S1 CONCRETE WORKS

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1 GENERAL

1.1 CROSS REFERENCES

1.1.1 General

Refer also to:

- "General Conditions of Contract" which shall apply to this section of the works.
- "PG1 - Preliminary and General" worksection.

2 SCOPE OF WORK

2.1 GENERAL

2.1.1 Works

The work includes furnishing all labour, plant, equipment and materials in connection with the supply, mixing and placing of all concrete and the supply, fabrication and erection of all reinforcing steel, together with all other associated trade work, complete as shown, as specified, or as necessary.

The Contractor shall make provisions and preparations and do all necessary work to receive or adjoin other work.

The Contractor shall be responsible for installation of fixings, etc., embedded in concrete, provision of holes, openings, etc., necessary to execute work of other trades.

Inspect embedded items and check accuracy prior to placing concrete.

Concrete, formwork and reinforcing steel requirements shall be as BS 5328 and BS 4449, except where modified by this Specification.

The Contractor shall ensure that copies of this standard are available on site for reference.

2.2 APPROVED SUBCONTRACTORS

The Contractor shall not sublet the work of this trade or any section of this trade without the approval of the Client.

2.3 ORDER OF WORK

The order of carrying out the Concretor's work shall be agreed with the Client, and shall conform to that agreed.

2.4 DRAWINGS

All plain and reinforced concrete work specified hereafter shall be carried out in strict accordance with the Structural Drawings, the Architectural Drawings and future details.

2.5 TESTS

2.5.1 Frequency of Tests

The Contractor as a minimum shall undertake 1 set of concrete tests for pours less than 12 m3.

For pours greater than 12 m3, 1 set of tests shall be undertaken for every 3 delivery trucks or 20 m3.

The tests shall be undertaken by a certified laboratory approved by the Client.

In addition to this, all delivery trucks supplying concrete for water tanks or other liquid containing structures shall have one set of test samples taken per delivery.

Each test set shall consist of three cubes tested at 7, 14 and 28 days.

The test results when evaluated statistically shall show a 0.95 probability of the specified strength being equalled or exceeded.

2.5.2 Costs of Tests

The costs of all materials, labour, transport, fees etc. incurred in testing shall be borne by the Contractor.

2.5.3 Standards of Tests

Concrete Compression Tests Shall Be Carried Out As BS 1881 : Part 116 : 1983

Concrete slump tests shall be carried out as BS 1881

2.5.4 Reinforcing

The Contractor shall, on request, demonstrate to the Client that all reinforcement complies with the Specification and produce manufacturer's certificates and certificates of origin.

2.6 STANDARD SPECIFICATIONS

2.6.1 References

This Specification shall be read in conjunction with BS 8110-1:1985 Structural use of concrete. Code of practice for design and construction.

All materials and workmanship shall comply with that Standard unless expressly noted otherwise.

In the event of this Specification being at variance with any provision of this Standard, the requirements of this Specification take precedence over the provisions of the Standard.

Reference to any Standard shall include any amendments thereto and any Standard in substitution therefor.

2.7 STANDARDS TABLE

2.7.1 General

The following British standards shall also apply:

Standards Table

Standard		Description
BS 8110 : 1985	-	The structural use of concrete
BS 6399 : 1	-	Loading for buildings - Dead and imposed loads
BS 6399 : 2	-	Loading for buildigs - Wind loads
BS 12	-	Portland cement
BS 812	-	Methods for sampling and testing of mineral aggregates, sand and fillers
BS 882	-	Aggregates from natural sources for concrete
BS 1881	-	Methods of testing concrete for strength
BS 1296	-	Ready mixed concrete
BS 3148	-	Tests for water for making concrete
BS 1305	-	Batch type concrete mixers

BS 3963	-	Methods for testing the mixing performance of concrete mixers
BS 4251	-	Truck type concrete mixers

And any relevant recent updates of these standards.

