
	VISAKH MARKETING INSTALLATION RESITEMENT PROJECT – BLACK OIL TERMINAL			
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SPECIFICATION FOR FLOORING



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Client	HINDUSTAN PETROLEUM CORPORATION LTD.
MMCI Project No.	254625

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1 Scope

- 1.1 This specification covers providing, laying, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes and allied items of work as listed below:
- Ironite/IPS/Granolithic floor finish
 - Ceramic tile finish
 - Kotah stone floor finish
 - Vitrified floor tile finish
 - Mastic Floor Finish
 - Rubble soling

2 General

- 2.1 Base: The base to receive the finish either formed concrete sub-base or floor slab covered under other relevant specifications.
- 2.2 Commencement, scheduling and sequence of the finishing works shall be planned in detail and must be specifically approved by the MMCI/HPCL Engineer-In-Charge, keeping in view the activities of other agencies working in the area. However, the contractor shall remain fully responsible for all normal precautions and vigilance to prevent any damage whatsoever till handing over.
- 2.3 Only workers specially experienced in particular items of finishing work shall be engaged; where such workers are not readily available, with the MMCI/HPCL Engineer-In-Charge's permission, experienced supervisors recommended by the manufacturer shall be engaged. In particular cases where the Consultant (MMCI) so desire, the Contractor shall get the finishing items installed by the manufacturer.
- 2.4 The surface to be treated shall be thoroughly examined by the Contractor. Any rectification necessary shall be brought to the notice of the Consultant (MMCI) and his approval shall be obtained regarding method and extent of such rectification work. For all types of flooring, skirting, dado and similar works the base to receive the finish shall be adequately roughened by chipping, raking out joints and cleaning thoroughly all dirt, grease etc., with water and hard brush and (detergent if required, unless otherwise directed by the manufacturer of any special finishing treatment, the base shall be thoroughly soaked with water and all excess water mopped up. The surface shall be done dry where adhesive are used for fixing the finishes. Prior to commencement of actual finishing the approval of the MMCI/HPCL Engineer-In-Charge shall be taken as to the acceptability of the surface.



3 Codes and Standards

- 3.1 All applicable standards, acts and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the Contractor.

Some of the applicable Indian standards, Codes, etc. are referred to here

IS 13630:1993

Method of test for ceramic tile

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- IS 15622:2006 Specification for pressed ceramic tile.
- IS : 13753:1993 Specification for dust pressed ceramic tiles with water absorption

General



Flooring in any Industrial Structure may have to be done in discontinuous strips or areas to suit the equipment erection. The flooring shall be done in close co-ordination with other agencies and shall keep pace with the requirements of erection.

4 Materials

- 4.1 Materials required for individual finishing items are specified under respective items. In general, all such materials shall be as per relevant IS Codes where available. In all cases these materials shall be of the best quality available indigenously unless specified otherwise.
- 4.2 The materials for finishing items must be procured from well-reputed specified manufacturers and on the basis of approval of samples by the MMCI/HPCL Engineer-In-Charge. The materials shall be ordered, procured and stored well in advance to avoid compulsion to use substandard items to maintain the construction schedule.

5 Ironite Floor Finish

- 5.1 It shall consist of an underbed and a topping (incorporating iron particles) laid over an already laid and matured concrete base.
- 5.2 Thickness: Unless otherwise specified the total thickness of the finish shall be minimum 50 mm for horizontal surface of which topping shall not be less than 12 mm. While topping shall be of uniform thickness, the under bed may vary in thickness to provide necessary slope. The vertical surface shall project 6 mm from adjacent plaster or other finishes. Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.
- 5.3 Material: The hardening compound shall be uniformly graded iron particles, free from non-ferrous metal impurities, oil, grease, sand, soluble alkaline compounds or other injurious materials. When desired by the MMCI/HPCL Engineer-In-Charge, actual samples shall be tested.
- 5.4 Mix
The under bed for floor and similar horizontal surfaces shall consist of a mix of 1 part of cement, 1 part of sand and 2 parts of stone aggregates by volume. The stone aggregates shall be 10 mm down well graded. Just sufficient water shall be added to give workable consistency.
- 5.5 Proportion of metallic hardener shall be as specified or as indicated by the manufacturer. However, in absence of any such direction 1 part metallic hardener shall be mixed dry with 4 parts cement, by weight. To this mixture 6 mm nominal size stone aggregates shall be added in proportion of 1 part cement mixed with hardener to 2 parts of stone aggregates by volume and uniformly mixed. Minimum quantity of water shall be added to make it workable.
- 5.6 Laying
The concrete floor shall be laid in panels of 1m x 1m or as directed by the Engineer. Alternate panels shall be laid on one day followed by the other group of alternate panels the next day. The

