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SECTION 0

SITE CLEARING, GRUBBING AND SETTING OUT OF WORKS

0.01 DESCRIPTIONS:

This section of specification shall consist of removal from the specified depth, grubbing and disposal of all surface objects, stumps, roots, bushes and trees with less than 150 mm girth, vegetation, logs, rubbish and other objectionable material except such objects as are designated to remain or are to be removed in accordance with other section of specification, and as directed by the Engineer.

0.02 SCOPE OF WORK

The work covered by this section of specifications consist of furnishing all labour, necessary equipment, services, miscellaneous and necessary items required to satisfactorily complete the clearing, grubbing and setting out of the works, as indicated on drawings, specified herein or both.

0.03 CLEARING

Clearing shall consist of cutting, or trimming of trees, if any, and the satisfactory disposal of tree and other vegetation designated for removal, together with the timber snags, bushes, and rubbish occurring within the area. Trees, other vegetation stumps, roots, and bushes in area to be cleared shall be cut off flush with or below the original ground surface except such individual trees, group of trees and vegetation as may be indicated on the drawing or designated by Engineer or his Representative to be left standing. Individual trees and other vegetation, to be left standing shall be thoroughly protected from damage during construction operation, by erection of barriers or by such other means as the circumstances require and as approved by the Engineer or his Representative. Clearing operation shall be conducted in a manner that existing structures and installations under construction, employees and others remain safe.

0.04 GRUBBING

Grubbing shall consist of the removal and disposal of all stumps, roots and matted roots in the designated grubbing areas. Stumps, roots, logs and timber and other debris, shall be excavated and removed to a depth not less than 2 feet below any sub-grade level. In areas where the cut is over 3'-6" grubbing shall not be necessary.

0.05 DISPOSAL OF DEBRIS

Timber and other refuse to be disposed off by burning shall be burned at location, approved by the Engineer or his Representative, in a manner that will avoid all hazard such as damage to existing structures, construction in progress, trees and vegetation. The contractor shall be responsible for compliance with all pertinent laws and regulations pertaining to the burning of fire. Disposal by burning shall be kept under constant attendance, and residual, until materials will not be permitted to be pushed or placed on the adjacent areas without written approval of the owner/owners. The stones and concrete shall be broken and removed from the site for receiving the structure/flooring where required. All debris shall be disposed off by

the Contractor as directed by the Engineer.

2.06 **SETTING OUT OF WORKS**

The Contractor shall set out the works and shall be responsible for true and perfect setting out of the same and for correctness of the direction, levels, dimension and alignment of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall, at his own expense, rectify the error to the satisfaction of the Engineer. The Contractor shall construct accurate benchmarks so that the lines and levels can easily be checked by the Engineer.

0.07 **DRAINAGE DITCHES**

The Contractor shall construct and maintain such ditches, in addition to those shown on drawings or as may be ordered by the Engineer to adequately drain and areas under construction.

0.08 **PAYMENTS**

Payment for all the items under this section shall be made at the rate entered in the BOQ as appended to the contract and in accordance with the applicable conditions of the contract

SECTION – 1

GENERAL

1. This General Specification is to be taken as applying to all the works in this Contract unless otherwise specifically mentioned elsewhere. Figured dimensions on the working drawings shall be followed in preference to the scale.
2. Until and unless specified otherwise, all goods and materials are to be Pakistan manufactured and to be of the best quality new and un-used and where not otherwise specified shall be according to latest engineering practice and conforming to Pakistan Standards (PS) or British Standard Specifications (BSS) or Standard of American Society of Testing Materials (ASTM). The Engineer or the Consultants may also supplement such specifications during the progress of work based on standard International Practice.
3. All materials and goods used for such and other items shall be subjected to standard testing and if found below the specified standard such as PS or BSS or ASTM or their equivalent shall be removed from the immediately at Contractor's own expense. All testing of materials finished and unfinished, shall be carried out by the Contractor at his cost, in the presence of Engineer or Engineer's Representative for which the Contractor shall make any other additional arrangement to the satisfaction and convenience of the Engineer. The Contractor shall include testing charges in his quotations and shall not be entitled to any reimbursement on this account.
4. The Contractor must give early attention to the submission of samples of materials for approval of the Engineer, indicating the names of the manufacturing firms, especially of pipes, fittings, valves, meters, cement, source of sand, aggregates, steel, and all fittings to be embedded. Whenever required samples shall be submitted at least three weeks before it is proposed to use the materials. Until and unless specified otherwise, whenever materials are ordered to be forwarded to a testing laboratory approved by the Engineer for checking / testing, the Contractor will bear the cost of fees for such tests. The Contractor shall indicate the name and address of factory from where he intends to get pipes manufactured and submits manufacturer's catalogues for valves, fittings, and water meters with his tender.
5. The Contractor must take all steps necessary to prevent damage or interference with all services such as road, water, electric power, fuel, telephones, drains, buried cables and any construction designed for the use of the public, government or semi government authorities or the Employer. The Contractor shall be responsible for any damage caused to such services or constructions and settle and make payment for all claims in respect of such damage.
6. The Contractor shall protect from damage or injury by covering all work, internally and externally needing protection including new concrete, block work / stone work,

surface renderings, floors, etc., to the satisfaction of the Engineer.

7. The whole work shall be carried out in the best manner in accordance with the instructions contained in these documents and those given by the Engineer from time to time during the progress of the work. The work shall be carried out in conformity with the best standard construction practices preferably the British Codes of Practices.
8. The Contractor shall submit to the Engineer for his approval before beginning the work, a complete plan of the proposed sequence and methods of operations for the execution of the works.
9. Orders and directions may be given orally by the Engineer or his Representative, and shall be received and promptly obeyed by the Contractor or his Representative or any superintendent or foreman or any supervisor of the Contractor who so ever may have charge of the particular part or section of work in relation to which the orders or directions are given, and a confirmation in writing of such order or directions will be given to the Contractor by the Engineer within seven days. The Contractor shall provide and maintain at his own expense, during the performance of the work, an office in the vicinity of work, where he or his authorized representative shall be present at all times. Orders or directions, written or oral, from the Engineer or his Representative delivered at such office shall be considered as delivered to the Contractor.
10. The Contractor shall construct suitable office for Consultants and Client staff. This office shall comprise of a room of size 5m x 4m with attached wash room and provided with suitable furniture. The Contractor shall provide maintenance service for Consultants office including lighting and water for wash room and daily cleaning. The Contractor shall submit a detail drawing of office along with list of furniture and fitting in his tender.

11. PAYMENT

Contractor shall not be entitled to any separate or additional payment on account of these entire general requirements and any other arrangement or action unless otherwise provide in the BOQ Contractor has to undertake, under the direction of the Engineer, for a proper carrying out of the works and meeting all obligations of the Contract.

12. INTERPRETATION

- 12.1 The clause headings in these specifications shall not be deemed to be part thereof or to be taken into consideration in the interpretation or construction thereof or of the Contract.
- 12.2 Any clauses in these specifications, which relate to works or materials not required, shall be deemed not to apply.

- 12.3** Where this general specification contains any amendments, implications, etc. to subsequent sections of the specifications, the General Specification shall be deemed to apply in cases of conflict.

13. AUTHORITY'S LETTERS

The Authority referred to in this specification shall be KW&SB unless specified otherwise.

14. CLIMATE

The climate of the district is on the whole moderate. The months of May and June are very hot during the day with maximum and minimum temperatures of 41°C and 26°C. This follows by an abrupt falls in temperature during night with pleasant breeze, which makes night comfortable. December and January are the coldest months with maximum and minimum temperatures of 25 °C and 9 °C. Sometimes cold winds from Balochistan make the winter severe. Humidity varies, highest about the end of August which is much less in May when the air is uncomfortably dry. Fogs are common in the cold season.

The district lies in rain shadow area. Heavily laden south west monsoon clouds, rising from the Arabian Sea pass over this area without any shower, except occasional showers in the month of July. In winter, the district gets some rain from the cyclonic winds blowing from the Persian Gulf.

15. BRIEF DESCRIPTION OF WORKS

The works under this Contract comprise of construction of Additional 65 MGD water supply scheme, from Haleji to Pipri, Karachi, Packages #01 according to the drawings and specifications and as per terms and conditions of contract.

16. KW&SB LOCATION AND ACCESS

As per related plans and drawings in Volume III of Tender Documents.

17. LEVELS AND REFERENCE POINTS

The levels shown on the drawings are related to survey of Pakistan. The contractor shall set out the works and shall be responsible for true and perfect setting out of the same and for correctness of the direction, levels, and dimensions and for the alignment of all the components of the works. If at any time any error in this respect shall appear during the progress of work, the contractor shall at his own expense, rectify the error to the satisfaction of the Engineer or his representative(s). The contractor shall construct accurate benchmark so that the Engineer's representative can easily check the lines and levels.

18. DRAWINGS

These specifications shall be read in conjunction with the drawings given in volume III of the tender documents. In case of errors or mistakes or any thing missing if required so shall be as decided by the Engineer.

Before proceeding to make preparation for fabrication, execution, and erection of any fittings and other details of any temporary or permanent works scaffolding, railings, shuttering, doors and windows, iron mongery works etc., the Contractor shall be under obligation to prepare and submit all detailed shop drawings for the approval of the Engineer before doing any or all of that described above or directed. KW&SB Karachi shall have the right to require the Contractor to make any change in the design, which may be necessary in the opinion of the Engineer to make the material or equipment conform to the requirement and intent of these specifications without any additional cost. Approval of Contractor's drawings shall not relieve from any part of his obligation to meet all the requirement of the specification or correctness of their drawings.

19. MATERIAL'S MAKE, STANDARDS AND REGULATIONS

- 19.1** Until and unless specified otherwise, all goods and materials are to be Pakistan manufactured and to be of the best quality.
- 19.2** All reference to standards throughout these specifications shall be deemed to refer the latest current edition at the date of tender, unless a particular edition has been referred to in the Specification.
- 19.3** All materials and equipment shall comply with the appropriate standard published by the British Standard Institution, Pakistan Standard Institution, and American Society of Testing Materials or with an acceptable International Standard. The Engineer may also supplement such specification during the progress of work based on Standard International Practice.
- 19.4** Alternative International Standards will only be acceptable if found equal to or better than the relevant British or Pakistan or American Standard. Two copies of each alternative standard, all in English, must accompany any request by the Contractor for approval of alternative International Standards.

20. UNITS OF MEASUREMENTS

- 20.1** The units shown in these specifications are in MKS. Units unless specified otherwise.
- 20.2** All gauges and instruments shall be calibrated in S.I. Units unless specified otherwise. Equipment and pipe work shall be designed in MKS. Units unless as decided by the Engineer.

21. WATER, ELECTRICITY SUPPLY, GAS AND OTHER UTILITIES

21.1 The contractor shall make his own arrangements with regard to the supply of water and electricity as required by him for the purpose of construction of Additional 65 MGD Water Supply Scheme from Haleji to Pipri, Karachi package #01. The Contractor shall apply for water connection direct to concerned authorities of KW&SB and it shall be his responsibility to obtain water connection from directly to authority under their prevailing terms and conditions. At the end of contract period, the Contractor shall arrange at his own risk and costs and shall furnish NO DUES CERTIFICATE (s) at the time of his final bills failing which the amount due shall be ascertained at his risks and costs by the Engineer and liable to be recovered from any money due to be paid to the Contractor. For electricity use for the Contractor's offices and during construction, the Contractor shall make his own arrangements and furnish NO DUES CERTIFICATE(s) from concerned authorities at the time of his final bills failing which the Engineer shall take necessary action as detailed above in respect of water supply dues. Similar procedure shall be adopted in case(s) of Gas Supply and other utilities.

22. PROGRESS REPORTING

On or about the first working day of every month, the Contractor shall furnish Six Copies of Monthly Progress Report along with Photographs to the Engineer with the following information:

Activities completed since the last report on the Performa as prescribed by the Engineer. The progress report in general shall contain changes in Contract programme if any, Parts of the work ready to be tested, inspected or commissioned prior to hand over.

23. ACCESS ROADS, FOOT PATHS ETC

The Contractor shall provide & maintain reasonable & safe access to the site, vehicular accesses to commercial and residential properties, footpaths etc. affected by the work in progress under the Contract. All such access shall be kept clear of Contractor's construction materials, machinery, equipment tools and plants as well as any debris to provide complete 'right of way' to the public, pedestrians and vehicles including vehicles of supervisory staff engaged on work at the .

24. DEMOLITION AND DISMANTLING OF THE EXISTING WORKS

The Contractor shall obtain the prior approval of the Engineer before proceeding with demolition of existing works like sewer, manholes and culverts etc.

25. CONSTRUCTION OF NEW CONCRETE STRUCTURES

The Contractor shall submit his proposals including drawings showing formwork

arrangement and position of construction joints to the Engineer for approval at least 7 days before execution

26. FLOATATION

The contractor is reminded that, fulfilling his obligations as to the care of the works in accordance with clause - 20 of the conditions of contract, Vol I he shall take all necessary precautions against floatation of structures and pipe works.

27. WORKS IN THE VICINITY OF RAILWAYS, HIGHWAYS, WATER COURSES AND OTHER EXISTING STRUCTURES AND SERVICE LINES

Any works crossing or having effect on railway property public highway watercourse and other existing structures shall be subject to the approval of the Engineer and the concerned competent authority.

28. PROGRAM

The Contractor shall submit along with his tender, his construction program, arrangement for dewatering, details of side supports for Concrete structure and trenches and Method Statement of Construction along with proposed sequence and methods of Operation for the execution of work.

29. TESTS

29.1 All materials and goods used for such and other items shall be subject to standard testing methods. If any item found below the specified standard shall be replaced immediately at Contractor's own expenses.

29.2 All reasonable facilities and assistance including access to drawings and production data shall be furnished when needed during the inspection at Contractor's or manufacturer's works or anywhere.

29.3 All testing of material items in finished or unfinished state if required shall be carried out by the Contractor at his cost in the presence of Engineer's Representative(s) for which the Contractor shall make all additional arrangements to the satisfaction and convenience of the Engineer. The Contractor shall construct a reasonably equipped laboratory at site area of work as instructed by the Engineer. The Contractor shall provide all machinery equipment, supply of Chemical, operate and maintain the laboratory besides employing competent and efficient staff up to the satisfaction of the Engineer to facilitate timely testing to expedite the progress of the works under Contract. The Contractor shall include testing charges in his tendered rates and shall not be entitled to any reimbursement on this account for testing other than permitted so.

29.4 The Contractor is required to submit the samples of materials required by the

Engineer for approval. The Contractor shall indicate the name of manufacturing firm of cement, steel, pumping machinery, pipes, valves, fittings and sources of aggregates etc. to be used. Whenever required the samples shall be submitted at least three weeks before materials are proposed to be used. Until and unless specified otherwise whenever materials are ordered to be forwarded to a testing laboratory approved by the Engineer for check and testing. The Contractor will bear all cost for transport, lodging, boarding and reasonable daily expenses on visit by Engineer and his Representative(s) for inspection any goods materials, machinery, pipes, etc. at the place or country of manufacture. The Contractor shall quote separate unit rates for each of the aforesaid items in the BOQ of the particular Contract of work under the project at the time of tendering without fail.

Sampling for testing of materials at site shall be carried out as per standard sampling procedure to the satisfaction of the Engineer or his representative(s).

30. TEST CERTIFICATES

- 30.1** When tests are carried out up to the approved appropriate standard the Contractor shall furnish to the Engineer such Test Certificate (in quadruplicate).
- 30.2** The Certificates shall display inter alia the date of each test location of each test and the results of each test together with the applicable limits defined in the standard. The certificates shall indicate as to whether in the manufacturer's opinion, the items have passed the test(s) satisfactorily or not. However the Engineer's or his representative's decision shall be final.
- 30.3** For Test which the Engineer or his representative(s) copies of the test records duly signed by the manufacture and the Engineer have witnessed or their representatives shall be appended to the test certificate.

31. FILL

i) Fill – Granular

- ia) Granular fill material shall comprise well graded gravel or crushed rock and lie within the following grading limits.

BS SIEVE SIZE	PERCENTAGE PASSING BY WEIGHT
75 mm	100
37.5mm	85 - 100
10mm	45 - 100
5mm	25 - 85
600 microns	8 - 45
75 microns	0 - 10

- ib. The particle size shall be determined in accordance with the requirements of BS 812: Part 103 and BS 1377.
- ic. The material passing the BS Sieve size 250 microns, when tested in Accordance with BS 1377 shall be non-plastic.

ii) **Fill Selected**

Selected fill shall comprise uniform, readily compactable material free from organic materials tree roots, vegetable matter, salts, building rubbish and excluding clay lumps retained on a 75 mm sieve, stones retained on a 25 mm sieve, and shall be selected from the excavated material. Where the Engineer orders material to be obtained from other sources such material will be classed as imported selected fill.

32. GROUT

- 32.1** Cement grout shall be made from either ordinary or sulphate resistant Portland cement as used for the structures with the minimum amount of water added to give the required degree of fluidity.
- 32.2** No sand or other materials shall be added except for grouting in holding-down bolts, etc when sufficient sand, graded in accordance with Table 1 of BS 1200, and an approved water reducing mixture complying with BS 5075: Part 1, to reduce shrinkage.

33. JOINT SEALING COMPOUNDS AND SEALANTS

- 33.1** Joint sealing materials shall be of approved manufacture and supplies delivered fresh with adequate shelf life to meet contract requirements.
- 33.2** Joint sealing compounds shall be impermeable ductile materials of a type suitable for the conditions of exposure in which they are to be placed, capable of providing a durable, flexible and watertight seal by adhesion to concrete throughout the range of joint movement.
- 33.3** All poured joint sealants shall comply with BS 2499, ordinary Type A-1 sealant.
- 33.4** Cold poured polymer-based joint sealants shall comply with BS 5212, Normal Type N Sealant.
- 33.5** Two-part poly sulphide-based sealants shall comply with the relevant provisions of BS 4254. Pouring Grade shall be applied to horizontal upward-facing and Gun Grade to joints of any other aspect or inclination. Other two-part polymer-based sealants of Gun or Trowel Grade shall comply with the physical and test requirements of BS 4254.
- 33.6** Silicon based building Sealants shall comply with the relevant provisions of BS 5889.

- 33.7** Polyurethane-based sealants shall comply with a specification of an approved manufacturer.
- 33.8** Primers for use with joint sealants shall be compatible with, and obtained from the same manufacturer as, the adjacent sealant. Primers shall have no harmful effects on concrete.
- 33.9** Sealants and primers, which will be in contact with water to be used for potable supply, shall not impart to water taste, colour, or any effect known to be harmful to health and shall be resistant to bacterial growth.
- 33.10** Sealants and primers, which will be in contact with sewage or sewage sludge, shall be resistant to biodegradation.

34. JOINT FILLER-PERFORMED

- 34.1** The material comprising the joint filler shall be of such quality that it can be satisfactorily installed in position at the joint.
- 34.2** Adhesives used to retain performed joint fillers in place during construction shall have no harmful effects on concrete, and, except for those used in connection with softwood fillers, shall be obtained from the same manufacturer as the joint filler.
- 34.3** Performed filler for joints in structures to retain aqueous liquids shall consist to cork granules, bound together with bitumen or synthetic resin.

35. CEMENT MORTAR

- 35.1** Cement for mortar shall be ordinary Portland Cement except for sub structure, brickwork in manholes, chambers, pond division walls, substructures etc, where Sulphate Resisting Cement shall be used or except otherwise specified. Sand for mortar shall be as described in BS 1200 Table-1.
- 35.2** Colouring agents and plasticizers shall not be used without the approval of the Engineer.
- 35.3** Cement mortar to be used for plaster and masonry work shall be 1:4 or as specified.

36. PIPES AND FITTINGS

36.1 RCC PIPES.

Pipes shall be of RCC manufactured in SR cement from approved pipe factory. The pipes shall conform in all respects to ASTM C-76/ BS 5911. The thickness of barrel of pipe shall be 30% more than the thickness proposed in ASTM C-76 for the same internal diameter of pipe. The pipes shall be socketed for push on rubber joints. The Contractor shall submit with his tender a detailed sketch of R.C.C. pipe with statement indicating details of socketed joints and also details of reinforcement including numbers and diameter of horizontal and spiral bars for each diameter of pipe. Conforming the requirements All R.C.C. pipes shall be manufactured to S.R cement.

The Contractor shall supply the required number of rubber rings of size and dimension suitable for the diameter of pipe provided for making a fully watertight joint. The rubber ring shall comply in all respect with BS 2494 or equivalent, approved by the engineer.

36.2 UPVC PIPES.

Upvc pipes for water supply manufactured from approved pipe factory .The pipe shall confirm in all respect to BS 3505 and PS 3051:1991. The uPVC pipe jointing shall be cement solvent joint or Z-joint.The all uPVC fittings shall be used to match the uPVC pipe as per manufacturer detail.

The contractor shall provide the technical detail and brochures to the Engineer or Engineer's representative for approval.

36.3 HDPE PIPES.

Polyethylene pipe for water supply manufactured from approved pipe factory. The pipe shall be confirmed in all respect to ISO 4427:1996. HDPE pipe for water supply applications DIN 8074 / 8075 and PS-3580:1994. The PE pipe must confirm SDR-17 and PN-8.

The HDPE fitting shall be compatible with ISO (or metric) Dimension pipe and confirm to the specifications. ISO 3458, 3459, 3501, 3503 and BS 5114. The Butt fusion method for jointing of HDPE pipes shall be used .Other method shall also be used after the approval of engineer. No payment shall be made to the contractor for jointing of the pipes by Butt fusion or compression fitting.

36.3 GRP PIPES

All GRP pipes and fittings shall be manufactured in accordance to International Standards. The GRP pipe and fitting laminate shall consist of an inner chemical resistant layer and an outer structural layer.

All pipes shall be manufactured by filament winding process employing a dual helix angle winding pattern, using pre-stressed continuous glass roving's.

The filament wound pipe shall be made on a straight steel mandrel with only slight taper to facilitate demoulding of the pipe from the mandrel.

The inner chemically resistant layer shall be composed of either a vinyl ester Oerakane 411-45 or Repoxy R-802 cr, suitably reinforced. This inner layer shall have a minimum thickness of 2mm for pipes conveying water and 1 mm for pipes conveying clean water and the inner surface shall be reinforced with 'C' glass. The resin content by weight reducing from approximately 90% at the inner surface to 65% - 75% at the outer surface of the liner.

The outer structural layer shall be composed of an isophthallic resin reinforced with 'ECR' (electro corrosion resistant) glass rovings, for pipes conveying clean water as appropriate to give a final product of sufficient strength to meet the tensile and flexural requirements of the pipe. The exterior surface shall be relatively smooth with no exposed fibers or projections.

37. SHORT PIPE LENGTHS

- 37.1** Short pipes shall be supplied in specific lengths according to pipe diameter and as detailed on the Drawings and in the Bill of Quantities.
- 37.2** Additional random short lengths of PVC lined concrete pipes of diameter less than 600mm will be necessary for completion of pipeline gaps between manholes where no cutting of pipes is permitted under normal circumstances.