3 MATERIALS

3.1 CEMENT

3.1.1 Portland Cement

Portland Cement (and rapid-hardening Portland Cement if used under conditions mentioned in Clause "3.1.2 – Special Cements" shall conform in every respect with the requirements of BS 12 : Portland cement

The brand of cement used shall not be changed without the Clients approval.

3.1.2 Special Cements

Quick setting or other special cements shall not be used without the permission in writing of the Client and only under such conditions as the Client may require and set down in writing.

No extra costs arising from the use of special cements will be accepted unless such special cement is specified.

3.1.3 Tests

See Clause "2.5 – Tests" relating to testing.

Notwithstanding the production of Certificates of vendor's tests and analyses as provided by BS 1924-2:1990 Stabilized materials for civil engineering purposes. Methods of test for cement-stabilized and lime-stabilized materials. The Client may at his discretion, require that, after the cement has been brought on to the works, such further tests shall be made as he considers necessary to ensure that the cement complies with the specification.

If the Client requires further tests to be made, the cement shall not be used without his permission.

3.2 AGGREGATES

3.2.1 Fine Aggregates

Fine aggregates shall consist of natural sand or of sand prepared from stone, gravel or other material, provided that the full requirements of BS 882 Aggregates from natural sources for concrete are met.

3.2.2 Coarse Aggregates

Coarse aggregate shall consist of gravel, crushed stone, or crushed gravel or other inert materials of similar characteristics or combination thereof, have hard, strong durable pieces, free from adherent coatings, provided that the full requirements of BS 882 Aggregates from natural sources for concrete are met.

The nominal maximum size of coarse aggregate shall be 20 mm unless otherwise approved or specified by the Client.

3.3 WATER

3.3.1 Supply

All water used in mixing with cement for concrete, mortar or grout, in cleaning out or wetting forms, in washing materials or in curing concrete shall be clean and fresh and where available, direct from the Local Authority mains.

All water used in mixing of concrete, mortar, in washing of aggregates shall be refered to the requirement of BS 3148 and the results shall be submitted to the consultant for approval.

3.4 REINFORCING

3.4.1 Steel bars for the reinforcement of concrete

Steel bars for the reinforcement of concrete shall conform to the requirements of BS 4449 – Hot rolled steel bars for reinforcement of concrete

3.5 FORMS

3.5.1 General

Refer Clause "4.1 – Formwork and Falsework".

3.5.2 Tolerances

The standard of the forms shall be such that finished concrete work shall be within the following maximum tolerances:

Tolerances table

Location	Tolerances	
Storey height:	+3 mm	-6 mm
Openings in walls:		
• Out of plumb	+3 mm	-3 mm
Dimensions:		
• Height	+3 mm	-6 mm
• Breadth	+3 mm	-6 mm
Member thickness:	+3 mm	-3 mm

3.5.3 3,000 straight edge test

Notwithstanding the above, a 3,000 mm straight edge placed in any direction on the surface of the formwork shall not disclose deviation in excess of 2 mm.

3.6 ORIGIN AND SUPPLY OF MATERIALS

3.6.1 General

It shall be the responsibility of the Contractor to obtain the maximum possible uniformity of colour in the concrete for external walls and thus the cement, sand and aggregate shall be from one origin and one supplier for the whole job.

The origin and supplier of the materials shall be approved by the Client.

3.7 CONCRETE GRADES AND MIXES

3.7.1 Cube Strength

The following 28 days standard cured crushing strength concretes are specified for this Contract:

- 30 MPa minimum throughout except as noted otherwise in this Specification or on the drawings.

3.7.2 Certified Supplier

Except as expressly specified to the contrary elsewhere, concrete shall be special grade concrete obtained from a Plant certified by the Ready Mixed Concrete Association as capable of making Special Grade Concrete.

3.7.3 Client Approved Supplier

Concrete manufactured under conditions in every respect complying with British Standards for Special Grade concrete, but obtained from another Plant approved by the Client.

