LPG & CNG Codes & Standards in India

C K Veda, Sc F & Head (Mech Engg)
Bureau of Indian Standards

New Delhi 15 February 2010
Indian Standard

BIS establishes Indian Standards under the Bureau of Indian Standards Act, 1986

- BIS amends revises or cancels the standards so established as may be necessary.
- The Standards are established by a process of consultation with consumers, manufacturers, technologists, scientists and officials through duly constituted committees.
STANDARD

• Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

NOTE – Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.

(ISO GUIDE 2)
TYPES OF STANDARDS

• Basic Standard
• Terminology Standard
• Testing Standard
• Product Standard
• Process Standard
• Service Standard
• Standard on data to be provided
BASIC CONSIDERATIONS IN EVOLVING NATIONAL STANDARDS

• Consensus Principle
• Access to International Technology
• Research & Development
• Co-ordination with other Levels of Standardization
Technical Sectors

- Production & General Engineering
- Chemical
- Civil Engineering
- Electronics & Telecommunications
- Electrotechnical
- Food And Agriculture
- Management And Systems
- Mechanical Engineering
- Medical Equipment And Hospital Planning
- Metallurgical Engineering
- Petrochemical, Coal & Related Products
- Textile
- Transport Engineering
- Water Resources
Standards on LPG and Test Method

LPG Standards

- IS 4576 : 1999 Liquefied Petroleum Gases - Specification
- IS 14861 : 2000 Liquefied Petroleum Gases (LPG) for Automotive Purposes – Specification
- IS 1448 : Part 70 : 1968 Methods of test for petroleum and its products: Part 70 Residue in liquefied petroleum gases
- IS 1448 : Part 111 : 1983 Methods of test for petroleum and its products: Part 111 Analysis of liquefied petroleum gases (LPG) and propylene concentrate by gas chromatography
**IS 4576 : 1999 Liquefied Petroleum Gases - Specification**

**Scope** — This standard prescribes the requirements and methods of sampling and test for all types of liquefied petroleum gases commercially marked for household, commercial and industrial applications excluding automotive use.

**Assistance derived from**

- DIN 51622-1973 (Liquefied gas; propane, propylene, butane and butylene quality requirements).
- ASTM D 1835 Specification for liquefied petroleum (LP) gases
IS 14861 : 2000 Liquefied Petroleum Gases (LPG) for Automotive Purposes - Specification

**Scope** — This standard prescribes the requirements and methods of sampling and test for liquefied petroleum gases for automotive use.

**Assistance derived from**
- ASTM D 1835 Specification for liquefied petroleum (LP) gases
- EN 589: 1993 CEN Automotive LPG specification. European National Standards
Scope – Describes a procedure for obtaining representative samples of liquefied petroleum gases such as propane, butane, or mixtures thereof, in containers other than those used in laboratory testing apparatus. These procedures are considered adequate for obtaining representative samples for all routine tests as per IS 4576. They are not intended for obtaining samples to be used for compositional analysis.

Technically Equivalent to ISO 4257:1988 Liquefied petroleum gases — Method of sampling with some minor changes
Standards on LPG Cylinders, Valves and Regulator

- IS 7142 : 1995 Welded low carbon steel cylinders for low pressure liquifiable gases not exceeding 5 litre water capacity – Specification
- IS 8737 : 1995 Valve fittings for use with liquefied petroleum gas (LPG) cylinders of more than 5 litre water capacity – Specification
Standards on LPG Cylinders, Valves and Regulator

- IS 13258 : 1991 Welded low carbon steel cylinders exceeding 5 litre water capacity for low pressure liquefiable gas - Code of practice for inspection and reconditioning of used LPG cylinders
- IS 14899 : 2000 Liquefied Petroleum Gas (LPG) Containers for Automotive Use - Specification
- IS 15100 : 2001 Multifunction Valve Assembly for Permanently Fixed Liquefied Petroleum Gas (LPG) Containers for Automotive Use
- IS 15637:2006 Welded Stainless Steel Cylinders for Liquefied Petroleum Gases (LPG) from 0.5 litre to 250 litre Water Capacity - Specification
Standards on LPG Equipments

- IS 5115 : 1969 Specification for Domestic Storage Type Water Heaters for Use With LPG
- IS 5116 : 1996 Domestic and commercial equipment for use with LPG - General requirements
- IS 5117 : 1993 Commercial boiling burners for use with LPG – Specification
- IS 5543 : 1970 Specification for Bains Marie for Use with LPG
- IS 5544 : 1970 Specification for Hot Food Cabinets for Use with LPG
Standards on LPG Equipments