38. ROAD MATERIALS

- 38.1** The aggregate for base course and wearing course shall consist of clean durable crushed rock complying with the quality requirements of BS 4987 "Bitumen Macadam with Crushed Rock or Slag Aggregate".
- 38.2** Filler shall consist of crushed rocks, or other material approved by the Engineer, and least 75% of it shall pass a No. 200 BS Sieve. Filler shall be used, if required for compliance with the grading limit for aggregates in base or wearing courses or for surface application.
- 38.3** Bitumen for surfacing shall be of grade 80 / 100 penetration (BS 3690 Part 1) and shall have a known specific gravity and a known temperature / viscosity relation.
- 38.4** Bitumen for prime coat to base shall be of mix on (MC-0) or similar approved cut back bitumen.
- 38.5** Bitumen for tack coat to existing carriage ways prior to resurfacing shall be 6 Mix Composition (MC-1) or similar approved cut back bitumen.

39. SAND FOR MORTAR, RENDERING AND SCREEDS:

- 39.1** Sand shall pass a 5mm (3 / 16") sieve and consist of disintegrated rock or crushed hard stone or gravel or a combination of these, graded in accordance with BS 1200:

Table - 1, as follows.

BS SIEVE	% BY WEIGHT PASSING SIEVE.
5MM	100
No. 7	90-100
No. 14	70-100

No. 25	40-80
No. 52	5-40
No.100	0-10

39.2 Sands shall be washed and free from impurities such as sulphate and organic material incompatible with cement; clay or oil that reduce bonding qualities; material that will expand or shrink; organic matter that can decompose salts and substances that attract moisture; minerals that can cause staining of mortar.

39.3 Sands shall be tested regularly in accordance with BS: 812 part 103 to give a continuing proof of suitability. The presence of fine clay, silt and dust shall be limited to 5% by weight.

40. DAMP PROOF COURSE

DPC where required shall be provided are to be used as per direction of Engineer in accordance with the following specifications:

40.1 Damp Proof Courses shall be of hessian based bituminous sheeting weighing 4.3 kg per sqm. and conform to BS 743. The damp proof course shall be of the proper width to suit the walls.

40.2 Damp Proof Course of cement concrete class C (1:2:4) of 2 Inches (50 mm) thickness shall be laid on walls at plinth or at location shown in drawing. Pudlo or other waterproofing agent as approved by Engineer shall be mixed with concrete as per the manufacturer's direction and approved by the Engineer. The size of the coarse aggregate shall be limited to 3 / 4" to 3 / 16" (19mm to 4.8mm). The damp proof course shall be of proper width to suit the wall.

41. MANHOLE COVER

41.1 Mild steel frame and R.C.C. cover shall be made as per drawings.

41.2 Cover shall be fitted to matching frames and tested at the manufacturer's working. Each set (cover and frame) shall be similarly numbered in a legible and permanent manner. The marked position is not to be visible when fitted in place.

41.3 The Contractor shall ensure that the covers are fitted to the appropriately numbered frames after the frames have been fitted.

41.4 KW&SB clearly casted in the upper side of the covers in letters approximately 3 inches (75 mm) high.

41.5 Covers shall be lockable to the frame by means of an inside catch which is key operated.

42. PAINTS

- 42.1** The Engineer shall approve all brands of paint, under coat and other finishing material. Different brands of paint shall not be intermixed or interchanged on any surface.
- 42.2** All coating materials shall be supplied in container not greater than 5 litres capacity and labelled with the type of material manufacturer's batch number, date of manufacture and manufacturer's name brand name, formula and shall be mixed and applied in accordance with directions of the manufacturer.
- 42.3** Batch deliveries of coating material shall be dated for use in order of delivery, shall be stored in a dry area, protected from extreme temperature and shall not be used if more than 18 months old from date of manufacture.
- 42.4** All material shall be acceptable, proven top grade products and shall meet exceed the minimum standards of reputable manufacturer as approved by the Engineer.
- 42.5** Colors shall be pure, non-fading pigments mildew-proof, finely ground in approved medium. Colors used on plaster and concrete surfaces shall be lime proof. All materials shall be subject to Engineer's approval.
- 42.6** All emulsion paints and primers for metal work and walls will be the best available of its type. The Engineer prior to its procurement shall be approved the make and shade.
- 42.7** Approved quality of Cement wash paint shall be used for painting the exteriors of the structures or other surfaces as directed by the Engineer.
- 42.8** The plastic emulsion paint or similar as approved by the Engineer shall be used for interior surface.
- 42.9** Un slaked lime, gun and marine blue shall be used for white washing.
- 42.10** All material for bitumen painting shall consist of Bitumen PB-4 Grade 10/ 20. It shall be used for foundation or wherever recommended by the Engineer.
- 42.11** Approved quality, Epilac enamel paint shall be used for chemicals and water resistance where specified.
- 42.12** DUROCEM a cement base heavy-duty waterproof coating manufactured approved by the Engineer shall be used for painting on the surface specified. The cement base water proof coating for concrete shall conform to ASTM C-109, C-67, D-822 and G-23 Solvent for cleaning metal work prior to application of metallic lead primers to BS 2523 shall be as recommended by manufacturer.

43. WATER PROOFING

- 43.1** Cement, aggregate and coarse sand shall be in accordance with the Specifications for "Concrete". Bitumen used for this purpose shall be as per B.S.S or P.S.

- 43.2** Samples of all materials proposed for use under this section shall be submitted to the Engineer for his approval.
- 43.3** Water Proof Building paper shall be grade B2 as per BS-1521.

44. LADDERS - RUNG TYPE

- 44.1** Steel ladder shall consist of specified size of M.S Plates in strings and 1" (25mm) dia. M.S Steel bars in rungs. The M.S Rungs shall be riveted and welded in 25mm dia. holes in Plates. The end of each climb of the ladder shall be embedded in the concrete.
- 44.2** Ladder shall be fixed using M 16 stainless steel bolts unless otherwise detailed.
- 44.3** Ladder shall be of integral or welded construction and shall comply with the requirements of BS 4211 for the spacing of stringers, rungs, safety hoops and hand holds unless otherwise detailed.
- 44.4** Ladders shall be made of mild steel and be hot dipped galvanized after manufacture.

SECTION – 2

EXCAVATION, FILLING, BACKFILLING AND DISPOSAL

1. GENERAL EXCAVATION AND BACKFILLING

The work covered by this section of the specifications consists of furnishing all plants, equipment, appliances, labour and materials in performing all operations in connection with excavating, filling and backfilling for all types of construction works including pipelines and other foundations complete in strict accordance with proper gradient, slope with top and bottom of trenches etc. as per specifications and drawings and subject to the terms and conditions of the Contract.

2. EXCAVATION – GENERAL

The Contractor shall remove the whole of the vegetation, top soil, concrete, flagging, paving, and curbing, road metalling and other materials from the site of any excavation and shall keep separately and preserve the same for reuse where applicable. The ground shall be excavated for the permanent and temporary works to the required depths, width and levels so that the dimensions of the permanent works shall not be less than as shown on the drawings or as may be directed by the Engineer.

All rubbish, filth and matter of an offensive nature taken out of any excavation shall be disposed off at once and not left on the surface within the site.

The major works for excavation involved in borrow pits indicated on drawings or otherwise proposed by the Contractor. The Contractor shall carryout the excavation in borrow areas for obtaining earth for construction of embankments. The Contractor shall provide necessary transport for excavated earth from the borrow areas to the site / location of embankment with means approved by the Engineer. The Contractor shall ensure that earth obtained from borrow areas is suitable for construction of embankments and shall not contain excess water. Excess water if any shall be removed by the Contractor through exposure to natural whether or through any other means approved by the Engineer. The borrow pits shall not be measured for accessing the quantity of earth required for excavation.

3. EXCAVATION – CONDUITS/ OPEN CANALS / PIPELINES / SUMP WELL

- 3.1 The excavation shall be carried out to the required alignment, levels, slopes or gradients as per drawings or described in the specifications and bill of quantities taking into account bedding required below pipes or to such other dimensions and slopes as the Engineer may direct in writing to facilitate laying of pipes. The Contractor shall provide masonry pillars of suitable size and fix temporary benchmarks at intervals to be determined by the Engineer or his representative. No trench excavations shall be commenced without prior approval of the Engineer. Excavation shall proceed at the same rate of laying, jointing and backfilling.
- 3.2 The quantity of excavation shall be the volume of materials removed from below the original surface of the ground to the limits of excavation specified or shown on the drawings. For soft and unstable soils, the Contractor shall provide adequate side

supports. The cost of supply of all material, plant and labour necessary for site clearance, excavation, over break, timbering, sheet piling, shoring, shuttering, refilling, watering and ramming etc. shall be included in the Contract rates for excavation. In case sides or ends of any excavation collapse under self-weight or due to any other reason, the Contractor shall at his own cost remove all disturbed material. Should sides or ends of any excavation give way, the Contractor shall at his own cost remove all disturbed material. **Any excavation outside the limits shown shall be treated as excess and shall not be paid for.**

- 3.3 Where the Contractor has excavated to depths in excess of the requirements, he shall refill and compact the excess excavation with 1:4:8 cement concrete up to the correct level at his own cost. **Any excavation done in excess of specified width due to any reason whatsoever shall not be paid.**
- 3.4 For excavation the width of the trench shall be equal to the 1750 mm times the external diameter of the pipes.
- 3.5 Additional excavation will be necessary at all valves chambers, sump well and pipe joint/ welding joints to facilitate the making of joints of pipes. Additional excavation for construction of valve chambers and jointing of pipes shall be of such dimensions as shown in the drawing, so as to give clear working space. **The Contractor shall make allowance for the additional excavation required for the sump well ,valves chambers and jointing of pipes in the price tendered for trench excavation. These shall not be separately measured or paid.**
- 3.6 The length of the trench shall be measured along the centreline of the trench and the depth shall be measured vertically for original ground level to the average bed level.

4. TIMBERING, SHORING AND BRACING

GENERAL

- 4.1 The Contractor shall provide where required all shoring, supports etc., to the sides of excavation to prevent sliding or any movement. The timbering, shoring and bracing; shall be of adequate strength to withstand the pressure encountered and the Contractor shall be solely responsible for the losses due to collapse or failure of shuttering, bracing, shoring etc.
- 4.2 **No payment for side support including shoring, shuttering or bracing or sheet piling shall be made. The Contractor's rate for excavation shall be deemed to include the cost of providing and removing side supports timbering, strutting and bracing with all connected operations.**
- 4.3 The Contractor shall at all times support effectively the sides of the pipe trenches and other excavation by suitable timbering, shuttering etc.
- 4.4 Where required the contractor shall use close timbering in all loose or sandy or unstable strata either above or below ground level, if found necessary by the Engineer and accord approval. It is intended that all timbering and side supports for pipe trenches shall be removed as the work proceeds. The Contractor shall ensure that the removal of timbering and side support is done gradually and carefully to

avoid any damage to existing or new structures, roads, pavements or any other private or public property. All timbering, sheeting and their supports shall be of adequate strength and dimension and full braced and strutted so that no collapse, subsidence or and damage to public or private property shall take place. The Contractor shall be solely responsible for the sufficiency put all timbering and their supports to be used an all damages to persons or property resulting from the improper quality, strength, placing, maintaining or removal of the same shall be payable by him under all circumstances.

5. PUMPING, BAILING AND DEWATERING

- 5.1 The work covered by this section of Specifications consists of furnishing all plants, labour, materials, and equipment appliances for performing all operations for Pumping, Bailing Dewatering and Draining water from the areas, excavated for all works in this contract in accordance with this section of Specifications, and subject to terms and conditions of the contract.
- 5.2 The Contractor shall at all times during the progress of work remove any water from any source which may accumulate, inflow or be found in the trenches and other excavations made under the contract and shall, keep them entirely free from water at all time while excavating.
- 5.3 The Contractor shall keep excavations free form water at all time and provide adequate pumping plant including special dewatering equipment and means of disposing off the pumped water as directed by the Engineer In charge. The Contract shall ensure to keep away un-desired water from all sumps clear of excavation and provide all necessary plant and equipment for dealing with any subsoil condition that may be encountered.
- 5.4 The work covered by this section of Specifications consists furnishing all plants, labour, materials, equipments are appliances for performing all operations for Pumping, Bailing Dewatering and Draining water from the areas, excavated and all other works in this contract accordance with this section of Specifications, and subject to terms and conditions of the contract.
- 5.5 If necessary for the construction of the works, the contractor shall lay-sub-drain where directed to convey the water to pumping sumps. The sub-drains shall be laid un-jointed with the invert not less than 300 mm below formation level of the permanent works and shall be covered with gravel to formation level.
- 5.6 Water pumped from the trenches shall be disposed off by the Contractor in a manner that will neither cause injury to the public health nor damage to the existing structures or the works completed or in progress or to the surface of any road or streets, nor cause any interference with the use of the same by the public.
- 5.7 The Contractor shall be held fully and wholly responsible for all damages done to structures or property resulting from his dewatering, pumping and all other connected operations. If he fails to make good or to pay the expenses of making good damages with all practicable dispatch the Engineer shall be at liberty to get the work done by other means or to pay the cost of the said damages by deducting the amount from any money that may be or become due to the Contractor or may recover the same from the Contractor from his dues, as decided and found feasible

by Engineer, the decision of Engineer will be final and contractor shall be liable to be bound.

6. FILL, BACKFILLING AND RESTORING OF GROUND TO ORIGINAL CONDITION

- 6.1 Fill where required to raise the sub-grade for concrete slabs shall be clean unadulterated local river sand and shall be free from wood, stones and other debris. Excavated material shall only be used for fill if approved by the Engineer or his representative.
- 6.2 All fill backfilling or earthwork in embankment shall be compacted by mechanical rammer, or other approved equipment in layers not more than 150 mm thick. Each layer shall be uniformly spread and fully compacted and shall have proper moisture content for the required degree of compaction that shall be done by mechanical tampers as approved by Engineer.
- 6.3 Backfill shall not be placed against walls etc., prior to the water proofing treatment if provided and approved by the Engineer. Backfill shall be brought up evenly on each side a wall as far as practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to tie wall than distance equal to the height of the backfill above the top of base slab footing. No back filling shall be done before the new structure has been cured for at least two weeks.

7. BACKFILLING AND RESTORING OF GROUND TO ORIGINAL CONDITION

- 7.1 The back filling of the trench shall be allowed after the conduit/pipe has been laid and jointed over the specified bed, inspected, checked, tested and approved by the Engineer.
- 7.2 Backfilling of the trenches shall be carried out by filling half conduit/ pipe level. The filling shall then be thoroughly rammed. More filling shall be carried out and rammed again until the consolidated filling reaches pipe top level. Only selected dry materials free from stones or debris shall be used for backfilling that shall be spread and rammed evenly across the trench. Thereafter, the trench shall be filled in layers not exceeding 150 mm in depth, each layer being properly rammed before the next layer is placed so that 95-100% compaction is obtained as per AASHTO Standard.
- 7.3 On completion of backfilling, the Contractor shall level a grounds disturbed by him in the course of the work, spread t soil where necessary as directed by the Engineer.

7.4 ROUGH GRADING

Necessary rough grading if required shall be carried out by the Contractor to establish the finish grade as specified in the drawings or construction requirements of the site, or otherwise indicated shall have uniform levels or slop between points on existing and finished grades. Abrupt changes in slopes shall be rounded.

8. COMPACTION

- 8.1 Fill and/or backfill within the building or structure and for a distance of five (5) feet

outside building or structure shall be compacted to a density of not less than 95% of the maximum density at optimum moisture as determined by 110 AASHO T-99.

- 8.2 Isolated boulders and rubble not exceeding 0.1 cubic meter in volume may be incorporated at the Engineer's discretion.
- 8.3 If any material after placing reaches a condition such that it cannot be thoroughly compacted the contractor shall either remove all of the material which is in unsuitable condition or improve the condition of the material by mechanical or chemical means.

9. REMOVAL OF EXCESS AND UNDESIRABLE MATERIALS

- 9.1 Excess and undesirable material from excavation not require for fill or backfill shall be disposed off, removed and/or deposited and levelled on the site where directed by the Engineer. Earth suitable and meant for backfill if required shall be stored at site in a manner not to interfere with the progress of construction works in progress.
- 9.2 The Contractor shall keep all excavated soil sprinkled with water during the excavation work so as to prevent any dust nuisance.
- 9.3 All surplus soil arising out of the work shall be carried away to approved site within a week, deposited and spread as directed by the Engineer.
- 9.4 The Contractor shall carry out the cutting of existing bituminous road as required for excavation for carrying out the work to the full depth of hard crust of any existing thickness. The stone metal soling etc. shall be separately stacked along the side of excavation for possible reuse.

10. PROTECTION OF UTILITY SERVICES

10.1 DAMAGE TO SURFACE

If carriage ways, verges or footways in roads whether paved or unpaved or gardens, plantations or other surfaces are damaged outside the limits of the excavations due to lack of proper traffic control or moving plant and equipment or other operations of the contractor then such surfaces shall be reinstated by the contractor at his own expenses. The surfaces shall be restored to their original condition using such materials as may be required whether obtained from the excavated materials or not.

10.2 MAINTENANCE OF TRAFFIC

When the excavation is in roads care shall be taken to cause the least inconvenience to traffic. When directed or necessary for the maintenance of traffic, the contractor shall remove from the site all materials as excavated from the trenches and return the same as necessary for refilling after the structures have been completed or the pipes tested and approved.

10.3 CONTROL OF TRAFFIC ON ROADS

The Contractor shall ensure that the flow of traffic over existing roads and access to properties is maintained at all times during the contract. The flow of traffic is to take

place at all time over a reasonable surface that is to be segregated as far as possible from areas where work is progress.

11. MEASUREMENT AND PAYMENT

- 11.1 All excavation shall be measured net and perpendicular **as shown in drawing** and no allowance shall be made for any increase in bulk of the excavated material after excavation or for sloping sides, or widened trenches to accommodate formwork, shoring and bracing etc. Similarly the measurements for filling/backfilling shall be thoroughly compacted and measured net and no allowance shall be made for any increase in bulk after excavation. Excavation, filling and Disposal shall include all leads and lifts as specified elsewhere in these specifications.
- 11.2 Payment for all the items under this section shall be made at the rates entered in the BOQs as appended to the contract and in accordance with the applicable conditions of the contract. **No additional payment will be made to the contractor for extra excavation during pipe laying and jointing or others works**

Rock Excavation shall be Classified as follows:

A) Hard Rock

Any rock which cannot be removed with ripper of a 200 H.P. Bulldozer and constitutes a firm and continuous bed of rock only.

B) Medium Rock

Any rock which cannot be removed with the blade of 200 H.P. Bulldozer but can be removed by the ripper, will be termed as medium rock, irrespective of the fact that it is removed by blasting.

C) Soft Rock

Any rock which can be removed with the blade of 200 H.P. Bulldozer. This item will be termed as Soft Rock, irrespective of the fact that it is removed by blasting.

SECTION – 3

MS PIPES AND SPECIALS

1. MILD SECTION SPECIFICATIONS

The pipes shall be made of Steel plate / coil X-42 of API standard No. 5 L Grade or PSS-0014-84.

1.1 CHEMICAL PROPERTIES AND TESTS

The Chemical Composition of the steel shall fall within the following limits:

- Carbon - 0.28% max
- Manganese - 1.25% max.
- Phosphorous - 0.04% max.
- Sulphur - 0.05% max.

1.2 MECHANICAL PROPERTIES AND TESTS

- Yield Stress - 42000 psi (min. psi)
- Ultimate Tensile Strength - 60000 psi (min. psi)
- Elongation on Gauge - 27 (min. %)

1.3 STANDARD SPECIFICATIONS

For sampling testing & tolerances limits, specifications no. AWWAC-200-80 shall be followed.

1.4 THICKNESS OF PLATES / COIL

Thickness of plate / coil shall be as specified in the respective items in the BOQ. All plates used shall be free of surface defects.

1.5 PIPE

The term pipe signifies a hollow cylinder made of M.S. Steel plate / coil of uniform internal dia. & having a uniform thickness of wall throughout its length.

1.6 DIAMETER

The internal diameter of the pipes shall correspond to the net specified diameter after protective lining.

The outside diameter of the body of the pipe as measured by taping the circumference shall be uniform.

1.7 LENGTHS

Pipes shall be finished in uniform lengths.

1.8 STRAIGHTNESS

The pipe shall be straight.

1.9 ENDS

The ends of the pipe shall be so formed that when pipes of the same class and diameter are welded or jointed together to form a continuous straight conduit with a smooth & uniform interior surface.

1.10 JOINTS

Joints shall be welded as per AWWA specifications.

1.11 MANUFACTURE OF PIPES

Before starting production of M.S. pipes the contractor shall furnish the following manufacturing procedure. This procedure shall include but not limited to the following information.

- i) Material quality, full details and checks analysis including residual elements.
- ii) Material manufacturing details.
- iii) Method of plate / coil forming.
- iv) Welding procedures, including procedures for skelp welding.
- v) Method & degree of coil expansion where applicable.
- vi) Method of straightening, sizing and hydrostatic testing.
- vii) Inside diameter.
- viii) Quality control and Inspection procedures. The submitted procedures and any agreed modifications shall be strictly followed in the production of pipes. The pipes shall be spirally welded with at least two welding passes, one of which shall be on the inside. The Contractor may propose straight welding for pipe manufacturing. This should be clearly mentioned in the tender submitted by the Contractor.

The Contractor shall submit all manufacturing procedures and qualification tests result to the Engineer for approval before the total production has exceeded 20 pipes. In the event test results are not available before production has exceeded 20 pipes, the contractor shall stop production and not restart until all test results have been approved by the Engineer.

The Engineer shall witness the manufacture and testing operation of desired quantity of pipes to verify compliance with the agreed procedure.

1.12 INTERNAL PROTECTION OF PIPES – CEMENT MORTAR LINING

The internal cement mortar lining shall be applied in-situ of cement, sand, mortar 1:3 after completion of laying and backfilling of pipeline in trench, in continuity, in one course or more, by electronically driven lining machine traveling through pipe and centrifugally distributing the mortar uniformly across the pipe. The discharge shall be from the rear of the machine so that machine will be continuously fed with mortar by train of intermediate loading machine fed by Power Loader and high speed electric mixers, to achieve desired standard of lining.

The rate of travel of machine and rate of mortar discharge shall be mechanically regulated to produce a smooth surface and uniform thickness throughout. The lining machine shall have electronically controlled rotary trowels for smoothing of the lining so as to obtain William Hazel Coefficient in range 130-140. The mortar shall be densely packed and adhere wherever applied, there shall be no injurious rebound.

2. INTERNAL LINING MATERIAL

a) SAND

Sand shall consist of inert granular material. The grains shall be strong, durable and uncoated. The sand shall be well graded and shall pass a No. 16 mesh screen, with not more than five 5 percent passing a No. 100 Sieve.

Graded sand will be bagged to ensure 1:1 mix while feeding the mixer.