If the Contractor wishes to employ such a firm, application for the Client's approval for their employment shall be made in writing to the Client at least two weeks before Tenders close, to enable the Client to inspect the proposed plant and approve it, or otherwise.

Such application shall be accompanied by a letter signed by the Registered Client in charge of concrete making for the firm in question, certifying that their equipment complies with British Standards for Special Grade concrete and setting out the mixes it is

proposed to use on this Contract, and consistency of results obtained therefrom.

3.7.4 Surface Finish

For concrete at all surfaces which will be visible on completion of the works, the absolute minimum cement content shall be 350 KG/m^3 mixed concrete, regardless of lesser quantities being allowed by the cement manufacturer of concrete grade for the relative structure.

The Contractor shall allow for supplying greater cement content than this, should that be necessary to achieve the specified surface finish.

3.7.5 Screeds

3.7.6 In-Situ Batching

If the Contractor wishes to set up a concrete batching plant on site and manufacture concrete in site, he shall provide full details of equipment, mix proportions, cement source, method of achieving a consistent mix, control of water content etc.

3.8 CONCRETE DELIVERY

3.8.1 Dockets

Delivery Dockets shall be supplied by the producer for each load.

Dockets shall contain as a minimum the following information:

- Class of concrete.
- Date and time of mixing.
- Actual weight of cement in mix.
- Meterage delivered.
- Identifying number.
- Slump.
- Quantity delivered.

4 EXECUTION

4.1 FORMWORK AND FALSEWORK

4.1.1 General

Particular attention must be paid to the pattern of joints for surfaces which will be visible on completion of the work.

Boxing for all such surfaces must be BS 5975:1996- Code of practice for falsework and approved by the Client before fabrication is commenced.

4.1.2 Materials

Steel, wooden or plastic formwork (as FUVI brand formwork) can be used. However, it is advised to use steel or plastic formwork for this construction. Only to use wooden formwork for smaller structures / components for the construction when it is allowed by the Client.

4.1.3 Boxing

All concrete work shall be boxed unless specified to the contrary elsewhere in the Specification or expressly approved by the Client.

4.1.4 Joints

The formworks must be formed tightly so that the water from concrete will not leak during vibration, and at the same time, the concrete can be secured under the weather impact.

Since grout leakage in formwork may produce unacceptable blemishes in fairface work particular care must be taken to prevent such an occurrence.

4.1.5 Rigidity

Forms shall be designed so that the deflection of sheathing shall not exceed 1/300 of the span between supports,

They shall be of sufficient rigidity and strength to prevent distortion due to pressure from the concrete or other loads incidental to construction.

Construction shall be such that these surfaces can be stripped without disturbing the boxing or supports to beam or slab soffits, which may require to be left in place for a longer period.

4.1.6 Corners and edges

All external angles in exposed members shall be protected against injury after stripping.

Give slight bevel to all projections to ensure easy removal without damage to the concrete.

4.1.7 Wire Ties

Wire ties are prohibited in any member in which any face will be in contact with water, exposed to weathering, where discolouration may take place, or where finished concrete is exposed to view.

Where permitted by the Client wire ties shall be cut at least 50 mm below the surface of the concrete and the surface shall be properly pointed up with cement mortar.

4.1.8 Openings

All openings, sleeves, fixings, etc., shall be positioned according to the Drawings.

In particular, refer to requirements of other trades.

All penetrations now shown on the Structural Drawings shall be approved by the Client before work starts in that area.

4.1.9 Inspection Doors

Doors or openings required in the formwork for any purpose (such as treating construction joints or cleaning) shall be equipped with fasteners suitable to the pressure to be withstood.

Such openings shall be provided at suitable positions to facilitate cleaning to formwork before concrete is poured.

4.1.10 Temporary Fittings

Bolts and other temporary metal fittings used in formwork erection shall be constructed so as to permit their easy removal to a depth of at least 50 mm from the face without injury to the concrete, and so that upon their removal the cavities left are of the smallest possible size. The cavities shall be filled to the Client's directions.

