



Uhde India Limited

**SECTION-10  
TECHNICAL SPECIFICATIONS  
WATERPROOFING & THERMAL AND  
ACOUSTIC INSULATION**

DOC NO.:  
CI-UCH-016-010

Rev. :R0

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**Applicable Revision:**

**Prepared:**

**Checked:**

**Approved:**

**Date:**

**Date:**

**Date:**

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**SD/-**

**SD/-**

**SD/-**

**Date: 07.08.03**

**Date: 07.08.03**

**Date: 07.08.03**

Server : \\KUMUS671\REFER\CIVIL\PRIVATE\DOCS\STD TENDER\PART2  
File Name : TSP10.DOC

**10.0 SCOPE OF WORK**

Waterproofing system and thermal and acoustic insulation work covered under this section shall be inclusive of providing, laying, all materials, labour, scaffolding, tools, equipment, finishing and testing etc. complete.

**10.1 IS CODES & STANDARDS**

- 1) IS : 73 : Specification for Paving Bitumen
- 2) IS : 702 : Specification for Industrial Bitumen
- 3) IS : 1203 : Methods of Testing Tar & Bitumen
- 4) IS : 1322 : Bitumen Felts for Waterproofing and Damp Proofing
- 5) IS : 1346 : Code of Practice for Waterproofing of Roofs with Bitumen Felts
- 6) IS :3384 : Bitumen Primer for use in Waterproofing and Damp Proofing.
- 7) IS :2645 : Specification for Integral Cement Waterproofing Compounds
- 8) IS :2591 : Code of Practice for Preparation & Use of Lime Concrete.

**10.2 Box Type Waterproofing**

Wherever specified in drawings, underground hollow construction like building basements should be provided with encasing box-type waterproofing to form a barrier between subsoil water and the basement wall and rafts. The specification shall be as given below:

## 10.2.1

Before laying the basement raft :

- (a) Lay the PCC (M-10) on the foundation strata. This will be by Civil Contractor and not to be included as part of waterproofing described under this section.
- (b) Clean the PCC top by removing all loose particles of sand, aggregate, cement etc.
- (c) Lay a layer of screed in C.M. (1:3) of average thickness of 25 mm or as specified in the drawing including approved waterproofing agent in specified proportion, over PCC.
- (d) Provide and lay minimum 38 mm thk. Rough Shahabad tiles of minimum size 600 x 600 mm over the screed and bedded (10 mm thk.) in waterproof C.M. (1:3). This layer should extend at least 300mm beyond the outer face-line of the basement walls, for integrity with vertical layers.
- (e) Provide and lay average 20mm thk. screed of cement mortar (1:2:1) in proportion of 1 Cement, 2 sand and 1 grit of size 3 mm to 6 mm (crushed metal) including approved waterproofing agent.

This layer should be cured for minimum 7 days before allowing reinforcement or formwork to be laid. Curing shall continue for 15 days after laying in humid weather and for 20 days in dry hot weather.

## 10.2.2

Over vertical surface of the basement walls.

After the RCC walls are constructed, cured and have attained at least 15 days strength, this layer shall be taken up for waterproofing as specified below:

- (A) Clean the surface and give a coat of cement wash (1 bag of cement in 80 litres of water) uniformly all over the surface.

- (B) Provide and lay minimum 38 thk. Rough Shahabad tiles in waterproof cement mortar (1:3). Bedding between tiling and wall should be minimum 10-15 thk.

This layer should be done in heights of not more than 1.2 Metres at a time (2 tiles of 600 x 600) and shall be started over the projecting waterproofing layer of raft.