- IS 5776 : 1988 Specification for Bulk Water Heater for Use with LPG
- IS 5777 : 1970 Specification for Fryers for Use with LPG
- IS 7342 : 1974 Specification for Commercial Gas Baking and Roasting Oven
- IS 11241 : 1985 Specification for Portable Liquefied Petroleum Gas Appliances Operating at Vapour Pressure
- IS 11480 : 1998 Domestic grillers for use with liquefied petroleum gases - Specification
- IS 14612 : 1999 Commercial Burners Using LPG at Inlet Pressure up to 147.1 kN/m² (1500 gf/cm²) - Specification
- IS 15558 : 2005 Mini Domestic Water Heater for Use with LPG - Specification
General Standards related to LPG

- IS 12011: 1987 Code of safety practice for domestic LPG installation
- IS 12012: 1992 Gas taps with or without flame failure devise for domestic and commercial gas burning appliances - Specification
- IS 12936: 1990 Code for basic requirements for delivery persons engaged in the delivery of LPG cylinders
IS 3196 : Part 1 : 2006

**Scope** –
- Deals with *welded low carbon steel cylinders* intended for storage and transportation of LPG of nominal Capacity exceeding 5 l to 250 l water capacity.
- Cylinders of up to 5 l capacity are covered in IS 7142
- This standard lays down the requirements for the materials, design, manufacture, construction, tests and marking of these cylinders.

**Tests:**
- Acceptance tests includes Tensile test, Bend test, % Elongation and Macro Examination.
- Burst and volumetric expansion test;
- Hydrostatic stretch test;
- Hydrostatic test;
- Pneumatic leakage test;
- Fatigue/Cycle Test and
- Radiographic examination.
- Checking of water Capacity
IS 14899 : 2000

**Scope** — Specifies the requirements of design, construction and testing of all welded steel containers for automotive LPG for vehicle propulsion

**Basic Difference**

<table>
<thead>
<tr>
<th>IS 3196 Part 1</th>
<th>IS 14899</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Pressure 2.5 MPa</td>
<td>Test Pressure 3 MPa</td>
</tr>
<tr>
<td>Capacity restricted upto 250 l</td>
<td>No capacity restriction specified</td>
</tr>
<tr>
<td>Additional tests:</td>
<td></td>
</tr>
<tr>
<td>➢ Bonfire Test</td>
<td></td>
</tr>
<tr>
<td>➢ Crash Test</td>
<td></td>
</tr>
<tr>
<td>➢ Strength Assessment (For Special Container)</td>
<td></td>
</tr>
<tr>
<td>In Cycle Test</td>
<td>In Cycle Test</td>
</tr>
<tr>
<td>10,000 Cycles if upper cycle pressure equals test pressure</td>
<td>12,000 Cycles if upper cycle pressure equals test pressure</td>
</tr>
</tbody>
</table>
**IS 8737:1995**

**Scope** –
- Covers the basic requirements of material and dimensions of **valve fittings** for gas cylinders of more than 5-litre water capacity, for LPG
- Covers valves with taper stems only.
- Valve fittings for LPG cylinders of water capacity up to 5 litres are covered in IS 8776

**Tests:**
- Hydrostatic test;
- Pneumatic test; and
- Fatigue/Cycle Test
IS 15100: 2001

Scope –

- Specifies materials, design, construction and testing requirements for multi function valve assembly for permanently fixed type of LPG containers for automotive use.
- Covers multi function valves of both liquid and vapour withdrawal type.

Type Tests:

- Over pressure test
- External leakage test
- High temperature test
- Low temperature test
- Seat leakage test
- Endurance test
- Operational test
- LPG compatibility test
- Corrosion resistance test
- Resistance to dry heat test
- Ozone ageing test
- Creep test
- Temperature cycle test
IS 9798: 1995

Scope — Specifies materials, construction, performance, and testing requirements for low pressure single or two stage regulators for use with liquefied petroleum gas mixtures in vapour phase up to 4.903 kN/m² outlet pressure.

Type Tests:
- Diaphragm material,
- Valve pad material,
- Hydrostatic test,
- Soundness test,
- Body for porosity, and
- Low and high temperature test

Routine Tests:
- Pneumatic test,
- Soundness test,
- Hydrostatic test,
- Chatter, and
- Setting and performance test.
**Scope** — This standard specifies construction, operation, safety requirements and tests for domestic gas stoves with metallic bodies intended for use with liquefied petroleum gases at 2942 kN/m² (30 gf/cm²) gas inlet pressure.