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edges of the panels shall be supported either by wooden strips or flat angle iron pieces fixed in position property. The concrete floor shall be laid upto the required grade. The forms if any shall remain sufficiently projecting to take the finish. The surface shall be roughened by wire brush as soon as possible.

- 5.7 The junction of floor and walls, floors and dado or skirting shall be rounded off as directed.
- 5.8 Wooden strips or flat iron pieces shall be removed from their places before the succeeding alternate layers are laid. The finish shall be laid while the concrete underbed is still very 'green' within about 3 hours of laying of the later. The finish shall be of uniform thickness and even dense surface without trowel marks, pinhole etc. The topping layer shall be pressed firmly and worked vigorously and quickly to secure full bond with the concrete base. Just when the initial set starts the surface shall be finished and smoothened with steel trowel. The finish floor shall be cured for 7 days by keeping it wet.

6 Ceramic Tile

6.1 Ceramic Tiles for flooring

The tiles shall be of approved make and shall generally conform to IS:15622. They shall be flat and true to shape and free from blisters, crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested in accordance with IS:13630.

The tiles shall be square or rectangular of nominal size such as 150 x 150 mm, 200 x 200 mm, 300 x 300 mm or as directed by the MMCI/HPCL Engineer-In-Charge. The thickness of the tiles shall be 7 mm as specified

Tolerance in Size

The length of all four sides shall be measured correct to 0.1 mm and average length / breadth shall not vary more than ± 0.8 mm from the specified dimension. The variation of individual dimension from average value of length/breadth shall not exceed ± 0.5 mm. Tolerance in thickness shall be ± 0.4 mm.



NOTE :

The actual size of tiles supplied shall be 1 mm less so that with 1 mm joint, the tile when laid shall conform to the nominal size.

The top surface of the tiles shall be glazed and the glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable, shall be permissible on only upto 50 per cent of the surface area of the edges.

6.2 Preparation of Surface and Laying

Base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as specified. The average thickness of the bedding shall be 10 mm while the thickness under any portion of the tiles shall not be less than 5 mm.

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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 to enable the mason to place wooden plank across and squat on it.

Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 3.3 kg of cement per square metre over such an area as would accommodate about twenty tiles. Tiles shall be soaked in water washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope.

Where full size tiles cannot be fixed these shall be cut (sawn) to the required size, and their edge rubbed smooth to ensure straight and true joints.

Tiles which are fixed in the floor adjoining the wall shall enter not less than 10 mm under the plaster, skirting or dado.

After tiles have been laid surplus cement slurry shall be cleaned off.

6.3 Pointing and Finishing

The joints shall be cleaned off the grey cement slurry with wire/coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean.

6.4 Acceptance Criteria

The finished floor shall not sound hollow when tapped with a wooden mallet.

No loose tiles shall be accepted. Joints cannot be too wide and too narrow, and shall be in straight lines or as per the layout drawing. Joints shall be parallel to wall and orthogonal.



7 Ceramic Tiles in Skirting and Dado

The tiles shall be of approved make and shall generally conform to IS:15622. The tiles shall be of earthenware covered by a glaze thoroughly matured and fitted to the body. The tiles shall be sound, true to shape, flat and free from flaws and other manufacturing defects affecting their utility.

7.1 Preparation of Surfaces

The joints shall be raked out to a depth of at least 10 mm in masonry walls.

