



**PRODUCT MANUAL FOR
SEAMLESS STEEL CYLINDERS FOR ON-BOARD STORAGE OF
COMPRESSED NATURAL GAS AS A FUEL FOR
AUTOMOTIVE VEHICLES
ACCORDING TO IS 15490:2017**

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification licence/certificate.

1.	Product	:	IS 15490:2017
	Title	:	Seamless Steel Cylinders for On-Board Storage of Compressed Natural Gas as a Fuel for Automotive Vehicles
	No. of Amendments	:	Nil
2.	Sampling Guidelines:		
a)	Raw material	:	Steel - Clause 5 of IS 15490
b)	Grouping guidelines	:	Each new design of cylinder shall be tested for all requirements for considering GoL/ CSoL. New design of cylinder is defined at Clause 9.1 of IS 15490.
c)	Sample Size	:	Please refer ANNEX – A
3.	List of Test Equipment	:	Please refer ANNEX – B
4.	Scheme of Inspection and Testing	:	Please refer ANNEX – C
5.	Possible tests in a day:		Please refer ANNEX – D
6.	Scope of the Licence:		Please refer ANNEX – E

ANNEX A**Sample Size**

For considering GoL/CSoL, a trial batch of prototype Cylinders as per the approved drawings shall be manufactured during the joint inspection of BIS and Statutory Authority after in-principle approval is received from the statutory authority. Unless otherwise stated by the statutory authority, the trial batch shall be of minimum 50 prototype containers. Following samples sample shall be drawn for factory testing and independent testing:

Samples for Type approval (Type tests):

Sl. No.	Description of test	Clause reference	No. of samples
1.	Material Test	9.3	One *
2.	Pressure cycling and Hydraulic Burst Test	9.2.3	Two
3.	Bonfire Test	9.2.7	One or two as appropriate
4.	Hardness Test, Hydrostatic stretch test, Ultrasonic examination, Leakage test, Water capacity, Thread checking, Colour identification, surface defect	11.1, 11.2, 11.3, 11.4, 11.5, 6.5.3	Two
5.	Leak Before Break Test, if applicable	9.2.6	One

* Four, if Sulphide Stress Cracking Resistance Test is required to be done.

Note: Currently being done in Factory in view of partial test facilities at BIS/OSLs.

Samples for Independent Tests (IT Samples):

Sl. No.	Description of test	Clause reference	No. of samples
1.	Mechanical Test	9.3	One
2.	Burst Test, Water capacity, surface defect	9.2.3, 11.5, 7.3	One
3.	Test piece for chemical analysis	5	Five pieces

ANNEX B**List of Test Equipment***Major test equipment required to test as per the Indian Standard*

Sl. No.	Tests used in with Clause Reference		Test Equipment
	Test	Clause No	
1	Cylinder Shape and Wall Thickness	7.2	Ultrasonic Thickness Gauge
2	Surface Defects	7.3, Annex A	Visual Inspection and Ultrasonic Testing Instrument with Reference Standard
3	Neck Threads	6.5, 7.5.1	Thread Inspection Gauges
4	Valve Fittings	6.5.3, 7.5.2	Torque Wrench
5	Mean Diameter	7.7	Pi Tape
			Outside Calliper with Steel rule
			Micrometer
6	Straightness	7.8	Feeler Gauge
			Steel Rule/ Straight Edge
7	Pressure Cyclic Test	9.2.3	Pressure Gauge
			Temperature Sensor
			Non-Corrosive liquid
			Pressure Cycling Set Up
			Stop Watch
8	Hydraulic Bursting Test	9.2.3 9.2.4 9.2.5	Pressure Gauge
			Test Fluid Reservoir
			Test Well
			High Pressure Pump
9	Leaf Before Break Test	9.2.6	Pressure Gauge
			Pressure Cycling Setup
			Stop Watch
10	Bonfire Test	9.2.7 Annex C	Finished Cylinder, complete with the fire protection system (cylinder valve, pressure relief devices and/or integral thermal insulation) specified in the design.
			Uniform fire source of 1.65m length
			3 thermocouples located along the bottom of the cylinder and spaced not more than 0.75 m apart
			Pressure gauge
			Stop Watch
11	Tensile Test	9.3.1	Universal Testing Machine

