



Uhde India Limited

**PART – II
SECTION-5
TECHNICAL SPECIFICATIONS
FLOORING / DADO**

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5.1 APPLICABLE CODES AND SPECIFICATIONS

The following codes, standards and specifications are made a part of this specification. All standards, specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern.

- 1) IS:777 - Glazed Earthenware tiles.
- 2) IS:2114 - Code of Practice for laying in situ terrazzo floor finish.
- 3) IS:2571 - Code of Practice for laying in situ concrete flooring.
- 4) IS:4860 - Specification for acid resistant bricks
- 5) IS:5491 - Code of Practice for laying in situ granolithic floor topping

5.2 Granolithic (IPS) Flooring

Granolithic finish of the thickness as indicated in drawings or as specified in schedule of items shall consist of 2 layers of M-15/M-20 grade (as in B.O.Q.) cement concrete. The first layer of machine mixed concrete of 30 mm thick shall be laid with 10 mm to 6 mm graded aggregate and well compacted. Within 15 minutes of laying this course, the second layer of minimum 10 mm thk. with 6 mm down aggregate shall be laid. the cement and aggregates for the top layer shall be mixed dry. After mixing, sufficient quantity of washed sand and water shall be added to make the mix plastic but not flowing. The mixtures shall be laid on the under-layer so that the two layers firmly grip together. The top layer shall be well tampered, trowelled and finished with a neat cement punning or with non-skid finish as required. At the junction of adjoining panels a thin string shall be given.

The castings of the granolithic finish layer shall be done in rectangular or square panels not exceeding 1.2m on any side, using wooden strips of height equal to the specified thickness of the floor finish. Required slope in the floor shall be given in the base course concrete without reduction in thickness. The work shall be in true plumb free from any unevenness, cracks, etc. Curing shall be done for a period of 7 days by ponding the finished area.

5.3 Abrasion Resistant Floors.

5.3.1 Floors using metallic Hardeners.

Unless otherwise specified one part of Ironite and four parts of ordinary portland cement by weight shall be mixed dry thoroughly on a clean and dry platform. This dry mixture shall be mixed with stone grit 6 mm and down size in the ratio of 1:2 (1 Ironite cement mixture:2 stone grit) by volume and well mixed over, just enough water shall be added to this dry mix before laying.

Laying

Over first layer of 38 mm thick M-15/M-20 grade (as in B.O.Q.) concrete 12 mm thick Ironite topping shall be laid. The topping shall be laid true to line to provide uniform and even surface. It shall be firmly pressed into bottom concrete so as to have a good bond with it. After the starting of initial setting the surface shall be finished smooth and true with steel floats. The laying as usual shall be done in rectangular or square panels, using wooden strips of height equal to the specified thickness of the floor finish. No dimension of a panel shall exceed 2M and the area of panel shall not be more than 2 sq.m.

Curing shall be done for period of 7 days by ponding the finished area.

5.3.2 Floors using Non metallic Hardener

5.3.2.1 Where ever industrial flooring using non metallic hardner is specified, the same shall essentially composed of thermo setting polymers reinforced with minerals and fibres suitably coupled and compounded with organo functional sealants. (Refer to Data Sheet 'B' for recommended Vendor / brand information).

5.3.2.2 Laying

The standard thickness shall be 12mm, 15mm, and 20mm. The thermal rating shall be 60°C continuous with max. permissible operating temperature of 110°C. The material chosen shall withstand acidic, alkaline or a combination of acidic & alkaline conditions and shall be laid as per manufacturer's specification.

5.3.2.3 Physical properties:

Typical physical properties of the material used shall be as per following details:

Compressive strength	=	1100 to 1500 kg/cm sq.
Tensile strength	=	220 to 350 "
Coeff of thermal	=	0.8 to 2 Kcal/mh °.c
Conductivity		
Imperviousness	=	0.05

Laboratory or field tests in order to check conformity with above specifications, if ordered by the Engineer, shall be performed by the Contractor without any extra payment.

