u> c. <u>Check operation for “Close & Open” as required</u> d. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok, collin etc.) or methane leak detector</u> 	

<p>6. <u>Regulator</u></p>	
<ul style="list-style-type: none"> • <u>Safety checks</u> a. <u>Verify the following as per type approval specification</u> <ul style="list-style-type: none"> ➤ <u>Make</u> ➤ <u>Type(if applicable)</u> ➤ <u>Identification No</u> b. <u>Check whether regulator is securely mounted</u> c. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or methane leak detector</u> 	
<p>7. <u>Gas-Air Mixer</u></p>	
<ul style="list-style-type: none"> • <u>Safety checks</u> a. <u>Verify the following as per type approval specification</u> <ul style="list-style-type: none"> ➤ <u>Make</u> ➤ <u>Type(if applicable)</u> ➤ <u>Identification No</u> b. <u>Check whether gas-air mixer is securely mounted</u> c. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or methane leak detector</u> 	

8. Electrical wiring: Safety checks

8.1 FOR OE & IN-USE VEHICLES –

- a. Check whether that current limiting device (fuse) is fitted as per manufacturer specifications and make
- b. Terminals are insulated to prevent shorting
- c. Wiring are taped and clipped with loom & mounted securely
- d. Battery shall be securely mounted and battery terminal shall be locked properly by means of suitable nut & bolt with washers.
- e. Check installation of battery cut-off switch as per vehicle / chassis manufacturer's recommendations (if applicable). Location of Battery cut-off switch should be within the reach of driver in seating posture in driving seat.
- f. Check routing of high tension cable to avoid accidental earthing and to be placed away from any heat source – as per Vehicle / chassis manufacturer's recommendations / layout or as approved by Test Agency.
- g. Check for proper make of high tension cable connected to Spark Plug as per Vehicle/chassis manufacturer's recommendation. Check for tight fitment of its terminal to the spark-plug

8.2 FOR OE VEHICLES -

- a. Check wiring harness layout under the floor and in the engine compartment to be in accordance with Vehicle/chassis manufacturer's layout / specifications / approval
- b. Check wiring harness in cabin and passenger compartment to be as per vehicle/chassis manufacturer's guidelines / approval
- c. Cable harness has to be as per the recommendations of OE chassis / vehicle manufacturers

8.3 FOR IN-USE VEHICLES –

- a. Check wiring harness layout under the floor / cabin and passenger compartment for proper sleeving and routing in order to avoid accidental sparking.

<p>9. <u>Service shut-off valve:</u></p> <ul style="list-style-type: none"> • <u>Safety checks –</u> <p>a. <u>Make & type</u></p> <p>b. <u>Check operation</u></p> <p>c. <u>Check whether service shut off valve is securely mounted</u></p> <p>d. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or methane leak detector</u></p>	
<p>10. <u>CNG Filter: (wherever separately provided)</u></p> <p>a. <u>Check whether CNG filter is securely mounted</u></p> <p>b. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or methane leak detector</u></p>	
<p>11. <u>CNG Pressure Gauge:</u></p> <p>a. <u>Make & type</u></p> <p>b. <u>Check whether CNG pressure indicator is securely mounted</u></p> <p>c. <u>Leak test using non-corrosive foaming agent(i.e. snoop of M/s Swagelok,collin etc.) or methane leak detector</u></p>	

12. Compliance Plate:

- Installation Check

<u>Check for following</u>	<u>Details for no. of Cylinders</u>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>.....</u>	<u>...</u>
<u>a. Cylinder identification No.</u>						
<u>b. Date of last testing and the name of certifying agency</u>						
<u>c. Water capacity (ltr)</u>						
<u>d. Next due date of testing</u>						
<u>e. Water capacity (ltr) of total installation</u>						
<u>f. Vehicle registration/ identification No. (to be furnished after registration)</u>						
<u>g. Seal /Identification of the checking /inspection agency(who carries out the 3rd party inspection)</u>						
<u>h. Check whether compliance plate is installed near filling connection & be clearly visible to the filling agency</u>						

<p>13. <u>Identification label in front and rear:</u></p> <p>a. <u>Located on left side of the front and rear safety glass and shall ensure visibility from front and rear sides</u></p>	
<p>14. <u>Compartment/Sub-compartment/Gas tight housing(for internally mounted cylinder/s)</u></p> <p>a. <u>Check whether Compartment/Sub-compartment/Gas tight housing is in good condition i.e. shall not show any crack/damage.</u></p> <p>b. <u>Check whether it is firmly clamped to the conduit/vent hose/ducting</u></p>	
<p>15. <u>Conduits/ducting/vent hose(for internally mounted cylinder/s)</u></p> <p>a. <u>Check whether Conduits/ducting is in good condition i.e. shall not show any crack/damage</u></p>	
<p>16. <u>Petrol Shut Off Valve (Solenoid) (if applicable i.e. Gasoline injection vehicle does not require such solenoid valve)</u></p> <p>a. <u>Check operation</u></p> <p>b. <u>Check whether Petrol shut off valve is securely mounted</u></p> <p>c. <u>Leak test (visual inspection)</u></p> <p>d. <u>Verify the make & type as per the Type Approval specification.</u></p>	
<p>17. <u>Fuel selection switch(for bi-fuel mode)</u></p> <ul style="list-style-type: none"> • <u>Check operation</u> 	
<p>18. <u>Catalytic Converter(whenever it is part of kit)</u></p> <p>a. <u>Verify make and type of the catalytic converter as per the vehicle manufacturer's specification and / as given in the type approval certificate as the case may be.</u></p>	
<p>19. <u>Low pressure hose</u></p> <p>a. <u>Verify make and type of the low pressure hose as per the Type Approval specification.</u></p> <p>b. <u>Check for kinks, damage or abrasion to the cover</u></p> <p><i><u>(Note: In case of doubt, Inspecting Agencies will request the OE vehicle manufacturer/retrofitter to supply the sample of material for low pressure hose which has been type approved by the testing agencies.)</u></i></p>	

20. Following additional points are to be complied at the time of registration/before endorsement by the competent authority (after conversion) of CNG vehicle for enhancement of safety of vehicle.

a. Fire retardant material conforming to FMVSS 302 for seat/upholstery/roof & side lining & IS:2465 for wiring cables shall be used. The OE / Vehicle manufacturer/retrofitter shall submit declaration with respect to design, manufacturing processes and material conforming the use of fire retardant materials.