4.1.11 Coating of Forms

No oil-based parting medium may be used.

The inside surface of all forms may be given a coat of approved material which shall not adhere to or stain the concrete or be incompatible with any final painting or treatment or alternatively shall be saturated with water immediately before placing concrete.

Except for water such coatings shall be applied prior to placing the reinforcing steel so as to avoid fouling of the surface of steel.

The same type of coating shall be used throughout the job unless otherwise approved.

4.1.12 Bulging

If, during a pour, undue settlement, bulging or other defects become apparent in the formwork, the Contractor shall cease pouring and shall take all necessary steps to remedy such defects.

Where such defect occurs in fairface surfaces, the Client must be immediately notified to enable a decision to be made on whether to continue the pouring when the defect has been remedied, provided that where such remedial work can be completed before the last concrete placed has hardened to the extent that is ceases to become plastic under vibration and where there is no danger of the quality of surface finish being affected the Contractor may elect to continue to pour.

Refer to Clauses “4.3.4 – Compaction”, “4.3.5 - Do Not Disturb Fresh Concrete” and “4.7.4 - Surface Blemishes”.

4.1.13 Forms Removal

This Clause is to be read in conjunction with Clause "4.5 – Curing".

4.1.14 Cleaning

Immediately before any concreting is commenced, formwork shall be carefully examined to see that all dirt, shavings, sawdust and other refuse has been removed.

See also sub-clause "4.1.12 – Bulging".

4.1.15 Re-used Formwork

Sound, unwarped forms may be re-used provided they satisfy all the specified requirements.

They must be thoroughly cleaned each time before re-use, and may need to be resized, retightened or repaired all as directed by the Client.

4.2 FABRICATION AND PLACING OF REINFORCEMENT

4.2.1 References

Refer to "S2 - Reinforcing Steel" of this Specification.

4.2.2 Inspection before Concreting

No concrete shall be placed until the Client has had the opportunity to satisfy himself that all the requirements of this Section have been properly complied with.

To this end the Contractor shall give the Client two day's notice when he will pour concrete.

Such notice and inspection in no way relieves the Contractor of any obligation under the terms of the Contract.

Concrete poured in violation of the foregoing is liable to condemnation and removal at no extra cost to the Contract.

4.3 CONCRETE CONVEYING AND PLACING

4.3.1 Conveying

The method of conveying the concrete from the mixer to the place of deposit shall be such as to ensure that the concrete will be placed in its final position within 20 minutes of cessation of its mixing and so that segregation of the materials or water shall not occur.

4.3.2 Placing

Concrete must be placed as close to its final position as possible and must not be dropped a distance of more than 1500 mm.

Long chutes may be used with the Clients approval and under unavoidable circumstances.

Between approved construction joints, the concrete shall be deposited in continuous horizontal layers of such depth and at such rate that no concrete will be placed against concrete which has hardened sufficiently to cause the formation of seams or planes of weakness by reason of failure of the respective deposits to thoroughly unite.

The vertical depth of each deposit shall not exceed 600 mm provided that each deposit shall be capable of being thoroughly compacted by the method of compaction approved by the Client.

4.3.3 Re-tempering

Re-tempering concrete which has partially hardened (i.e. remixing with or without additional cement, aggregate, or water) is forbidden.

4.3.4 Compaction

During and immediately after placing, concrete shall be thoroughly compacted and worked around reinforcement and embedded fixtures, and into the corners of the forms, by means of approved mechanical immersion type vibrators used in a manner such that every part of the concrete is thoroughly compacted in the shortest practicable time.

Vibration shall not be applied directly or through reinforcement to concrete which has hardened to an extent that it ceases to become plastic under vibration, unless such

concrete is at least 3 days old.

The Contractor shall have at least two immersion type vibrators in full working order at each part of the site where concrete is being poured.