Sand shall be clean and free from injurious amount of dust, clay, lumps, shale, soft or flaky particles, mica, loam, oil, alkali and other deleterious substances. The total weight of such substances shall not exceed three percent of the combined weight of the substances and the sand that contains them.

b) SULPHATE RESISTANT CEMENT

Sulphate Resistant cement shall confirm to type I or type II of ASTM C150 or shall be as otherwise specified by the Engineer.

c) WATER

Water for mixing mortar shall be clean and free of mud, oil and injurious amounts of organic materials or the deleterious substances. Potable water shall be used.

2.1 MIX FOR LINING

a) COMPOSITION

Mortar for lining shall be composed of cement, sand and water that have been well mixed by the concrete mixer and shall be such consistency as to produce a dense, homogeneous lining.

b) PROPORTIONS

The approximate proportions of cement and sand in the mortar for the lining shall be 1 part of Portland cement to 1 part of sand by volume. The exact proportions shall be determined by the characteristics of the sand used as approved by the Engineer.

c) WATER CONTENT

The water content shall be the minimum that produces a workable mixture, with full allowance made for moisture collecting on the interior of the pipe surface.

d) MIXING

Mortar shall be mixed long enough to obtain maximum plasticity. The mortar shall be used well before initial set.

2.2 THICKNESS OF LINING

The lining shall be uniform in thickness within the allowable tolerance, except at joints or deformations in the pipeline, at which places also the thickness shall be as uniform as possible to the satisfaction of the Engineer. Cement Mortar Lining thickness shall be as specified by AWWA C602-83 and approved by the Engineer.

2.3 CURING

Curing operations shall begin immediately following completion of the machine placement of the mortar lining in a section of pipeline. The selection of pipe shall be closed with airtight cover over all openings and shall be maintained in a moist condition.

When a section of pipeline has been completed, the Contractor shall be responsible for careful curing of the mortar lining until the Engineer fills the section with water, or until the lining work has been accepted by the Engineer, but in no case for less than seven days.

2.4 CLEANING OF PIPE FOR LINING

The interior surface of pipe to be lined shall be cleaned to remove corrosion products, chemicals or other deposits, loose and deteriorated remains of old coating materials, oil, grease and accumulations of water, dirt and debris. Shot or sand blasting is not required to prepare surface for lining.

2.5 MACHINE APPLICATION OF MORTAR LINING

The lining shall be applied in one course or more by machine traveling through the pipe and distributing the mortar uniformly across the pipe. The discharge shall be from the rear of the machine so that the newly applied mortar is not marked. The rate of travel of the machine and the rate of mortar discharge shall be mechanically regulated to produce a smooth surface and uniform thickness throughout to the satisfaction of the Engineer. The mortar is density packed and adheres wherever applied; there shall be no injurious rebound.

2.6 GUARANTEE AND PERFORMANCE CRITERIA

Internal Cement Mortar Lining should be got done by an approved and specified firm, who must have proven past experience in machine application of cement mortar lining. During the warranty period if any damage occurs because of lining defect it shall be got rectified by the specialist company at no cost to the Employer. 15 years written warranty would be required to be provided by the specialist

company with proven record. The Contractor will be allowed cement lining for individual pipes and specials in case of inclined or vertical length or for start length of pipes.

2.7 EXTERNAL COATING MATERIAL

External lining on MS Pipes shall comprise of asphalt coated with Fiberglass 5mm thick as per American Water Works Association (AWWA) specifications.

2.8 PAYMENT

Payment for the internal cement lining and external protection of the steel pipeline shall be made for the acceptably completed work as per specifications at the approved tender rates, which shall include all costs for labour, material and equipments etc.

3. MILD STEEL SPECIALS

3.1 GENERAL

The specials like bends; tees etc. to be used shall be manufactured with mild steel plates of specified thickness. Internal diameters shall be as given on the drawings or as directed by the Engineer. The Contractor shall submit shop drawing for all special before the manufacturing of special

3.2 QUALITY OF STEEL

a) CHEMICAL PROPERTIES

All collars and specials shall be made from steel, the analysis of which shows not more than 0.06% of sulphur or phosphorous.

b) PHYSICAL PROPERTIES

The steel shall comply with the requirements as described for M.S. Pipes.

3.3 DIAMETER

The internal diameter of the specials and collars shall be as specified for pipes or as approved and directed by the Engineer.

3.4 JOINTS

The specials shall have standard flanges with holes at both ends and nuts and bolts with matching flanges provided with pipes. Plain ended bends shall be provided where specified for making weld joints or as approved and directed by the Engineer.

3.5 LENGTH / WIDTH

Length of each special and the width of the collar shall be as shown in drawing or approved and directed by the Engineer.

3.6 COATING

The internal and external coating for specials for rising main shall be same as provided for M.S. Pipes.

3.7 TESTS

The specials and the pipes shall withstand a pressure of 61 meters.

3.8 PAYMENT

The rates quoted for M.S. specials shall include cost of providing for material, labour, equipment including cost of cutting, rolling, levelling, chamfering, welding, drilling holes in flanges etc. complete including internal and external protection similar to M.S. Pipes mentioned in these specification cement lining. Payment shall be made as per tendered rates.

4. VALVES

The valve body shall be made of cast iron of good quality from approved manufacture. The metal of casting shall be strong, tough, even grained, smooth surfaced and free from all defects without plugging or filling. All valves shall be flanged and conform to the dimensions of specials, fittings and pipes to be supplied and installed by the same Contractor. All valves shall be designed for a working pressure of not less than 100 psi and tested by hydro-statistically to a pressure of 200 psi. The marking cast on the body of valve shall indicate manufacturer's name, size of valve and designated working water pressure. Asphalt varnish shall be applied to the ferrous parts of the valve except bearing surfaces. Jointing material including nuts, bolts, washers and rubber packing shall be supplied in quantities required plus 10% extra.

4.1 SLUICE VALVES

The sluice valves shall be in general conform to the requirements of BS 5163. The sluice valve shall provide an unobstructed waterway of same nominal diameter as of connecting pipe. The valve shall be provided with bronze seats accurately machined and fitted. The spindle shall be non-rising and shall be of solid forged bronze with a tensile strength of 28 to 30 tons per sq. in. shaped properly and machined all over with strong square threads to suit valve nut. The stuffing box shall be deep, large and liberal and capable of packing under pressure. The stuffing shall be properly packed and ready for service when delivered. The stuffing box packing shall be made of asbestos. Hemp or jute packing shall not be used. The valve shall be provided with cast iron cap for manual operation of the valve through key. One operating key of length of 3.28 ft shall be supplied free of cost. The valve shall open anticlockwise and close clockwise direction.

4.2 BUTTERFLY VALVES

(Manually Operated) (Direct mounted Worm gear, Clockwise rotation to close).

1. All butterfly valves shall be of the double flanged, rubber sealed, droplight closure type.

2. Valve shall be drop-tight at rated pressure with flow in either direction and shall be satisfactory for duties involving flow regulation and frequent operation.
3. Valve shafts shall be of stainless steel operating in self-lubricating bushes. Shaft seals shall be designed for the use of standard split-V type packing or 'O' ring seals. The design of the shaft seal shall be such as to allow replacement of seals without removing the valve shaft.
4. Disc seals shall be removable and made of high quality nitrile rubber attached to the disc edge by a retaining ring.
5. Disc shall be of ductile iron and have curve streamlining to minimise the head loss. Seat shall be of red brass and secure to valve body by corrosion resistant screws.
6. The valve body shall be of Mehanite cast iron and shall be capable of withstanding a test pressure of 10 bars without leakage.
7. Bearing shall be of special type self-lubricating to carry the stub shafts and shall be designed to ensure good bearing performance at maximum hydraulic head.

4.3 GATE VALVES

Gate valves shall generally comply with BS 5163. Valves shall be of the non-rising stem thrust bridge shall be of best quality cast iron to BS 1452 Grade 14, the seats, nut, faces and guides of gunmetal to BS 1400 Grade LG2-C and the stem of forged bronze to BS 2872 Grade CZ114. Each valve shall have a drain plug fitted at the bottom of its seating along with proper arrangement of disposal of drain water. Stuffing boxes shall be designed to have soft packing fitted. Valves shall be rated for 20 bar maximum working pressure with the bodies capable of withstanding a test pressure of 30 bars and the seat 20 bar without leakage.

4.4 AIR RELEASE VALVES

Air release valves shall be of 4 inches and 6 inches diameter double acting float type having a cast iron body and bolted cover, bottom inlet, a ball float and valve operating mechanism. The float and all parts of the valve and operating mechanism shall be made of non-corrodible materials. Every valve must be tested to required pressure before installation. All air valves shall be fitted with isolating gate valves of 4 inches and 6 inches diameter.

5. PENSTOCKS (INCLUDING SLUICE GATES)

5.1 GENERAL

- a) Penstocks shall be of robust design, suitable for their application, and their construction shall be capable of resisting deflection under the worst operating head conditions. Each penstock shall be provided with a suitable hand wheel of adequate diameter for the duty required. To be to BS 7775: 2005.

Penstocks shall carry identification marks and/or brass plates to identify the penstock number and function.

- b) All penstocks shall be clockwise closing.
- c) Gearing shall be supplied where necessary to ensure that the required operating force applied by hand to the rim of the wheel does not exceed 25kgf. If the hand wheel cannot be readily accessed, extension spindles, headstocks and foot brackets shall be provided where specified.
- d) Penstocks shall be fabricated stainless steel 316L to BS EN ISO 10088: Where applicable the penstock shall be electrically actuated. The hand wheel shall have the direction of closing cast thereon. Bituminous paints shall not be applied to the hand wheel.
- e) Penstocks spindles specified to be key operated shall be fitted with stem caps. The caps shall be drilled and each provided with nut and bolt for securing to the spindle, which shall likewise be drilled to accept the bolt. Where caps are fitted, they shall be supplied complete with operating tee key. The extended spindle shall be such that the tee key will be operated at 0.9-7.2 metres above floor level.
- f) The penstocks shall be supplied complete with all accessories, fittings, fixing bolts, nuts and washers ready for installation. Fixing nuts and bolts shall be supplied by the manufacturer and shall be of stainless steel 316L.
- g) The penstocks shall be wall or channel-mounted full frame "Flush Invert" type suitable for extended operation.
- h) They shall offer excellent corrosion resistance, be lightweight in operation and require minimum maintenance.
- i) The doors shall be designed for ON or OFF seating pressures, suitable for an off-seating head of 8.5m. The seals shall be watertight under these conditions for head and direction of flow.
- j) Thrust tubes shall be provided between the penstock frame and headstock in order to absorb the thrust in both directions of operation. Thrust tubes shall incorporate all necessary fixing brackets and spindle guide plates.
- k) Penstock welding to be in accordance with BS EN ISO 15614.

5.2 PRESSURE SEALS

- a) The unseating sides of the frames shall be fitted with adjustable pressure seals. Frame seals shall be EPDM and shall be fitted with corrosion resisting retaining strips and stainless steel 316L fixing bolts. The seals shall be readily adjustable in situ using adjustable stainless steel fasteners, which shall be replaceable. The seals shall not project into the flow through the penstock aperture.

- b) The invert seal shall be EPDM.

5.3 DRIVE SPINDLE AND NUT

- a) Penstocks shall be of the rising spindle type with the lifting bracket securely bolted to the top of the door with stainless steel fasteners. The spindles shall be manufactured from stainless steel, machined all over, with a machine cut robust trapezoidal or square form thread, operating in a gunmetal nut. Polyethylene or similar materials are not permitted
- b) All spindles shall be protected by a protection tube complete with position indicator end cap and grease nipple. Where the spindle length exceeds 2.5m, guide brackets shall be provided for the drive spindle and shall be bushed with aluminium bronze or similar non-ferrous material. These shall be of the split bearing type.

5.4 FIXING BOLTS

The penstock frame shall be fixed by stainless steel anchor bolts or encapsulated epoxy resin bonded type. The design of anchor bolts shall be such that a minimum of civil preparation will be necessary for satisfactory erection of the penstock.

5.5 HEADSTOCK PILLAR

- a) Fabricated mild steel or cast iron pillars shall be provided for the mounting of the drive gear on the penstock.
- b) The penstock frame shall be fabricated from 316L stainless steel sections. All welds shall be continuous and adequate drainage of hollow sections shall be provided where applicable. Any strengthening of doors by the provision of ribs and gussets shall be carried out by welding and not by bolting.
- c) The penstock door shall be stainless steel sandwich construction. The door shall be stiffened by a steel matrix in a chemically bonded filler of rigid cellular polymer. The matrix shall be grit-blasted before polymer filling. Both outer faces of the door shall be protected with stainless steel sheeting.
- d) The door shall have sufficient strength to withstand the working pressures without significant deflection or distortion.
- e) The side sealing faces may consist of simple metal-to-metal contact between the door and frames or of synthetic rubber seals and plastic guides as necessary to withstand the required working pressure without leakages.
- f) Penstocks shall be prepared and painted in accordance with Section 15004: Corrosion Protection.

5.6 ACTUATORS ELECTRICAL

- a) Valve actuators shall be directly mounted onto and supported by the valves that they control, unless the valve is underground where the actuator shall be mounted at coping level. Actuators shall be suitable for remote automatic control and shall incorporate means for local manual operation using a hand wheel or lever. Actuators shall have integral starters and control equipment, unless the actuator motor is of a size that necessitates a panel-mounted starter, in which case it will be specified in the particular specification.
- b) The output shaft shall be hollow to accept a rising stem and incorporate thrust bearings of the ball or roller type.
- c) The design shall permit the gear case to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.
- d) Valves stems and threads shall be provided with grease lubrication, rising spindle valves being protected with totally enclosed grease packed cover tube.
- e) The actuator shall be fitted with a drive bushing which is easily detachable for machining to suit the valve stem or gearbox input shaft. Bushing shall be fitted in the base of the actuator to enable standard length valve stems to be used.
- f) Only two categories of sealing are permitted:

All equipment selected for use in a hazardous area shall have undergone an appropriate conformity assessment procedure (CAP) to demonstrate compliance with the essential health and safety requirements of European Directive 94/9/EC (ATEX 95), as enacted in the UK by the Equipment and Protective Systems Intended For Use in Potentially Explosive Atmospheres Regulations 1996 and the Equipment and Protective Systems (Amended) Regulations 2007.

Water tight, dust-tight complying with the requirements of BS EN 60529 IP67 or better.

- g) Actuators shall be suitable for pedestal mounting and interchangeable without removal of the associated valve, penstock, pedestal, etc.
- h) Actuator mounting flanges to be to BSEN ISO 5210 for multi turn actuators and BS EN ISO 5211 for quarter turn actuators.
- i) Sealing of static joints shall be by 'O-ring' on moving components to prevent leakage of lubricant from the machine.

- j) The actuator shall provide double sealing between the terminal compartment and the internal electrical elements of the actuator, fully protecting the motor and all other internal electrical elements of the actuator from ingress of moisture and dust when terminal cover is removed on site for cabling.
- k) For control purposes, limit switches shall be fitted to the actuator at both the closed and opened positions of the valve. Limit switches shall also be fitted for signalling purposes. All these shall be fitted internally. Limit switches contacts shall be volt-free. The switch contact rating shall be 5A, 250V A.C 30V D.C. Valve position shall be clearly marked externally on the actuator.
- l) The actuators shall be sized so that they develop sufficient torque to reliably seat/unseat the valve or penstock off its seat, and to provide adequate torque throughout its operating range. The torque output must be at least 20% more than is required under maximum operating conditions (i.e. maximum differential head). The drive shall incorporate a lost motion hammer blow feature.
- m) Adequate overload protection shall be provided to prevent actuator motor damage in the event of seizure. This shall either be in the form of torque switches or over-temperature thermostats. The torque switch shall latch out on operation, and to be reset by driving in the opposite directions. A mechanical latch shall be provided to prevent the open torque switch tripping while the initial unsealing hammer blow is applied.
- n) Setting of the torque and limit switches shall be carried out without the requirement to remove any electrical compartment covers.
- o) Adjustable mechanical limit stops shall be provided for opened and closed positions of actuators.
- p) Actuators supplies shall be 415V, three-phase or 110V single-phase or less for quarter-turn and 415V, three-phase for multi-turn.
- q) The Motor shall have Class F insulation in accordance with BS 2757 and shall be rated for a Class B (80K) temperature rise. Temperature rise shall be measured by the resistance of the windings during full load conditions, in accordance with BS EN 60034-7.
- r) Actuators in hazardous Areas shall be in accordance with ATEX11 2G EEx de 11CT4 in accordance with EN 50014, EN 50018 and EN50019.
- s) Certain valve actuators will require fail-safe operation in the event of an electricity mains failure. The Contractor may achieve this either by using fail-safe actuators or by providing standby power supplies for the affected actuators. There should be no

tendency for any actuator to "creep" either opened or closed, both in normal operation or under mains failure conditions.

- t) Anti-condensation heaters for use on 110V A.C. shall be provided for all actuator motors.
- u) The actuator motor gearbox shall be of the total enclosed oil bath lubricated type suitable for operation at any angle and provided with appropriate filling and drain plugs.
- v) A hand wheel shall be provided for manual operation of the valve. It shall not operate during powered actuator movement by way of a positive means of disconnection from the motor driven mechanism. The wheel shall be maintained in its engaged position once this is selected until powered movement takes place when it shall automatically disconnect and "free wheel". The hand wheel gearing shall be selected to allow valve operation without undue effort i.e. not exceeding 25kgf.
- w) The hand wheel shall be provided for manual operation of the valve in accordance with BS EN 12570. Hand wheel gearing shall enable one person to manually open/close the valve without undue effort and in a reasonable time period, in accordance with BS EN 12570.
- x) It shall be possible to secure hand or powered operation by means of padlocking in the selected mode.
- y) Where necessary to present the actuator hand wheel at a convenient operating height, flange-mounted pillars shall be provided which fully enclose the necessary valve stem extension spindles. Supplementary support of the extension spindle within its pillar shall be provided for long shafts.
- z) The open/close direction of rotation shall be clearly indicated on the hand wheel.
- aa) A visual position indicator shall be provided within the actuator, complete with a pointer showing opened /closed and in travel positions, and a sealed potentiometer to transmit continuous remote position, where necessary. Where specified in the particular specification, this indicator shall be illuminated.
- bb) Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gear case.
- cc) Modulating duty actuators shall be capable of 3000 operations per hour as a minimum.
- dd) Standards BS2757- Method of determining the thermal classification of electrical insulation.

BSEN 12570- Industrial Valves Method for sizing the operating element

BSEN 60034- 1 - Rotating Electrical machines. Rating and performance

BSEN 60947-7- Specification for low voltage switchgear and control gear

Ancillary equipment

BSEN ISO 5210 - Industrial Valves. Multi turn valve actuator attachments

BSEN ISO 5211 - Industrial Valves. Part turn valve actuator attachments

5.7 PNEUMATIC

1. Air actuators shall only be used where specified in the particular specification and shall be of the double acting type and be field interchangeable without the necessity of removal of the valve or penstock.
2. Where a pneumatic actuator is used for modulating control it shall be fitted with integral feedback.

6. PAYMENT

No advance payment shall be made to Contractor except as allowable under the conditions of contract. Part payment will be allowed for material at site brought or imported and transported to Contractor's store at site approved by Engineer duly provided with watch and ward and protection arrangements.

SECTION – 4

LAYING AND JOINTING OF PIPES, VALVES AND FITTINGS

1. SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plants, equipments, appliances labour and materials in performing all operations in connection with construction of Additional 65 MGD Water Supply Scheme, from Haleji to Pipri, Karachi Package#01

2. ALIGNMENT AND GRADE

The Contractor shall follow the alignment and grade as given in the drawings and approved by the Engineer.

3. PIPE LAYING

- 3.1** All pipes shall be examined for defects before lowering in the trench. Defective or damaged pipes shall not be used. Pipes shall be handled carefully so as not to damage them in any way. Wide slings shall be used. The pipe shall be laid as per instruction of the manufacture and directions given below.

Each pipe immediately before being laid shall be carefully brushed out and tested for soundness. Each pipe shall be laid accurately to line and levels so that except where horizontal and vertical deflection is required as per drawings or directions of the Engineer, the finished pipeline shall be in a straight-line both in horizontal and vertical planes. Pipes shall be laid upon an even bed of well compacted bed of granular material as shown in the drawing and specified for the full length of each pipe, extending for the full width of the trench and with sufficient material at the sides to permit the pipes being marked on the bed and firmly supported to true line and level. Sufficient space should be left to enable the field joints, tested and inspected but the Contractor shall ensure that at least three quarters of the pipe length is fully supported. After the pipeline has been tested and approved by the Engineer or his representative, the space left out at the joints should be carefully filled with granular or concrete bedding. Each pipe shall be laid in such a manner as to prevent the ingress of sand, mud or other deleterious materials. The open ends of pipes shall be suitably protected at the end of each day's work or whenever a pipe end is left unattended, to prevent any foreign matter gaining access to the pipes.

3.2 Granular Bedding for Pipes

Where directed by the Engineer, the pipes shall be laid by the Contractor on granular bedding. This bedding material shall consist of broken stone or gravel mixed with coarse sand. The material shall be graded from 20mm to 5mm, all passing 20mm sieve and not more than 20% passing 5mm B.S. sieve. The thickness of the bedding material below the pipe shall be 150mm or as specified and directed by the Engineer. It shall be laid in full width of the trench in layers not exceeding 150mm in thickness and shall be thoroughly compacted with an

approved type of vibrating plate or light vibrating roller. After pipe laying and if directed by the Engineer, further granular bedding material shall be placed and compacted in a similar manner to fill the entire space between the pipe and the undisturbed sides of the trench up to specified depth.

If the granular bedding material is contaminated by water, sewage or collapse of the sides of the trench, it shall be removed and replaced with new material before the pipes are laid or re-laid.

3.3 Concrete Surround and Bedding for Pipes

The pipes shall be encased in reinforced cement concrete of nominal mix 1:2:4 at Nullah or road crossings as per directions of the Engineer. The minimum thickness for the concrete surround shall be as shown in the drawings.

The pipes shall be laid on a reinforced cement concrete bed of nominal mix 1:2:4 at locations where directed by the Engineer. The concrete shall be laid on well-compacted and levelled bed. The reinforcement steel shall consists of 10 bars of 12mm diameter as shown in drawing to the entire length of pipe to be encased and cross stirrups of 10 mm at 1000 mm centre to centre.

The material used in the concrete, method used in mixing, laying and curing etc. of the concrete shall be as described under the section 5 "Concrete". The reinforcement steel has confirmed to the requirements given to Section 6 of reinforcement steel.

4. VALVES

All valves shall be laid and jointed as shown on the drawings or as per manufacturer's specifications.

5. VALVE CHAMBERS

Valves shall be housed in R.C.C. chambers to be constructed by the Contractor. These valve chambers and method of assembly shall be as shown in the drawings or as directed and approved by the Engineer. All manhole covers and frames in the slab of chambers of size 600mm x 600mm shall be of cast iron of robust construction and suitable for heavy duties and provided with locking arrangements.