(Notes:

- For OE fully built vehicles, type approval is subjected to meeting the requirements as mentioned above. In case of type approval of drive-away chassis, declaration from chassis manufacturer for above tests shall be verified by inspection agency.
- In case of doubt, Inspecting Agencies will request the OE vehicle manufacturer/retrofitter to supply the sample of material for cables/Seat/upholstery/roof & side lining which has been type approved by the testing agencies.

b. One number each of dry powder type / CO₂ type fire extinguishers (1 kg), for 3 & 4wheelers (car, LCV, etc) only, shall be provided in driver's and passenger's compartment.

c. For servicing of CNG vehicle proper instructions, detailed operational & service manual with Dos & DON'Ts shall be provided by kit/vehicle manufacturer's. Vehicle / kit manufacturer/ kit supplier should devise training module and impart training to drivers and technicians for safe operation of CNG system.

d. Check for First-Aid kit as per CMVR..

e. Safety plates / shield below the pipe joints shall be welded and proper inspection windows shall be provided near the cylinder joints.

f. Minimum two copies of safety instructions shall be displayed in passenger's compartment.

g. Check the following for the vehicles other than M1 category; fitted with multi CNG cylinders not incorporating the independent venting system.

- ☛ Check for proper venting provided by louvers / holes / mesh on the side skirt so that in case of any leakage the entrapped gas under the floor escapes to the atmosphere
- ☛ The Vehicle/kit manufacturer/kit supplier to provide at least two (total minimum area of 550 sq. mm) vent pipes connecting the under floor of the vehicle to the rooftop for CNG gas to vent out in case of leakage. The vent pipes to be located close to the cylinder valves cluster as per recommendations of chassis manufacturer. Construction should be such that leakage into passenger compartment is avoided

h. Any other safety recommendations provided or advised by the Vehicle/kit manufacturer/kit supplier to be complied with.

Note: The instructions issued by OE manufacturer/retrofitter for third party evaluation, in their instruction manual, shall contain all the necessary details on the methodology & the procedure for carrying out these checks.

Signature & Seal with date

AIS 024: SAFETY AND PROCEDURAL REQUIREMENTS FOR TYPE APPROVAL OF CNG OPERATED VEHICLES

Safety and Procedural Requirements for Type Approval of CNG Operated Vehicles			
	For CNG Fitment by OE Manufacturer for New Vehicle	For Retrofitment of In-Use Vehicle	For Replacement of In-Use Diesel Engine by New CNG Engine
Documents to be submitted	<p>Specification of CNG kit in the given format as per Annexure I.</p> <p>Detailed and brief technical specifications of vehicle in AISC format (AIS 007).</p>	<p>Specification of CNG kit as per Annexure I.</p> <p>Technical specification of the retrofitted vehicle as per Annexure II.</p> <p>Details of alterations carried out on diesel engine to CNG along with names of the supplier.</p>	<p>Specification of CNG kit as per Annexure I.</p> <p>Technical specifications of in-use diesel vehicle as per Annexure II.</p> <p>Technical specification of vehicle and CNG engine as per Table 2 and 4 of AIS 007.</p>

	For CNG Fitment by OE Manufacturer for New Vehicle	For Retrofitment of In-Use Vehicle	For Replacement of In-Use Diesel Engine by New CNG Engine
CMVR Checks	<p>CMVR checks / tests are to be conducted by Test Agency as per CMVR No. 93 to 125.</p> <p>Certificates of original petrol/diesel engined vehicles to be produced for checking compliance of as many common rules of CMVR for petrol/ diesel vehicle and CNG vehicle.</p> <p>Whichever rules are not complied with because of changes made for conversion, the same are to be re-checked as per applicable CMVR.</p>	<p>Undertaking by the kit manufacturer/ supplier regarding fitness (as per Annexure III) and fitness compliance as per CMVR as amended by the Government of India from time to time, of the in-use vehicle to be submitted to the test agency for the examination and evaluation before undertaking performance tests on CNG fuelled vehicles.</p> <p>Assessment of structural integrity in case of heavy passenger/goods diesel vehicles to be provided by the retrofitter or kit installer.</p>	<p>Undertaking by the vehicle manufacturer/kit manufacturer/ kit supplier regarding fitness (as per Annexure III) and fitness compliance as per CMVR as amended by the Government of India from time to time, of the in-use vehicle to be submitted to the test agency for the examination and evaluation before undertaking performance test on CNG fuelled vehicles.</p> <p>Assessment of structural integrity in case of heavy passenger/goods diesel vehicles to be provided by the retrofitter or kit installer.</p>