- (C) After 1.2 M height is constructed, a protective brick wall 115 mm thick in C.M. (1:4) jointing and a filling of 10-15 mm thk. CM (1:4) between brick wall and tiling shall be constructed, leaving 75 to 100mm of tile layer above brick wall top.
- (D) This process of tiling upto 1.2 M height and brick wall shall be continued till the entire lining reaches about 100 mm above finished grade level around the basement.
- (E) Sealing at top of vertical waterproofing shall be done by laying a chamfered seal of cement concrete (1:1:2) at 45° covering a total thickness of tiling and brick wall (approx. 200 mm).
- (F) This layer and brickwall should be cured for minimum of 15 days before backfilling can be taken up. Care should be taken to backfill the space around basement with good selected murum free from stones, grit or hard material which may damage the brickwall.

### 10.2.3

#### Rendering Rectification:

After putting the basement into operation if any leakage, seepage or dampness is noticed inside the basement on account of ground water, the same shall be stopped by method of injection grouting through 25 mm sockets grouted in walls or raft from inside the basement and pouring cement grout or any other chemical grout as necessary, through pipe connected to the sockets/nozzles until the seepage/leakage is stopped. Detailed procedure including materials proposed to be used for grout shall be submitted by Contractor for Engineer's approval. Such rectification shall not be at contractor's cost and shall not be paid separately.

**10.3**                      **ROOF WATERPROOFING**

Following specifications shall be followed for providing waterproofing over RCC slabs, parapet walls etc. on building roofs, terraces etc.

10.3.1                      **Roof waterproofing TYPE I (Cement based)**10.3.1.1                      **Over Slabs - Plain or Sloping**

(A) Clean the surface of the slab by removing all loose materials, dust, etc. and wash with clean water.

(B) Provide and lay a screed of C.M. (1:2) over the clean and damp surface including waterproofing agent mixed with C.M. Total average thickness shall be 20 mm. This is to seal all pores and make the concrete as impervious as possible.

(C) Lay an average thickness of 125 mm consisting of brick bat layer laid in random pattern to avoid continuity of joints on 10mm thk. bedding, 10 mm thk. jointing with water proof cement mortar of (1:3). This layer shall be laid to appropriate slopes towards rain water downtake outlets already provided by Civil Contractor. This brick bat layer shall continue in rounded manner over at least 200 mm of vertical surface of parapet walls. This layer shall be cured for minimum 3 days before taking up the next layer. The surface which is not taken up for next layer shall be continued to be cured for minimum 10 days.

(D) **Final Layer**

Provide and lay minimum 40 mm thick IPS layer in cement concrete (1:2:4) with maximum size of aggregate 3 mm to 6 mm, finished smooth with polishing trowel, using C.M. (1:2) wherever necessary to hide aggregate projecting at surface level. Use waterproofing agent as approved in this layer.

(E) Curing

This layer shall be cured for 21 days by flooding the water to 25 mm depth in panel of 1M x 1M formed by weak cement mortar bonding.

10.3.1.2

On vertical surface and top of parapet walls (RCC or Brick):

- (A) Clean the surface to be treated and apply a coat of Cement wash using mixture of Cement and Water in proportion (1 bag : 80 litres).
- (B) Provide and apply minimum 20 mm thk. waterproof plaster with cement mortar (1:2), finished smooth with polishing trowel, in continuation with finish layer of terrace top. This layer shall be laid over entire inside surface of parapet, taken over top of parapet in slope and continued over outside surface at least upto 300 mm below top of roof slab or as directed by the Engineer.
- (C) This layer shall be cured for 21 days by spreading clean hessian/jute cloth which should be kept wet throughout the curing period.

10.3.2

Roof Waterproofing TYPE II [Lime terracing using brick bat Coba]

- (A) Lime concrete shall consist of one part of lime mortar to 3 parts of 38mm and downgraded burnt brick ballast. The mortar shall consist of one part of lime and two parts of surkhi well ground in mortar mill.
- (B) The concrete surface to be covered with lime concrete shall be brushed thoroughly and then painted with a coat of bitumen of 80/100 grade applied hot at the rate of 1.5 kg per M<sup>2</sup> and allowed to cool. The surface shall then be covered with lime concrete to the required levels, falls etc. and thoroughly consolidated by beating with wooden thapies and continually checked during the process with straight edges.