In case of concrete walls, the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

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7.2 Laying

12 mm thick plaster of cement mortar 1:4 (1 cement : 4 coarse sand) mix or as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonally at close intervals.

The tiles shall be soaked in water for one day, washed clean, and a coat of buttery cement slurry applied liberally at the back of the tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines.

The tiles shall be set in the required pattern and jointed. The joints shall be as fine as possible. Top of skirting or dado shall be truly horizontal and joints truly vertical except where otherwise indicated.

Skirting and dado shall rest on the top of the flooring. Where full size tiles cannot be fixed these shall be cut (sawn) to the required size and their edges rubbed smooth.

7.3 Curing and Finishing

The joints shall be cleaned off the grey cement grout with wire/coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigments if required to match the colour of tiles. The work shall then be kept wet for 7 days.

7.4 Acceptance Criteria

After curing, the surface shall be washed and finished clean. The finished work shall not sound hollow when tapped with a wooden mallet, shall be in true level and plain. Joints shall be straight, not too wide, too narrow etc. Tiles shall be laid as per slope indicated. Slope shall be uniform if indicated.

8 Kota Stone Flooring

8.1 Kota Stone flooring



The tile shall be of selected quality, hard, sound, dense, homogenous in texture, free from cracks, decay, weathering and flaws. They shall be hand or machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as instructed by the MMCI/HPCL Engineer-In-Charge.

The tile shall have the top (exposed) face machine polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work the contractor shall get the samples of slabs approved by the MMCI/HPCL Engineer-In-Charge.

8.2 Dressing

Every tile shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth. The edges shall be table rubbed with coarse sand or machine rubbed before placing. All angles and edges of the tile shall be true, square and free from chippings and the surface shall be smooth and plane.

The thickness of the tile after it is dressed shall be 30 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth

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of slabs, tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

8.3 Preparation of Surface and Laying

Base concrete or the RCC floor on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tiles shall be with cement mortar 1:4 (1 cement : 4 coarse sand).

The average thickness of the bedding mortar under the tile shall be 20 mm and the thickness at any place under the tile shall be not less than 12 mm.

The Kota tiles shall be laid in the following manner :

Mortar of the specified mix shall be spread under the area of each tile, roughly to the average thickness specified. The tile shall be washed clean before laying. It shall be laid on top of bedding, pressed, tapped with wooden mallet and brought to level with the adjoining tiles. It shall be lifted and laid aside.

The top surface of the mortar shall then be corrected by adding fresh mortar at hollows. The mortar is allowed to harden a bit and cement slurry of honey like consistency shall be spread over the same at the rate of 4.4 kg of cement per sqm.

The edges of the tile already laid shall be buttered with grey or white cement with or without admixture of pigment to match the shade of the kota tiles as specified.

The tile to be laid shall then be lowered gently back in position and tapped with a wooden mallet till it is properly bedded in level with and close to the adjoining tiles with as fine a joint as possible. Subsequent tiles shall be laid in the same manner. After each tile has been laid, surplus cement on the surface of the tiles shall be cleaned off. The flooring shall be cured for a minimum period of seven days. The surface of the flooring as laid shall be true to levels and slopes as instructed by the MMCI/HPCL Engineer-In-Charge.

Due care shall be taken to match the grains of tiles which shall be selected judiciously having uniform pattern of Veins/streaks or as directed by the MMCI/HPCL Engineer-In-Charge.

The tiles shall be matched as shown in drawings or as instructed by the MMCI/HPCL Engineer-In-Charge.



Tiles which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.

8.4 Polishing and Finishing

8.4.1 Curing, Polishing and Finishing

The day after the tiles are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be ground evenly with a machine fitted with with fine grade grit block (No. 120). Water shall be

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used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. The surface shall be again cured.

The final grinding with machine fitted with the finest grade grit blocks (No.320) shall be carried out the day after the first grinding described in the preceding para or before handing over the floor, as ordered by the MMCI/HPCL Engineer-In-Charge.

For small areas or where circumstances so require, hand polishing may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundum stones, shall be used :

First polishing	-	medium grade stone(No. 80)
Final grinding	-	fine grade (No. 120)

In all other respects, the process shall be similar as for machine polishing.

