

## **QUALITY AND STANDARDS OF WORK**

### **1.0 General.**

Replaced or repaired work shall match existing in original type, material and construction unless otherwise approved by SO.

WHEN MAINTAINING / REPAIRING BUILDINGS WHICH ARE ON THE DEMOLITION LIST OR WHICH ARE VACANT, THE CONTRACTOR IS TO USE MINIMUM REPAIR METHODS AND TECHNIQUES WHICH PROVIDE A MINIMUM LEVEL OF WEATHER PROTECTION AND OCCUPANT SAFETY. MINIMUM REPAIRS METHODS. WHEN IN DOUBT AS TO LEVEL OF REPAIRS APPROPRIATE THE CONTRACTOR IS TO COORDINATE WITH S.O.

If not specified, quality of workmanship shall be to current UiTM standard. The manufacturer recommendation and industry practice will be used in addition to the requirements of this Exhibit. The contractor shall clean up, repair and restore areas affected by damage or repair and replacement work. The contractor shall restore area to its appearance prior to damage. For example, clean-up broken glass, vacuum or remove hot water tank leakage, remove overspray, and restore grass.

Temporary removal of portions of walls, floors, cabinets, appliances, foundations etc. may be required to gain access for repairs to electrical, mechanical, plumbing or other work. Removal includes opening portions of floors to locate plumbing leaks and repairs. Removal of material shall be done between existing joint lines or cut vertical and horizontal lines. Removed material that is salvageable may be used to restore the repaired area. Removed material that cannot be salvaged shall be replaced. Excavation and backfilling may be required.

Repair of the area shall be included in the work performed and no additional task shall be used. If repair limits specified in the contract are exceeded, a replacement task number may be used. If a two inch hole was required to repair the leak, no additional task number would be allowed. The contractor shall restore repaired areas to a condition comparable to the original construction or site. Split, crushed or deformed wood elements shall be replaced with new wood. Restore lawn areas with sod immediately after backfilling. Items damaged due to Contractor's negligence or operations shall be repaired at no additional cost to UiTM. The contractor shall investigate, troubleshoot and repair all ordered work.

## 2.0 CONCRETE WORKS

This section shall apply to the construction of all structures or parts of structures to be composed of concrete with or without steel reinforcement. The Work shall be carried out all in accordance with this specification and the lines, levels, grades, dimensions and cross-sections specified and as required by the S.O.

### 2.1 Cement

The cement to be used throughout the Work shall be Portland cement obtained from an approved manufacturer. The cement shall be described under the following headings:

- i) Ordinary Portland Cement to comply with MS 522
- ii) Rapid Hardening Portland Cement to comply with MS 522
- iii) Sulphate Resisting Portland Cement to comply with MS 1037
- iv) Portland Pulverized-Fuel Ash Cement to comply with MS 1227
- v) Portland Slag Cement to comply with MS 1389

The cement shall be transported to the Site in covered vehicles adequately protected against water. It shall be stored in a weatherproof cement store to the approval of the S.O. Cement stored in bags shall not be laid directly on the ground. It shall be taken for use in the Work in the order of its delivery into the store. Cement delivered in bulk shall be stored in silos of an approved design.

### 2.1 Aggregates

Aggregates shall be naturally occurring sand, granite or limestone, crushed or uncrushed except as otherwise specified, and shall comply with MS 29. They shall be obtained from a source approved by the S.O. Marine aggregates shall not be used unless otherwise specified by SO. Coarse aggregates shall comply with MS 29. For work below ground level, only crushed granite shall be used. Unless otherwise specified in the Drawings, tests shall be carried out according to MS 30. The maximum nominal size of aggregate shall be as specified by SO.

### 2.2 Water

Water shall comply with the requirements of MS 28. It shall be clean and free from materials deleterious to concrete in the plastic and hardened state and shall be from a source approved by the S.O. The S.O. may instruct the Contractor to carry out chemical tests at any approved laboratory at the expense of the Contractor. The Contractor shall make adequate arrangement to supply and store sufficient water at the Site for use in mixing and curing of concrete.

### **3.0 BRICKWORKS**

The whole of the brickwork shown in the Drawings, unless otherwise specified, shall be constructed with standard size clay bricks in mortar as described and leave the surface ready for plastering.

#### **3.1 Samples**

Separate samples of each type of bricks and blocks taken at random from the load, shall be submitted to the S.O. for approval before the bricks and blocks are used. All subsequent deliveries shall generally be up to the standard of the samples approved. No soft, broken, twisted or otherwise defective bricks and blocks will be permitted to be used.

#### **3.2 Clay Bricks**

All ordinary clay bricks shall be machine-made and wire cut complying with MS 76 and shall be hard, well burnt, sound, square and clean.

All clay bricks shall be soaked in a suitable tank or pit to be provided by the Contractor for at least half an hour before being laid and shall be kept wet whilst being laid. The top of walls left off shall be thoroughly wet before work is resumed. All constructed walling must be left wet and properly protected from the direct sunlight during the following day. The Contractor shall provide sufficient means to ensure that this is done.

#### **3.3 Cement Sand Bricks and Hollow Blocks**

All cement sand bricks and hollow blocks shall comply with MS 27.  
Size of cement sand bricks shall be of a nominal size as given below:

Length(mm)  $225 \pm 3.2$

Width(mm)  $113 \pm 1.6$

Depth(mm)  $75 \pm 1.6$

Dimensional tolerances for hollow blocks shall be  $\pm 3\text{mm}$  on all faces. The shell of each hollow block shall be 38mm thick minimum on all sides.

Cement sand bricks shall not be soaked but dipped in water before being laid and all constructed brickwork shall be protected from direct sunlight during the day on which it is laid and also during the following day and the Contractor shall provide sufficient means to ensure that this is done.

## **4.0 ROOFING WORKS**

Unless otherwise stated, the pitch and laps for each type of roof covering shall be strictly in accordance with the manufacturer's instructions. Unless otherwise approved, all roof covering accessories such as eaves piece, hips, ridges and valley pieces, shall be of the same material as the general covering.

