

**PRODUCT MANUAL FOR
Steel Plate for Pressure Vessel for Intermediate
and High Temperature Service including Boilers
According to IS 2002:2009**

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 2002:2009
	Title	:	Steel Plate for Pressure Vessel for Intermediate and High Temperature Service including Boilers
	No. of amendments	:	1
2.	Sampling Guidelines		
a)	Raw material	:	No specific requirement
b)	Grouping Guidelines	:	Please refer Annex – A
c)	Sample Size	:	For physical tests: 0.5 m + Prepared sample for Tensile, Bend, Dimension Test For chemical tests : 50 gm drillings or 5pcs each of length 5 cm for OES (ref:LPPD/OES dated:21 Sep 2015)
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	:	All Physical and Chemical tests
6.	Scope of the Licence :		
	Licence is granted to use Standard Mark as per IS 2002:2009 with the following scope:		
	Name of the product	Steel Plate for Pressure Vessel for Intermediate and High Temperature Service including Boilers	
	Dimensions	Thickness from ...mm upto and including ...mm Width from ...mm upto and including ...mm Length from ...mm upto and including ...mm	
	Grade	1(excluding plates for fire boxes), 2, ...	
	Optional Requirements	Including Steel plates suitable for elevated temperature requirements at XXX °C, Excluding Steel plates conforming to internal soundness requirement by ultrasound testing for thickness 25 mm and above	

ANNEXURE A
TO PRODUCT MANUAL FOR
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GROUPING GUIDELINES

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1. Steel Plate for Pressure Vessel for intermediate and high temperature service including boilers according to IS 2002: 2009 is classified as per the following:

- Grade
- Optional requirements: yield stress at elevated temperature, Ultrasonic testing
- Homogeneity test

2. The following grouping based on type of product, shall be followed for considering grant of licence/inclusion as per IS 2002:2009 :-

2.1 If a sample has been drawn & tested for higher grade of material offered (e.g. Grade 3), the recommendation shall include lower grades e.g. Grade 2 & 1 (excluding Grade 1 materials suitable for fire boxes) also.

2.1.1 In order to include Grade 1 materials suitable for fire boxes in the above scope of licence, separate sample of Grade 1 for fire box is also to be drawn and tested.

2.2 Where the applicant/licensee has not declared/guaranteed the required yield stress at elevated temperature requirement, the scope of the licence to clearly stipulate, "Excluding yield stress at elevated temperature requirement". Similarly, where the applicant/licensee has intended for licence/inclusion for thickness 25 mm and above in licence scope, but has no test facility for ultrasonic testing for internal soundness, the scope of licence shall clearly exclude "steel plate conforming to internal soundness requirement by ultrasound testing for thickness 25 mm and above".

2.3 The scope of licence to clearly stipulate suitability for the declared/ guaranteed elevated temperature (e.g. "including suitable for elevated temperature xxx degree C")

2.4 Applicant/licensee to submit appropriate undertaking regarding the addition of alloying elements.

3. It shall however be ensured that firm has necessary manufacturing capabilities and testing facilities for the entire grades/conditions proposed to be covered under scope of BIS Certification.

4. During the operation of license, BO shall ensure that all sizes / grades covered in the license are drawn for independent testing on rotation over a period of time.

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LIST OF TEST EQUIPMENTS

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Major test equipment essentially required to test as per requirements of Indian Standard.

Sl. No.	Test Equipment/Chemicals and Identification Numbers (Where applicable)	Tests Used in with Clause Reference
1.	Rough Polishing Machine, Cutting Machine, Fine Polishing Machine, Grinder Machine, Lathe, notch cutter	Preparation of specimen
2.	Vernier Callipers	Cl.9, 19 (Tolerances on Dimensions & Shape)
3.	Micrometer, Steel tape, Steel Scale, Flat surface, Straightedge 1000,2000 or 4000 mm	
4.	UTM (0-1000KN)	Cl.12 (Tensile Test)
5.	Tensile testing machine with a furnace carousel fitted with extensometer	Cl.12.3 (Tensile Test at elevated temperature)
6.	Steel Mandrels (for bend tests), UTM attachments/clamps/vice/Vernier Callipers	Cl.13 (Bend Test)
7.	Analytical balance (0-200g,Lc:0.1mg)	Cl.8 (Chemical Composition)
8.	Weigh bridge	Cl.9.3 (Rolling Mass)
9.	Metallurgical microscope	Cl. 5 (Austenitic Grain Size Number)
10.	Instrumental methods Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry. Spectrophotometer	Cl 6.1,6.2 for C,S,P,Mn,Si,Al, Cu, Microalloying and alloying elements content Mn,S,P,Si
11.	Strohlein or Leco apparatus with all attachments Barometer with chart, Hot plate, Muffle furnace, Complete range of glass wares, measuring cylinders, Desiccator, porcelain boats or ceramic crucibles, Thermometer, Electronic Balance, Distilled Water,Hot air oven, Oxygen - 99.5 percent minimum purity,ether or acetoneStandard Reference Material (NML) with certificate Reagents for C: tin granules or pure iron fillings, acidulated water/brine water, methyl red,caustic potash Reagents for S: Ceramic boats/crucibles – desiccators, Fluxes -Low sulphur copper, tin or iron, Dilute hydrochloric acid, Starch Iodide solution, Potassium iodate	cl.6.1, 6.2 –C& S (chemical method, alternative to instrumental method)