- (C) The beating shall be carried out with two rows of workers sitting across the entire width of the roof as closely as they can sit slowly traversing its length backward and forward, beating all the time with wooden rammers (weight 1 to 2 kgs.). This process shall be continued for not less than three days until the mortar is almost settled and shall be sprinkled with a mixture consisting of 1.75 kg of gur and 1.00 kg of Bel fruit boiled in 60 litres of water.
- (D) As soon as beating is completed, clean water shall be sprinkled on the surface to soften it and the mortar that would have come to the surface shall be well rubbed and then finished smooth with a steel trowel.
- (E) The average thickness of lime concrete terracing shall be not less than 110 mm and minimum thickness shall be 50 mm. The slope of the finished terrace shall not be flatter than 1 in 50 unless specifically permitted by the Engineer.

## 10.3.3

Waterproofing TYPE III [using Felt](A) Asphaltic Bonding Material

This shall consist of Air blown bitumen conforming to IS:702. The penetration of bitumen used shall not exceed 40 in any case. Generally blown bitumen of low penetration shall be used for the base and intermediate layers of bonding material.

Suitable residual type petroleum bitumen is of penetration 30/40 (IS Grade S-35).

(B) Self Finished Felt

The self finished felt shall be of the brand and manufacture conforming to the type and grade as described in the item. They are fibre glass or hessian base felts. These shall conform in all respects to IS:1322 and IS:7193 [Refer to Data Sheet 'B' for recommended vendor / brand information].

(C) Stone Grit and Pea Gravel

Stone grit shall conform to specifications of stone aggregate and shall be 6 mm down size. Where pea gravel is used it shall be hard, round and free from dust, dirt, etc. Stone grit or pea gravel shall be spread uniformly at the specified volume per unit area. This shall not be spread over vertical and sloping faces and at drain mouths. At these places the surface shall be painted with two coats of bituminous solution. If so specified in the item, in lieu of pea-gravel finish, two coats of bituminous aluminium paint at the rate of 0.1/m<sup>2</sup> per coat shall be applied. Alternatively, one coat of colour bituminous emulsion at 0.5 l/m<sup>2</sup> or one coat of acrylic based coating at 0.3 l/m<sup>2</sup> shall be applied as specified.

## 10.3.3.1

Laying of Waterproofing Treatment

Waterproofing treatment shall be laid by a reputed agency generally as per IS:1346. The treatment shall be one of the following.

Normal Treatment [5 course Layer Treatment] – Five courses for moderate conditions.

1. Bitumen Primer conforming to IS 3384 at the rate of 0.27 litre/sq.m. min.
2. Hot applied bitumen @ 1.2 Kg/m<sup>2</sup> minimum
3. Hessian base self finished felt type 3 grade 1;
4. Hot applied bitumen @ 1.2 kg/m<sup>2</sup> minimum.
5. Pea sized gravel or grit devoid of fine sand @ 0.006 Cu.m./M<sup>2</sup>, adequately embedded under the bitumen.



Heavy Treatment [7 course Layer Treatment] – Seven courses for severe conditions.

1. Bitumen Primer conforming to IS 3384 at the rate of 0.27 litres/sq.m. min.
2. Hot applied Bitumen @ 1.2 Kg/m<sup>2</sup> minimum.
3. Hessian based self finished felt type 3 grade 1.
4. Hot applied Bitumen @ 1.2 Kg/M<sup>2</sup> minimum.
5. Hessian based self finished felt type 3 grade 1.
6. Hot applied Bitumen @ 1.2 Kg/M<sup>2</sup> minimum.
7. Pea-sized gravel or grit devoid of fine sand, @ 0.006 Cu.m./M<sup>2</sup>, adequately embedded under the bitumen.

Extra Heavy Treatment [9 Course Treatment] – Nine courses for very severe conditions.