### **4.1 Interlocking Concrete Tiles**

Interlocking concrete tiles shall be of approved type and colour and shall conform to MS 797 and shall be laid on timber or steel battens approved for roofing at spacings and tightly screwed as recommended by the manufacturer

### **4.2 Clay Tiles**

Unless otherwise instructed, clay tiles shall be of Marseilles pattern conforming to BS 402 and shall be laid on timber or steel battens approved for roofing at spacings and tightly screwed as recommended by the manufacturer. The tiles shall be 400mm to 425mm in length by 225mm to 263mm in width and shall be free from cracks, chips and warps.

### **4.3 Corrugated Aluminium Roofing Sheets**

Where aluminium roofing sheets are to be used, unless otherwise stated, they shall be of the type, gauge and finish as existing and to be fixed strictly in accordance with the manufacturer's instructions.

### **4.4 Galvanized Steel Prepainted Steel Roofing and Wall Cladding**

Where metal roof decks or wall claddings are to be used, unless otherwise stated, they shall be of prepainted hot-dipped zinc-coated roof decking of standard nominal thickness, width and length prior to corrugation and shall comply with JKR Standard No.2-95(BN) JKR 20709-0347-95. 6.2 Surfaces of galvanized steel roof decking or wall cladding shall be uniformly produced by coating and baking durable synthetic resin paint over either one or both surfaces of hot-

## **5.0 CARPENTRY, JOINERY AND IRONMONGERY WORKS**

### **5.1 Carpentry Works**

Unless otherwise specified, the timber species used for the Works shall be as existing. The strength grouping for timber shall be in accordance with Malaysian

Standard MS 544-Table 2.3 All carpentry and joinery work shall include all necessary notching, halving, morticing and tenoning, wedging, scarfing, dovetailing, sinking for heads of bolts and nuts and trimming for opening. All carpentry work shall be left with a sawn surface except where particularly described to be wrot. All joinery shall be wrot and finished with sand paper as required. All carpentry shall be accurately set out in strict accordance with the Drawings and shall be framed together and securely fixed to the satisfaction of the S.O. Timber framing shall be properly braced and checked, halved, screwed or bolted together as required. Longitudinal joints in plates, ridge, fascias, etc. shall be formed over supports. Those timber members with lapped joints shall lap at least 150mm or twice the depth of the timber whichever is the greater. The brads, nails, screws, spikes, plugs, bolts, framing anchors and timber connectors shall be provided wherever necessary and as detailed. Other than those detailed, no joints are permitted in structural work unless prior permission is obtained from the S.O. No structural member shall be notched unless instructed by the S.O.

For other carpentry works, timbers shall, as far as possible be in one piece between continuing lengths. At corners, timbers shall be halved for materials of the same thickness, and sufficiently lapped for materials of different thicknesses.

Material of wood must follow JKR Specification.

## 5.2 **Doors, Door Frames and Locksets**

The contractor shall repair and replace doors and frames such that doors fit squarely, are within 1/8 inch of the frame when closed, operate freely, close and shut without being forced. The contractor shall lubricate, adjust, and repair hardware. The contractor shall replace hardware that is corroded and hardware that does not allow the door to operate as originally intended. Hardware includes fasteners, interior passage sets, interior and exterior locksets, anchors, knobs, hinges, latch sets and other manufactured items. The contractor shall repair or replace weatherstripping and all door components.

The contractor shall replace removed or missing exterior doors the same day as removal or discovery of the missing door. This may include providing a new temporary door until a replacement door matching the removed or missing original door can be obtained.

Warped, bent, rotted, broken, or missing frames, threshold and components shall be replaced. Areas may be repaired if other deficiencies not described in the preceding sentence are present and the door operates freely.

Screens and Screen Doors. Replacement screening shall be of the same material as existing metallic or nonmetallic screening. Small holes under one inch in screens shall be repaired with a patch matching the existing screening. There shall be no more than two patches per screen prior to replacement. The patch shall be installed over the damaged section. The free end wires of patch shall be bent around the screen to secure the patch in position. Exposed screening ends shall be commented with a colorless plastic cement. No exposed screening ends shall protrude from the screen. Warped screen and screen doors and frames shall be straightened if possible to fit squarely in the opening. If beyond repair, warped items shall be replaced.

### **5.3 Window Framing**

Repair or replacement of muntins, glazing compound and other work required to remove and replace glass shall be considered part of glass replacement. All material up to the window rough opening (i.e., up to studs, lintels and wall framing members or block and brickwork) shall be considered part of the window framing. Window framing includes steel casement and aluminum windows. The repair or replacement of the window frame shall ensure a water and weather tight installation. Hardware, weather stripping, counterweights, wire or rope, pulleys and other accessories shall be included in the window frame repair and replacement. Repaired and replacement windows shall operate fully after installation.

### **5.4 Framing**

The contractor shall or replace wood framing using new material installed in accordance with the Uniform Building Code (**JKR Specification Standard**) except that existing material sizing shall govern. Walls, ceilings and floors shall be level and plumb after repair or replacement of framing members. Repair shall include splicing or sistering (sandwiching) of cracked or broken members. Rotted, missing or water logged material shall not be repaired. The contractor shall replace rotted, missing, warped, water logged or other deteriorated framing members only if continued occupancy is required and such replacement is necessary for safety.

## **6.0 STRUCTURAL STEEL AND METAL WORKS**

All materials shall conform to the relevant Malaysian or British Standards. Other equivalent standard may be accepted with the approval of the S.O. All materials testing and verification shall comply with BS 4360 and not limited to the requirements as specified in the JKR Standard Specification for Structural Steelwork. The manufacturer's mill certificates shall be produced to the S.O before any structural steel can be accepted. All test certificates shall contain embossed seal and/or watermarked logo of the manufacturer.

## **7.0 PLASTERING, PAVING AND TILING WORKS**

The cement, unless otherwise described shall be Ordinary Portland Cement, complying with MS 522 as specified in SECTION D: CONCRETE WORK or Masonry Cement complying with MS 794. White and coloured cement shall be of approved manufacture.

The plasticiser shall be of approved manufacture and used strictly in accordance with the manufacturer's instructions.

The plasterlime shall be of approved manufacture and shall comply with BS 890 and shall be applied strictly in accordance with the manufacturer's instructions.