	For CNG Fitment by OE Manufacturer for New Vehicle	For Retrofitment of In-Use Vehicle	For Replacement of In-Use Diesel Engine by New CNG Engine
Performance Tests as per CMVR	<p>Performance Tests to be carried out by Test Agency:</p> <p>(a) <u>For Converted Gasoline Vehicles</u></p> <p>(i) Mass Emission Test</p> <p>(ii) Engine Performance Test</p> <p>(iii) Constant Speed Fuel Consumption Test</p> <p>(b) <u>For OE Dedicated CNG Vehicles.</u></p> <p>(i) Mass Emission Test</p> <p>(ii) Engine Performance Test</p> <p>(iii) Gradeability Test</p> <p>(iv) Constant Speed Fuel Consumption Test</p> <p>(v) EMI Test</p> <p>(vi) Range Test of at least 250 km for buses.</p> <p>(vii) Cooling Performance Test as per IS 14557</p> <p>(c) Any other tests as made applicable by Government of India from time to time.</p>	<p>Performance Tests to be carried out by Test Agency, as per applicable CMVR prevailing in the year of manufacture of vehicle model:</p> <p>(a) <u>For In-Use Gasoline Vehicles</u></p> <p>(i) Mass Emission Test</p> <p>(ii) Constant Speed Fuel Consumption Test</p> <p>(b) <u>For Retrofitment/Modification of In-Use Diesel Vehicles.</u></p> <p>(i) Mass Emission Test</p> <p>(ii) Engine Performance Test</p> <p>(iii) Gradeability Test</p> <p>(iv) Constant Speed Fuel Consumption Test</p> <p>(v) EMI Test</p> <p>(vi) Range Test of at least 250 km for buses.</p> <p>(vii) Cooling Performance Test as per IS 14557</p> <p>(c) Any other tests as made applicable by Government of India from time to time.</p>	<p>Performance Tests to be carried out by Test Agency:</p> <p>(a) <u>For Replacement of In-Use Diesel Engine by New CNG Engine.</u></p> <p>(i) Mass Emission Test</p> <p>(ii) Engine Performance Test</p> <p>(iii) Gradeability Test</p> <p>(iv) EMI Test</p> <p>(v) Range Test of at least 250 km for buses.</p> <p>(vi) Cooling Performance Test as per IS 14557</p> <p>(vii) Constant Speed Fuel Consumption Test</p> <p>(b) Any other tests as made applicable by Government of India from time to time.</p>

Safety Checks as per AIS 028.	As given in Annexure IV of AIS 024.	As given in Annexure IV of AIS 024.	As given in Annexure IV of AIS 024.
Criteria to authorize kit installer and responsibility of the vehicle / kit manufacturer / supplier / installer	-	As given in Annexure V of AIS 024.	As given in Annexure V of AIS 024
Format of installation certificate for converted CNG vehicle	As per Annexure VI of AIS 024	As per Annexure VI of AIS 024	As per Annexure VI of AIS 024
<u>Checklist for third party checking or inspection of built-up CNG buses before registration</u>	<u>As per Annexure VII of AIS 024</u>	-	-
<u>Checklist for preventive maintenance of in-use CNG vehicles</u>	-	<u>As per Annexure VIII of AIS 024</u>	<u>As per Annexure VIII of AIS 024</u>

TECHNICAL SPECIFICATION OF CNG CONVERSION KIT

<p>1. Details of Kit Manufacturer / Supplier / Installer</p> <p>a. Name of the Manufacturer b. Address c. Telephone No. & Fax No. d. Contact person</p>	
<p>2. CNG Kit Identification</p> <p>a. Identification No. b. Variants, if any</p>	
<p>3. CNG Cylinder (DOE approved/endorsed)</p> <p>a. Name of manufacturer b. Identification No. c. Type d. Working pressure (kg/cm²) e. Max. test pressure (kg/cm²) f. Cylinder capacity (water equivalent) g. Approval reference from DOE</p>	
<p>4. Cylinder Valve(s)(DOE approved/endorsed)</p> <p>a. Name of manufacturer b. Model name/Identification No. c. Type d. Working pressure (kg/cm²) e. Max. test pressure (kg/cm²) f. Approval reference from DOE</p>	
<p>5. CNG Solenoid Valve</p> <p>a. Name of manufacturer b. Model Name/Identification No. c. Type d. Working pressure (kg/cm²) e. Max test pressure (kg/cm²)</p>	
<p>6. Petrol Solenoid Valve</p> <p>a. Name of manufacturer b. Model Name/Identification No. c. Type d. Working pressure (kg/cm²) e. Max test pressure (kg/cm²)</p>	

Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	Sheet No.-----of-----

<p>7. Refilling valve</p> <p>a. Name of the manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>d. Working pressure (kg/cm²)</p> <p>e. Max test pressure (kg/cm²)</p>	
<p>8. Pressure Regulator</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>d. Inlet pressure (kg/cm²)</p> <p>e. Outlet pressure (kg/cm²)</p> <p>f. No. of stages</p>	
<p>9. CNG Filter</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>d. Inlet pressure (kg/cm²)</p> <p>e. Outlet pressure (kg/cm²)</p>	
<p>10. Oil Pump or Lubrication System, if any</p> <p>a. Name of manufacturer</p> <p>b. Type</p>	
<p>11. High Pressure Tubing</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>d. Working pressure (kg/cm²)</p> <p>e. Max. test pressure (kg/cm²)</p> <p>f. Outer diameter/Inner Diameter</p> <p>g. Protection quality (material used)</p>	
<p>12. Low Pressure Tubing</p> <p>a. Name of manufacturer</p> <p>b. Model name/Identification No.</p> <p>c. Type</p> <p>d. Working pressure (kg/cm²)</p> <p>e. Max test pressure (kg/cm²)</p> <p>f. Outer diameter/Inner Diameter</p> <p>g. Protection quality (material used)</p>	

Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	Sheet No.-----of-----

13. Gas-Air Mixer a. Name of manufacturer b. Model name/Identification No c. Type & drawing d. Venturi Size	
14. ON/OFF Switch a. Name of manufacturer b. Model name/Identification No c. Type	
15. Ignition System & Wiring Harness (for CNG system) (Ref. Clause A11 of Table 2 of AIS 007) a. Name of manufacturer a. Type of Ignition System b. Spark plug gap, mm c. Electrical circuit diagram	
16. Interfacing Unit (for closed loop engines) a. Name of manufacturer b. Model name/Identification No. c. Type	
17. Ignition Timing Advancer a. Name of manufacturer b. Type c. Timing on CNG mode d. Timing on baseline fuel.	
18. Brief Description of System Including Dimensional Layout for Cylinder and other kit components installation	
19. Catalytic Converter Make & Model	
20. Any other information	

Note: In case of OE fitment, if any of the above information is already covered in the information submitted as per AIS 007, only the reference need be given and it is not necessary to duplicate the information.

Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	Sheet No.-----of-----

<u>Steering</u> Steering Wheel Diameter Ratio	
<u>Frame</u> Long Member Size, mm Number of Cross Members	
<u>Suspension</u> Spring Anti-Roll Bar	
<u>Shock Absorber</u>	
<u>Brake</u> Service Brake Front Rear Total Braking Area Parking Brake Wheels and Tyres	
<u>Electrical System</u> System Voltage Battery Alternator (Max. Output) Type Wiper Motor	
<u>Fuel Tank</u>	
<u>Dimensions</u> Wheel Base, mm Overall Width, mm Overall Length, mm Front Track, mm Rear Track, mm Min. Ground Clearance, mm Cargo Box Dimensions Load Body Platform Area	
<u>Weights</u> Maximum GVW Maximum Permissible FAW Maximum Permissible RAW KERB weight with 90% fuel (with spare wheel, tools, etc.) Maximum Gradeability in 1 st Gear	

<u>Seating Capacity</u>		
Test Agency	Manufacturer	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	Sheet No.-----of-----

**CHECKLIST FOR FITNESS TESTS AND CERTIFICATION FOR IN-USE
VEHICLES AFTER FITMENT / CONVERSION TO CNG MODE**

<i>Sr. No.</i>	<i>Description</i>	
1.	Spark plug /Suppression cap / HT cables	
2.	Head lights	
3.	Other lights	
4.	Reflectors	
5.	Bulbs	
6.	Rear view mirrors	
7.	Safety glass	
8.	Horn	
9.	Silencer	
10.	Sari guard, passenger hold	
11.	Dash board equipment	
12.	Windshield Wiper	
13.	Exhaust emission	
14.	Brake	
15.	Speedometer	
16.	Steering	
17.	Seat Belt	
18.	Suspension springs, viz. a. No. of leaves b. Size of flat (width and thickness) front and rear	
19.	Tyre, viz. a. Size, ply rating b. Condition of Tyre (new/remoulded) c. Tread depth	
20.	Location of exhaust pipe	
21.	Over Dimension, viz. a. Length b. Height c. Width d. Overhang	
22.	Structural Integrity a. Changes to the chassis/ vehicle body	
23.	Visual inspection of propeller shaft and universal joint to be carried out.	

Vehicle Model	Engine No.
Year of manufacture	Chassis No.
Vehicle Registration/Identification No:	
Name of the Kit Installer	Document No. (indicating also revision status)
Signature with Seal	
Name	
Designation	
Date	Sheet No.-----of-----

**SAFETY CHECKS FOR USE OF CNG FUELS IN INTERNAL
COMBUSTION ENGINED VEHICLES (AS PER AIS 028) & INDIAN
GAS CYLINDER RULES, 1981 (as amended from time to time)**

CNG Kit Component	Certifying / Verifying Authority	Clause of AIS 028 /Other Rules, Standards, etc.
1) - Cylinder* - Fitment of cylinder on vehicle	<ul style="list-style-type: none"> ◆ DOE, Nagpur to certify/endorse in case of foreign make ◆ Test agency to verify as per AIS 028 . 	<ul style="list-style-type: none"> ◆ Gas Cylinder Rules, 1981. ◆ Clauses 2.3, 2.5 & 2.6 of AIS 028.
2) Cylinder Valves*	DOE, Nagpur to certify / endorse in case of foreign make	IS:3224 or Gas Cylinder Rules, 1981
3) Regulator*	Testing of the component as per ISO-15500 or equivalent standard by test agency. Alternatively, test agency to verify the test certificate/report conforming to the above standard issued by manufacturer /accredited testing laboratory.	ISO-15500 or equivalent standard.
4) Gas-Air Mixer*	Testing of the component as per ISO-15500 or equivalent standard by test agency. Alternatively, test agency to verify the test certificate/report conforming to the above standard issued by manufacturer/accredited testing laboratory.	ISO-15500 or equivalent standard.
5) Petrol & Gas Solenoid Valves*	Testing of the component as per ISO-15500 or equivalent standard by test agency. Alternatively, test agency to verify the test certificate/report conforming to the above standard issued by manufacturer/accredited testing laboratory.	ISO-15500 or equivalent standard
6) Filling Connection (NZS & NGV-1 type)	Installation on vehicle to be checked by test agency as per AIS 028	Clauses 2.2.2, 2.2.3, 2.2.4, 2.2.5 and 2.2.6 of AIS 028
7) Ventilation	Test agency to verify	Clause 2.4.2 of AIS 028
8) Testing of Conduit*	Testing of the component/verification of certificate or test report as per AIS 028 or equivalent standard by test agency.	Clause 2.4.3.1 of AIS 028

**SAFETY CHECKS FOR USE OF CNG FUELS IN INTERNAL COMBUSTION
ENGINED VEHICLES (AS PER AIS 028) & INDIAN GAS CYLINDER RULES,
1981 (as amended from time to time)**

CNG Kit Component	Certifying / Verifying Authority	Clause of AIS 028 / Other Rules, Standards, etc.
9) CNG fuel line a) High pressure – exceeding 100 kPa* ♦ Exceeding 2.15 MPa - Rigid Pipe - Flexible Hose ♦ Exceeding 100 kPa and less than 2.15 MPa b) Low pressure- not exceeding 100 kPa* c) Joints and connections	Testing of the component/verification of certificate or test report as per AIS 028 or equivalent standard by test agency. Testing of the component/verification of certificate or test report as per AIS 028 or equivalent standard by test agency. Testing of the component/verification of certificate or test report as per AIS 028 or equivalent standard by test agency. Testing of the component/verification of certificate or test report as per AIS 028 or equivalent standard by test agency. Testing by test agency.	Clause 3.1.1 of AIS 028 Clauses 3.1.3.1, 3.1.3.2 and 3.1.3.3.1 of AIS 028 Clause 3.1.2 of AIS 028 Clause 3.2.1 (a) of AIS 028 Clauses 3.1.4.1,3.2.1 (b) of AIS 028
10) Compartment/Sub-compartment*	Testing of the component/verification of certificate or test report as per AIS 028 or equivalent standard by test agency.	Clause 2.4.1 of AIS 028. Clause 2.4.3.5 of AIS 028 (for pliable material).
11) Safety check for installation of CNG system	Safety checks to be carried out by test agency as per AIS 028.	Relevant clauses of AIS 028.

