	OISD – STD – 179	Page 13
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

10.0 CNG PIPING / TUBING

- 10.1 All rigid piping, tubing, fittings and other piping components shall conform to the recommendations of ANSI B 31.3. All the elements of piping should be designed for the full range of pressures, temperatures and loading to which they may be subjected with a factor of safety of at least 4 based on the minimum specified tensile strength at 20 deg. C.
- 10.2 Gaskets, packing and any other materials used shall be compatible with natural gas and its service conditions.
- 10.3 All the piping and tubing shall have minimum turns with adequate provision for expansion, contraction, jarring, vibration and settling. Exterior piping may be either buried with suitable corrosion protection or installed 30 cm. above the ground level with supports and protection against mechanical and corrosive damage.
- 10.4 Rigid pipelines shall have welded joints between their respective components.
- 10.5 All the piping and tubing shall withstand a pressure equal to that of safety relief device and tested accordingly after assembly. The testing to be done by inert gas, in case natural gas is used the suitable safety measures to be adhered to.


10.6 VALVES

- 10.6.1 A minimum of four shut off valves shall be fitted between the gas storage unit and vehicle refuelling filling nozzle as explained below:
- a) Each CNG storage unit to have quick action isolation valve in the steel supply pipe immediately adjacent to such storage unit to enable isolation of individual storage unit. These valves shall be within fencing of storage unit.
 - b) Master shut off valve with locking arrangement in close position, shall be installed in steel outlet pipe outside but immediately adjacent to the gas storage unit to isolate all downstream equipment from the gas storage unit. This valve shall be outside the fencing.
 - c) A quick action emergency and isolation shut off valve shall be installed near dispensing unit with easy approach and to remain closed when refuelling is not being done.
 - d) A vehicle refuelling shut off valve shall be installed for each flexible vehicle refuelling hose to control the refuelling operation and shall have venting provision to allow for the bleeding of the residual high pressure gas after refuelling is complete.
- 10.6.2 All these valves and other elements of piping shall be suitable for the full range of pressure and temperature to which they may be subjected. These valves are to have permanent marking for service rating etc.

11.0 CNG HOSES

- 11.1 Internally braided, electrically continuous, non-metallic and metallic hoses resistant to corrosion and suitable to the natural gas service shall be used for CNG service in the downstream of emergency and isolation shut off valve.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 14
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

- 11.2 These flexible hoses and their connections shall be suitable for most severe pressure and temperature service condition expected with a burst pressure of at least four times the maximum working pressure.
- 11.3 The flexible hoses with their connections shall be tested after assembly and prior to use to atleast two times the working pressure and also tested to a pneumatic pressure of atleast 400 bar under water. Thereafter, all the hoses shall be examined visually and tested for leaks with soapsuds or equivalent at an interval not exceeding one year. Hoses shall be rejected and destroyed in the event of any leakage. These tests are to be recorded and such records shall be available at installations at all times.
This shall be done safely in a controlled environment by the trained technicians having adequate expertise with respect to the assembly of hoses, breakaways, valves and fuel nozzles.
- 11.4 Flexible hoses shall have permanent marking indicating the manufacturer's name/ identification, working pressure and suitability for use with CNG.


12.0 PRESSURE GAUGES

- 12.1 Every CNG storage unit including each cascade or bulk storage tank shall be provided with a suitable pressure gauge directly in communication with them.
- 12.2 The CNG storage unit shall have an opening not to exceed 1.4-mm diameter at the connection where pressure gauge is mounted.
- 12.3 The pressure gauge shall have dial graduated to read approximately double the operating pressure but in no case less than 1.2 times the pressure at which pressure relief valve is set to function.
- 12.4 All pressure gauges in the installation shall be tested and calibrated atleast once a year and records maintained.