The sand for external rendering, internal plastering and floor screeding shall comply with MS 29 for fine aggregates. Sand for plastering using gypsum shall comply with MS 701. Water for mixing shall be clear and free from harmful matter as specified in SECTION D: CONCRETE WORK.

All mixing of mortar for plaster and screed shall be done by machine. Hand mixing shall only be allowed for small quantities and with the approval of the S.O. Hand mixing shall be done on a clean platform. The water content of the mix shall be only the minimum required to give a workable mix. Mortar for plaster and screed shall be used up within 45 minutes after mixing. For gypsum plaster, mixes shall be used up within one hour after mixing.

### **7.1 Surface Preparation**

Where possible cement paving, screeding and rendering on concrete surface shall be laid while the concrete is still green i.e. after the final set but not later than 24 hours of laying concrete. The concrete surfaces shall be brushed with a stiff broom before it has hardened to remove laitance and give a roughened surface. Hardened concrete surfaces shall be thoroughly hacked to form key to the approval of the S.O. Before any paving, screeding or rendering is applied, all surfaces shall be thoroughly cleaned and wetted and be in damp state at the time the paving, screeding or rendering is applied. Where plastering and rendering are to be applied in several coats, the surface of each preceding coat shall be scratched while still green to form key for the subsequent coat.

### **7.2 Making Good**

Defective screeds shall be cut out and made good with fresh screed and sufficient time shall be allowed for the screed to dry prior to the laying of the floor finish. Defective plastering and rendering shall be made good by cutting out the defective part to a rectangular shape, and the edges shall be undercut to form dovetail-key and finished flush with the surrounding work.

### 7.3 **Samples**

The Contractor shall supply the S.O. with samples of materials and/or sample of finished work for approval. Approved samples shall be kept at site for reference. Proper tools shall be used for all scribing, scoring, splicing, smoothing edges, making angles etc. of tiles, bricks and others so as to produce neat and fit joints.

### 7.4 **Plain Plaster**

Plain plaster shall consist of one part masonry cement to six parts sand by volume. Where Ordinary Portland Cement is used, plasticiser or plasterlime shall be added to the mix in accordance with the manufacturer's instructions. The plaster shall be applied in two coats generally to a total thickness of 16mm to brickwall and 12mm to soffits, beams, columns, block-walls and other smooth surfaces. The first coat shall consist of rough plastering to a thickness of 10mm for the 16mm plainface, and 6mm for 12mm plainface. The second coat of 6mm thick shall be finished with a steel trowel for internal surfaces and with a straight-edged wood float for external surfaces.

### 7.5 **Granolithic Plaster**

Granolithic plaster shall consist of by volume, two parts cement, one part sand, five parts granite chipping passing 6mm mesh and retaining upon 3mm mesh, applied in two coats to a total thickness of 10mm to a backing coat, finished smooth with wood float. The backing coat shall consist of 12mm thick plain plaster as described hereinbefore. The finished surface shall be brushed lightly to achieve the required texture after it has reached initial set.

### 7.6 **Shanghai Plaster**

Shanghai plaster shall consist of two parts approved coloured cement, one part sand and five parts of selected lime-stone chipping passing 6mm mesh and retaining upon 3mm mesh by volume applied in two coats to a total thickness of 10mm to the backing coat, finished smooth with wood float. The backing coat shall consist of 12mm thick plain plaster as described hereinbefore. The surface shall be brushed lightly to achieve the required texture after it has reached initial set.

### 7.7 **Textured Finish Plaster**

Textured finish plaster shall consist of a 20mm thick backing coat of plain plaster as described hereinbefore ruled into a plain and even surface and a finishing coat as existing and described hereinafter. For rough cast finish, the mix shall consist of



selected cement, sand and aggregate in the proportion to give the required finish to the approval of the S.O. For Tyrolean finish, the mix shall consist of one part selected coloured cement and two parts sand by volume applied to the backing coat by means of a Tyrolean machine in accordance with the manufacturer's instructions. The finish shall be built up in three layers to a total thickness of not exceeding 6mm. Each coat shall be allowed to dry before the application of a subsequent coat. 2.4.4 For pebble-dash finish, the dry pebble for the finish shall be thrown onto the backing coat while the latter is still wet. The pebbles to be used shall be clean and of size and quality approved by the S.O.

## **8.0 Paving Work**

Unless otherwise specified or described in the Bills of Quantities, cement paving shall be 20mm thick consisting of one part cement to three parts sand by volume. The paving shall be thoroughly rammed within 30 minutes of laying and trowelled smooth after it has stiffened sufficiently to prevent laitance being brought to the surface. Paving to apron shall finish to a slight fall towards surface drains. Unless otherwise specified or described in the Bills of Quantities, skirtings shall be formed to a height of 150mm and thickness of 20mm, coved at bottom and rounded at top. The paving forming the nosing edge of concrete stair treads shall be slightly rounded and shall have four rows of 6mm half round grooves set at 12mm apart as non-slip nosing edge.

## **8.1 Granolithic Paving**

Granolithic paving shall be 20mm thick, consisting of two parts cement and five parts granite chipping passing 6mm mesh and retained upon 3mm mesh by volume. The chipping shall be washed and free from dust. The paving shall be trowelled smooth to proper level or fall where appropriate. After initial set the surface shall be brushed lightly to achieve the required textured finish. Unless otherwise shown in the Drawings, granolithic skirtings shall be 100mm high and 20mm thick, coved at bottom and slightly rounded at top. The edge of threshold and treads of concrete stairs shall be finished with 150mm x 75mm x 12mm thick vitreous non-slip nosing tiles laid lengthwise bedded and pointed in 1:3 cement and sand mortar. The sides of open stringers shall be finished with granolithic plaster worked to profile of treads and risers to the approval of the S.O.