If the Contractor is of the opinion that the use of immersion type vibrators is not practicable, he shall seek the approval of the Client, before such work begins, for the method of compaction to be used.

4.3.5 Do Not Disturb Fresh Concrete

Care shall be taken that no shock or vibration reaches concrete after setting until it is at least 3 days old, and that any starters projecting from green concrete are not shaken or disturbed.

4.3.6 Placing on DPC etc.

Where concrete is placed on damp courses etc, extreme care shall be taken in order to avoid any injury to these materials.

4.3.7 Slabs

Slabs (including beams forming an integral part of the slab) shall be poured in one operation over the full depth.

The Contractor shall take care to provide a well balanced concrete for this purpose, so as to avoid excess water and mortar appearing on the surface after compacting.

The Contractor shall have competent workmen for finishing the floor surfaces to the standard specified.

The use of dryers shall not be permitted without the approval of the Client.

4.3.8 Columns

At least two hours shall elapse after depositing concrete in columns before concreting may start in any member supported thereon.

4.3.9 Inspection Before Concreting

No concrete shall be placed until the Client is satisfied that all provisions of the Specification with respect to foundations, formwork, reinforcing, construction joints, etc., have been complied with entirely and to his satisfaction.

To this end the Contractor shall give the Client at least 48 hours notice of his intention to pour concrete.

4.3.10 Concreting in Rain

No concreting shall proceed during times when the rate of rainfall exceeds 1.5 mm per hour or when, in the opinion of the Client, the rainfall is likely to be injurious to the concrete either directly or through run off from directly adjoining surfaces.

Unset concrete must be effectively protected against injury from rain.

The Contractor shall ensure that he has on site the requisite materials for such protection.

4.3.11 Clean Formwork

Immediately before any concreting is commenced, all formwork shall be carefully examined to see that all dirt, shavings, sawdust and other deleterious matter is removed.

4.3.12 In Wet Situations

Where reinforced concrete is to be in contact with water or saturated ground, the mix shall be adjusted in respect of water cement ratio and minimum cement content on the basis of British Standard

The Client shall advise on the job if extra cement is necessary.

4.4 CONSTRUCTION JOINTS

4.4.1 General

In general, construction joints are detailed in the Drawings and shall not be varied without the Client's express approval.

Vertical joints shall be formed with approved bulkheads.

Reinforcement shall run continuously through construction joints unless shown otherwise in the drawings.

At least three clear days shall elapse between adjacent pours of concrete.

4.4.2 Positions of Joints

The following joint position is the maximum permitted if not shown on the Drawings.

- Slabs

  These shall be as shown on the drawings; however, the Precast Flooring Contractor shall submit to the Client within 4 weeks of Tender acceptance, his proposed joint layout, should it vary from that shown.

- Columns and Walls

  May be poured in lifts exceeding 1500 mm provided that the Contractor can demonstrate to the Client prior to construction commencement his ability to do so properly and consistently.

- Beams

  Unless detailed otherwise on the drawings, or approved by the Client, lengths of pours shall not exceed 9 metres for beams.

Exterior construction joints in external concrete beams, walls and parapets and where indicated or directed by the Client, shall be sealed with an approved 10 x 15 grey polysulphide sealant applied under pressure against an approved continuous polythene tube back up.

Particular care must be taken to strictly follow the manufacturer's instructions for preparation of surfaces and mixing and application of the material.

4.4.3 Preparation of Joints

Joints shall be prepared by removing all laitance from the surface against which new concrete is to be poured, so that clean metal is exposed.

Chip away from edges so that these are not damaged.

In the event of edges being damaged, the Client reserves the right to nominate the method of repair the Contractor shall adopt.

Immediately before the new concrete is poured, the surface against which it is to be poured shall be thoroughly wetted, after which excess water shall be removed.

4.5 CURING

4.5.1 General

The following is in addition to the BS 5328-Concrete

All concrete shall be cured for at least 14 days.

