

Indian Standard

**LOW GRADE GYPSUM — USE IN BUILDING
INDUSTRY — CODE OF PRACTICE**

भारतीय मानक

निम्न ग्रेड जिप्सम — भवन निर्माण उद्योग में प्रयोग — रीति संहिता

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 20 March 1989, after the draft finalized by the Gypsum and Gypsum Based Products for Buildings Sectional Committee had been approved by the Civil Engineering Division Council.

India is endowed with more than 1 200 million tonnes of mineral gypsum. Out of it, about 92 percent occurs in Rajasthan alone. High grade gypsum is required for the manufacture of fertilizer, as an additive to Portland cement or for surgical, ceramic plaster, etc. However, large deposits of low grade gypsum are available at several places in Rajasthan and are considered unsuitable for the above uses and hence remain unutilized.

Studies carried out at Central Building Research Institute (CBRI), Roorkee have shown that suitable plaster for use as masonry mortar and for making blocks can be produced from gypsum having purity less than 70 percent.

Considering the huge availability of low grade gypsum and its scope for utilization in the building construction, the Committee felt it necessary to bring out a code of practice on the use of low grade gypsum in building construction as this gypsum can be conveniently used as mortar and in the manufacture of light weight blocks for non-load bearing walls. This standard, it is expected, would help in promoting the wider use of low grade gypsum in low cost housing.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LOW GRADE GYPSUM — USE IN BUILDING INDUSTRY — CODE OF PRACTICE

1 SCOPE

1.1 This standard covers the preparation and physical requirements of calcined gypsum made from low grade gypsum and its use in masonry mortar, internal plaster and light weight blocks.

2 REFERENCES

2.1 The Indian Standards listed below are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
IS 1288 : 1982	Methods of test for mineral gypsum (<i>second revision</i>)
IS 2250 : 1981	Code of practice for preparation and use of masonry mortars (<i>first revision</i>)
IS 2469 : 1976	Glossary of terms relating to gypsum (<i>first revision</i>)
IS 2542 (Part 1/Sec 1 to 12) : 1978	Methods of test for gypsum plaster, concrete and products: Part 1 Plaster and concrete (<i>first revision</i>)
IS 2542 (Part 2/Sec 1 to 8) : 1981	Methods of test for gypsum plaster, concrete and products: Part 2 Gypsum products (<i>first revision</i>)
IS 3808 : 1979	Method of test for non-combustibility of building materials (<i>first revision</i>)
IS 8272 : 1984	Specification for gypsum plaster for use in the manufacture of fibrous plaster boards (<i>first revision</i>)

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2469 : 1976 shall apply.

4 PURITY OF GYPSUM

4.1 The purity of low grade gypsum when determined according to IS 1288 : 1982, shall be not less than 60 percent ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Such gypsum generally contains major impurities, namely, silica, dolomite, carbonates

of calcium and magnesium, and clayey materials and minor impurities, such as, sodium chloride, sodium sulphate, sodium carbonate, gypsum anhydrite, etc.

5 PREPARATION OF CALCINED GYPSUM OR GYPSUM PLASTER

5.1 Gypsum should be calcined by methods, such as, open pan or rotary drum or kettle calcinators or by any other suitable method. Before calcination, gypsum should be crushed and ground generally to a fineness of about 60 percent passing through 150 μm IS Sieve. Gypsum starts giving out steam after the removal of mechanically held water. The temperature of calcination should be controlled. Gypsum starts boiling at about 120°C and during the entire calcination process the maximum temperature should not exceed 170°C. During the calcination process, the temperature remains constant when the entire charge boils vigorously. The calcination of gypsum is considered complete when boiling stops and the calcined material starts settling.

NOTE — A fully covered pan with a chimney to avoid dust pollution with mechanical agitation is the modified design introduced recently by CBRI in the open pan calcination process. In addition to improving the quality of product, this process also effects considerable saving in fuel consumption.

6 PHYSICAL REQUIREMENTS

6.1 Gypsum plaster shall conform to the requirements given in Table 1.

7 GYPSUM MORTAR

7.1 Materials

7.1.1 Gypsum Plaster

Gypsum plaster shall conform to the requirements given in Table 1.

7.1.2 Retarder

A suitable quantity of retarder, such as, glue or citrate may be used for prolonging the setting time of mortar.

7.1.3 Sand

Sand of fineness modulus 1.75 to 2.0 is recommended for preparing mortar. The sand shall

Table 1 Physical Requirements of Low Grade Gypsum Plaster
(Clauses 6.1, 7.1.1 and 8.1.1)

Sl No.	Particulars	Requirements	Method of Test, Ref to
i)	Fineness, percentage passing through 150 micron IS Sieve, <i>Min</i>	95.0	Annex A
ii)	Setting time, minutes	10 to 30	IS 2542 (Part 1/Sec 1 to 12) : 1978
iii)	Compressive strength, N/mm ² , <i>Min</i>	7.0	IS 8272 : 1984 (Appendix D)

contain no harmful material in such quantity as to affect the strength or durability of mortar adversely. Iron pyrites, coal, alkali, organic impurities, mica, clay, shale or similar laminated materials shall not be present.