## **8.2 In-Situ Terrazzo**

In-situ terrazzo shall consist of one part approved coloured cement and three parts selected limestone chipping passing through 12mm mesh and retained upon 3mm mesh by volume. The terrazzo topping shall be 20mm thick laid on 20mm thick cement and sand (1:3) screed. The concrete base to receive the screed shall be

thoroughly cleaned and wetted. While laying the screed, aluminium or brass strips of size 32mm wide x 3mm thick shall be set in vertically on edge into the screed to form panels. Each panel shall not exceed 4 sq. metres with top edges of the strips standing sufficiently high to finish flush with the finished terrazzo floor level. The terrazzo shall be trowelled to a dense even finish. When sufficiently hard but not less than two days after being laid it shall be rubbed down to a smooth surface by means of Carborundum stone. Tile impregnator then shall be applied strictly in accordance to the manufacturer's instructions onto the terrazzo surface to prevent future staining. Unless otherwise specified or described in the Bills of Quantities, terrazzo skirtings and girths shall be of 100mm high x 20mm thick rounded at top and coved at bottom. The edge of the threshold and treads of concrete stairs shall be finished with 150mm x 76mm x 12mm vitreous non-slip nosing tiles of approved colour laid lengthwise bedded and pointed. The sides of open stringers shall be finished with in-situ terrazzo working to profile of treads and risers to the approval of the S.O.

### **8.3 Precast Concrete Paving**

Precast concrete paving slabs shall be of size 600mm x 600mm x 50mm thick each and made of 1:2:4-20mm concrete reinforced with 'A6' fabric reinforcement to MS 145. The top surfaces of slab shall be brushed with stiff broom or wire brush after the initial set to give a rough finish. Paving slabs shall be laid to the pattern as existing or approved by the S O. The slabs shall be bedded on 25mm thick semi-dry cement and sand (1:3) screed laid on 100mm properly compacted and blinded hardcore. The joints shall be 20mm wide filled with cement mortar (1:3) and raked to a depth of 6mm.

### **8.4 Interlocking Concrete Paving**

Interlocking concrete paving shall comprise of segmental interlocking concrete paving units laid on minimum 30mm thick sand bedding course. The grade of the concrete and the thickness of the paving unit shall be as detailed in the Drawings. Concrete edge restraints shall be provided at the perimeter of the pavement to ensure the paving units are tightly abutted and to separate areas of different laying pattern. The gap between paving units shall be filled with fine sand of different grading to that required for the bedding sand. The pavement which has been laid shall be compacted by vibrator.

### **8.5 In-Situ Concrete Paving Footpath**

In-situ concrete paving shall consist of 75mm thick concrete of 1:3:6-20mm mix by volume as specified in SECTION D: CONCRETE WORK, laid on 100mm thick properly compacted and blinded hardcore to panels as existing or as approved by the S.O. The concrete shall be well compacted and floated with a wooden float to a

smooth and even finish. After the concrete has achieved the initial set, the surface shall be brushed with stiff broom or wire brush to give a rough finish. The joints between the panels shall be filled with approved cold-poured polyurethane joint filler.

## **8.6 Brick Pavings**

Bricks for paving shall be of semi-vitreous bricks 225mm x 75mm x 50mm thick of approved quality and colour. The bricks shall be soaked as specified in SECTION E: BRICKWORKS before laying and shall be laid flat on 25mm semi-dry cement and sand (1:3) screed with 6mm spacing to the pattern as existing or as approved by the S.O. The screed shall be laid on 75mm thick concrete (1:3:6-19mm) base founded on properly compacted and blinded 100mm thick hardcore. The joints shall be filled with cement mortar (1:2) and finished flush.

## **9.0 TILING WORK**

### **9.1 Precast Terrazzo Tiles**

Unless otherwise specified, precast terrazzo tiles of an approved manufacture shall be 300mm x 300mm x 20mm thick machine-pressed tiles comprising of 6mm limestone aggregate and coloured cement. The tiles shall be soaked prior to laying and shall be laid butt jointed on 20mm thick semi-dry cement and sand screed. The laying shall be done while the screed is still green. All joints between the tiles shall be grouted with coloured cement to match. The tiles shall be rubbed down to a smooth surface after a minimum of two days or laying by means of Carborundum stone. Tile impregnator shall then be applied strictly in accordance with the manufacturer's instructions on to the terrazzo surface to prevent future staining. All skirtings, girths, edges of threshold and treads etc. shall be as described for insitu terrazzo.

### **9.2 Mosaic**

Unless otherwise specified, mosaic tiling to floors shall be semi-glazed tiles and shall be of an approved colour and manufacture. Unless otherwise specified, mosaic tiling to walls shall be fully glazed tile and shall be of approved colour and manufacture. Unless otherwise specified or described in the Bills of Quantities, all skirtings shall be 100mm high to match floor tiling. The tiles at the bottom of the skirting shall be set at 45 degrees to the horizontal and the top finished with cove tiles. The tiles required to form angles to skirting shall be neatly cut and fit to all abutments. Mosaic tiling to floors shall be bedded on 20mm thick semi-dry cement and sand (1:3) screed, laid on the concrete base which has been thoroughly cleaned and wetted. Mosaic tiling to walls shall be evenly buttered with cement paste before bedding on

20mm thick cement and sand (1:3) screed which has sufficiently hardened. Alternatively the tiling shall be bedded with 6mm thick approved adhesive onto the screed. During bedding, the surface of the mosaic shall be checked and any unevenness shall be made good. Any misaligned or defective tiles shall be adjusted or replaced. All joints shall be grouted with approved adhesive or cement grout to match. The tiling shall be allowed to mature under damp condition for at least four (4) days before cleaning down.

### **9.3 Quarry Tiles**

Quarry tiles shall be of non-slip type 150mm x 150mm x 12mm thick complying with MS 1088, 1089, 1090 and 1091. The tiles shall be bedded on 20mm thick semi-dry cement and sand (1:3) screed with joints about 2mm wide, laid on the concrete base which has been thoroughly cleaned and wetted. All tiles shall be soaked overnight before laying. All skirtings shall be 100mm high with rounded top edge to match the tiles flooring. The tiles required to form angles to skirting shall be neatly cut and fit to all abutments.

### **9.4 Glazed Wall Tiles**

Unless otherwise specified, glazed wall tiles shall be 200mm x 200mm x 6mm thick cushion-edged glazed tiles complying with MS 858. The tiles shall be bedded with cement paste or alternatively with 6mm approved tile adhesive on 20mm thick cement and sand (1:3) screed which has sufficiently hardened. The surface of the screed shall be properly roughened to form key to the tiling. The tiles shall be laid closed-butt and all joints shall be filled with adhesive or approved white cement. Exposed edges of tiling shall be finished with rounded on edge tiles.