13.0 COMPRESSOR STATION

- 13.1 The piping and its fittings upto the battery limit of CNG installation shall conform to ASME B 31.8 or equivalent.
- 13.2 Compressor shall be designed for use in CNG service and for the pressures and temperature to which it may be subjected under normal operating conditions conforming to API 618/ API 813 / API 11 P or equivalent standard and Flame proof electric motor and associated fittings should conform to IS/IEC 60079 suitable for Gas Group IIA as applicable for Natural Gas.
- 13.3 Compressor shall be fitted with the following minimum devices :
- a) Pressure relief valves on inlet and all stages to prevent pressure build up above the predetermined set point.
 - b) High discharge temperature shut down
 - c) High cooling water temperature switch fitted to cooling water return line to shut the compressor in the event of a fault.
 - d) High, inlet, inter stage & discharge pressures shut down.
 - e) Low lube oil pressure shut down
 - f) Low cooling water flow switch fitted to the cooling water return line to shut the compressor in the event of fault.
 - g) A remote isolation switch for emergency shut down to be provided with manual reset at control panel.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 15
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

13.4 Compressor shall be provided atleast the following clear and permanent markings readily accessible and easy to read in the installed position :

- a) Manufacturer's name
- b) Model
- c) Serial No./ month & year of manufacture
- d) Certificate of approval no.
- e) Rated capacity (cubic meter per hour)
- f) Operating speed (RPM)
- g) Required driving power(in kW)
- h) Maximum & minimum supply pressures
- i) Maximum outlet pressure
- j) Certification for Natural Gas use

13.5 A compressor and its all fittings shall be tested for compliance of relevant standard suitable for CNG use by a qualified engineer.

14.0 PRESSURE RELIEF DEVICE

14.1 Safety Relief Devices may consist of either burst disc or safety relief valve and should conform to the requirements of OISD-STD-132.

14.2 Safety relief devices shall be installed with unobstructed full size discharge to a safe place on bulk tanks and cylinders in the vertical position with suitable rain caps. These devices should have their outlet arranged in a manner so that in case of emergency a high-pressure gas escapes from these should not directly hit on operators/ persons in the close vicinity.

14.3 Cylinder should have safety relief devices fitted in conformity to the Gas Cylinder Rules.

14.4 Piping shall be protected by safety relief devices in conformity to OISD-STD-132.

14.5 Safety relief valves shall have a locking arrangement to prevent tampering by unauthorised persons. Any adjustments to the safety relief valve shall be made by manufacturer or a competent person. These valves should have a permanent tag indicating pressure setting, date of re-setting/ setting and capacity.

14.6 All safety relief devices shall be tested at least once a year for proper operations and records to be maintained.

14.7 All the safety relief devices shall have manufacturer's permanent marking indicating following:

- a) Set pressure to start discharge
- b) Discharge capacity in CuM / min.


14.8 No shut off valves shall be installed between the safety relief device and the gas storage unit or bulk tank.

14.9 All natural gas devices not otherwise specifically mentioned shall be constructed and installed to provide a safety equivalent to that other parts of the system.

14.10 Gas detectors interlocked with compressor cut out switch in the electrical system of the compressor are to be installed which would automatically switch off the unit in case of major gas leak.

15.0 ELECTRICAL EQUIPMENT

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 16
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

- 15.1 All electrical wiring and equipment, gas storage dispensing unit located in hazardous area Division I and II shall be in accordance with the Indian Electricity Rules, Gas Cylinder Rules, IS:5571, IS:5572 , NFPA - 52.
- 15.2 The earthing at the installation, protection against ignition arising out of static, lightning and stray currents shall be as described in OISD-STD-110 and further maintained as per the guidelines given in OISD-STD-137.