5.4 Terrazzo (Mosaic) Tile flooring

Terrazzo tile shall be 20 mm thick of approved shade, and size, conforming in all respect to IS:1237. (Refer to Data Sheet 'B' for Vendor / brand information).

Laying

The bedding for the tiles shall be of cement mortar 1:3 (1 cement : 3 sand) mix. The average thickness of bedding mortar shall be 20mm and the thickness at any place shall not be less than 13 mm. Cement mortar bedding shall be spread, tamped and corrected to proper levels and allowed to harden for a day before the tiles are set.

Over this bedding neat cement slurry of honey like consistency shall be spread at the rate of 5 kg. of cement per square metre. Tiles shall be soaked in water for 20 minutes and allowed to drain out for 20 minutes before laying. Tiles shall be laid in the mortar bedding from centre to outwards to obtain a symmetrical pattern, each tile being gently tapped with wooden mallet till it is properly bedded and is in level. Laying shall be frequently checked with a straight edge at least 2m long so as to obtain true surface with required slope. Fractional tiles shall be used where full tiles cannot be used. If the extra space left out is less than 25mm it shall be filled with coloured terrazzo to match the tile pattern and finished to match tiled floor.

Joints.

The joints shall be uniform and as thin as possible and run in straight lines or to suit the required pattern.

Tiles which are fixed in the floor adjoining the wall shall enter not less than 13mm under the plaster, skirting or dado. The junction between wall plaster and tile work shall be finished neatly and without wavings.

After the tiles have been laid, surplus cement grout that may have come out of the joints shall be cleaned off.

Curing, Polishing and finishing

The day after the tiles are laid, all joints shall be cleaned with wire brush to the depth of 5mm and all dust and loose mortar removed. Joints shall then be grouted with grey or white cement, mixed with or without pigment to match the shade of the topping of the wearing layer of the tiles. Pigment shall conform to IS:59.

However this may be noted that the properties may vary slightly depending upon the individual manufactures. Manufacturer's specifications, after prior approval from Engineer shall be followed.

The floor shall then be kept wet for minimum period of 7 days. The surface thereafter be ground evenly to the satisfaction of the engineer with machine grinders in 3 phase with grade stones from coarse to fine grade. The surface shall receive wash of neat cement mixed with or without pigment and cured before every grinding operation. After final polish, surface shall be cleaned and oxalic acid shall be dusted over the surface @ 35 gms. per sq.m sprinkled with water and rubbed hard with pad of wooden fags and wiped and dried with soft cloth. Finally the finished Terrazo surface is to be rendered with turpentine or similar approved material. The surface after polishing shall be hand polished. In all other respects the process shall be similar as per machine polishing.

Tests to determine Transverse strength, water absorption, Abrasion etc. may be ordered by Engineer for checking with IS requirements. Contractor shall perform all tests without any extra payment.

5.5 PVC TILE FLOORING

PVC (vinyl) tiles shall be 3mm thick. These shall be of approved make conforming to IS:3461 or 3462.

Laying

A course of approved base binding agent shall be applied evenly over the bedding which shall be finished even and smooth. The tiles shall be sufficiently dried before fixing to the floor. The tiles shall be jointed with binding agent. After allowing it to become sufficiently dry, the tiles shall be pressed down with even pressure until it adheres well to the bed material. In case the binding agent rises from the joints it shall be removed. The tile floor shall be cleaned with the tile finish wax and polished with the muslin cloth. The binding material shall be from approved manufacturer.

The pattern and colour arrangement for the flooring and dado shall be as indicated on the drawings or as specified by the Engineer. The contractor shall assume full responsibility for any failures and defects in the tile finish work.

The tiles shall be laid in accordance with approved manufacturer's directions.

All flooring shall be thoroughly cleaned upto full satisfaction of the Engineer.

5.6 White/coloured Glazed tiles

Tiles shall conform to IS:777 in all respect and shall be of approved quality and make.

These shall be flat, true to shape and of uniform shade. These shall also be free from cracks, spots, chipped edges and corner. Thickness of tiles shall be 6mm, unless otherwise specifically mentioned in drawings or schedule of items.