### **9.5 Ceramic Tiles**

Unless otherwise specified, ceramic tiles for floor shall be vitreous hard wearing non-slip glazed tiles 200mm x 100mm x 12mm thick complying with BS 6431. Unless otherwise stated in the Drawings or described in the Bills of Quantities, ceramic tile skirtings shall match flooring and shall be 200mm x 100mm x 12mm thick laid lengthwise on cement and sand (1:3) screed as described. All angles to skirting shall be neatly cut to fit all abutments. Unless otherwise stated in the Drawings, nosing and edging tiles to edges of flooring and treads of concrete stairs shall be of an approved type and to match with the flooring. Unless otherwise specified, ceramic tiles for walls shall be scruff-resistant glazed tiles 200mm x 100mm x 6.5mm thick complying with MS 858. Unless otherwise stated in the Drawings, all ceramic tiles shall be of approved colour and manufacture. Ceramic tiles shall be bedded with

cement paste or alternatively with 6mm thick approved tile adhesive on 20mm thick cement and sand (1:3) screed as described. The tiles shall be laid close-butt and all joints shall be filled with tile adhesive or coloured cement to match.

#### **9.6 PVC Tiles/Sheets**

PVC tiles or sheets shall be of approved pattern and colour. PVC tiles or sheets are to be of non-slip type and shall comply with MS 602. Tiles shall be 250mm x 250mm x 2mm thick. Sheets shall be 1.5m wide x 2mm thick. The tiles or sheet shall be laid and jointed on 20mm thick cement and sand (1:3) screed with an approved waterproof adhesive strictly in accordance with manufacturer's instructions. The screed shall be finished smooth with a steel trowel to an even surface and shall be dry, clean and free from dust and sand before laying the tiles and sheets. 4.6.3 Accessories such as skirting, stair nosing, edging strips etc. shall be of the same manufacture from similar material to match flooring. Unless otherwise described skirting shall be 100mm high; stair nosing shall be 60mm wide laid full length of the treads and of bullnose profiles; and edging strips shall be 25mm wide. 4.6.4 On completion, the flooring shall be well-cleaned and treated or polished in accordance with the manufacturer's instructions.

#### **9.7 Timber Strip Flooring**

Unless otherwise specified, timber strip flooring shall be ready-made, laminated three ply timber strip or floor board of approved manufacture. The timber species for use in timber strip flooring shall be as specified in CARPENTRY, JOINERY AND IRONMONGERY WORKS. The nails shall be punched below the surface and the holes filled with approved putty. Any jointing of the skirting shall use splayed butt joints. The face edges of the flooring shall be lined with wrot timber edging to match. The edging strips shall be fixed to the base using adhesive as specified. Edging strips shall be jointed using glued splayed butt joints. After sanding the flooring shall be cleaned, any gap sealed with approved sealer, stained and finished with three coats of approved polyurethane paint. Each coat shall be applied strictly in accordance with the manufacturer's instructions.

#### **9.8 Parquet Flooring**

Unless otherwise specified, parquet tiles shall be ready-made 120mm x 120mm x 10mm thick consisting of 120mm x 25mm x 10mm pressure treated kempas, keruing or other approved medium hardwood timber battens. The timber species for use in parquet flooring shall be as specified in SECTION CARPENTRY, JOINERY AND IRONMONGERY WORKS. The flooring shall be laid to the pattern as approved by the S.O. Any misaligned or defective parquet shall be adjusted or replaced. Any jointing of the skirting shall use splayed butt joints. The face edges of the flooring

shall be lined with wrot timber edging to match. The edging strips shall be fixed to the base using adhesive as specified. Any edging strips shall be jointed using glued splayed butt joints.

## **9.9 Homogenous Tiles**

Unless otherwise specified, homogenous tiles for flooring shall be of Gred A 300mm x 300mm x 8.5mm thick (interior flooring) and 100mm x 100mm x 11mm thick (exterior flooring) fully-vitrified hard-wearing, non-slip unglazed porcelain tiles of approved colour and manufacture. The tiles shall be bedded with cement paste or alternatively with approved tile adhesive 6mm thick complying with ANSIA 118.1-1992 on to 20mm thick cement and sand (1:3) screed as described hereinbefore. Accessories such as skirting (bull nose or cove base), step tiles, step nosings, edging strips, angle tiles (internal and external), etc, shall be of standard manufacture from the same material to match flooring. Unless otherwise shown in the Drawings, skirtings shall be 77mm high, stair nosing 20mm wide laid full length of the treads and of bull nose profile, and edging strips 25mm wide. The tiles shall be laid closed-butt with joints not exceeding 3 mm wide and shall be filled with coloured grout mixed with grout admix. For polished tiles, tile impregnator solution shall be applied before grouting to prevent grout haze. On completion, the tiles shall be well-cleaned with tile cleaning solution.

## **9.10 Granite Slabs**

Unless otherwise specified, granite slabs shall be 600mm x 600mm x 25mm thick shall be bedded with cement paste or alternatively with 9mm thick approved tile adhesive onto 25mm thick cement and sand (1:3) screed as described hereinbefore. The slabs shall be laid butt-jointed. Any gap shall be filled with approved grout powder mixed with grout adhesive. After grouting, the surface then shall be polished, buffered and finished with a layer of impregnator. If used in wet or exposed areas, or on ground floor, waterproofing system shall be installed prior to laying of granite slabs.

## **9.11 Marble Slab**

Unless otherwise specified, marble slabs shall be 600mm x 600mm x 25mm thick shall be bedded with cement paste or alternatively with 9mm thick approved tile adhesive onto 25mm thick cement and sand (1:3) screed. The slabs shall be laid butt-jointed. Any gap shall be filled with approved mixture of the adhesive and grout powder. After grouting, the surface then shall be polished, buffered and finished with a layer of impregnator. If used in wet or exposed areas, or ground floor, waterproofing system shall be installed prior to laying of marble slabs.