<table>
<thead>
<tr>
<th>IS 4246</th>
<th>EN 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal efficiency minimum 68%</td>
<td>Thermal efficiency minimum 58%</td>
</tr>
<tr>
<td>Gas consumption is measured using air</td>
<td>Measured Using Gas</td>
</tr>
<tr>
<td>leakage of gas is measured through bubble leak indicator</td>
<td>Measured by actual measurement. The rate of leak permitted is higher than specified in IS</td>
</tr>
<tr>
<td>Limits the flame temperature at a particular height</td>
<td>No such test</td>
</tr>
<tr>
<td>Carbonmonoxide/Carbondioxide Ratio is measured</td>
<td>Specifies the limit of carbon monoxide</td>
</tr>
</tbody>
</table>
Scope –

- Covers the requirements for instantaneous and continuous production of hot water for domestic use, of nominal useful less than 25 kW for use with LPG at a working pressure of 2.942 kN/m² (30 gf/cm²).

Performance Requirement

- Gas soundness
- Water soundness
- Combustion
- Gas consumption
- Ignition and flame travel
- Flame stability
- Flash back
- Noise control
- Resistance to draught
- Fire hazard and limiting time
- Time for temperature rise
- Thermal efficiency
  - 84 percent with a nominal heat input exceeding 10 kW, and
  - 82 percent with a nominal heat input not exceeding 10 kW.
STANDARDS FOR HIGH PRESSURE CYLINDERS

Seamless Steel Cylinders:

  - Base Standard- ISO 9809-3:1999

- IS 7285(PT 2):2004 Refillable seamless steel gas cylinders - Specification: Part 2 Quenched and tempered steel cylinder with tensile strength less than 1100 MPa (112 kgf/mm²) (third revision)
  - Base Standard- ISO 9809-1:1999
Tests For IS 7285(PT 1):2004

Prototype Tests
- Hydraulic bursting test
- Pressure cycling test
- Base check (for cylinder made from tube only)

Batch Tests
- Tensile test
- Impact test
- Bend test and flattening test

Test on Every Cylinder
- Hydraulic test
- Hardness test
- Leakage test
- Capacity check
Chemical Composition of Steel

- Carbon: 0.45, Max
- Manganese: 1.20-1.70
- Silicon: 0.10-0.35
- Chromium: 0.20, Max
- Nickel: 0.20, Max
- Copper: 0.20, Max
- Combined value of micro alloying elements V, Nb, Ti, B, Zr, Sn: 0.15, Max
- Sulphur: 0.02, Max
- Phosphorus: 0.02, Max
- Sulphur + Phosphorus: 0.03, Max
Prototype Tests
- Pressure cycling test
- Sulphide stress cracking resistance test
  (For tensile strength ≥ 950 MPa)
- Base check (for cylinder made from tube only)

Batch Tests
- Hydraulic bursting test
- Tensile test
- Impact test
- Bend test

Test on Every Cylinder
- Hydraulic test
- Hardness test
- Leakage test
- Leakage test
- Capacity check
- Ultrasonic examination
Typical Steels

- Chromium molybdenum steel (Q & T)
- Carbon manganese steel (Q & T)

<table>
<thead>
<tr>
<th></th>
<th>CrMo (Q &amp; T)</th>
<th>CMn (Q&amp;T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>0.25-0.38</td>
<td>0.38, <strong>Max</strong></td>
</tr>
<tr>
<td>Silicon</td>
<td>0.1-0.4</td>
<td>0.1-0.35</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.4-1.0</td>
<td>1.35-1.70</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.02, Max</td>
<td>0.02, <strong>Max</strong></td>
</tr>
<tr>
<td>Sulphur</td>
<td>0.02, Max</td>
<td>0.02, Max</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.8-1.2</td>
<td>—</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>0.15-0.40</td>
<td>—</td>
</tr>
</tbody>
</table>
## Basic Difference in IS and ISO

<table>
<thead>
<tr>
<th>Indian Standard</th>
<th>ISO Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers gas cylinders of water capacities from 0.5 litre up to and including <strong>400 litres</strong></td>
<td>Covers gas cylinders of water capacities from 0.5 litre up to and including <strong>150 litres</strong></td>
</tr>
<tr>
<td>Test Pressure $\frac{5}{3}$ of working pressure at $15^\circ$C</td>
<td>Test Pressure <strong>1.5</strong> of working pressure at $15^\circ$C</td>
</tr>
<tr>
<td>Calculation of cylindrical shell thickness</td>
<td>Calculation of cylindrical shell thickness</td>
</tr>
</tbody>
</table>

### Calculation of cylindrical shell thickness

- **Indian Standard**
  \[
  f = \frac{P_h (1.3 \ D_o^2 + 0.4 \ D_i^2)}{100 (D_o^2 - D_i^2)}
  \]