6. CONCRETE THRUST BLOCKS / ANCHORAGES

Concrete thrust blocks and cradles shall be constructed of 1:2:4 cement concrete or as directed by the Engineer. Concrete thrust blocks of adequate sizes shown in drawing or directed by the Engineer shall be provided at all tees and bends. Thrust blocks shall be poured against proper formwork or against undisturbed earth where possible and approved by the Engineer. The concrete shall be cured for minimum 7 days by keeping the surface wet. All forms shall be removed prior to backfilling.

7. HYDROSTATIC TESTS (Water supply System)

Hydrostatic tests shall be performed as per AWWA C-200-80 for = 150 psi test pressure.

a) The test pressure shall be held for not less than 15 Minutes

The test information shall be recorded on a suitable recording chart. The pipeline shall be manually cleaned of all debris, stones and sand prior to laying, jointing and hydraulic test. Pipeline and pipe work shall be subjected to hydraulic pressure tests in the presence of the Engineer. Such tests shall comply with BS 8010 or CP 312, unless otherwise specified. Testing shall be carried out in two stages.

- (i) Test of sections as construction proceeds.
- (ii) A final test of the whole of the pipe work or pipeline on completion.

The Contractor shall provide all plant, equipment, and fittings etc. including water, necessary for the hydraulic test. He shall inform the Engineer, well in advance of the time for tests, details of his proposals including the supply of water, its source and method of conveyance. No connections to the pipeline or pipe work which would involve cutting, tapping or altering the Permanent Works, shall be allowed.

Test gauge shall be of approved manufacture having dials at least 200 mm diameter, graduated such that the test pressure is at least 75 % of the full scale reading. If necessary different gauges shall be supplied for different pipeline sections. Two gauges of each type shall be provide for the sole use of the Engineer and shall remain in the Engineer's possession for the duration of the Contract.

7.1 Test Procedure

Each section of the pipeline or pipe work to be tested shall be capped or blanked off at each end and securely strutted or restrained to 'withstand the forces that will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Hydrants, washout valves and isolation valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test. The air valve manufacturer's confirmation shall be obtained that the valves are capable of withstanding the test pressure involved.

Proposals for testing where thrusts on structures are involved, even where thrust collars on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The Contractor's proposed method of filling the pipeline or pipe work with water shall be approved by the Engineer. The sectional length under test shall be filled making certain that all air is displaced through an air valve

installed at the high end of the line. The section shall then remain under constant pressure - 10 to 20 m head of water - for a period of several hours until the pressure can be maintained without additional pumping. Pipes of materials liable to absorb water, e.g. concrete lined pipes shall be allowed to become saturated under this moderate pressure for 24 hours.

The pressure shall then be slowly increased to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10 m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe section shall pass the test if the leakage is not more than 0.35 litre per mm of pipe diameter per kilometre per 24 hours for each 100 m head of pressure applied.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test.

No pipeline shall be accepted until and unless the leakage of any section of the pipeline tested is not more than the rate of leakage specified above and all sources of discernible leakage have been rectified.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by consideration other than those applying to the pipeline system.

7.2 Test Pressure

Test pressure is to be measured at the centre of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown on the drawing all pipelines and pipe work shall be tested at a pressure 150 psi or as determined by the Engineer.

The contractor shall submit a schedule of pipeline test pressures to the Engineer for approval prior to commencing testing.

7.3 Sectional Hydraulic Test

The Sectional Hydraulic Test shall be carried out after the pipeline or pipe work section to be tested has been laid, jointed and backfilled to a depth sufficient to prevent flotation of the pipeline, but leaving the joints exposed. The sections to be tested shall be to the approval of the Engineer and shall be no longer than 2,000 m or 500 m when either the pipeline is laid adjacent to or underneath the carriageway. The joints between each tested section shall be left exposed until the pipeline has passed the Test on Completion:

8. HYDRAULIC TEST ON COMPLETION

The test on completion shall be carried out after all the pipeline or pipe valve sections have been joined together on completion of sectional testing. The joints between sections shall be backfilled once the test is satisfactorily completed.

9. DISINFECTION & CLEANING OF PIPE

9.1 Disinfecting Water Mains

Applicable procedures for disinfecting new and repaired potable water mains are presented in standards such as ANSI/ AWWA C651, Disinfecting Water Mains.(8) ANSI/ AWWA C651 or equivalents uses liquid chlorine, sodium hypochlorite, or calcium hypochlorite to chemically disinfect the main. The level of Chlorine dosing shall be such as to make available 50mg/litre of free Chlorine throughout the pipe line. The water dosed with chlorine shall stand in the pipe line for a period of 24 hour or for such longer period as the Engineer shall required and Valve all valve in the system shall be operated twice during this period.

At the termination of the required period, chlorine residual test shall be taken at the end of the pipe line farthest from the point of injection and the test shall be repeated if necessary until the residual is not less than 10mg/litre

9.2 Cleaning

Pipelines operating at low flow rates (around 2 ft/sec or less) may allow solids to settle in the pipe invert. Upvc has a smooth, non-wetting surface that resists the adherence of sedimentation deposits. If the pipeline is occasionally subject to higher flow rates, much of the sedimentation will be flushed from the system during these peak flows. If cleaning is required, sedimentation deposits can usually be flushed from the system with high pressure water.

Pressure piping systems may be cleaned with the water-jet process, or may be pigged. Pigging involves forcing a resilient plastic plug (soft pig) through the pipeline. Usually, hydrostatic or pneumatic pressure is applied behind the pig to move it down the pipeline. Pigging should employ a pig launcher and a pig catcher.

9.3 Payment for Testing, Disinfection and Cleaning of Pipelines

No separate payment will be made for pressure and leakage testing of pipelines for the supply of clean water and all necessary testing apparatus, pumps, gauges and pipe-works, the cost of supervision and labour in testing and retesting, if necessary and all other work, materials and equipment in complying with the requirements of testing of pipelines.

9.4 Measurement and Payment

Measurement and payment will be based on completed work performed in accordance with the drawings, specifications, and the contract payment schedules.

9.5 Measurement

Pipes shall be measured in linear meter, their lengths the net length of the pipe as laid, after deduction of the length of overlap at any spigot and socket joint to be made with the pipe. Plain ended pipe shall be measured and paid by effective length as laid.

9.6 PAYMENT

Payment shall be made for the acceptably completed pipeline valves, fittings, granular, bedding valve chambers and concrete thrust block laid in accordance with the specifications, drawings and directions of the Engineer including all costs for labour, materials, equipment, transportation, handling, testing and disinfection complete at the approved tender rates.

SECTION – 5**CONCRETE****1. SCOPE OF WORK**

The work covered by this section of the Specifications consists of furnishing all plants, labour equipment appliances and materials and in performing all operations in connection with concrete work complete in strict accordance with the applicable drawings and the Specifications herein and subject to the terms and Condition of the Contract.

2. GENERAL

Full cooperation shall be extended to other trades to install embedded items, and opening etc. Embedded items shall have been inspected and check tests for concrete and other materials or for mechanical operations shall have been completed and approved before concrete is placed.

3. MATERIALS**3.1 PORTLAND CEMENT****1) General Requirements**

- a) Portland Cement shall be indigenous stuff unless otherwise approved by the Engineer.
- b) Unless otherwise permitted, cement from not more than two plants shall be used and in general, the product of only one plant shall be used in any particular section of the work.

2) Specification

These specifications cover five types of Portland cement, as follows:

No.	Applicable Specifications		Application
	ASTM	BS	
a.	C150 (Type I)	BS 12	Ordinary Portland Cement: For use in general concrete construction when the special properties specified for Type II, III, IV and V are not required.
b.	C150 (Type II)	BS 1370	Moderate Heat Portland Cement: For use in general concrete construction exposed to moderate sulphate action, or when moderate heat of hydration is required.
c.	C150 (Type III)	BS 12	Rapid Hardening Portland Cement: For use when high early strength is required.
d.	C150 (Type IV)	BS 1370	Low Heat Portland Cement: For use when low heat of hydration is required.
e.	C150 (Type V)	BS 4027	Sulphate Resisting Portland Cement: For use when high sulphate resistance is required.

3) Packing and Marking

- a) Cement shall be furnished in sacks or in bulk form, as approved by the Engineer.
- b) Cement in sacks shall be delivered in strong, well made, paper or cloth bags, each plainly marked with the manufacturer's name, brand, type of cement and the weight of cement contained therein, except that, in the case of Type-I cement, the type need not be identified.
- c) A bag shall contain 50 Kg. net.
- d) When the cement is delivered in bulk; this information shall be contained in the shipping invoice, accompanying the shipment.

4) Inspection

The Contractor shall facilitate the Engineer, in all respects, for careful sampling and inspection, either at the mill or at the site of work, as may be specified by the Engineer. The following periods, in days, from the time of sampling shall be allowed for completion of testing.

- | | | |
|----|-------------|----|
| a) | 1-day test | 6 |
| b) | 3-day test | 8 |
| c) | 7-day test | 12 |
| d) | 28-day test | 33 |

5) Rejection

- a) Cement may be rejected if it fails to meet any of the requirements of these specifications.
- b) Cement remaining in bulk storage at the mill, prior to shipment, for a period greater than six months after completion to the tests, may be tested and may be rejected if it fails to conform to any of the requirements of these specifications.
- c) Packages varying more than 3% from the weight marked thereon may be rejected and if the average weight of packages in any consignment as determined by weighing fifty packages taken at random, is less than that marked on the packages, the entire consignment may be rejected.
- d) Packages received in broken or damaged condition shall be rejected or may be accepted only as fractional packages as determined by the Engineer.
- e) Cement that is found to be adversely affected by moisture, as determined by the Engineer, shall be rejected.

6) Method of Sampling and Testing

- a) The sampling and testing of Portland cement shall be in accordance with relevant BS or ASTM standard specifications.
- b) Contractor shall carry out all tests on Portland cement, at his own cost, if required by the Engineer.

7) Transportation of Cement

Transportation of the cement from the mill to the site stores and to the point of use shall be accomplished in such a manner that the cement is completely protected from exposure to moisture.

8) Storage

- a) Cement shall be stored in dry, weather tight and properly ventilated structures. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification of each consignment.
- b) The sacks should be stacked closely on a damp proof floor or on timber planks, raised by a minimum of 12" (300 mm), from the ground, with air space below. There should be similar air space between the stacks and walls.
- c) To avoid bursting of bags and setting under pressure, the height of the stacks shall be limited 8 bags.
- d) Adequate storage capacity shall be furnished to provide sufficient cement to meet the peak needs of the project.
- e) Cement storage facilities shall be emptied and cleaned by the Contractor when so directed, however, the interval between required cleaning normally will not be less than four months.

9) Usage

- a) The Contractor shall use cement in the approximate chronological order in which it is received at the site. All empty sacks shall be promptly disposed off as approved by the Engineer.
- b) No cement stored through a monsoon, or for a period of more than six months, should be used, unless tests have been applied and cement found up to the requisite standard.
- c) Suitable, accurate scales shall be provided by the Contractor for weighing the cement in stores and elsewhere on the work, if required, and he shall also furnish all necessary test weights.

10) Delivery and Usage Record

Accurate records of delivery of cement and its use in the works shall be kept by the Contractor. Copies of these records shall be supplied to the Engineer in such a form as he may require.

3.2 AGGREGATE

1) General Requirements

- a) Aggregates for normal concrete shall conform to the requirements of ASTM Designation C 33 "Specifications for Concrete Aggregates".
- b) In case the Contractor prefers to use aggregate from a source other than that approved by the Engineer; following tests shall be carried

out, at the Contractor's cost, to determine suitability of the material for the intended use:

- i) Mechanical properties
 - ii) Porosity
 - iii) Organic impurities
 - iv) Clay and Silt Contents
 - v) Abrasion and Soundness Tests
 - vi) Alkali Reactivity Potential
 - vii) Water soluble Chloride Contents
- c) The nominal maximum size of the aggregate shall not be larger than one fifth of the narrowest dimension of the finished wall or slab, or larger than three fourth of the minimum clear spacing between the reinforcing steel and embedment.

2) **Nature of Aggregate**

- a) Fine Aggregate: The use of natural sand or a combination of natural and manufactured sands may be permitted, provided that the fine aggregate meets the applicable requirements of the specifications herein, for particular use intended.
- b) Coarse Aggregate: Except where otherwise specified, coarse aggregate shall consist of crushed natural stone.

3) **Source**

The Contractor shall obtain concrete aggregate from deposits of natural sand and gravel or shall procure crushed aggregate from approved quarries, which produce aggregates meeting with the Specifications contained herein.

4) **Sampling and Testing**

- a) The Contractor shall provide facilities, as may be necessary, for the ready collection of representative test samples, of the aggregates, to determine compliance with specifications.
- b) The Engineer will obtain and test such samples, at the expense of the Contractor, using appropriate standard test methods, selected by the Engineer.
- c) Testing of concrete aggregates by the Engineer shall not relieve the Contractor of his responsibility to maintain, control and ensure the production, stockpiling and handling of both fine and coarse aggregates, in accordance with these Specifications.

5) **Aggregate Processing**

- a) General: All aggregates, as delivered to the mixer, shall consist of clean, hard, dense and durable and uncoated particles.
- b) Light Weight Elements: Light weight elements, like chalk, clay and organic matter shall be separated by vibro-floatation process. Where required, fines shall be removed from the coarse aggregate by adequate washing.

c) Soft Particles

- i) The Contractor in planning his aggregate processing operations shall make necessary provisions, as regards methods and equipment, to ensure effective elimination of soft particles from all aggregates.
- ii) The percentage of soft particles present in the processed coarse aggregate shall not exceed 3 percent by weight, when determined in accordance with the applicable requirements of ASTM Designation C235 "Standard Method of Test for Scratch Hardness of Coarse Aggregate Particles" or other standard test method, selected by the Engineer.
- iii) Test Samples shall be representative of the each size group of processed coarse aggregate, as specified in Article 5.6, obtained according to the ASTM Methods D 75.

6) **Grading Requirements**

Compliance with the aggregate grading and uniformity requirements will be determined at the mixer. The aggregates, as delivered to the mixers, shall conform to the following specific grading requirements:

a) **Fine Aggregates**

- i. The grading of fine aggregate shall conform to the following requirements:

U.S. Standard Sieve Mesh	Percent Passing
0.375" (9.50 mm)	100
No.4 (4.75 mm)	95-100
No.8 (2.37 mm)	80-100
No.16 (1.18 mm)	50-85
No.30 (0.60 mm)	25-60
No.50 (0.30 mm)	10-30
No.100 (0.15 mm)	2-10

- ii. Fineness modulus shall range between 1.9 and 2.78.
- iii. The sand equivalent value, as determined by ASTM Designation D 2419, "Standard Test Method for Sand Equivalence Value of Soils and Fine Aggregate", shall not be less than 75.

- b) Coarse Aggregate: The grading of the coarse aggregate, within the separated size groups, shall conform to the following requirements:

US Standard Sieve Size (Nominal Size)	Percent by Weight Finer than Each Laboratory Sieve			
	1/4"(6.25 mm) to No. 4 Group	3/4"(19 mm) to No. 4 Group	1"(25 mm) to No. 4 Group	1.5"(37.5 mm) to No. 4 Group
2.00" (50.00 mm)	-	-	-	100
1.50" (37.50 mm)	-	-	100	95-100
1.00" (25.00 mm)	-	100	95-100	-
0.75" (19.00 mm)	100	90-100	-	35-70
0.50" (12.50 mm)	90-100	-	25-60	-
0.375" (9.50 mm)	40-70	20-55	-	10-30
No. 4 (4.75 mm)	0-15	0-10	0-10	0-5
No. 8 (2.37 mm)	0-5	0-5	0-5	-

7) **Particle Shape**

- A flat particle is one having a ratio of width to thickness greater than three. An elongated particle is one having a ratio of length to width greater than three.
- The shape of the particles shall generally be spherical or cubical.
- The quantity of flat and elongated particles, in the separated size groups of coarse aggregate, as defined and determined by standard tests, approved by the Engineer, shall not exceed 15% by weight in any size group.

8) **Deleterious Substances**

- Fine Aggregate: The maximum percentages of deleterious substances, in the fine aggregate, as delivered to the mixer, shall not exceed the following values, with sum of the percentages of all deleterious substances not to exceed 5 percent, by weight.

Substances	Percent of Weight
Material passing No. 200 sieve	3
Shale	1
Total of other deleterious substances including mica, chloride, coated grains and soft flaky particles	3

- b) Course Aggregate: The maximum percentages of deleterious substances, in any size of coarse aggregate, as delivered to the mixer, shall not exceed the following values, with the sum of the percentages of all deleterious substances not to exceed 3 percent by weight.

4. Deleterious Substances	<i>Percent of Weight</i>
Material passing No. 200 sieve	1
Shale	1
Clay lumps	0.5
Other deleterious substances	1

9) **Storage**

- a) Aggregate shall be stored, at the site, in such a manner as to prevent its deterioration or the inclusion of foreign matter.
- b) Aggregate, which has deteriorated or which has been contaminated, shall not be used for concrete.
- c) All methods employed by the Contractor for loading, unloading, handling and stock-piling aggregates shall be subject to the approval of the Engineer, at all times.
- d) Sufficient aggregate shall be maintained at the site, at all times, to assure continuous placement and completion of any lift of concrete started.

10) **Moisture Control**

- a) All fine aggregate and smallest size group of the coarse aggregate shall remain in free draining storage at the site for at least 72 hours, immediately prior to use.
- b) The free moisture content of the fine aggregate and of the smallest size group of coarse aggregate, as delivered to the mixer, shall be controlled so as not to exceed 4% and 1% respectively, expressed as percent by weight, of the dry aggregates; unless higher limits are allowed by the Engineer.
- c) In addition to the limits on the maximum amounts of free moisture in aggregate, the moisture content shall be controlled so that, for each size, the variation in the free moisture will not be more than 0.5 percent, during any one hour of mixing plant operation.
- d) Coarse aggregates, with other sizes, as delivered to the mixers, shall have the least amount and least variation, of the free moisture contents, practicable under the job conditions.
- e) Under no conditions shall the aggregate be delivered to the mixed plant being dripping wet.

- f) The Contractor shall carry out such tests, at his own expense, as the Engineer may deem necessary, to determine the free moisture content of aggregate.

3.3 WATER

Water is discussed in water section.

3.4 CONCRETE STRENGTH

The minimum compressive strength of concrete required on the basis of test cubes and minimum quantity of cement required for the concrete shall be as under:

Class of Concrete	Min. Qty. of Cement		Cylindrical Strength	
	Lbs per 100 cft.	Kg. per Cu.m.	At 7 Days	At 28 Days
			Lbs./ Sq. in.	Lbs./ Sq. in.
A	3024	485	3000	4000
B	2520	404	2250	3000
C	2016	323	1875	2500
D	1344	216	900	1200
E	1008	161	600	800

3.5 PROPORTIONING OF CONCRETE MIXES

All concrete shall be proportioned by volume for design of concrete mixes, unless specifically directed by the Engineer to proportion them by weight. The Contractor shall submit to the Engineer before the start of concreting proposed mix designs for concrete to be used based on laboratory tests to determine the proportion of cement, aggregates, and water in the concrete conforming to the quality and strength requirements specified. The source and specific gravity of aggregates and name of laboratory shall be submitted along with mix design. The cost of all such testing and mix design shall be deemed to have been included in the item rates of Contractor.

3.6 MAXIMUM ALLOWABLE WATER CONTENT

All concrete specimens shall be made, cured and tested in accordance with British Standard or ASTM Standard and Water cement ratio shall be varied to achieve the required strength and this ratio shall be got approved by the Engineer before the start of concrete work.

3.7 SLUMP TEST

The slump for concrete, determined in accordance with PS 422:1964 "Slump Test for concrete" should be minimum of 25 mm (1") and a maximum of 75 mm (3") provided the requisite strength is obtained.

3.8 MIXING

Concrete shall be mixed by mechanical mixing with adequate facilities for accurate measurements and control of each material entering the mixer and for changing the proportions to conform to varying conditions of the work. Volumetric batching can be adopted, using cement by weight, according to the following table:

Nominal	Cement		Sand Cft.	Coarse Aggregate Cft.
1:1½:3	110 Lbs	50 Kg.	1 7/8	3 ¾
1:2:4	110 Lbs	50 Kg.	2 ½	5
1:3:6	110 Lbs	50 Kg.	3 ¾	7 ½
1:4:8	110 Lbs	50 Kg.	5	10

Water shall be measured for every batch with due allowance made for water already present in aggregates.

- 1) Mixers shall not be charged in excess of noted capacity nor be operated in excess of noted speed. Excessive mixing shall not be permitted. The entire batch shall be discharged before re-charging.
- 2) Mixing time shall be measured from the instant water is introduced into the mixer drum containing all solids.
- 3) Mixing water shall be introduced before one-fourth of the mixing time has elapsed. Mixing time for mixers of one cubic meter or less shall be 2 minutes.
- 4) No hand mixing shall be permitted. If during concreting the mixing plant fails, the concrete already poured shall be removed, unless otherwise directed by the Engineer or his Representative.
- 5) Test cubes of concrete shall be prepared and stored by the Contractor, in accordance with PS: 560:1965, as and when directed by the Engineer or his Representative. Test cube be tested in laboratory and the Contractor shall bear the charges for the same.

3.9 TRANSPORTING AND PLACING CONCRETE

- 3.9.1 Concrete shall be conveyed and deposited as quickly as possible after mixing and shall proceed so that, as far as possible, a complete section of the work is done in on operation. Concrete that has attained its initial set or has contained its mixing water for more than 30 minute shall not be allowed to be placed in the works.
- 3.9.2 Transport of concrete shall be in a manner approved by the Engineer or Engineer's Representative and shall be so as to avoid segregation or loss of ingredients of concrete.
- 3.9.3 All foundations and portions of work to be concreted shall be approved by the Engineer's Representative before concrete is poured.