## **10.0 WATER SUPPLY PLUMBING, SANITARY AND RAINWATER GOODS INSTALLATION**

### **10.1 Water Supply Plumbing**

The whole of the water supply plumbing and installation shall be executed by a licensed plumber having valid and relevant license issued by the relevant state water authority. The Contractor shall at his own cost be responsible for employing the licensed plumber, and shall be responsible for all the work performed by the licensed plumber. All water supply plumbing and installation shall be executed in accordance with the relevant state water supply rules and to the approval of the state water authority, notwithstanding any approval given by the S.O. All pipes, fittings and equipment used for water supply plumbing and installation shall be of the type and make approved by the relevant state water authority.

### **10.2 Pipework**

Pipework for water supply plumbing shall be to the dimensions shown or as specified hereinafter and shall be complete with all bends, tees, sockets, plugs, reducers, brackets, supports and everything else necessary to complete the installation. Unless otherwise shown, the unplasticized polyvinyl chloride (uPVC) pipes and fittings shall be executed in approved Class 7 of MS 762 for sizes 50mm and below. For sizes greater than 50mm, a minimum pressure rating of approved Class 'E' of MS 628 (PN 15) (equivalent to 12 bar derated at 30oC) shall be used. Both Class 7 of MS 762 and Class 'E' of MS 628 uPVC pipes and fittings shall comply with BS 6920 or MS 1583 on their effects on drinking water quality. Solvent cement used for both types of pipe and fittings shall be approved in accordance with MS 628. All uPVC pipes, fittings and solvent cement shall be supplied by the same manufacturers.

Where polyethylene (PE) pipe is used, unless otherwise stated shall have a minimum wall thickness and pressure rating of PN 12.5 at 20oC (equivalent to 10 Bar derated working pressure at 30oC) and manufactured to MS 1058 or EN 12201. All PE pipes used shall be marked with SIRIM certification numbers. All metal fittings moulded integrally shall be dezincified brass with BSP threads to CZ132 of BS 2872 or BS 2874 and Nickel & Chromium plated to BS 1224, service condition No. 2, classification number Cu/Ni 10b Crr.

Where stainless steel pipe (suitable for cold and hot water) is stated or shown, all service pipes, pump delivery pipe works, plumbing works below and above ground level shall be welded austenitic stainless steel pipes ( using Schedule 40S pipes for sizes ranging ½" to 2" diameter and threaded, and Schedule 10S pipes for 2" to 8" Diameter pipes by way of welding ) manufactured according to ASTM A312/A312M

together with stainless steel butt-welding fittings manufactured according to ASTM A403/A403M or stainless steel screwed fittings manufactured according to ASTM A351/A351M.

However for pipe work in plumbing above ground level (which include service pipes, pump delivery pipe works), as an option, stainless steel tubes manufactured according to BS4127 specification for light gauge stainless steel tube, primarily for water application, may be used. It shall be made of stainless steel material grade 304 S15 of BS 1449 Part 2. Compression fittings and capillary fittings made in accordance with the following standards shall be used with stainless steel tubes conforming to BS 4127:

### **10.3 Stop Valves**

High pressure full way brass screw-down stop valves of the same diameter as the pipe shall be provided and fixed for control in the following positions:

- i) On the service pipe before it enters the building.
- ii) On each branch of the service pipe.
- iii) On the inlet to each storage or feed cistern.
- iv) On the inlet to each flushing cistern.
- v) On the outlet of each storage or feed cistern.
- vi) In other positions on the pipe as shown or indicated, other than on overflow/warning pipe. All stop valves shall be of the type approved and complied with MS 1022.

### **10.4 Water Tank**

Storage tank for water supply shall be of the type and capacity shown or stated in the Drawings. The storage tank shall be watertight and properly supported. The storage tank shall be provided with dust and mosquito-proof cover. The cover shall be so constructed that it shall not be airtight. The storage tank shall be provided with a high pressure ball valve to BS 1212 on the inlet and of the same size as inlet pipe. Overflow/ warning pipe, scour pipe and outlet tapping shall be in accordance with the relevant state water supply rules. The scour and overflow/warning pipe shall discharge outside the building or to a point shown or stated in the Drawings.

### **10.5 Examination, Test and Approval of Water Supply Plumbing**

If required by SO on completion of all the water supply plumbing and fittings installation, the Contractor shall notify the relevant state water authority that they are ready for examination and test and the Contractor shall carry out the test as required by the state water authority.



## **11.0 SANITARY INSTALLATION**

### **11.1 Fittings**

Unless otherwise specified, all fittings including all necessary brackets and accessories shall be as scheduled in Table A1 hereinafter. The Contractor shall be responsible for determining the type of trap required for each fitting. All necessary concrete backing shall be provided to fittings secured to floors.

### **11.2 Water Supply Plumbing for Low Pressure W/C Flush Valve and Low Pressure W/C Flushing Cistern**

A separate internal plumbing system shall be provided for low pressure w/c flush valves to have adequate dynamic pressure and flow, to ensure effective operation of each flush valve, i.e. for hydraulics of water closet to function properly. Alternatively water supply to flush valves for w/c pan shall be derived from a feeder tank which is isolated from the potable water supply main and is not connected in any way with all other fittings serving to basins, sinks, heaters etc. in the building. The following requirement for each low pressure w/c flush valve as in Table A2 shall be followed in the design of internal plumbing for flush valve system.

### **11.2 Cast Iron Soil, Waste and Vent Pipes**

Where shown or stated in the Drawings, 100mm diameter cast iron soil and vent pipes internally coated with anti corrosive bituminous coating shall be provided, fixed and connected to the fittings and sanitary system. The pipe shall be jointed with an approved resin with molten lead and well caulked. All necessary bends, branches, offsets, inspection pieces, hopper heads, holder bats shall be provided where necessary. Vertical stacks shall terminate 600mm above roof level with open ends and provided with approved galvanised balloon grating. Where shown or stated in the Drawings, 50mm diameter anti siphonage pipes of similar quality as above shall be provided and fixed. Galvanised wrought iron waste pipes of the same diameter as the outlet served shall be provided and fixed to fittings complete with all necessary bends, tees, sockets, plugs, etc.