After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square metre sprinkled with water and rubbed hard with a 'namdah' block (pad of woollen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished.

8.4.2 Acceptance Criteria

The finished floor shall not sound hollow when tapped with a wooden mallet. No loose stone shall be accepted. Joints shall not be too wide or too narrow and shall be in straight line. Joints shall be parallel to the rectangular wall.

9 Kota Stone in Risers of Steps, Skirting and Dado

Kota Stone tiles and Dressing shall be as specified above except that the thickness of the slabs shall be 30 mm or as specified. The tile may be of uniform size if required.



9.1 Preparation of Surfaces

The joints shall be raked out to a depth of at least 10 mm in masonry walls.

In case of concrete walls, the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

9.2 Laying

The mortar shall be in grey or white cement mixed with or without pigment to match the shade of stone, as specified in the description of the item, with the line of the slab at such a distance from the wall that the average width of the gap shall be 12 mm and at no place the width shall be less than 10 mm.

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12 mm thick plaster of cement mortar 1:4 (1 cement : 4 coarse sand) mix or as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonally at close intervals.

The tiles shall be soaked in water for one day, washed clean, and a coat of buttery cement slurry applied liberally at the back of the tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines.

The tiles shall be set in the required pattern and jointed. The joints shall be as fine as possible. Top of skirting or dado shall be truly horizontal and joints truly vertical except where otherwise indicated.

Skirting and dado shall rest on the top of the flooring. Where full size tiles cannot be fixed these shall be cut (sawn) to the required size and their edges rubbed smooth.

9.3 Curing, Polishing and Finishing

Curing, Polishing and Finishing shall be as specified in Kotah stone flooring above except that polishing shall be done only with hand. The face and top of skirting shall be polished.

9.4 Acceptance Criteria

Acceptance Criteria shall be same as specified in Kotah stone flooring.

10 Vitrified Tile Flooring Dado / Skirting / Facia

10.1 Materials



Vitrified Tiles: The tiles shall be of approved make like Marbonite / Granamite or equivalent and shall generally conform to the approved standards. They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. Unless otherwise specified, the nominal sizes of tiles shall be as under:

The tiles shall be square or rectangular of nominal sizes such as: 600 x 600 mm; 900 x 900 mm or as per tender schedule / drawings or as directed by the Engineer-in-Charge. Thickness shall be as per recommendations of the approved manufacturers.

Technical specifications of the tiles shall be generally conforming to the following standards:

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES (TABLE)

NO	PROPERTY	EXPECTED STANDARDS
1	Deviation in length	(+/-) 0.6%
2	Straightness of sides	(+/-) 0.5%
3	Rectangularity	(+/-) 0.6%
4	Surface flatness	(+/-) 0.5%
5	Water absorption	< 0.50%
6	Mohs. hardness	>6
7	Flexural strength	> 27 N / mm ²
8	Abrasion resistance	< 204 mm ²
9	Skid resistance (friction coefficient)	>0.4
10	Glossiness	Min. 85% reflection

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The tiles shall conform to the relevant standards in all respects. Samples of tiles shall be got approved from the Engineer-in-charge before bulk procurement for incorporation in the work.

10.2 Preparation of Surface for Flooring

Following procedure shall be followed:

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped.



Mortar and bedding: Cement mortar for bedding shall be prepared of mix 1:4 or as specified in the schedule of items, to a consistent paste and shall conform to the specification for materials, preparations etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned off all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be evenly and smoothly spread over the base by use of screed battens to proper level or slope.

Once the mix is prepared, no further water be added and the same shall be used within one hour of adding water. Apply on an average 20 mm thick bedding of mortar over an area of 1 sqm. at a time over surface of the area for laying tiles, in proper level and allowed to harden sufficiently to offer a fairly good cushion for the tiles to set.