12.	<p>Weighing balance, Heater/ Heating element along with energy regulator, Ice water bath, Vol Flask Cap – 1 litre, (Whatman) filter paper No. 040, Suction Filtration Facility, Filter paper pulp pad, Standard Reference Material (NML) with certificate</p> <p>Potassium Permanganate (KMnO₄), Sodium Nitrite (NaNO₂), Ammonium Molybdate [(NH₄)₂MoO₇], Ammonium Phosphate [(NH₄)₃PO₄], Potassium Nitrate (KNO₃), Phenolphthalein Solution, Rectified spirit or methyl alcohol, Sodium Hydroxide (NaOH), Hydrofluoric Acid (HF), Perchloric Acid (HClO₄), Sulphurous Acid, Hydrobromic Acid (HBr), other chemicals and reagent as applicable</p>	Phosphorus content Cl 6.1, 6.2 (chemical method, alternative to instrumental method)
13.	<p>Hot plate, Conical flask</p> <p>Reagents:</p> <p>silver nitrate, ammonium persulphate sodium arsenite solution, Dilute Nitric Acid, Phosphoric Acid, Dilute Sulphuric Acid, Concentrated Nitric Acid, NaCl Solution, Permanganic acid</p>	Manganese content Cl 6.1, 6.2 (chemical method, alternative to instrumental method)
14.	<p>Medium textured filter paper, Porcelain casserole, platinum crucible, filter paper pulp, hot plate, hot air oven, muffle furnace</p> <p>Reagents: Silver nitrate solution, concentrated nitric acid, concentrated sulphuric acid, Dilute Hydrochloric Acid, Dilute Sulphuric Acid, Perchloric Acid, Tartaric acid and hydrofluoric acid</p>	Silicon content Cl 6.1, 6.2 (chemical method, alternative to instrumental method)
15.	<p>Plate, Muffle Furnace, porcelain or silica crucible,</p> <p>Reagents: Hot Wash Solution (dilute sulphuric acid solution 1 : 99 v/v with hydrogen sulphide), dilute sulphuric acid, hydrogen sulphide, Dilute Nitric Acid, Sodium Fluoride, solid, Dilute Ammonium Hydroxide, Acetic Acid, Potassium Iodide, Starch Solution, Sodium Thiosulphate Solution, Ammonium Bifluoride Solution</p>	Cu content Cl 6.1, 6.2 (chemical method, alternative to instrumental method)
16.	<p>ashless paper pulp, paper pulp pad, hot plate, dessicator,</p> <p>Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated hydrochloric acid, Concentrated nitric acid, Perchloric acid, Hydrofluoric Acid</p>	Ni content Cl 6.1, 6.2 (chemical method, alternative to instrumental method)
17.	<p>Hot plate, stop watch</p> <p>Reagents: dilute sulphuric acid and phosphoric acid mixture, concentrated nitric acid, ammonium persulphate, silver nitrate, dilute</p>	Cr content Cl 6.1, 6.2 (chemical method, alternative to instrumental method)

	hydrochloric acid, ferrous ammonium sulphate, standard potassium permanganate solution.	
18.	Determination of Nitrogen by Thermal Conductivity Method/ By Inert gas fusion followed by thermal conductivity detection/ By Steam Distillation Method	Cl. 6.1(Nitrogen Content)
19.	Notch cutter, Magnifying glass, Optical microscope	Cl 14 (Homogeneity test)
20.	Ultrasonic detector	Cl 15 (Ultrasonic test)

Note: The above is an indicative list for the purpose of guidance only

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SCHEME OF INSPECTION AND TESTING

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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 equipments.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

3. MARKING, PACKING –

The Standard Mark as given in Column (1) of the First Schedule of the license and Licence Number (i.e. CM/L.....) shall be incorporated, and the marking and packing shall be done as per the provisions of the Indian Standard, provided always that the product thus marked and packed conforms to all the requirement of the specification. In addition, details of BIS website shall be marked as follows: “For details of BIS certification please visit www.bis.gov.in”

4. CONTROL UNIT – All steel plates hot rolled to same dimensions and heat treatment, representing the same cast & grade, manufactured under uniform conditions of production in a day in the same place constitutes a control unit.

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 All the production which conforms to the Indian Standards and covered by the licence should be marked with Standard Mark.

