



PRODUCT MANUAL FOR PORTLAND CEMENT CLINKER ACCORDING TO IS 16353: 2015

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 16353 : 2015
	Title	:	PORTLAND CEMENT CLINKER
	No. of Amendments	:	Nil
2.	Sampling Guidelines:		
a)	Raw material	:	-
b)	Grouping guidelines	:	-
c)	Sample Size	:	For Physical test – 8 kg For Chemical test – 2 kg
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 :		
	(i) Insoluble Residue (ii) Loss of ignition (iii) Fineness (iv) Setting time		
6.	Scope of the Licence :		
	“Licence is granted to use Standard Mark on Portland Cement clinker as per IS 16353 : 2015”.		

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

SI No.	Tests used in with Clause Reference	Test equipment
1	Fineness Clause 6.1	Blaine's apparatus variable flow type
		Stop watch with start-stop mechanism
		Mercury for calibration
		Balance, Standard weights
		Standard Cement
		Manometer liquid (di-butyl phthalate or light mineral oil.)
		Mercury of reagent grade or better, Pyknometer
		Circular discs of filter paper of medium porosity (mean pore diameter 7 μ).
		Le-Chatelier's flask
		Constant temperature water bath to maintain temp. within ± 0.1 °C
2	Soundness by Autoclave Clause 6.1 Table 2	Auto clamp machine with thermostatic control to maintain pressure of 2.1 MPa for 3 hrs, pressure to be attained within 1-1 ¼ hrs; L-Shape thermometer LC 1 °C
		Pressure gauge 0-42 kg/cm ² LC = 0.4 kg/cm ²
		Humidity chamber with temperature & RH control 27 \pm 2 °C, RH 90 to 100 %
		Standard bar 308 mm, max
		Bar moulds 25x25x282 mm
		Length comparator with dial gauge
		Mineral oil for covering moulds
3	Soundness by Le-chatelier Method Clause 6.1 Table 2	Le-Chatelier's water bath preferably with thermostatic control raising temperature from 27 \pm 2 °C to boiling in 27 \pm 3 minutes
		Le-Chatelier's moulds with weights and cover glasses minimum 8 nos.
		Humidity chamber with temperature & RH control 27 \pm 2 °C, RH 90 to 100 %
		Steel scale 12" (304.8 mm)

4	Setting time Clause 6.1 Table 2	Vicat apparatus
		Needle for Consistency, IST& FST testings
		Moulds
		Stop Watch
		Balance - 1000g \pm 0.1g and Standard Weights 1mg to 500 gm
		Gauging trowel of weight 210 \pm 10 g
5	Compressive Strength Clause 6.1 Table 2	Vibration machine with timer & cube mould fitting assembly 12000 \pm 400 vibration per min.
		Compressive Strength machine
		Poking Rod , Petroleum Jelly
		Proving ring with all accessories suitable for calibration of CST machine
		Tachometer
		Cube Moulds 70.6 \times 70.6 mm, Poking rod
		Gauging trowel (210 \pm 10 g) gauging plate, stainless steel(non-perforated)
		Standard sand grade 1, 2 and 3 (as per IS 650)
		Curing tank of appropriate size with water circulation arrangement
		Graduated glass cylinders 150 to 200 ml
		Humidity chamber with temperature & RH Control 27 \pm 2° C, RH 90 to 100 %
6	Particle size distribution for clinker Clause 6.2, Table 3	Scoope for sample collection
		IS Sieves – 5 mm & 50 mm
		Weighing balance
7	IS 16353 : 2015	General equipments for Cement testing
a)	To control humidity & temperature in lab	1. Humidity chamber with temperature & RH control 27 \pm 2°C, RH 90 to 100 % 2. Suitable arrangement to demonstrate maintenance of temp. of 27 \pm 2 ° C & RH 65 \pm 5% constantly
b)	For cement Sampling	Mixing trays –adequate size including trays of 24 partitions for keeping hourly samples
c)	To control the residue of cement	Sieve of size 150 μ
d)	To measure temperature	Thermometers