*Certificate issued conforming to the equivalent prescribed standards by accredited testing agency of the country of origin or a report issued by internationally accredited test laboratory or the manufacturer’s test report (at the discretion of the testing agency) may also be accepted.

NOTE - Only the latest version of all the standards, as mentioned, shall be referred for compliance.

**CRITERIA TO AUTHORIZE THE KIT INSTALLER AND
RESPONSIBILITY OF VEHICLE / KIT MANUFACTURER / SUPPLIER /
INSTALLER**

The following are the criteria to be complied by the kit supplier/manufacturer for conversion of in-use vehicles to operate on CNG fuel.

1. The **replacement of engine** / retrofitment of CNG kit shall be type approved by any one of the testing agencies specified in Rule 126 of the Central Motor Vehicle Rules. The responsibility of the type approval and ensuring that the kits manufactured comply with the provisions and installation thereof shall be that of the vehicle/kit manufacturer/supplier as the case may be.
2. Only the Installer authorized by vehicle/kit manufacturer/supplier shall fit the kit on vehicles. For this purpose, the vehicle/kit manufacturer/supplier shall issue a certificate of authorization to the Installer concerned duly authorizing them to fit the kit **on behalf of manufacturer**.
3. Kit installer shall be equipped with the following tools and equipment.
 - Two post lift / ramp
 - Electric hand drill machine and H.S.S. drill bits
 - Tube bender
 - Tube cutter
 - Deburring tool for tube
 - Set of 'D' ring and box spanners
 - Set of screw driver (both flat and star)
 - Set of allen keys
 - H.S.S. hand saw
 - Crimping tool for electrical cable termination
 - Soap bubble bottle
 - Set letter and number punch
 - Infrared pollution meter
 - Timing gun
 - Filler gauge
 - Measurement tape
 - Air compressor
 - Flame proof inspection light
 - Vernier caliper
 - Multimeter
 - Silicon seal/sealant

Fire fighting equipment

- Dry chemical powder (DCP) type fire extinguisher – minimum two numbers of 5 kg each with ISI mark.
 - CO₂ type fire extinguisher – minimum 1 number of 5 kg with ISI mark.
 - Fire buckets – 2 buckets.
4. Installer shall have trained technicians having minimum ITI qualification and at least two years of experience in the similar field. Vehicle/kit

manufacturer/supplier to impart extensive training to the technicians on CNG kit installation.

5. Installer to display in the premises, authorization certificate issued by vehicle manufacturer/kit manufacturer/supplier. Also, installer to display details of the facilities available in terms of equipment and trained manpower.
6. After obtaining the type approval certification, the vehicle/kit manufacturer/supplier(s) shall authorize the installer to undertake CNG conversion, who meets the following requirements.
 - i) Name and communication details like address, telephone number, etc. of the installer.
 - ii) Business profile
 - iii) Qualification
 - iv) Experience
 - v) Details of technical staff and equipment
 - vi) Specification of workshop/land use certificate from appropriate authority.

The vehicle / kit manufacturer or supplier shall submit the above information to the regional transport authorities.

7. Installer to carry out conversion/installation as per “Code of Practice for Use of CNG fuels in internal combustion engines (AIS 028)”.
8. Installer to carry out the inspection, testing, commissioning & garaging/repair of CNG system as per clause 7 & 8 of AIS 028”.
9. Installer shall issue installation certificate **as per Annexure VI of AIS 024**, to the vehicle owner, that the conversion kit has been fitted in safe and proper manner, in compliance with “Code of Practice for Use of CNG fuel in Internal combustion Engines (AIS 028) ”.
10. Installer to send a copy of installation certificate **as per Annexure VI of AIS 024** and duly filled checklist as per “Appendix A of AIS 028 **(for vehicles other than CNG buses) / Annexure VII of AIS 024 (for CNG buses)**” to **RTO** and Test Agency, who has type approved the **CNG** conversion kit.
11. The record of conversion / alteration of vehicles carried out by the kit installer shall be maintained and made available to the authorities such as **MORTH** / Test Agencies / Transport Authorities as and when demanded.
12. The vehicle owner shall apply to the concerned registering authority within 14 days of undertaking the alteration, as required under Section 52 of Motor Vehicle Act 1988, for endorsement of particular alteration in registration certificate mentioning place and date of installation and installation certificate number. This shall also be ensured by the kit installer.
13. The vehicle/kit manufacturer or supplier shall impart training to installer on installation, maintenance and operation of CNG system and issue the training certificate to installer after completion of training. The test agency may devise the appropriate training programme as required.