Laying of Tiles for Flooring

The tiling work shall be done as per the pattern shown in the drawing or as directed by the MMCI/HPCL Engineer-in-Charge. As a general practice laying of tiles shall be commenced from the centre of the area and advanced towards the walls. Cut tiles, if any, shall be laid along wall with necessary border pattern as shown / directed by the MMCI/HPCL Engineer-in-Charge. Tiling work shall be completed by pressing tiles firmly into place along the wall / floor. A white cement slurry to the back of the tile to be applied to ensure proper and full bedding. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Press gently the tile with wooden mallet for even adherence at the back of the tile. Do not use an iron hammer or some heavy material to press the tile.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight line. Unless otherwise specified, jointless tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1 mm. in width. The joint shall be grouted with white / matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

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10.3 Fixing Tiles for Dado & Skirting / Facia

The fixing of tiles on wall surfaces shall be done only after completing fixing of the tiles on the floor. Following procedure shall be followed;

The back of tiles shall be cleaned off and covered with layer of approved adhesive like BAL-ENDURA or equivalent with proper towelling as per manufacturer's recommendations.

The edges of the tiles shall be smeared with the adhesive and fixed on the wall one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly fixed in level with the adjoining tiles. There shall be no hollows on the back or in joints. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1 mm. in width. The joint shall be grouted with approved adhesive. The joints shall be kept in straight line or as per the approved pattern

While fixing tiles in dado / skirting work, care shall be taken to break the joints vertically. The top line shall be touched up neatly with the rest of the plaster above. If doors, windows or other openings are located within the dado area, the corners, sills, jambs etc, shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

The fixing shall be done from bottom of wall to upward without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. All tiles faces shall be in one vertical plane.

10.4 Grouting of Joints in Floor / Skirting / Dado

The joints, if specified, shall be cleaned off and all dust and loose particles removed. Joints shall then be filled with approved adhesive like BAL-ENDURA or equivalent grouts. After finishing the grouting process, after 15 minute, wipe off excess grout with a damp sponge and polish the tiles with a soft & dry cloth for a clean surface. The Finished work shall not sound hollow when tapped with a wooden mallet.

10.5 Cleaning

As directed by the MMCI/HPCL Engineer-in-Charge, the tiles shall be cleaned by mild acid (However, Hydrofluoric acid and its derivatives should not be used). After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout / adhesive that may have come out of the joints shall be cleaned off before it sets. The dado / skirting shall be thoroughly cleaned. In the case of flooring, once the floor has set, the floor shall be carefully washed clean and dried. When drying, the floor shall be covered with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

10.6 Mode of Measurement and Rate

Dado / flooring / skirting shall be measured in sq. m. correct to two places of decimal. Length and breadth shall be measured correct to 1 cm between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening of area up to 0.1 sq. m. The rate shall include all the cost of labour and materials involved.

10.7 Cleaning Agents for Vitrified Tiles

Vitrified tiles are resistant to all chemicals (except hydrofluoric acid and its derivatives), hence commercially available detergents and cleaning agents can also be used for regular maintenance. Any spills and stains must be removed immediately. If left dry they may leave stains, which may be difficult to remove completely.

10.8 Cleaning Agents for Vitrified Tiles

STAINS	CLEANING AGENT
Robin Blue	Household detergent / Warm water
Marker ink	Turpentine / Acetone / Trichloroethylene
Pen ink	Acetone / Isopropyl alcohol
Methylene blue	Isopropyl alcohol / Acetone
Sauce	Ammonia solution
Cement	Turpentine / Acetone / Trichloroethylene / Cone. HCL
Tea	Hydrochloric acid / Bleaching powder
Coffee	Sodium hydroxide / Potassium hydroxide
Beer	Sodium hydroxide / Potassium hydroxide
Diesel	Acetone / Petrol
Lab indicator	Acetone / Isopropyl alcohol
Cement and grouting	Hydrochloric acid
Pencil mark	Benzene or Toluene or Xylene
Plaster of Paris (POP)	Ammonium sulphate solution
Iodine (Tincture iodine)	Sodium hydroxide / Potassium hydroxide
Hair dye	Per chloric acid
Paan	Lemon juice or citric acid
Marker pen	Acetone



11 Mastic Flooring

The bitumen Mastic to be applied shall be anti-static and electrically conducting conforming to IS: 8374 of latest edition. The mastic shall contain in specified quantities Graphite powder and lime powder in addition to the usual ingredients as specified in the code. Mastic shall be mixed by using mastic cooker with batching arrangements for various ingredients. Manual mixing is not acceptable. The work shall include cleaning of floors and columns on which mastic has to be applied.