e)	Lab ball mill (motorized)	To grind the clinker, slag & gypsum sample in lab ball mill for testing
f)	To weigh the material	1. Platform type balance 2. Electrical balance 3 Weight box with weights (1 mg - 500 g)
9	General test equipments for chemical testing Clause 5 , Table 1 of IS 16353 : 2015	
		Muffle Furnace with thermostatic control, Range 0 – 1200° C
		Oven with thermostatic control 0-300° C
		Heater and hot plate
		Distillation Assembly
		Crucible: Platinum or Porcelain / silica
		Filter paper (No- 1, 40, 41, 42)
		Desiccators with cover & Desiccant
		Water bath
		pH meter/paper
		Glassware - volumetric flask -0-250 ml, beaker 0-250 ml, measuring cylinder 0-50,100,500, 1000 ml, burette 0-25/50 ml, conical flasks- 0-250 ml, pipette 0-5,10, 25, 50 ml
		All chemicals required for complete chemical analysis of cement
		Tongs including platinum tipped tong
		Wire gauge with asbestos sheet at the middle
		Washing bottle
		Mortar mixer- 4.75 l
		Glass thermometer
		All required chemicals as per IS 4032 for Portland clinker testing.

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 equipments. The following equipments shall be calibrated at a frequency shown against each and records kept.

Sl. No.	TEST EQUIPMENT	FREQUENCY OF CALIBRATION
1.	Blaine's apparatus	Daily with licensee's own Standard cement sample and monthly with standard cement samples supplied by NCCBM.
2.	Compressive strength Testing machine	Once in a month with Licensee's own Proving Ring and the Proving Ring shall be Calibrated once in two years from a NPL/NABL Accredited Calibrating body or NPL or NPL accredited Proving Ring manufacturer.
3.	Autoclave pressure gauge	Once in a month by licensee's own dead weight pressure gauge tester OR once in six months from accredited calibrating body or NPL/NABL accredited manufacturer of such gauges.
4.	Vibration machine	Once in a month by licensee's own Tachometer. The tachometer shall be calibrated once in a year from NPL/NABL accredited outside agency.
5.	Dead weight pressure gauge Tester (if available)	Once in four years from NABL accredited Tester (if available) Lab or OEM (original Equipment manufacturer) having NPL/NABL accredited calibrator.

2. TEST RECORDS – The manufacturer shall maintain test records in various formats, Form 1 to Form 5 for the tests carried out to establish conformity.

3. LABELLING AND MARKING – Labeling and marking shall be as given below:

3.1 STANDARD MARK – The consignment of Portland Cement Clinker may also be marked with the Standard Mark

3.2 MARKING - As per the requirements of IS 16353: 2015.

3.2.1 In addition to above, each consignment shall be accompanied by a certificate bearing the manufacturer's name or trade mark, the quantity of clinker and the word 'Portland cement clinker'

4. CONTROL UNIT –

4.1 For manufacturing units of Portland Cement Clinker: The tests, as indicated in Table 1 attached and at the levels of control specified therein, shall be carried out on the whole production of the factory which is covered by this scheme and appropriate records maintained in accordance with clause 2 above.

4.2 RAW MATERIALS

4.2.1 Routine analysis of various raw materials used in the manufacture of Portland Cement clinker shall be made at intervals of a month or whenever there is a change in the source/mine area stratification whichever is earlier and appropriate records of the analysis and of the Physical composition of the mixtures shall be maintained in Form 2.

4.3. DELIVERY – Supplies of Portland cement clinker shall be done in compliance with clause 10.1 of IS 16353 : 2015.

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 clause 2 above.

5.1. PRODUCTION DATA - The licensee shall send to BIS a statement of quantity produced, marked and exported by him and the value thereof at the end of each quarter of the operative period as per the enclosed proforma and shall also submit these details to BIS at the end of the operative year duly authenticated by a Chartered Accountant.