1. Bitumen Primer coat conforming to IS 3384 at the rate of 0.27 litres/sq.m.
2. Hot applied Bitumen @ 1.2 Kg/m<sup>2</sup> minimum.
3. Hessian based self finished felt type 3 grade 1.
4. Hot applied Bitumen @ 1.2 Kg/M<sup>2</sup> minimum.
5. Hessian based self finished felt type 3 grade 1.
6. Hot applied Bitumen @ 1.2 Kg/M<sup>2</sup> minimum.
7. Hessian based self finished felt type 3 grade 1.
8. Hot applied bitumen @ 1.2 Kg/M<sup>2</sup> minimum.

9. Pea sized gravel or grit devoid fine sand @ 0.006 Cu.m./M<sup>2</sup>, adequately embedded under the bitumen.

The bitumen to be used as bonding material shall be prepared by heating to the correct working temperature as recommended by manufacturer and spread on the roof with a rubber squeeze or cloth brush. Rolls of self finished felt shall be laid over the hot bitumen and pressed properly to avoid air gaps. A minimum end lap of 100 mm and side lap of 75 mm shall be provided in the felt layer. For multilayer treatment the joints between the layers shall be staggered. For junction of roof and parapet wall, the felt shall be laid over a cement concrete fillet and then tucked into a groove, 50 x 50 mm in the parapet wall. The groove shall then be filled with cement mortar 1:4. The top layer of pea-gravel or grit shall be laid over the hot bitumen.

Where pea-sized gravel or grit is not available, coarse sand may be used.

In order to prolong the life of the waterproofing treatment or when the roof surface is subjected to foot traffic or in order to provide fire protection to the roof surface, cement concrete flooring tiles conforming to IS:1237 shall be provided on top if specified in the item.

In all the above treatments, a surface finish of pea-sized gravel affords a measure of protection to the treatment and increase its durability. Alternatively, a screeding of proportion of 1:4 of cement and sand, 45 mm thick can be laid over the roofing treatment and marked off into squares of 600 mm made with expansion joints provided at a clearance of 3M which shall be properly caulked with bituminous sealing compound conforming to Grade-A of IS 1834.

## 10.4 INJECTION GROUTING SYSTEM

### 10.4.1 Introduction

This specification covers the material and method of application of water proofing for hollow underground structures like Basements.

**10.3.2**      Bottom Raft

10.4.2.1      2 coats of solventless epoxy coating shall be applied over the lean concrete surface to act as an impermeable membrane.

10.4.2.2      12 mm dia. threaded nozzles of length equal to half the depth of raft shall be placed in grid pattern at a spacing not exceeding 1.5 metres centre to centre all over the raft. These nozzles shall be placed during casting of concrete. Similar threaded nozzles shall also be placed at critical points like construction joints. The top of the nozzle shall be kept closed by providing plugs.

10.4.2.3      Non-shrink polymeric waterproof grouting compound mixed with neat cement slurry shall be injected through these nozzles under pressure by pump. The grout will run through all pores, cracks etc. thereby sealing them.

10.4.2.4      After injection operation the nozzles shall be sealed with water proofing admixtures.

**10.4.3**      Walls & Roof Slabs

10.4.3.1      Solventless epoxy coating placement of 12 mm dia. Nozzles, grouting and final sealing of nozzles shall also be carried out in walls and roof slabs as described above for bottom raft.

**10.5**      MODE OF MEASUREMENT

The payment shall be made on M<sup>2</sup> basis of finished area. The rate shall include all materials, labours, tools and tackles, making ponds, curing etc. complete as specified.

**10.6**      Testing of Underground Waterproofed Concrete Structures.

The contractor shall test the water proofness of the structure by the following procedure:

(a) After making the inside surface completely dry the outside earth shall be suitably ponded and flooded with water. This shall remain for 24 hours. The inside surface shall then be checked for any wet patch.

(b) After external testing, the pit shall be filled with water and the level noted. After expiry of 24 hours the level shall be again observed. The fall in level of water shall not be more than 10 mm.