Supply and testing of the mastic as per code shall be carried out during initial stages and after completion of work. Three representative samples shall be collected on each occasion so as to cover the total work done.

Following is the detailed requirement for antistatic mastic asphalt.

- Bitumen – Industrial Bitumen of grade 90/15 and 75/15.
- Aggregate and filler – The aggregate and filler used in preparing mastic shall meet the grading requirement of IS 8374.
- Suitable material like carbon black of conductive grade like graphite should be incorporated.

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- iv. The bitumen content shall be between 13 to 18 percent by mass of the total mastic.

Ratio of the mastic mix adopted at site shall be AS FOLLOWS:

i.	Sand	20%
ii.	Stone aggregate	30%
iii.	(6 mm down graded)	
iv.	(iii) Bitumen (90/15 grade)	15%
v.	(iv) Lime Powder	25%
vi.	(v) Graphite Powder	10%

For providing mastic cover to the vertical surfaces and columns, stone aggregate shall be replaced with equivalent weight of sand. Mastic on vertical column shall be reinforced with 20 gauge steel wire mesh. The rates should include chipping of column for gripping the wire mesh.



12 Soling & Hardcore

12.1 General

The work covered under this specification includes all type of soling work either by rubble stones laid under floors / hard core under foundations, hand packed, complete as per under mentioned specification and applicable drawings.

12.2 Rubble Stone Soling

- 12.2.1 The rubble stone shall be of best variety of black trap / granite / basalt or other approved variety of stone available locally. The stone shall be hard, durable, free from defects and of required size and shall be approved by the MMCI/HPCL Engineer in-charge before incorporation in the work.
- 12.2.2 Preparation of Surface & laying:
- 12.2.3 The bed on which rubble soling is to be laid shall be cleared of all loose materials, levelled, watered and compacted and got approved by the MMCI/HPCL Engineer In-charge before laying rubble soling. Cable or pipe trenches if shown in the drawing and as required by the MMCI/HPCL Engineer in-charge shall be got done before the soling is started.
- 12.2.4 Over the prepared surface, the stone shall be set as closely as possible and well packed and firmly set. The stones shall be of full height and shall be laid so as to have their bases of the largest area resting on the sub-grade. Soling shall be laid in one layer of 230mm or 150mm or other specified thickness and no stones shall be less than 230mm or 150mm depth or specified thickness of soling with a tolerance of 25mm.
- 12.2.5 After packing the stones properly in position, the interstices between them shall be carefully filled with quarry spoils of stone chips of larger size possible to obtain a hard, compact surface. Spreading of loose spoils or stone chips is prohibited.
- 12.2.6 The entire surface shall be examined for any protrusions and the same shall be knocked off by a hammer and all interstices shall be filled with approved murrum. Excess murrum if any over the surfaces shall be removed. Unless otherwise specified, the murrum shall be supplied by the contractor at his own cost from the selected areas. The surfaces shall then be watered and consolidated with mechanical or sufficiently heavy wooden tampers and log- rammers as approved by the MMCI/HPCL Engineer in-charge to give the required slope or level and dense sub-base. After compaction, the surface shall present clean look. Adequate care shall be taken by the contractor while laying and compacting the rubble soling to see that concrete surfaces in contact with soling are not damaged.

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- 12.2.7 The payment shall be on Sq.m. basis. The rate shall include supply of rubble, stone chips, murrum, quarry spoil, handling, labour, watering, rolling compaction etc. complete.

13 Concrete Floor Laid With Mechanical Trowelling And Suction Drying Material and Quality Control

Portland cement of 43 Grade conforming to IS:8112 of normal grinding fineness, which corresponds to a specific surface of 2600-3500 cm²/g is required. Cement of higher grinding fineness, e.g. rapid-hardening Portland cement of larger specific surface shall be avoided especially in concrete mixes with cement content 0.3 t/m³ recommended content is 0.2 - 0.3 t/m³.