			Vernier Calliper, Micrometre
			Air Conditioner
12	Bend Test	9.3.2	Universal Testing Machine
13	Impact Test	9.3.3	Impact Testing Machine
			Deep Freezer
			Thermometer- Digital/ Glass Type
			Profile projector/ Go-No Go Gauges
14	Sulphide Stress Cracking resistance	9.3.4 Annex E	Universal Testing Machine
			Sodium Acetate tri-hydrate
			Distilled Water, Acetic Acid
			pH meter
			Hydrogen sulphide
15	Hardness Test	11.1	Hardness Testing Machine (Brinell or Rockwell)
16	Hydrostatic Stretch Test	11.2 Water Jacket Method	Hydraulic Line Valve
			Water Supply
			Jacket Filling Valve
			Air Bleed Valve
			Pump
			Relief Device
			Drain
			Calibrated Burette
			Priming Valve
			Pressure Gauge
		Weighing Balance- Electronic	
		Non-Water Jacket Method	Water Tank
			Bleed Valve
			Pump
			Pressure Gauge
			Weighing Balance- Electronic
		17	Ultrasonic Examination
Standard Piece for UT			
Ultrasonic Flaw Detector			
18	Leakage Test	11.4	Pressure Gauge
			Tank With lighting arrangement
19	Water Capacity	11.5	Digital Electronic Balance
20	Colour Identification	15	Coating thickness Gauge

The above list is indicative only and may not be treated as exhaustive.

ANNEX C

Scheme of Inspection And Testing

1. LABORATORY - A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

1.1 The manufacturer shall prepare a calibration plan for the test equipment. The following equipment shall be calibrated at a frequency shown against each and records kept:

1.1.1 Tensile Testing Machine - Once in a year

1.1.2 Impact Testing Machine - Once in a year

1.1.3 Pressure Gauges - At least once in a month

1.1.4 Pyrometer used for heat treatment furnace - Once in six months.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity. Records of all the tests made at the cylinder manufacturer's work shall be kept for the life time of the cylinder and copies of test certificates shall be forwarded to the purchaser of the cylinder and the inspecting authority.

3. LABELLING AND MARKING – As per the requirement of IS 15490:2017.

4. BATCH - Quantity of up to 200 cylinders plus cylinders for destructive testing of the same nominal diameter, thickness and design, made successively from the same steel and same heat and subjected to the same heat treatment for the same duration of time shall constitute a batch.

4.1 The identity of each batch shall be maintained. Each batch conforming to all the requirements shall be accompanied by a Certificate in accordance with clause 12 of IS 15490:2017.

5. LEVELS OF CONTROL - The tests as indicated in column 1 of Table 1 and the levels of control in column 3 of Table 1, shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

6. Design drawing- A fully dimensioned drawing shall be prepared which includes the specification of the material (cast analyses), neck threads, mechanical properties selected for calculating the wall thickness, heat treatment parameters, hardness range, working pressure, test pressure, water capacity, length and weight and shall be submitted to inspecting authority for final approval by statutory authority.

6.1 In respect of design and manufacture, the requirements of clause 6 and 7 of IS 15490: 2017 shall be complied with.

7. HEAT TREATMENT - The heat treatment of cylinders shall be done as per clause 5.6 of IS 15490:2017. The cylinders shall be punched with serial number before heat treatment to maintain traceability throughout the manufacturing process.

7.1 Adequate care shall be taken to ensure the consistency of heat treatment cycle. The deviation of temperature shall be within the specified temperature range. In case the temperature goes outside the specified limits, furnace shall be stopped and all such cylinders shall be segregated. Heat treatment shall be resumed only after attaining the requisite temperature and the furnace temperature

is maintained between the specified limits. The complete records of heat treatment cycle and interruptions of cycle shall be maintained.

8. INSPECTION AND TESTING/ RE-TESTS

8.1 In order to ensure that the cylinders are in compliance with IS 15490:2017 they shall be subjected to Inspection and Testing in accordance with clause 8 of IS 15490:2017.

8.2 In the event of failure of cylinders in meeting the requirements, procedure in accordance with clause 7.10 of IS 15490:2017 shall be followed for retesting/re-heat treatment.

9. REJECTIONS – Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1

(1)				(2)	(3)		
Test Details				Test equipment requirement R: required (or) S: Sub-contracting permitted	Levels of Control		
Cl.	Requirement	Test Method			No. of Sample	Frequency	Remarks
		Clause	Reference				
5	MATERIAL						
	Steel	5	IS 15490	S	One	Each heat of material received	The cylinder manufacturer shall obtain and provide certificates of cast (heat) analysis of the steel supplied for the construction of gas cylinder.
	Material for Neck Ring	As per design/ Drawing		-----	Two	Each Consignment	In case the consignment is received with a Test Certificate showing compliance to the specification no further testing is necessary.
6	DESIGN						
6.5	Neck Design	6.5.1 6.5.2	IS 15490	R	Each Cylinder		---
	Valve Fitting	6.5.3	IS 15490	R	Each Cylinder		---
7	MANUFACTURE						
7.1	Examination before closing in operation	7.1	IS 15490	R	Each Cylinder		---
7.2	Cylinder shape and wall thickness	7.2	IS 15490	R	Each Cylinder		---
7.3	Surface defects	7.3, Annex A	IS 15490	R	Each Cylinder		---
7.4	Ultrasonic Examination	7.4 Annex B	IS 15490	R	Each Cylinder		The ultrasonic testing shall be certified by the cylinder manufacturer. Every cylinder which has passed the ultrasonic testing shall be stamp -marked with the symbol "UT"
7.5	Cylinder neck threads and fittings	7.5	IS 15490	R	Each Cylinder		---