The training shall encompass the following:

- 13.1 CNG Tank
 - a) Fitments on tank
 - b) Location and ventilation of tanks.
 - c) Construction of compartment and sub-compartment
 - d) Installation of tank
 - e) Shielding
 - 13.2 CNG Fuel Line
 - a) Testing of CNG fuel line
 - b) Flexibility
 - c) Installation
 - 13.3 CNG Control Equipment
 - a) Installation of regulator and its functioning
 - b) Installation of fuel selection switch and its information
 - 13.4 Inspection, Testing and Commissioning of CNG System
 - a) Commissioning
 - b) Leak testing
 - 13.5 Garaging and Repair
 - a) Repair operation of CNG vehicles
 - b) Scrapping
 - 13.6 Periodic inspection
 - 13.7 CNG Characteristics and Safety Aspects for Handling and Storage
14. The kit installer shall ensure compliance to the emission norms and Sub-rule 2 of Rule 115 and the code of practice for the use of CNG fuel in internal combustion engined vehicles.
- 15. Responsibility of the vehicle /kit manufacturer/supplier/installer: The owner/driver shall be instructed in the correct way the gas system and controls function along with a owners operation manual for the gas system outlining the following:**
- 15.1 Basic gas system explanation with a diagram**
 - 15.2 Fuel change over switch operation if bi-fuel system is fitted**
 - 15.3 Starting procedure for cold and hot starting**
 - 15.4 How the vehicle is refueled**
 - 15.5 In the event of backfiring check procedure**
 - 15.6 In the event of a gas leak shut off procedure**
 - 15.7 Emergence or information contact numbers**

**INSTALLATION CERTIFICATE FOR CONVERTED CNG
VEHICLE (to be filled in by installer)**

A. Details of Installer Approval:	
1. Installation Certificate issued by	Name and address of installer
2. Approval of installer	Name of vehicle manufacturer/kit manufacturer/ kit supplier, who has approved the installer
3. Type of vehicle converted	3-Wheeler/Car/LCV/HCV, etc.
4. Approval of the CNG kit	
a) Name of the Test Agency	
b) Approval Certificate No. & Date	
B. Details of Converted Vehicles	
1. Regn. No. & year of manufacture	
2. Chassis and engine No.	
3. Type of Operation	Bi-fuel / dedicated fuel
C. Details of CNG Kit	
1. Cylinders:	
a) No. of Cylinder/s	
b) Type of Cylinder/s	
c) Cylinder No/s.	
d) Make	
e) Water Capacity (litres)	
f) Working Pressure (kg/cm²)	
g) Approval reference of DOE	
h) Validity of DOE Certificate	
2. Cylinder Valves	
a) Make	
b) Valve No.	
c) Working Pressure (kg/cm²)	
d) Approval reference of DOE	
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	
a) Make	
b) Type	
c) Sr. No.	

8. Gas-Air Mixer	
a) Make	
b) Type	
<i>Note:</i> 1) This certificate shall be filled and provided to vehicle owner for all vehicles converted for CNG operation. 2) A copy of this certificate along with checklist as per Appendix A of safety document shall be forwarded to RTO and test agency from where the approval for CNG kit is obtained.	
Signature & Seal of Installer	

**CHECKLIST FOR THIRD PARTY CHECKING / INSPECTION
OF BUILT UP CNG BUSES BEFORE REGISTRATION**

This checklist is for third party inspection of fully built CNG buses before registration by RTOs. Reference to relevant clauses of Safety Code of Practice, e.g. AIS 028, and guidelines issued by Central Government from time to time should be made wherever appropriate.

<u>A. Details of CNG Bus</u>	
<u>1. Name and address of chassis manufacturer / retrofitter</u>	
<u>2. Name of type approval agency</u>	
<u>3. Details of type approval certificate _____</u>	
<u>4. Name and address of bus body builder</u>	
<u>5. Name and address of approved inspecting agency at R.T.O.</u>	
<u>6. Chassis and engine No.</u>	
<u>7. Year of manufacture</u>	
<u>B. Detail of CNG System</u>	
<u>1. Checking of Cylinders as per DOE/ vehicle testing agency approvals</u>	
<ul style="list-style-type: none"> • <u>Validity of DOE Certificate</u> 	
<ul style="list-style-type: none"> • <u>Safety checks</u> <ul style="list-style-type: none"> • <u>Check for corrosion on any CNG components / mountings of gas circuit</u> • <u>Ensure cylinder is securely mounted within the vehicle and check tightness of nuts and bolts</u> • <u>Ensure minimum 5 mm clearance is kept between cylinders and vehicle body structure</u> • <u>Distance between fuel line and exhaust heat source shall not be less than 75 mm</u> • <u>Distance between cylinder valve and bus body extremities shall not be less 200 mm</u> 	
<u>2. Cylinder Valves</u>	
<ul style="list-style-type: none"> a) <u>Approval from DOE</u> 	

<u>b) Check for Shield / protection and physical damage to valves</u>	
<u>c) Leak test using non corrosive foaming agent or Methane leak detector</u>	
<u>3. Refilling Valve</u>	
<ul style="list-style-type: none"> • <u>Safety checks -</u> <ul style="list-style-type: none"> • <u>Check for dust cap / plug</u> • <u>Check that engine should not start when dust cap / plug is removed or open</u> • <u>Check leakage for non-return valve using non corrosive foaming agent or Methane leak detector</u> 	
<u>4. Fuel Line</u>	
<ul style="list-style-type: none"> • <u>Safety checks</u> <ul style="list-style-type: none"> • <u>Check for corrosion on CNG fuel line</u> • <u>Ensure fuel line is securely mounted</u> • <u>Check for deformation of U and Pigtail bends provided in high pressure piping for flexibility as per approved layout</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	
<u>5. Shut Off Valve (Solenoid Valve(s)) wherever separately provided</u>	
<ul style="list-style-type: none"> • <u>Safety checks</u> <ul style="list-style-type: none"> • <u>Ensure shut off valve is securely mounted</u> • <u>Check operation for “Close & Open” as required</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	
<u>6. Regulator</u>	
<ul style="list-style-type: none"> • <u>Safety checks</u> <ul style="list-style-type: none"> • <u>Ensure regulator is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	