**Table A1 SCHEDULE OF SANITARY FITTINGS**

TYPE	DESCRIPTION
1. Wash Basins	<p>a) 560mm x 410mm wash basin in approved colour vitreous china complete with chromium plated tap, blank tap hole stopper, 30mm 'p' or 's' trap with 40mm seal, waste fittings, plug with chain and painted bracket supports.</p> <p>(b) Ditto, but with two chromium plated tap, marked 'hot' and 'cold' (for cold and hot water supply only).</p>
2. Vanity Tops	<p>(a) Vanity top as specified, with integrated sink as shown in the Drawings, complete with chromium-plated tap, blank tap hole stopper, 30mm 'p' or 's' trap with 40mm seal, waste fittings and plug with chain.</p> <p>(b) Vanity top as specified, but with holes pre-punched to receive an under-counter vanity basin and tap respectively, as shown in the Drawings, complete with 555mm x 415mm under-counter vanity basin in vitreous china, complete with chromium-plated tap, 30mm 'p' or 's' trap with 40mm seal, waste fittings and plug with chain, and painted bracket supports.</p>
3. Sink	<p>(a) 600mm x 400mm x 200mm earthenware plain edge sink in white fireclay complete with chromium plated tap, 40mm 'p' or 's' trap with 40mm seal, waste fittings, plug with chain and painted cast iron brackets.</p> <p>(b) Metal sinks in stainless steel to size and shape as shown in the Drawings, complete with chromium plated tap as required, 40mm 'p' or 's' trap with 40mm seal, waste fittings, plug with chain and painted cast iron supports.</p>
4. Water Closet	<p>(a) Pedestal closet in white vitreous china conforming to MS 1522:2001 or JKR Standard Specification 20200-0110-01 complete with pedestal pan, 'p' trap and ventilation outlet, plastic hinged seat and rubber buffers.</p> <p>(b) Squatting closet in white vitreous china conforming to MS 1522:2001 or JKR Standard Specification 20200-0110-01 complete with pair of raised foot treads in white fire clay with 'p' trap and 40mm diameter uPVC flush pipe.</p>
5. Urinals	<p>(a) Single urinal bowl in white vitreous china conforming to JKR Standard Specification 20200-0131-01 or AS 3982:1996 complete with back inlets, hangers and steadying brackets, 40mm outlet with hinged gratings and 50mm uPVC waste pipe.</p> <p>(b) Urinal range of 2 or more bowls as (a) but with white vitreous china division between bowls.</p>
6. Cistern for water closet	<p>(a) All W/C Cisterns shall be low pressure or Type B flushing cisterns conforming to JKR Standard Specification 20200-0160-03. Note: Type B flushing cistern – flushing cistern complete with low pressure inlet valve that at 34.5Kpa (5psi) static pressure and 0.1 litre /sec flow rate, the time taken for refilling 6 litre of water through the inlet valve into the cistern shall be within 60 secs after flushing. The dynamic pressure at the inlet of the inlet valve shall be not less than 31.8 kpa.</p> <p>(b) Single flush 6 litres or dual-flush 6 / 3 liters low level vitreous china</p>

Table A2 – Low Pressure W/C Flush Valve

Requirement	W/C Flush Valve
a) Dynamic/ operating head at the inlet of flush valve	3.25 m
b) Flow rate	1.8 litres/ sec

The waste pipes shall be carried through walls and angled to flow into concrete surface drains or if from upper floors connected to the waste or soil stack as shown in the Drawings. Cast iron waste pipes shall be as specified hereinbefore for soil pipes and shall be of an adequate diameter unless otherwise detailed in the Drawings.

## 12.0 RAIN WATER GOODS

### 12.1 Flashing

Unless otherwise specified, all flashing shall be of aluminium sheet, free from cracks, dross, scales, excess blisters and any other defects which might be detrimental to its wearing or working properties. Sheets shall be reasonably flat before forming and cutting. All aluminium sheets used for flashing shall be at least 1.2mm thick. Flashing shall have a minimum depth of 180mm with the upper edge turned into the wall and pointed in cement. Where nails or screws are used for fixing, they shall be of the heavily galvanised type. The flashing work shall be performed by skilled workmen.

### 12.2 Gutters

Where gutters are to be provided they shall conform to the shape, dimensions and materials existing. All gutters shall be provided and fixed complete with all necessary angles, squares and obtuse, stop end, outlets and other necessary gutter fittings. 3.2.1.2 Gutter outlets shall be located at the position existing and each provided with a galvanised iron wire balloon grating. All gutters other than those of reinforced concrete shall be properly fixed and adequately supported and all necessary brackets shall be provided. Brackets shall be of the type and pattern that will conform to the profile of the gutter and unless otherwise shown or stated in the Drawings, shall be of galvanised steel screwed to the fascia. Unless otherwise shown or stated in the Drawings, all gutters shall be laid to a minimum fall of 12mm in 1m with properly constructed laps or joints

### 12.3 Rainwater Downpipes

Where rainwater downpipes are to be provided (Class 'C' UPVC Pipe), they shall conform to the shape, dimensions and materials existing and fixed in the position indicated therein to receive the gutter outlets. All downpipes shall be provided complete with all necessary fittings including rainwater heads, rainwater shoes, radius, bends, offsets and everything else required. Outlets in flat roof and balcony

connected to downpipe shall be provided with an approved uPVC or stainless steel grating. All downpipes and fittings shall be properly installed and adequately secured into position using necessary clamps, brackets or holderbats. Unless otherwise specified, clamps, brackets or holderbats shall be secured using approved galvanised nails or screws driven not less than 8mm into hardwood plug or other approved plugs in walls or columns.

### **13.0 GLAZING WORK**

Cracked or broken glass shall be removed and disposed of by the contractor. Glazing compound or sealant shall be removed. Preparations and installation of glazing shall be in accordance with the manufacturer's application recommendations. Replacement glass shall be installed the same day damaged glass is removed. If this is not possible, the contractor shall completely close and seal the window opening with ½ -inch exterior grade plywood and plastic. Plywood shall be secured on the exterior and shall be mounted to deflect rain from the building. Temporary enclosures shall be subject to approval by the Contracting Officer. Temporary enclosure and plywood shall be used for emergency service orders if glass is a special order. Temporary enclosure shall be replaced with permanent glass installation within 2 working days. The replacement glass for exterior doors shall be of the same type and tempered as the original. The contractor shall clean all replacement glass and glazing after installation.

#### **13.1 Glass**

All glass shall conform to MS 1135 and shall be free from bubbles, specks and other defects. Samples shall be submitted for the approval of the S.O. Unless otherwise specified, the type and thickness of glass and sealants shall be as existing.