In case injection grouting or any other technique is to be adopted to rectify the defective workmanship, the same shall be done by the Contractor at no extra cost to the Owner. The water required for testing shall be arranged by the Contractor in case the same is in contractor's responsibility or otherwise the same shall be supplied to the Contractor as per agreed relevant clause of the contract.

## 10.7 GUARANTEE

Water proofing treatment and injection grouting system shall be laid as per manufacturers instruction and as directed. Contractor shall guarantee this work for minimum period of 10 years from the date of finishing and acceptance from Client/Engineer.

## 10.8 THERMAL AND ACOUSTIC INSULATION

The insulation material shall be mineral-vermiculite. Vermiculite is the geological name given to a group of hydrated laminar minerals which are aluminium-iron magnesium silicates.

This shall consists of thin flat flakes, containing innumerable microscopic voids.

### 10.8.1 TECHNICAL DATA

#### Exfoliation

On being suddenly subjected to high temperatures, (700°C to 1000°C) the flakes exfoliate (expand) to many times their original volume due to the formation of steam which forces the laminae apart as it is driven off.

Ex-foliated vermiculite consists of accordion-like granules, containing microscopic layers, which gives optimum insulation properties.

#### CHARACTER PROPERTIES

Sintering temperature	- about 2300°F (1260°C)
Melting point	- about 2400°F (1315°C)
Specific Heat	- 0.2
Specific Gravity	- 2.6
pH value	- 7.0
Cation exchange properties.	- 90-100 milli-equiv. per 100 grams.
Thermal conductivity	- 0.53 - 0.56 Kcal
Incombustibility	- Incombustible and can be used upto 1100°C.
Insolubility	- Inert to organic solvents.
Density of laid mix	- 400 - 480 kg/Cu.m.
Cold crushing strength	- 14 - 24 kg/sq.m.
Air contraction at max. service temperature	- Less than 1%
Insulation effective	- Sub-Zero to 1100°C
Chemical property	- Chemically inert

#### OTHER PROPERTIES

- Light in weight
- Fire proof
- Rot proof
- Porous
- Non-abrasive
- Flaky material

### 10.8.2

#### APPLICATIONS

##### (A) Building Construction

Thermal insulation, by way of :-

- a) Roof screeding
- b) Interior wall plaster
- c) Cavity wall filling (Loose fill)

Acoustic treatment, by way of:-

- a) Interior wall plaster
- b) Ceiling plaster

### 10.8.3

### METHOD OF APPLICATIONS

#### Thermal Insulation

#### Roof Screeding

"Vermiculite" is to be mixed with cement in the proportion of 5 Vermiculite to 1 Cement by volume. After properly dry-mixing, the lot is to be mixed with water. This mix is to be immediately spread over the slab or roof surface in the prescribed thickness, which for non-a/c building is 50 mm and for fully air conditioned units is 75 mm.

The layer does not need any curing and the layer should be further treated with bitumen / tiling / or cement plaster or any other terracing as may be desired.

#### Wall Plaster

Vermiculite is to be mixed with Cement in the proportion of 4 Vermiculite to 1 Cement by volume and as in the case of roof screeding, it is to be directly plastered over the surfaces of interior walls (exposed to sun) in 25 mm layer thickness.

No curing is to be done over this plaster.

In ordinary cases, the surface can be treated with white washing, painting etc.

Acoustic Treatment

Vermiculite mixed with cement in 5:1 ratio by volume is to be plastered over the surface where acoustic treatment is desired. The thickness should be minimum 25 mm.

The acoustic plaster may be done on all walls and ceilings.

This plaster should not be treated and should remain exposed. However, for decoration, if desired, other perforated boards may be used over this surface.

## 10.8.4

SPECIAL CARES

Vermiculite surfaces need not be cured. When used for accoustics, no other treatment should be done on these surfaces.

No sand is required for the treatment.

## 10.8.5

MODE OF MEASUREMENT & PAYMENT

The measurement shall be on square meter basis. The rate shall include supply of all materials and fixing including labour, tools and tackles complete in all respects including all taxes / levies etc.