Since the durability, strength, and water-tightness of the structure will depend on proper curing, the Contractor must pay careful attention to this Clause, whose requirements are the acceptable minimum.

It is recommended to extend the curing period wherever practicable.

Failure to comply with this Clause may lead to concrete being condemned by the Client, in which case it shall be taken out and replaced and correctly cured at the expense of the Contractor.

4.5.2 First 7 Days After Pouring

All concrete and its enclosing forms, and all surfaces at joints shall be kept continuously wet by approved means and shall be thoroughly protected from frost, from direct rays of the sun, and from drying winds.

To this end, as soon as concrete has set sufficiently, covers of continuously wetted approved materials shall be placed as required, or a system of fine water sprays shall be set up and operated continuously against the work or another suitable method adopted.

The method adopted for any part of the works shall be approved by the Client in advance.

"Ritecure" of similar membrane curing shall only be used with the Client's express approval and shall not entitle the Contractor to any extra payment.

The Contractor shall be responsible for the maintenance of such a membrane in good condition.

4.5.3 8-14 Days After Pouring

All concrete surfaces shall be protected from direct rays of the sun and from exposure to severe drying winds.

The surface shall be kept damp by occasional hosing, the frequency of this depending on the prevailing weather conditions.

At no time during this period shall any surface be allowed to completely dry out.

4.5.4 Slabs

Polythene or similar, laid onto the wetted surface as soon as the latter shall have hardened sufficiently, and maintained for at least 14 days, is an acceptable method of curing slabs.

4.5.5 Particular Requirements

The use of "Ritecure" or similar is forbidden on any surface due to receive any surface treatment.

The Contractor's attention is drawn to the Schedule of Finishes which shows the extent of surface treatments specified.

4.6 TOLERANCES

4.6.1 General

The following tolerances shall apply to the hardened concrete when still supported by the forms.

Closer tolerances shall be maintained where called for elsewhere in the Specification.

Any work exceeding a Specification tolerance shall be cut out and replaced.

These tolerances shall have precedence over those in British Standard if at variance with those shown in that table.

4.6.2 Cross Sectional Dimensions of Slabs, Walls, Columns, Beams etc.

- For Cross Sectional Dimensions of Slabs, Walls, Columns, Beams etc. the following applies:

Tolerance Table

	Under	Over
Dimensions up to 300 mm:	3 mm	9 mm
Dimensions from 300 mm to 600 mm:	6 mm	12 mm
Dimensions over 600 mm:	6 mm	15 mm

4.6.3 Variations from Plumb

- For lines and surfaces of columns, piers, walls and in arrises the following applies:

Tolerance Table

In 3,000 mm:	3 mm
In any storey or 6,000 mm maximum:	9 mm
In 12,000 mm or more:	18 mm

- For exposed corner columns, control-joint grooves and other conspicuous lines the following applies:

Tolerance Table

In any bay or 6000 maximum	6 mm
In 12000 or more	12 mm

4.6.4 Variation from Level or from Grades

Slabs shall be finished so that a 3,000 straight-edge shall show no out-of-plane exceeding 3 mm.

- For ceilings, beam soffits and in arrises the following applies:

Tolerance Table

In 3,000 mm:	6 mm
In any bay or 6,000 mm maximum:	9 mm
In 12,000 mm or more:	18 mm

4.6.5 Variation of the Building Grid

- For variations of the Building Grid lines from their true position in plan and related position of columns and walls the following applies:

Tolerance Table

In any bay or 6,000 mm maximum:	12 mm
In 12,000 mm or more:	24 mm

4.6.6 Correction of Errors

Offsets of column and wall centre lines above and below any floor are not permitted.

Where it is necessary to correct on the next floor a column which has been cast out of position, such correction shall have the approval of the Client.

The general attitude will be to have the offending member removed and made good.

