PRODUCT MANUAL FOR COMPRESSED NATURAL GAS CYLINDER VALVE INTEGRATED WITH SOLENOID OPERATION (REMOTELY CONTROLLED) FOR AUTOMOTIVE USE ACCORDING TO IS 16988: 2018

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 license/certificate.

1.	**Product**	:	IS 16988: 2018
	Title	:	Compressed Natural Gas Cylinder Valve Integrated with Solenoid Operation (Remotely Controlled) for Automotive Use
	No. of Amendments	:	Two
2.	**Sampling Guidelines:**		
a)	**Raw material**	:	As per Cl. 5 of IS 16988
b)	**Grouping guidelines**	:	Each Variety of valve shall be tested for GoL/CSoL
c)	**Sample Size**	:	(a) Assembled valves- 35 pieces (b) Samples for Material Testing, Izod and Tensile- 3 pieces each (c) Valve body piece for chemical testing- 3 pieces (d) Other Brass components
3.	**List of Test Equipment**	:	Please refer ANNEX – A
4.	**Scheme of Inspection and Testing**	:	Please refer ANNEX –B
5.	**Possible tests in a day**	:	Please refer ANNEX –C
6.	**Scope of the Licence:**	:	Please refer ANNEX –D

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ANNEX -A

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
1.	Tensile strength and % Elongation, 5.4.1	Tensile testing machine
2.	Izod impact test, Cl. 5.4.2	Izod Impact testing machine
3.	Fusible alloy, Cl. 7.1.5	Test bath
4.	Minimum flow capacity, Cl. 7.1.6	Test bench with suitable arrangement
5.	PRD Test, Cl. 7.2	Suitable test bench
6.	Valve inlet connections, Cl. 8	Thread Plug Gauges and Ring gauges of suitable sizes
7.	Valve outlet connections, Cl. 9	Thread Plug Gauges and Ring gauges of suitable sizes
8.	Valve Impact Test, Cl. 10.2.1.	Suitable Test Setup as per Cl. 10.2.1
9.	Valving Torque Test, 10.2.2	Torque wrench with fixture
10.	Excessive Torque Test Cl.10.2.3	Test bench with Torque wrench
11.	Flame Impingement Test Cl.10.3	Suitable test bench as per Cl.10.3
12.	Flow capacity of PRD Cl. 10.4	Test bench with Flow meter
13.	Leak Tightness Test, Cl. 10.5	Test bench with pressure gauge
14.	Endurance Test, Cl. 10.6	Suitable test bench with Cycle counter as per Cl. 10.6
15.	Resistance to Extrusion Test, Cl. 11.1.1	Test bench with pressure gauge
16.	Accelerated life Test, cl. 11.1.2	Suitable test bench with pressure gauge
17.	Continued Operation Test Cl.11.1.3	Suitable test bench with Cycle counter
18.	Thermal Cyclic Test, Cl. 11.1.4	Suitable test bench
19.	Condensate Corrosion Resistance Test, Cl. 11.1.5	Suitable test bench
20.	Vibration Test, Cl.11.1.6	Vibration Test bench
21.	Leakage Test at Low and High Temperature, Cl. 11.1.7	Suitable Test bench with pressure gauge
22.	Activation Test, Cl.11.1.8	Suitable test bench

23.	Hydraulic Test ,Cl. 12.1	Test bench with pressure gauge
24.	Excess flow valve cut off test ,Cl 12.2	Suitable test bench
25.	Excess flow valve flow test ,Cl 12.3	Suitable test bench with fixture
26.	Excess flow valve Cycle test ,Cl 12.4	Suitable test bench with fixture
27.	Hydraulic Strength Test ,Cl. 13.1	Test bench with pressure gauge
28.	Internal and External Leak Tightness Test, Cl 13.2	Suitable Test bench with pressure gauge
29.	Continued Operation Test, Cl 13.3	Suitable test bench with Cycle counter
30.	Insulation Resistance Test, Cl 13.4	Insulation resistance tester
31.	Minimum Opening Voltage Test, Cl 13.5	Test bench with pressure gauge
32.	Electrical Over Voltage Test, Cl 13.6	Suitable test bench
33.	Corrosion Resistance Test, Cl 14	Salt Spray Test setup as per 10 of IS 15711
34.	Oxygen Aging Test, Cl 15	Suitable test bench with weighing machine as per 11 of IS 15711
35.	Non Metallic Material Immersion Test, Cl 16	Suitable test bench with weighing machine as per 13 of IS 15711
36.	Brass Material Compatibility Test, Cl 17	Suitable test bench as per 15 of IS 15711
37.	Dimensions, Minimum thickness, Cl. 6	Vernier caliper, Inside pistol caliper