7.6	Out of Roundness	7.6	IS 15490	R	Each Cylinder	---
7.7	Mean Diameter	7.7	IS 15490	R	Each Cylinder	---
7.8	Straightness	7.8	IS 15490	R	Each Cylinder	---
9, 9.1, 9.2 - TYPE APPROVAL PROCEDURE						
9.2.3	Pressure Cycling Test and Hydraulic Bursting Test	9.2.3	IS 15490	R	Two Cylinder	Each new design of cylinder as per details given in <i>clause 9.1</i> of IS 15490: 2017 shall be subjected to prototype testing. Any change in design shall also require the prototype testing in accordance with <i>clause 9.2.8</i> of IS 15490:2017. If the results are satisfactory type approval certificate shall be issued as per <i>clause 9.2.9</i> of IS 15490: 2017.
9.2.6	Leak Before Break Test (LBB)	9.2.6	IS 15490	R	One Cylinder	
9.2.7	Bonfire Test	9.2.7	IS 15490	R	One or Two Cylinders as appropriate	
9.3.4	Sulphide Stress Cracking Resistance Test	9.3.4	IS 15490	R	Three Cylinders	Each new design of cylinder as per details given in <i>clause 9.1</i> of IS 15490: 2017 as well as cylinders with any change of design shall also be subjected to these tests for prototype testing. Test shall be conducted only if the upper limit of the specified tensile strength of steel exceeds 950 MPa.
9.3, 10 - MATERIAL TEST/ BATCH TEST						
10.1	Tensile Test	9.3.1	IS 15490	R	One cylinder from each Batch. Number of test specimen shall be as given below: (i) Tensile Test: One in longitudinal direction (ii) Bend Test: Four in circumferential direction (iii) Impact Test: Three each in longitudinal or transverse direction	Each new design of cylinder as per details given in <i>clause 9.1</i> of IS 15490: 2017 as well as cylinders with any change of design shall also be subjected to these tests for prototype testing.
	Bend Test	9.3.2	IS 15490	R		
	Impact Test	9.3.3	IS 15490	R		

10.2	Pressure Cycling Test and Bursting Test	9.2.3	IS 15490	R	One cylinder	Each batch	----
11	TEST ON EVERY CYLINDER						
11.1	Hardness Test	11.1	IS 15490	R	Each Cylinder		---
11.2	Hydrostatic Stretch Test	11.2	IS 15490	R	Each Cylinder		---
11.3	Ultrasonic Examination	11.3	IS 15490	R	Each Cylinder		---
11.4	Leakage Test	11.4	IS 15490	R	Each Cylinder		---
11.5	Water Capacity	11.5	IS 15490	R	Each Cylinder		---
15	Colour Identification	15.1 15.2	IS 15490	R	Each Cylinder		---

Note-1: Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empanelled by the Bureau.

Note-2: The control unit and levels of control as decided by the Bureau are obligatory, to which the licensee shall comply with.

ANNEX D

Possible Tests in a day

1. Wall thickness and other dimensions/requirements as per approved drawing (Cl. 5, 6)
2. Surface defects (Cl. 7.3)
3. Ultrasonic examination (Cl. 11.3)
4. Hardness Test (Cl. 11.1)
5. Tensile Test (Cl. 9.3)
6. Bend test (Cl. 9.3)
7. Impact Test (Cl. 9.3)
8. Water Capacity (Cl. 11.5)
9. Hydrostatic Stretch Test (Cl. 11.2)
10. Leakage Test (Cl. 11.4)
11. Hydraulic Bursting Test (Cl. 9.2.3)

ANNEX E**Scope of the Licence**

Licence is granted to use Standard Mark as per IS 15490:2017 with the following scope:	
Name of the Product	Seamless Steel Cylinders for On-Board Storage of Compressed Natural Gas as a Fuel for Automotive Vehicles
Variety	Material Water Capacity (litre) Diameter (mm) Wall thickness (mm) Working Pressure (bar or kgf/cm ²) Test Pressure (bar or kgf/cm ²) Bottom Profile
Any other aspect	PESO approved drawing number and approval number