4.7 SURFACE FINISH

4.7.1 General

Surface finish and truth of line in all concrete work is required to be of a high order, attained by a high standard of formwork, placing of concrete, and composition of concrete.

4.7.2 Visible Surfaces

All surfaces visible on completion of the works shall be free from surface blemishes, entrapped air bubbles, and ridges and surface displacements greater than 2 mm at joints.

Forms shall be of plywood with joints flushed up with epoxy fillers and the whole surface finished with at least 3 coats of gloss polyurethane to obtain the maximum smoothness when stripping. Refer Clause "4.1 – Formwork and Falsework".

In all formwork the set out of tie bolts shall be to the Client's approval.

Special care shall be taken to compact concrete very carefully at these surfaces.

The Contractor shall ensure that for such surfaces he uses a mix entirely suited to the finish required, refer to Clause "3.7.2 - Surface Finish".

The general appearance of these surfaces must be neat and uniform with an approved regular joint pattern. Refer Clause "4.1 – Formwork and Falsework".

4.7.3 Hidden Surfaces

Reasonable care must be taken with these surfaces, and the Structural Dimensions shall not be less than shown on the Drawings.

4.7.4 Surface Blemishes

Should defective or honeycombed areas, projecting fins or other blemishes exist, the Contractor shall at once inform the Client and shall under no circumstances undertake any remedial measures without the prior instruction of the Client.

The Client reserves the right to reject any defective work back to the next construction joint and to have it replaced.

The Client may, however, order remedial works to be carried out.

All work repaired by the use of new materials shall be properly cured in place to the

Client's satisfaction.

Surface plastering or cement washing to cover up poor workmanship will not be permitted.

The cost of any work arising from this Clause shall be borne by the Contractor.

4.7.5 Slabs

In general slabs shall be finished so that a 3000 straight edge shows no out-of-plane exceeding 3 mm and shall have a surface finish achieved from the skilful use of a powered steel float.

The use of the spot method of screeding will not be permitted.

Screed boards or pipes shall be used in conjunction with vibrating screeds.

4.8 TRIM AND BUILD IN

4.8.1 General

Trim openings in the work as required.

Provide and build in all necessary plugs, bolts, ties, clamps, dowels and fastenings required by other trades, including bolts for timber plates, metal angles, concrete block reinforcement and approved steel and sleeves for pipes.

The Contractor shall be responsible for the set out of holes, sleeves and other items to be trimmed for or built in, and shall obtain all necessary information relating thereto from the Subcontractors concerned.

Every care shall be taken to ensure that as little cutting as possible is needed after pouring is complete.

4.8.2 Build in

Build in fixings for steel steps, cartdock leveller trim, column protectors, door protectors etc.

Build in probes and tobies for temperature recorders, as detailed.

4.9 SLAB POURED ON HARDFILLING

4.9.1 Ground Preparation

When compacting around any works beneath or adjacent to the slab, care shall be taken not to cause any displacement of structure.

Should any waterproofing, hardfill, or underlying ground be disturbed by construction activities, the Contractor shall make good any damage at his own expense to the specified standard before concreting may begin.

The Client will require to inspect all hardfill before DPC is placed on it.

4.9.2 Damp Proof Course

DPC shall be laid where shown over the area of the slabs, immediately before the placing of reinforcement and extreme care shall be taken to protect DPC from damage of any kind.

Use either:

- Lay "Grade 1000 Polythene (250 microns)" DPC on top of hardfill in as long lengths as practicable, taping the joints strictly in accordance with the manufacturer's recommendations.
- All joints being lapped a minimum of 150 mm and sealed with approved tape strictly in accordance with the manufacturer's recommendations.

Any DPC damaged by construction work shall be repaired as directed by the Client before concrete is placed.

4.9.3 Reinforcing

Reinforcing as shown on drawings shall be supported on concrete blocks of at least 50 x 50 base area and at least 2 per m2.

Reinforcing in top of slab to be supported on stools – 2 per m2.