7.1.4 Water

Potable water is generally considered satisfactory for mixing plaster and sand. It should be clean and free from suspended impurities.

7.2 Preparation of Mortar

Gypsum plaster and sand should generally be mixed in the proportion of 1 : 2 by mass mixing of different materials shall be done preferably in a mechanical mixer. Gypsum plaster and sand shall be mixed dry in the required proportions to obtain a uniform colour. The required quantity of water shall than be added and the materials mixed thoroughly to produce a mortar of workable consistency. In case of mechanical mixing, the mortar shall be mixed for at least three minutes after addition of water. In the case of hand mixing, the mortar shall be thoroughly mixed for 5 to 10 minutes with addition of water.

7.3 Consistency of Gypsum Mortar

The working consistency of mortar is usually judged by the worker during application. The quantity of water should be enough to maintain the fluidity of the mortar during application but at the same time it shall not be excessive leading to segregation of aggregates from the gypsum plaster. The quantity of water required for maintaining consistency of fluidity will depend upon the masonry for which the mortar is used, for example, thinner joints will require greater fluidity and bed joints subject to heavy pressure may require stiffer mortar.

7.4 Physical Requirements

7.4.1 Setting Time of Gypsum Mortar

The setting time of mortar, determined according to the method described in IS 2542 (Part 1/Sec 1 to 12) : 1978 shall not be less than one hour and greater than two hours.

7.4.2 Compressive Strength of Gypsum Mortar

The average compressive strength of six 1 : 2 gypsum plaster and sand cubes (by mass), determined according to the method described in IS 2250 : 1981 shall not be less than 2.5 N/mm².

7.4.3 Weathering Test of Gypsum Mortar

Gypsum mortar specimens moulded in 50 mm cubes are subject to alternate wetting and drying cycles. One cycle comprises of 16 hours of drying the cubes in an oven at 42°C followed by one hour cooling and seven hours immersion in water.

7.4.3.1 Gypsum mortar cube shall not show any sign of deterioration, such as, crumbling, cracking, chipping, when tested up to 5 cycles of weathering test. For this test, observations should be made on six cubes.

7.5 Application of Gypsum Mortar

Gypsum mortar is generally recommended for use as internal plastering and masonry work. It shall not be exposed to external weather conditions except where rainfall is very scanty.

The field performance of gypsum mortar can be assessed by applying a mixture of 1 part of gypsum plaster and 2 parts of sand with 50 percent water (all by mass) on a clean and wetted brick surface. The set mortar shall not show any visible shrinkage crack, chalking, crazing, etc, when observed after 48 h of application. The set mortar shall adhere well with the masonry surface and shall not peel off after drying.

8 LIGHT WEIGHT SOLID GYPSUM BLOCKS FOR NON-LOAD BEARING WALL

8.1 Materials

8.1.1 Gypsum Plaster

Gypsum plaster shall conform to the requirements given in Table 1.

8.1.2 Water

Potable water is generally considered satisfactory for mixing plaster.

8.2 Dimensions and Tolerances

8.2.1 The nominal dimensions of the blocks shall be as given below:

<i>Length</i> mm	<i>Breadth</i> mm	<i>Height</i> mm
700, <i>Max</i> in multiples of 100	75 100 125 150	300, <i>Max</i> in multiples of 100

8.2.2 The tolerances on length shall be ± 3.0 mm and on breadth and height ± 1.5 mm.

8.3 Method of Casting of Gypsum Blocks

Gypsum plaster with sand, saw dust, wood shavings, etc, or without any aggregate is mixed with sufficient quantity of water to form a uniform workable plaster or slurry. The wet mix is poured into well greased moulds in such a way that all the gaps are filled up properly. The superfluous material is removed with a spatula to give a smooth surface. The material after setting is demoulded and dried in air.

8.4 Physical Requirements**8.4.1 Compressive Strength**

The average compressive strength of three blocks when tested according to the procedure given in IS 2542 (Part 2, Sec 1 to 8)-1981 shall not be less than 1.5 N/mm^2 .

8.4.2 Non-combustibility

When tested according to the procedure given in IS 3808 : 1979, the blocks shall not:

- cause the temperature readings of the furnace thermocouple to rise by more than 40°C above the initial furnace temperature,
- cause the temperature readings of the specimen thermocouple to rise by more than 40°C above the initial furnace temperature, or
- flame for more than 5 s.

8.5 Visual Inspection

All blocks shall be sound and free from cracks, broken edges and other imperfections that would render them unfit for use.

8.6 Application of Gypsum Blocks

8.6.1 These blocks are recommended for use as internal partition walls or for inner leaf of cavity construction in external walls.

8.6.2 These gypsum blocks shall not be used externally whether protected or unprotected.

ANNEX A

(Table 1)

METHOD FOR DETERMINATION OF FINENESS**A-1 PROCEDURE**

A-1.1 One hundred grams of dried sample shall be sifted continuously on a $150 \mu\text{m}$ IS Sieve for five minutes. Air set lumps in the

sample may be broken down with fingers but nothing shall be rubbed on the sieve. The mass of the material retained on the sieve shall be expressed as a percentage of the original mass of the sample.

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