Preparation of Surface and Laying

Base course concrete or RCC slab on which tiles are to be laid shall be well cleaned, wetted and mopped. The bedding for the tiles shall be with cement mortar 1:3 or as specified. The average thickness of the bedding shall be not less than 10 mm.

Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set and also to enable the mason to place wooden plank across and to sit on it for the work.

Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread, at the rate of 3.3 kg per square metre, over an area such that approximately 20 tiles can be accommodated. Tiles shall be washed cleaned and fixed on this mortar one after another, each tile being gently tapped with a wooden mallet till it is properly bedded in level with adjoining tiles.

Joints shall be uniform and as thin as possible.

Curing, Pointing and finishing

The joints shall be cleaned off the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed. Joints shall then be pointed with white cement.

Flooring shall be kept wet for 7 days. The tiled surface shall then be finished with a 3% solution of Oxalic Acid duly waxed and polished as directed by the Engineer.

Tests to determine water absorption, crazing, impact strength, chemical resistance etc. may be ordered by Engineer for checking with IS requirements. Contractor shall perform all tests without any extra payment.

5.7 Kotah stone flooring:

Kotah stone shall be obtained from reputed suppliers as approved by the Engineer.

The stone shall have natural split non slip surface and non porous. As the stones are natural riven material supplies may not be in a particular thickness, The range of thickness shall be 12-15 mm, 16-24 mm and 25-37 mm. The standard size shall be 600 mm x 600 mm. The bedding mortar will be either 1:2 cement sand or chemically resistant mortar as per duty conditions shown on the drawing. The tiles will have hand pitched edges.

5.8 TREMIX CONCRETE FLOORS.

5.8.1 GENERAL

The contractor shall improve the quality of all concrete floor slabs by placing the concrete according to the Tremix system as indicated on the contract drawings and as specified herein.

5.8.2 TECHNICAL ASSISTANCE/TRAINING OF LABOUR

During the placement of concrete, the Contractor shall have a minimum of one person present at all times who has been adequately trained by a representative of the equipment and shall direct all concrete dewatering work performed. The contractor shall provide the services of a representative from the manufacturer of the vacuum dewatering equipment on site. The manufacturer's representative shall provide technical assistance for the vacuum dewatering process on the initial day of operation. (Refer to Data Sheet 'B' for Vendor / brand information).

5.8.3 EQUIPMENT FOR COMPACTING, PLACING, VACUUM PROCESSING AND FINISHING OF SLAB

All process equipment to be used shall be of proven design, and shall be subject to the approval of the engineer. Equipment shall be Tremix or approved equal. The system shall have demonstrated five years history of performing such work. The vacuum pumps shall be able to generate a minimum vacuum of 609 mm(24 inches) of mercury(0.80 atmospheres) in actual operation using the maximum number and size of suction mats required for this work.

The contractor shall have at the job site sufficient equipment(vacuum pumps, mats, filter pads and accessories) to ensure that the vacuum dewatering process continues uninterrupted till completion.

5.8.4 MIX DESIGN

The contractor will be responsible for the mix design of the class as called for on the Contract Drawings and must submit the mix proposed for use in the Contract before any work is started. All mix parameters must conform to the values specified in Tremix recommendations and preferably be tested with Trevac Meter.

The contractor shall utilize knowledgeable and experienced concrete technicians for the design and production of mix mixes meeting all the requirements of the specifications.

5.8.5 QUALITY CONTROL

The contractor has the responsibility for achieving the quality of concrete specified by controlling the concrete mixes, placing, vacuum process finishing and curing. The concrete technician in charge must be present at the site when work is in progress.

The contractor shall be responsible for mix adjustments, performing necessary tests, correcting deficiencies and trouble shooting in general.

The contractor shall be required to maintain control charts showing individual test results for aggregate gradation, slump, air content, cement content and compressive strength.