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

6. 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 – Levels of Control (Grinding/Packing Unit)

(1)				(2)	(3)			
TEST DETAILS				Test equipment requirement R: required (or) S: Sub-contracting permitted	RECOMMENDED LEVELS OF CONTROL			
Clause	Requirement	Test Methods Clause Reference			Number of sample	Frequency		Remark
						Clinker manufactured in a day	Clinker delivered / supplied	
5 Table 1	Chemical Requirement							
i)	$\frac{CaO}{2.8SiO_2 + 1.2Al_2O_3 + 0.65Fe_2O_3}$	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
ii)	AF Ratio	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
iii)	C ₃ S	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	May be carried out if so desired by the purchaser
iv)	C ₃ A	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	
v)	C ₃ S + C ₂ S	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	
vi)	Total Sulphur content calculated as Sulphuric anhydride (SO ₃)	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
vii)	Free lime	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
viii)	Chloride content	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	This test shall also be carried out whenever there is any change in source of any raw material. Please also see note 2 below Table 1 of IS 16353 : 2015
ix)	Magnesia	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-

x)	Alkali content (expressed as Sodium Oxide Na ₂ O)	5	IS 16353 IS 4032	R	One	-	-	Pl see note under Table 3 of IS 16353: 2015.
xi)	Total loss on ignition	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
xii)	Insoluble residue	5	IS 16353 IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
6.1	SO ₃	6.1	IS 16353	R	One	-	-	These tests shall be done on grounded clinkers, used for physical testing.
6.1	Fineness	6.1	IS 16353 IS 4031 (Part 2)	R	One	-	-	
6.1 Table 2	Physical Requirement							
i)	Soundness (Le-Chatelier method and Autoclave method)	6.1, Table 2	IS 16353 IS 4031 (Part 3)	R	One	Daily Composite sample	Daily Composite sample	-
ii)	Setting Time	6.1, Table 2	IS 16353 IS 4031 (Part 5)	R	One	Daily Composite sample	Daily Composite sample	-
iii)	Compressive strength	6.1, Table 2	IS 16353 IS 4031 (Part 6)	R	One	Daily Composite sample	Daily Composite sample	-
6.2	Particle size of clinker	6.2	IS 16353 IS 4031 (Part 8)	-	-	-	-	As per agreement between manufacturer and purchaser

Note -1: Daily composite sample shall be made out of hourly samples for the required period (Pl see IS 3535 Methods of sampling hydraulic cements). Weekly composite sample shall be made out of daily composite sample. If clinker is dispatched directly from clinkerization unit without storing, weekly composite sample may not be required. If Clinker is manufactured using same proportion of raw materials from more than one kiln, sample from each kiln shall be tested for requirements as per the above table. If clinker is manufactured using different proportion of raw materials from more than one kiln, sample from each kiln shall be tested for all requirements as per the above table.

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

Form No. 1
RAW MATERIAL TESTING

Date of receipt of material	Date of testing	Name of Material	Source of supply and consignment No.	Details of analysis for specified requirements

Form 2
PRODUCTION DATA
(DETAILS OF PRODUCTION ACCEPTED AND REJECTED FOR STANDARD MARK)

Shift	Quantity	Passed for Standard mark	Rejected	Remark

Form No. 3
CLINKER CHEMICAL COMPOSITION (DAILY COMPOSITE SAMPLE) – CLINKERIZATION AND LOADING

Date of manufacture	Total loss on ignition	Insoluble residue	Alkali content as Na ₂ O	C ₃ S	C ₃ A	C ₃ S+ C ₂ S	SO ₃	MgO	Chloride	Free lime	LSF	Alumina factor	Sample Pass/Fail	Remarks

Form No. 4
CLINKER GROUND WITH GYPSUM (DAILY COMPOSITE SAMPLE) – CLINKERIZATION AND LOADING

Date of grinding	Fineness	SO ₃	Soundness		Setting time		Compressive strength			Particle size of clinker	Sample Pass/Fail	Remark
			Le-Chatelier	Autoclave	Initial	Final	3 days	7 days	28 days			

Form No 5
CALIBRATION

Sl. No	Date of calibration	Result of Calibration (Test records indicating details of standard values and observed values for each equipment to be kept in proforma for which various columns be devised; as required)	Name of equipment Action taken if equipment found defective	Sl.No. (If any) & Remarks

Note: The above records are to be kept separately for each equipment.