<p><u>7. Gas-Air Mixer</u></p>	
<ul style="list-style-type: none"> • <u>Safety checks</u> <ul style="list-style-type: none"> • <u>Ensure gas-air mixer is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	
<p><u>8. Electrical wiring:</u></p> <ul style="list-style-type: none"> • <u>Safety checks</u> <ul style="list-style-type: none"> • <u>Ensure that current limiting device (fuse) is fitted as per chassis manufacturer's specifications and make</u> • <u>Check wiring harness layout under the floor and in the engine compartment to be in accordance with chassis manufacturer's layout / specifications / approval</u> • <u>Check wiring harness in cabin and passenger compartment to be as per chassis manufacturer's guidelines / approval</u> • <u>Terminals are insulated to prevent shorting</u> • <u>Wiring are taped and clipped with loom & mounted securely</u> • <u>Cable harness has to be as per the recommendations of OE chassis/ vehicle manufacturers</u> • <u>Battery terminal has to have a positive locking</u> • <u>Check installation of battery cut-off switch as per chassis manufacturer's recommendations</u> • <u>Check routing of high tension cable to avoid accidental earthing and to be placed away from any heat source – as per chassis manufacturer's recommendations/ layout</u> • <u>Check for proper make of high tension cable as per chassis manufacturer's recommendation as well as check for tight fitment of its terminal to the spark-plug</u> 	

<p><u>9 Service shut-off valve:</u></p> <ul style="list-style-type: none"> • <u>Safety checks -</u> <ul style="list-style-type: none"> • <u>Check operation</u> • <u>Ensure service shut off valve is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	
<p><u>10. CNG Filter:</u></p> <ul style="list-style-type: none"> • <u>Ensure CNG filter is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	
<p><u>11. CNG Pressure Gauge:</u></p> <ul style="list-style-type: none"> • <u>Ensure CNG pressure indicator is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 	
<p><u>12. Compliance Plate:</u></p> <ul style="list-style-type: none"> • <u>Installation Check</u> • <u>Check for following</u> <ul style="list-style-type: none"> ✓ <u>Cylinder identification No.</u> ✓ <u>Date of installation</u> ✓ <u>Water capacity (ltr) of total installation</u> ✓ <u>Date of last reset</u> ✓ <u>Vehicle registration/ identification No. (to be furnished after registration)</u> ✓ <u>Seal of the checking /inspection agency</u> 	
<p><u>13. Identification label in front and rear:</u></p> <ul style="list-style-type: none"> • <u>Located on left side of the front and rear safety glass and shall ensure visibility from front and rear sides</u> 	

14 Following additional points are to be complied at the time of registration of CNG vehicle for enhancement of safety of vehicle.

- Fire retardant material shall be used for seat/upholstery/roof & side lining as per manufacturer's and bus body builder's specification.
- One number each of dry powder type fire extinguishers (2 kg) shall be provided in driver's and passenger's compartment.
- For servicing of CNG vehicle proper instructions, detail operational & service manual with Dos & DON'Ts shall be provided by chassis manufacturer and body builder. Vehicle / chassis manufacturer should devise training module and impart training to drivers and technicians for safe operation of CNG system.
- Check for First-Aid kit as per CMVR.
- Buses should be properly maintained and checked every day before starting and bringing on road.
- Distance between the exhaust line , muffler and fuel line shall be a minimum of 75 mm. If not a radiant heat shield of 2mm thickness shall be welded inbetween.
- Safety plates / shield below the pipe joints shall be welded and proper inspection windows shall be provided near the cylinder joints.
- Minimum two copies of safety instructions shall be displayed in passenger's compartment.
- Check for proper venting provided by louvers / holes / mesh on the side skirt so that in case of any leakage the entrapped gas under the floor escapes to the atmosphere.
- The bus body builder to provide at least two (total minimum area of 550 sq. mm) vent pipes connecting the under floor of the bus to the rooftop for CNG gas to vent out in case of leakage. The vent pipes to be located close to the cylinder valves cluster as per recommendations of chassis manufacturer. Construction should be such that leakage into passenger compartment is avoided.
- Any other safety recommendations provided or advised by the chassis manufacturers to be complied with.

Note: The instructions issued by OE manufacturer/retrofitter for third party evaluation, in their instruction manual ,shall contain all the necessary details on the methodology & the procedure for carrying out these checks.

Signature & Seal with date

CHECKLIST FOR PREVENTIVE MAINTENANCE OF IN-USE CNG VEHICLES

This checklist is A GUIDE for preventive maintenance of fully built in-use CNG vehicles. Preventive maintenance shall be carried out by authorized installer at authorized workshop only, as prescribed in CMVR. Reference to relevant clauses of Safety Code of Practice, e.g. AIS 028, and guidelines issued by Central Government from time to time should be made wherever appropriate.

<u>A. Details of CNG Vehicle</u>		
<u>1. Name and address of owner of vehicle</u>		
<u>2. (a) Type of vehicle (LCV/HCV)</u> <u>(b) Model</u>		
<u>3. (a) Name of OE manufacturer</u> <u>(b) Name of kit retrofitting agency</u>		
<u>4. Name and address of bus body builder</u>		
<u>5. Name and address of approved inspecting agency at R.T.O.</u>		
<u>6. Chassis No., Engine No. and Vehicle Registration No.</u>		
<u>7. (a) Year of manufacture of vehicle</u> <u>(b) Date of endorsement of CNG kit in RCTC book</u>		
<u>B. Detail of CNG System</u>		
<u>1. Checking of Cylinders as per DOE/ vehicle testing agency approvals</u>	<u>Approved Specification at the time of Type Approval</u>	<u>Remarks of Inspection Authority</u>
<u>a) No. of Cylinders</u>		
<u>b) Approval from DOE</u>		
<u>c) Validity of DOE Certificate</u>		<u>Check or Re-test cylinders as per Gas Cylinder Rules, 1981</u>