5.8.6 PLANNING OF PLACING

The contractor shall submit for review shop drawings for floor slabs detailing the location of all construction joints and the sequence of slab placement, and manufacturer's literature describing the equipment to be used. In addition to the shop drawings, the Contractor shall indicate the quantity of each dewatering equipment that will be located at the construction site and shall include the dimensions of all suction mats.

Before concreting, the work should be planned with a view to determine areas to be placed daily, the required amount of equipment, size of vacuum mats, length of vacuum hoses, arrangement of rails, if any, or screeds etc. Placing, vibration, vacuum treatment and floating to follow immediately behind each other. The planning shall be approved by the Engineer.

5.8.7 Cement

Portland cement of normal grinding fineness, which corresponds to a specific surface of 2600 - 3500 cm.sq/g is required in Tremix concrete. Cement of higher grinding fineness, e.g.rapid-hardening Portland cement of larger specific surface/g shall be avoided.

5.8.8 EQUIPMENT SPECIFICATION TREMIX SYSTEM

Poker vibrator with frequency preferably 335 hz(20,000 vibr/min) dia. 25 to 40mm.

Surface vibrator type double beam with beam spacing 300 mm.

Preferably one piece beam in full length exceeding bay width within 20 to 60cm. Beam should easily be adjusted to absolute straightness and controlled every morning before placing of concrete starts.

Suction mat 100% light plastic material weight 650 gram/sq.m. Width same as bay size and length 6 M for capacity and flexibility.

Filter pad weight 600 g/sq.m. width 1.2 M, length-bay width minus 20 cm.

Vacuum pump with 10 HP engine and specially designed pump unit with heavy duty chrome housing and sealing, Adjustable vacuum by valve on top of tank for ease of operation with different mix designs.

Skimfloater with disc which allows direct floating of dewatered concrete. Weight maximum 90 kg for 1000 mm. Finishing is done with blades only and is normally done with 30 minutes intervals between passes.

The above equipment specified should be used for the production of quality concrete floors according to the Tremix System. Interchangeability of equipment is not recommended.

5.8.9 EXECUTION TREMIX SYSTEM

5.8.9.1 General

The work shall be planned and executed so that there is no delay between the placement, screeding, dewatering and floating of the concrete. Concrete to be vacuum dewatered shall be handled and placed so as to prevent segregation. The concrete shall be properly vibrated prior to screeding.

5.8.9.2 Levelling

Immediately following placement, the concrete shall be levelled with a vibrating screed running on a true surface, set at the proper elevation required to provide the specified finished elevation. The concrete surface shall be screeded high by 2% of the slab's thickness to compensate for the compaction caused by the vacuum dewatering process. The vibrating screed shall be moved forward as rapidly as proper consolidation allows. The proper surcharge of concrete must be maintained in front of the leading edge of the screed.

5.8.9.3 Vacuum

Immediately after levelling, the concrete shall be covered with filter pads and suction mats in strict accordance with the recommendation of the manufacturer to have slab fully dewatered. The suction mat shall extend 10 cm beyond the edge of the filter pad on all sides. The pads shall extend to within 10 cm of the edge of concrete slab, and the mats shall cover entire slab. Before connecting the hose on the suction mat to the vacuum pump, the edges of the mat shall be smoothed to enable an airtight seal to be created. Vacuum shall then be applied to the mat.

The vacuum shall be maintained for at least 12 minutes per 10 cm of concrete thickness at 0.80 atmospheres. (Where aggregate hardeners are specified, sufficient moisture shall be maintained to meet manufacturer's requirements). The suction mats and filter pads shall then be removed and moved to the next section in a leapfrog manner.

Stop the vacuum dewatering when light foot prints only are left in the concrete when stepped upon. A suitable suction time can also be checked with a Proctor-apparatus which should show 1.5-2 kg/sq.cm pressure.

5.8.10 Floating

Upon removal of the suction mats and filter pads the concrete surface shall be power-floated without delay until all imprints from the vacuum process are removed. If crusting occurs, the floating operation must be delayed.

Higher speed is recommended for the floating operation. Two passes with the floating disc should be made in the junction of two mats in order to avoid risk for cracking.