- **ISO Standard**
  \[
  a = \frac{D}{2} \left(1 - \sqrt{\frac{10 \ FR_{eg} - \sqrt{3} \ p_h}{10 \ FR_{eg}}}ight)
  \]
CNG Cylinders for automotive Vehicles

IS 15490 : 2004 Cylinders for on-board storage of compressed natural gas as a fuel for automotive vehicles - Specification
  ➢ Base Standard-ISO 11439:2000
  ➢ Covers CNG-1 Metal cylinders
  ➢ Water Capacity not exceeding 250 litres

Doc MED 16 (815) Composite cylinders for on-board storage of compressed natural gas (CNG) as a fuel for automotive vehicle – Specification (Covers CNG-2, CNG-3 and CNG-4 Cylinders) (Under Print)
  ➢ Base Standard-ISO 11439:2000

Covers
  ➢ CNG-2: Metal lined hoop wrapped composite cylinders
  ➢ CNG-3: Metal lined full wrapped composite cylinders
  ➢ CNG-4: Non-metal lined full wrapped composite cylinders
Test on CNG-1 Metal Cylinders

Prototype Tests
- Hydraulic burst test
- Pressure cycle test
- Leak before break test (LBB)
- Bonfire test
- Sulphide stress cracking resistance test

Batch Tests
- Tensile test
- Impact test
- Bend test
- Pressure cycle and hydraulic burst testing

Test on Every Cylinder
- Hydraulic test
- Hardness test
- Leakage test
- Ultrasonic examination
Test on CNG-2 Cylinders

Prototype Tests

- Ambient temperature pressure cycling test
- Leak before break test (LBB)
- Bonfire test
- Penetration test
- Acid environment test
- Flaw tolerance test
- High temperature creep test
- Accelerated stress rupture test
- Extreme temperature pressure cycling test
- Resin shear strength

For Steel Liner

- Tensile test
- Impact test
- Sulphide stress cracking resistance test

For Aluminium Liner

- Tensile test
- Corrosion test
- Sulphide stress cracking resistance test
Test on CNG-2 Cylinders

Batch Tests

- Hydraulic pressure burst test
- Pressure cycling test

Test on Liners

- Tensile test
- Impact test (On Steel Liner only)

Test on Every Cylinder

- NDE of metallic liners (Ultrasonic Inspection)
- Hydraulic test
- Hardness test of metallic liners
Additional Test on CNG 3 & CNG-4 Cylinders

For CNG 3 Cylinders
Prototype Tests
- Drop Test

For CNG 4 Cylinders
Prototype Tests
- Material Test For Plastic Liners
- Drop Test
- Boss Torques Test
- Permeation Test

Batch Tests on Plastic Liners
- Tensile Test
- Softening Temperature Test

Test on Every Cylinder
- Leakage Test
Standards on High Pressure Valves, Visual inspection of Cylinders and CNG Components

- IS 8451 : 1984 Code of practice for visual inspection of high pressure gas cylinders (Under Revision)
- IS 15710 : 2006 Road Vehicles - Compressed Natural Gas (CNG) Fuel System Components - General Requirements and Definitions
- IS 15711 : 2006 Road Vehicles - Compressed Natural Gas (CNG) Fuel System Components - Performance and General Test Methods
- IS 15712:2006| ISO 15500-6:2001 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Automatic valve (Solenoid valve)
Standards on High Pressure Valves, Visual inspection of Cylinders and CNG Components

- IS 15713:2006 | ISO 15500-9:2001 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Pressure regulator
- IS 15714:2006 | ISO 15500-11:2001 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Gas/Air mixer
- IS 15715:2008 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Conduit (Ventilation hose)
- IS 15716:2006 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - CNG High pressure fuel line (Rigid) with end connections [Having pressure exceeding 2.15 MPa (21.5 Bar)]
Standards on High Pressure Valves, Visual inspection of Cylinders and CNG Components

- IS 15717:2006 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Petrol valve (automatic/manual)
- IS 15718:2006 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - CNG high pressure fuel line (flexible hose) with end connections (having service pressure exceeding 2.15 MPa (21.5 Bar))
- IS 15719:2006 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Electrical wiring kit
- IS 15720:2008 Road vehicles - Compressed Natural Gas (CNG) Fuel system components - Compartments/Sub compartments
Standards on High Pressure Valves, Visual inspection of Cylinders and CNG Components

- IS 15721:2006 Road vehicles - Compressed Natural Gas (CNG) - Fire retardant material for seat, upholstery, roof and side lining
- IS 15722 : 2006 Road Vehicles - Compressed Natural Gas (CNG) Fuel System Components - CNG low pressure flexible fuel line with end connections [CNG fuel line having pressure not exceeding 2.15 MPa (21.5 Bar)]
- IS 15870:2009 Road vehicles - Use of Compressed Natural Gas (CNG) fuel system in internal combustion engine vehicles - Code of practice
BIS PRODUCT CERTIFICATION

BIS Product Certification Scheme aims at providing third party guarantee of quality, safety and dependability of products conforming to relevant Indian standard.