<p><u>Other checks</u></p> <ul style="list-style-type: none"> • <u>Check for corrosion on any CNG components / mountings of gas cylinders</u> • <u>Ensure cylinder is securely mounted within the vehicle; check tightness of nuts and bolts</u> • <u>Ensure minimum 5 mm clearance is kept between cylinders and vehicle body structure</u> • <u>Distance between cylinder valve and bus body extremities shall not be less than 200 mm.</u> 		<p><u>Periodicity of checks</u></p> <p><u>Weekly</u></p> <p><u>Weekly</u></p> <p><u>Weekly</u></p> <p><u>Weekly</u></p>
<p><u>2. Cylinder Valves</u></p>		
<p><u>a) Approval from DOE</u></p>		<p><u>Periodicity of checks</u></p>
<p><u>b) Check for Shield / protection and physical damage to valves</u></p>		<p><u>Weekly</u></p>
<p><u>c) Leak test using non-corrosive foaming agent or Methane leak detector</u></p>		<p><u>Daily</u></p>
<p><u>3. Refilling Valve</u></p> <ul style="list-style-type: none"> • <u>Check for dust cap / plug</u> • <u>Check that engine should not start when dust cap / plug is removed or open</u> • <u>Check leakage for non-return valve using non corrosive foaming agent or Methane leak detector</u> 		<p><u>Periodicity of checks</u></p> <p><u>Weekly</u></p> <p><u>Weekly</u></p> <p><u>Daily</u></p>

4. <u>Fuel Line</u>		<u>Periodicity of checks</u>
<ul style="list-style-type: none"> • <u>Check for corrosion on CNG fuel line</u> • <u>Ensure fuel line is securely mounted</u> • <u>Check for deformation of U & pigtail bends</u> • <u>Check hose for twists, kinks and damage or abrasions to the cover, which expose the wire/fiber and shall be condemned on detection of any one of these defects.</u> • <u>During servicing hose shall be replaced by new hose; after removal from vehicle</u> • <u>Check distance between fuel line and exhaust heat source is more than 75 mm.</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Weekly</u> <u>Weekly</u> <u>Weekly</u> <u>Weekly</u> <u>Weekly</u> <u>Daily</u>
<u>5. Shut Off Valve (Solenoid Valve(s)) wherever separately provided</u>		<u>Periodicity of checks</u>
<ul style="list-style-type: none"> • <u>Ensure shut off valve is securely mounted</u> • <u>Check operation for “Close & Open” as required and replace if found damaged</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Weekly</u> <u>Weekly</u> <u>Daily</u>
<u>6. Regulator</u>		<u>Periodicity of checks</u>
<ul style="list-style-type: none"> • <u>Ensure regulator is securely mounted</u> • <u>Check for shield or protection</u> • <u>Replace regulator diaphragms, hot water hoses, seals in accordance with _____ manufacturer's recommendation</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Weekly</u> <u>Weekly</u> <u>Weekly</u> <u>Daily</u>

7. <u>Gas-Air Mixer</u>		<u>Periodicity of checks</u>
<ul style="list-style-type: none"> • <u>Ensure gas-air mixer is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Weekly</u> <u>Daily</u>
8. <u>Electrical wiring</u>		<u>Periodicity of checks</u>
<ul style="list-style-type: none"> • <u>Ensure that current limiting device (fuse) is fitted as per manufacturer's specs and make</u> • <u>Check any loose or open or broken wiring harness in engine compartment, under chassis and driver's cabin and take corrective action.</u> • <u>Cable harness has to be as recommended/ approved by the OE _____ vehicle manufacturers/retrofiters)</u> • <u>Battery terminal has to have a positive locking</u> • <u>Check operation of battery cut-off switch as per manufacturer's recommendations</u> • <u>Check for proper tight fitness and clamping of terminal fitting. Replace high tension cables as per manufacturer's recommendation.</u> 		<u>Weekly</u> <u>Monthly</u> <u>Monthly</u> <u>Monthly</u> <u>Monthly</u> <u>Monthly</u>
9 <u>Service shut-off valve</u>		<u>Periodicity of checks</u>
<ul style="list-style-type: none"> • <u>Check operation, replace in case inoperative</u> • <u>Ensure service shut off valve is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Weekly</u> <u>Weekly</u> <u>Daily</u>

<u>10. CNG Filter</u> <ul style="list-style-type: none"> • <u>Ensure CNG filter is securely mounted</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Periodicity of checks</u> <u>Weekly</u> <u>Daily</u>
<u>11. CNG Pressure Gauge</u> <ul style="list-style-type: none"> • <u>Ensure CNG pressure indicator is securely mounted</u> • <u>Check for operation, replace if it is inoperative</u> • <u>Leak test using non-corrosive foaming agent or methane leak detector</u> 		<u>Periodicity of checks</u> <u>Weekly</u> <u>Weekly</u> <u>Daily</u>
<p><u>12. Following additional points need to be complied for carrying out preventive maintenance every month, unless and otherwise specified.</u></p> <ul style="list-style-type: none"> ➤ <u>Replace spark plugs and high tension cables as per manufacturer's recommendations.</u> ➤ <u>Check ignition timing by using timing light at engine idle speed (and other speeds as specified) and correct, if required.</u> ➤ <u>Check function of O₂ sensor output (milli-volt variation using multimeter) as per manufacturer's recommendations.</u> ➤ <u>Check for any exhaust gas leak before the catalytic converter and correct, if necessary.</u> ➤ <u>Replace catalytic converter as per manufacturer's recommendations.</u> ➤ <u>One number each type of dry powder type fire extinguisher (2 kg) shall be provided in driver and passenger compartment</u> ➤ <u>Buses should be properly maintained and checked every day before starting and bringing on road.</u> ➤ <u>Distance between the exhaust line , muffler and fuel line shall be a minimum of 75 mm. If not a radiant heat shield of 2mm thickness shall be welded in between.</u> ➤ <u>Safety plates / shield below the pipe joints shall be welded and proper inspection windows shall be provided near the cylinder joints.</u> ➤ <u>Check for First-Aid kit as per CMVR</u> ➤ <u>Minimum two copies of safety instructions shall be displayed in passenger compartment.</u> ➤ <u>Any other preventive safety recommendations provided or advised by chassis manufacturers/ retrofitters to be complied with.</u> <p><i>Note: The instructions issued by OE manufacturer/retrofitter for preventive maintenance, in their instruction manual ,shall contain all the necessary details on the methodology & the procedure for carrying out these checks.</i></p>		
<u>Signature & Seal with Date</u>		