5.8.11 Finishing

The waiting time after the floating operation depends on concrete temperature and humidity and varies from 10 minutes to 2 hours.

The trowelling operation should not take place before the concrete has hardened enough to carry the machine. i.e the trowelling blades will not leave any marks on the concrete. Repeated trowelling, with intervals between the passes should be adopted.

At least two passes are recommended for floors which are not to be covered.

5.8.12 Curing

Vacuum dewatered concrete should be cured like any other quality concrete in order to achieve a good final result. Use curing compounds, plastic sheets or wet burlap.

5.9 Magnesium Oxychloride Floors

5.9.1 Magnesium oxychloride flooring shall be laid generally as per recommendation of IS:657 and IS:658.

5.9.2 Application

Preparation of the base shall be sound, rigid, free from rising damp and not unduly porous. The base may be of cement concrete, or timber. Highly absorbent materials such as pumice concrete, breeze or clinker concrete and aerated concrete shall not be used unless a layer of damp proof course is laid between the base and the main floor.

New cement concrete Base

The base or screed should have a true and even surface which has been slightly coarsened by means of a stiff broom or wire brush and should be free from ridges and hollows. A steel trowelled finish is not desirable.

The levels of the base should be such that the specified thickness of magnesium oxychloride can be applied uniformly. It is of particular importance to ensure that there is a minimum cover of at least 25 mm of impervious uncracked dense concrete or a screeded bed over any base containing reinforcement either as rods or in filler joints. Any magnesium chloride solution gaining access to the reinforcement may cause serious damage. New concrete to which oxychloride composition is to be applied directly should be allowed to age for at least 28 days

before the application of oxychloride composition. No hardening agent other than water shall be used in the concrete. No lime admixture shall be allowed in the concrete where oxychloride is to be applied directly to the concrete.

Existing concrete Base

This should be checked for absorption. The existing cement concrete base should be roughened to suitable degree by tooth chiselling, picking or by any other suitable process before oxychloride composition is laid.

Timber base

A suitable mechanical key should be provided between the timber base and the floor finish such as dove tailed wooden battens or galvanised wire netting firmly secured to the base at approximately 200 mm centres with galvanised clout nails driven home at joints of the mesh. An equal number of galvanised clout nails should be used at 200 mm centres and be left proud of the base.

The moisture content of the timber base shall not exceed the limits specified for the corresponding zones given in IS:287.

5.9.3 Preparation of Floor Finish Mixture

Magnesium Chloride Solution – Magnesium chloride both before and after it has been dissolved should not be allowed to come into contact with any floors or walls. Whenever possible, the work of breaking up and dissolving the solid material or diluting the solution should be performed outside the building. Where the work has to be done inside, adequate protection should be provided under and around all vessels containing the chloride by means of tarpaulins, trays or other suitable devices. The solid chloride should be broken up and dissolved in a watertight vessel by covering the same with clean water, that is, clean and free from deleterious acids, alkalies, salts organic material and stirring the same from time to time. The solution should be allowed to stand over night so that residue, dust, impurities, etc. may settle to the bottom. The clean concentrated solution should be well stirred after each dilution before determining the specific gravity. The solution shall be prepared sufficiently early so that it is cooled to room temperature before use. The specific gravity of the chloride solution should be maintained at a selected value within the limits in Table 1. This value will depend on the type of work, the nature of the base and ambient temperature conditions.

TABLE 1 : SPECIFIC GRAVITY OF MAGNESIUM CHLORIDE SOLUTION

Flooring finish mix (1)	Baume (be)-conc. Scale (2)	Specific gravity (3)
Single coat and top coat	20° to 24°	1.16 to 1.20
Bottom coat, loves and Skirtings	18° to 20°	1.14 to 1.16

5.9.4 Final mixing

The mixing of the chloride solution with the dry mix should be carried out in trough or box or on a bunker and in no case directly on the floor. The quantity of material mixed in any one batch should be such as can be laid easily before initial set begins. The addition of further quantities of chloride solution during laying should not be permitted. If the mix becomes too stiff to be worked, it should be discarded.