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

ANNEX -B

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 Universal Testing Machine - Once in a year

1.1.2 Impact Testing Machine- Once in three years

1.1.3 Pressure Gauges - Once in a year

1.1.4 Temperature Controllers- Once in a year

1.1.5 Timer Controllers- Once in a year

1.1.6 All Measuring Instruments- Once in a year

1.1.7 Master gauges against which inspection gauges are checked periodically shall be sent for rechecking in an independent laboratory once in three years.

1.2 The firm shall procure a set of certified gauges for inspection of different components.

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 valve manufacturer's works shall be kept and copies of test certificates shall be forwarded to the purchaser of the valve and the inspecting authority.

3. LABELLING AND MARKING – As per the requirements of IS 16988:2018.

4. CONTROL UNIT – The control unit shall consist of a lot of forged valve blanks of the same type and size manufactured in a day/different days from the material of the same supplier and same heat number, under similar process of production.

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.

5.1 Each control unit of finished valves shall be offered for inspection to BIS before dispatch (See Table 2). Valves failing to meet the requirements of the specification shall not be marked with the BIS Standard Mark.

5.2 A certificate as per ANNEX-I shall be issued by the BIS Inspecting Officer in respect of every batch/inspection lots of valves marked with BIS Standard Mark.

5.3 The manufacturer shall maintain a system of works inspection at all stages of manufacture to ensure that the individual valve fittings are free from all manufacturing defects and comply in all respect with the requirements of the Indian Standards Specification.

5.4 One sample of each consignment of raw materials received in the factory shall be analyzed for chemical composition. The composition shall be such that the material shall be compatible under the conditions of service with the gas to be contained in the cylinder and complies with the declaration submitted at the time grant of license or inclusion.

5.5 The material shall conform to the requirements specified in 5.1 to 5.6 of IS 16988:2018. A test certificate shall be supplied by the supplier with the supply of the material for the valve fabrication. BIS shall be given the opportunity of making an independent check test, if necessary. The manufacturer of the valves should establish means to identify the valves with the certificate. Material with seams, cracks, lamination or other injurious defects shall not be used.

5.6 **DESIGN -** At the time of design approval the valves shall be checked for conformity to all the requirements of the specification. Whenever there is a change in material or design of the valve it shall be retested and shall conform to all the requirements of IS 16988:2018.

5.7 In respect of all other clauses of the specification at all stages of production, appropriate controls and checks shall be maintained by the factory so as to ensure that the product conforms to the various requirements of the specification.

6. FORGING & MACHINING - The licensee shall possess all the requisite infrastructure for the forging and machining of the valve housing in their own premises. Under no circumstances, the forgings of valve housing (body) or machining there of shall be permitted to be sub-contracted or bought from outside.

7. 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: Required (R) or Sub contracting permitted (S)**	**Levels of Control**		
Cl.	**Requirement**	**Test Method**			**No. of Sample**	**Frequency**	**Remarks**
		Clause	**Reference**				
5	**MATERIAL**						
	Chemical Composition						
	Valve Body	5.2.1	IS 16988 IS 6912	S	One	Each Consignment	No further testing is required, if accompanied with test certificate or ISI marked. The approved material as per drawing shall only be used.
	Other Brass components	5.2.3	IS 16988 IS 319 IS 6912	S	One	Each Consignment	No further testing is required, if accompanied with test certificate or ISI marked. The approved material as per drawing shall only be used.
	Brass components and sub-components	5.3 15	IS 16988 IS 15711	S			
	Mechanical Properties						
	Tensile Strength and Elongation	5.4.1	IS 16988	R	As per Annex B of IS 16988		--
	Impact Strength	5.4.2	IS 16988	R			
5.6	Protective finishes	5.6	IS 16988	R	One		--

