



उत्पाद मैनुअल

**Specification for Quenched and Tempered Alloy Steel Forgings for Pressure Vessels
IS 12145:1987 के अनुसार**

**PRODUCT MANUAL FOR
Specification for Quenched and Tempered Alloy Steel Forgings for Pressure Vessels
According to IS 12145:1987**

विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो (अनुरूपता मूल्यांकन) विनियम, 2018 की योजना -I के तहत प्रमाणन के संचालन में एकरूपता और पारदर्शिता के लिए इस उत्पाद मैनुअल का उपयोग सभी क्षेत्रीय / शाखा कार्यालयों और लाइसेंसधारियों द्वारा संदर्भ सामग्री के रूप में किया जाएगा। दस्तावेज़ का उपयोग बीआईएस प्रमाणन प्राप्त करने के इच्छुक संभावित आवेदकों द्वारा भी किया जा सकता है।

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure uniformity 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.

1.	मानक संख्या IS No.	:	IS 12145:1987
	शीर्षक Title	:	Specification for Quenched and Tempered Alloy Steel Forgings for Pressure Vessels
	संशोधनों की संख्या No. of amendments	:	1
2.	नमूना दिशानिर्देश Sampling Guidelines		
a)	कच्चा माल Raw material	:	No specific raw material requirement. Note: This section indicates the requirements for raw material (if specified in the IS) for which compliance is to be established during Grant of Licence/Change in Scope of Licence/Factory Surveillance.
b)	समूहीकरण दिशानिर्देश Grouping Guidelines	:	Please refer Annex - A

c)	नमूने का परिमाण Sample Quantity	:	Tests for dimensional and tolerances shall be carried out on full forgings selected as sample in factory & conformity shall be reported against the agreed requirements between the manufacturer and purchaser For Physical test: As per Cl 9.2.1., Table 4 & Cl 11 of IS 12145:1987 and/or prepared test specimen for Tensile Test and Impact Test For chemical test : 5 pieces of 50 mm length/50 g drilling (Samples are to be drawn by discarding the heat affected zone in case of gas cutting) No market samples shall be drawn for the product as the product is bulky in nature Note: This section indicates the quantity of the sample of the product and/or the raw material (if applicable), required to be sent to the laboratory for testing, for the purpose of Grant of Licence/Change in Scope of Licence/ Factory Surveillance (incase of market surveillance, effort may be made to procure therequired quantity of product sample, as far as possible since raw material sample may not be available in market)
3.	परीक्षण उपकरणों की सूची List of Test Equipment	:	Please refer Annex - B
4.	निरीक्षण और परीक्षण की स्कीम Scheme of Inspection and Testing	:	Please refer Annex - C
5.	एक दिन में संभावित परीक्षण Possible tests in a day	:	All tests are possible to be carried out in a day. Note: This section is for the guidance of BIS Certification Officers/Technical Auditors of BIS Authorized Outside Surveillance Agencies (OSAs) during factory inspection to provide readyreference regarding the tests which can be witnessed during the inspection in the factory by the officer/auditor.
6.	लाइसेंस का दायरा /Scope of the Licence:		
	Licence is granted to use Standard Mark as per IS 12145:1987 with the following scope:		
	Name of the product	Specification for Quenched and Tempered Alloy Steel Forgings for Pressure Vessels	
	Grade	Grade-I A,I B,II A,II B,III	

ANNEXURE A
GROUPING GUIDELINES

- a) Specification for Quenched and Tempered Alloy Steel Forgings for Pressure Vessels according to IS 12145: 1987 classified forgings into 3 grades namely I, II and III based upon chemical composition (C, Mn and Alloy Content (Ni,Cr, Mo)) and Mechanical Properties (YS,TS, Elongation, Impact). Grades I and II have been further classified into grades I A, I B and II A, II B with higher YS for B grades. Grade III has the least carbon, highest alloy content and the highest YS among the 3 grades.
- b) Based on the above, the following Grouping Guidelines shall be considered for GoL/CSoL:-
 - 1. Manufacturer shall declare the Grades intended to be covered in the Scope of Licence.
 - 2. Sample of each Grade shall be drawn and tested to cover all Grades in the Scope of the Licence.
 - 3. Scope of licence shall be restricted based on the manufacturing and testing facilities available.
 - 4. During operation of licence, samples of each variety covered in the scope of licence, shall be tested in rotation, to the extent possible

ANNEXURE B**LIST OF TEST EQUIPMENTS
(INDICATIVE LIST, FOR GUIDANCE ONLY)**

Sl. No.	Tests Used in with ClauseReference	Test Equipment/Chemicals and IdentificationNumbers (Where applicable)
1.	Tensile test , Cl.6.1. (Table 4)	Universal Tensile Testing Machine(UTM) with Extensometer, Brinell Hardness Testing Machine with Standard Block
2.	Dimensions and Tolerances, Cl 8.1.	Vernier Calliper, Steel scale, Micrometer, Steel Tape
3.	Impact Test, Cl.6.1. (Table 4)	Charpy Impact Tester, Cold Chamber(as per grade)
4.	Ultrasonic testing, Cl.11	Ultrasonic flaw detector
5.	Chemical composition, Cl 5(C,Si,Mn, Ni,Cr,Mo,V,S,P)	Device for instrumental chemical analysis such as Spark Optical Emission Spectrometer, Atomic Absorption Spectrometer etc. with all requisite channels, certified reference materials/standard reference materials OR Equipment, Apparatus and reagents as per the relevant parts of IS 228 in case of analysis as per IS 228 (chemical method)
6.	C & S - cl.5. (chemical method, alternative to instrumental method)	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 acetone, Standard 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
7.	Phosphorus content – cl.5. (chemical method, alternative to instrumental method)	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 Potassium Permanganate (KMnO ₄), Sodium Nitrite (Na ₂ NO ₃), Ammonium Molybdate [(NH ₄) ₂ Mo ₂ O ₇], Ammonium Phosphate [(NH ₄) ₃ PO ₄], Potassium Nitrate (K ₂ NO ₃), Phenolphthalein Solution, Rectified spirit or methylalcohol, Sodium Hydroxide (NaOH), Hydrofluoric Acid (HF), Perchloric Acid (HClO ₄), Sulphurous Acid, Hydrobromic Acid (HBr), other chemicals and reagent as applicable.

