



PRODUCT MANUAL FOR GROUND GRANULATED BLAST FURNACE SLAG FOR USE IN CEMENT, MORTAR AND CONCRETE ACCORDING TO IS 16714 : 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 licence/certificate.

1.	Product	:	IS 16714 : 2018
	Title	:	GROUND GRANULATED BLAST FURNACE SLAG FOR USE IN CEMENT, MORTAR AND CONCRETE
	No. of Amendments	:	NIL
2.	Sampling Guidelines:		
a)	Raw material	:	-
b)	Grouping guidelines	:	NA
c)	Sample Size	:	For Physical test – 8 kg For Chemical test – 1 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) Fineness (Clause 6) (ii) Moisture content (Clause 5.2) (iii) Loss on ignition (Clause 5.1) (iv) Insoluble residue (Clause 5.1)		
6.	Scope of the Licence :		
	“Licence is granted to use Standard Mark on Ground Granulated Blast Furnace Slag for Use in Cement , Mortar and Concrete as per IS 16714 : 2018.		

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

S. No.	Tests used in with Clause Reference	Test Equipment
1	Fineness Clause 6 Table 2	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 temperature within ± 0.1 ° C
2	Slag Activity Index Clause 6 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 (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 %
		Vicat apparatus
		Needle for Consistency testing
		Moulds
		Stop Watch

3	IS 16714 : 2018	General equipments for Cement testing
	To control humidity & temperature in lab	1. Humidity chamber with temperature & RH control $27 \pm 2^{\circ}\text{C}$, RH 90 to 100 % 2. Suitable arrangement to demonstrate maintenance of temperature of $27 \pm 2^{\circ}\text{C}$ & RH $65 \pm 5\%$ constantly
	For cement Sampling	Mixing trays –adequate size including trays of 24 partitions for keeping hourly samples
	To control the residue of cement	Sieves of size (300, 212, 150, 90, 75 & 45 μ)
	To measure temperature	Thermometers
	Lab ball mill (motorized)	To grind the clinker, slag & gypsum sample in lab ball mill for testing
	To weigh the material	Platform type balance Electrical balance Weight box with weights (1 mg - 500 g)
4	General test equipments for chemical testing Clause 5.1 , Table 1 of IS 16714 : 2018	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 Erlenmeyer flask Gas generating flask, etc
		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 Ground Granulated Blast Furnace Slag testing
5	Moisture content (Clause 5.2)	Petri dish Oven Weighing balance Desiccator
6	Glass content (Clause 5.3)	Optical microscope min 100 X Bromoform IS sieve 90 and 52 microns Weighing balance Rectangular glass side

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. However calibration of following test equipments shall be carried out at a frequency shown against each and record of same shall be 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	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.

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

3. LABELLING AND MARKING – As per the requirements of IS 16714 : 2018

4. CONTROL UNIT – Entire quantity of Ground granulated blast furnace slag produced from same source of granulated blast furnace slag in a week shall constitute 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 Standard and covered by the licence should be marked with Standard Mark.

5.2 PACKING – Packing of Ground granulated blast furnace slag shall be done as per clause 7 of IS 16714 : 2018.

5.3 WEIGHMENT – One filled bag from each nozzle shall be taken at random twice in each shift of operation and weight checked in case of electronic packers with recorders. In all other cases one filled bag from each nozzle shall be checked once in two hours. The bag shall be so

chosen for weighment such that bags from each nozzle are taken for weighment. The weighing and packing machines shall be adjusted as and when necessary in such a way that net quantity of each bag shall be in accordance with the tolerances given clause 7.2.1 of IS 16714 : 2018. Such adjustments for each nozzle shall be recorded.

5.3.1 For packing of Ground granulated blast furnace slag in bulk cement terminal weighment of hourly check of mass of drums also shall be done in addition to weighment of bags mentioned in para 5.3 above. The records of weighments shall be maintained.

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

(1)				(2)	(3)			
Test Details				Test equipment requirement R: required (or) S: Sub-contracting permitted	Levels of Control			
Cl.	Requirement	Test Methods			Number of sample	Frequency		Remarks
		Clause	Reference			Grinding stage	Packing stage	
5.1 & Table 1	Chemical requirements							
i)	Manganese oxide	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
ii)	Magnesium oxide	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
iii)	Sulphide sulphur	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
iv)	Sulphate as SO ₃	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
v)	Insoluble residue	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
vi)	Chloride content	5.1	IS 4032	R	One	-	Weekly composite sample	-
vii)	Loss on ignition	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
viii)	$\frac{CaO + MgO + \frac{1}{3}Al\ O_3}{Si\ O_2 + \frac{2}{3}Al\ O_3}$	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
ix)	$\frac{CaO + MgO + Al_2\ O_3}{Si\ O_2}$	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	-
x)	$\frac{CaO + CaS + \frac{1}{2}MgO + Al_2\ O_3}{Si\ O_2 + MnO}$	5.1	IS 4032	R	One	Daily Composite sample	Weekly composite sample	For slag with MnO >2.5 % only
5.2	Moisture content	5.2 Annex – B	IS 16714	R	One	Daily Composite sample	Weekly composite sample	-
5.3	Glass content	5.3 Annex – C	IS 16714	S	One	Alternate control unit	Alternate control unit	-

6 & Table 2	Physical requirements							
i)	Fineness	6	IS 4031 (Part 2)	R	One	1. Every alternate hourly from each mill separately. 2. Daily Composite sample	Daily Composite sample	-
ii)	Slag activity index	6	IS 4031 (Part 6)	R	One	Daily Composite sample	Daily Composite sample	-

Note-1: Composite sample shall be made out of hourly samples for the required period (Pl see IS 3535 Methods of sampling hydraulic cements).

If slag is manufactured using same raw materials from more than one grinding mill, sample from each mill shall be tested for fineness as per the above table. For all other parameters composite samples from all the mills shall be tested. If slag is manufactured using different source of raw materials from more than one grinding mill, sample from each mill shall be tested for all requirements as per the above table.

Note 2 : For manufacturing units where there is no packing silo and slag is packed directly from grinding mill, the frequency of tests specified for grinding stage would apply for the various tests to be carried out on samples taken from packing spouts along with weekly chloride content test.

Note- 3 : Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empanelled by the Bureau.

Note- 4 : Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification for approval by BO Head.