7	**Pressure relief devices**						
7.1	Design	7.1.1 to 7.1.6	IS 16988	S	One	Each consignment	No further testing is required, if accompanied with a test certificate from manufacturer
7.2	Pressure Relief devices design of pressure relief devices	7.2.1, 7.2.2	IS 16988	R	Two	Each Control unit	--
8	Valve Inlet connection	8	IS 16988	R	Each valve		Thread shall be checked with approved gauges as applicable to types of thread.
9	Valve Outlet Connection	9	IS 16988	R	Each valve		
10	**Type Tests**						
	Valve Impact Test	10.2.1	IS 16988	R	One sample out of 5000 valves of same type subject to minimum of one valve in a month		--
	Valving Torque Test	10.2.2	IS 16988	R	One sample out of 5000 valves of same type subject to minimum of one valve in a month		--
	Excessive Torque Test	10.2.3	IS 16988	R	Four	Once in a year	--
	Flame Impingement Test	10.3	IS 16988	R	One	Once in a year	--
	Flow Capacity of pressure relief devices	10.4	IS 16988	R	Three	Each Control unit	--
	Leak Tightness Test	10.5	IS 16988	R	Five	Once in a year	--
	Endurance Test	10.6	IS 16988	R	Five	Once in a year	--
	Visual examination	10.7	IS 16988	R	Each Valve	Visual examination	--

11	**Type Test For PRD**						
	Resistance to Extrusion Test	11.1.1	IS 16988	R	Three	Once in a year	--
	Accelerated life Test	11.1.2	IS 16988	R	Five	Once in a year	
	Continued Operation (Cyclic) Test	11.1.3	IS 16988	R	Four	Once in a year	
	Thermal Cyclic Test	11.1.4	IS 16988	R	One	Once in a year	
	Condensate Corrosion Resistance Test	11.1.5	IS 16988	R	One	Once in a year	
	Vibration Test	11.1.6	IS 16988	R	One	Once in a year	
	Leakage Test	11.1.7	IS 16988	R	Six	Once in a year	
	Activation Test	11.1.8	IS 16988	R	One	Once in a year	
12	**Type Test for Excess Flow Valve, if provided**						
	Hydraulic Test	12.1	IS 16988	R	One	Once in a year	--
	Excess Flow Valve Cut off test	12.2	IS 16988	R	One	Once in a year	
	Excess Flow Valve residual leak test	12.3	IS 16988	R	Two	Each Control Unit	
	Excess Flow Valve Cycle test	12.4	IS 16988	R	Two	Once in a year	

13	**Type Test For Solenoid Operating Mechanism**						
	Hydraulic Strength Test	13.1	IS 16988	R	One	Each Control unit	--
	Internal & External Leak tightness Test	13.2	IS 16988	R	Five	Once in a year	
	Continued Operation	13.3	IS 16988	R	Two	Once in a year	
	Insulation Resistance Test	13.4	IS 16988	R	Two	Each Control Unit	
	Minimum Opening Voltage	13.5	IS 16988	R	Two	Each Control Unit	
	Electrical Over Voltage Test	13.6	IS 16988	R	Two	Each Control Unit	
14	Corrosion Resistance Test	14	IS 16988	R	One	Once in a year	--
15	Oxygen Aging Test	15	IS 16988	R	Three	Once in a year	--
16	Non- Metallic Material Immersion Test	16	IS 16988	R	Three	Once in a year	--
17	Brass Material Compatibility	17	IS 16988	R	Three	Once in a year	--
18	**Production inspection and testing**						
	Internal and External Leakage testing	18.3	IS 16988	R	Each valve		--
	Test for PRD	18.4.1 to 18.4.6	IS 16988	R	As per Table 18, 19 of IS 16988		

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.

Table 2

(*Cl. 5.1 of SIT)*

INSPECTION OF FINISHED LOT

Lot – For the purpose of lot inspection, the lot shall be the same as the Control Unit defined in Clause 4 of the Scheme of Inspection and Testing.