- 3.9.4 All forms and reinforcement shall be completed, cleared inspected and approved before pouring of concrete. No concrete is to be deposited till the Engineer's Representative has inspected and approved in writing all reinforcement, foundations forms, details, positioning of all fixture and materials to be embedded in concrete. The Engineer or his representative shall issue an authorization to start concrete for each day work in a form to be called pour slip. This pour slip will give the result of checking of form work, reinforcement, and quality of aggregates cement and mixing & vibrating equipment and date of, pouring of concrete. This pour slip shall form the basis for payment to Contractor. No payment will be made for the concrete for which pour slip has not been issued by the Engineer or his representative. The Contractor: shall maintain a complete record of concrete pour slips issued by the Engineer or his authorized representative. Laying concrete shall be carried out only in presence of authorized representative of the Engineer. Dry concrete laid without the presence of Engineer's representative will not be accepted and will not be paid for.
- 3.9.5 All concrete shall be thoroughly compacted and consolidated by means of Pneumatic or mechanical vibrators or other approved compacting method. Care shall be taken to avoid segregation due to excessive vibration. The Contractor shall maintain on site at all times one or more stand by vibrators. Tapping or other external vibration of forms shall not be allowed, unless so directed by the Engineer's Representative. Compaction shall be done until the whole mass assumes a jelly like appearance and consistency with the water just appearing on the surface. Concrete shall be sufficiently tamped and consolidated around the steel rods, care taken that the vibrator does not touch steel or formwork and is worked into all parts of the moulds in order that no voids or cavities are left. Steel shall not be disturbed during operations of concreting. Concrete shall be brought up in even layers of about 300 mm (12") thickness or as approved by the Engineer and worked against side of forms to give a smooth and uniform surface. No surplus water shall be allowed to come out and lie on the surface of concrete. The concrete must be of such a consistency that after ramming, consolidating and tamping is completed, a thin film of water is just appearing on the surface.
- 3.9.6 Hardened concrete, debris and foreign material shall be removed from interior of forms and from inner surface of mixing and conveying equipments.
- 3.9.7 Runways shall be provided for wheeled concrete handling equipment, and such equipment shall not be wheeled over reinforcement, nor shall runways be supported on reinforcement.
- 3.9.8 Concrete shall not be dropped freely from a height of more than 2.5 m in columns and 1.5 m (5 ft) elsewhere. In case where an excessive drop is inevitable the Contractor shall provide spouts, down pipes, chutes, or side ports to form with pockets that will let concrete flow easily into the form without any risk of segregation. The discharge of the spouts, down pipes or chutes shall be controlled so that the concrete may be effectively compacted into horizontal layers not more than 300 mm (12") thick.
- 3.9.9 When concrete is laid on hard-core, such as sub grade for floor slabs, or other absorbent material, the surface is to be watered, consolidated and, where specified, blinded before the concrete is deposited.
- 3.9.10 Fresh concrete shall not be placed on previously laid concrete or on old concrete

surfaces until the latter has been cleaned of dirt, scum and laitance by wire brushes. The clean surface shall then be thoroughly wetted and grouted with cement slurry as approved by the Engineer's Representative.

- 3.9.11 Care shall be taken not to disturb newly placed concrete by vibrator, indirect loading or otherwise. No traffic or loading shall be allowed on the concrete until it has thoroughly set and hardened.
- 3.9.12 No concrete shall be placed during rains or when the sun, heat, winds or other weather conditions prevent proper placing, finishing and curing of concrete or when the temperature is above 43 degree Centigrade and below 35 degree Fahrenheit or when the concrete is likely to be subjected to freezing temperatures. All fresh concrete shall be suitably protected from rainfall and excessive heat or cold.
- 3.9.13 Should any part of the exposed surface present a rough uneven or imperfect appearance when the shuttering is removed, it shall be picked out to such depth and refilled and properly re-surfaced or entirely redone as per directions of Engineer or his Representative at the cost of the Contractor.
- 3.9.14 On removal of the forms and before the skin has had time to harden, all faces of the concrete inside or outside, to be kept exposed shall be rubbed over with carborundum stone and washed with cement to remove all marks, projections hollows or any other defect. No extra payment shall be made for this work.
- 3.9.15 all exposed surfaces and lines of the concrete work are to be true and fair without cracks, bends, windings and distortions of all kinds without any extra charges by the Contractor.

3.10 PROTECTION AND CURING

All exposed concrete shall be cured. Curing shall be accomplished by preventing loss of moisture, rapid temperature change and mechanical injury or injury from rain or flowing water for a period of at least ten days. Curing shall be started as soon as the concrete has hardened sufficiently for the surface not to be marked. Curing shall be done either by continuous sprinkling of water on the surface or by covering with sand, hessian, canvas or other approved fabric mats that shall be kept continually wet. If required and so directed by the Engineer or his Representative, formed surfaces with form in position shall also be cured by keeping all form continually wet.

Minimum period of curing for any concrete shall be ten days or more as directed by the Engineer. All concrete pours and concreted structures shall be clearly marked with non-wash able paints to indicate the date of placing concrete. During hot weather curing shall be done even at nights.

3.11 FORMWORK

3.11.1 GENERAL

The form work shall be inclusive of all labour, material, workmanship and alike. All formwork and supports thereto shall be designed by the Contractor and relevant drawings shall be submitted to the Engineer and his Representative for approval before the work is put in hand. Such approval shall not relieve the contractor from all

the obligations of the contract or give rise to any claim.

3.11.2 MAKING FORMS

The formwork for all concrete work to be cast in situ shall be made of sound and properly seasoned timber or other approved material for all works above ground water table. For all works below ground water table formwork of steel shall be used. These formworks shall be properly jointed and erected with packing material to provide watertight forms. These forms shall be properly cleaned to give a smooth finished surface and shall be rigidly formed and designed by the Contractor to the shapes and forms as per drawings in accordance with the best existing practices so as to be able to withstand, without displacement deflection or deformation movements of any kind, the pressure of the moist concrete and all other loads.

3.11.3 RIGID WITH ALLOWANCE FOR CAMBER AND BULGES

It shall be fabricated and erected in position, perfect in alignment, levels and true to plumb and shape and securely braced so as to enable it to with stand all weights, live and vibrating, to be endured during placing of concrete and its subsequent hardening till the formwork is struck. It shall be sufficiently rigid as not to lose its form or bulge, or deflect and to give the finished concrete the required lines, plumb, size and shape.

3.11.4 MATERIALS AND LABOUR

The Contractor shall supply all materials and labour necessary for a good and speedily erecting formwork such as shuttering, planks, struts, bolts, stays, gangways boards, fillets etc. and shall do all that is essential in executing the job in a workman like manner to the satisfaction of the Engineer.

3.11.5 FORMWORK NOT TO INTERFERE OR INJURE WORK

The formwork shall be so designed and arranged as not to unduly interfere with concrete during its placing and easy to be removed without injuring the finished concrete.

Wedges, clamps, bolts and the rods shall be used when permitted and where practicable in making the formwork rigid and in holding it to true position.

3.11.6 JOINTS IN FORMWORK

All joints in the formwork shall be sufficiently closed to prevent undue leakage of mortar from concrete or show an appearance of leaking mortar on concrete surface.

3.11.7 TREATMENT AND INSPECTION OF FORMS

All rubbish particularly chipping, shavings and saw etc. shall be removed from the interior of the forms immediately before placing concrete. Forms shall be coated with approved mould oil before reinforcement is placed. Surplus oil on forms and any oil on reinforcing steel shall be removed.

3.11.8 REMOVAL OF SHUTTERING

No struts or timbering which serves the purpose of supporting the shuttering or centring shall be struck or removed before the minimum periods for the main classes of work given as under:

Removal of Shuttering	Cold Whether Days	Normal Whether Days
Beams, sides, walls and columns (unloaded)	5	3
Slabs soffits (Props left under)	10	7
Removal of props to slabs	18	14
Beams soffits (props left under)	13	10

Struts or other timbers or supports, the removal of which may cause the transference of load to the finished work shall be kept in place for three weeks after the placing of the concrete.

3.11.9 INJURY OR DAMAGE

The Contractor shall be responsible for any injury to the work and any consequential damages caused by or arising from the removal and striking of forms, centring and supports, and any advice, permission or approval given by the Engineer or his Authorised Representative, related to the removal and striking of forms, centring and support shall not relieve the Contractor from the responsibilities herein defined.

3.11.10 TREATMENT AFTER REMOVAL OF FORMS

Any minor surface honey combing or other irregularities are to be properly made good immediately upon the removal the formwork and the surface made good to the satisfaction of the Engineer and his Representative. Any small voids shall be neatly stopped with cement mortar consisting of one part of cement to two parts of sand and the whole surface rubbed over with carborundum stone and cements wash and bring the whole to a smooth and pleasing finish and uniform colour.

3.11.11 MEASUREMENT AND PAYMENT

Formwork shall not be measured or paid for separately and shall be deemed to be included in the unit price of concrete whether cast-in-situ or pre-cast and subsequently fixed in position.

3.12 CONSTRUCTION JOINTS

Construction joints shall be located as indicated on the drawings and / or as approved or directed by the Engineer or his Representative.

3.13 ANCHOR BOLTS, INSERTS, SLEEVES, CHASES, RECESSES, STEEL FRAMES ETC.

The Contractor shall furnish and place in position accurately shown on drawings, all inserts, sleeves, chases, recesses. etc., supplied by himself or other Contractors, as directed and full cooperation and coordination shall be maintained with other Contractors, Sub-Contractors in this regard.

3.14 CLEANING AND REMOVAL OF RUBBISH

On completion of works herein the Contractor shall remove all concrete debris, rubbish, shuttering materials, scraps etc., from the vicinity of the structures completed. All areas shall be cleaned to the satisfaction and approval of the Engineer.

3.15 PLACING STEEL REINFORCEMENT ON FORM WORK

3.15.1 Clear cover to main reinforcement in concrete members is as follows:

a.	For slabs, projections, chajjas, fins, walls, staircases pre-cast slabs.	19 mm
b.	For beams, Columns, all members of water retaining structures on the side in contact with water	50 mm
c.	For foundations retaining walls and foundation beams	50 mm

3.15.2 All the reinforcing bars are to be properly placed and spaced as shown on the working drawings. Steel chairs and concrete spacer blocks are to be used without any extra cost. Concrete spacer blocks are to be properly cured to avoid their damage during concreting thereby causing displacement of bars. Holes made by bolts etc., introduced for keeping the shuttering in act should be properly treated after striking the shuttering. No such hole shall be allowed in walls of water retaining structures and earth retaining walls.

3.16 WATER PROOF CONCRETE

All concrete work below ground level shall be executed in SR cement with water proof compound of approved type and shall be mixed in with concrete in strict accordance with the instruction of manufacturer or as directed by the Engineer.

3.17 FINISHING OF FORMED SURFACES

All concrete surfaces exposed to public view or inside of sump or wet well and screening chamber shall be smooth form finish. No plastering will be allowed or paid for. The concrete surfaces not exposed to public view e.g. external surfaces of sump or wet well or screening chamber shall be fairly smooth for application of water proofing treatment. Other surface may be rough form finish.

3.18 BITUMEN COATING ON WALLS

Unless otherwise specified all concrete and masonry work in contact with earth upto plinth level shall be given an application of two coats of Industrial Bitumen paints at the rate of 15 lbs per 100 sq.ft ensuring that no pin holes / patches are left out.

Bitumen will be applied after cleaning all dirt, dust and loose material from the surface and ensuring that the concrete or masonry has been cured and dried. Second coat will be applied after the first coat completely dried backfilling of each in foundation up to plinth will only be carried out after the application of bitumen coats and after the final coat completely dried as specified hereinabove or as directed by the Engineer. Bitumen coat shall be measured in square metre of area to be coated and payment for all the items under this section shall be made at the rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

3.19 MEASUREMENT AND PAYMENT

Payment for concrete shall be made on the basis of approved tendered rates of the Contractor for all types of concrete work carried out by the Contractor and approved by the Engineer except that no separate payment shall be made for concrete work in valve chambers. This shall be deemed to have included in the lump sum rate for valve chambers quoted by the Contractor.

The rate of concrete quoted by the contractor shall be deemed to include the cost of formwork to produce fair faced concrete.

No payment shall be made for the concrete work that has been laid without the issue of pour slip by the Engineer or his representative.

SECTION – 6

STEEL REINFORCEMENT

1. DESCRIPTION

Contractor to require in this section is to supplying, cutting, fabricating, bending, placing and installing/binding in position etc., straight or curved hot rolled or cold-worked deformed steel bar reinforcement having minimum yield strength 414 Mpa , including cost of G.I binding wire 18SWG, chairs, wastages, precast c.c. spacers and welding where required by the Engineer, as per ASTM A615 standard. Only those overlaps shall be paid which are according to the approved Bar Bending Schedule/shown on drawings or instructed by the Engineer/as per BSI 4466, complete in all respects as per drawing and specifications for all kind of R.C.C. work. Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer.

2. SCOPE OF WORK

The work covered by the section of the specification consists of furnishing all materials, tools, labour, equipment & appliances and in performing all operations in connection with the providing, straightening, cutting, bending, binding, fixing, elsewhere with necessary overlaps, wastage including binding wire, chairs, pins, spacer block complete in strict accordance with this section of the Specifications, the applicable drawings, approved bar bending schedule according to BS-4466 and the terms and conditions of the Contract. All steel reinforcement should be placed at locations, to lines and level as shown in the drawings and as the directed by the Engineer.

3. MATERIALS

- 3.1 Reinforcing steel to be new billet stock of mild steel (plain bar), hard grade (deformed bar) and Ribbed Tor steel as specified on the drawings and shall conform to British Standard Specifications or equivalent ASTM or Pakistan Standard.
- 3.2 The Contractor shall furnish to the Engineer's Representative Manufacturers' mills certificate to guarantee that steel meets the standard, specifications requirements and minimum certified yield stresses as follows:-

- i. Mild Steel plain bars conforming to B.S.S. 4449 or PS-231
 - a) Tensile Strength - 438 to 517 N/Sq.mm (63.5 to 75 Kips/Sq. in).
 - b) Yield Strength - 250 N/Sq. mm (36 Kips/Sq. in)
 - c) Elongation - 16% to 24% (average 20%).
- ii. Hot rolled deformed bars conforming to ASTM A-615 Grade 60 or PS-605
 - a) Tensile Strength - 560 N/Sq. mm (81 Kips/Sq. in).
 - b) Yield Strength - 415 N/Sq. mm (60 Kips/Sq. in).
 - c) Elongation - 11%

- 3.3 All steel to be true to the Standard Specifications with regard to bend ability specially the hard grade deformed bars under 19 mm (3/4") dia. shall be capable of being bent cold through 90 degree round a bar of four times its own diameter without fractures or injury of any kind. In case of deformed bars over 19 mm (3/4") dia. and under 28 mm (1-1/8") dia. round a bar of 6 times its own diameter.

- 3.4 18 gauge galvanized wire shall be used for binding the steel reinforcement.

4. TESTING

Reinforcement shall be obtained only from manufacturers approved by the Engineer or his Representative. All reinforcement shall be tested according to ASTM standard.

If and when required samples shall be tested for above specification in an approved laboratory when required by the Engineer or his Representative and all costs of such tests shall be borne by the Contractor as a minimum three (03) samples will be tasted per twenty (20) ton of steel.

5. STORAGE

Reinforcing bars shall be stored on platforms above surface of ground and be free from scales, oil, structural defects prior to placement in works. Rusted or dirty steel bars shall not be used in the works unless brushed and cleaned by proper steel wire brushes and after being approved for use by the Engineer or his Representative.

6. REINFORCEMENT CUTTING AND PLACING

- 6.1 All reinforcement steel shall be cut and bent cold in strict accordance with bar bending schedules approved and drawings supplied by Engineer. The Contractor shall prepare bar bending schedule from approved structural working drawings conform to ACI 318-02 section 12.5. The bending schedules shall be drawn on approved forms and submitted to the Engineer or his Representative for checking and approval. The steel reinforcement shall be cut and bent to sizes as per drawings and approved bending schedules. In case any bars, cut, bent or even fixed in position are found incorrect in dimensions size or shape according to the requirements of the drawings and instructions of Engineer, the Contractor shall replace such steel bars cut bent or fixed in position by correct sized bars at his own cost and no extra payment shall be made to the Contractor on such account. The system of holding bars in place shall ensure that all steel in top section will support weight of workmen without displacement or distortion. Suitable spacers and chairs as approved by the Engineer or his Representative shall be used for supporting and spacing purposes of bars. In case any bars are bent or displaced they shall be straightened or replaced prior to pouring. All reinforcement bars within the limit of a day's pour shall be in place and firmly tied with 18 gauge G.I. wires. Bars with kinks or bends not shown on drawings shall not be used.
- 6.2 Where indicated in the drawings, mesh shall be of the sizes as shown on drawings and conform to British Standard B.S.785. Mesh reinforcement when used in slabs shall be supported at proper elevations by standard accessories. In slabs on ground, pre cast concrete blocks may be substituted for chairs.

7. LAPS AND SPLICES

- 7.1 No splicing of bars shall be allowed at position other than shown on the drawings. All lap lengths shall be of the minimum sizes as indicated on the drawings or in conform to ACI-318-02 section 12.5 and in no case shall lap length be less than 40 times the diameter of the bigger lapping bars for nominal M.S. bars. Hard grade bars and tor steel shall have laps of 50 times the bigger diameter of lapping bars. Splices of adjacent bars shall be staggered unless approved otherwise by the Engineer or his Representative.
- 7.2 All reinforcing steel fixed in position shall be inspected by the Engineers Representative and no concrete shall be poured until steel placement has been approved by the Engineers Representative. For inspection purposes the Contractor shall give to the Engineers Representative reasonable notice before the scheduled pouring time. Clear concrete cover to reinforcement steel shall be as indicated on the drawings/specified.

8. MANUFACTURE

Steel shall be manufactured from prime Pakistan Steel billets.

9. MEASUREMENT AND PAYMENT

- 9.1 The quantity to be paid for shall be the calculated in theoretical number of metric ton of reinforcement steel bars or mesh as determined from the approved bar bending diagrams and incorporated in the concrete and accepted, except when reinforcement is paid for under other items.
- 9.2 The weight of plain or deformed bars will be computed from the theoretical weight of plain round bars of the same nominal size as shown in the following tabulation:

Size Inch	Weight in		Size Inch	Weight in	
	lbs per ft.	Kg. per ft.		lbs per ft.	Kg per ft.
1/4	0.167	0.076	3/4	1.502	0.681
3/8	0.376	0.170	7/8	2.044	0.927
1/2	0.668	0.303	1	2.672	1.212
5/8`	1.043	0.473	1-1/8	3.382	1.534

- 9.3 Clips, ties, separators, and other material used for positioning and fastening the reinforcement in place, and structural steel, shall not be included in the weight calculated for payment under this item. If bars are substituted upon the Contractor's request and as a result more steel is used than specified only the amount specified shall be included.

- 9.4 When laps are made for splices, other than those shown on the drawings or required by the Engineer and for the convenience of the Contractor, the extra steel shall not be measured nor paid for.
- 9.5 When continuous bars are shown on the drawings, without the splices being shown, the necessary steel in the splices will be paid for on the basis of the individual bars not being shorter than 40 ft (12 m).
- 9.6 The accepted quantity measured as provided above shall be paid for at the contract unit price for the items listed in the Bill of Quantities, which price and payment shall be full compensation for furnishing materials, labour, equipment and incidentals necessary to complete the item.

SECTION – 7

WATER

1. SCOPE:

The work covered by this section of the Specification consists of furnishing all labour, appliances and in performing all operations in connection with obtaining, conveying and storing water at site of work.

2. QUALITY OF WATER:

The water used for construction the contractor shall supply sufficient water for all purposes, including mixing the concrete, curing and cleaning plants and tools. Where doubt exists as to the suitability of the water, it shall be tested at the cost of the contractor in accordance with BS3148. Where water shall be shown to contain any organic impurities sugar or an excess of acid, alkali or salt, or inorganic impurities in solution or suspension, the engineer shall refuse to permit its use. The suitability of water shall be subject to test when required by the engineer.

3. CHEMICAL REQUIREMENTS

As a guide, water may be used as mixing water if the chemical contents do not exceed the following limits, otherwise control test's to show the suitability have to be made.

<u>Kinds of Ingredient</u>	<u>Permissible Limits</u>	
Dissolved Solids	2,000	ppm
Alkali Carbonate and Bicarbonate	1,000	ppm
Chloride*	500	ppm
Sulphate (So ₄)	3,000	ppm
Alkalis (Na ₂ O+0.658 K ₂ O)	600	ppm
PH – Value	(minimum)	

* The maximum concentration of chloride (Cl) in prestressed concrete should not be higher than 500 ppm.

In general, for reinforcement concrete in moist environment, or concrete containing imbedded aluminium structures with dissimilar metals, a maximum concentration of 1000 ppm is acceptable.

If the result of the acceptance tests are within 90% of the permissible limits, the quality control tests for above impurities shall be down each month, of not otherwise directed by the engineer.

If the amounts of each chemical ingredient are lower than specified in the section, and trial mixes show that no harmful effects appear due to the subject tested, the water can be used as mixing water.

4. TEMPORARY STORAGE TANK:

The Contractor shall provide on site at his own cost temporary storage water tank with all necessary G.I. Pipes and fittings as per instructions of the Engineer. No separate payment will be made for tank, pipes and accessories, etc. These tanks shall be removed or dismantled or demolished and the area shall be cleaned and made good on completion of work as per direction of Engineer.

5. PAYMENT:

No separate payment will be made for the work covered under this section, and all costs in connection therewith shall be deemed to be included in the unit rates.

SECTION – 8

BITUMEN COATING

1. SCOPE

The work under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations for bitumen coating treatment to foundations, complete in strict accordance with this section of this section of the specifications and the applicable drawings and subject to the terms and conditions of the Contract.

2. SUBMITTAL

Samples of all materials proposed for use under this section, shall be submitted to the Engineer for approval.

3. MATERIALS

Bitumen 80/100 grade

4. DELIVERY STORAGE AND HANDLING

Materials shall be protected from damage during loading shipment delivery and storage Non-staining materials shall be used for blocking and packing.

5. PREPARATORY WORK

All surfaces, to be treated shall be dust free and dry. Application shall not start unless the preparatory work has been inspected and approved by the Engineer.

6. WATER PROOFING TREATMENT IN FOUNDATION / SUB-STRUCTURES

All surfaces to be bitumen painted shall be thoroughly cleaned of any accretion, dust, dirt etc. by scraping, wire brushing or as directed by the Engineer. The surface shall be primed with a coat of asphalt oil used at the rate of not less than 1 gallon /100 square feet. Two coats of hot bitumen paint shall be applied at the rate of 40 lbs/100 sft each coat. The first coat shall be allowed to dry for about 6 hours before applying the second coat. During operation of painting great care shall be taken to avoid air bubbles. The manufacturer's advice/ recommendations shall be taken to avoid air bubbles. The manufacturer's instructions and Engineer's directions shall be followed.

7. MEASUREMENT AND PAYMENT

7.1 GENERAL

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the BOQ.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

7.1.1 All preparatory work, scrapping, scratching and cleaning.

7.2 BITUMEN COATING

7.2.1 MEASUREMENT

Measurement of acceptably completed works of bitumen coating will be made on the basis of net actual area in square meter as shown on the Drawings or as directed by the Engineer.

7.2.2 PAYMENT

Payment will be made for acceptable measured quantity of bitumen coating on the basis of unit rate per square meter quoted in the Bills of Quantities. The unit rate shall include all cost of surface preparation and shall constitute full compensation for all the works related to the item.

SECTION – 9

PLASTER

1. SCOPE OF WORK

The work covered by this section of specifications consists of furnishing all plant labour, appliances and material and services required for cement plastering, including all items incidental thereto as specified herein and as shown on the Drawings.

2. GENERAL REQUIREMENTS

- 2.1 Contractor shall examine all other sections of the specifications for requirements that affect work of this section whether or not such work is specifically mentioned in this section. Plaster surface shall include walls, partitions, jambs, recesses, heads of doors & windows soffits etc.
- 2.2. Contractor shall co-ordinate work with that of all other trades affecting or affected by work of this section especially all embedded items in walls.

3. MATERIALS

For specification of sand and cement for plastering refer Section II (Materials).