5.9.5 Laying the Floor Finish

If the floor finish is to be laid on a concrete base, this should be thoroughly dry before commencement of laying.

The floor finish should not be laid over or near any localised source of heat.

Size of Bay

The floor finish should be laid between battens trued and levelled to ensure that the thickness of each coat complies with the requirements. The optimum size of bay will depend upon the temperature conditions at the time of laying and, generally, the controlling factor would be the time taken to obtain adequate compaction of the floor finish.

Jointing

Where a dimension of floor surface in either direction is 7.5 M or more, joint shall be provided at interval of not more than 5M. These may be in the form of mastic insertions or may consist of strips 5 mm in width of hard wood, vulcanite, nonferrous metal or other suitable material bedded flush with the surface of the flooring materials. Where the flooring is laid over concrete sub-floor, it is important that any joint in the flooring should be made not to coincide with joint in the sub-floor.

Laying

A concrete base or screed should be damped before laying the floor, finish, but excessive wetting or flooding should be avoided. The damping should be carried out with either:

- a) A solution of magnesium chloride which should be not weaker than 12° – nor stronger than 14°C or
- b) A wash composed of a 14°C. Magnesium chloride solution and magnesia mixed to the consistency of cream and brushed over the base.

5.9.6 Curing

Rapid drying of the floor finish should be avoided for atleast the first 24 hours after laying . It should be allowed to set and harden, undisturbed for at least three days before being opened to traffic. The setting and hardening process is affected by the surrounding temperature conditions and in cold weather it may be advisable to allow a longer period before the floor is put into use. In any case, some weeks should necessarily elapse before the floor finish is fully dried and hardened and, for this reason, it should not be exposed to abnormally havy traffic during this period.

Protection of the Surface

During laying and until the floor finish has hardened, It should not be exposed to extremes of heat or cold. The surface should be protected from the direct rays of the sun and rain.

5.9.7 Magnesium Chloride

5.9.8 Chemical Requirements

The composition of calcined magnesite when tested in accordance with the method given in IS:10032 shall be as specified in Table 2

TABLE 2 : CHEMICAL REQUIREMENTS OF CALCINED MAGNESITE

Sr. No. (1)	Characteristic (2)	Requirements (3)
i)	Magnesium oxide (Mgo) percent by mass	87 Min.
ii)	Calcium oxide (CaO), percent by mass	2.5 max.
iii)	Carbon dioxide (Co2), percent by mass	2.5 max.
iv)	Loss on ignition (Carbon dioxide and water), percent by mass.	8 max.
v)	Total contents of MgO, CaO, Al2O3, SiO2 and loss on ignition, percent by mass.	99.5 min.

5.9.9 Physical requirements

The physical requirements of calcined magnesite when tested in accordance with the method given in IS:10032 shall be as specified in Table 3.

TABLE 3 : PHYSICAL REQUIREMENTS OF CALCINED MAGNESITE

Sr. No. (1)	Characteristic (2)	Requirements (3)
1	Bulk density, Kg/1	0.65 to 0.85
2	Fineness	
	a) Percent by mass passing through 150 micron IS Sieve.	97 (min).
	b) Percent by mass passing through 75 micron IS Sieve.	95 (min).
3	Setting time, hours a) Initial b) Final	3 to 6 hrs. 7 to 15 hrs.
4	Modules of rupture N/sq.m. At 7 days At 28 days	7 (min). 10.5 (min).
5	Linear change, percent : The average change in length Duration expansion Duration contraction	0.15 (max). 0.25 (max).

5.10 MODE OF MEASUREMENT (IS:1200)**5.10.1 Flooring and Dado finishes**

The payment shall be made on sq.m. basis of finished area. The rate shall include all materials, labour, tools and tackles, curing, cleaning, wastages etc. complete as specified.

5.10.2 Skirting

The payment shall be in RM basis. The rate shall include all materials, labour, curing etc. complete as specified.