1. Depending upon the size of the lot, the number of samples as given below shall be drawn at random and subjected to the test for valve inlet connections, valve outlet connections and Leakage test etc.:

Control Unit Size	**Sample Size**
Upto 500	13
501 to 1000	20
Over 1000	32

In case of failure of any sample in any of the requirements mentioned at Sl. No. 1 above, all the valves in the lot shall be tested by the licensee for the requirement in which failure has occurred and the segregated lot be reoffered for BIS Inspection as fresh lot. Any subsequent failure shall result in the rejection of the whole lot. Lot can be reoffered only once. All rejected valves shall be scrapped.

2. Hydraulic Strength Test (Cl. 13.1), Relief Pressure (Cl. 7.2) and Flow Capacity of Pressure Relief Devices (Cl. 10.4), Electrical Over Voltage Test (Cl. 13.6), Minimum Opening Voltage Test (Cl. 13.5), Insulation Resistance Test(Cl. 13.4) and Excess flow Valve residual leak Test (Cl. 12.3) shall be carried out on two Valves from each control unit.

3. The lot may be considered as having passed the requirements of IS 16988:2018 if all the samples tested above are found to be conforming.

NOTE:

1. Tensile Strength, Elongation and Impact Strength of the material of valve body as per frequency given in Table 1 of SIT shall be carried out by the licensee. BIS officer will verify the relevant test records before carrying out lot inspection. However, such tests to be witnessed by BIS officer whenever possible.

2. Valve Impact Test and Valving Torque Test as per the frequency given in Table 1 of SIT shall be carried out by the licensee in the presence of BIS officer whenever possible. Records of such tests shall be verified by BIS officer before carrying out lot inspection.

ANNEX – I

(Para 5.2 of the Scheme of inspection and Testing)

Test Certificate for Compressed Natural Gas Cylinder Valve Integrated with Solenoid Operation (Remotely Controlled) for Automotive Use - IS 16988

Manufacturer:
Certificate No.
Purchaser:
Order No: --
Control unit No:
CNG Cylinder Valve Description:
Quantity offered for Inspection:
This is to certify that the CNG Cylinder Valve as mentioned below were inspected at M/s----------.
and these meet the Requirements of IS 16988 :2018 and Drawing No----------, Model No.----------

Results of Inspection	Inspected	Passed	Rejected
1) Valve inlet			
2) Valve outlet			
3) Leakage Test			
4) *Tensile Strength and Elongation Tests			
5) *Impact Strength Test			
6) Hydraulic Strength Test			
7) *Valve Impact Test			
8) *Valve Torque Test			
9) Relief Pressure Test			
10) Flow Capacity of Pressure Relief Devices			
11) Electrical Over Voltage			
12) Insulation Resistance			
13) Minimum Opening Voltage			
14) Excess Flow Valve residual leak Test			

*From manufacturers test record - Batch No. Satisfactory
Quantity Passed:
Valve scraped During Destructive Testing:
The method of their disposal: Scrap

Signature: Signature

Name & Designation of the Officer Inspecting Officer

Representative of Company Bureau of Indian Standards

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ANNEX-C

POSSIBLE TESTS IN A DAY

Sl. No.	Tests	Clause reference
1	Leakage Test	Cl. 6.6
2	Relief pressure Test on PRD	Cl.7
3	Valve inlet Connections	Cl.8
4	Valve outlet Connections	Cl. 9
5	Flow Capacity of PRD	Cl. 10.4
6	Excess Flow Valve Flow Test	Cl. 12.3
7	Hydraulic Strength Test	Cl. 13.1
8	Insulation Resistance	Cl. 13.4
9	Minimum Opening Voltage	Cl. 13.5
10	Electrical Over Voltage	Cl. 13.6

ANNEX D

Scope of Licence

"Licence is granted to use Standard Mark as per IS 16988:2018 with the following scope:	
Name of the product	Compressed Natural Gas Cylinder Valve Integrated with Solenoid Operation (Remotely Controlled) for Automotive Use
Type of valve design	
Type of thread on valve inlet	Taper screw threads-Type 1/2/4 and corresponding size Oversized threads- Type 1/2/4 and corresponding size Parallel threads
Outlet No.(21/21A/21B)	
Any other aspect	PESO approved drawing number and approval number