4. WORKMAN SHIP

- 4.1. All work shall be done in the best possible manner by skilled workmen of the plastering trade. Contractor will be responsible for results of the highest quality. Unsound and unsightly work shall be removed and replaced by work satisfactory to the Engineer at no additional cost.
- 4.2. All finished surfaces shall be even and properly trowelled. Finished surfaces shall be even in colour, free from stains, marks or defects. Finished surfaces shall be straight-edged and plumb or level in every direction; angles shall be straight, true and perfect.
- 4.3 All work shall be protected from rapid drying- Exterior openings shall be kept properly adjusted to regulate the drying and curing of cement plaster.

5. CEMENT PLASTER APPLICATION

5.1 INSERTS AND EMBEDDED ITEMS

Plastering shall not commence until all metal lath, electric conduits, drainage and sanitary pipes, inlets to tanks, brackets, clamps, doors and window frames and all sorts of inserts are fixed in position. It shall be the responsibility of the Contractor to make sure that all such work is carried out before starting of plasterwork. Chiselling and repairing of cement plaster shall not be permitted. Before commencing

plasterwork Contractor shall check to ensure that all embedded and other items are in place.

5.2 PREPARATION OF MASONRY SURFACE TO BE PLASTERED

All masonry surfaces to be plastered shall be cleaned to remove all matter which will otherwise adversely affect the adhesion of plaster to the surface concerned. All masonry joints and concrete surfaces shall be properly roughened before plaster work is commenced. The surface thus prepared shall be treated uniformly with cement and sand slurry. The slurry to be used shall be one part cement to one part sieved sand by volume with water added to make a thick creamy mix. The slurry shall be applied with a stiff brush on surface that shall be well wetted before the application of the slurry.

5.3 PREPARATION OF CEMENT MORTAR FOR PLASTER

- a. The mortar shall be prepared from prescribed cement mixed with clean sieved sand in the volumetric ratio of one part cement to three parts of sand (1:3) or as specified. The mixtures shall be turned over and over till the ingredients are thoroughly mixed.
- b. Only limited quantity of water shall be added for proper workability and such quantity of the mortar shall be prepared that will be consumed in thirty minutes after preparation. Preparation of mortar in bulk quantity for use during the entire day or for any other times more than that stipulated above is expressly prohibited.

5.4 APPLICATION OF PLASTER

The minimum thickness of plaster shall be 13 mm. If the plaster is to be more than 18 mm thick it shall be done in two layers. The surface of first layer shall be made rough after the initial set. The second layer shall be applied after a period of three (3) days of application of the first layer. The plaster shall not have wavy surfaces and shall be perfectly in line level and plumb. The edges and corners shall represent straight lines. The plaster shall be kept wet continuously for at least 10 (ten) days. - Plaster shall be carried in jambs, junctions, corners, edges, round surfaces. The plasterwork is to cover all. Conduits, pipes etc. fixed in the walls and ceiling.

5.5 PATCHING

Plaster containing cracks, blisters, pits, discoloration or any defects shall not be acceptable. Any such plaster or loose plaster shall be removed and replaced with plaster in conformity with these specifications and as directed by the Engineer.

Contractor shall remove completely and provide plaster in lieu of all defective work in patches as directed, at no additional expense to the employer.

Patching plaster shall match appearance of and shall be finished level with the adjoining plaster.

5.6 DRIPS

The Contractor shall make drips for rainwater protection.

5.7 ALIGNMENT AND SMOOTHNESS

All cement plaster shall be uniformly true in line level and plumb, smooth trowel finished, free of waves and blemishes etc. to the full satisfaction of the Engineer.

5.8 CLEANING AND PROTECTION

Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed by the Engineer.

As each room or space is completed all rubbish, debris, scaffolding and tools should be removed to leave the roof clean.

Protect finished plaster from injury by any source.

Prior to plastering all windows doors and finished metal shall be covered by plastic adhesive tape or any other approved system to completely protect it from damage and defacement.

Contractor shall also protect walls, floors and work of other trades from plaster materials.

6. WATERPROOF PLASTER

6.1 STRUCTURE BELOW GROUND WATER TABLE

All structures to be constructed below ground water level shall be given a waterproofing treatment on the inside and outside. The plaster shall be made by mixing Puddlo or another equivalent water proofing compound approved by the Engineer in the cement-sand mix of 1:3 by volume according to the manufacturer's instructions for treatment and applied in one layer of 19 mm on all required surfaces. Waterproofing compound in sealed containers only shall be allowed. Only water proofing compound duly approved by the Engineer shall be allowed for use. The surfaces to receive waterproofing treatment shall be made rough for bonding. The layer of waterproofing plaster 19 mm thick shall be then applied and its surface shall be made smooth by the use of a trowel or other suitable instrument. The plaster shall be allowed to cure for a minimum of 14 days.

6.2 Waterproof plasterwork shall not be started till all pipes have been installed. Any damage or leak discovered shall be repaired by the Contractor at his own cost.

7. CUTTING AND PATCHING

When so directed and prior to painting and finishing of cement plastered surfaces, the Contractor shall check all cement plastering throughout the work, including all cutting, patching and refinishing required in a manner satisfactory to the Engineer.

8. PROTECTION AND CLEANING

- 8.1** During the operation of cement plastering, protect the work of other trades against undue spoilage and damage by the exercise of reasonable care and precautions. Repair, replace, or both, any work so damaged and soiled.
- 8.2** Upon completion of all work remove all rubbish, scaffolding and tools from the work and leave the premises clean and to the Engineer's satisfaction.

9. MEASUREMENT AND PAYMENT

Plasterwork will be measured and paid for the net area over which it is laid. All openings exceeding one sq. metre shall be deducted. The cost for drips and architectural grooves corner jambs and sills shall be included in the unit rate of plaster and no separate payment shall be made for these. All unit rates shall include cost of all, materials, labour, scaffolding and curing etc.

No extra payment shall be made to the Contractor for thicker plaster required due to unevenness in the masonry or defective masonry.

SECTION – 10

BLOCK MASONRY

1. SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all Plant, Labour, Equipment, Appliances, and materials and in performing all the operations in connection with brick masonry work complete in strict accordance with the specifications herein and the applicable drawings and subject to the terms and conditions of the Contract.

2. MATERIAL

2.1 CEMENT

Cement shall be Portland cement meeting the requirements specified under clause of section of “Concrete.”

2.2 AGGREGATES

Aggregates used shall meet the requirements specified under clause of section of “Concrete” .

2.3 WATER

Water shall be as specified under clauses of the section of “Concrete”.

2.4 CONCRETE MASONRY UNITS.

- 2.4.1 Concrete masonry units shall be made on the project site and shall be of the size required by the drawings and / or directed by the Engineer In charge.
- 2.4.2 The blocs shall be solid or hollow as required and shall be carefully made so that they are true in line and face with square corners and free from all defects.
- 2.4.3 The concrete for the blocks shall be mixed in the proportion of one (1) part of cement, three (3) parts of sand and six (6) parts of well graded coarse aggregate not exceeding 1/2” in size.
- 2.4.4 Concrete blocks shall be machine molded. The concrete shall be well worked in the moulds, vibrated tamped and pressed to ensure that the blocks are dense and free from voids.
- 2.4.5 The blocks shall be cured by keep moist continuously for a period of at least ten (10A) days and then shall be allowed to dry in a shady location for at least eight (8) days before being used in masonry.
- 2.4.6 Where blocks are to be exposed to view they shall have clean, cut straight and true, edges, smooth dense faces of uniform appearance without voids, honeycombs, projections or variation in texture and shall be free from cracks, spells, chips, ragged edges or other defects detrimental of their appearance.

- 2.4.7 Where blocks are to be plastered the exposed surfaces shall have a coarse texture suitable for bonding the plaster as approved by the Consultants.
- 2.4.8 .The average compressive strength of any five blocks priced at random shall be not less than the strength as specified for 1:3:6 concrete under clause of the section of "Concrete".
- 2.4.9 The average moisture content of all concrete masonry units shall not exceed 30% of the total absorption of the units.

3. MATERIAL

Concrete masonry unit shall be stacked on platforms and covered or stored in any other manner approved by the Consultants to protect from contact with the soil and exposure to weather. Care shall be taken in handling to avoid chipping and breakage. Storage piles stacks, or bins shall be so to avoid being disturbed or shall be barricaded to protect the blocks from damaged by construction operations.

4. MORTAR FOR MASONRY

- 4.1 Cement shall be Portland as specified under Clause of the Section of "Concrete".
- 4.2 Fine aggregate shall be clean, hard, durable particles free from laminated material well graded from No. 4 to 100 sieve.
- 4.3 Water shall be clean and free from injurious acids, alkalis and organic impurities.
- 4.4 All mortar for masonry shall be proportion of one (1) cement and four (4) sand (fine aggregate) and the ingredients shall be mixed by volume.
- 4.5 Mortar shall be mixed thoroughly in a drum type batch mixer for a period of not less than three minutes, using the quantity of water required to obtain the desired workability. Hand mixing shall be subject to approval by the Engineer Incharge and if he allows the mortar materials shall be mixed in a light mortar mixing box. In no case the mixing of mortar shall be done on open platform.
- 4.6 The mortar shall be subject to compressive strength test and the average compressive strength of three numbers 2" cubes of mortar shall be not less than 1,800 lbs per sq. inch at 28 days.
- 4.7 Mortar shall be used in the masonry within half an hour from addition of water into the mortar. The mortar which has already set shall not be used in the masonry.

5. MASONRY AND JOINTING

- 5.1 All masonry shall be laid plumb, true to the line and level and accurately spaced coursed and with each course breaking joints with the course below. Bond shall be keeping plumb, corners and reveals shall be plumb and true. Chases, grooves, reglet blocks and raked out joints shall be kept free from mortar and other debris.

- 5.2 The thickness and length of various walls shall be as indicated on the drawings.
- 5.3 Unless otherwise shown on the drawings or specified the spaces around forms and other built in items shall be solidly filled with mortar except that joints that are to be caulked shall be raked out $\frac{3}{4}$ inch.
- 5.4 Work required to be built-in with masonry including anchors, wall plugs and accessories shall be built-in as the work progress. Wood plugs and blocking shall not be built into masonry.
- 5.5 All horizontal and vertical joints shall be completely and solidly filled with mortar when and as the blocks are laid.
- 5.6 The thickness of joints shall not exceed $\frac{3}{8}$ " and the joints shall be raked $\frac{1}{2}$ "deep" when the mortar is still fresh so as to give proper bond to the plaster.
- 5.7 Where masonry abuts RCC columns or walls it shall be anchored thereto by means of wire anchors of galvanized metal not less than 10 gauge or 1" wide G.I. strip 22 gauge located at every fourth horizontal joint.
- 5.8 The top course of partitions under slabs beam shall not be laid until the forms have been removed and the roofing placed.
 - i. Masonry walls shall be cured for at least ten
 - ii. Days from the day it is installed.

6. MEASUREMENT AND PAYMENT

All the items of work covered by this section of the specifications shall be measured by the standard method of measurements and paid in accordance with unit rates entered in the Bill of Quantities. No separate payment will be made for masonry anchor etc. required.

SECTION – 11

VALVES

1. DESCRIPTION

Supplying, installing, jointing and fixing Valve as mentioned in BOQ, complete arrangement with flanges, gaskets, nuts & bolts pipes etc required for draining out the lines including pipe, fittings (test pressure 21.0 Kg/sq cm or 300 PSI) as per standard etc. complete in all respect, as per specifications & relevant drawings and all works to the entire satisfaction of the Engineer.

2. GENERAL

All valves shall be made of Cast iron obtained from approved manufacturer. The metal of casting shall be strong tough, even grains, smooth surfaced and free from all defects without plugging or filling. All valves shall be flanged conforming to the flange dimensions of specials, fittings and pipes to be supplied and installed by the same contractor. All valves shall be designed for a working pressure of not less than 10.55 Kg/Sq.cm (150 PSI) and tested Hydro statistically to a pressure of 21.10 Kg/Sq.cm (300 PSI). The markings cast on the body of the valve shall indicate manufacturer's name, size of valve and designated working water pressure. Asphalt or/and varnish as directed by the Engineer shall be applied to the ferrous parts of the valve except bearing surfaces. Jointing material including nuts, bolts, washers and rubber packing shall be supplied in quantities of approved quality required plus 10 packing extra. The material of all type of valves & penstocks including appurtenances such as nuts bolt and flanges e.t.c. shall be resistant to saline water up to the design life. The Contractor shall submit along with his tender a statement showing the name of manufacturer or alternate manufacturers along with cost details, type, pressure rating and weights of each type a valve and pipes if required so in the form as approved by the Engineer.

3. VALVE IDENTIFICATION

All valves shall be identified by permanently fixed trifoliate labels/brass plates which shall identify the valve number and function, and be attached by stainless steel cable ties to an integral part of the valve - not the hand wheel or lever. Information on the tags shall be:

NO - Normally Opened

NC - Normally Closed

NT - Normally Throttled

NA - Normally Automatic

SOC - Set On Commissioning

4. REPLACEMENT

Where replacement of existing valves with new or alternative valves is specified in the Contract then the Contractor shall be responsible for the provision of double-flanged spool-pieces, as required, and their protective finish. Restoration of any finish damaged in the removal of the old valves and the supply of gaskets, nuts, bolts and washers shall be included.

5. WASHOUT VALVE

The washout valves shall be in general conforming to the requirements of BS 5163. The Washout valve shall provide an unobstructed waterway of the same nominal diameter as of connecting pipe. The spindle shall be non-rising and shall be of solid forged bronze with a tensile strength of 4.34 to 4.65 Tons per Sq. Cm. shaped properly and machined all over with strong square threads suit valve nut. The stuffing box shall be deep large and liberal and capable of packing under pressure. The stuffing box shall be properly packed and ready for service when delivered. The stuffing box packing shall be made of Asbestos Hemp or jute packing shall not be used. The valve shall be provided with cast iron wheel for manual operation of the valve. The valve shall open anticlockwise and close in clockwise direction. Washout valve shall be imported confirming to the standards described herein.

6. DOUBLE ACTING AIR VALVES

Air valves shall be of float type having cast iron body and bolted cover, bottom inlet, a ball float and valve operating mechanism. The air valve float chamber and float chamber cover shall be of cast iron with all other parts of non-corrodible materials. All orifices shall be located well clear of the liquid level in the float chambers, and designed to prevent sedimentation of floating solids. Valve bases shall be as specified. Air valves shall be provided with separate isolating valves and drain plugs. Air valves with 'built in' isolation facility are not permitted. The installation of air valves utilizing solid cylindrical control floats is acceptable. Air valves shall be imported, procured from manufacturer of international repute and as approved by the Engineer.

7. GATE VALVES

Gate valves shall generally comply with BS 5163. Valves shall be of the non-rising stem type with flanged ends to BS 4504 PN 16. The body, wedge, bonnet, stuffing box, gland and thrust bridge shall be of best quality cast iron to BS 1452 Grade 14, the seats, nut, faces and guides of gunmetal to BS 1400 Grade LG2-C and the stem of forged bronze to BS 2872 Grade CZ114. Each valve shall have a drain plug fitted at the bottom of its seating along with proper arrangement of disposal of drain water. Stuffing boxes shall be designed to have soft packing fitted. Valves shall be rated for 150 PSI maximum working pressure with the bodies capable of withstanding a test pressure of 300 PSI without leakage.

8. NON-RETURN VALVE

Non-return valves shall be of the free-acting type capable of withstanding and reducing shock following rapid flow reversal in a pipeline. They shall be suitable for pumps and delivery system provided. Valve bodies shall be of two part construction in best quality cast iron with detachable cover plates to facilitate inspection of the bearing and door. Doors shall be of best quality cast iron with renewable seats of gunmetal to BS 1400. Hinges pins shall be of stainless steel totally enclosed within the valve body. The doors shall be arranged such that they do not swing through an angle of more than 45 degree. Valves shall be rated for 150 PSI maximum working pressure with the bodies capable of withstanding a test pressure of 300 PSI without leakage. The maximum velocity through any check valve shall not exceed 3.5m / sec. without the written approval of the Engineer.

9. MEASUREMENT AND PAYMENT

9.1 MEASUREMENT

The quantity of each valve shall be measured in Numbers as approved by the Engineer or as designated in the BOQ.

9.2 PAYMENT

Each quantity payable according to the BOQ.

SECTION – 12

VALVE CHAMBER

1. DESCRIPTION

The work shall consist of the furnishing and erecting pre-cast or cast in situ concrete valve chamber of sizes shown in drawings with the necessary frames and covers constructed in accordance with these specifications and the specifications for the other work items involved and in conformity with the dimensions, lines, elevations and design shown in the Drawings.

2. MATERIAL REQUIREMENTS

2.1 PRECAST CONCRETE UNITS

These units shall be cast to the dimensions shown on the drawings. Structural concrete shall be Class-A in accordance with Section “**Concrete**”. Reinforcement shall be used as per design drawings. The precast units shall be cured in accordance with AASHTO M 170. Water absorption of individual cores taken from such units shall not exceed seven (7) percent.

A sufficient number of cylinders shall be cast to permit compression tests at seven (7) and twenty-eight (28) days, and to allow for at least two cylinders for each test. If the strength requirement is met at seven (7) days, the units will be certified for use fourteen (14) days from date to casting. If the strength requirements are not met at 28 days, all units made from that batch will be rejected.

Cracks in units, honeycombed or patched areas in excess of two hundred 200 square centimetres (31.00 inch²), excessive water absorption, and failure to meet strength requirements will be cause for rejection.

2.2 STEEL REINFORCEMENT

Steel reinforcement shall be in accordance with the requirements in Section “**Steel Reinforcement**”.

2.3 LADDER RUNGS

Metal units shall conform to the dimensions shown on the Drawings and to the following requirements for the designated materials.

Gray iron castings shall conform to the requirements of AASHTO M 105, Strength class shall be optional unless otherwise specified.

Carbon steel casting shall conform to the requirements of AASHTO M 103. Grade shall be optional unless otherwise specified.

Structural steel shall conform to the requirements of AASHTO M 193 or ASTM A 283, Grade B or better.

Grey iron items shall conform to AASHTO M 105.

Galvanizing, where specified for these units, shall conform to the requirements of AASHTO M 111.

Malleable iron castings shall conform to the requirements of AASHTO M 106. Grade shall be optional unless otherwise specified.

2.4 MORTAR

Mortar shall be composed of one part Portland cement and two parts of fine aggregate, by volume unless otherwise specified and sufficient water to make the mortar of such consistency that it can be handled easily and spread with a trowel. Aggregate for mortar shall conform to the requirements prescribed under sub heading **“Fine Aggregates” of Section “Concrete”**.

2.5 CONCRETE

In case of cast in situ concrete manholes/valve chamber, concrete shall be of Class A unless otherwise shown on the Drawings or as directed by the Engineer, and shall conform to the requirements prescribed for that particular class of concrete in section **“Concrete”**. Forms of approved quality shall be used to give reasonable fair finish from inside, while rough form work may be allowed for outside finish. All other specifications shall be followed as prescribed in Section **“Concrete”**.

3. CONSTRUCTION REQUIREMENTS

3.1 EXCAVATION

Excavation shall conform to the requirements under Section “Structural Excavation and Backfill.”

3.2 BACKFILL

Granular backfill as specified in Section “Structural Excavation and Backfill” is required by the Drawings, or is specified in writing by the Engineer.

3.3 CONCRETE

Concrete construction shall conform to the requirements under Section “Concrete”.

3.4 STEEL REINFORCEMENT

Bending and fixing of steel shall conform to the requirements under Section “Steel Reinforcement”.

3.5 PRECAST CONCRETE UNITS

Precast concrete units shall be erected in the positions shown on the Drawings, or as required by the Engineer.

During erection of the units outside of the manhole/valve chamber shall be finished smooth and the joints flushed full with mortar.

3.6 CONNECTIONS

Sections of connection pipe shall be incorporated into the construction and placed at the elevation, direction and grade required. The inner ends of the pipe shall be flush with the inner faces of the walls.

3.7 METAL FRAMES

Metal frames shall be set on full mortar beds or otherwise secured as shown on the Drawings and the frames, covers, and gratings shall be accurately set true to the line and elevation required to fit the adjoining surface as approved by the Engineer.

3.8 CLEANING

Upon completion each manhole/valve chamber shall be thoroughly cleaned of any accumulation of silt, debris, or foreign matter of any kind and shall be kept clear of such accumulations until final acceptance of the work.

4. MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

The quantities to be paid for shall be **as per BOQ and all** frames and covers and other relevant components, in position and accepted by the Engineer as described in the bill of quantities.

4.2 PAYMENT

The quantities measured as provided above shall be paid for at the contract unit price respectively, for each of the pay items listed below that is shown in the Bill of Quantities, which prices and payment shall be full compensation for furnishing and placing all materials, and for all other costs necessary or usual to the proper completion of the work prescribed in this item.

Excavation and backfill shall be measured and paid for as specified under Section 2 "Granular backfill, which is in place and accepted, shall be measured and paid for as specified in Section 2"

SECTION – 13**POLYVINYLCHLORIDE WATER STOPPER****1. DESCRIPTION**

The work shall comprise providing and installing of all types of polyvinylchloride (PVC) water stops and expansion joints, in concrete structures and elsewhere, in accordance with these specifications and to the location, lines, grades and cross-sections shown on the Drawings and/or as directed by the Engineer.

2. MATERIAL REQUIREMENTS

- a. PVC water stops shall be extruded from an elastomeric plastic compound, having basic resin of polyvinylchloride (PVC).
- b. The compound shall contain such additive resins, plasticizers, stabilizers or other materials, needed to ensure following physical characteristics when tested by the ASTM methods. Test Methods as specified below:

Characteristics	Minimum Requirement	Test Method
Tensile strength, using die III	123 kg/cm ² (1750 psi)	ASTM-D-412
Ultimate elongation, using die III	350%	ASTM-471/1415
Low temperature brittleness with no sign of failure such as cracking or chipping	- 35° F	ASTM-D 746
Stiffness in flexure, 1/2" span	28 kg/cm ² (400 psi)	ASTM-D-2240

3. CONSTRUCTION REQUIREMENTS

All the operations of installing, jointing and splicing the water stops shall be carried out in accordance with the recommendations and instructions of the Manufacturer and the directions of the Engineer.

- a. All embedment in concrete, lapping, turning and sealing shall ensure absolute water tightness.
- b. No holes shall be made through any water stops.
- c. The water stops, wherever indicated on drawings or directed by the Engineer, shall be cast
- d. Integrally with the in-situ concrete, with separate junction and intersection

pieces, placed and jointed at Site.

- e. The water stops shall be installed, in such a way that they are held securely, in their correct position, during the placement of concrete.
- f. The concrete shall be fully and properly compacted around the water stops to ensure that no voids or porous areas remain.
- g. Where reinforcement is present; adequate clearance shall be left, between water stops and the reinforcement, to permit proper compaction of concrete.
- h. Splices, in the continuity, or at the intersections of runs of PVC water stops, shall be performed by heat-sealing the adjacent surfaces.
- i. A thermostatically controlled electric source of heat shall be used to make all splices. The correct temperature at which splices should be made will differ with the material used but should be sufficient to melt but not char the plastic.
- j. After splicing, a remoulding iron, with ribs and corrugations to match the pattern of the water stop, shall be used to reform the ribs at the splice. The continuity, of the characteristic components of the cross-section, of the water stop design (ribs, tabular centre axis, protrusions, and the like) shall be maintained across the splice.