PRODUCT CERTIFICATION

- Licences in operation - 28912
- Products under certification - 939
BIS PRODUCT CERTIFICATION

Standard Mark

- Standard Mark consists of two components i.e. Monogram and a reference to the relevant Indian standard

IS 9798
CM/L-xxxxxx
LPG/CNG Standards Under Mandatory Certification

- IS 7142 : 1995 Welded low carbon steel cylinders for low pressure liquifiable gases not exceeding 5 litre water capacity – Specification
- IS 8737 Valve fittings for use with liquefied petroleum gas cylinders of more than 5 litre water capacity: Pt 2 Valve fittings for newly manufactured LPG cylinders
- IS 8776:1988 Specification for valve fittings for use with liquefied petroleum gas (LPG) cylinders up to and including 5-litre water capacity
- IS 9798 : 1995 Low pressure regulators for use with liquefied petroleum gas (LPG) mixtures – Specification
- IS 14899 : 2000 Liquefied petroleum gas (LPG) containers for automotive use - Specification
- IS 15100 : 2001 Multifunction valve assembly for permanently fixed liquefied petroleum gas (LPG) containers for automotive use
LPG/CNG Standards Under Mandatory Certification

- **IS 7285(PT 2):2004** Refillable seamless steel gas cylinders - Specification: Part 2 Quenched and tempered steel cylinder with tensile strength less than 1100 MPa (112 kgf/mm2) (third revision)
- **IS 15490 : 2004** Cylinders for on-board storage of compressed natural gas as a fuel for automotive vehicles - Specification
BIS CERTIFICATION SCHEME

Other certification schemes operated by BIS

- Hallmarking of gold Jewellery ---- as per IS 1417
- Silver Jewellery and articles ----as per IS 2112
- Quality Management System--- as per IS/ISO 9001.
- Environment Management System --as per IS/ISO 14001.
- Service Quality Management System--- as per IS 15070
- Hazard Analysis and Critical Control Point (HACCP)
  - HACCP Stand-alone Certification against IS 15000:1998
  - HACCP based Quality System Certification provides for two Certification through one audit Certification of Quality System against IS/ISO 9000 and Certification of HACCP against IS 15000:1998
- Occupational health and safety management system (OHSMS)--- as per IS 18001
- Food Safety Management Systems Certification--- as per IS 22000
PROCEDURE FOR GRANT OF BIS LICENCE FOR DOMESTIC MANUFACTURERS

The applicant has the option to choose any of the following two procedures for grant of BIS licence:

i) **Normal Procedure** – In the normal procedure, the applicant is required to submit the filled in application along with required documents and requisite fee to the nearest BIS branch office. Subsequently, after recording of the application, a preliminary factory evaluation is carried out by BIS officer to ascertain the capability of the applicant/manufacturer to produce goods according to the relevant Indian Standard and to verify the availability of complete testing facility and competent technical personnel. Samples are tested in the factory and also drawn for independent testing. Grant of licence is considered by BIS provided the samples pass during independent testing, preliminary evaluation is satisfactory and the applicant agrees to operate the defined Scheme of Testing & Inspection and pay the prescribed marking fee.
ii) **Simplified Procedure** – In the simplified procedure, applicant is required to furnish the test report(s) of the sample(s) got tested by him in the BIS approved laboratories, along with the application. If the test report(s) and other documents are found satisfactory, a verification visit is carried out by BIS. The licence is granted thereafter if the verification report is found satisfactory. The applicant also has the option to get the documents and other details as specified in the application, certified by a Chartered Engineer and submit the same to BIS. The licence then shall be granted after scrutiny of the documents and report submitted by Chartered Engineer. By this procedure the licence is expected to be granted within 30 days of receipt of application by BIS, provided all required documents are furnished and found satisfactory.

- Simplified procedure is available for all products except certain items under mandatory certification like gas cylinders, valves, regulators, cement, etc.
- If any licence granted as per simplified procedure is cancelled in the event of failure of verification samples, the fresh application shall only be considered as per normal procedure.
- All India first licence for any product shall be granted as per normal procedure only.
- There is a separate scheme for Foreign Manufacturers and Indian Importers.
THANK YOU