16.0 SAFETY AT VEHICLE FOR REFUELLING

- 16.1 The vehicles shall have approved type of CNG kit fitted in accordance with the guidelines of Ministry of Surface Transport, Govt. of India by an authorised workshop and such workshop should issue a fitness certificate to the vehicle for its suitability for CNG use. Such certificate should be always carried by the driver of the vehicle at all times.
- 16.2 Driver of the vehicle should also carry the record showing the last examination of the vital parts of the system fitted in the vehicle for CNG use and their next due date for such examination. The details must include the test periodicity of cylinder, pressure relief devices, pressure gauges, piping etc.
- 16.3 The cylinder with valves and connected facilities fitted in the vehicle shall be in accordance with Gas Cylinder Rules. These cylinders should be subjected to hydraulic test at least once every three years.
- 16.4 Every vehicle using CNG fuel system should display “CNG” labels prominently in compliance to Central Motor Vehicle Rules.
- 16.5 Manufacturing of Type-1 & Type 2 Nozzles shall be in accordance with NGV1 & ISO14469-2 standards.


17.0 DISPENSING UNIT

- 17.1 Dispensers shall be installed on a suitable foundation observing the minimum safety distances etc. as given in 6.0 above. Dispensing unit to be protected against possible damage by vehicular movement. Dispenser mounting and installation shall be in accordance with NFPA 52, and NFPA30A
- 17.2 The flexible hoses fitted on the dispenser shall be mechanically and electrically continuous. The design, material and construction of hoses shall be suitable for CNG and shall withstand not less than four times the maximum working pressure of the system.
- 17.3 The dispensing unit shall be of a type approved by the Chief Controller of Explosives / Statutory Authorities .
- 17.4 Dispensing unit shall be suitable for use of CNG in accordance with NGV 4.1, Hoses as per NGV 4.2 and Breakaway as per NGV 4.4.

18.0 CNG REFUELLING INTO VEHICLES

- 18.1 The vehicle refuelling shall be done by an experienced operator duly certified by the oil / gas company having control over the refuelling station.
- 18.2 The operator of the CNG dispensing unit shall check the following prior to refuelling the gas:
- a) The driver of the vehicle is carrying updated history record as given in clause 16.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 17
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

- b) There is no smoking, naked flame or any other source of ignition within six meter of the refuelling point.
- c) There is no leakage in the CNG fuel system reported by the driver of the vehicle.
- d) The fuel connection is in good condition and matches the dispensers filling nozzle. Fuel connection shall be tight without any leakage.
- e) The engine is switched off, hand brake is firmly applied, the vehicle parked in gear or in "P" with automatic transmission.
- f) No passenger remains inside the vehicle.
- 18.3 Detailed precautions (refer 18.2) and procedure of refuelling to be displayed near the dispensing unit and strictly followed by the operator.
- 18.4 The operator of the dispensing machine should not leave the vehicle being refuelled.
- 18.5 The cylinder on the vehicle shall not be charged in excess of maximum allowable working pressure at normal temperature for the cylinder.
- 18.6 Before the refuelled vehicle is driven away from the dispensing point the operator and driver should ensure that there are no apparent gas leaks either on the vehicle or on the dispensing point that may have been caused through faulty filling or the faulty action of connecting or disconnecting.
- 18.7 Warning signs with the words "STOP VEHICLE", "NO SMOKING", "NO OPEN FLAME PERMITTED", "FLAMMABLE GAS", "NO MOBILE PHONE", "SWITCHED OFF THE MOBILE PHONES" shall be displayed at dispensing station and compressor areas. The location of the signs shall be such that these are prominently visible from each point of transfer/ operation.
- 18.8 The operator shall take all measures for ensuring smooth vehicle movement in the outlet including restriction on number of vehicles near the fill points.


19.0 FIRE PROTECTION

- 19.1 Fire fighting facilities need to be carefully planned after considering the availability of municipal fire tenders etc. However, atleast the following Portable fire extinguishers shall be positioned:

S.No.	Location	Type of Extinguishers
1	Dispensing Unit	1 x 10 kg. DCP
2	Compressor (on-line)	1 x 10 kg. DCP
3	Mother station	1x 75 kg DCP
4	CNG Storage	1 x 10 kg. DCP
5	Cascade refuelling area	1 x 10 kg. DCP
6	MCC/ Electrical Installation	1 x 4.5 kg CO ₂ Per 25 Sq.M floor area

- 19.2 Any other flammable materials not specified in this standard in the CNG installation shall be stored in a non-flammable chamber with a minimum safety distance of 15 M from compressor station/ MCC/ electrical installation.
- 19.3 All approaches to machines, compressors, storage facilities and work places shall be free from obstacles, so that they are readily accessible in an emergency.

"OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines."

	OISD – STD – 179	Page 18
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

- 19.4 The electrical installations shall be inspected by an Electrical Inspector as per IE Rules and compliance shall be made as pointed out in the inspection. Records shall be maintained for all periodic inspections.
- 19.5 The flameproof characteristics of electrical equipment shall be checked through visual checks, condition of gasket, completeness and tightness of bolts, glands and as recommended by manufacturer's test certificates.
- 19.6 No unauthorised additions or modifications of the service station whether temporary or permanent shall be taken up.
- 19.7 Proper illumination to be ensured for all operating and non-operating areas.
- 19.8 All electrical maintenance at the Automotive Station shall be undertaken by licensed electrical technician under supervision of authorised person.
- 19.9 Each installation shall have minimum two numbers hand held explosive meter in working conditions at all times.
- 19.10 The work permit shall be followed (Refer OISD-STD-105).


20.0 EMERGENCY PLAN AND PROCEDURE

- 20.1 The Oil Companies / CNG Retailing companies having control over the refuelling station shall draw an operational emergency plan in consultation with adjoining establishments and local authorities e.g. fire brigade, police, and other District Emergency Authorities etc. for the following circumstances:
 - a) Loss of or interruption to the gas supplies due to leaks or failure of pipeline
 - b) Over-odorisation of the gas
 - c) Major failure of CNG fittings
 - d) Accidents or other emergencies, which can affect the CNG refuelling, station
 - e) Civil emergencies
 - f) Any other risk arising from the existence or use of the CNG refuelling station.
- 20.2 The above emergency plan shall be disseminated amongst all personnel involved and ensured that they understand their roles and responsibilities in the event of an emergency.
- 20.3 The operator of the refuelling station should have close liaison with Fire Service, the Police, the Municipal Authorities and the person supplying gas to CNG facility.
- 20.4 Important telephone numbers for emergency use shall be displayed prominently.
- 20.5 Means of communication shall be always at the disposal of the Incharge of the installation on 24 hours basis.
- 20.6 The emergency plan should be tested with drill atleast once a year.

21.0 TRAINING

- 21.1 The objective of training is to provide good understanding of all the facets of dispensing activities including operations, procedures, maintenance and hazards of CNG and the risks associated with handling of the product. Training shall ensure that the jobs are performed in accordance with the laid down procedures and practices.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 19
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

21.2 Training shall be imparted to the staff attached with the CNG dispensing station at the time of induction, which is to be followed up by periodic refresher courses once every year. The training programme shall inter alia cover following aspects:


- a) Hazardous characteristics of CNG.
- b) Familiarisation with operational procedures & practices.
- c) Commissioning of new facilities and equipment.
- d) Hands on experience on operation of equipment.
- e) Routine maintenance activities of the facilities.
- f) Knowledge of emergency and manual shut down systems
- g) Immediate and effective isolation of any CNG leak.
- h) Accounting of product
- i) Safety regulations and accident prevention.
- j) Fire fighting facilities, methods of fire fighting and its upkeep.
- k) Evacuation and safe egress of the vehicles.
- l) Housekeeping
- m) Safety in transportation of CNG.
- n) First aid.
- o) Emergency plan /drills
- p) Natural gas leakage possibility and its containment.
- q) Filling nozzles, types of gasket/ seal etc.
- r) Fitness of vehicles - Mandatory testing requirements of CNG cylinders fitted on Vehicles.