4. MEASUREMENT

- a. Measurement, for PVC water stops, will be made in the specified units of length, of the water stops, of specified type and size, acceptably placed, on the basis of the dimensions, in accordance with the Drawings or directions of the Engineer.
- b. No allowance will be made, in the above computed lengths, for the laps and splices.

5. PAYMENT

- a. Payment for, PVC water stops, of specified type and size, will be made for the quantity of water stops, measured in accordance with Article 4, at the unit rates, tendered in the priced Bill of Quantities.
- b. The unit rates tendered, for all items of concrete, shall be deemed to be inclusive of, but not limited to the following:
 - i. Providing all materials including splicing, sealing, jointing and filler materials
 - ii. All operations related with transportation, involved in the process
 - iii. All operations related with storage of materials
 - iv. All sorts of wastages

- v. All operations including installing, splicing, sealing, jointing and securing water stops; laying of sealants and fillers in expansion joints; and protection, maintenance and repairs, of the water stops
- vi. Carrying out all sampling and testing
- vii. All other operations, procedures and requirements necessary to complete the work in accordance with these specifications.

SECTION - 14

REINSTATEMENT OF ROAD

1. SCOPE OF WORK

The work covered by this section of specifications consists of furnishing all plants, labour, equipment, appliances, and material required for all operations in connection with road cutting works during pipe laying work and restoring the road to original condition.

2. GENERAL

The Contractor shall arrange and provide adequate warning, lights and a sign to the satisfaction of the Engineer for the road cutting from the start of the road cutting work till it is restored to its original condition. Contractor shall be fully responsible for any damage or claim in case any accident takes place due to his negligence in not making proper arrangements in this regard.

3. CUTTING AND RESTORATION OF ROAD

Whenever a road is required to be cut for lying of pipe line or otherwise, prior intimation shall be given by the Contractor and approval taken from the Engineer. Also the Contractor shall have to obtain prior permission for cutting the road from the concerned Authority having the administrative control of the road in question. The Engineer shall provide the required authorization for obtaining the required permission. Cutting of road, digging the trench to the required level, laying and jointing the pipes, and backfilling and reinstatement work of the road shall be done as quickly as possible. After laying jointing and testing of pipes proper compaction of the backfill shall be done. Sub-base course and surface treatment of road in the reinstatement work shall be of the same quality and thickness as that of the original road. In all cases the Contractor shall carry out backfilling with required compaction. The sub-grade shall be prepared by using the dismantled hard crust of existing road.

4. PAYMENT

Payment for each road cutting and reinstatement work if required shall be made as per the approved BOQ rates after restoring the road to the satisfaction of the Engineer. The width of road cutting allowed for payment shall be same as allowed for payment of excavation for trenches.

SECTION - 15

CAST IRON COVERS WITH FRAMES

1. SCOPE OF WORK

The work to be done under this section of the specifications consists of furnishing all plant, labour, equipment, appliances, materials and performing all operations required in connection with the installation of C.I. cover with frame, gratings and ladder rungs, complete as specified herein, as shown on the drawings and or as directed by the Engineer.

2. CAST IRON COVERS WITH FRAME

Cast iron cover and frame shall be of the sizes and duty as specified on the drawings. The specified size means the clear opening. The cover shall be complete with frame. Top of cover shall be roughened in an approved pattern. Locking and latching arrangement shall also be provided. The frame shall be well set in place at the time of pouring of concrete. The cover shall tightly fit in the frame. It shall be airtight and water-tight.

The duty, weight, test and working load for 600mm circular or square C.I. cover and frame shall be as follows: -

Class/Duty of Cover and Frame	Gross* Weight (Approx.)	Peak or Test Load	Services Working Load
Extra Heavy Duty	-----	900 KN	300 KN
Heavy Duty	225-285 Kg	400 KN	135 KN
Medium Duty	130-140 Kg	50 KN	17 KN
Light Duty	70-80 Kg	10 KN	3.5 KN

* The column of gross weight is indicative only for the duty of manhole. The Contractor shall ensure that the manhole is rated for above mentioned test load irrespective of the weight.

3. CAST IRON GRATING AND FRAME

All cast Iron grating and frame shall be of the sizes and duty as specified on the drawings. The specified size means the clear opening. Cast iron grating shall be complete with frame. They shall be of heavy-duty type (230-280kg) to resist heavy traffic loads. The casting shall be sound and free from all defects. The frame shall be set in place at the time of pouring of concrete. Opening in gratings shall be in an approved pattern.

4. MEASUREMENT AND PAYMENT

4.1 GENERAL

Except otherwise specified therein or elsewhere in the contract documents, no separate measurement and payment will be made for the under-mentioned works related to the relevant BOQ items but shall not be limited to the following. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bills of quantities:

- Applying bituminous paint

4.2 MEASUREMENT

Measurement of acceptably completed work of cast iron will be made on the basis of actual number of cover with frame provided and installed in position as shown on the drawings or as directed by the Engineer.

4.3 PAYMENT

Payment for the acceptable measured number of Cast Iron shall be made on the basis of unit rate per number quoted in the bills of quantities and shall constitute full compensation for all the works related to the item.

SECTION - 16

STEEL WORKS FOR DOOR, WINDOWS AND VENTILATORS

1. SCOPE OF WORK

The work covered by this section of the Specification consists of furnishing all plant, labour, equipment appliances, and materials and in performing all operations in connection with the furnishing and installing of steel doors, windows etc; complete, in strict accordance with this section of the Specifications and the applicable drawings, and subject to the terms and conditions of the Contract.

2. MANUFACTURE

The drawing and details show profiles and design of door windows and ventilators etc; and pressed steel frames and these specifications describe minimum requirements. Stock fabricated items complying with these profiles, designs and requirements may be used subject to approval of the Engineer and provided the quality is at least equal to that specified. The work required under this section shall be made by approved manufacturer regularly engaged in the production the kind of the work shown and specified.

3. SHOP DRAWINGS

The Contractor shall prepare shop drawings of all work under this section. These drawings, illustrating in detail profile gauges of metal, details of construction to other work fastenings anchors, reinforcing for hardware, and all other pertinent information shall be submitted to the Engineer for approval.

4. METAL DOORS AND WINDOWS ETC.

- 4.1 All shapes shall be formed, rolled and formed or cold drawn with contours and rises as true and sharp as can produced in the thickness of metal required. With approval of the Engineer doors, windows etc. shall be a local product conforming to the requirements of the specification.
- 4.2 Construction Joints of steel work shall be welded full depth and width, or equivalent splice plates shall be welded on unexposed faces of frames. Exposed surfaces welded joints shall be dressed to produce invisible connection. Spot welding shall be used where practicable in preference to the use of rivets, screws, or bolts.
- 4.3 The finished work shall be strong and rigid, neat appearance and free from defects. Plain surfaces shall be smooth and free from warp or buckle. Moulded member shall be cleaned out straight and true. Mitres shall be well formed and in true alignment. Fastenings shall concealed where practicable.
- 4.4 Cut-outs shall be accurately located and made to fit the hardware. Cut-outs shall have dust covers of galvanized sheet welded in place to prevent mortar and plaster from contact with the reinforcing plates and lock strikes.

- 4.5 Reinforcing for hardware shall be provided in doors and windows etc. The reinforcing shall be concealed, welded in place and tapped for hardware fastenings.
- 4.6 Fittings for hardware shall be done at the factory to template or to the hardware. Metal drips shall be provided on the lower rails of hinged doors in exterior openings. They shall be formed 16 gauge steel and shall be tap screwed in place at not over 150 mm (6") intervals. Bolt sockets shall be provided in concrete under sliding doors and located where directed. These sockets shall consist of lengths of pipe set into the concrete while it is still green.
- 4.7 Doors shall have not more than 3 mm (1/8") clearance at jambs and heads and not more than 4.5 mm (3/16") clearance from floor or from threshold at the bottom and shall have the proper level on lock stiles or rails to operate without bending. They shall be made strong and reinforced at corners sufficiently to prevent sagging or twisting.
- 4.8 The doors should be made from mild steel sheeting of specified thickness and braced in mild steel standard sections obtained from approved supplier. Doors, windows etc shall also include angle iron frame as approved by the Engineer. These shall be complete with heavy-duty hinges, handles, bolts for fastening to lintel, and floor and locks. Each swinging leaf shall be provided with three (3) heavy steel half surface template butt hinges. Double doors shall be provided with astragals. Sliding leaves shall be equipped with steel tracks, track brackets, trolleys, guides, and stops bearing. Each sliding door shall be equipped with a cam bolt and nut and staple for locking with a pad lock. Tracks shall be of hot rolled steel and of sufficient weight.
- 4.9 Glazing to windows and Ventilators shall be provided by the Contractor of best Pakistani made sheet glass of specified thickness having no defects, blemishes or cracks. Proper arrangement for fixing the glass with best quality putty, wooden beading and clamps etc as approved by the Engineer shall be provided. The rate quoted for windows and ventilators should also include the cost of providing glazing.
- 4.10 The Pressed Steel Door Frames shall be fabricated from 16 gauge steel or as specified and directed by the Engineer. Edges of flanges shall be turned to form plaster keys where plaster occurs and to form retainers for adjustable anchors.
- 4.11 Adjustable masonry anchors for frames in masonry shall be of steel T-shaped and of the same thickness as metal of the frames. The head shall have equivalent strength and shall positively engage the retainers on both flanges of each jamb member when in place. The stem shall be corrugated for mortar bond and extend 10 inches in to the masonry. The stem generally shall be 3 inches into the masonry. The stem generally shall be 3 inches wide in masonry having a nominal thickness of 3 inches or less. Anchors shall be placed near the top and bottom of each jamb and at intermediate points not over 3 feet apart and shall lie flatly in the masonry joints. A clip shall be provided at the bottom of each Jamb.
- 4.12 Reinforcement for door butts, door closers, close bracket, locks and latch strikes shall be 4.5 mm (3/16) plate; butt reinforcement 150 mm 6" longer than butt; 16 gauge steel housing back of strike reinforcement.
- 4.13 Base angle for fastening to floor shall be welded to each jamb section.

- 4.14 Provide removable angle spreaders securely fastened to each Jamb.
- 4.15 Install frames Plumb, rigid and in true alignment and brace to retain position and clearance during construction of partitions.
- 4.16 Shop Painting: Metal doors window, ventilators and frame shall be cleaned by a hot dip phosphate or a cold phosphate chromate treatment standard with the manufacturer. Immediately after drying, these shall be applied shop coat of rust-inhibitive paint which will produce hard tough film of good appearance, flexibility and true resistance. Shop coat shall be applied on both exposed and inside surfaces and surfaces inaccessible after erection. After erection final
- 4.17 Painting of three coats of approve enamel paint shall be done. No separate payment for painting doors, windows and ventilators etc will be allowed.

5. ERECTION

Doors, windows, ventilators, frames, and related work shall be hung and adjusted in their proper locations so that they operate properly and are in a condition satisfactory to the Engineer.

6. STEEL LADDER

Steel ladder shall consist of specified size of M.S. flats in strings and 1" (25, mm) diameter M.S. steel bars in rungs. The M.S. rungs shall be riveted and welded in 25 mm diameter holes in flats. The ends of each climb of the ladder shall be embedded in the concrete.

All components of ladder shall first be painted with two coats of approved red oxide primer and then with three coats of black enamel paint. The steel ladder shall be fabricated installed as per drawing or as directed by Engineer.

Payment shall be made on the basis of approved tender rates for each item of accepted work as per contract.

7. MEASUREMENT AND PAYMENT

Measurement for the accepted quantity of doors, windows, ventilators where specified provided as per specification and directions of the Engineer shall be made as per standard method of measurements and payment shall be made as per the approved tender rates.

SECTION – 17

PAINTING AND FINISHING

1. SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all materials, plant, labour, equipment, appliances and performing all operations in connection with surface preparation and painting works, gates, frames, steel and wooden doors, windows, louvers, walls, ceilings and all such surfaces as shown on the Drawings and / or as directed by the Engineer. The scope of this section of specifications is covered with and detailed specifications laid down herein.

2. GENERAL

Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Building as applicable to the work".

The Contractor shall repair at his own expense all damaged or defective areas of shop-painter metal work. Metal surfaces against which concrete is to be placed will be furnished shop-painted and shall be cleaned prior to being embedded in concrete, except as otherwise specified, all concrete and plastered surfaces are to be painted.

3. MATERIALS

All materials shall be acceptable, proven top grad products and shall meet or exceed the minimum standards of reputable manufacturers as approved by the Engineer.

Colours shall be pure, non fading pigments, mildew proof, and sun-proof, finely ground in approved medium. Colours used on plaster and concrete surfaces shall be lime-proof. All materials shall be subject to Engineer's approval.

All emulsion paints and primers for metal work and walls will be the best available of its type. The make and shade shall be got approved by the Engineer prior to its procurement.

Approved quality of cement wash paint shall be used for painting the exteriors of the structures or other surfaces as directed by the Engineer.

The plastic emulsion paint or similar as approved by the Engineer shall be used for interior surfaces.

Un-slaked lime, gum and marine blue shall be used for white washing.

All material for bitumen painting shall consist of Bitumen P B4 Grade 10 / 20. It shall be used for foundation or wherever recommended by the Engineer.

Approved quality, Epilac enamel paint shall be used for chemicals and water resistance where specified.

DUROCEM a cement base heavy-duty waterproof coating manufactured by ICI or any equivalent approved by the Engineer shall be used for painting on the surface specified. The cement base waterproof coating for concrete shall conform to ASTM C-109, C-67, D-822 and G-23.

All materials shall be delivered to site in their original unbroken and scaled containers or packages and bear the manufacturer's name, label, brand and formula and shall be mixed and applied in accordance with directions of the manufacturer.

4. SURFACE PREPARATION

All oil, grease, dirt, dust, loose mill, scales and any other foreign substance shall be removed from the surface to be painted, polished and white washed by the use of a solvent and clean wiping material. Following the solvent cleaning, the surfaces shall be cleaned by scraping, chipping, wire brushing or other effective means as approved by the Engineer.

In the event the surface becomes otherwise contaminated in the interval between cleaning and painting, re-cleaning will be done by the Contractor at no additional cost.

Surfaces of stainless steel, aluminium, bronze and machined surfaces adjacent to metal work being cleaned or painted shall be protected by effective masking or other suitable means, during the cleaning and painting operations.

All the surfaces to be painted with approved quality cement wash paints shall be free from dust, dirt, fungus, lichen, algae etc. Oil paint, varnish and lime wash should always be removed by scrapping and washing.

All surfaces to be bitumen painted shall be thoroughly cleaned of any accretion, dust, dirt etc. by scraping wire, brushing or as directed by the Engineer. The surface shall be primed with a coat of asphalt oil used at the rate of not less than 1 litre per 2 square meters.

No work in this Section shall be allowed until all surfaces or conditions have been inspected and approved by the Engineer or his representative.

All damaged portions of surfaces shall be repaired and all other adjustments carried out before the start of painting or finishing. No addition or alteration on surface shall be allowed after the painting and finishing work is done.

5. APPLICATION

All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workmanlike manner, leaving the finished

surface free from drips, ridges, waves, laps and brush marks. All paints shall be applied under dry and dust free conditions. Unless approved by the Engineer paint shall not be applied when the temperature of the metal or of the surrounding air is below 10 Degree Centigrade. Surfaces shall be free from moisture at the time of painting.

All primary paint shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning. When paint is applied by spraying, suitable measures shall be taken to prevent segregation of the paint in the container during painting operations.

Effective means shall be adopted for removing all free oil and moisture from the air supply lines of the spraying equipment.

Each coat of paint shall be allowed to dry or harden thoroughly before the succeeding coat is applied. Surfaces to be painted that will be inaccessible after Installation shall be completely painted prior to Installation.

Two coats of cement wash shall be applied in accordance with the manufacturer's instructions or as directed by the Engineer.

Only as much material should be mixed as can be used in one hour. Over-thinning will not be permitted. After the first coat the surfaces will be soaked evenly four or five times and the second coat shall be applied after leaving for at least overnight.

All steel doors, windows and ventilators shall be painted with two coats of approved enamel paint over one coat of a red oxide primer as directed by the Engineer. Two coats of bituminous paint shall be provided on the external side of walls of manholes and under sides of the manhole covers.

Plastic emulsion paint of the approved make and shade shall be applied to interior surfaces required as per finishing schedule and as per manufacturer's instructions.

Epilac enamel paint of the approved make and shade shall be applied to surfaces required as per finishing schedule and as per instructions of the manufacturer.

For bitumen paint to be applied, the first coat shall be allowed to dry for about 6 hours before applying the second coat. During the operation of painting care should be taken to avoid air bubbles. The manufacturer's instruction and Engineer's directions shall be adhered to.

For applying Durocem the surface shall be dampened with clean water immediately ahead of application. Durocem and clean water shall be mixed as per directions of the manufacturer. A heavy first coat at 20 lbs / 100 sq.ft. (1 kg per sq.m) shall be applied. This shall be followed by a second brush coat at 10 lbs / 100 sq.ft. (0.5 kg per sq.m) after the first coat has set. When finish coat has set, it shall be floated to uniform texture with a sponge float. The work shall include cleaning the surface,

sand papering and smooth finishing, scaffolding, curing etc. complete as per the approval of the Engineer.

6. WHITE AND COLOUR WASHING

The surfaces shall be well cleaned and brushed before white washing. The white washing material shall be prepared from un-slaked lime. The lime shall be dissolved in a tub with sufficient quantity of water and then well mixed and strained through a clean cloth. 4 kg clean gum boiled with 12 kg of rice for each cu.m of lime shall be added to the liquid lime along with a small quantity of marine blue as directed by the Engineer.

The mixture shall be in thoroughly mixed condition in suitable consistency and suitable screened and shall be applied in three coats with a brush.

Each coat of white wash shall be allowed to dry, so that no sign of cracking shall appear on the surface and also white wash shall not come off readily on fingers when rubbed. The white wash when completed, shall form an opaque coat of uniform white colour, through which the old work does not show and shall present a smooth regular surface free from powdery matter. For colour washing approved quality of colouring matter shall be added to the liquid and thoroughly mixed by stirring.

7. DISTEMPERING

Distempers of approved quality and shade shall be applied on internal wall surfaces where shown in drawing or directed by the Engineer.

8. SUBMITTALS

Colour samples shall be submitted on 6"x 6" (150x150 mm) asbestos cement boards, showing each type of paint for Engineer's colour selections.

9. PRODUCT DELIVERY

Deliver materials in manufacturer's original unopened containers with labels intact and legible identifying brand names and contents.

10. JOB CONDITION

Observe manufacturer's recommended minimum and maximum temperature but do not apply paint or finish to any surface unless ambient temperature is 10 degree C or above and less than 43 degree C. No painting shall be done above 90% relative humidity.

Place drop cloths to adequately protect all finished work.

Remove and replace all items of finished hardware, device plates, and accessories including fixtures or other removable items.

The surface shall be prepared first by filling depressions with putty, rubbing, sand papering and cleaning. A priming coat shall first be applied of petrifying liquid of approved manufacture. Distemper shall be applied with broad stiff brush of

approved make. Distemper shall be applied quickly and boldly. Each coat of distemper should first be got approved by the Engineer before applying the next coat.

11. MEASUREMENT AND PAYMENT

Measurement of the work completed, accepted and specified herein as painting, distempering, bitumen painting and white / colour washing for steel grill, railing, steel works, doors, windows, ventilators and manholes etc. will be made on the basis of actual area in square meter of the respective job including all preparatory work like scraping, scratching, sand papering, filling depressions with putty, priming and scaffolding etc. complete in all respect as directed by the Engineer. Payment for these items shall be made at the approved tendered rates.

SECTION – 18

BRICK MASONRY

1. SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all Plant, Labour, Equipment, Appliances, and materials and in performing all the operations in connection with brick masonry work complete in strict accordance with the specifications herein and the applicable drawings and subject to the terms and conditions of the Contract.

2. BURNT BRICKS

For specification of bricks refer Section II (Materials)

3. CEMENT MORTAR FOR MASONRY

3.1 Cement mortar to be used for all brick masonry work shall be 1:4 (one part cement and 4 parts of approve fine sand).

3.2 The dry materials shall be dry mixed for approximately 2 minutes and for 3 minutes after addition of water making total minimum time of 5 minutes. If mixing is not satisfactorily done, then the Contractor shall take such steps as directed by the Engineer.

For dry mix, turn over materials for each batch before adding water, until uniform colour of mixed material indicates cementing material thoroughly distribute throughout the mass. After dry mixing is complete, add water thoroughly until mortar of the required plasticity is obtained.

Mortars shall be used within half an hour of mixing. Mortars standing more than half an hour shall not be used.

3.3 The ingredients for mortar shall be measured in boxes. No re-tampering of mortar shall be allowed nor shall mixing of any anti-freezing ingredients be permitted.

3.4 The thickness of Joints shall not be less than 6 mm. The overall height of 4 courses of Bricks shall not be less than 300 mm.

4. MASONRY AND JOINTING

4.1 All bricks to be used in brickwork with mortar joint shall be immersed in water from 3 to 4 hours before these are used.

- 4.2** No half bricks or bats shall be used except where necessary to complete the bond. At all corners alternate courses of bricks shall be laid header wise and stretcher wise, so as to bind the two walls together. All brickwork shall be truly plumb and each set of four brick courses shall be checked with plumb bob for straight edges. The Joints of brickwork which is to be pointed or plastered shall be raked out to a depth of half an inch. The raking shall be done before the mortar sets each day.
- 4.3** All masonry shall be laid plumb, true to line and level in accurately spaced courses with each course breaking joints with the course below. Corners & reveals shall be plumb and true. Chases, grooves, regret block and raked out joints shall be kept free from mortar and other debris.
- 4.4** All brickwork shall be cured with water. The brickwork shall be kept wet for at least 7 days after laying.
- 4.5** To join the brick masonry wall with RCC. or CC work proper type of dove-tail shall be used as directed and approved by the Engineer without extra payment.

5. COORDINATION

- 5.1** The Contractor shall provide chases and openings required under other sections to sizes and location shown in the drawings.
- 5.2** The Contractor will be required to ascertain all particulars relating to positions in which chases, holes mortises, conduit ducts and similar item will be required to be formed or left before the general work is put in hand and this will be deemed to be included as part of the Contractors attendance as described in the specifications for Contract under Particular Conditions.
- 5.3** The Contractor shall operate with other trades in setting built-in-items, take special care in cutting, fitting, setting units so that built in members are in their true and respective positions.
- 5.4** Items provided in other sections such as doorframes, hold fasts, miscellaneous metal work occurring in the masonry. Sleeves, anchors supports, nailing stripe, braces, Jambs, etc. are to be built-in the masonry.
- 5.5** Special care shall be taken in laying bricks at doorframes. Contractor shall see that frames are square and in plumb. Brick masonry at door location shall be carried out after wooden or hollow metal doorframes are installed in plumb. The anchors are embedded in mortar Joints, filling of hollow metal doorframes with 1:2:4 concrete shall be done along with masonry work.
- 5.6** The Contractor shall be responsible for any damage to his own work, and also to the work of other sections.