4.9.4 Formed and Sawn Joints

These shall be made as and where shown in the Drawings.

This shall be done using a 8 mm blade, by a Specialist Sub-Contractor.

The sawing of sawn joints shall be done as soon after the pouring of the concrete as the concrete shall have hardened sufficiently to permit sawing to be done without damaging the concrete.

As late as possible boxed joints shall be similarly sawn.

As late as possible in the Contract, the joints in the general service and store areas shall be filled with an approved polysulphide sealant.

No joint filler is required in tiled or epoxy finished floors.

The Contractor's attention is drawn to the necessity of ensuring that all sawing is done in straight continuous lines.

The Contractor shall ensure that no foreign matter is permitted to enter a saw cut, thereby making the placing of the filling unsatisfactory and shall take positive steps to overcome this.

4.9.5 Surface Finish

- Tiled Floors:

  The concrete floor shall be finished using a powered float.

  In order to improve the bond of the dry mortar base for the floor tiles, the concrete should lightly broomed.

- Plant rooms:

  The stores floor surface shall receive an application of an integral mineral aggregate based hardtopping (Natural Grey) at the rate of 3 to 5 kg/m^2.

  Use:

  Sika – CHAPDUR and ANISOL E CURING AGENT

  Or

  MBT – MASTERTOP 100 and MASTERKURE 128

  The application of the material shall be carried out under the direct continuous supervision of a specialist provided by the product supplier.

  The hardener should be applied in two layers by broadcasting by hand.

  Approximately two-thirds of the total quantity should be applied in the first broadcast and balance in the second.

  First shake on application

  Mark the floor area in bays of convenient size and keep the required number of bags of the hardener ready for each bay depending on the rate of application specified.

  Broadcast the powder evenly by hand on the floor surface after the concrete has been floated and evaporation of bleed water.

  Apply first on floor areas adjacent to walls, columns, joints, doorways where the concrete is likely to loose moisture rapidly.

  After the application the hardener darkens in colour indicating absorption of moisture from concrete and when the concrete has stiffened enough to prevent float blades from digging into the surface, float the applied surface using power floats.

  Float just enough to bring excess moisture to the surface.

  Second shake on application

  Follow with the second application of the hardener as the first application proceeds to the next bay.

  Broadcast the remaining third of the hardener evenly by hand, compensating with extra material over areas under applied during the first broadcast.

As soon as the second layer has darkened by moisture absorption, float the surface with a power trowel equipped with float blades or disc floats.

Finish

To obtain a fine non slip finish, trowel the surface after it stiffens further using a power float keeping the blades as flat as possible without digging in the surface.

Work areas Process Areas

Provide a smooth power float finish, suitable for the direct application of an Epoxy topping.

Curing

Start curing immediately after final finishing using a liquid membrane curing compound on all concrete surfaces.

Ensure the compound chosen is compatible will the floor finishes to be placed later.

4.10 CONCRETE WATER TANKS

4.10.1 General

Great care shall be taken in the construction of the water reservoirs to ensure complete water tightness of the Structure.

Careful preparation of all construction joints to ensure proper bonding between old and new concrete, the installation of water sealants in the construction joints, joints sealants and the application of an internal membrane water barrier is required.

4.10.2 Water sealant

SIKA – HYDROTITE CJ – 0725 – 3K

Install hydrotite rubber sealing strips in all construction joints in accordance with the Sika manual.

4.10.3 Rebated joints

SIKAFLEX 1a

Install Sikaflex joint sealer in 20 x 20 rebated primed joints on the internal wall face of all construction joints in accordance with the recommendation in the Sika manual.

4.10.4 Water Barrier

On the interior face of all tanks (Walls and Floors) as well as the top of the roof slab apply a flexible cementitious water proof membrane such as SPECTITE CW 100 or equal and approved.

Apply to a minimum thickness of 2mm in two coats, all in accordance with the Spectite Manual.