21.3 Appropriate training techniques shall be adopted which will include:

- a) Classroom training
- b) Hands on/ practical training
- c) Demonstration
- d) Case studies
- e) Training aids

21.4 Proper records for the training and refresher courses shall be maintained at the installation.


“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 20
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

REFERENCES

S.No	Ref Code No.	Title
1	GCR 2004	Gas Cylinder Rules 2004 under The Explosives Act 1884 of Govt of India
2	IS 15958 (2012)	Compressed Natural Gas (CNG) for Automotive Purposes -Specification
3	IS 15320-1 (2012): ISO 15403-1 : 2006	Natural Gas – Natural Gas for use as a Compressed Fuel for Vehicles, Part 1: Designation of the Quality
4	IS 7285-1 (2004):	Refillable Seamless Steel Gas Cylinders, Part 1: Normalized Steel Cylinders
5	IS 7285-2 (2004):	Refillable Seamless Steel Gas Cylinders, Part 2: Quenched and Tempered Steel Cylinders with Tensile Strength Less Than 1 100 MPa (112 kgf/mm ²)
6	IS 1642 (1989):	Code of practice for fire safety of buildings (general): Details of construction
7	IS 875- Part 1 to 5 (1987):	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures
8	IS 1893 (Part 1) 2002	Criteria for Earthquake Resistant Design of Structures,
9	IS 800	General Construction In Steel
10	IS:5571	Guide for selection of electrical equipment for hazardous areas
11	IS:5572	Classification of Hazardous areas (other than mines) having flammable gases and vapours for electrical equipment.
12	IS/IEC 60079- (2007):	Explosive Atmospheres, Equipment Protection
13	NFPA 12	Standard on Carbon Dioxide Extinguishing Systems
14	NFPA 17	Standard for Dry Chemical Extinguishing Systems
15	NFPA 52	Vehicular Gaseous Fuel Systems Code
16	ISO 11439:2013	Gas cylinders - High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles
17	ISO 11119-1	Gas cylinders--Gas cylinders of composite construction--Specification and test methods--Part 1: Hoop-wrapped composite gas Cylinders
18	ISO 11119-2	Gas cylinders—Gas cylinders of composite construction—Specification and test methods—Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal liners
19	ISO 11119-3	Gas cylinders of composite construction - Specification and test methods - Part 3: Fully wrapped fibre reinforced composite gas cylinders with non-load-sharing metallic or non-metallic liners
20	ISO 11120	Gas cylinders - Refillable seamless steel tubes of water capacity between 150 L and 3000 L Design, construction and testing
21	EN 12245	Transportable gas cylinders - Fully wrapped composite cylinders
22	EN 12257	Transportable gas cylinders - Seamless, hoop-wrapped composite cylinders
23	CGA TB-25	Design Considerations For Tube Trailers
24	NZS5425: Part 1:1980	Code of Practice for CNG Compressor and Refuelling Stations Part 1: On Site Storage and Location of Equipment.
25	NZS5425: Part 2:1982	Code of Practice for CNG Compressor and Refuelling Stations Part 2: Compressor Equipment.
26	Petroleum Rules 2002	The Petroleum Rules 2002 under Petroleum Act 1934, Govt of India
27	CCOE Guidelines	Chief Controller of Explosives, Govt. of India, for CNG Refuelling Stations.
28	ISO 6346	Coding, Identification and Marking of Containers: International Container Bureau (BIC).
29	OISD-STD-105	Work Permit system
30	NGV 1	Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices
31	NGV 4.1	Dispensing Systems

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”

	OISD – STD – 179	Page 21
	SAFETY REQUIREMENTS ON COMPRESSION, STORAGE, HANDLING & REFUELING OF NATURAL GAS (CNG) FOR USE IN AUTOMOTIVE SECTOR.	

32	NGV 4.2	Hoses for Natural Gas Vehicles and Dispensing Systems
33	NGV 4.4	Breakaway Devices for Natural Gas Dispensing Hoses and Systems
34	ISO 14469-2	Road vehicles - Compressed natural gas (CNG) refuelling connector - Part 2

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”