6. SAMPLES

Samples of all bricks & other materials to be used under this section shall be submitted to the Engineer for his approval.

7. TESTING

All the brick samples and materials shall be subject to standard testing and if found below the recognized standard specifications such as BS, ASTM or equal shall be rejected. Rejected material shall be removed from the OPF immediately. All testing shall be done at Contractor's cost from laboratory approved by the Engineer.

8. MEASUREMENT AND PAYMENT

8.1 Measurement

Measurement for payment for brickwork will be made for actual front face of brick work. No measurement of Jamb sills etc. shall be made.

8.2 Payment

Payment for brick work will be made as per the unit rate in the Bill of Quantities for actual work executed. The unit rate tendered for such work shall include the cost of bricks, mortar and placing curing and all other operations, procedures and requirements necessary to complete the brick work in accordance with this specification.

SECTION -19

WATER PROOFING AND MOISTURE TREATMENT WORKS

1. SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with installation of insulation, water proofing complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract.

2. MATERIALS:

- a) Cement, aggregate and coarse sand shall be in accordance with the specifications for Concrete.
- b) Samples of all materials proposed for use under this section shall be submitted to the Engineer for his approval.

3. APPLICATION:

After the entire surface to be treated has been broomed and cleaned a 2" (50 mm) thick average screeding with cement concrete 1:2:4 shall be provided over RCC roof slabs with proper slope for roof drainage through rain water spouts. Screeding shall be finished to have smooth surface and junctions with vertical walls or surfaces shall be chamfered as shown in drawing or as directed by the Engineer.

After the concrete of screed has been cured and has set and dried it shall be cleaned and one coats of plastic Bitumen # 4 with coarse sand shall be applied as mentioned hereunder:

9.8 Kg Bitumen with 0.05 cu. m of coarse sand for blinding per 10 sq. m.

4. BITUMEN COATING

Unless otherwise specified all concrete and brickwork in contact with earth unto plinth level shall be given a application of hot bitumen PB-4 at the rate of 7 Kg per 10 sq. m. ensuring that no pin holes or patches are left out. Bitumen should be applied after ensuring that concrete has been cured and dried. One layer of two-ply bitumen felt weighing 32 Kg. per 20 sq. m shall be applied with sticking coat, paint coat and flood coat. Backfilling of earth in foundation up to plinth will only be carried out after applying the bitumen coat as specified herein above or as directed by the Engineer.

5. DAMP PROOF COURSE

Damp proof course of cement concrete class C (1:2:4) of 50 mm thickness shall be laid on walls or at plinth or at location shown in drawing. Pudlo or other waterproofing agent as approved by the Engineer shall be mixed with concrete as per manufacturer's directions and approved by the Engineer. The mixing, laying and curing etc. of the concrete shall be as described under the section of Concrete. The size of the coarse aggregate shall be limited to 3/4" to 3/16- (19 mm to 4.8 mm). The damp proof course shall be of proper width to suit the wall.

6. RAIN WATER SPOUTS

A.C. pipe 4" (100 mm) diameter shall be provided on roof at locations shown on the drawing or as directed by the Engineer. These shall be fixed in the roof at proper level so that rainwater easily passes out through the spouts without any hindrance. The job will include making chase in the roof and wall, fixing and jointing the pipe, making good the roof and painting the pipe complete in all respect as directed by the Engineer.

7. WATER PROOFING BASE SLAB

The cement concrete of mix 1:4:8 below the base slab shall be finished smooth. After this concrete has been cured and dried hot Bitumen PB-4 shall be applied over the surface at the rate of 7 Kg per 10 Sq. m while the bitumen is still hot and in liquid stage, one layer of 2 ply bituminous felt shall be spread over the surface so that the felt fully sticks to the surface of bituminous coat, the overlapping joints of two rolls of bituminous felt shall be made fully watertight by application of hot bituminous coat or other approved method.

8. MEASUREMENT AND PAYMENT

The items of Bitumen Coating, Damp Proof Course, Bituminous felt and Rain Water spout for the accepted work as executed according to the drawings, specifications and directions of the Engineer shall be measured as per standard method of measurement and payment shall be made as per the approved tender rates.

SECTION 20

QUALITY ASSURANCE & QUALITY CONTROL REGIMEN

1. GENERAL

The objective of Quality Assurance (QA) and Quality Control (QC) activities is to ensure the quality of the construction of the Project. The quality of the construction activities are interlinked to both the materials used in the construction and the way of performing the construction by a systematic, schematic and effective usage of men and material.

In order to provide assurance to the Concerned Authority, the Contractor shall comply scrupulously with the following procedural points during the execution of the Project.

2. TOOLS OF QA AND QC

- 2.1 The submittal of any material shall be given to the Engineer/ Department in advance of at least one month for approval.
- 2.2 All the inspection reports, testing reports, approvals submitted and sought from the Engineer/ Department and the relevant records shall be safely maintained and properly filed in liaison with and in a manner agreed with the Department to facilitate checking at any time by the Department during the Contract.
- 2.3 Materials approval statement report shall be prepared in liaison with and in a manner agreed with the Department and in the approved format and programme of the Department.
- 2.4 Submittal Action Summary (SAS) spreadsheets for materials shall be prepared in liaison with and in a format agreed with the Department.
- 2.5 All references to BS, AASHTO, ASTM, AWWA, DIN, EN, ISO etc or any other standards given in the Specification (in this Section or the rest of the Specification) shall mean the latest versions of these Standards. The latest version may also mean a completely new Standard that has superseded the Standard mentioned in the Specification.
- 2.6 The approval of materials should be obtained in the standard forms whose specimen copies "Form P" is bound in this volume of the Specification.
- 2.7 No two Suppliers/ Manufacturers shall be allowed to supply the same material for the Contract, unless the first one failed in quality or supplies schedule. This should be documented properly in record. This measure is to prevent the mixing of material and to facilitate the traceability in future.
- 2.8 In case of imported materials, no payment shall be made unless the Contractor/ Engineer sign the bill of lading. However, the responsibility of authenticity always lies

solely with the Contractor. The bill of lading shall be made available to the Department on demand.

- 2.9 All the Engineering materials/equipment/instruments or any other items used in the permanent works of the Contract shall be compulsorily and legibly marked with the manufacturer's name, casting or making references and all other specified relevant requirements. In the absence of the above, the products will not be considered genuine.
- 2.10 All the materials that are brought from the manufacturers located outside the PAKISTAN shall preferably be registered in their respective countries with their respective standard institutions For example,
- The registration means the acquisition of their logo, i.e.” Kite mark “or “French mark”, etc. No deviation from this is allowed.
- 2.11 All properties/characteristics mentioned in the technical data of the submitted material shall authenticate by test results preferably from an independent laboratory.
- 2.12 All the type tests or the approved tests carried out on the pipes or any other material shall be performed in the worst conditions of loading as per the standards and specification, corrosion, strain, etc. Subsequently the material supplied thereafter shall be quality better than or at least equal to the tested one.
- 2.13 All the records of tests conducted in the factory shall be maintained by the factory for the inspection by the Engineer/Department at any time.
- 2.14 The Engineer/Client shall have free and unhindered access to the manufacturing company at any time to check for compliance. Failure to provide such access shall lead to the withdrawal of the approval.
- 2.15 Raw material that is being used to fabricate the product shall be approved first and then its use shall be continued for that whole Project unless permitted in writing to change.
- 2.16 All electromechanical related tests on material will have to be performed before and during handing over. Test certificates shall be submitted to the Engineer.
- 2.17 All products shall be designed to achieve a minimum service life of 50 years in accordance with AWWA M45, under all applicable loads, environmental, installation and operating conditions. Manufacturer will provide certificate of the minimum service life of 50 years.

All the suppliers have to give the definite guarantees of performance and materials in PAKISTAN environment. No material will be accepted without the guarantees.

Any material (small or big) will not be accepted, even if it complies with specifications and standards, unless it is accompanied by guarantee letter for a definite period, the minimum of which shall be 10 years. Guarantee shall cover the likely wear and tear due to handling/installation/service etc.

Guarantee means at the end of the specified guarantee period the product shall retain 90% of its original properties.

Guarantee letter shall be in the name of the Client and it shall be comprehensive and straightforward and shall not have any hidden meaning or objective. In any case, whatever guarantee is given; it does not mean that this guarantee is enough and relieves from any QA/QC tests as and when laid down by the Department.

The guarantee is meant for the period starting from the issue of the Preliminary Acceptance Certificate of the Contract.

- 2.18 If a factory's approval is suspended /withdrawn then the manufacturer will not be allowed to continue the supply of that failed /passed item from the date of suspension.
- 2.19 The Contractor/Engineer/Department may be requested to have an amalgamated filing system
- 2.20 Standards are binding for the Contractor unless modified/changed/alterd by the Engineer/Department for betterment.
- 2.21 If any discrepancy is brought to light in specifications, standards, Engineer's instructions, comments on general approval letter, comments of approval forms, it shall immediately be brought to the notice of the Department.

3. FLOW DIAGRAM

The Contractor shall comply with the procedures of materials approval as outlined below. The Department reserves the right to modify the procedure as it sees fit.

- 3.1 Flow Diagram for Previously Approved Material
- 3.2 The Contractor shall comply with the Conditions of the general approval of the factory as mentioned in the general approval letter issued by The Client for various materials.
- 3.3 In case of any discrepancy regarding the quality requirements of the materials and works in the different contract documents the highest standard will be applicable.
- 3.4 The complete procedure with forms and flow chart for the materials approval is given below

I. PURPOSE:

To submit the organized transmittal for the approval of material in a contract.

II. SCOPE

The procedures applicable to all Contractual approval of any materials

III. RESPONSIBILITY

Main: contractor, consultant, project management, if any, and manufacturer.

IV. PROCEDURE

NOTE: NEVER WRITE SEE ATTACHED OR AS ATTACHED. WRITE THE MAXIMUM POSSIBLE SUMMARIZED INFORMATION WHICH SHALL BE USED TO IDENTIFY THE MATERIAL IN FUTURE.

This form is to be filled whenever the contractor asks for the approval of an item/material to be used in the works. Be this material be civil, electro-mechanical, structural, chemical, small/big, etc. for their work.

Form "P" shall be used for any material that has been previously approved by Concerned Authority.

This Materials approval form is divided into 5 Sections.

Contractor's Section: Which is to be filled by contractor only

Consultant's Section: Which is to be filled by consultant only

Project Management Section: Which is to be filled by Project Management only, if any

Client Section: To be filled by Client personnel only

Attachments: Which is to be filled by contractor only, he will have to check mark the box beside that attachment which he has included in the Materials approval submittal

I. CONTRACTOR'S SECTION

Project and / or Area:

Name: Write the official name of the contract

Consultant: The name of the site supervision consultant of the project and its full address including the site telephone numbers, the fax numbers and the official email

Contractor: The name of the contractor of the project and its full address including the site telephone numbers, the fax numbers and the official email

Submittal No. Write the number of the Submittal No.

Rev.: if a particular Material is returned to the contractor for any reason by any department then he has to revise it after removing the objection. When this is done it is called revised. This rev number is to be written in the box provide below. Write A if it is first revision, B if second and so on like 5A then 5B, then 5C if needed.

Date Submitted: The date when these Materials are actually submitted to the consultant. Be it revised or original.

Producer/Fabricator: The complete postal name and address which shall include the:

Name & Address: Street address if any, Telephone and Fax Nos, and email or website. This is for cross checking the authenticity.

Supplier's The complete postal name and address which shall include the:

Name & Address: Street address if any, Telephone and Fax Nos, and email or website.

Specification Ref: The specification reference article No. of these material in the general/particular Spec.

BOQ Reference: The specification reference article No. of these material in BOQ.

Product Registration: This is the product certification acquired by any organization.

Body: For example

BSI Kite mark, DWI mark for the product from UK;

DIN, MPA, FRG, DVGW from Germany;

AENOR from France;

ACI, ANSI, ASTM from USA, and so on

These registration bodies are govt controlled/sponsored bodies formed by the act of law. They generally give the certificate for the compliance of the product with a particular well known latest international material standard. After issuing certification these registration bodies continue to monitor the said factory every six months/one year to check whether the company is continuing to implement the basic product quality or not (for they are certified).

ISO Registration: This is the Quality Management System certification issued to an organization by ISO Registrar, who is entitled to issue ISO certification. After issuing certification these registration bodies continue to monitor the said factory every Six Months / One Year to check whether the company is continuing to implement the basic Quality Management System.(for they are certified)

Technical Details: These shall include the main summary of details of the product like class, type, strength, dimensions, in the nutshell the identifying properties by which we will be able to identify and differentiate our product from the other similar products and the main raw materials used also should be mentioned and if there is a space the properties of it as well.

Previous Contract & its Scope of Application or limitation:

Where this Product is used and applied in the contract with the name of the contract. Was there any limitation placed at that time of approval/application. Attach a copy of the previous approval that can be obtained from the supplier/manufacture

Proposed area/s of application/s:

Where this materials is to be used now with respect to the application and environment.

Project Manager The signature of the PM of the contractor after thoroughly going through the statement written for his name. The date and the stamp shall also be imprinted.

II. CONSULTANT SECTION

STATUS: Approved / Not Approved

If not approved by the consultant then he shall send it back to the contractor for revision. If approved then passed it to the project management/client after check marking the status

A.R.E/M.E: To be signed by the ARE or Material Engineer of Consultant after thoroughly going through the submission and made sure that it is submitted as authority/department wants it.

R.E: To be signed and stamped by the RE of Consultant after thoroughly going

Through submission and made sure that it is submitted as authority/department wants it.

III. CLIENT

To be filled by the client.

You can have a look at the ideal submission which is with the Quality Incharge, Quality Section or Quality Consultant of Concerned Authority.

IV. ATTACHMENTS

All the attachments that needs to be appended shall be check marked

Compliance checklist: It shall be in the form of table where a comparison is made between the specified parameters and the submitted parameters and contractor's inference about its compliance.

Specification/s: General and Particular specifications & addendum if any.

Drawings: Related Drawings of the material submitted for approval.

Catalogue/Brochure: Where the technical Details of the product are given.

Test Certificates: Test certificates of the test conducted on the submitted product within last one year but preferably 6 months. These certificates are of those parameters that are mentioned in specifications.

BOQ: Related BOQ articles of the submitted material.

Complying Standards copy: A copy of the international standards with which the submitted material complies or that is mentioned in specifications.

Previous approvals: A copy of the previous approval from Gwadar Authority.

General Approval: A copy of the latest/last issued General Approval, if any.

Sample: Sample of the product submitted.

Guarantee: A letter of Guarantee of the products from the manufacturer signed by president, CEO, and authenticated by the supplier.

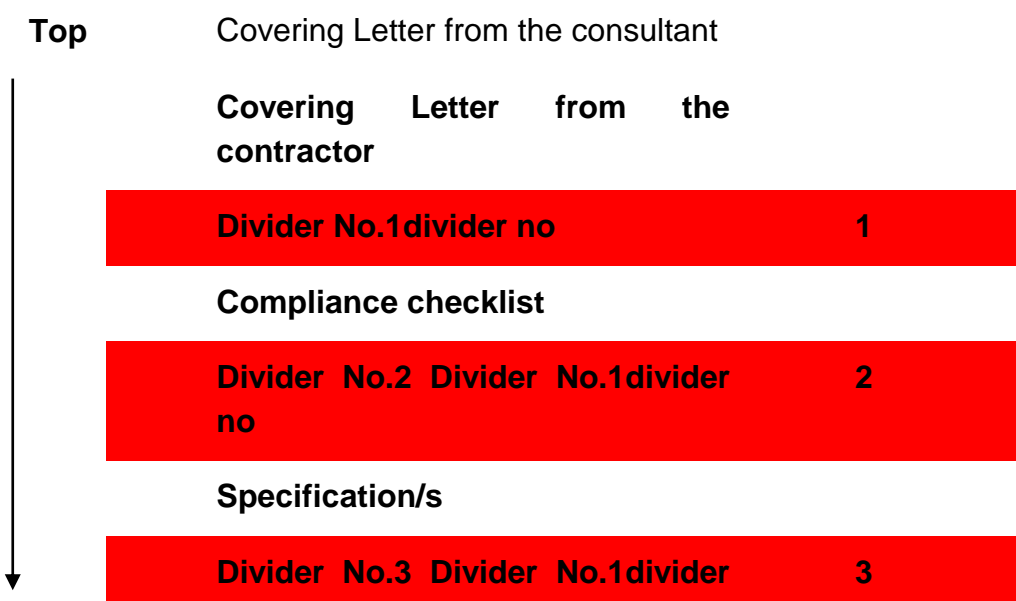
ISO Certifications: ISO 9000 Certificate and if needed both the manual and processes.

- Product Certification:** Product certificate from product certifying international standard bodies like BSI Kite mark , DIN, AENOR, MPA, FRG, ETC.
- Certificate of Origin:** From where this material is coming attested by the PAKISTAN embassy and chamber of commerce of that country.
- Certificate of Manufacture:** The address of the factory where this material is manufactured attested by the PAKISTAN embassy and chamber of commerce of that country.
- Bill of Lading:** Bill that shows the details of shipment of the submitted materials.
- Packing List:** Which comes along with the Bill of Lading which shows what is packed.
- License/s:** License of the manufacturer and preferably of the supplier too. In any case manufacturer's license is obligatory.
- Letter of Appointment:** Letter of appointment as authorized distributor or agent from the manufacturer to the supplier, preferably attested.

Arrangement of the Materials Approval Submittal in a folder

ALL ATTACHMENTS SHALL BE STAMPED AND APPROVED

FOLDER SETTING



no

Drawings

Divider No.4 Divider No.1divider 4
no

Catalogue/Brochure

Divider No.5 Divider No.1divider 5
no

Test Certificates

Divider No.6 Divider No.1divider 6
no

BOQ

Divider No.7 Divider No.1divider 7
no

Complying Standards copy

Divider No.8 Divider No.1divider 8
no

Previous approvals

Divider No.9 Divider No.1divider 9
no

General Approval

Divider No.10 Divider No.1divider 10
no


Sample

Divider No.11 Divider No.1divider 11
no

Warranty

Divider No.12 Divider No.1divider 12
no

ISO Certifications



Divider No.13	Divider No.1	divider no	13
Product Certification			
Divider No.14	Divider No.1	divider no	14
Certificate of Origin			
Divider No.15	Divider No.1	divider no	15
Certificate of Manufacture			
Divider No.16	Divider No.1	divider no	16
Bill of Lading			
Divider No.18	Divider No.1	divider no	18
Packing List			
Divider No.19	Divider No.1	divider no	19
License/s			
Divider No.20	Divider No.1	divider no	20
Chamber of Commerce			
Divider No.21	20	Divider No.1	divider no 21
Letter of Appointment			

4. FOLDER SETTINGS

There are 12/21 or more attachments required for any Materials approval. All these are given in the Materials approval form. All these attachments are numbered from 1 to 21. There are certain blanks left which is used only when some special need comes. Special attachments shall be mentioned in these blanks.

There shall be 1 copy and one original Materials approval submittal.

The submittal for the Materials is to be arranged in the above mentioned fashion, every time you make a submittal.

On the Top the official covering letter of the consultant. Followed by the Contractor's letter.

Next to it is the contractors detailed Materials approval submittal arranged AS MENTIONED ABOVE in the form of sections separated by numbered plastic dividers. The number of numbered plastic dividers shall be at least 25. Numbered as 1, 2, 3...14, 21... Each number represents the number of the attachment that is mentioned in the Materials approval form.

Please Note Even if you are not attaching any sheet in these dividers then also you still have to keep this divider without any attachments.

For example:

Divider Number 1 represents the Compliance checklist.

Divider Number 2 Specification/s

Divider Number 3 Drawings

Divider Number 4 represents the technical Details of the product. In this division separate each product by A4 size coloured sheet on which the product name is mentioned and then append the product details. Suppose you're submitted materials has a total of 10 different products/models then you shall have 10 A4 size coloured sheets with the product name written on it. Likewise if you materials has 15 products/ model bills you shall have 15 A4 size colour sheet dividers.

Divider Number 5 Test Certificates of the submitted product/s

Divider Numbers 21, 22, 23 is left blank to accommodate any other irregular attachment that may be required. If there is any such attachment then you write the name of that attachment in these numbers 21, 22, 23.

5. PIPE MANUFACTURER/SUPPLIER ASSISTANCE:

Manufacturer shall ensure to provide technical assistance during and till whole length of pipe installation period including, but not limited to:

- 5.1 Unhindered technical assistance, via modern modes of communication i.e. Email, Telephone, Fax etc.
- 5.2 Full time technical staff deployment to the site for fool proof installation of pipe and to ascertain up to the mark workman ship.
- 5.3 Number of deployed technical staff, their schedule of working and other relevant details shall be provided prior to the start of installation of the pipe.
- 5.4 Qualification details and experience of all deployed technical staff shall be made available prior to the deputation to the site.
- 5.5 Any special equipment or machinery which is essential for the installation of pipe on site, if deemed necessary, shall be supplied by the manufacturer.
- 5.6 Manufacturer's technical staff shall supervise loading, unloading and transportation process of the pipe for each consignment.
- 5.7 On site hydraulic test, as listed in the specifications, shall be carried out in the presence of, and up to entire satisfaction and approval of the manufacturer's technical staff.
- 5.8 Formal approval certificate duly signed by in charge of manufacturer's technical staff shall be provided for further approval by the Engineer.

6. FIELD QUALITY CONTROL

- 6.1 All sampling and testing of material and work shall be carried out by the Contractor under the direction of the Engineer in accordance with the specifications and standards specified.
- 6.2 The Contractor shall provide all material, labour, plant and testing equipment required to carry out the tests. Costs for all testing are deemed to be included in the rates and Contract price.
- 6.3 Random tests of field density of backfill shall be taken at formation level and at each layer of backfill and at location and frequency as directed and required by the Engineer.
- 6.4 If tests indicate Works does not meet specified requirements, the Contractor shall remove Work, replace, compact, and retest, all at the Contractors expense.
- 6.5 Where instructed by the Engineer, the Contractor shall arrange for an approved independent testing laboratory to carry out tests to determine in-situ the density of the backfill material.

- 6.6 Compaction, testing and analysis of soil materials shall be performed in compliance with the following standards:

Description	AASHTO Standard
Sampling	T-2, T-88
Sample Preparation	T-87
Sieve Analysis	T-27
Density in place (Sand Cone Method)	T-191
Liquid Limit	T-89
Plastic Limit & Plasticity Index	T-90
Moisture Content	T-93, T-217
Modified Proctor Compaction	T-180
Sand Equivalent	T-176
CBR	T-193
Classification	M-145