8.	Manganese content –cl.5. (chemical method, alternative to instrumental method)	Hot plate, Conical flask Reagents: silver nitrate, ammonium persulphate sodium arsenite solution, Dilute Nitric Acid, Phosphoric Acid, Dilute Sulphuric Acid, Concentrated Nitric Acid, NaCl Solution, Permanganic acid
9.	Silicon content –cl.5.	Medium textured filter paper, Porcelain casserole, platinum crucible, filter paper pulp, hot plate, hot air oven, muffle furnace Reagents: Silver nitrate solution, concentrated nitric acid, concentrated sulphuric acid, Dilute Hydrochloric Acid, Dilute Sulphuric Acid, Perchloric Acid, Tartaric acid and hydrofluoric acid
11.	(chemical method, alternative to instrumental method)	Hot plate, stop watch Reagents: dilute sulphuric acid and phosphoric acid mixture, concentrated nitric acid, ammonium persulphate, silver nitrate, dilute hydrochloric acid, ferrous ammonium sulphate, standard potassium permanganate solution.
12.	Cr content	Hot Plate, Reagents: distilled water, Acid Mixture (700 ml of perchloric acid (rd=1.67), Phosphoric acid (rd=1.70) and Nitric Acid (rd=1.42), Concentrated Hydrochloric Acid (rd=1.16), Dilute sulphuric Acid 1:1 and 1:5, Potassium Thiocyanate solution, 100g/Ltr, Stannous Chloride Solution, N-Butyl Acetate, Iron Molybdenum Free (Mo < 0.001 percent), Standard Molybdenum solution (1 ml = 0.01 mg Mo)

ANNEXURE C

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance Plan i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT:

1.3.1 For the guidance of manufacturers, the recommended definition of control unit is : For the purpose of this scheme, all forgings of the same cast, grade and manufactured under uniform conditions of production on the same forging line in one go shall constitute a control unit.

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in **Table 1**.

1.3.3 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING- It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.1 For the guidance of manufacturers, Table 1 giving the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as “R” or other tests which can be subcontracted as “S”. Subcontracting is permitted to BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.2 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as “R” in Column 2 of Table 1) is also optional.

2.2.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as “R” in Column 2 of Table 1), where different tests given in the specification shall be carried out in accordance with the method given in the specification. They shall also implement a calibration plan for the in-house test equipment.

2.3.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.4 TEST RECORDS- The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. PACKING AND MARKING - The Standard Mark as given in schedule of the licence 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 conform to all the requirements of the specification.

3.1 Packing and Marking shall be done as per the Indian Standard.

4. TEST CERTIFICATE - For each consignment of BIS Certified material conforming to IS 12145:1987 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)

5. REJECTION - All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. 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
(ONLY FOR GUIDANCE PURPOSE)

(1) (ONLY FOR GUIDANCE FOR USE)				(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				
4	Manufacture	4.1 to 4.4	IS 12145	R	-----	-----	Applicable for all manufacturers including: i) manufacturers with steel making facilities i i) Manufacturers producing forgings from Ingots as raw material: Must ensure that Ingots procured by them comply with Cl 4.1 to 4.3 of IS 12145:1987. Accordingly, records in support of the same shall be maintained which shall include raw material certificate indicating steel manufacturing process, freedom from defects etc.
5	Chemical Composition						
	Ladle Analysis	5.1 & Table 2	IS 228 (various parts)	R	One	Each Heat	-----
	Product Analysis	5.2 , Table-2 and Table-3	-do-	R	One	Each Heat	Sample shall be taken as per Cl 5.2 of IS 12145 No further testing if the raw material ingots received are ISI marked and are received with Test Certificate
	Chemical composition shall be determined either by method specified in IS 228 or any other established instrumental/Chemical Method						
6.1	Mechanical Properties	6.1 and Table 4	IS 1608 (Part 1) IS 1499	R	One	Each Heat	-----
8	Appearance	7	IS 12145	R	Firm shall exercise adequate in-process controls to ensure that each		

					forging remains free from harmful defects
7	Shapes, Dimensions and Tolerances	8	IS 12145	R	Firm to have adequate in-process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity
11	Ultrasonic Testing	11.1	IS 12145	R	Requirements as agreed between purchaser and manufacturer. Test Method for Ultrasonic Testing to be specified by the manufacturer.

ANNEXURE I
XYZ IRON AND STEEL COMPANY
(Registered office Address and works address)
**TEST CERTIFICATE FOR Specifications for Quenched and Tempered Alloy Steel
Forgings for Pressure Vessels**



TEST CERTIFICATE No. _____

To M/s _____

DATE _____

We certified that the material described below fully conforms to 12145:1987 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 12145:1987 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No. & Date	Size	Control Unit No.	Grade	Quantity in tonnes	CHEMICAL COMPOSITION									MECHANICAL PROPERTIES					Ultrasonic testing	Remarks
					C %	Si %	Mn %	Ni %	Cr %	Mo %	V %	S %	P %	TS	%El	0.2% Proof Stress	% Reduction in Area	Impact Test		

REMARKS
WAGON NO.
TRUCK NO.
(It is suggested that size A4 paper be used for this test certificate)

FOR XYZ IRON AND STEEL COMPANY