If stipulated in work specification; VDF Recron 3s synthetic fibres (manufactured by RIL or equivalent) may be used. Minimum dosage shall be 900 gms / m³ or as recommended by the manufacturer of the fibre.

The fibre shall be as per the following specification:



- (a) Cut length – 12mm
- (b) Shape of fibre – unique triangular cross section for improved bonding aggregates in concrete.
- (c) Tensile strength – 4000 to 6000 kg/cm²
- (d) Melting point - > 250°C
- (e) Batching, Mixing, Transporting, placing, compaction finishing and curing shall be as per relevant clause.

If stipulated in work specification, floor hardener (Nitofloor hard top or equivalent) shall be laid as per manufacturer's specifications with concrete as per intended use.

Application * Rate (kg / m ²)	Intended Traffic Use
7	Heavy
5	Medium
3	Light

* Applicable to Nitofloor brand.

The Contractor shall be responsible 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.

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The Contractor shall be required to maintain control charts showing individual test results for aggregate gradation, slump, air content, cement content and compressive strength. Data for slump, eventual air content and compressive strength shall be supplied to the MMCI/HPCL Engineer In-charge.

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

Equipment

The following equipment shall be provided by the Contractor;

Poker vibrator with high frequency preferably 335 hz, dia 25 to 38 cm.

Double beam, surface vibrator. Beam should be adjusted to absolute straightness and controlled every morning before placing of concrete starts.

Suction mat 100% made from air tight plastic material. Width of the mat shall be same as bay size and length 6m.

Filter pad 1200 mm length, width shall be less than the bay width by about 200 mm.

Vacuum Pump.

Skim floater with disc.

Execution

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 internally vibrated prior to screeding.

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. (Slabs that have an aggregate hardener shall have compensation made to maintain elevation). 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.

Vacuum Drying

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 the 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 the 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 air tight seal to be created. A vacuum shall then be applied to the mat.

After a minute the gauge on the vacuum pump should indicate a minimum vacuum of 0.70 atmospheres (24.0 in Hg) and if not, the mat must be checked for leakage. For concrete that dewater readily the vacuum should then be maintained at 0.70 - 0.80 atmospheres (24.0 to 25.5 in Hg). For concrete which dewater less efficiently (e.g. air-entrained concrete) the vacuum shall then be reduced to 0.50 - 0.60 atmospheres (15.0 to 18.0 in Hg). After approximately 10 minutes the vacuum can then be increased to 0.80 atmospheres.

The vacuum shall be maintained for at least 3 minutes per 25 mm of concrete thickness at 0.80 atmospheres. (Where aggregate hardeners are specified, sufficient moisture shall be maintained

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to meet manufacturer's requirements). The suction mats and filter pads shall then be removed and moved to the next section in a leap frog manner.

The vacuum dewatering shall be stopped when only light foot prints are left in the concrete when stepped upon.

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.

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 can not take place before the concrete has hardened enough to carry the machine i.e. the trowelling blades shall not leave any marks on the concrete.

Repeated trowelling, with intervals between the passes, which are adapted to the setting of the concrete, greatly improves the surface characteristics.

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

Curing

Vacuum dewatered concrete shall be cured like any other quality concrete in order to achieve a good final result. Curing compounds or plastic sheets shall be used.

Acceptance Criteria

In general, the following shall be checked for acceptance:

- ~ Concrete cube strength as specified in the drawing
- ~ General level of finish of the floor shall not vary by ± 5 mm in 10 metres
- ~ Finished floor shall not exhibit cracks, creases and crustiness. It shall be sound at edges and corners.
- ~ Floor shall not have laitance and shall not generate dust on movement of traffic.
- ~ It should not give hollow sound on tapping.

During Inspection if any of the above defects are observed, Contractor shall be informed of non-acceptance and the Contractor shall in workman like manner take all necessary corrective action without undue delay at his cost so that the installation meets all acceptance criteria