6. TEST CERTIFICATE-For each consignment of BIS Certified material conforming to IS 2002:2009 there shall be a test certificate which shall contain the Standard Mark, the cast/Control Unit number and the corresponding test results (as given in Annexure-I enclosed)

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. Any rejected material which is potentially re-salable be sheared or cut or deformed in such a manner that it cannot be used for any other purpose except re-melting. A separate record shall be maintained giving information on quantity and cast number/coil number/control unit number, as applicable, relating to all such rejections/defective/sub-standard material of the production not conforming to the requirements of the Specification and the method of its disposal. Such material shall in no case be stored together with that conforming to the Specification. The Standard Mark (if already applied) on rejected material should be defaced.

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TABLE 1: LEVELS OF CONTROL

(1)		(2)	(3)		(4)		
TEST DETAILS			LEVELS OF CONTROL		REMARKS		
Clause	Requirements	Test Method	Test equipment requirement	No. of Samples		Frequency	
		Clause	Reference				
5	Manufacture	5.1 , 5.1.1,5.1.2,5.1.3	IS 2002 IS 4748	R	One	Each Control Unit	
6	Chemical Composition		IS 2002 & IS 228 (Various Parts) Or any established Chemical/ Instr. method				
	Ladle Analysis	6.1 Table-1	-do-	R	One	Each Heat	
	Product Analysis	6.2 Table-1	-do-	R	One	Each Cast	
7	Heat Treatment	7.1 to 7.3	IS 2002	R	As agreed to between manufacturer and purchaser.		
8	Freedom from defects	8.1 to 8.2.3	IS 2002	R	Each Plate	Each Plate	
9 & 19	Dimensions & Tolerances	17, 9.1 to 9.3, 19 & Table 2	IS 2002 ISO 7452 IS 16998	R	Adequate inspection to ensure each item to be within the limits of the specification		

(1)				(2)	(3)		(4)
TEST DETAILS					LEVELS OF CONTROL		REMARKS
Clause	Requirements	Test Method		Test equipment requirement R: required (or) S: Sub-contracting permitted	No. of Samples	Frequency	
		Clause	Reference				
12.1 & 12.2	Tensile Test	11, 17, 12.1 to 12.2.2, Table-3	IS 2002 & IS 1608 Pt.1	R	1	Every Plate/Each Coil	In case of plates over 7m of length, Two samples (one sample each from both ends) are to be tested.
12.3	Tensile Test (at elevated temperature)	11, 17, 12.3 to 12.3.1, Table-4	IS 2002 & IS 1608 Pt.2	S	1	Every Plate/Each Coil	In case of plates over 7m of length, Two samples (one sample each from both ends) are to be tested.
13	Bend Test	11, 17, 13.1 to 13.2.2	IS 2002 & IS 1599	R	1	-do-	In case of plates over 7m of length, Two samples (one sample each from both ends) are to be tested.
14	Homogeneity test	17, 14.1 to 14.4 Fig 1,2,3	IS 2002	R	1	Each Cast	For grade 1 Plate for fire boxes only
15	Ultrasonic testing	17, 15.1 to 15.3	IS 2002 & IS 4225	R	For 25mm thick & Above. As agreed to between manufacturer and purchaser.		
16	Other tests	16	IS 2002	S	As and if agreed to between manufacturer and purchaser.		
18	Rust Protection	18	IS 2002	R	As and if agreed to between manufacturer and purchaser.		

Note-1: Whether test equipment is required or sub-contracting is permitted in column 2 shall be decided by the Bureau and shall be mandatory. Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empaneled 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.

ANNEXURE I



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(Para 6 of the Scheme of Inspection and Testing)
XYZ IRON AND STEEL COMPANY
(Registered office Address and works address)

TEST CERTIFICATE FOR Steel Plate for pressure vessel for intermediate and high temperature service including boilers

TEST CERTIFICATE No. _____

DATE _____

TO M/s _____

We certified that the material described below fully conforms to IS 2002:2009 Chemical composition and Mechanical properties of the product, as tested in accordance with the Scheme of Testing and Inspection contained in the BIS Certification Marks Licence No. CM/L _____ are as indicated below against each order No.

(PLEASE REFER TO IS 2002:2009 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No. & Date	Section (nom Size)	Control Unit No.	Grade	Quantity in tonnes	CHEMICAL COMPOSITION								MECHANICAL PROPERTIES					Optional	Remarks	
					C	S	P	Si	Mn	*Cu	@Micro Alloying Elements	Al	CE	Tensile strength	Elongation	Yield Stress	Bend test			Homogeneity test
					%	%	%	%	%	%	%	%	%							

* For copper-bearing quality

@ Micro-alloying element present should be indicated

REMARKS

WAGON NO.

TRUCK NO.

(It is suggested that size A4 paper be used for this test certificate)

FOR XYZ IRON AND STEEL COMPANY