#### **13.2 Sealants**

Unless otherwise specified, sealant shall be silicone, polysulphide or other approved type applied in accordance with the manufacturer's instructions. The putty for glazing shall be of an approved type and shall comply with BS 544.

#### **13.3 Glazing**

All doors, windows, etc. except louvred windows shall be glazed as specified. All glass shall be cut to size with 2mm clearance all round the rebates. All exposed edges of glass panes shall be rounded off. All glazing works shall be carried out strictly in accordance with the manufacturer's instructions. Figured or textured glass surface for windows shall be installed facing the interior.

#### **13.4 Cleaning on completion**

On completion, all glass shall be cleaned both inside and outside and any broken, cracked or defective panes shall be replaced to the approval of the S.O.

## 14.0 PAINTING WORK

### 14.1 General

Paints shall contain no mercury or lead. All paints to be used shall be those supplied by approved manufacturers. The quality of paints shall comply with **MS 125** in respect of oil/ enamel paints and **MS 134** in respect of emulsion paints/acrylic paint.

Paint color shall match the existing unless otherwise ordered. When viewed from 5 feet away, painted surfaces shall be uniform in : texture or smoothness; color and reflectance. There shall be no dents, runs, holes, peeling paint or sharp edges. Patches and repairs shall blend into surrounding areas. Completed areas shall be clean, dry to touch, non-chalking with no objectionable odor and no stained or wet areas.

All overspray, paint splatterings, runs and drops left by the Contractor shall be removed. Paint as described in the previous sentence shall be removed from all appliances, electrical fixtures, rubber, glass, switchplates, receptacles, covers, screens, hardware and window runners. Do not paint any of the items listed in this paragraph. For painting purposes only, hardware is defined as: Barrels of cabinet hinges and door butts, exposed bathroom p-traps, exhaust fan covers, escutcheons, strike plates, window latches, thresholds, bathroom accessories, door knobs and finger pulls. Do not remove paint from previously painted hinges. Factory finished hinges (not previously painted) shall not be painted.

Paint surface to produce complete hiding. The contractor shall move and protect occupant's furniture and UiTM property during work performance in order to accomplish the work. All property shall be protected. The contractor shall move and reset all property in vacant buildings as required to accomplish the work. The contractor shall not apply paint, unless approved by the S.O. Surface to be painted shall be free of water, dew or frost. The contractor shall furnish, upon the S.O request, the paint supplier's batch production data and test results for weight per gallon, viscosity, fineness of grind, drying time, color and gloss.

The contractor shall use compatible paint over existing paint or prime existing paint with a paint manufacturer's standard conditioner prior to painting, at no additional cost to the UiTM.

The contractor shall remove rust and oxidation from metal to be painted. The contractor shall prime all bare metal with a zinc chromate paint prior to painting, except radiators shall be primed using a paint manufacturer's heat resistant (450° F) primer. The contractor shall clean galvanized and zinc/copper alloy surfaces with an acid wash. The contractor shall apply a galvanized primer prior to painting and within 2 hours after the acid wash.

### **13.2 Surface Preparation**

Surfaces to be painted shall be dry, free from dirt, oil, grease, old loose paint and other deleterious matter. All cracks shall be raked out and stopped and all holes and dents shall be filled. Contractor shall use a wet scraping method for removing any loose and peeled paint. If this condition is not present this step may be omitted.

### **13.3 Repainting Existing Timberwork**

All ironmongeries except hinges shall be removed before painting begins and shall be carefully refixed. Where repainting to existing timber work is specified, the following procedure shall be adhered to. If the surface is intact, it shall be rubbed down with fine sand paper to the approval of the S.O. Then one coat of undercoat shall be applied followed by two coats of gloss enamel paint unless otherwise specified. Where cracking and flaking have occurred, the entire existing paint shall be removed by burning off or by use of paint remover as approved by the S.O. The surface shall then be thoroughly cleaned and shall be applied with one coat aluminium wood primer followed by one undercoat and unless otherwise specified by SO, shall be finished with two coats of gloss enamel paint.

### **13.4 Repainting Existing Steel and Ironwork**

Where repainting to existing steel or ironwork, the following procedure shall be adhered to. Where a firm surface exists, it shall be scuffed with fine sand paper to the approval of the S.O. and spot primed if necessary before the application of one undercoat and unless otherwise specified, shall be finished with two coats of gloss enamel paint. If the old paint is in a bad, deteriorated condition the whole paint shall be removed by the use of approved paint remover or by scraping as approved by the S.O. The surface shall be thoroughly cleaned and shall be applied with one coat approved metallic primer, one undercoat and unless otherwise specified, shall be finished with two coats of gloss enamel paint.

### **13.5 Repainting Existing Plastered or Masonry Surfaces**

Where repainting to existing plastered or the masonry surface is specified, the following procedure shall be adhered to. If existing paintwork is still intact, the surfaces shall be washed down and applied with two coats of emulsion paint. If the existing paintwork is loose or chalky, the paint shall be removed by scraping and the surface shall be washed. All cracks and other imperfections shall be made good and the surface allowed to dry completely. The surface shall then be applied with one coat approved alkali resisting primer sealer and, unless otherwise stated in the Drawings, followed with two coats of emulsion paint. Where specified, acrylic paint

to MS 134 shall be applied on new or existing surfaces such as brickwork, plaster and cement rendering in accordance with the manufacturer's instructions. Acrylic painting work shall be carried out by painting applicator approved by approved manufacturer. Prior to commencement of the painting work, the Contractor shall submit to the S.O the following

### **13.6 Revarnishing to Existing Timberwork**

Where revarnishing to timberwork is stated in the Drawings or described in the Bills of Quantities, the surface shall first be thoroughly scuffed to remove the existing varnish. The surface shall then be smoothened with fine sand paper, cleaned, dried and free from dust, dirt and wax. It shall then be varnished as described hereinbefore for new timberwork

### **13.7 Completion of Painting Work**

On completion of paintwork, all paint marks inadvertently left on glass, floors, tiles and other surfaces shall be removed. Any stain or marking on finished paintwork shall be removed and touched up to the approval of the S.O.